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ENVIRONMENTAL IMPACT ASSESSMENT REPORT

SUBMITTED IN TERMS OF THE NEMA ACT 107 OF 1998

EXXARO BELFAST PROJECT

REFERENCE: 17/2/3 N-131

FINAL REPORT

FEBRUARY 2012

MARSH & McLENNAN COMPANIES

MARSH

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ENVIRONMENTAL IMPACT ASSESSMENT REPORT

EXXARO BELFAST PROJECT

Reference:	**17/2/3 N-131**
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Date:	February 2012
Status:	Final EIA Report
Revision:	0

MARSH & McLENNAN COMPANIES

EXECUTIVE SUMMARY

Marsh Environmental Services (MES), a division of Marsh (Pty) Ltd, has been appointed as an independent Environmental Assessment Practitioner (EAP) by Exxaro Resources Limited (Exxaro) to undertake an Environmental Impact Assessment (EIA) process for the proposed Belfast Mining Operations.

Location

The proposed mining operation will be situated on various portions of the farms Zoekop 426JS, Leeuwbank 427 JS and Blyvooruitzicht 383 JT in the Magisterial district of Belfast in Mpumalanga.

Exxaro currently operates a coal mining complex in the province of Mpumalanga which is situated between the towns of Carolina and Belfast. This complex is referred to as the North Block Complex (NBC) and consists of the Glisa and Strathae coal mines as well as the Eerstelingsfontein and Belfast coal projects.

Coal mining

The Belfast Project for which this EIA has been conducted entails the development of an opencast mine to produce 2.0 Mtpa of coal for Eskom and 1.5 Mtpa of A-grade thermal coal for export markets. The proposed Belfast Project will consist of two mining areas (A and B block) of 2,390ha in extent. Exxaro plans to undertake opencast mining using a conventional truck and shovel operation, assisted by roll-over dozing, to allow for continuous backfilling and rehabilitation of the mined-out area, which will in all likelihood not exceed 200ha at any time. A Phase 1 and Phase 2 plant will be constructed for the processing of raw coal to produce both export quality and Eskom product coal. The process will consist of crushing, screening and washing of coal. The current planned life-of-mine consists of two years for the construction phase, followed by an estimated 30 year operational (production) phase, and four years for decommissioning, closure, rehabilitation, monitoring and maintenance.

Application

The proposed mining activity necessitates the undertaking of activities listed in terms of G.N. R 544, 545 and 546 (June 2010), promulgated in terms of Sections 24 and 24D of National Environmental Management Act 107 of 1998 (NEMA) which requires environmental authorisation from the relevant competent environmental authority, the Mpumalanga Department of Economic Development, Environment and Tourism (DEDET). Environmental authorisation for the following activities is required before mining activities may commence:

Applicable Listed Activities as per the G.N. R544, 545 and 546

Government Notice	Activity	Description of listed activity
		Activities identified in GNR 544
GN R 544 18 June 2010	9	The construction of facilities or-infrastructure exceeding 1000 metres in length for the bulk transportation of water, sewage or storm water (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more,

Government Notice	Activity	Description of listed activity
		excluding where: a. such facilities or infrastructure are for bulk transportation of water, sewage or storm water or storm water drainage inside a road reserve; or b. where such construction will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse.
GN R 544 18 June 2010	10	The construction of facilities or infrastructure for the transmission and distribution of electricity (i) **outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts**; or (ii) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more.
GN R 544 18 June 2010	11	The construction of: **(i) canals;** **(ii) channels;** **(iii) bridges;** **(iv) dams;** **(v) weirs;** **(vi) bulk storm water outlet structures;** (vii) marinas; (viii) jetties exceeding 50 square metres in size; (ix) slipways exceeding 50 square metres in size; (x) buildings exceeding 50 square metres in size; or (xi) infrastructure or structures covering 50 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.
GN R 544 18 June 2010	12	The construction of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50000 cubic metres or more, unless such storage falls within the ambit of activity 19 of Notice 545 of 2010;
GN R 544 18 June 2010	18	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from- **(i) a watercourse;** (ii) the sea; (iii) the seashore; (iv) the littoral active zone, an estuary or a distance of 100 metres inland of the high water mark of the sea or an estuary, whichever distance is the greater but excluding where such infilling, depositing, dredging, excavation, removal or moving (i) is for maintenance purposes undertaken in accordance with a management plan

Government Notice	Activity	Description of listed activity
		agreed to by the relevant environmental authority; or (ii) occurs behind the development setback line.
GN R 544 18 June 2010	22	The construction of a road, outside urban areas, (i) with a reserve wider than 13,5 meters, or, (ii) where no reserve exists where the road is wider than 8 metres, or (iii) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Notice 545 of 2010.
		Activities identified in GNR 545
GN R 545 18 June 2010	3	The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.
GN R 545 18 June 2010	5	The construction of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent and which is not identified in Notice No. 544 of 2010 or included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case that Act will apply.
GN R 545 18 June 2010	6	The construction of facilities or infrastructure for the bulk transportation of dangerous goods - i. in gas form outside an industrial complex, using pipelines, exceeding 1000 metres in length, with a throughput capacity of more than 700 tons per day ii. in liquid form, outside an industrial complex, using pipelines, exceeding 1000 metres in length, with a throughput capacity more than 50 cubic metres per day; or **iii. in solid form, outside an industrial complex, using funiculars or conveyors with a throughput capacity of more than 50 tons day.**
GN R 545 18 June 2010	10	The construction of facilities or infrastructure for the transfer of 50 000 cubic metres or more water per day, from and to or between any combination of the following: (i) water catchments, (ii) water treatment works; or **(iii) impoundments,** excluding treatment works where water is to be treated for drinking purposes.
GN R 545 18 June 2010	11	The construction of railway lines, stations or shunting yards, excluding - (i) railway lines, shunting yards and railway stations in industrial complexes or zones; (ii) underground railway lines in a mining area; and (iii) additional railway lines within the reserve of an existing railway line;
GN R 545 18 June 2010	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, **industrial** or institutional use where the total area **to be transformed is 20 hectares or more;** except where such physical alteration takes place for:

Government Notice	Activity	Description of listed activity
		(i) linear development activities; or (ii) agriculture or afforrestation where activity 16 in this Schedule will apply.
Activities identified in GN R 546 for Mpumalanga		
GN R 546 18 June 2010	13	The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for a linear activity falling below the thresholds mentioned in Listing Notice 1 in terms of GN No. 544 of 2010.
GN R 546 18 June 2010	14	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation in all areas outside urban areas
GN R 546 18 June 2010	19	The widening of a road by more than 4 metres or the lengthening of a road by more than 1 kilometre.

Approach

This EIA report provides a description of the various potential environmental impacts which may result from the proposed mining project and assesses the significance of such impacts via the various specialist assessments which have been undertaken:

- Destruction of geology and alteration of topography;
- Soil disturbance and loss of agricultural capability;
- Impacts on flora and fauna;
- Impacts on surface water resources
- Impacts on groundwater;
- Destruction of wetland areas;
- Air quality and dust impacts;
- Noise impacts;
- Heritage resource impacts;
- Change in land-use and visual impacts;
- Social impacts;
- Traffic impacts.

Conclusion

Based on the information contained in this report, it is the opinion of the EAP that the negative environmental impacts resulting from the Belfast Project can be mitigated to within acceptable limits. Should the project be approved, it is recommended that the following be undertaken in addition to measures contained in the project EMP in order to further limit the potential impact on the receiving environment (based on the overall composite sensitivity map in Section 4):

- The management measures detailed in the EMP must be adhered to.

- Legal requirements must be fulfilled.
- Exxaro must operate to adhere to the NEMA principles.
- Exxaro must operate following industry Best Practice guidelines.
- Exxaro must adopt a proactive and transparent approach to engaging and informing the local community regarding environmental and social aspects of the project, in addition to maintaining the issues and response register.
- Wetland offsetting must be undertaken for the wetlands which will be destroyed as a result of the project.

Recommendations

The above recommendations are not exhaustive, and all recommendations made by project specialists in the respective specialist reports should be adhered to in the interest of environmental best practice unless all practical measures have been exhausted with which to implement the specific mitigating action. The significant environmental impacts identified by the specialists, stakeholders and the environmental assessment practitioner can be mitigated to acceptable standards provided that the mitigation measures proposed are implemented during the construction, operational and closure phases of the project.

Monitoring is required in order to check compliance with agreed-upon standards or objectives and targets and assists in establishing trends and patterns on environmental indicators. Monitoring further assists in predicting non-compliance and describes remedial measures to address non-compliance. Monitoring programmes will be implemented by Exxaro for this purpose and will commence prior to construction and continue post closure.

There are a number of environmental and social aspects which require monitoring during the various phases of the project. Monitoring plans are recommended throughout the life-of-mine.

Soil Monitoring

Progressive monitoring of the stripping, stockpiling, shaping of spoil surfaces and replacing of topsoil will ensure successful post mining land and soil reclamation. A rehabilitation plan should be compiled and contain the following information:

- Location of soil types than can be stripped and stockpiled together;
- Stripping depths of different soil types;
- The location, dimensions and volume of planned stockpiles for different soil types.

Progressive soil monitoring should take place on at least a quarterly basis and should involve the following:

- Inspection of stripping depths;
- Inspection of stockpiles to check degradation and/or pollution;
- Inspection of spoil surfaces before replacing soil to ensure that pre mined topography is emulated;
- Random inspection of soil thickness on rehabilitated sections;
- Fertility analysis and amelioration procedures prior to re-vegetation;
- Evaluating and readjusting the rehabilitation plan.

Ecological Monitoring

A long-term biannual bio-monitoring plan of ecosystems including water quality, habitats and terrestrial fauna and flora, riparian vegetation, diatoms, aquatic macroinvertebrates and fish needs to be compiled. It is recommended that this be supplemented by a Biodiversity Action Plan for the project area once the seasonal baseline dataset is complete.

Surface Water Monitoring

A water monitoring plan should be designed so as to allow for remedial action and provide for sustainable water management. In terms of surface water monitoring, sediment loads, water quality and metals concentration in the adjacent and downstream aquatic ecosystems should be monitored on a quarterly basis.

Groundwater Monitoring

A monitoring programme must be put in place from the operational phase until after closure to monitor the occurrence of any adverse groundwater impacts. Monitoring data will be used to update the current numerical model simulation for more accurate predictions of groundwater flow and quality and action plans will be formulated and implemented if adverse impacts are identified.

Air Quality Monitoring

It is recommended that a dust fallout monitoring network, consisting of 6 single buckets be implemented for the operational phase positioned at the largest contributing sources and at receptors. It is further recommended that site inspections and air quality progress reporting be undertaken at regular intervals (at least quarterly) when mining operations begin with annual environmental audits being conducted. A budget should be drawn to provide a clear indication of the capital and annual maintenance costs associated with dust control measures and dust monitoring plans.

Noise Monitoring

Environmental noise monitoring should be carried out regularly at bi-annual intervals at specific positions to detect deviations from predicted noise levels and enable corrective measures to be taken where warranted. Monitoring of blast, ground vibration and human response to noise should be undertaken to ensure that accepted levels are in fact acceptable and are being adhered to, and to modify the blasting design as required.

Blast Monitoring

It is recommended that a process of monitoring of blasting operations must be applied for all blasting to be done in the mine operation to ensure that levels are within levels at all times. Third party monitoring should be considered for all ground vibration and air blast monitoring work to bring about unbiased evaluation of levels and influence from an independent group.

Traffic

Traffic counts should be undertaken and a comprehensive traffic study should be conducted after receipt of the counts. Consideration should be given to providing a direct link between Road 1110 and Road 383 and by so doing eliminating coal traffic from making use of the N4 Toll Road.

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Introduction

Marsh Environmental Services (MES), a division of Marsh (Pty) Ltd has been appointed as an independent Environmental Assessment Practitioner (EAP) by Exxaro Resources Limited [referred to as Exxaro] to undertake an Environmental Impact Assessment (EIA) process for the proposed Belfast Mining Project. This would involve an opencast coal mining operation on various portions of the farms Zoekop 426JS, Leeuwbank 427 JS and Blyvooruitzicht 383 JT in the magisterial district of Belfast in Mpumalanga.

Exxaro already operates a coal mining complex in the province of Mpumalanga which is situated between the towns of Carolina and Belfast. This complex is referred to as the North Block Complex (NBC) and consists of the Glisa and Strathae coal mines as well as the Eerstelingsfontein and Belfast coal projects The complex uses both underground and opencast mining methods and employs 250 people to produce 3 million tons per annum (Mtpa) of thermal coal for both the domestic and export markets. The complex has a reserve base of 43.8 million tons (Mt) and a resource of 52.6 Mt (excluding the Belfast project).

As part of the NBC, Exxaro is in the process of assessing the feasibility of the Belfast Project, situated approximately 10km southwest of Belfast town in Mpumalanga. For the Belfast Project, Exxaro proposes to develop an opencast mine for the production of 2.0 Mtpa of coal for Eskom and 1.5 Mtpa of A-grade thermal coal for export markets.

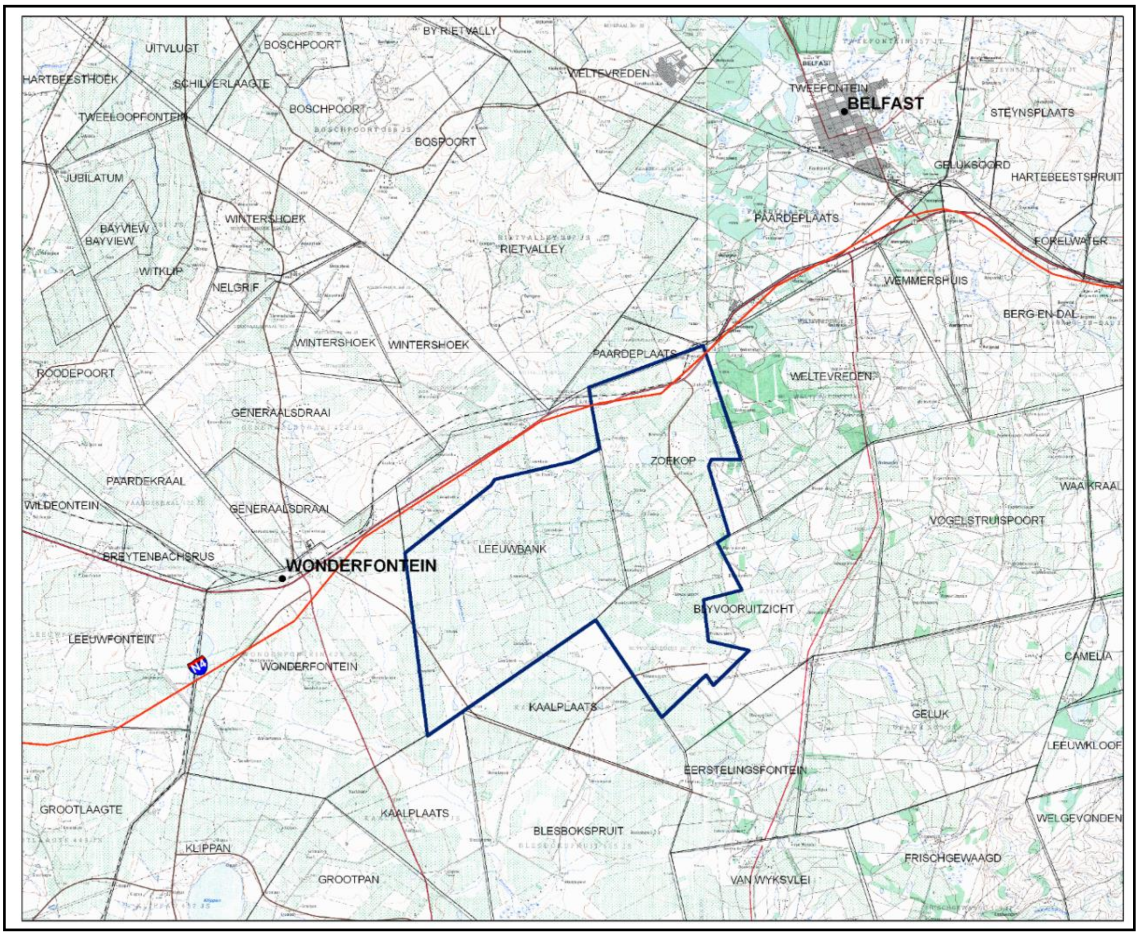

Figure 1: The proposed Belfast Project site

The proposed Belfast Project will consist of two mining areas (A and B block) of 2,390 hectares (ha) in extent. Exxaro plans to undertake opencast mining using a conventional truck and shovel operation, assisted by roll-over dozing, to allow for continuous backfilling and rehabilitation of the mined-out area, which is not anticipated to exceed 200 ha at any time. A plant will be constructed for the processing of raw coal to produce both export quality and Eskom product coal. The process will consist of crushing, screening and washing of coal. The current planned life-of-mine is:

- Two years for the construction.
- An estimated 30 year operational (production) phase.
- Four years for decommissioning, closure, rehabilitation, monitoring and maintenance.

The proposed development necessitates the undertaking of activities listed in terms of G.N. R 544, 545 and 546 (June 2010), promulgated in terms of Sections 24 and 24D of the National Environmental Management Act of 1998 [NEMA] (Act No. 107 of 1998) which requires environmental authorisation from the relevant competent environmental authority, the Mpumalanga Department of Economic Development, Environment and Tourism (DEDET).

1.1 Environmental Impact Report – Guiding Framework

This Environmental Impact Report (EIR) is compiled in accordance with the provisions of the Environmental Impact Assessment Regulations (June 2010) promulgated in terms of Chapter 5 of the NEMA. The EIR content is dictated by Regulation 31(2) of G.N. R 543 (2010) and must include the following, as a minimum requirement:

(2) An environmental impact assessment report must contain all information that is necessary for the competent authority to consider the application and to reach a decision contemplated in regulation 36, and must include –

a) details of –
i. the EAP who compiled the report; and
ii. the expertise of the EAP to carry out an environmental impact assessment;

b) a detailed description of the proposed activity;

c) a description of the property on which the activity is to be undertaken and the location of the activity on the property, or if it is –
i. a linear activity, a description of the route of the activity; or
ii. an ocean-based activity, the coordinates where the activity is to be undertaken;

d) a description of the environment that may be affected by the activity and the manner in which the physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity;

e) details of the public participation process conducted in terms of subregulation (1), including –
i. steps undertaken in accordance with the plan of study;
ii. a list of persons, organisations and organs of state that were registered as interested and affected parties;
iii. a summary of comments received from, and a summary of issues raised by registered interested and affected parties, the date of receipt of these comments and the response of the EAP to those comments; and
iv. copies of any representations, objections and comments received from registered interested and affected parties;

f) a description of the need and desirability of the proposed activity

g) A description of identified potential alternatives to the proposed activity, including advantages and disadvantages that the proposed activity or alternatives may have on the environment and the community that may be affected by the activity;

h) an indication of the methodology used in determining the significance of potential environmental *impacts;*

- i) *a description and comparative assessment of all alternatives identified during the environmental impact assessment process;*
- j) *a summary of the findings and recommendations of any specialist report or report on a specialised process;*
- k) *a description of all environmental issues that were identified during the environmental impact assessment process, an assessment of the significance of each issue and an indication of the extent to which the issue could be addressed by the adoption of mitigation measures;*
- l) *an assessment of each identified potentially significant impact, including –*
  - i. *cumulative impacts;*
  - ii. *the nature of the impact;*
  - iii. *the extent and duration of the impact;*
  - iv. *the probability of the impact occurring;*
  - v. *the degree to which the impact can be reversed;*
  - vi. *the degree to which the impact may cause irreplaceable loss of resources; and*
  - vii. *the degree to which the impact can be mitigated;*
- m) *a description of any assumptions, uncertainties and gaps in knowledge;*
- n) *a reasoned opinion as to whether the activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation;*
- o) *an environmental impact statement which contains –*
  - i) *a summary of the key findings of the environmental impact assessment; and*
  - ii) *a comparative assessment of the positive and negative implications of the proposed activity and identified alternatives;*
- p) *a draft environmental management programme containing the aspects contem[lated in regulation 33;*
- q) *copies of any specialist reports and reports on specialised processes complying with regulation 32; and*
- r) *any other matters required in terms of sections 24(4)(a) and (b) of the Act..*

1.2 Details of the Environmental Assessment Practitioner

As stipulated in the environmental regulations, the details of the EAP are included below.

Marsh Risk Consulting
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MARSH

Marsh Environmental Services, a division of Marsh (Pty) Ltd, is an environmental, health and safety service provider to South African government, business and industry, and is committed to enhancing profitability through pro-active risk management. We utilise a wide network of specialist services allowing us to offer a comprehensive solution to any environmental problem. Marsh Environmental Services has a particularly strong focus on project management, technical solution generation and review, and strategic environmental management. Marsh (Pty) Ltd is a registered Broad Based Black Economic Empowerment company.

The division has done work for companies such as De Beers, Anglo Coal, Omnia, BHP Billiton, Xstrata, LionOre, Department of Environmental Affairs, Water Research Commission, Mondi, Mittal Steel, Sasol, Kumba Resources, Pretoria Portland Cement Company (PPC), AngloGold Ashanti, Rand Water, Johannesburg Water and Impala Platinum to mention a few.

MES has extensive experience in the mining industry. A list of key mining projects undertaken by MES are presented in **Table 1**, while **Table 2** lists major EIA projects undertaken by MES..

Table 1: Mining projects undertaken by MES

Client	Type of Service	Description
Gem Diamonds	Social and Environmental Impact Assessment (SEIA)	Compilation of Legal Framework (i.e. legal requirements) as part of the SEIA for a proposed diamond mining operation within the Central Kalahari Game Reserve, Botswana.
Gem Diamonds (Pty) Ltd	L&VIA	Landscape and Visual Impact Assessment for the proposed new Diamond Mine in the Central Kalahari Game Reserve.
Minéro Consulting (Pty) Ltd	M&A / Environmental Due Diligence	For the acquisition and reopening of a previously rehabilitated mine in South Africa (company name confidential). Legal review and identification of potential enviro-legal liabilities. Quantification of environmental costs associated with these liabilities.
Minéro Consulting (Pty) Ltd	Environmental Impact Assessment	Development of an Environmental Management Programme and Integrated Water Use License Application, including public consultation for the Pering Mine located in the North-West Province.
Pixley Prospecting and Mining Operation DMC Coal Mining	Environmental Screening Report	Marsh undertook a site sensitivity analysis (Environmental Screening Analysis) of the area proposed for future mining of coal and torbanite to establish the environmental risks and associated cost relating to the mitigation of significant impacts. As part of the process, Marsh further undertook a stakeholder engagement process to assess community. NGO and public concerns. The assessment included a due process review for the approved prospecting rights
Ridge Mining	Site Selection Process	Alternative Site Analysis for the proposed new smelter.
Department of Minerals and Energy	Social and Environmental Impact Assessment	Project Manager: Social and Environmental Impact Assessment for the development of an Open-Cycle Gas Turbine Peaking Power Plant in KwaZulu-Natal, South Africa.
Investec	IFC Guidelines Compliance Review	Review of Environmental Impact Assessment and Environmental Management for proposed mining operation to assess compliance against the International Finance Corporation (IFC) social and environmental sustainability guidelines (and EHS requirements).
Confidential	M&A / Environmental Due	Investigation to determine current and future environmental liabilities as part of the due diligence undertaken for the

	Diligence	acquisition of an existing coal mine.
Bell Dewar Hall	Independent Review	Independent review of the public participation process undertaken by Mining Company (Confidential), in respect of prospecting rights application required in accordance with the provisions of the Mineral Petroleum and Resource Development Act 28 of 2002.
Confidential	Environmental Due Diligence	Identification of environmental risks associated with the development of a new opencast lime quarry and cement manufacturing plant and supporting infrastructure.
Confidential	M&A / Environmental Due Diligence	For the acquisition a gold mine in the Middle East.
GVM Metals Limited	Exit Strategy / Environmental Due Diligence	Exit strategy - independent environmental due diligence of the liabilities attaching to one of the company's mining operations and plant and independent evaluation of the maximum exit liability.
Accelor Mittal	Environmental Due Diligence	Environmental due diligence undertaken in respect of a coal mining operation located near Newcastle, South Africa.
Implex Legal Compliance Solutions – Langer Heinrich Uranium Mine	Environmental Legal Compliance Audit	Environmental legal compliance audit and associated reporting for newly established uranium mine in Namibia.

Table 2: EIA projects undertaken by MES

Client	Type of Service	Description
PPC Cement (Pty) Ltd	Environmental Impact Assessment	The introduction of Secondary Materials in the cement kiln to partly replace coal.
Robor (Pty) Ltd	Environmental Impact Assessment	Environmental Impact Assessment for the decommissioning of the RPS pickling plant.
Bombela Civils Joint Venture: Gautrain	Environmental Impact Assessment	Environmental Impact Assessment for the various unforeseen development activities initiated during the construction phase of the project.
Eskom Distribution	Environmental Impact Assessment	Project manager: Environmental Impact Assessment for a substation in Sandton, Johannesburg
Ridge Mining	Site Selection Process	Alternative Site Analysis for the proposed new smelter.
Department of Minerals and Energy	Social and Environmental Impact Assessment	Project Manager: Social and Environmental Impact Assessment for the development of an Open-Cycle Gas Turbine Peaking Power Plant in KwaZulu-Natal, South Africa.
Metal Finishing Association	Legal	Development of Environmental Legal Handbook for the Metal Finishing Association of Johannesburg, Pretoria, Durban and Cape Town.

Refer to Appendix A for further information on the EAP.

1.3 Details of the Applicant

Exxaro Coal Mpumalanga (Pty) Ltd

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1.4 Legislative Framework

1.4.1 NEMA & Applicable Listed Activities

According to Section 24 of NEMA, an activity which may have a substantial detrimental impact on the environment requires environmental authorisation from the relevant competent authority prior to the commencement of such activities proposed by the applicant.

Activities considered as having a substantial detrimental impact on the environment are listed in the EIA Regulations (2010) G.N. R 544, 545 and 546 (**Table 3** and Error! Reference source not found.**).**

Table 3: Applicable Listed Activities as per the G.N. R544, 545 and 546

Government Notice	Activity	Description of listed activity
		Activities identified in GNR 544 (Listing Notice 1)
GN R 544 18 June 2010	9	The construction of facilities or-infrastructure exceeding 1000 metres in length for the bulk transportation of water, sewage or storm water (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more, excluding where: a. such facilities or infrastructure are for bulk transportation of water, sewage or storm water or storm water drainage inside a road reserve; or b. where such construction will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse.
GN R 544 18 June 2010	10	The construction of facilities or infrastructure for the transmission and distribution of electricity (iii) **outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts**; or (iv) inside urban areas or industrial complexes with a capacity of 275 kilovolts or more.
GN R 544 18 June 2010	11	The construction of: **(i) canals;** **(ii) channels;** **(iii) bridges;** **(iv) dams;** **(v) weirs;** **(vi) bulk storm water outlet structures;**

Government Notice	Activity	Description of listed activity
		(vii) marinas; (viii) jetties exceeding 50 square metres in size; (ix) slipways exceeding 50 square metres in size; (x) buildings exceeding 50 square metres in size; or (xi) infrastructure or structures covering 50 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.
GN R 544 18 June 2010	12	The construction of facilities or infrastructure for the off-stream storage of water, including dams and reservoirs, with a combined capacity of 50000 cubic metres or more, unless such storage falls within the ambit of activity 19 of Notice 545 of 2010;
GN R 544 18 June 2010	18	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from- **(i) a watercourse;** (ii) the sea; (iii) the seashore; (iv) the littoral active zone, an estuary or a distance of 100 metres inland of the high water mark of the sea or an estuary, whichever distance is the greater but excluding where such infilling, depositing, dredging, excavation, removal or moving (i) is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority; or (ii) occurs behind the development setback line.
GN R 544 18 June 2010	22	The construction of a road, outside urban areas, (i) with a reserve wider than 13,5 meters, or, (ii) where no reserve exists where the road is wider than 8 metres, or (iii) for which an environmental authorisation was obtained for the route determination in terms of activity 5 in Government Notice 387 of 2006 or activity 18 in Notice 545 of 2010.
		Activities identified in GNR 545 (Listing Notice 2)
GN R 545 18 June 2010	3	The construction of facilities or infrastructure for the storage, or storage and handling of a dangerous good, where such storage occurs in containers with a combined capacity of more than 500 cubic metres.
GN R 545 18 June 2010	5	The construction of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent and which is not identified in Notice No. 544 of 2010 or included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case that Act will apply.
GN R 545 18 June 2010	6	The construction of facilities or infrastructure for the bulk transportation of dangerous goods - iv. in gas form outside an industrial complex, using pipelines, exceeding 1000 metres in length, with a throughput capacity of more than 700 tons per day v. in liquid form, outside an industrial complex, using pipelines, exceeding 1000 metres in length, with a throughput capacity more than 50 cubic metres per day; or

Government Notice	Activity	Description of listed activity
		vi. in solid form, outside an industrial complex, using funiculars or conveyors with a throughput capacity of more than 50 tons day.
GN R 545 18 June 2010	10	The construction of facilities or infrastructure for the transfer of 50 000 cubic metres or more water per day, from and to or between any combination of the following: (i) water catchments, (ii) water treatment works; or **(iii) impoundments,** excluding treatment works where water is to be treated for drinking purposes.
GN R 545 18 June 2010	11	The construction of railway lines, stations or shunting yards, excluding - (i) railway lines, shunting yards and railway stations in industrial complexes or zones; (ii) underground railway lines in a mining area; and (iii) additional railway lines within the reserve of an existing railway line;
GN R 545 18 June 2010	15	Physical alteration of undeveloped, vacant or derelict land for residential, retail, commercial, recreational, **industrial** or institutional use where the total area **to be transformed is 20 hectares or more;** except where such physical alteration takes place for: (i) linear development activities; or (ii) agriculture or afforrestation where activity 16 in this Schedule will apply.
Activities identified in GN R 546 for Mpumalanga (Listing Notice 3)		
GN R 546 18 June 2010	13	The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for a linear activity falling below the thresholds mentioned in Listing Notice 1 in terms of GN No. 544 of 2010.
GN R 546 18 June 2010	14	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation in all areas outside urban areas
GN R 546 18 June 2010	19	The widening of a road by more than 4 metres or the lengthening of a road by more than 1 kilometre.

In terms of the EIA Regulations any activity listed in G.N. R 545 (Listing Notice 2) is subject to the Scoping / Environmental Impact Assessment Process (Error! Reference source not found.), prescribed by Part 3 of G.N. R 543. The purpose of the EIA Process is to identify the potential environmental impacts associated with the proposed activity and further assess the extent and significance thereof.

1.6 Additional Applications

In addition to obtaining environmental authorization in terms of NEMA from DEDET for the above listed activities, the proposed project must be authorised in terms of the following legislation before proposed mining activities may be initiated.

1.6.1 Mineral and Petroleum Resource Development Act, Act 28 of 2002

Exxaro must be in possession of an approved Mining Right for the mining of coal within the study area before mining operations may commence.

Exxaro submitted a mining right application to the Department of Minerals and Energy (DME)[1], Mpumalanga Province which was accepted on 10 July 2009 [MP 30/5/1/2/2/431 MR]. A Scoping Report, as per Regulation 49(1) of the Mineral and Petroleum Resources Development Act [MPRDA] (Act No. 28 of 2002), was submitted to the DME on 07 August 2009. An Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP) Report in terms of Regulations 50 and 51 were submitted on 8 January 2010 to the DME for approval.

A final decision has not yet been issued by the DMR.

1.6.2 National Water Act, Act 36 of 1998

In accordance with Section 21 and 40 of the NWA a water use licence application is under review with the Department of Water Affairs (DWA). The following water uses have been applied for:

- Section 21 a – Abstraction of water for water from a pipeline or groundwater
- Section 21 b – Storage of water for both raw and potable water use
- Section 21 c & i – Impeding or diverting the flow of water in a watercourse & altering the bed, banks, course or characteristics of a watercourse
- Section 21 f – Discharging waste or water containing waste into a water resource through a pipe or canal for the disposal of sewage works effluent and the disposal of sludge at the water purification plant
- Section 21 g – Disposing waste or water containing waste in a manner which may detrimentally impact on a water resource for the pollution control dams, overburden dumps, coal stockpiles and discard dumps
- Section 21 j – Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity for the safety of the people for the dewatering of the mining pits to facilitate mining and to provide a safe mining environment

Groundwater Consulting Services (GCS) have completed the requisite Integrated Water Use License Application (IWULA) for the proposed mining project. The application was submitted to the DWA in February 2012 for consideration.

1.7 Legislation and Policy Documents considered during the Environmental Assessment

1.7.1 General

Environmental Rights
The Constitution of the Republic of South Africa Act, No. 108 of 1996
Section 24 states that: ▪ Everyone has the right to an environment that is not harmful to their health or well-being ▪ Everyone has the right to have the environment protected for the benefit of present and future generations

Environmental Management Guiding Principles
National Environmental Management Act, No. 107 of 1998
Comments or findings pertaining to the principles are not included specifically though all sections in this report but

[1] Now referred to as the Department of Mineral Resources (DMR)

have been applied with these principles in mind.

The National Environmental Management principles, listed at Section 2 of the National Environmental Management Act 107 of 1998 (NEMA), which provide for the social, environmental and economic sustainability of activities, apply "to the actions of all organs of state that may significantly affect the environment".

- Environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental and cultural and social interests equitably (Section 2(2))
- Pollution and degradation of the environment must be avoided, or, where they cannot be altogether avoided, are minimised and remedied (Section 2(4)(ii)
- The use and exploitation of non-renewable natural resources is responsible and equitable, and takes into account the consequences of the depletion of the resource (Section 2(4)(v)
- A risk-averse and cautious approach is applied, which takes into account the limits of current knowledge about the consequences of decisions and actions (Section 2(4)(vii)
- The participation of all interested and affected parties in environmental governance must be promoted, and all people must have the opportunity to develop the understanding, skills and capacity necessary for achieving equitable and effective participation, and participation by vulnerable and disadvantaged persons must be ensured (Section 2(4)(f))
- Decisions must take into account the interests, needs and values of all interested and affected parties, and this includes recognising all forms of knowledge, including traditional and ordinary knowledge (Section 2(4)(g))
- The social, economic and environmental impacts of activities, including disadvantages and benefits, must be considered, assessed and evaluated, and decisions must be appropriate in the light of such consideration and assessment (Section 2(4)(i))

Duty of Care and Remediation of Environmental Damage

The duty of care principle is overtly regulated in sections 28 (1) and (3) of the National Environmental Management Act of 1998, and the National Water Act, Section 1:

(1) Every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment
(3) The measures required in terms of subsection (1) may include measures to-

- Investigate, assess and evaluate the impact on the environment
- Inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed in order to avoid causing significant pollution or degradation of the environment
- Cease, modify or control any act, activity or process causing the pollution or degradation
- Contain or prevent the movement of pollutants or the cause of degradation
- Eliminate any source of the pollution or degradation
- Remedy the effects of the pollution or degradation
- Remedy the effects of any disturbance to the bed and banks of a watercourse

Although Section 28 is applicable to all areas of pollution and environmental impact, only those items which have not specifically been addressed in subsequent sections and items of particular importance to Section 28 are included here. However, this section must be borne in mind when assessing any environmental impact described in subsequent sections.

Access to Environmental Information

Promotion of Access to Information Act of 2000 Section 70 and NEMA Section 31

Anyone has the right to request information of an environmental nature from the Client and cannot be refused on grounds that are not compliant with the legal requirements.

1.7.2 National Environmental Air Quality Act, No. 39 of 2004

The object of this Act is-
(a) to protect the environment by providing reasonable measures for-
(i) the protection and enhancement of the quality of air in the Republic;
(ii) the prevention of air pollution and ecological degradation; and
(iii) securing ecologically sustainable development while promoting justifiable economic and social development; and
(b) generally to give effect to section 24(b) of the Constitution in order to enhance the quality of ambient air for the sake of securing an environment that is not harmful to the health and well-being of people.

The act aims to minimise pollution through vigorous control, cleaner technologies and cleaner production practices, thereby ensuring that air quality is improved.

Comments or findings pertaining to these principles are not included specifically though all sections in this report but have been applied with these principles in mind.

Air Quality Standards

Air quality guidelines and standards are fundamental to effective air quality management, providing the link between the source of atmospheric emissions and the user of that air at the downstream receptor site. The ambient air quality guideline values indicate safe daily exposure levels for the majority of the population, including the very young and the elderly, throughout an individual's lifetime. The South African Air Quality Standards are provided in **Table 4**.

Table 4: South African Air Quality Standards

Status	Averaging period						
	Instantaneous peak	1 hour	8 hours	24 hours		Annual	
Standards ($\mu g/m^3$)	Current [(a)]	Proposed [(b)]		Current [(a)]	Proposed [(b)]	Current [(a)]	Proposed [(b)]
PM10				180	75	60	40
SO_2	500	350		125		50	
NO_2	940	376		188	200	94	40
CO_2		30,000	10,000				

[(a)] As per Schedule 2 of the NEM Air Quality Act (Act No. 39) of 2004
[(b)] As per Government Notice 263 in Government Gazette 31987 published 13 March 2009 for public comment)

Updated ambient air quality standards for South Africa were published (Gazette No. 32816, 24 December 2009). The updated PM10 standards issued nationally are documented in **Table 5**.

Table 5: National Air Quality Standard for Inhalable Particulates less than 10 µm in Diameter (PM10)

Authority	Maximum 24-Hour Concentration ($\mu m/m^3$)	Annual Average Concentration ($\mu m/m^3$)
SA Standards (Government Gazette No.: 32816)	120[(a)]	60
SA Standards (Government Gazette No.: 32816)	75[(b)]	40

[a] Not to be exceeded more than 4 times per year. Applicable immediately to 31 December 2014.
[b] Not to be exceeded more than 4 times per year. Applicable from 1 January 2015.

Water and Wastewater Management

Pollution of Water Resources
National Water Act, No. 36 of 1998: Section 19
Measures must be undertaken by the Developer/Proponent to: ▪ Cease, modify or control any act or process causing pollution ▪ To contain or prevent the movement of pollutants ▪ To remedy the effects of pollution

Water Wastage
National Water Act of 1998, Section 22(2)(d)
Water wastage is prohibited under this section. The developer/proponent must therefore be able take account for all the water received and be able to demonstrate the optimal use of water.

Waste Management

Disposal of Waste
National Environmental Management Waste Act, No.59 of 2008
The objects of this Act are— (a) to protect health, well-being and the environment by providing reasonable 15 measures for— (i) minimising the consumption of natural resources; (ii) avoiding and minimising the generation of waste; (iii) reducing, re-using, recycling and recovering waste; (iv) treating and safely disposing of waste as a last resort; (v) preventing pollution and ecological degradation; (vi) securing ecologically sustainable development while promoting justifiable economic and social development; (vii) promoting and ensuring the effective delivery of waste services; (viii) remediating land where contamination presents, or may present, a significant risk of harm to health or the environment: and (ix) achieving integrated waste management reporting and planning; (b) to ensure that people are aware of the impact of waste on their health, well-being and the environment; (c) to provide for compliance with the measures set out in paragraph (a)\ and (d) generally, to give efleet to section 24 of the Constitution in order to secure an environment that is not harmful to health and well-being. No person may commence, undertake or conduct a waste management activity listed in the General Notice 718 unless a licence is issued in respect of that activity.

Governing Principles for Waste Management
Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste, 2nd Edition (DWAF, 1998)
The following principles, many of which are considered internationally as being essential for the management of Hazardous Waste, are acknowledged in the Minimum Requirements and will also be acknowledged in future regulations. **'**Duty of Care Principle' – whereby the generator of the waste is ultimately responsible for ensuring that the waste is

handled, stored, transported and disposed of according to the legislation and in an environmentally sound and responsible manner.

'Polluter Pays Principle' – the person or organisation causing pollution is liable for any costs involved in remediation or rehabilitating its effects. The generator of the waste is thus liable unless able to prove that the transferral of management of the waste was a responsible action.

'Precautionary Principle' – All waste is assumed to be both highly hazardous and toxic until proven otherwise.

Waste Collection and Storage

Section 20(1) of the Environmental Conservation Act, 1989 (Act No. 73 of 1989) states that no disposal site may be established or operated without a permit issued by the Department of Water Affairs.

"Disposal site" means a site used for the accumulation of waste with the purpose of disposing or treatment of such waste, and as such covers any permanent (> 90 days) on-site waste accumulation areas on Client's premises.

Biodiversity

Weeds and Invader Plants

The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983)

Specifies certain plants that declared weeds and invader plants that must be controlled or eradicated. These species are divided into three categories, and the control measures applicable to the respective categories are as follows:
Category 1: Invader plants which have been declared weeds and which may not be allowed to occur on land or in inland water surfaces (other than in biological control reserves).
Category 2: Invader plants that may only occur in areas that have been specifically demarcated for this purpose.
Category 3: Invader plants that may continue to grow where they already exist. However, no propagating, new planting or trade is allowed and such plants may not occur within 30 metres of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland.

International Law

Convention on Biological Diversity (CBD), June 1993, Ratified 2 November 1995

The aim of the CBD is to effect international co-operation in the conservation of biological diversity and to promote sustainable use of the living natural resources worldwide. It also aims to bring about the sharing of the benefits arising from the utilisation of natural resources.

Threatened or Protected Species

National Environmental Management: Biodiversity Act 10 of 2004 section 57

A person may not carry out a restricted activity involving a specimen of a listed threatened or protected species without a permit.

New Activities

Environmental Impact Assessments

Environmental authorisation for the project is required in terms of Sections 24 and 24D of the National Environmental Management Act (NEMA), 1998 (Act No. 107 of 1998), in terms of which GN R 544, 545 and 546 were promulgated, which lists the activities that require such an assessment. The applicable activities are listed in Section 2.1.

Contractors and Tenants

The Law of Contract

As a general rule, the Developer/Proponent cannot escape liability to third parties in terms of an agreement between themselves and a contractor. Such an agreement is not binding on third parties. A third party will still be able to hold Developer/Proponent liable. It is possible for Developer/Proponent to join the contractor as a defendant in legal proceedings, alternatively, recover the damages (or part thereof) paid to the third party from the contractor on a contractual basis.

The agreement between Developer/Proponent and the contractor must at least state that the contractor is aware of all the applicable environmental legislation pertaining to his tasks and that the contractor will strictly adhere to this legislation.

Contractors / Tenants on Site

This section applies to any contractor working on site or tenant on the property controlled by the Proponent. This section is included as additional information in ensuring compliance (with regards to all section above) of Client is maintained - compliance remarks is thus not included in this section.

As mentioned in section 3 in this Register, NEMA section 28(1) states that reasonable measures must be taken to prevent pollution or degradation of the environment. Section 28(2) states that the persons on whom subsection (1) imposes an obligation to take reasonable measures include an owner of land or premises, a person in control of land or premises or a person who has a right to use the land or premises.

Section 154(a) of the National Water Act states the following:

154. Offences in relation to employer and employee relationships:
Whenever an act or omission by an employee or agent constitutes an offence in terms of this Act, and takes place with the express or implied permission of the employer or principal, as the case may be, the employer or principal, as the case may be, is, in addition to the employee or agent, liable to conviction for that offence.

The Proponent would be considered as the Employer or Principal, the employee or agent being the tenant or contractor. Developer/Proponent is therefore responsible for ensuring that contractors and tenants are compliant with the legislation where it affects the site. Thus Proponent may be liable for any illegal discharges, spills or accidents caused by these contractors or tenants (in addition to these contractors or tenants being liable).

Heritage

South African Heritage Resources

National Heritage Resources Act, Act 25 of 1999

The SA Heritage Resources Agency (SAHRA) must be notified during the early stages certain planned activities (barriers, bridges, change of site character). Certain permit and reporting requirements apply for heritage sites, structures older than 60 years, archaeological, palaeontological and meteorite findings, burial grounds and graves and public monuments and memorials.

Common Law

Common law principles form the basis of current neighbour law and the law of nuisance. It protects an individuals use and enjoyment of property, but limits the use of property so such use does not interfere with the rights of other people (i.e. Neighbours).

Developer/Proponent has not taken reasonable measures to ensure that contractors/stakeholders on site are aware of their responsibility on site and the environmental legal requirements (indicated by the incidents and potential incidents that may have caused environmental degradation associated with the contractors/stakeholders activities.

Delict, Nuisance & Neighbour Law

Nuisance and neighbour law are both fall under the law of delict. Nuisance law means to cause a disturbance to another person. This means that the requirements for a successful delict as outlined below apply to neighbour law and the law of nuisance.

The common law rules of delict, nuisance and neighbours can be used to protect your client's environmental rights relating to:

- Noise Pollution
- Air Pollution
- Water Pollution

The Law of Delict – Actions of other People that Cause Harm to Your Clients

The common law of delict allows an individual to claim compensation from someone who does something that causes harm.

Requirements for a successful delictual claim

For such a claim to succeed the person making the claim (the claimant) must prove:

- That the action of the other person was wrong
- That the person doing the action was negligent, i.e. that the other person was at fault
- That the claimant suffered a loss which can be given a monetary value
- That the action of the negligent person caused the monetary loss
- The requirements of wrongfulness and negligence are very important here

Was the Action Wrong?

In deciding whether an action was wrong the law tries to determine which actions are seen as wrong by the community as a whole. The action must be wrong because it violates a legal duty to take care (e.g. NEMA, Section 28: ‘Duty of Care’) or because it results in an unjustified infringement of the legally protected rights of another person. Generally speaking it is wrong to cause harm to another person or their property through negligent conduct.

Was the Action Negligent?

A person's liability to pay a claim (their guilt) usually depends on whether or not the court finds that they were at fault - i.e. Whether they acted negligently or not. In order to test whether the person doing the action was negligent, the courts apply the test of the "reasonable man". In applying this test the court asks:

- Would the reasonable man, in the position of the person doing the action, have foreseen that the action would cause harm?
- Would the reasonable man have taken steps to avoid the harm?
- The court may find the action of a person caused the damage to the claimant and he or she will have to pay the claimant a sum of money equal to the amount of damage that the claimant suffered to compensate the claimant for his loss, if the court finds:
  - That the reasonable person would have foreseen that the action would cause harm
  - That the reasonable person would then have taken steps to avoid the harm
  - That the person who actually did the action did not take steps to avoid the harm

The Law of Nuisance

The Law of Nuisance is divided into three categories:

- Public nuisance - where someone's action causes an inconvenience to the general public
- Private nuisance - where an action by one person interferes with another person in the ordinary use of his or her property
- Statutory nuisance - where a legislative authority declares an action or process to be a nuisance

The Law of Private Nuisance

The law of Private Nuisance recognises the right of an owner of land to enjoy their land in physical comfort, convenience and well-being without unreasonable interference from others. Due to the fact that we have to make some allowances for the actions of the people with whom we share our society, each landowner must be prepared to put up with some interference with their right to enjoy their land. It is therefore possible for this right to enjoy land to be interfered with by smoke, gas, fumes or noise generated by another person, as long as it is not unreasonably interfered with. If the interference is unreasonable then the landowner can take legal action to protect his right to enjoy his land under the law of private nuisance.

In the case of private nuisance the person who is usually liable is the person who owns the land from which the nuisance originates. The following people may be liable:

- The owner or occupier of the land who actually causes the nuisance
- The person who did not cause the nuisance in the first place, but who has control of the land or has taken over control of the land

The person who has taken over the land is only liable if that the nuisance is on-going, he or she became aware of the nuisance, and failed to take reasonable steps to stop or limit the nuisance.

The Law of Neighbours

It is a general rule of our law that a landowner may not use his or her property in a way that causes harm to another person. This means that a landowner's right to use the property is limited and that there is an obligation on him or her not to act in a way that will infringe the rights of a neighbour.

The test of whether the landowner's use of his property fails to comply with this obligation is one of reasonableness and fairness. This principle of reasonableness is relevant to all forms of polluting activities.

1.8 Study Limitations and Constraints

This section of the report identifies the knowledge gaps applicable to the EIA.

1.8.1 Restricted Access to Farm Portions

Access to the following farm portions was not provided to the specialist consulting team or EAP for the concise collection of data (in which case a desktop analysis was undertaken) for document compilation:

- Portion 3, 6, 9 and 16 of the Farm Zoekop 426 JS registered in favour of G.L. Roos and Soekop Trust
- Portion of Re of Portion 4, Portion of Portion 5 and portion of Portion 6 of the Farm Leeuwbank 427 JS registered in favour of G.L. Roos and Soekop Trust

1.8.2 Assumptions and Limitations

Air Quality Impact Assessment

- The impact assessment was limited to airborne particulates (including Total Suspended Particulates (TSP)) and inhalable particulate matter (PM10).
- A baseline air quality assessment is established through monitoring and/or simulating the dispersion of air pollutants from all significant sources in the area of interest. As no baseline air pollution monitoring data could be sourced for the study, the predicted concentrations were limited to incremental impacts from the Belfast mining activities.
- Particle size distributions for stockpiles (i.e. topsoil, overburden, run of mine (ROM) and road surfaces were not available for the current study. Use was therefore made of particle sizes obtained from similar operations.
- Average mining process throughputs were utilised for the dispersion model (AERMOD).

Ecological Impact Assessment

- Local access permission issues in and around many of the sites and locations reduced the number of sites, thus the baseline assessment of certain areas within the study area could not be conducted. This was in the northern part of the project area on the farms: Leeuwbank 427/6, Zoekop 426/6 and 426/3.

Heritage Impact Assessment

The investigation has been influenced by the following factors related to the overall Heritage Impact Assessment:

- Availability and reliability of baseline information about the affected area.
- Unpredictability of buried archaeological / palaeontological remains.
- Difficulty in establishing any intangible heritage issues.
- Owners of some farm portions did not give permission of access.
- Dense vegetation that may have obscured heritage features.

Social Impact Assessment

- Although Stats SA provides certain statistical updates on a regular basis these updates are at the national and provincial levels, with some such as the Community Survey, 2007, extending to the municipal level. At the municipal and ward levels, however, there are gaps in the official data obtainable from Stats SA as data, at these levels, dates back to Census 2001. Although this lack of more recent area specific data has been a limiting factor these limitations have not been insurmountable as a fair, if not relatively accurate estimate, can be obtained by plotting the available data against updated provincial and national trends.
- While every attempt was made to provide an opportunity for all affected and interested parties to participate in this study, what is usually the case with research of this nature is that only those people with fairly strong views about the proposed project are prepared to take the time and make the effort to participate. Consequently, the results of the study cannot be generalised to the entire research population and in analysing the results conclusions are drawn in regard to the characteristics and views of those I&APs who participated in the study.

Traffic Impacts

A detailed Traffic Impact Assessment must be undertaken in order to determine the potential impact on roads and upgrades/infrastructure required in order for roads to accommodate the proposed Exxaro Belfast project.

General

- Conditions may exist which were undetectable given the limited nature of the enquiry Marsh was retained to undertake with respect to the site. Variations in conditions may occur between investigatory locations, and there may be special conditions pertaining to the site which have not been revealed by the investigations and which have not therefore been taken into account in the document.
- It is recognised that the passage of time affects the information and assessment provided in this Document. Marsh's opinions are based upon information that existed at the time of the production of the Document. It is understood that the Services provided allowed Marsh to form no more than an opinion of the actual conditions of the site at the time the site was visited and cannot be used to assess the effect of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.
- Any assessments made in this Document are based on the conditions indicated from published sources and the investigations described. No warranty is included, either express or implied, that the actual conditions will conform exactly to the assessments contained in this Document.
- Where data supplied by the client or other external sources, including previous site investigation data and specialist reports, have been used, it has been assumed that the information is correct unless otherwise stated. No responsibility is accepted by Marsh for incomplete or inaccurate data supplied by others.

2

Project Description

2.1 Project Background

As previously mentioned, Exxaro currently operates a coal mining complex in the Mpumalanga province. As part of the NBC, Exxaro is in the process of assessing the feasibility of the Belfast Project, situated approximately 10 km southwest of the Belfast town.

Exxaro aim to undertake the opencast mining of coal on selected farms listed in **Table 6**. Exxaro will undertake continuous rehabilitation throughout the Life of Mine (LoM) and the active mining area will in all likelihood not exceed 200 ha at any time.

2.2 Location of the Proposed Activity

Exxaro have applied to the Department of Minerals Resources (DMR) for a mining right over an area in extent of approximately 5,819.18 ha on various portions of the farms Zoekop 426 JS, Leeuwbank 427 JS and Blyvooruitzicht 383 JT (**Table 6**) in the magisterial district of Belfast in Mpumalanga (**Figure 2** and **Figure 3**).

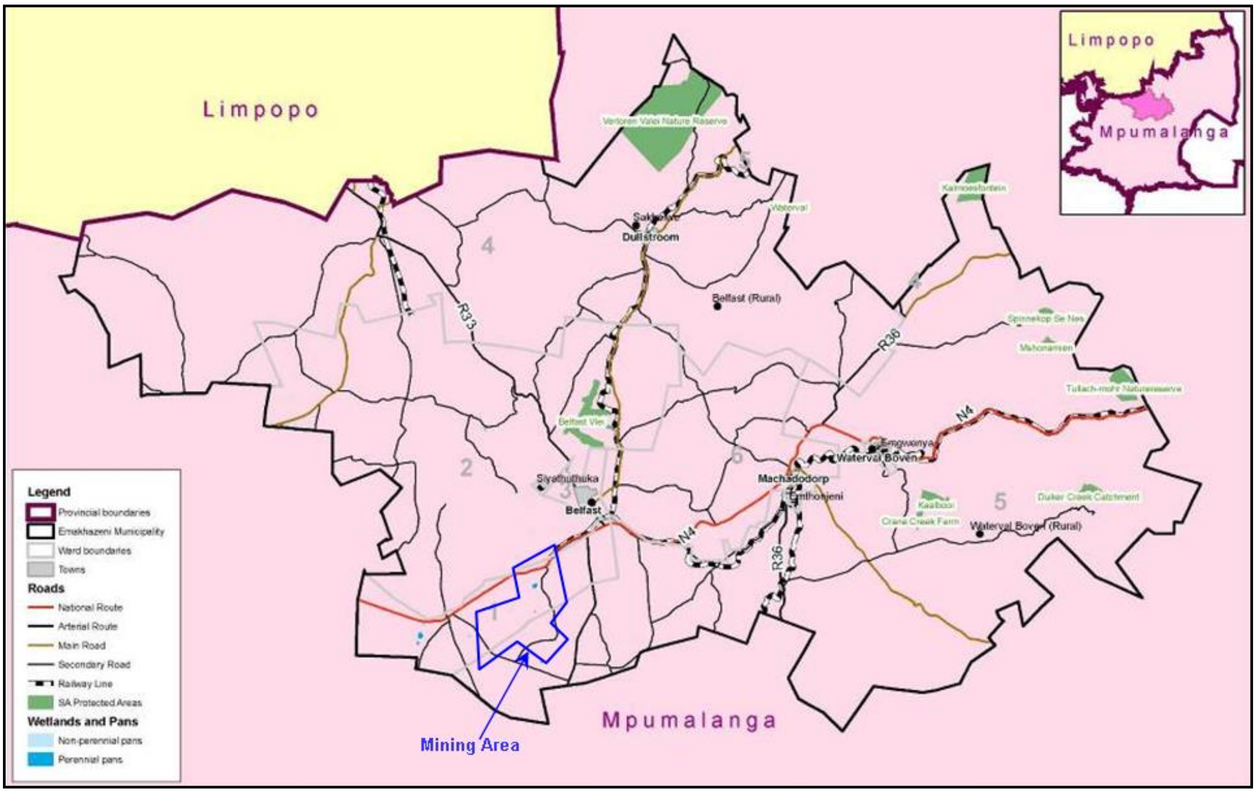

Figure 2: Location of the Belfast Project Area within the Emakhazeni Local Municipality, Mpumalanga

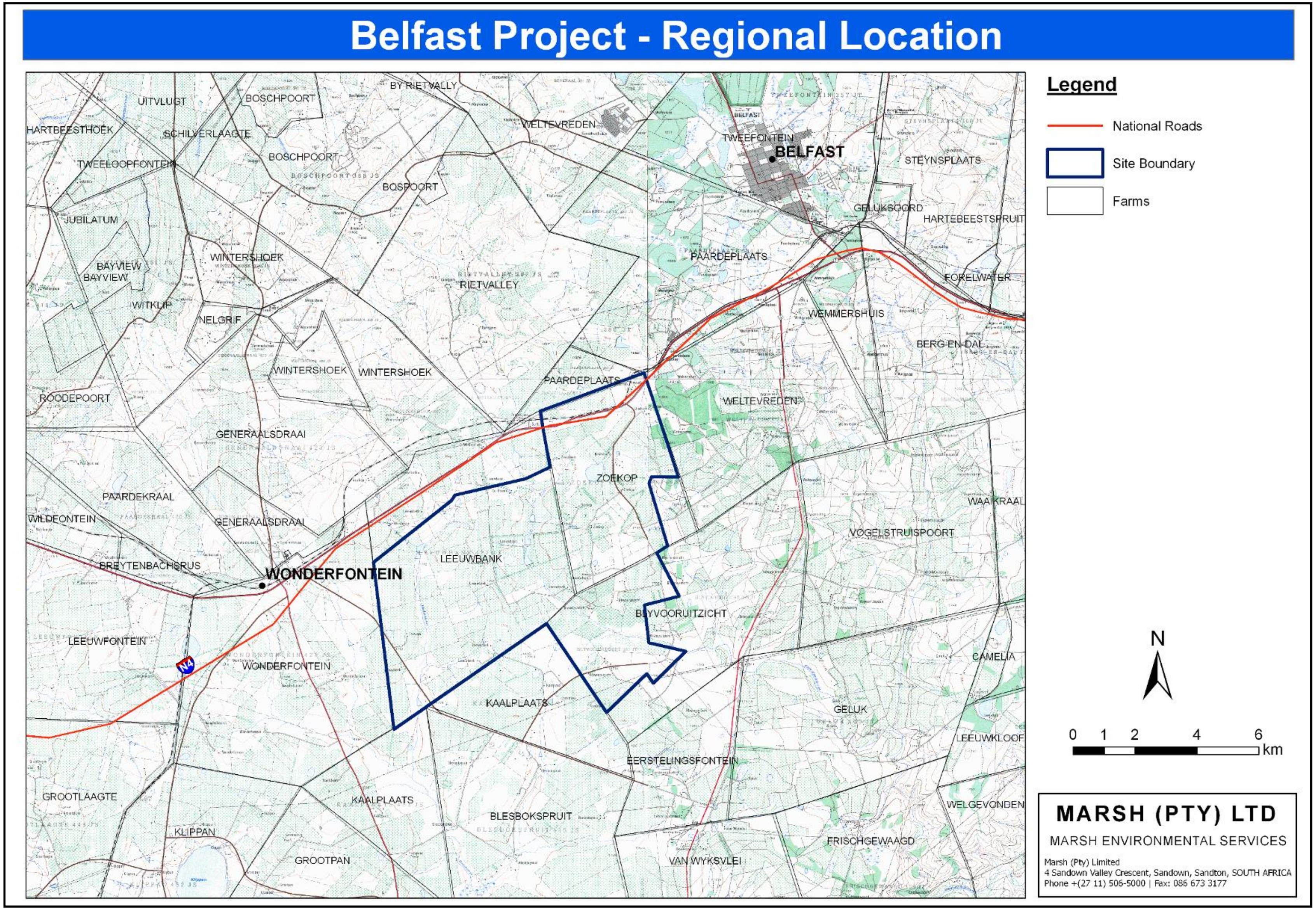

Figure 3: NBC – Belfast Project Regional Location

Table 6: Description of the Mining Area

Farm name	Portion	Deed Number	Owner
Zoekop 426 JS	Remaining Extent (RE)	T 108970 / 1997	Exxaro Resources Ltd
	Portion 1	T 38438 / 1990	Exxaro Resources Ltd
	RE Portion 2	T 108970 / 1997	Exxaro Resources Ltd
	RE Portion 3	T 17060 / 1997	Soekop Trust
	RE Portion 4	T 3358 / 1990	A. Viljoen
	Portion 5	T 10909 / 1985	Exxaro Resources Ltd
	Portion 6	T 53815 / 1986	G. Roos
	RE Portion 7	T 79636 / 189	Exxaro Resources Ltd
	Portion 8	T 16689 / 1982	J. Gerrits
	Portion 9	T 53815 / 1986	G. Roos
	RE Portion 11	T 14481 / 2008	Zoekop Farmers Trust
	Portion 12	T 38438 / 1990	Exxaro Resources Ltd
	RE Portion 13	T 77921 / 2003	Exxaro Resources Ltd
	RE Portion 14	T 17438 / 1995	Victory Fellowship Church
	Portion 15	T 10909 / 1985	Exxaro Resources Ltd
	Portion 16	T 142225 / 2004	Soekop Trust
	Portion 21	T 16398 / 1992	Transnet Ltd
Leeuwbank 427 JS	Portion of the RE	T 44235 / 1980	G. Roos
	Portion of RE of Portion 2	T 23347 / 2003	P. van Wyk
	Portion 3	T 13090 / 1968	D. Botha
	Portion of RE of Portion 4	T 5 188 / 1988	G. Roos
	Portion of Portion 5	T 40298 / 1975	G. Roos
	Portion of Portion 6	T 40298 / 1975	G. Roos
	Portion 7	T 31222 / 1991	J. Burger
	Portion 8	T 31222 / 1991	J. Burger
	RE Portion 9	T 46510 / 2001	Hooggenoeg Boerdery cc
	Portion 10	T 84645 / 1989	J. Burger
	Portion 11	T 10909 / 1985	Exxaro Resources Ltd
	Portion 15	T 46510 / 2001	Hooggenoeg Boerdery cc
	Portion 16	T 113513 / 2000	Beestepan Boerdery (Pty) Ltd

Farm name	Portion	Deed Number	Owner
Blyvooruitzicht 383 JT	RE Portion 2	T 101146 / 1993	Exxaro Resources Ltd
	RE Portion 6	T 15402 / 1987	J. Burger
	RE Portion 7	T 101146 / 1993	Exxaro Resources Ltd
	RE Portion 8	T 101146 / 1993	Exxaro Resources Ltd
	Portion 9	T 8150 / 1996	Exxaro Resources Ltd
	RE Portion 10	T 62917 / 1987	Exxaro Resources Ltd

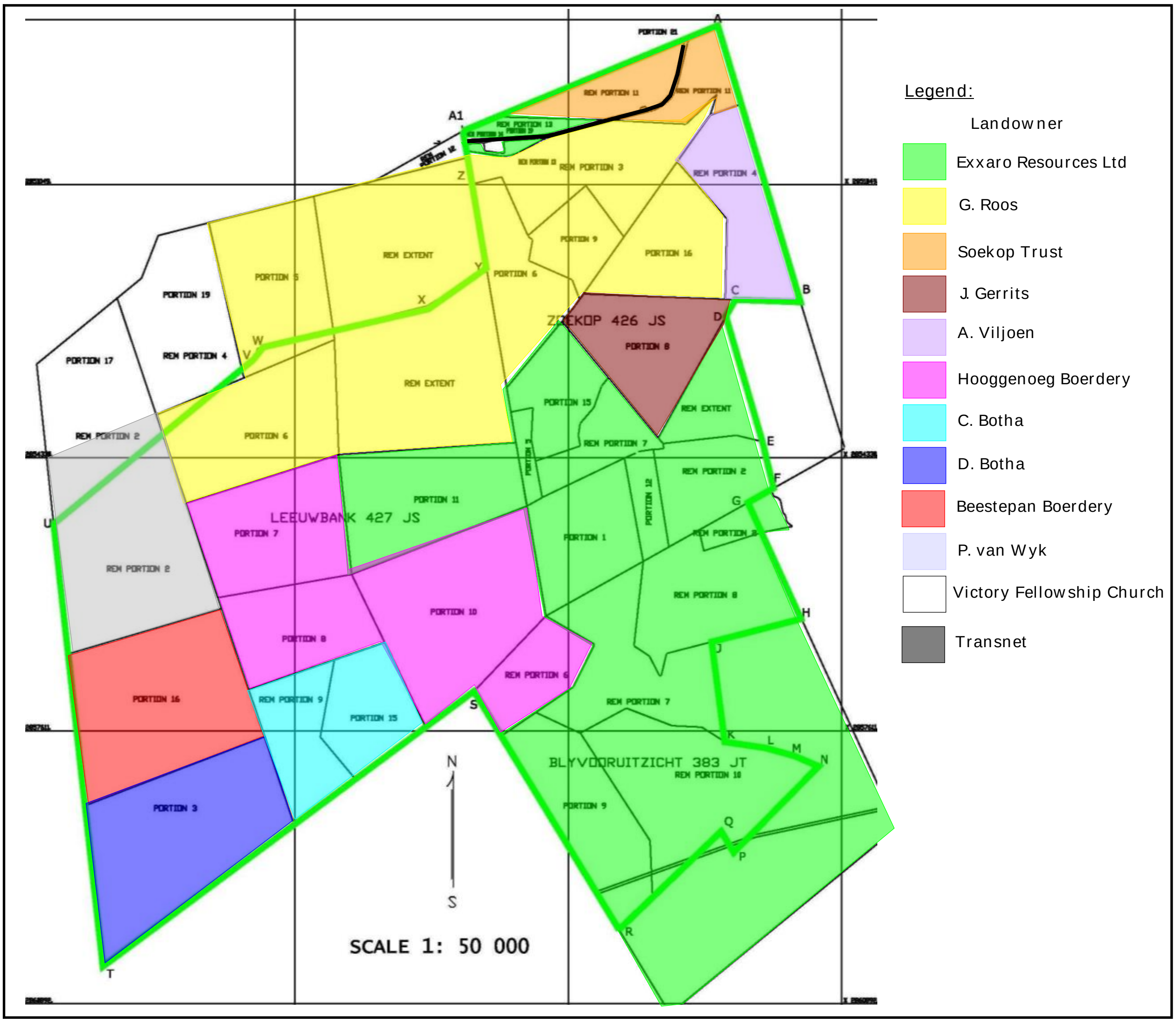

Figure 4: Belfast Project Showing the Various Farms Portions

The co-ordinates of the mining area shown in **Figure 4** and are listed in **Table 7.** The co-ordinates are provided in datum WGS84.

Table 7: Geographic Co-ordinates of the Registered Mining Area

Reference	WGS 84 – Hartebeesthoek 94	
	Y Co-ordinate (East)	X Co-ordinate (South)
A	-100191,990	2849434,594
B	-101184,153	2852757,695
C	-100400,345	2852729,934
D	-100288,946	2852930,702
E	-100726,778	2854434,096
F	-100861,185	2854994,963
G	-100553,946	2855167,736
H	-101189,624	2856565,248
J	-100118,779	2856841,218
K	-100274,897	2858042,592
L	-100768,915	2858116,498
M	-101107,826	2858211,404
N	-101400,740	2858336,103
P	-100383,523	2859371,166
Q	-100233,076	2859118,367
R	-99007, 025	2860299,027
S	-97267,705	2857434,109
T	-92817,381	2860741,573
U	-92226,642	2855423,900
V	-94623,824	2853448,560
W	-94675,776	2853315,985
X	-96712,743	2852804,853
Y	-97418,499	2852360,870
Z	-97190,969	2851021,366
A1	-97125,296	2850643,684

2.3 Surrounding Land Uses

The area around the Belfast Project area is currently used for agricultural purposes (the cultivation of maize, potatoes, sunflower and other crops), grazing and forestry (Eucalyptus and Wattle). The following infrastructure is encountered in the area:

- The N4 toll road.
- Farm roads.
- Farm dams.
- The railway line from Johannesburg to Maputo.
- Power lines.
- Telephone lines.
- Agricultural homesteads.
- Dwellings.

Residential

The proposed site is surrounded by agricultural homesteads as well as other dwellings that are mostly used by farm workers. To the south of the site is Eerstelingsfontein which is a small residential area with a farm school. This residential area is mainly for the farms workers in the area. Other residential areas include the town of Belfast, located to the northeast of the site and Arnot which is located approximately 17 km southwest of the site.

Tourism

The N4 is a well know tourist route that provides access to tourist destinations such as Nelspruit, Kruger National Park and Maputo. During the site visit it was noted that there are currently no tourist facilities in the direct vicinity of the proposed NBC Belfast site but there are tourist facilities (spa and guest houses) closer to Belfast.

Infrastructure and Business

Most of the business activities are located closer to Belfast. There are however smaller businesses spread throughout the proposed site such as the Wonderfontein area and horse farmers. An existing mine is located directly west of the proposed plant site. Other infrastructure in the area are existing power lines, railway and local farm roads.

Transportation systems

Major roads in the area include the N4 directly north / east / south / west of the site, the R33 directly east of the site as well as other farm roads. To the north of the N4 is the railway line from Johannesburg to Maputo.

Mining Operations

There are a number of mines and proposed mining operations situated in the Komati catchment, as indicated in **Table 8**.

Table 8: Mines Occurring in the Komati Catchment[2]

Mine	Company	Type	Current status
Operational			
Grootpan / Klippan / Steelecoal	Umcebo	Opencast / Underground	Open pit evaporation
Blinkpan	-	Opencast	Decommissioned
Strathrae	Umcebo / Exxaro	Opencast / underground	Unknown
Onverdacht	Xstrata Alloys	Opencast	Unknown
Jagtlus	Northern Coal	Opencast	Unknown
Mimosa	Northern Coal	Opencast	Unknown
Tselentis	Xstrata	Opencast	Decanting
Eastside Coal	Eastside Colliery	Opencast	Unknown

[2] Information provided by email by Mr. Pretorius from the Escarpment Environment Protection Group (EEPOG) on 08 December 2009.

Mine	Company	Type	Current status
Worldwide Coal	Worldwide Coal	Opencast	Unknown
Paardeplaats and Droogvallei Collieries	Coastal Fuels	Opencast / Underground	Open pit evaporation
Closed			
Witrand	Coastal Fuels	Opencast	Decanting
Witkrans	Coastal Fuels	Opencast	Decanting
Bankfontein		Underground	Decanting
Fortum		Opencast	Decanting / Open pit evaporation
Eerstelingsfontein	Sumo Colliery	Opencast	Decanting
Applications			
Wonderfontein	Umcebo	Opencast / Underground	Application - submitted EMPR
Belfast Block	Exxaro	Opencast	Application - EMPR being compiled
Richtrau	Richtrau	-	Application - submitted EMPR
Bankfontein	Benicon	-	Application - submitted EMPR
Weltevreden	Northern Coal	-	Application - submitted EMPR
Goedenhoop Colliery	Lumpasa Mining	Opencast / Underground	Application - submitted EMPR
Spitskop Greenfields	Xstrata Coal	Opencast / Underground	Application - submitted EMPR
Other			
Eerstelingsfontein	Exxaro	Opencast	EMPR approved

Figure 5 shows the surrounding land uses and location of infrastructure around the Belfast Project area.

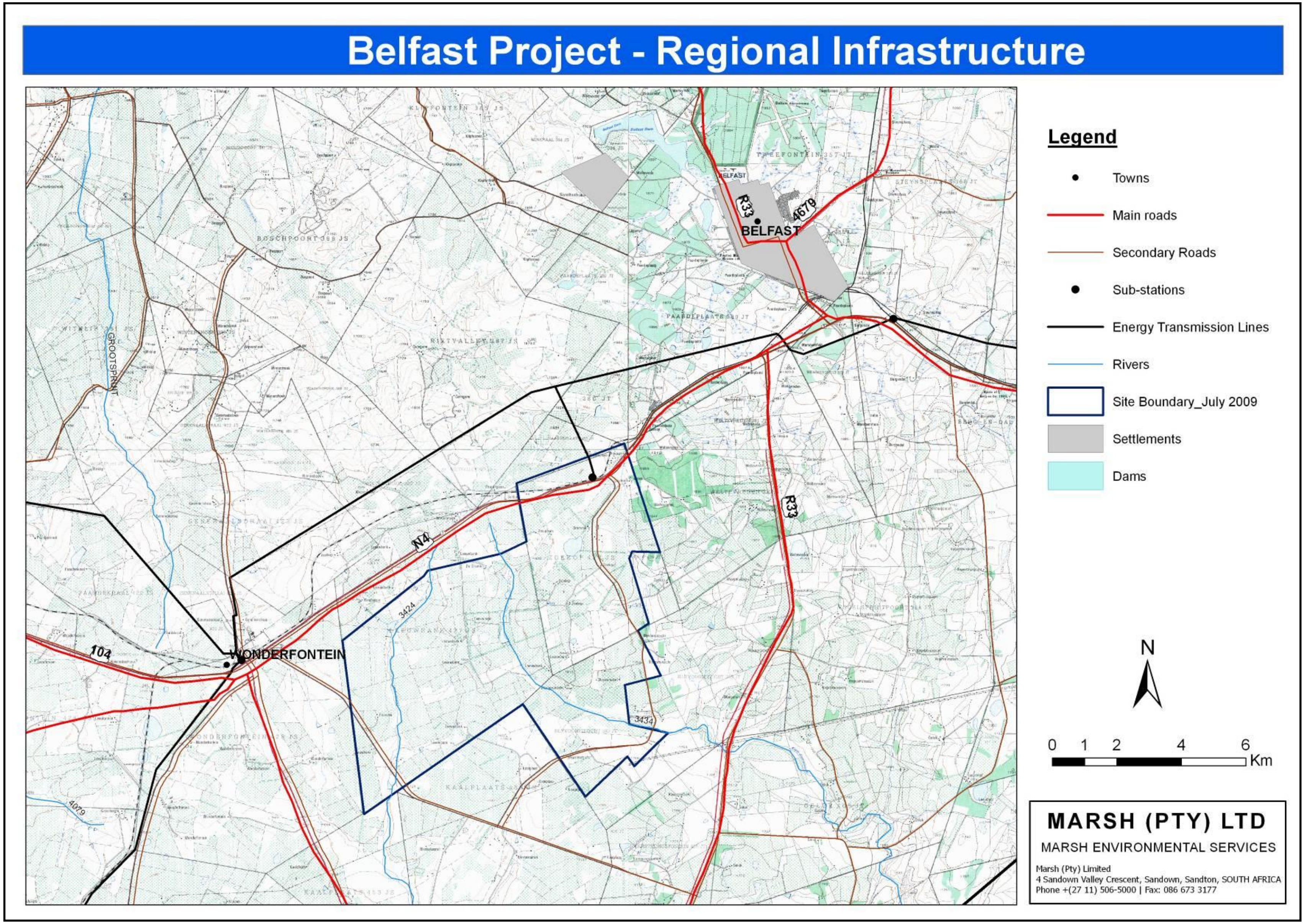

Figure 5: Surrounding Land Uses

2.4 Description of the Proposed Activity

The current planned life-of-mine consists of the following phases:

Phases		Duration
Construction Phase	Infrastructure development	2 years
	Mine development	
Operational Phase	Mining Phase	30 years
	Processing Phase	
Closure and Decommissioning Phase	Decommissioning	4 years
	Closure and rehabilitation	
	Maintenance and monitoring	

2.4.1 Construction Phase

The construction phase will take place over 2 years and will include the following activities:

Infrastructure Development

Roads

- Construction of surfaced access roads and internal roads, as well as un-surfaced haul roads and surfaced parking areas.

Processing Plants

- Exxaro plan to build two processing plants, namely a Phase 1: crushing and screening plant, and a Phase 2: crushing, screening and washing plant.
- Phase 1 will consist of crushing and screening the mined coal to produce an Eskom product, and this phase will continue througout the life of mine (LoM).
- Phase 2 will be initiated a few years after Phase 1, and involve crushing, screening and washing the coal to produce A / B-grade and Eskom products.

Buildings

- Construction of buildings including:
  - A guard house.
  - Office blocks.
  - Weighbridge and weighbridge office.
  - Change-houses.
  - Plant and mine workshops: Concreted, bunded workshop facilities will be constructed on the site. These workshops are purely for repairs and maintenance purposes. No vehicle maintenance is performed in the workshop. Should contractor vehicles be housed on the mining site temporarily, they will be parked on the concreted workshop area over night.
  - Laboratory.

Explosives Magazine

- The construction of an explosives magazine.

Diesel Storage Area

- For the refuelling of plant, machinery and vehicles.

Water Related Infrastructure

- Process water pipeline.
- Storm water channels and pollution control dams.
- Water treatment and purification plants.
- Process water and return water dam.
- Boreholes.
- Sewage treatment plant.
- Silt traps.
- Washing bays.
- River diversions / crossings.
- Raw water storage dam.

Co-disposal Facility

- A co-disposal facility will be established south of the crushing, screening and washing plant.

Reticulation Infrastructure

- Fire water reticulation, process water reticulation and internal potable water reticulation and internal sewer reticulation, and electrical reticulation

Fencing

- For security and safety reasons for both the employees and the surrounding local communities, the site will be fenced with the appropriate notices displayed on the fence warning people of the danger of a mining site. The fence will follow the boundary of the mining area and associated infrastructure. The fence will also act to ensure that no employees of the mine can trespass onto surrounding agricultural land.

Mine Development

During the mine development phase an initial boxcut[3] will be established by removing topsoil and subsoil from the initial box-cut area with a bulldozer and then stockpiled at void positions. The overburden will then be drilled and blasted and removed with a bulldozer and stockpiled at void positions.

During this time coal handling stockpiles will be established in the plant area.

[3] The first cut made into the mining area is refered to as a box-cut. It results in a long pit with a highwall on both sides of the cut.This trench is extended to the limits of the property in the strike direction.

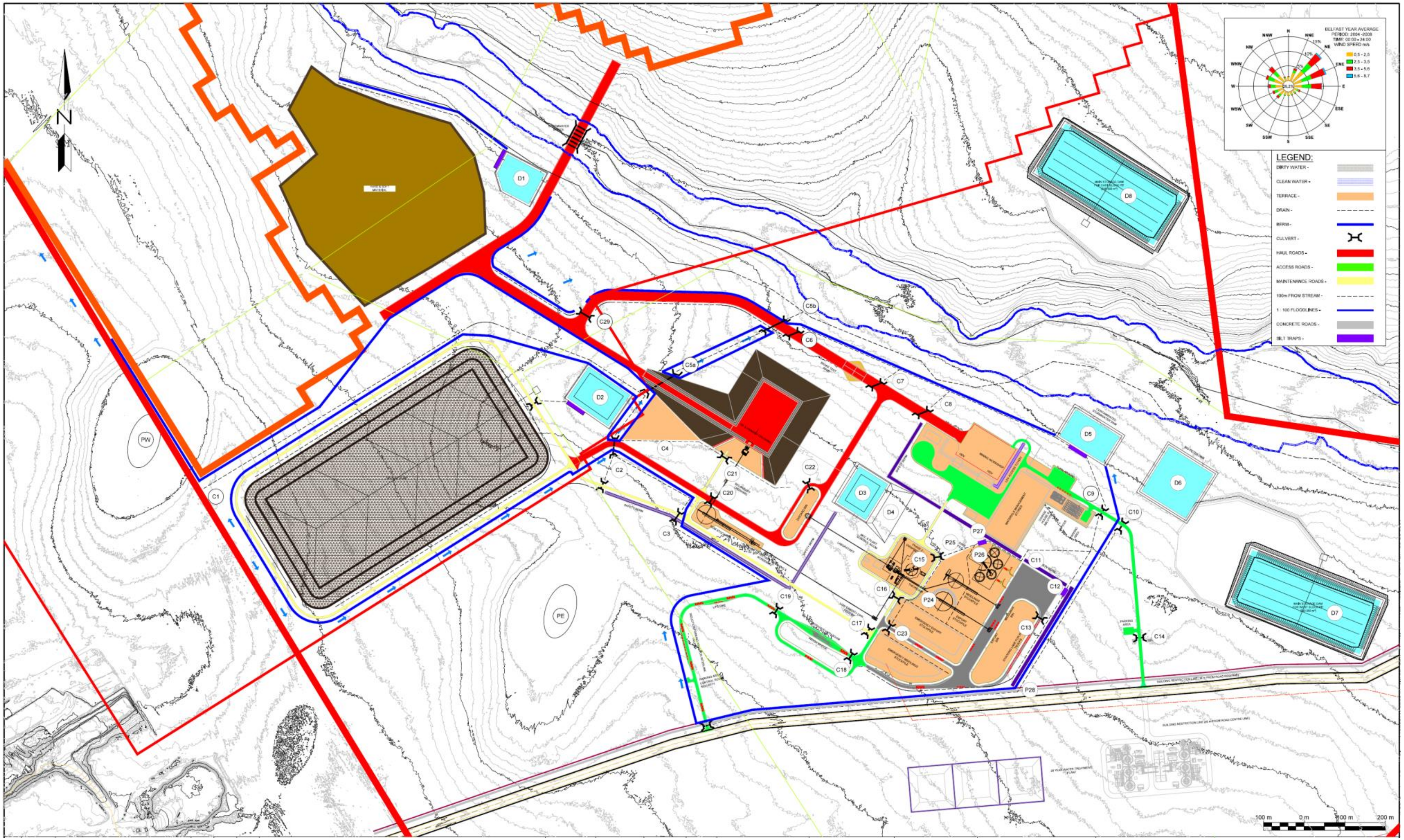

Figure 6: Belfast Mine – Storm water management and associated infrastructure design (Jeffares and Green)

2.4.2 Operational Phase (Mining Phase)

The mining operational phase is planned for an estimated 30 years.

Mine Plan

The Belfast Project reserves consist of two mining areas separated by a watercourse (**Figure 7**). The general direction of mining will be from south to north. The proposed mining sequence is illustrated in **Figure 8**.

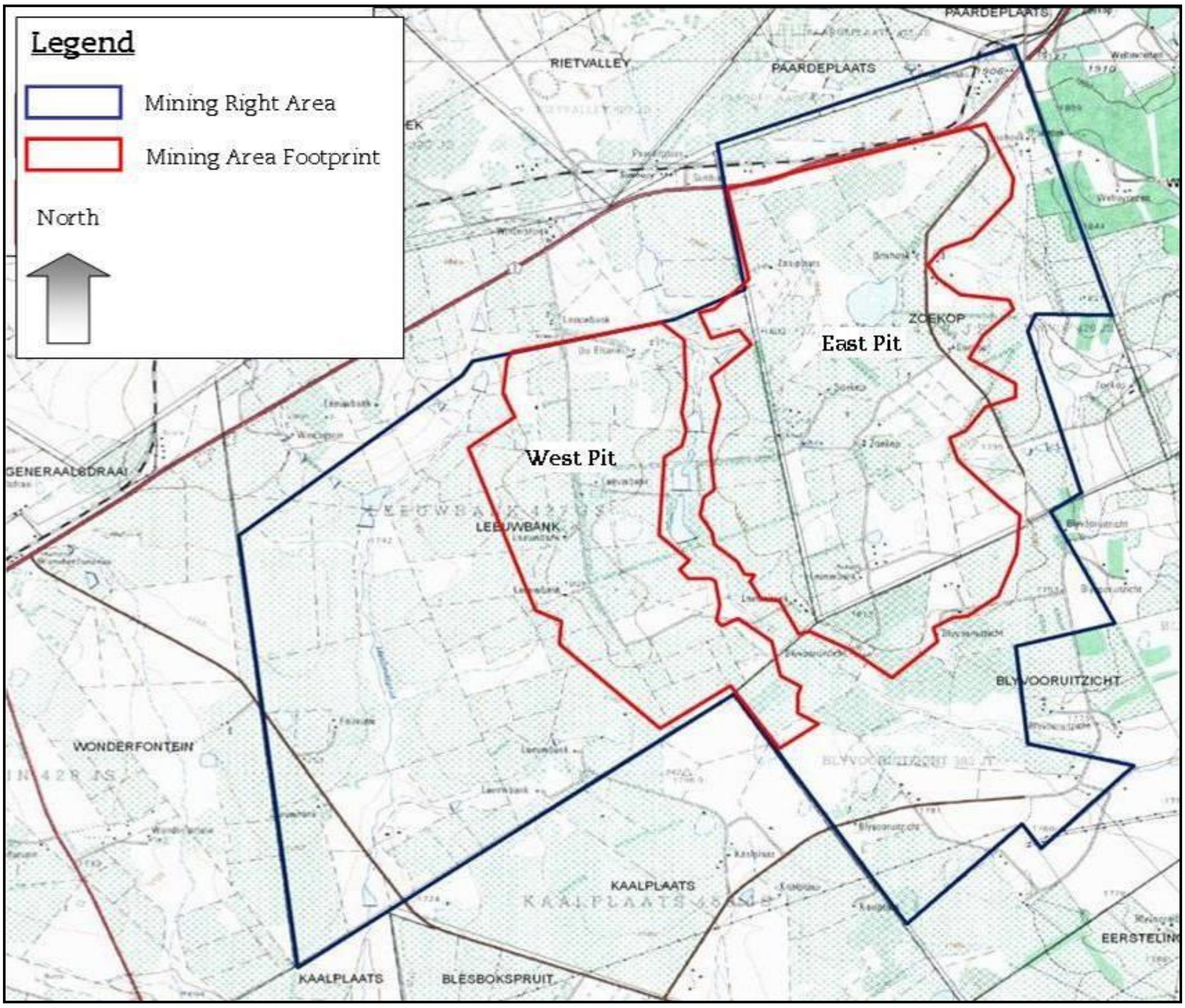

Figure 7: Mining Area Footprint

The western area has better quality raw coal than the eastern area. A-grade coal can be produced from the western area, and a P58 (5,800 kCal/kg) or B-grade from the eastern area. The quality of the raw coal also deteriorates in a northerly direction to such an extent that it is only economically viable to produce a B-grade coal from the northern areas.

The Phase 1 mining operation will commence in the south to produce coal for Eskom. The mining operations will then be expanded in Phase 2 to supply Eskom and the export markets.

Exxaro plans to mine the eastern and western areas at the same time to achieve the correct product mix. Mining and batch washing of different quality coal will take place to maximise product yields.

Currently it is planned that mining will take place on a 24-hour day, 7-day week basis.

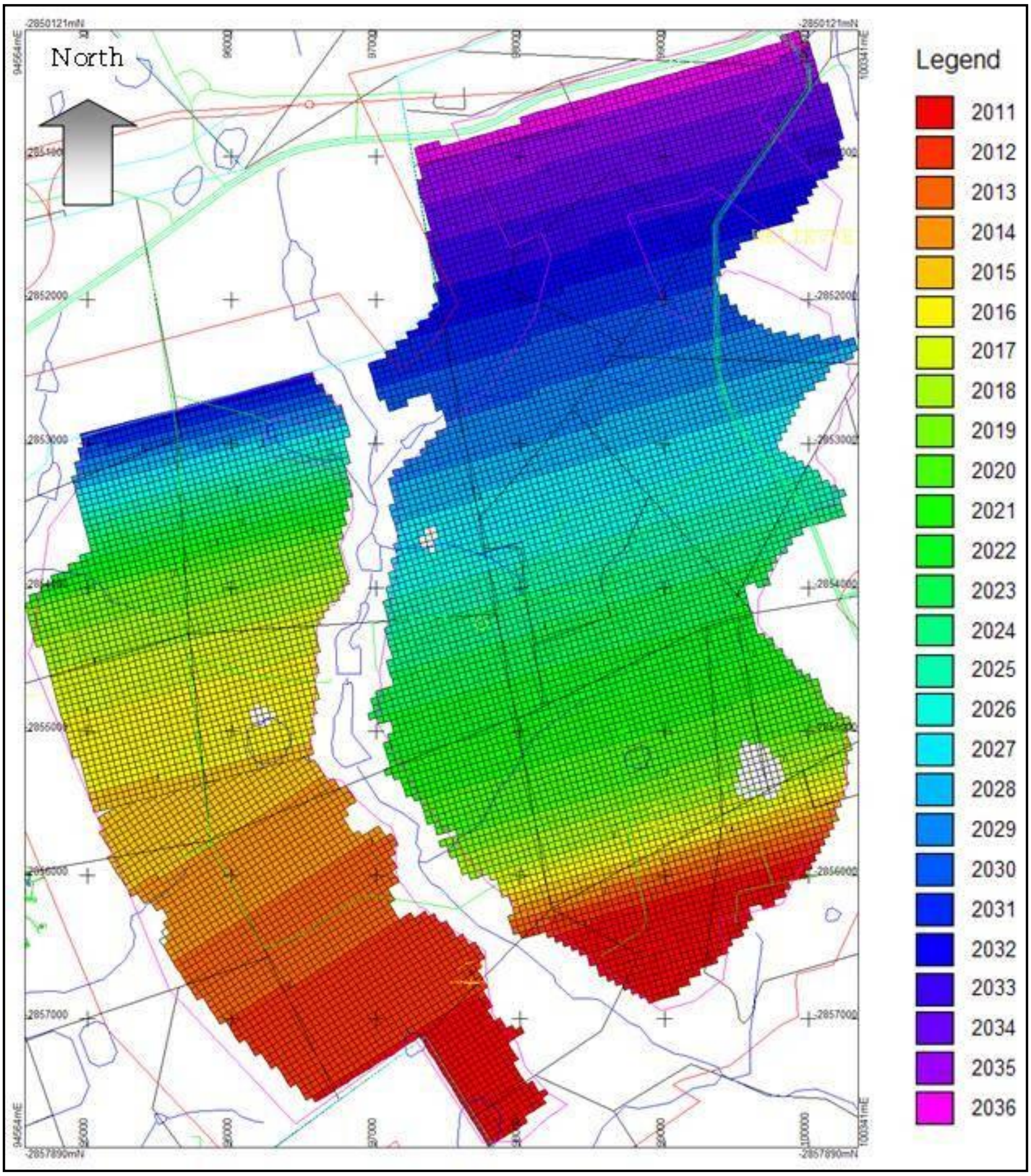

Figure 8: The Proposed Mining Plan Showing the Annual Advance of Mining Operations

Mining Method

Opencast mining will take place using a conventional truck and shovel operation. Roll-over dozing, where overburden material from the second cut is pushed into the first cut using a bulldozer, is undertaken to allow for continuous backfilling and rehabilitation of the mined-out area. The final void will be backfilled with the overburden from the initial box-cut. Rehabilitation and final closure will take place on a continuous basis to minimise activities at closure.

Figure 9 provides a schematic representation of the mining process after the first 4 box-cuts cuts, at which stage a steady state will have been reached. The following generic actions involved, are sequenced as follows:

- Strip topsoil using a front end loader (FEL).

- Remove sub-soil with an FEL and load onto a truck and dumped on the side of the open pits (voids).
- Drill and blast overburden.
- Load and haul the top off and dump the overburden at designated overburden dumps (Section 2.4.2.3).
- Doze the roll over using a bulldozer.
- Clean the top of the coal.
- Dig trench to prevent contamination.
- Drill and blast coal if the coal seam is too hard to remove by conventional truck and shovel operation.
- Load coal onto dump trucks and haul coal to the processing plant.
- Start with next cut.

The diagram is explained step by step below:

1. Depicts a section through the general stratigraphic sequence. The mining direction is from the left to the right.
2. The box-cut is now excavated after removal of the topsoil and the subsoil.
3. Coal is removed from the box-cut, subsoil from cut 2 and topsoil from cut 3.
4. The overburden of cut 2 is blasted.
5. The top part of the overburden is hauled to a stockpile as there is not enough pit room available.
6. The bottom part is dozed over and the coal face is cleaned.
7. Coal is removed from cut 2 and subsoil from cut 3.
8. The cut 3 overburden is blasted.
9. The top part of blasted overburden is hauled and placed at the beginning of the low wall.
10. The bottom part of cut 3 is dozed over and the coal face cleaned.
11. Coal is removed from cut 3 and subsoil from cut 4.
12. Overburden of cut 4 is blasted. The pit is now in steady state and no more material is stockpiled as all can be accommodated in the pit. Rehabilitation now follows logically as soon as subsoil gets stripped in front it gets placed at the back. The same goes for the top soil which gets placed over the sub soil in a continuous process.

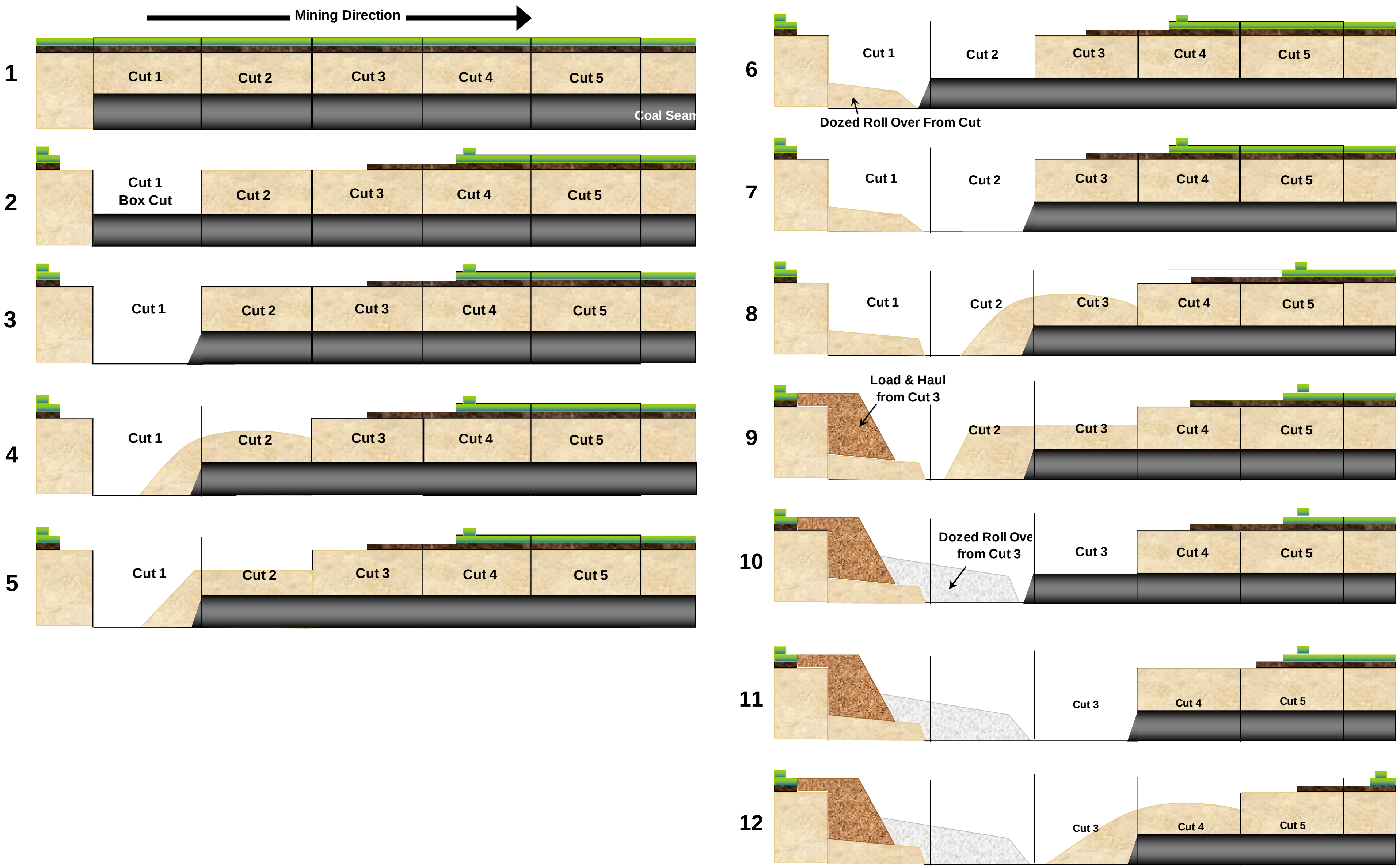

Figure 9: Steps 1 to 12 of the Proposed Mining Method

Overburden Dumps

Four (4) overburden dumps are planned for the life of the mine. These dumps (**Table 9** and **Table 9**) will be built in two phases with dumps P1–D1 and P1–D2 being built first and situated at the bottom (south) of the mining area, and dumps P2–D3 and P2–D4 being built a few years after the start of the mining area and situated at the top (north) of the mining area.

Table 9: Overburden Dump Size

Dump Name	Area
P1 – D1	207,889 m^2
P1 – D2	124,006 m^2
P2 – D3	207,414 m^2
P2 – D4	259,400 m^2

Figure 10: Overburden Dump Location

2.4.3 Processing Phase

Processing of raw coal in the plant through the conventional and proven Dense Medium Separation (DMS)[4] and gravity concentration using spirals on the fine fraction or fine DMS cyclone. This project involves a greenfields coal washing plant to produce both export quality and local Eskom product coal.

Phase 1 Plant

[4] The DMS plant creates a two-product output that can be blended to satisfy the requirements of multiple markets.

Phase 1 (**Figure 11**) will consist of crushing and screening the Run-of-Mine (RoM)[5] coal to produce an Eskom product. Phase 1 will continue for the life of mine. The plant will be designed for a feed rate of 5 million tons per annum (Mtpa).

The RoM feed (-1,000 mm) from the open pit will be tipped and crushed to -50 mm through a crushing and screening plant (1). The crushing and screening plant will consist of a primary double roll crusher, feeding a secondary double roll crusher (2), in closed circuit with a classifying screen at 50 mm. The secondary crushing circuit is a closed circuit to ensure proper top size control. The crushed RoM will then stockpiled on a normal conical stockpile (3).

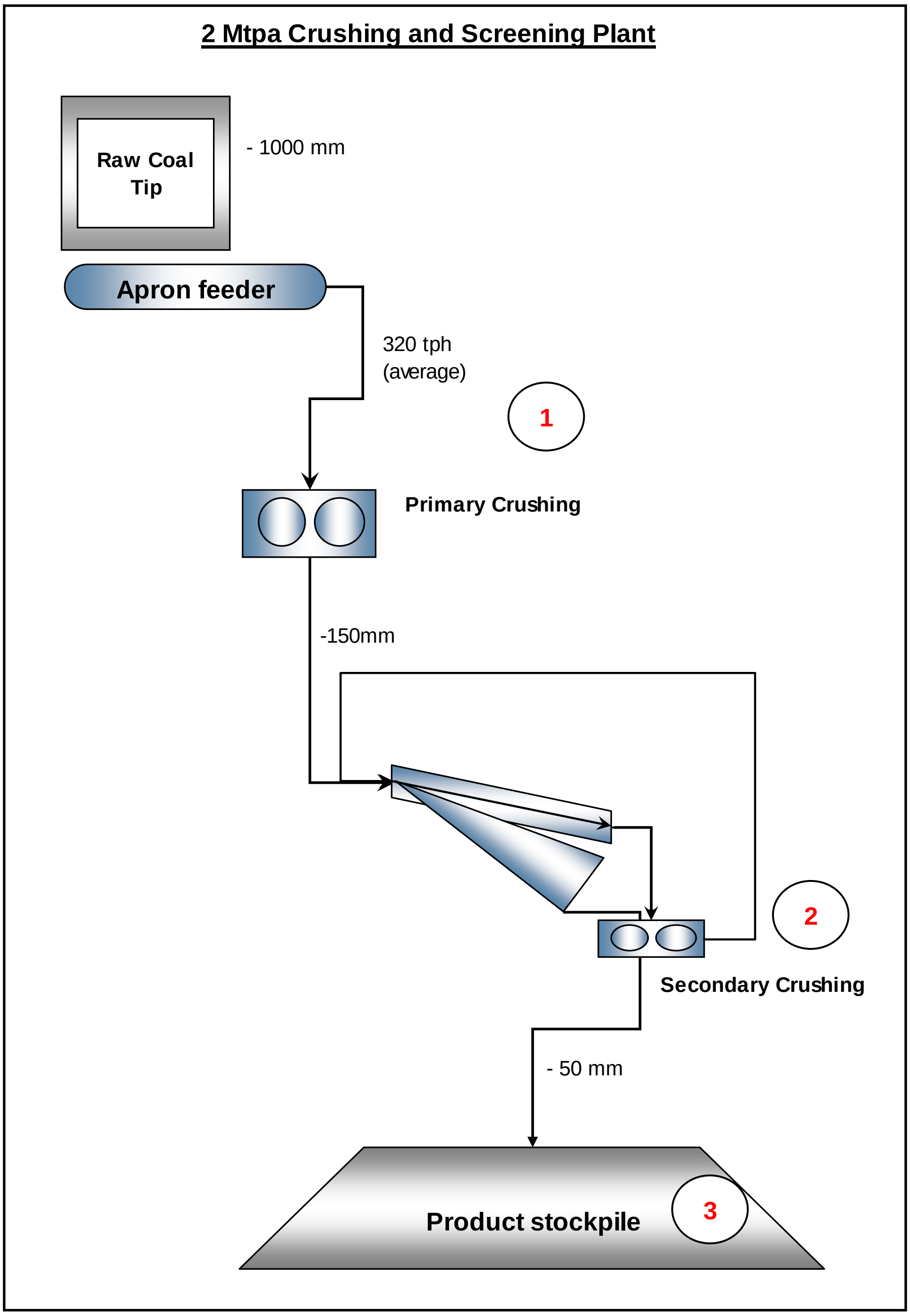

Figure 11: Flow Diagram Illustrating Phase 1 Processing

[5] Coal as it comes from the mine prior to screening or any other treatment.

Phase 2 Plant

Phase 2 Plant **(Figure 12**), which is to be initiated a few years after the Phase 1 Plant , will consist of crushing, screening and washing the coal to produce A / B-grade and Eskom products.

The crushing and screening phase will be identical to that of the Phase 1 plant. Once the crushed RoM is stockpiled on a normal conical stockpile, it will be fed over vibrating feeders to the coal washing plant at a maximum rate of 805 tons per hour (4). Three fractions will be screened out, -50 mm, -12 to +1 mm, and -1 mm and fed to the dense medium cyclones and fines sections and beneficiation to 14% ash (air dried) product for export purposes .

Conventional dense medium cyclone circuit (5) will beneficiate the -50 mm +1.5 mm material. The minus 1.5 mm +0.1 mm fraction will be beneficiated using spirals (6). The minus 0.1 mm slimes fraction (7) will report to the co-disposal site or to the Eskom product.

The undersize from the de-sliming screens will be fed to the de-sliming cyclones (8) with the overflow reporting to the thickener and the underflow to the spiral plant. The product will be dewatered through fine coal centrifuges and the discard on a dewatering screen. The thickener underflow will be fed to the filter plant, producing a filter cake (11). The filtrate will recycle back to the thickener allowing a closed water circuit plant.

The final product is a minus 50 mm (9) A-grade steam coal for export through the Phase V expansion of the Richards Bay Coal Terminal (RBCT) and an Eskom grade coal (10) for local supply. The plant has also been designed to produce a B-grade coal if warranted by market conditions.

All final products will be collected on a conveyor and transported to a transfer. The filter cake will have a separate conveyor onto a ground stockpile. The discard will be discharged into a discard bin to be trucked away by the operation.

The product will initially be transported from the mine to Eskom power stations by road.

In Phase 2 the A / B-grade and Eskom product will be transported via conveyor from the plant to the new Belfast siding to be loaded onto 100 x 85 tonne wagon trains. The local coal will be transported to Eskom sites while the export coal will be transported via Transnet to RBCT.

The plant and coal transportation systems will be operated on a 24-hour day, 7-day week basis, with scheduled maintenance shifts.

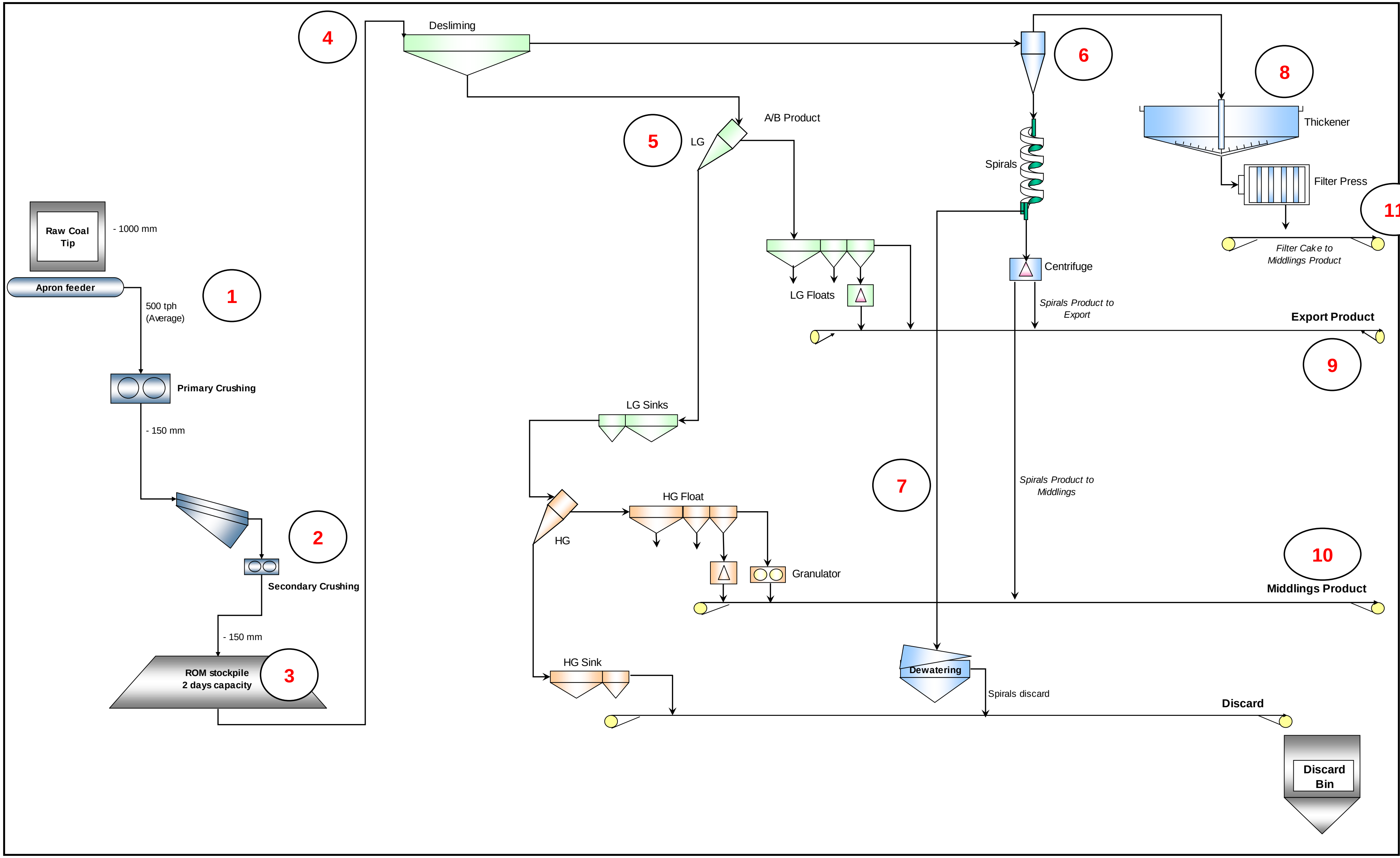

Figure 12: Flow Diagram Illustrating Phase 2 Processing

2.4.4 Decommissioning Phase

The decommissioning phase will take place over approximately four (4) years, and will be undertaken in three (3) phases, namely decommissioning, and maintenance and monitoring.

Decommissioning Phase

The decommissioning phase will include the following activities:

- Notifying the Authorities of the intention to close the operation.
- Scaling down of the operation.
- Implementing the SLP retrenchment plan.
- Retrenching the non-essential workforce.

Closure and Rehabilitation Phase

The closure and rehabilitation phase will include the activities listed below. The DME published a guideline document[6] for the evaluation of the quantum of closure-related financial provision. Section C of this guideline lists the generally acceptable closure methods, which describe in details the methods that should be used when dismantling structures. These guidelines will be applied when rehabilitating the mining area.

The following activities will be undertaken during the closure and rehabilitation phase:

- Dismantling of processing plant and related structures.
- Demolition of steel buildings and structures, reinforced concrete buildings and. structures, administration facilities and housing.
- Rehabilitation of access roads.
- Opencast rehabilitation.
- Fencing off pit areas.
- Rehabilitation of overburden, spoil and process plant waste.
- General surface rehabilitation inlcuding:
  - Grading and shaping.
  - Re-vegetation.
- Waste removal.
- Water management.

Golder Associates provided a closure framework and closure cost estimates for the proposed Belfast Project (Appendix Q). The closure costs were determined for the Belfast Project area, comprising the following:

- Two (2) mine pits, east and west of a central drainage line;
- Primary and secondary crushers;
- A washing and screening plant;
- Material stockpile areas;
- One co-disposal dump;
- Return water and raw water dam;
- Surface water management infrastructure;
- Conveyors;
- Workshops;
- Offices and change house facilities;
- Electricity supply network; and

[6] Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision provided by a Mine – Official guideline as contemplated in Regulation 54(1) to the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002)

- Access and haul roads

A general layout plan of the above-mentioned areas is provided in Appendix B.

Maintenance and Monitoring Phase

The maintenance and monitoring phase will include, but may not be limited to the following activities:

- Fertilisation of rehabilitated areas.
- Surface water quality monitoring.
- Groundwater quality monitoring.
- Fauna and flora monitoring.
- Alien and invasive plant species monitoring and control.
- General maintenance, including rehabilitation of cracks and subsidence.
- Annual environmental performance assessment report development.
- Environmental closure report development.
- Annual environmental aspect reporting.
- Final closure application development and motivation.

2.5 Mine Water Management

Water collected in the pits sumps will be used for dust suppression and excess water will be pumped into a storage dam that will be used as a buffer. Dewatering of the backfilled spoils will occur for three scenarios, namely:

- To prevent water from decanting into the Klein Komati River.
- To prevent water from overflowing into the pit.
- To supply water to the plant.

A conceptual design of a surface water runoff system for the project area was undertaken by Jeffares and Green (complete report appended as Appendix B1) as a requirement in application for a Water Use License. The storm water management design is specific to the proposed plant area addresses the following:

- Clean and dirty water separation and systems
- Drain and culvert designs
- Pollution Control Dam designs and lining requirements
- Return water and process dams including lining requirements
- Storm water dams
- Sewerage treatment plant and biofilter dam

As indicated in Section 1.6.2, a water use licence application is under review with the Department of Water Affairs in accordance with Section 21 and 40 of the NWA. Groundwater Consulting Services (GCS) have completed the requisite Integrated Water Use License Application (IWULA) for the proposed mining project. The application was submitted to the DWA in February 2012 for consideration.

2.5.1 Clean and dirty water separation

In terms of GN 704, 4 June 2009 of the NWA, unpolluted water should be confined to a clean water system away from dirty water areas and polluted water inclusive of runoff and seepage should be confined to a closed system.

The proposed system intends to divert water as close as possible to its natural drainage path while still complying with the maximum of 1:50 year spillage requirement. This drainage path through the plant should be designed such that it can accommodate the runoff and that there is no possibility for contamination with polluted water that may occur during the operational phase of the mine.

In compliance with the regulations, the outer perimeter of the systems is designed to ensure there is no contamination within a 50 year recurrence period. The outer perimeter consists of a combination of open drains and berms as well as roads with safety berms and side drains.

Clean water system

The clean water system incorporates two Natural Pans located to the west of the plant referred to as Natural Pan East and Natural Pan West (refer to **Figure 13**). The Natural Pan East has a relatively low natural overflow level. Natural Pan West is intersected by the property boundary as well as the mining perimeter. Two surface water management scenarios have been considered, namely dividing the pan with a wall on the property boundary with the advantage of not sterilizing coal reserves and any overflow would be diverted as clean water to the Klein-Komatirivier, or, the pan will remain in its natural state but coal reserves will be sterilized. The runoff from the clean water areas is conveyed by a system of drains and culverts through or around the dirty areas. Where clean water has to be diverted through the dirty areas, it is protected by a berm on all sides of sufficient height to prevent cross contamination for a 50 year recurrence event.

Dirty water system

Given the topography of the area and to reduce risk, the dirty water system is divided into three separate areas (refer to **Figure 13**):

- Hard and Soft Stockpile Area (D1)
- Discard Facility (D2)
- Plant Area (D5)

A network of open drains collects water from the dirty areas and discharges the runoff into the Storm Water Dams. To protect Storm Water Dams from sedimentation, silt traps are located as close as possible to the source of contamination. Some drainage lines may pass through more than one silt trap. Silt traps are also provided next to all Storm Water Dams with a side overflow into the dams.

Sections of the haul roads pass through clean water areas and to simplify the drainage network and to reduce maintenance requirements, berms and drains have been integrated into the roads.

Figure 13: Clean (Blue) and Dirty (Red) Water Catchment Areas

2.5.2 Drain and culvert designs

It is preferred to keep runoff as close to its natural state as possible. In a developed area this is not always possible as the vegetation and permeability of the catchment area is changed and may also change over time.

The following order of preference for drains will be applied at the proposed mine site:

- Maintain natural flow conditions.
- Provide wide shallow drains.
- Grass lined drains.
- Grass block lined drains.
- Concrete lined drains.

Energy dissipation will be required where flow velocities become too high and will need to be reduced to acceptable levels e.g. where drains discharge into pans. Gabion boxes and mattresses are proposed for energy dissipation purposes and silt traps have been employed at the dams and the plant. Culverts have been designed taking into consideration the sizes required for the haul roads and capacity.

2.5.3 Dam designs

A description of the operational requirements for each of the dams (eight Pollution Control Dams and two Clean Water dams) is provided in the table below and indicated in **Figure 14**. Additional technical information relating to the sizing and design of the spillways, freeboard etc can be sourced in Appendix B1.

Table 10: Operational requirements and content of dams

Dam type	Dam Description	Dam #	Operational Requirement
Pollution Control Dams	Storm Water Dams	D1	Keep empty by: Evaporation, return to process water system, manage water quality dynamically and release into clean water system if quality complies. Source: Storm water runoff from Hard and Soft Stockpile Area.
	Storm Water Dams	D2, D5	Keep empty by: Return to process water system. Source: Storm water runoff from Discard Facility and Plant Area.
	Process Water Dam	D3	Operate at level to accommodate dirty water inflow, less outflow and losses and maintain required freeboard. Source: Pumped from Return Water Dams and other dirty areas.
	Emergency Slurry Dam	D4	Evaporate excess fluid and remove to dump / discard facility. Source: Plant processing.
	Biofilter Dam (Evaporation Dam)	D6	Operate at a level to accommodate inflow, less outflow, losses and maintain required freeboard by returning to process water should water quality comply with regulations. Sourced: Outflow from Sewage Package Plant.
	Return Water Dams	D7,D8	Operate at level to accommodate dirty water inflow, less outflow and losses and maintain at required operational level. Operational level provides for direct rain collection and freeboard. Source: Pumped from Mining Areas
Clean Water Types	Natural Pan	PE	None. Pan will overflow naturally and follow clean water path and drain. Source: Clean storm water runoff.
	Divided Pan	PW	None. Pan may overflow through spillway provided and follow clean water drain. Source: Clean storm water runoff.

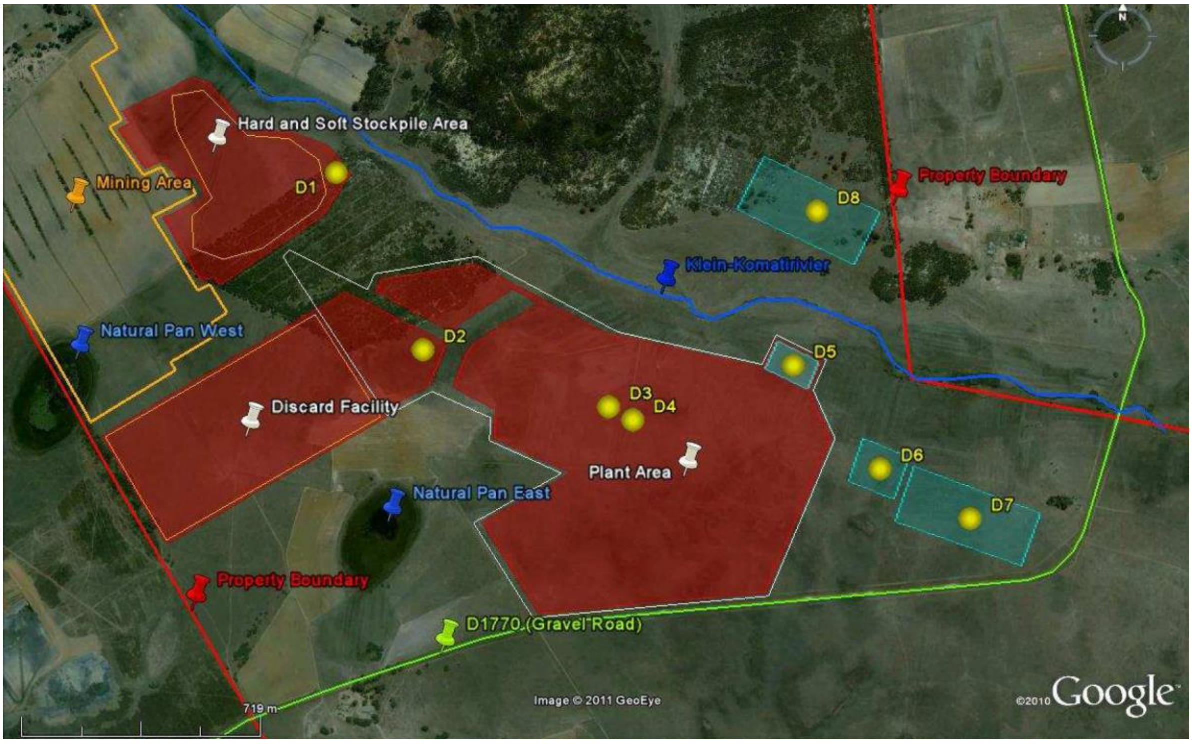

Figure 14: Dam positions on the project site

2.5.5 Sewage treatment plant & evaporation pond

A sewage treatment plant is proposed. The estimated total sewage flow from the facility is $63m^3/d$ modeled on 450 personnel. It is recommended that a package plant based on the extended aeration activated sludge process be implemented. The package plant should have facilities to store and possibly digest sludge in order to minimise the maintenance required by the mine. An evaporation pond will receive treated effluent from the package sewage treatment plant.

The effluent from the package sewage treatment plant would be of a quality that could be suitable for irrigation, but not for discharge off site. Shower water makes up approximately 30% of the total sewage flow and this fraction could be separated before the sewage treatment plant and irrigated. This would reduce the size of the evaporation pond by 30%. This shower water could irrigate between 0.5 and 1.0 ha.

An alternative to the package plant would be to construct a reedbed preceded by a large septic tank. This would have the advantage of not requiring electricity to operate and would significantly reduce the maintenance requirements. An area of between $2500m^2$ and $3000m^2$ would be required for a reedbed to treat the sewage from 450 people. This could be reduced if the grey water from the showers is diverted prior to the septic tank. The reedbed would have to be lined, preferably with a geo-synthetic clay liner and would be planted with a commonly available reed.

A schematic concept design of the water management systems and supporting infrastructure discussed in this section is provided in Figure 7**.**

2.5.1 Mine Water Balance

A water balance was developed of the integrated water system using Goldsim simulation software. The mine water balance is dynamic and depends on many factors including rainfall, the mine plan, floor contours, rehabilitation scheduling and standards as well as mine water requirements. Water will have to be managed either for use to meet the mine water requirements or treatment and discharge.

The plant water demand varies over the years due to changes in tonnages. The annual average water demand fluctuates and peaks in 2039 at $1,850m^3$/day when it operates at 455 ROM t/hr. The lowest plant demand during Phase 2 is reached in 2013 at about $1,500m^3$/day. Fluctuations within a year are due to change of moisture in the ROM, discard and product.

It is to be noted that the values are in accordance with the macro water balance value of $1,878m^3$/day when the plant operates at a ROM feed of 480 t/hr.

2.5.2 Post-Closure Water Systems

Dewatering of the backfilled spoils will pump water back to the storage dam before being treated by the treatment plant. The excess mine water that will have to be managed post-closure was based on the following assumptions:

- The co-disposal facility will be rehabilitated with a cover so that the surface runoff is clean;
- The return water dam and plant areas will be removed and the area rehabilitated;
- The pits will be rehabilitated to be free draining with a standard 600 mm thick cover;
- The waste dumps located adjacent to the pits will be removed and returned to the pits; and
- A treatment plant will be constructed to treat the excess water.

Once the mining of a pit is completed, the pit will fill with water up to 5m below the decant level. Once the pit has reached this elevation then water is abstracted at the capacity of the pumping system. The water being discharged into the storage dam associated with the pit.

The storage capacity within the backfilled spoils increases as mining continues. The rehabilitated area grows from 0 m^2 in 2010 to 8.9km^2 and 10.9km^2 for the West block and East block respectively. There is very significant storage in the West block with a capacity reaching its peak in 2029 at 4,200,000m^3. There is almost no storage in East block and therefore the East block will present no buffer storage. Due to the low capacity of storage in the East block backfilled spoils, dewatering should be continuous and water should be kept at a low level for the life of the mine.

Dewatering occurs when the plant demand is not met by the co-disposal return water or if water is about to overflow into the pit sump, or over the decant level. If there is insufficient volume in the stores, then only the available volume will be abstracted.

2.5.3 Sump Pump Capacity

Water is pumped from the workings sump for dust suppression first and, following this, the rest into the storage dam. The pumping rate from the sump to the dam is limited by the sump pump capacity. The operating rule for the sump pump is that the pumping to the storage dam takes place regardless of the storage in the storage dam.

2.5.4 Dust Suppression Demands

The dust suppression demands of the mine pits are calculated as follows:

- A daily dust suppression value was set to be a fixed value of 500m^3/day for the whole mine during the life of the mine;
- The dust suppression is only supplied when the pit is active. If the mining of the pit has not started or the mining of the pit is complete the dust suppression demand is set to zero;
- If the pit is active and the daily rainfall depth is less than 8 mm/day, then the dust suppression demand is applied; and
- If the daily rainfall depth is greater than 8 mm/day then the dust suppression demand is not applied.

3

Baseline Description

This section of the report primarily provides information sourced from specialist studies conducted to provide a baseline from which the overall environmental risks associated with the proposed project can be determined. Baseline information on the following aspects is provided:

- Physical environment
- Biophysical environment
- Cultural / Heritage environment
- Socio-economic environment

3.1 Overview of the Site

3.1.1 Natural Features

The Belfast Project area is currently used for agricultural purposes, grazing and forestry **(Figure 15**). The area is characterised by the following natural features:

- Rolling hills
- Farm dams
- Rivers and streams
- Grassland
- Cultivated fields (maize, potatoes, sunflower, cherries and other crops)
- Eucalyptus and wattle forests
- Wetlands

3.1.2 Surface Infrastructure

The following infrastructure **(Figure 16**) is encountered in the area:

- The N4 toll road through the northern section of Zoekop
- Farm roads
- Farm dams
- The railway line from Johannesburg to Maputo runs through the northern section of Zoekop
- Power lines. These will be used to supply electricity to the mine.
- Telephone lines
- Agricultural homesteads
- Dwellings

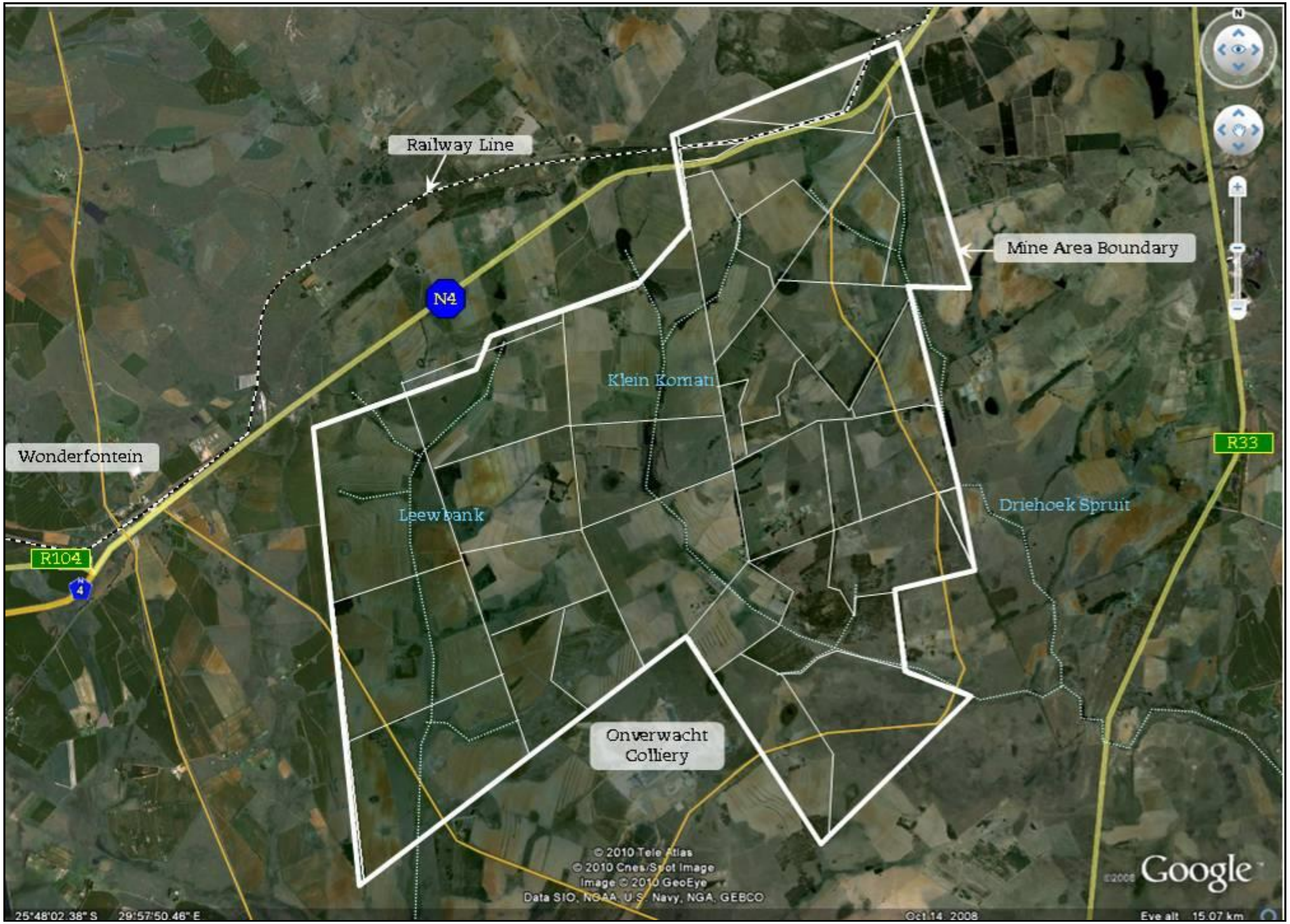

Figure 15: Belfast Project Locality Map

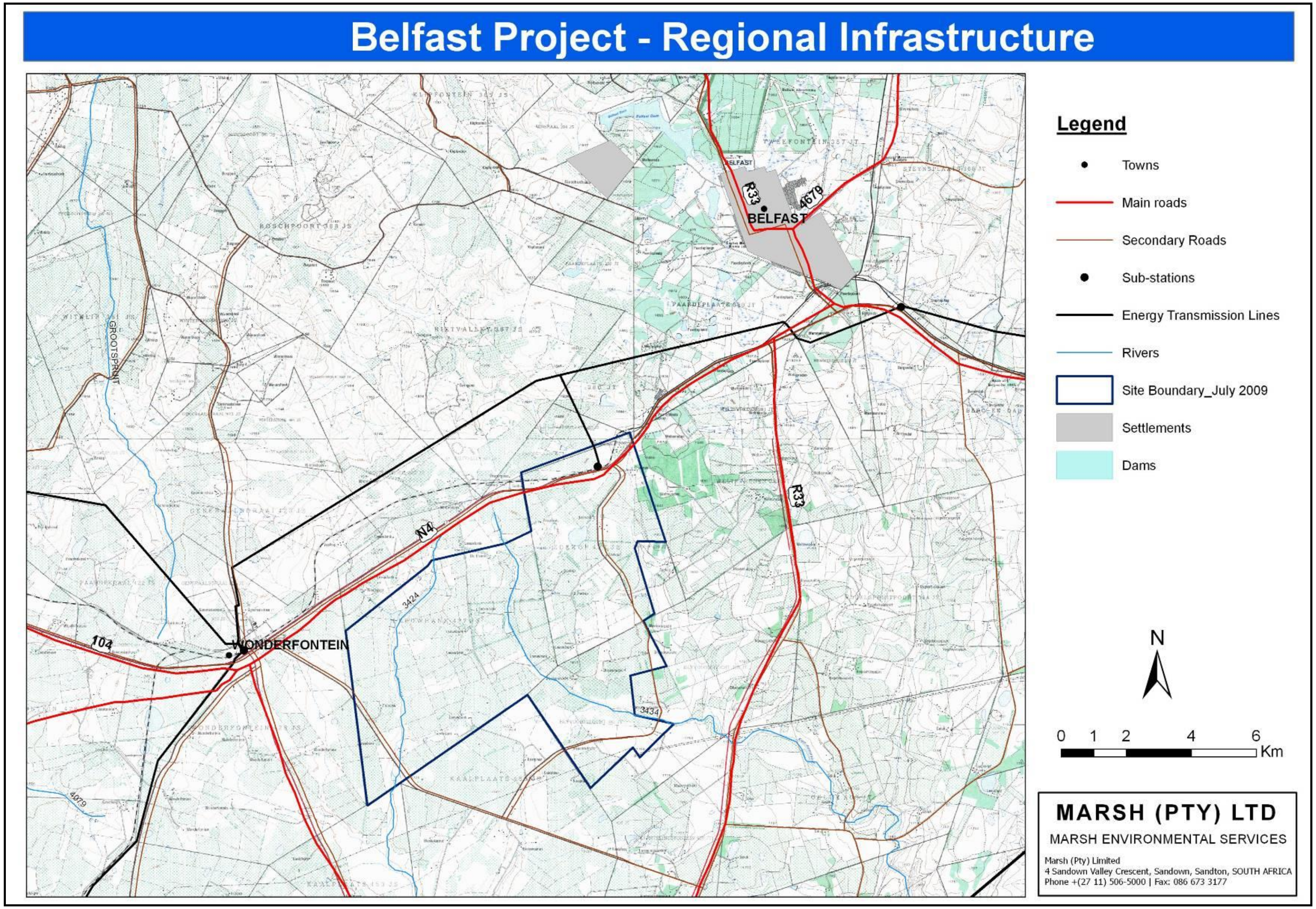

Figure 16: Surface Infrastructure Layout

3.2 Climate

The regional climate is included in the description of the receiving environment to provide the appropriate data that will be used in the assessment of impacts that are influenced by seasonal factors such as dust fallout and storm water run-off.

The hydrological cycle in South Africa runs from October to September, therefore, all climatic information illustrated in the tables and graphs presented in this section of the report are presented from October to September.

South African Weather Services (SAWS) monitoring stations are located in Belfast, approximately 8 km to the north-east of the Belfast Project site. Data from the Carolina SAWS was also used for comparative purposes. **Table 11** gives the details of the SAWS stations used and **Figure 17** indicates their location relative to the Belfast Project site. Data recorded at these stations was used to get an approximation of what the climatic conditions experienced within the mining area may be like.

Table 11: Details of the SAWS Used for Climatic Data

SAWS Name	SAWS Number	Co-ordinates	Height (metres)	Years Recorded Data
Belfast	0517041	Lat: 25°41'27.60"S Lon: 30° 2' 2.40"E	1,879 m	2005 – 2009
Belfast	0517072	Lat: 25°41' 60.00"S Lon: 30° 3' 0.00"E	1,970 m	1994 – 2009
Carolina	0480184	Lat: 26° 4' 12.00"S Lon: 30° 7' 12.00"E	1,700 m	1994 – 2009
Rietvallei	-	Lat: 25° 42' 54.40"S Lon: 29° 55' 56.26"E[7]	1,675m	2007 – 2009
Roodepoort	0516554	Lat: 25° 44' S Lon: 29° 49'E	-	1903 - 2000

The SAWS recommends using a minimum of a 30 year period to generate what is known as the "*normal*" climatic conditions. This is to allow for the fluctuation in climatic conditions, particularly when considering rainfall. It must be noted however, that for this report, the long-term average data obtained from the SAWS (with the exception of the Roodepoort Station) did not cover a 30 year period. The averaging periods for rainfall were not the same as the averaging period for wind field data.

[7] These co-ordinates were extrapolated from google Earth and are only an approximation.

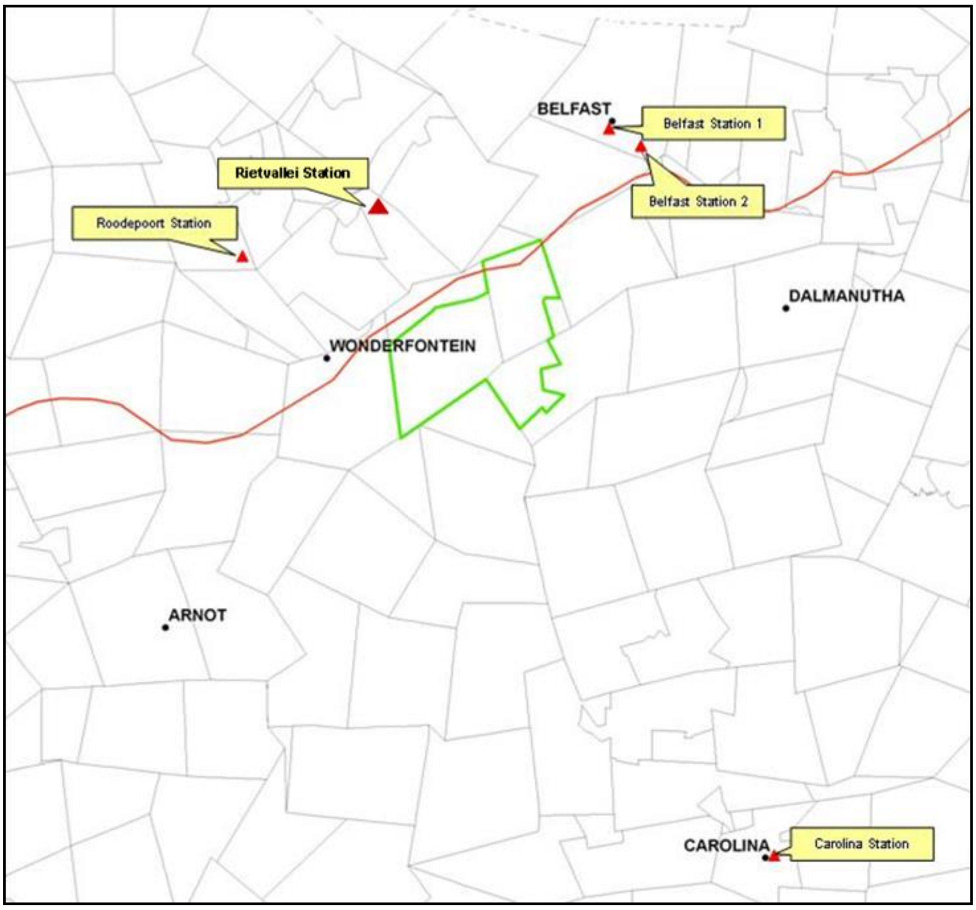

Figure 17: Location of the SAWS used for Climatic Data

The following aspects have been examined for the following reasons:

- Rainfall: Affects impacts resulting from dust and rainfall intensities are analysed to determine storm water management design requirements.
- Fog: Affects noise range from mining and processing activities.
- Evaporation: As with rainfall, evaporation influences how much water will be required to reduce the amount of dust liberated on site.
- Temperature: Temperatures, wind velocities and evaporation are linked. The higher the temperature and the wind velocity, the more likely it is for the evaporation rates to be high.
- Wind roses are analysed determine dust dispersion.

3.2.1 Mean Monthly Annual Rainfall

Precipitation is an important factor considered as part of air pollution studies since it reduces atmospheric pollutants and inhibits dust generation potentials. Based on the long-term average rainfall data, the region is characterised by summer rainfall, with approximately 80% of the annual rainfall occurring between November and March (**Table 12**). The annual rainfall varies between 500 mm and 1000 mm, with an average precipitation of 730 mm and the maximum precipitation normally occurring in January.

Table 12: Average Monthly Rainfall recorded at the Belfast and Carolina SAWS Stations

Month	Belfast 0517041 2 2005 – 2009 (mm)	Belfast 0517072 6 1994 – 2009 (mm)	Carolina 0480184e1 1994 – 2009 (mm)
October	56	73.37	96.06
November	96.7	118.93	130.09
December	83.95	116.11	144.70
January	113.68	107.09	123.53

Month	Belfast 0517041 2 2005 – 2009 (mm)	Belfast 0517072 6 1994 – 2009 (mm)	Carolina 0480184e1 1994 – 2009 (mm)
February	68.88	70.88	91.23
March	36.72	71.93	89.48
April	25.85	41.15	43.78
May	1.05	25.04	16.13
June	4.8	1.73	7.51
July	0.3	2.523	6.24
August	9.3	7.05	8.81
September	3.5	11.19	17.25
TOTAL	500.73	647.01	774.82

Records from Roodepoort rain gauge (No. 0516554), located 18 km away from the project site were used. This station was chosen because of its long record and the quality of the record. The daily rainfall record covered the period January 1903 to September 2000. The Mean Annual Precipitation (MAP) in the vicinity of the mine is about 690 mm. About 85% of the annual rainfall falls in summer (October – March), in the form of showers and thunderstorms, with the maximum precipitation falling in January. The average number of rain days is 55 per year.

3.2.2 Maximum Rainfall Intensities per Month

The long-term 24-hour maximum rainfalls recorded for the SAWS station at the Belfast and Carolina SAWS stations are given in **Table 13.** The highest 24-hour maximum rainfall occurred in November.

Table 13: Long-Term 24-Hour Maximum Rainfalls Recorded for the SAWS Stations at the Belfast and Carolina SAWS Stations

Month	Belfast 0517041 2		Belfast 0517072 6		Carolina 0480184e1	
	Rainfall (mm)	Year of Occurrence	Rainfall (mm)	Year of Occurrence	Rainfall (mm)	Year of Occurrence
October	34.8	26/10/2006	50	15/10/1998	63	08/10/1997
November	39	12/11/2006	160.5	20/11/2000	61	12/11/1994
December	28.6	03/12/2008	91	26/12/2006	74	16/12/2005
January	44.6	08/01/2006	69	10/01/2009	66	28/01/2005
February	28.2	24/02/2006	87	12/01/1996	70	20/02/2003
March	19	17/03/2006	92.5	29/03/2000	43	22/03/2006
April	16.4	03/04/2005	42	05/04/2000	39.6	21/04/1999
May	2	26/05/2008	50	04/05/2001	29.3	01/05/2008
June	18.6	06/06/2007	10	13/06/2002	18.5	06/06/2007
July	0.8	05/07/2007	19.5	28/07/2004	18.5	07/07/1996
August	18.6	01/08/2006	22	06/08/2003	19	24/08/2006
September	8.6	27/09/2007	25	26/09/1999	35	28/09/1998

The 24-hour rainfall depths recorded at Roodepoort for the different recurrence interval storms are listed in **Table 14**. Roodepoort station, with its long record length, enables a statistical analysis for different recurrence intervals.

Table 14: Roodepoort 24 Hour Rainfall Depths for the Different Recurrence Intervals

Recurrence Interval (years)	2	5	10	20	50	100	200
24 Hour Rainfall Depth (mm)	58	77	90	104	123	137	153

3.2.3 Fog Occurrence

There are different types of fog including advection fog (which occurs when moist air passes over a cool surface by advection [wind] and is cooled) and radiation fog (which forms when the atmosphere is very stable and the skies are clear leading to heat radiation from the ground). Radiation fog, as is characteristic in the Belfast area, mostly occurs in the morning and has been largely linked to the 'cleaning up of air pollution'.

Fog is a common phenomenon in the Belfast area and may contribute to the collection of particles. However, site specific information on fog scavenging in the Belfast area is not available to verify the extent of this removal process.

3.2.4 Mean Monthly Evaporation

Evaporation data was sourced from the report Surface Water Resources of South Africa 1990 (Volume VI: Klein-Komati). The mean annual Symons-pan evaporation in the vicinity of the mine is 1,450mm (WR90). Mean monthly evaporation values are presented in **Table 15**.

Table 15: Mean Monthly S-Pan Evaporation values for the Belfast Project Area

Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Average evaporation (mm)	138	138	156	164	140	138	104	91	75	81	102	124	1,451

The monthly evaporation rate exceeds the monthly rainfall rate throughout the year (**Figure 18**), indicating that alternative dust suppression techniques may be required on site.

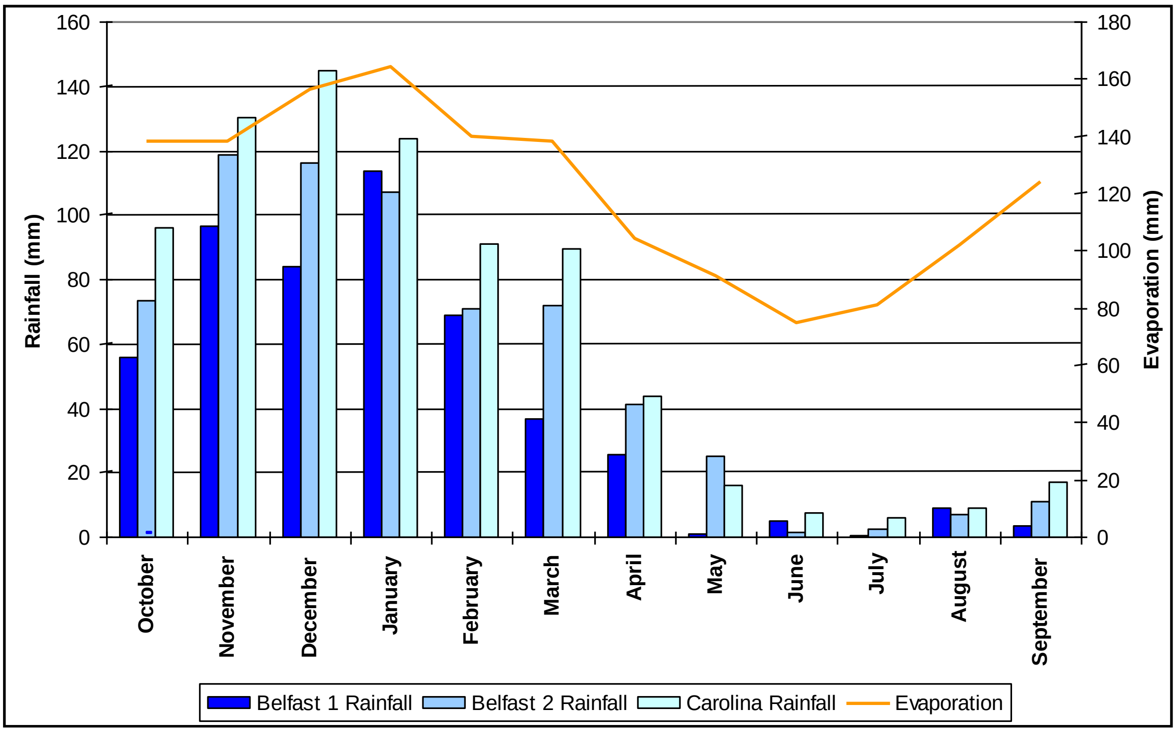

Figure 18: Rainfall and Evaporation Rate Comparisons

3.2.5 Mean Monthly, Maximum and Minimum Temperatures

The monthly average of daily temperatures, illustrating the long-term monthly mean, minimum and maximum temperatures are presented in Table 16 As is typical throughout South Africa, there is a distinct seasonal variation in temperature. The mean monthly temperatures are highest between November and February which are typically summer months. Temperatures gradually drop with the lowest temperatures being recorded during June and July, which are typically winter months in South Africa.

Temperatures, wind velocities and evaporation are linked. The higher the temperature and the wind velocity, the more likely it is for the evaporation rates to be high. This can be seen through the correlation of evaporation rates and temperature when comparing **Table 15** and **Table 16.** From these tables it is noted that increased evaporation occurs in the months where the average temperatures are high.

Table 16: Long Term Monthly Maximum, Minimum and Mean Temperatures Recorded at the Belfast SAWS

Month	Minimum Temperature (°c)		Maximum Temperature (°c)	
	Lowest Recorded	Daily Average	Highest Recorded	Daily Average
October	8.9	9.2	25.1	23.3
November	8.9	10.6	22.8	22.2
December	8.7	11.2	23.7	22.6
January	11.2	12.4	23.4	22.3
February	10.9	11.8	25.6	23.4
March	10	10.5	24	22.1
April	5.9	7.2	20.8	20.0
May	2	3.4	21.1	18.2
June	0.5	1.8	19.5	16.5
July	-0.4	0.6	19.1	17.1
August	1.8	3.1	22.6	19.5
September	4.7	6.3	26	23.4

3.2.6 Monthly Wind Direction and Speed

Data from the Rietvallei SAWS[8] surface station and upper air station were used for the air quality impact assessment simulations (Appendix D). The wind roses indicate the wind frequencies for the 16 cardinal wind directions. The frequency of occurrence of winds in each direction is indicated by the length of the shaft compared with the dotted circles, representing a 5% frequency of occurrence. At the bottom of each wind rose are wind speed classes. These illustrate the frequencies of occurrence of winds in each category, for each wind direction. The frequencies of calm periods, wind speeds are below 1 m/s, are indicated as a percentage value in the centre of each wind rose.

Over the period January 2007 to August 2009, the prevailing winds are recorded from the east, east-southeast and west-northwest with frequencies of occurrence of more than 10%. Day-time wind speeds indicate the dominancy of winds from the north- western sector while night conditions indicate an increase of winds from the east and east-southeast (**Figure 19**).

[8] Concern was raised as to the Rietvallei data being representative of the meteorological conditions of the Belfast mining site. The difference in altitude between the Rietvallei SAWS station site (1674 masl) and the proposed Belfast site (~1825 masl) is ~150m. The slope between the two sites is thus ~0.023. The study area is therefore not representative of complex terrain and thus will not experience topographically induced airflow. The meteorological data at Rietvallei (having high data quality and availability) will thus be representative of the study site.

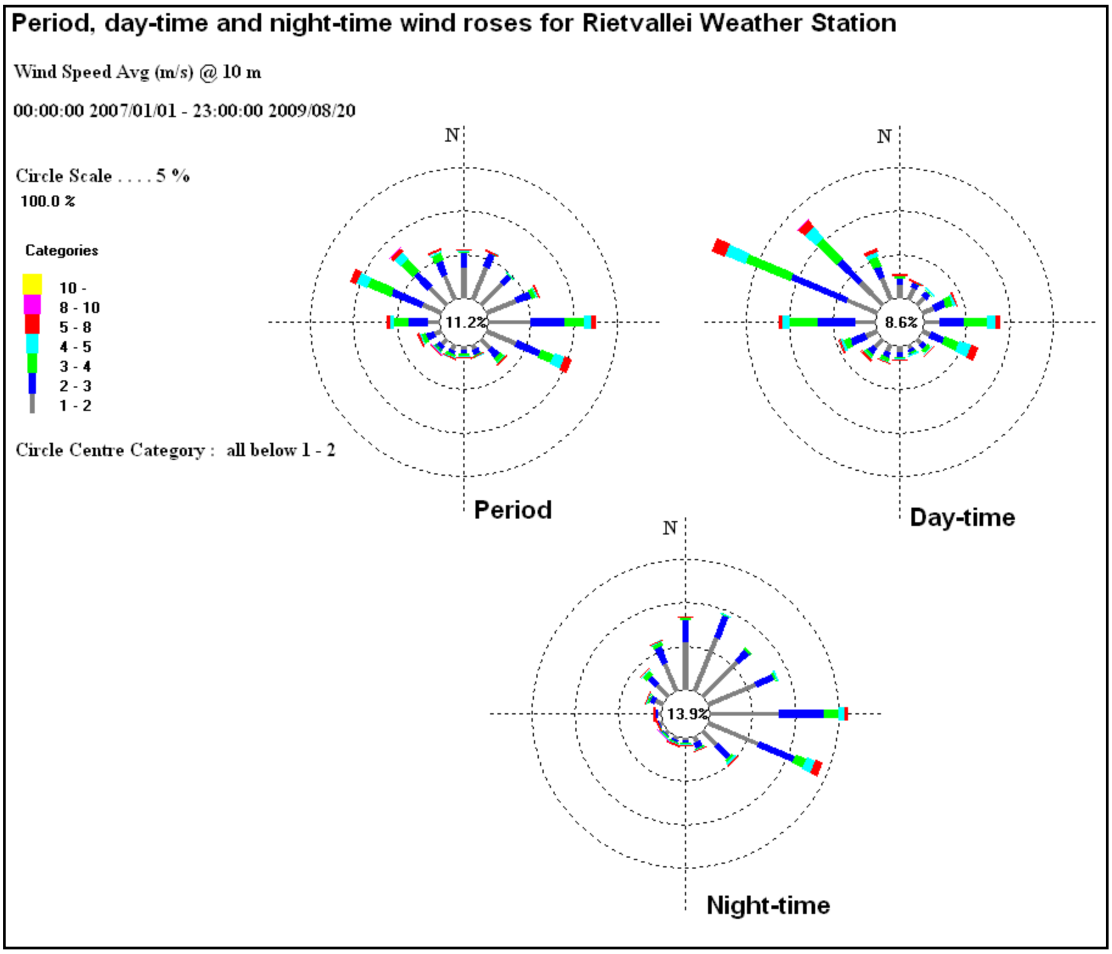

Figure 19: Wind Roses for the Rietvallei SAWS Site for the Period 2007 - 2009

The seasonal variation in wind-flow is shown in **Figure 20**. During the summer months, winds from the east and east southeast are dominant, while the prevailing winds during spring are mainly from the north east, east and north-west sectors. The winter months are characterised by west-north-westerly winds, with frequencies of occurrence of more than 10%. Winds from the east and east-southeast are predominant during the autumn months.

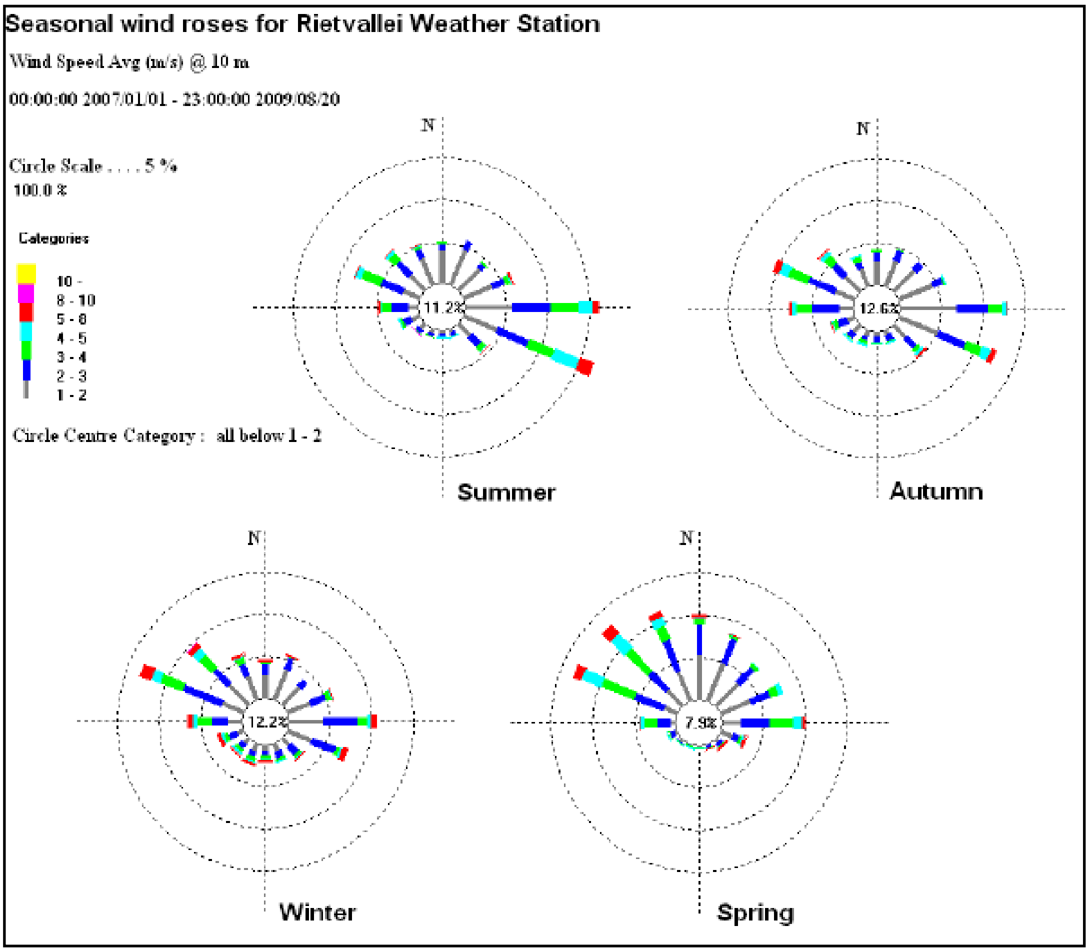

Figure 20: Seasonal wind roses for Rietvallei for the period 2007- August 2009

3.3 Topography

The general topography of the area consists of strongly undulating plains (ENPAT, 2004). The terrain morphology as described by Kruger (1989) forms part of Division E, namely closed hills and mountains with a moderate and high relief, and sub-division 27, namely low mountains. The slopes consist of concave, convex and straight slopes with a relief of between 450 – 900m. Less than 20% of the area consists of areas with a slope of less than 5% (Kruger, 1989).

Figure 21 and **Figure 22** illustrate the topography of the site. The site specific topography is gently undulating, with three drainage systems falling from the north to south over the study area. **Figure 23** shows the contour lines of the site.

Figure 21: Indication of the Undulating Topography with Rocky Outcrops

Figure 22: Indication of the Undulating Topography with Rocky Outcrops

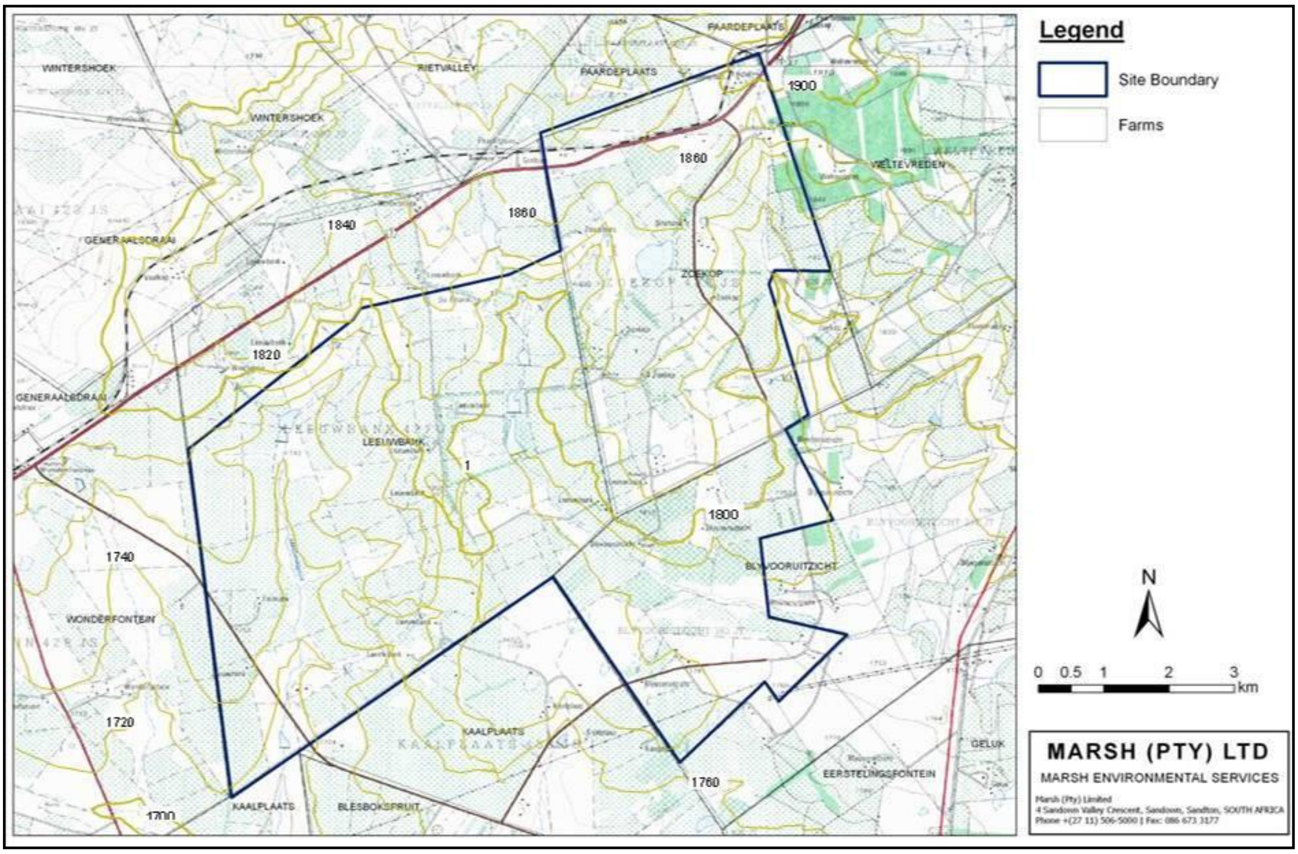

Figure 23: Site Topography

3.4 Geology

3.4.1 Regional Geology

Due to the economic importance of the coal seams developed in Southern Africa, a significant amount of research has been conducted and numerous coalfields have been identified and defined. The proposed Belfast mine will be developed to exploit a section of the Witbank Coalfields. The boundaries of the Witbank Coalfield in the Mpumalanga Province are shown in **Figure 24**. Typically five seams are developed (i.e. from the base up, the 1, 2, 3, 4 and 5 seams) of which up to four can be mined. The 3-seam is persistent across the entire coalfield but is too thin (i.e. generally <0.5m thick) to be economically viable.

South African coal seams are hosted by sedimentary strata of the Karoo Supergroup. These sediments were deposited during the Permian, Triassic and Jurassic periods over a time span in excess of 70 million years (Ma) (from ~ 270Ma to 200Ma). Sedimentary strata accumulated on a gently subsiding shelf platform, which was in turn part of a large and relatively stable intra-cratonic basin.

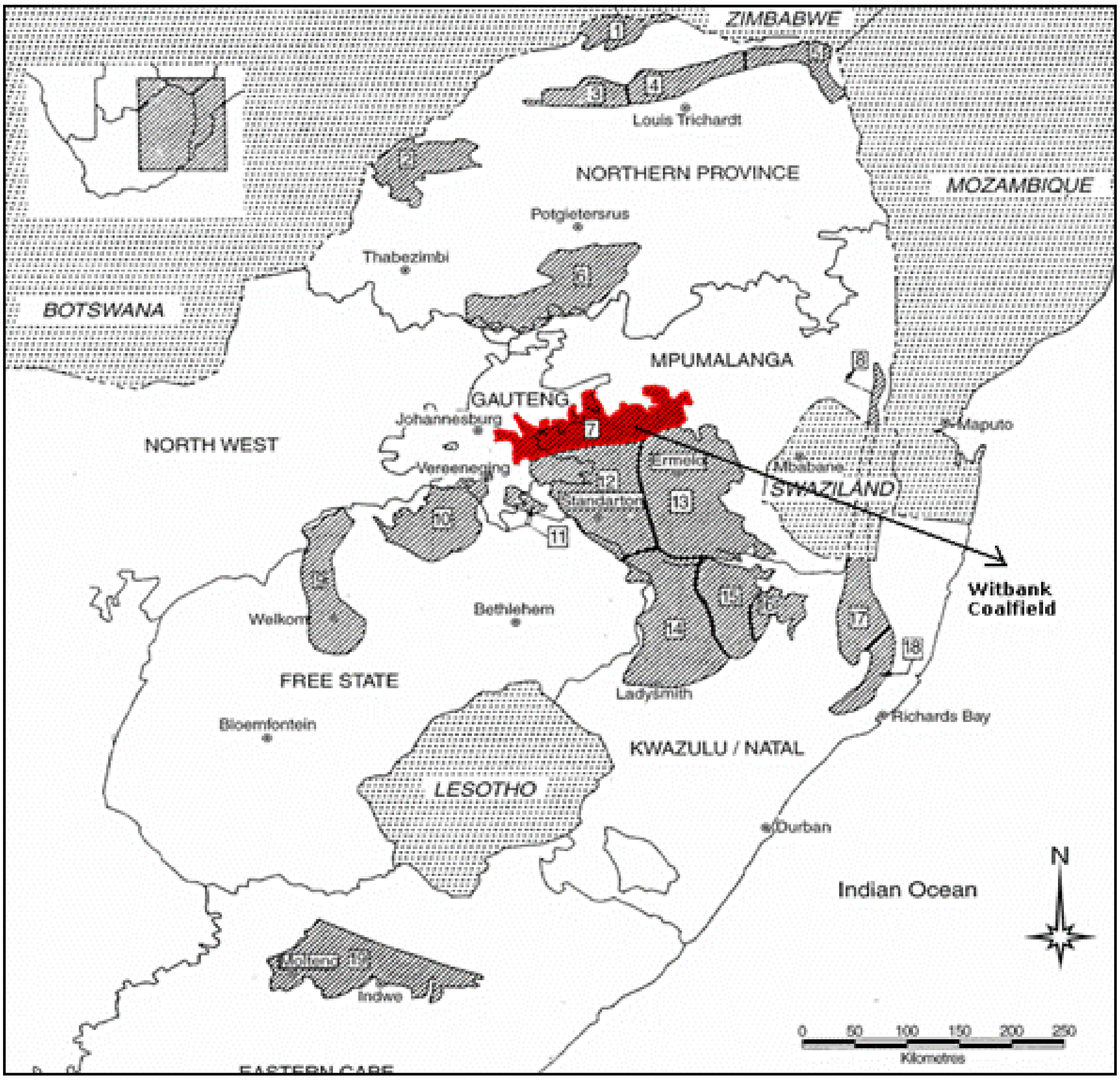

Figure 24: Witbank Coalfield (Mining work Programme)

Stratigraphically, the sedimentary sequence has been broadly sub-divided into the following units which are described from the base upwards.

- **Dwyka Group**
  At the base of the Karoo Supergroup is the Dwyka Group (Late Carboniferous to Early Permian (~320Ma) which comprises a mixed sequence of glacial and peri glacial sedimentary strata including diamictite, till, moraine, conglomerate, grits, sandstone and mudstone.
- **Ecca Group**
  Sedimentary strata of the Ecca Group overlie the glacial sediments of the Dwyka Group. Ecca Group sediments are an Early to Late Permian (~260Ma) sequence comprising sandstone, shale, mudstone with several significant coal seams which were deposited in a fluvio-deltaic environment. Coal seams of the Witbank Coalfield are found in the Vryheid Formation of the lower Ecca Group.
- **Beaufort Group**
  The Beaufort Group overlies the Ecca Group and is of Early Triassic age (~260-210Ma). Strata are typically comprised of multicoloured mudstone and sandstone units with very minor coal. These sediments were deposited in a predominately fluvial environment.

Other sedimentary and volcanic strata of the Karoo Supergroup overlie the Beaufort Group.

3.4.2 Local Geology

The Belfast project area lies within the Witbank Coalfield on the northeast margin of the Karoo Basin. The Karoo sequence is represented by the Dwyka Formation, consisting of diamicrite and the overlying Vryheid Formation containing coal seams locally referred to as 1-seam through 5-seam in a clastic assemblage dominated by sandstones. Only the 2-seam is being considered for resource exploitation. The lowermost 1-seam occurs as thin coal bands that rarely exceed 0.75 meters in thickness. The 3-seam occurs approximately 13m above the 2-seam. The 3-seam ranges in thickness from 0.05 to 7.34m, with an average thickness of 0.9m. The 4-seam varies widely in thickness, from 0.0 to 12.4m. Additionally, the 4-seam splits into three sub-seams and lacks lateral continuity. Portions of the 4-seam have been removed by surface erosion. Most of the 5-seam has been removed by surface erosion, its extents limited primarily to the northeast of the subject property. The general stratigraphic column for the project area is shown in **Figure 25.**

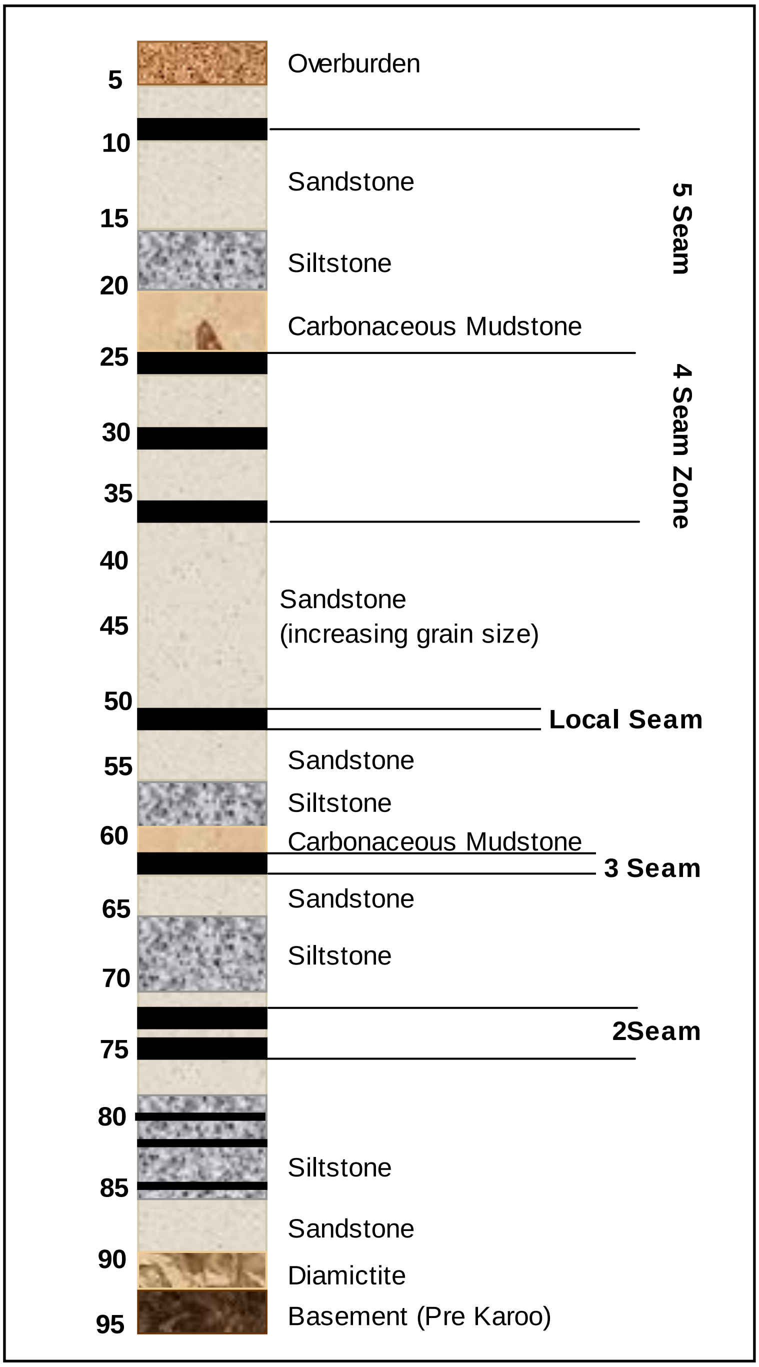

Figure 25: Stratigraphic Column of the Belfast Project Area

The geological sequence is described from the top to the bottom as follows:

- **Soil and Weathered Material**
  The soil and weathered material in the Belfast Project area is approximately 5m deep. The borehole log information indicates that the material consists of sandy soil, which is reddish-yellowish brown in most areas.
- **5-Seam**
  The 5-seam was intersected by only two boreholes that are on the extreme northeast of the farm Zoekop 426 JS. This is an indication that the No. 5 seam was probably removed by erosion.
  Parting (between 5- and 4-seams)
  Medium grained sandstone, approximately 1 m thick, overlies the uppermost part of 4-seam. This sandstone is followed by a coarsening-upwards cycle. The cycle begins with a basal carbonaceous siltstone and mudstone that coarsens upwards into a thick unit of inter-bedded fine grained sandstone and siltstone. This coarsens upwards into fine grained sandstone.
- **4-Seam**
  The rock between the 4-seam zones is predominately carbonaceous mudstone and siltstone. Cross-bedded, coarse grained sandstone is also present between the coal seams.
- **Parting (between 4-seam and local seam)**
  Where the local seam is present it is overlain by an upwards coarsening cycle. The cycle is frequently replaced by a large sandstone body, consisting of a number of upwards fining cycles that have an erosive base overlain by thin conglomerates of small pebbles.
- **Local Seam**
  The local seam or its lateral equivalent of carbonaceous mudstone, caps the upward coarsening cycle.
- **Parting (between local seam and 3-seam)**
  A fine grained, bio-turbated sandstone unit lies above 3-seam and is followed by a large upward coarsening cycle that has a thick basal carbonaceous mudstone. The mudstone coarsens upwards into carbonaceous siltstone that contains sandstone lenses. The lenses increase in thickness as the cycle coarsens upward into inter-bedded fine grained sandstone and carbonaceous siltstone. The inter-bedded sandstone and siltstone coarsen upwards through a ripple cross laminated, fine grained sandstone, into a cross bedded, medium gained sandstone. The carbonaceous material decreases upwards through the cycle.
- **3-Seam**
  3-Seam has been partially to completely removed by fluvial erosion on the southern half of Zoekop 426 JS. The 3-seam ranges in thickness from 0.15 to 1.23m with an average thickness of 0.73m.
- **Parting (between 3-seam and 2-seam)**
  The 2-seam is overlain by a 2 to 3m upward fining cycle that has an erosive base and consists of medium to coarse grained, cross bedded sandstone. The sandstone fines upwards into a fine grained sandstone through to carbonaceous siltstone. This cycle is followed by a 4 to 6m upwards coarsening cycle containing coarse grained siltstone, fine grained sandstone, and medium to coarse grained sandstone.
- **2-Seam**
  The 2-seam thickness varies from the 1.0m cut-off to 4.33m with an average thickness of 2.83m. In the northern part of the farm Zoekop 426 JS, the seam has been split into 2-seam and 2U-seam. The seams are separated by a clastic parting, which consists of an upward fining cycle of 0.44 to 4.27m of basal, medium to coarse grained sandstone. The sandstone fines upwards into carbonaceous siltstone.
- **The Sequence from the Diamictite to the 2-Seam**
  The sequence ranges from 10 to 15 m in thickness and it is divided into two units. The first unit is 2 to 7m and consists of medium to coarse grained sandstone, containing numerous fragments of reworked diamictite and pre-Karoo rocks. The second unit contains alternating mudstone, siltstone and sandstone with three small seams interspersed within the succession. Those coals include the 1-seam.
- **Dwyka Formation**

The diamictite was not described in detail in the borehole logs. Published literature describes diamictite as a dark to light grey, often pinkish, silt and clay matrix in which angular clasts, most frequently in pebble size range, are supported. The clasts vary in composition and colour depending on the type of the source rock.

3.5 Soil

A soil, land use, land capability assessment was undertaken for the Belfast Project by Viljoen & Associates. Results from this report are presented herewith and the full report is provided in Appendix E.

3.5.1 Soil Typology

According to the latest soil assessment, the types of soil found on site are Arcadia, Katspruit, Bainsvlei, Hutton and Avalon soils (**Figure 26**). The effective depth of the Bainsvlei, Avalon and Hutton soils exceed 300 mm inclusive of the Orthic A – Horizons, Soft Plinthic B – Horizons, Yellow and Red Apedalic B – Horizons (**Table 17**).

The Arcadia, Avalon, Bainsvlei, Hutton, and Katspruit soils are characterised by neutral pH values (5.3 and 7.2) and low electrical conductivity values (<250mS/m). Under these conditions plant available nitrogen (15-20mg/kg), phosphorus (10 – 15mg/kg) and potassium (>50mg/kg) are readily available for plant uptake and sustainable plant growth.

The Orthic A-Horizon is typically characterised by a low dense structure and texture distribution of approximately 65% sand, 20% silt and 15% clay with drainage properties in order of 10mm/h.

Table 17: Description of the Soil Types for the Belfast Project Area

Soil Type	Diagnostic Horizons	Effective Depth (mm)	Agricultural Potential	
			Dry Land	Irrigation
Arcardia	Vertic A-horizon / Unspecified	< 300	Low	Low
Bainsvlei	Orthic A-horizon / red Apedalic B-horizon / soft Plinthic B-horizon	> 300	Medium	High
Avalon	Orthic A-horizon / yellow-brown Apedalic B-horizon / soft Plinthic B-horizon	> 300	Medium	High
Hutton	Orthic A-horizon / red Apedalic B-horizon / Unspecified	> 300	High	High
Katspruit	Orthic A-horizon / G-horizon	< 300	Low	Low

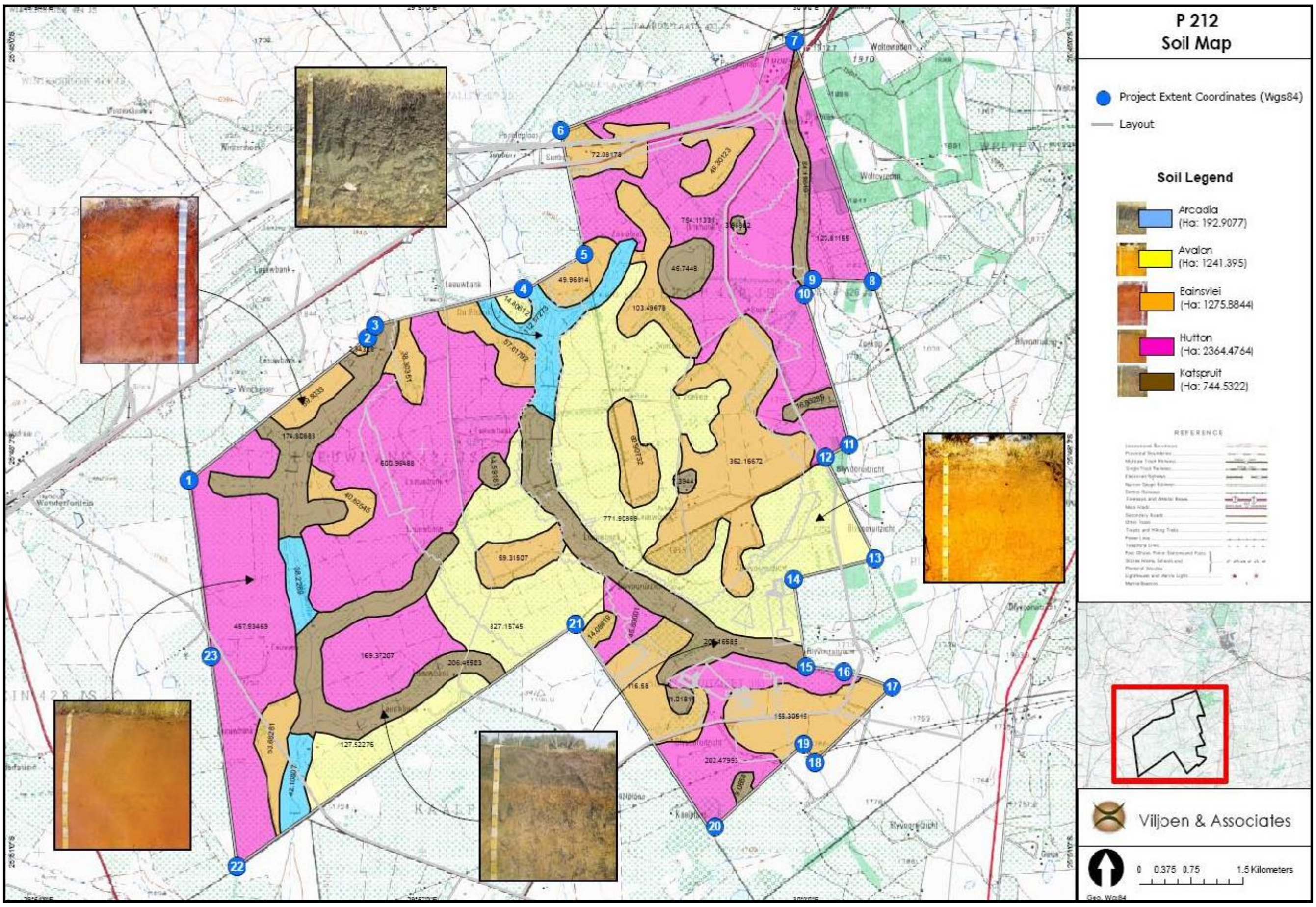

Figure 26: Soil Map of the Belfast Project Area

3.6 Land Capability and Land Use

3.6.1 Pre-Mining Land Use

The predominant land use on this site consists of (**Figure 27**):

- Arable land (plantation and ploughed land)
- Wetlands (large areas along the two main rivers namely the Leeuwbank Spruit and the Klein Komati Rivers, as well as their tributaries and various pans and farm dams are present)
- Grazing (natural grazing along rocky outcrop areas and wetlands)

Arable land is present in the form of ploughed land and plantations and is used for the production of maize, but also for potatoes and sunflower from time to time. Grazing in the form of pastures and natural grassland along wetlands and rocky outcrops also take place. Grazing is limited to areas where the soils are either too wet (i.e. wetlands) or too shallow and rocky (i.e. rocky outcrops) to be ploughed. Various bush clumps of Eucalyptus species and Wattles are present and are sold for commercial purposes. Wetlands also occur within the project area (**Table 18**).

Table 18: Current Land Use within the Belfast Project Area

Land Use	Surface Area (ha)	% of Total
Natural Veld	1,418	25
Plantations	320	4
Wetlands	913	16
Ploughed Land	3,166	55

Total	**5,817**	**100**

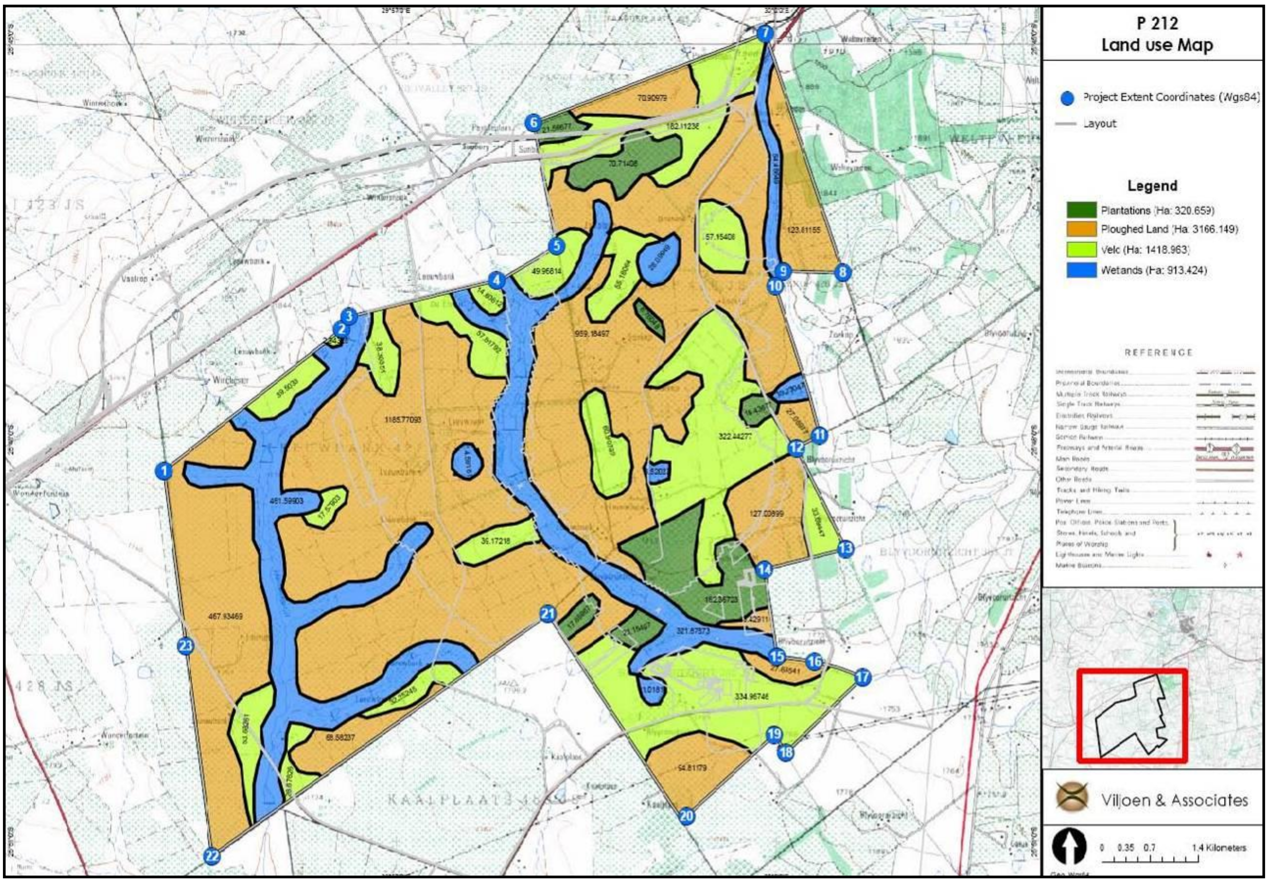

Figure 27: Current Land Use within the Belfast Project Area

3.6.2 Pre-Mining Land Capability

The different land capabilities identified for the Belfast Project area (**Figure 28**) are provided in **Table 19.**

Table 19: Land Capability for the Belfast Project Area

Land Capability	Surface Area (ha)	% of Total
Arable	3,442	59
Veld	1,450	25
Wetlands	925	16
Total	5,817	100

The agricultural potential of the Avalon, Bainsvlei and Hutton soils is considered medium to high under dryland (650mm/y rainfall) and irrigation conditions (>10-15mm/week, 33 – 1,500kPa plant available water). No evidence of soil erosion was observed on any of the soils during the investigation.

The land capability of the Emakhazeni Local Municipality (ELM) region in which the project area is located has been determined by the National Department of Agriculture (NDA) and is based on soil classification. **Table 20** shows the distribution of land capability classes that were used by the NDA. The relevant region of the ELM has been classified as Class III or Class VI, which gives and indication that the area has generally moderate conditions for cultivation and soil management and conservation is required (ELM, 2006).

Table 20: Land Capability Classes for Emakhazeni Local Municipality (ELM, 2006)

Land Capability Class	Percentage Coverage in ELM	Description
Class I	0%	No limitations.
Class II	12.5%	Some limitations that reduce the choice of plants or require moderate conservation practices, less latitude in the choice of crops or management practices.
Class III	20.3%	Severe limitations that reduce the choice of plants or require special conservation practices, or both, may be used for cultivated crops, but has more restrictions.
Class IV	11.5%	Very severe limitations that restrict the choice of plants, requires very careful management, or both. It may be used for cultivated crops.
Class V	8%	Little or no erosion hazard but has other limitations impractical to remove that limit its use largely to pasture, range, woodland.
Class VI	22.3%	Severe limitations that make it generally unsuited to cultivation and limit its use largely to pasture, range, woodland or wildlife.
Class VII	7.6%	Very severe limitation that makes it unsuited to cultivation and that restrict its use largely to grazing, woodland or wildlife.
Class VIII	17.8%	Limitations that preclude its use for commercial plant production and restrict its use to recreation, wildlife, water supply or aesthetic purposes.

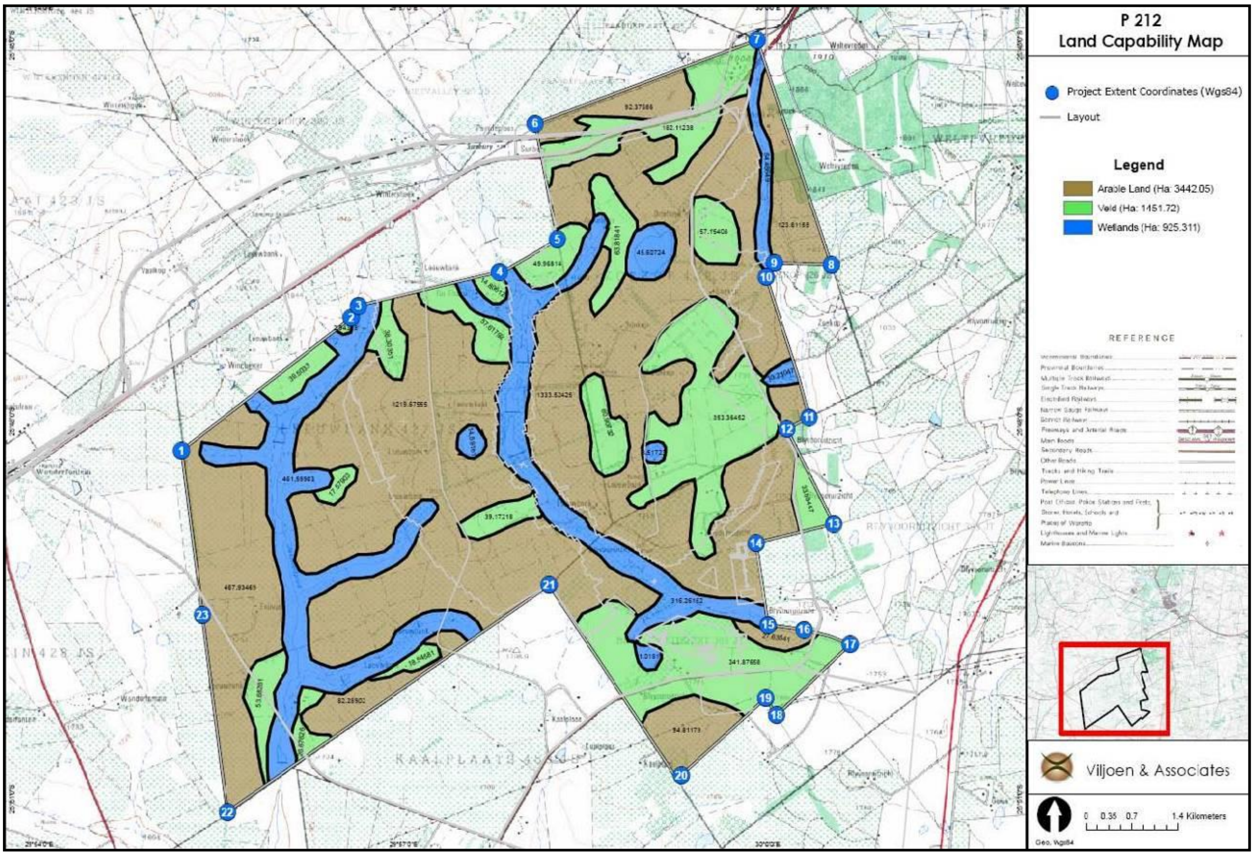

Figure 28: Land Capability of the Belfast Project Area

3.6.3 Land Use Zoning & the EMF

The Emakhazeni Local Municipality Environmental Management Framework (EMF) acts to translate environmental attributes of the study area in such a way as to inform planning and management of the environment, and provides a means to support decision-making around land use planning and management.

According to the EMF (**Figure 29**), part of the Belfast Project falls in an area classified as "agriculture" (37%), with intermittent areas classified as "no natural areas remaining" (62%), which are areas in between the agricultural lands where habitats have already been transformed. The meaning of "no natural areas remaining" and their relevance in the EMF is unclear – no reference is made to this class or term in the documentation. As this area is therefore unclassified, it follows that other land uses can be allocated to the same, and therefore, mining land use is not in direct conflict with the EMF. It is however noted that the majority of these areas are areas currently under cultivation with high potential soils.

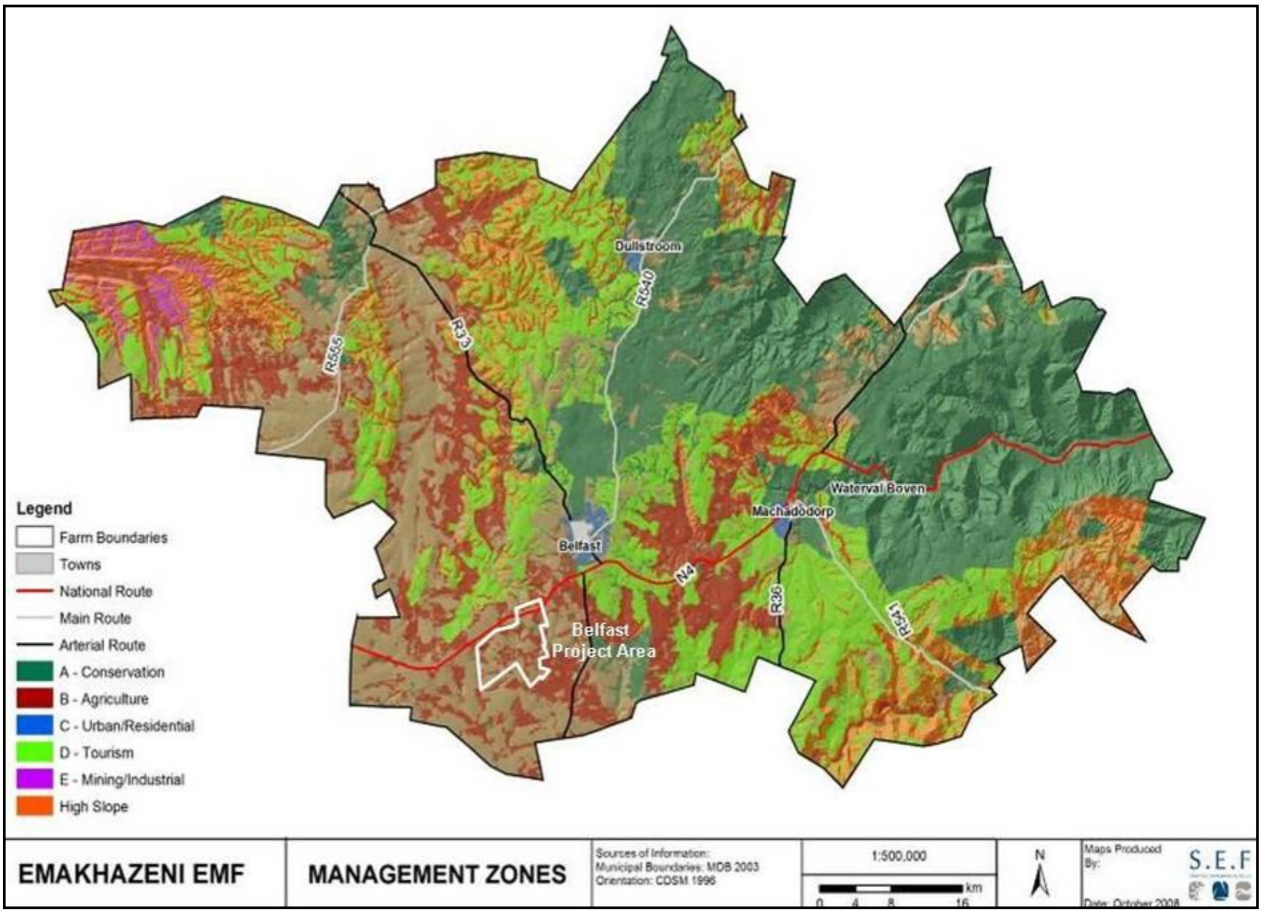

Figure 29: Emakhazeni Local Municipality Environmental Management Framework

3.7 Surface Water

A surface water assessment was undertaken by Golder Associates. Results from this report are presented below and the full report is provided in Appendix B2. It must be noted here that engineering aspects relating to surface water management in the Golder report have since been updated in the report by Jeffares and Green (refer to Appendix B1).

3.7.1 Regional Catchment Description

The proposed development is located in the headwaters of the Komati River. Three streams cross the proposed project area, namely the Leeuwbank Spruit, Klein Komati Spruit and the Driehoek Spruit. The Leeuwbank Spruit discharges its water in the Nooitgedacht dam whereas the Klein Komati Spruit and Driehoek Spruit discharge their water into the Klein Komati River between the Nooitgedacht and Vygeboom dams (**Figure 30**).

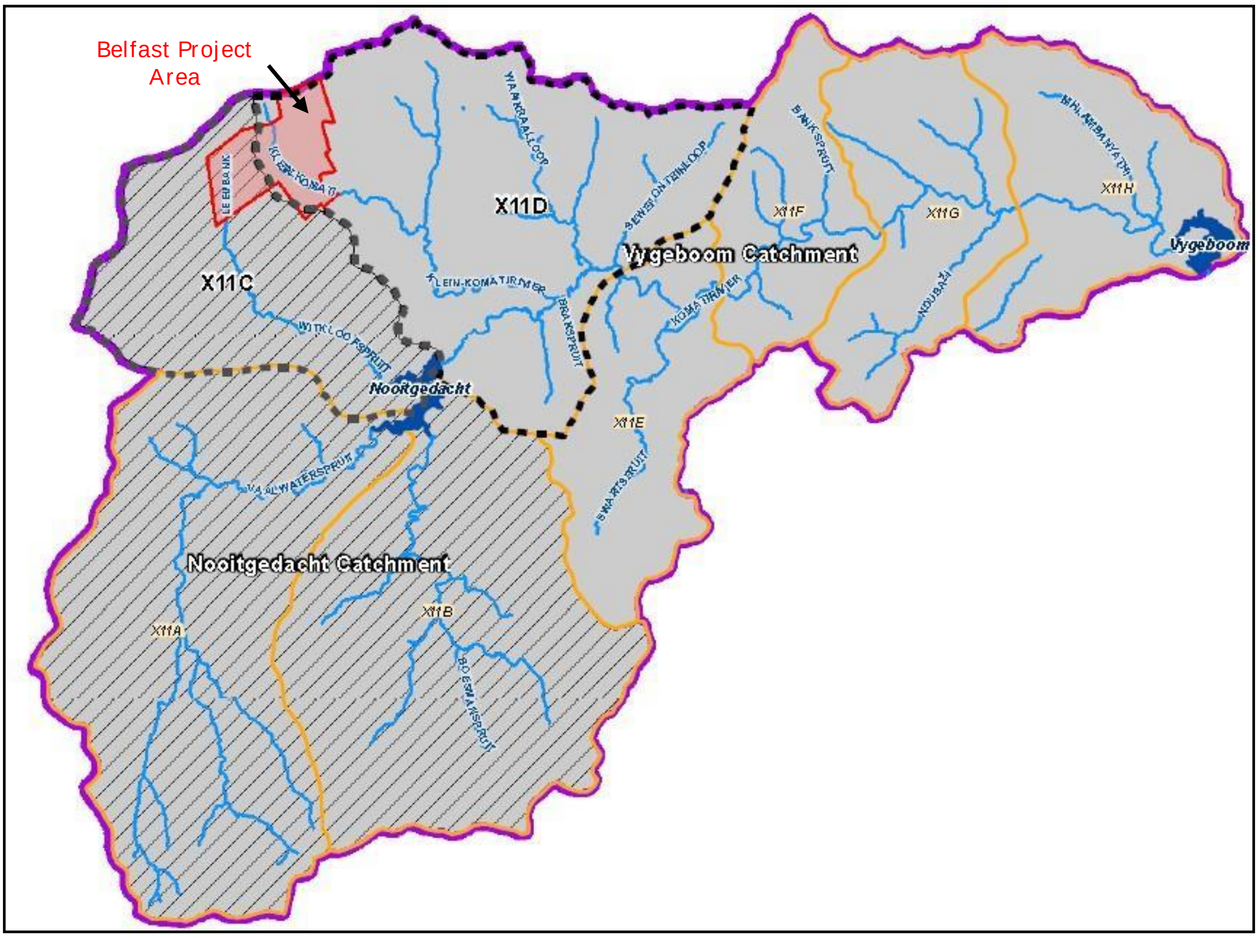

Figure 30: The Nooitgedacht and Vygeboom Catchments

The Komati River falls within the X1 drainage region of South Africa and has a catchment area of about 11,200km^2. The River is bordered by towns such as Carolina, Eerstehoek, Machadodorp, Waterval Boven, Ekulindeni, Mbojane, Barberton, Emangweni, Sibayeni and Komatipoort. The River is a shared watercourse, and crosses the South African border into Swaziland, and back into South Africa, to the north of Swaziland, and eventually flows into Mozambique (**Figure 31**). The major water requirements in the catchment include:

- The provision of water for power generation in the Olifants Water Management Area (WMA), currently met by water transferred from the Komati River
- Irrigation
- Afforestation
- Industrial activities
- Increasing domestic water demand (AfriDev, 2006)

Currently the major stresses facing the Inkomati Catchment are the high water demands for Eskom, irrigation, afforestation and industry and rapidly increasing domestic water demands. The water shortages experienced in the area have led to competition for the available water resources among user sectors. A substantial portion of the population in the catchment does not have access to a basic level of services and a number of planned expansions to water uses have been put on hold. Furthermore the major dams in the study area change the flow regime and impact on the water quality.

The Komati River catchment study detailed in a report by AfriDev Consultants (AfriDev, 2006) revealed that the water in the headwaters of the Komati River was generally of good quality with no major water quality problems being experienced. Some water quality impact is experienced in terms of dry land farming and forestry in the Upper Komati River between the Nooitgedacht and Vygeboom Dams; however the catchment is in good ecological condition (AfriDev, 2006). The two main dams in the Upper Komati catchment are operated to ensure the maximum yield. The volumes of water abstracted are based on the water available through the inter-basin transfers from the Vaal-Eastern Sub-system. The water is abstracted by Eskom for power generation. Eskom power stations receiving water from the Komati catchment were designed for use of this high quality (low sulphate) water. The continued supply of good quality water to Eskom is of strategic national importance and a key factor for the management of the catchment water resources. Due to the abstraction and rigid operating rules, the low flows of the Komati River between the dams have been impacted upon. This has resulted in an increase of nutrients in this reach of the river due to trout dams and tourism activities (AfriDev, 2006).

Water management in the Upper Komati region is therefore very sensitive and attention has to be given to changes in flow and water quality.

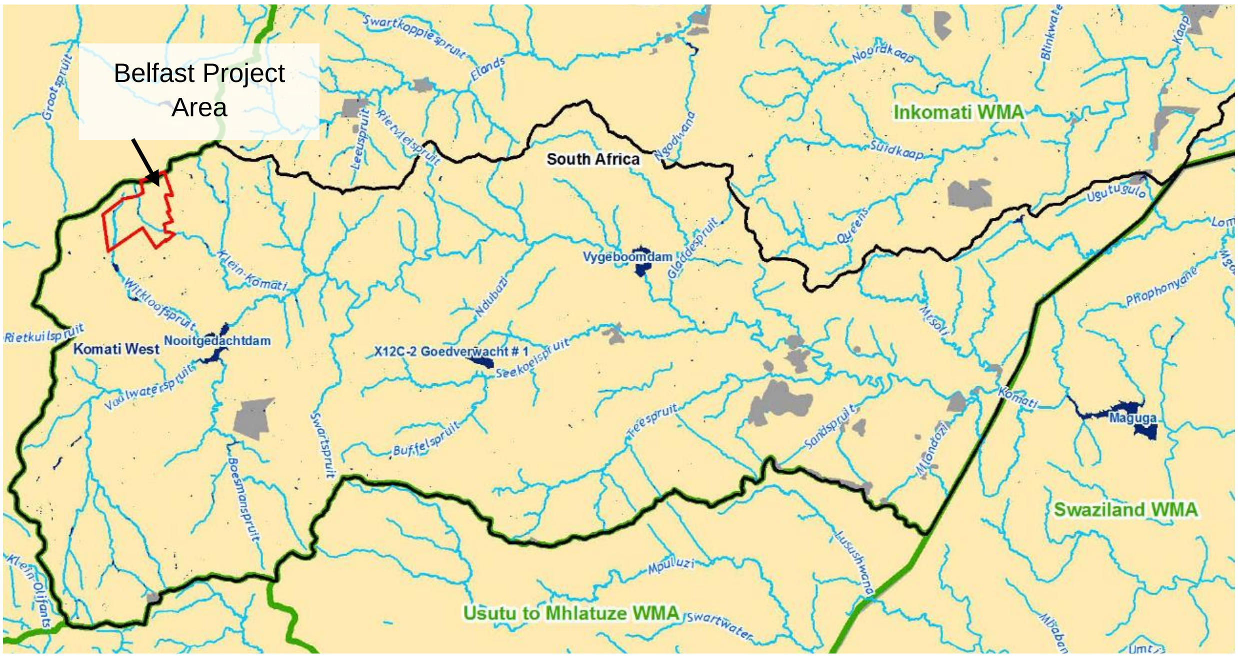

Figure 31: Inkomati River Catchment

3.7.2 Local Catchment Description

The Belfast Project is located in the Quarternary Catchments of the Leeuwbank Spruit and the Klein Komati Rivers in the Komati River Basin. A number of smaller sub-catchments have also been delineated as indicated in **Figure 32**. The three catchments depicted in **Figure 32** are characterised by moderately undulating plains and pans, with grasslands vegetation and no industrial / urban areas.

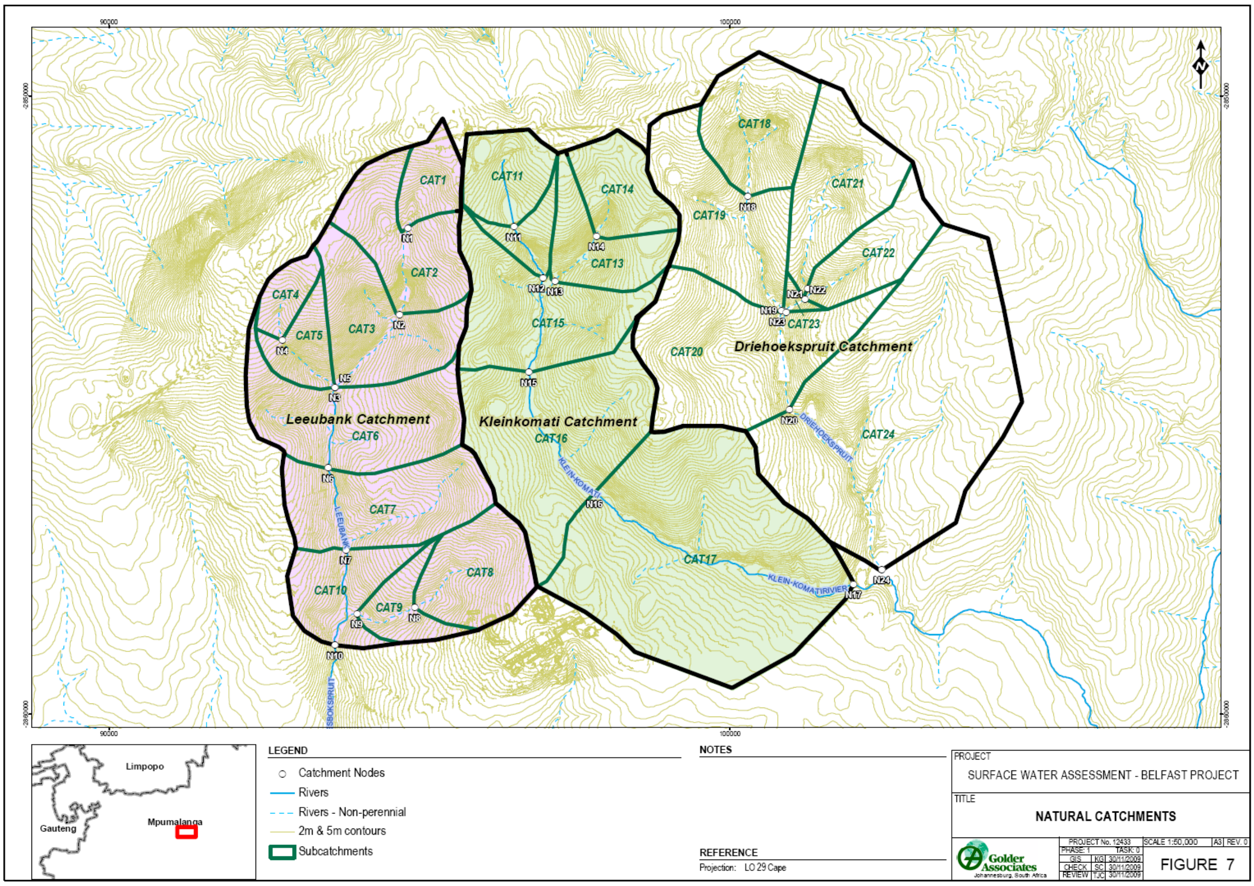

Figure 32: Sub-Catchments Occurring Within the Belfast Project Area

Driehoek Spruit Catchment

The Driehoek Spruit is on the eastern boundary of the identified coal outcrop. The stream flows in a southerly direction and joins the Klein Komati River 4km after the proposed mining area. There are 8 farm dams and 4 pans in the identified catchment. The catchment area, which may be impacted upon by mining is 36.43km^2 in size.

Field surveys indicated that the farm dams located in this catchment usually have water in them. The lack of runoff during the dry season indicates that the water table releases water constantly during the dry season to maintain the water level in the dams and the soils in the basin are such that seepage from the dam is low.

Leeuwbank

The Leeuwbank is a stream on the western most catchment. The stream flows in a southerly direction and joins up to the Blesbok Spruit to the south of the project. The stream then changes names to the Witkloof Spruit before flowing into the Nooitgedacht Dam. The catchment area of the portion of the river, which may be impacted upon by the mine is 31.2km^2. The catchment has 6 farm dams and 4 pans that have the same characteristics as described previously. A photograph of the Leeuwbank and its floodplain is provided in **Figure 33**.

After the Driehoek Spruit and Klein Komati join, the river flows in a south- easterly direction to join the Komati River, ±10km downstream of the Nooitgedacht dam. The Komati River flows in an easterly direction into the Vygeboom Dam and then into Mozambique and the Indian Ocean.

Figure 33: Photograph of the Leeuwbank Spruit - Looking Upstream

Klein Komati

The Klein Komati is the stream running through the control catchment, which is likely to be impacted upon by the mining activities. The catchment will be affected by the proposed open cast activities as well as possible mining infrastructure. The stream flows in a southerly direction and joins the Driehoek Spruit 5km downstream of the project area. The catchment area is 23.40km^2 at the point where the mine activities may affect the stream. There are approximately 7 farm dams and 10 pans in the identified area of the catchment. Field surveys indicated that the farm dams usually contain water while water was observed flowing in the stream during the field survey conducted at the end of the dry season.

3.7.3 Water Quantity

The DWA has recently completed the Inkomati Water Availability Assessment Study during which the hydrology of the Inkomati Basin was updated. The hydrology was produced at quinary[9] level. At quaternary level, the Leeuwbank Spruit falls within the X11C catchment whereas the Klein Komati and Driehoek Spruit fall within the X11D catchment. The study produced a naturalised flow record of 226 km^2 and 572km^2 for the X11C and X11D catchments respectively. The maximum catchment area that is isolated by the mine was calculated to be 0.7km^2 and 2.5km^2 for the X11C and X11D catchments respectively. The impact of the mine on the flows can be assessed by removing the area isolated by the mine water management system from the quaternary catchments and looking at the impact on the naturalized hydrology. The minimum, average and maximum monthly flow volumes are given in **Table 21** and **Table 22** for the catchments with and without the mining area isolated. The reduction in the naturalized Mean Annual Runoff (MAR) for the X11C catchment is from 11.35 million m^3/a to 11.32 million m^3/a which is a reduction of 0.30% which is in line with the fraction of the area that is isolated by the mining. The reduction in the naturalized MAR for the X11D catchment is from 47.49 million m^3/a to 47.29

[9] Quinary: In sets of five; having a base of five.

million m^3/a which is a reduction of 0.42%. The reduction is therefore small for this mine. However if other mines are established in the catchment, an integrated approach should be followed by DWA.

The Komati river catchment is particularly sensitive due to abstraction of water from the Nooitgedacht Dam and Vygeboom Dam for power supply, therefore the impact on water availability at these dams was investigated. Results are shown in **Table 23** and **Table 24.** The impact is relatively low as a reduction of the MAR of 0.06% and 0.12% is expected at the Nooitgedacht Dam and Vygeboom Dam respectively.

Table 21: Average, Minimum and Maximum Naturalized Monthly Runoff Volumes for Quaternary X11C (million m^3/month) without and with the Mining Area

Month	Area (m^3)	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Average (without mine)	230	0.38	1.26	1.86	2.24	2.31	1.4	0.73	0.35	0.24	0.21	0.18	0.19	11.35
Average (with mine)	229	0.38	1.26	1.85	2.23	2.3	1.4	0.73	0.35	0.24	0.21	0.18	0.19	11.32
Minimum (without mine)	230	0.07	0.09	0.12	0.23	0.21	0.18	0.12	0.09	0.1	0.09	0.08	0.06	1.44
Minimum (with mine)	229	0.07	0.09	0.12	0.23	0.21	0.18	0.12	0.09	0.1	0.09	0.08	0.06	1.44
Maximum (without mine)	230	4.48	12.15	13.47	16.33	22.11	16.4	6.17	4.4	0.57	0.53	0.59	1.82	99.02
Maximum (with mine)	229	4.47	12.11	13.43	16.28	22.04	16.35	6.15	4.39	0.57	0.53	0.59	1.81	98.72

Table 22: Average, Minimum and Maximum Naturalized Monthly Runoff Volumes for Quaternary X11D (million m^3/month) without and with the Mining Area

Month	Area (m^3)	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Average (without mine)	593	1.45	3.63	5.85	7.8	8.91	7.34	4.96	2.98	1.69	1.13	0.9	0.85	47.49
Average (with mine)	591	1.44	3.61	5.83	7.77	8.87	7.31	4.94	2.97	1.68	1.13	0.9	0.85	47.29
Minimum (without mine)	593	0.44	0.4	0.76	1.18	1.14	1.51	1.18	0.65	0.55	0.53	0.48	0.42	9.24
Minimum (with mine)	591	0.44	0.4	0.76	1.17	1.14	1.5	1.17	0.65	0.55	0.53	0.48	0.42	9.2
Maximum (without mine)	593	4.88	16.84	26.12	28.08	48.88	39.3	24.39	21.18	8.93	4.09	3.31	3.04	229.04
Maximum (with mine)	591	4.86	16.77	26.01	27.96	48.67	39.13	24.29	21.09	8.89	4.07	3.3	3.03	228.07

Table 23: Average, Minimum and Maximum Naturalized Monthly Runoff Volumes for the Nooitgedacht Dam (million m^3/month) without and with the Mining Area

Month	Area (m^3)	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Average (without mine)	1,174	2.41	7.82	10.97	12.67	13.27	8.3	4.49	2.25	1.52	1.37	1.15	1.17	67.39
Average (with mine)	1,173	2.41	7.82	10.96	12.66	13.26	8.3	4.49	2.25	1.52	1.37	1.15	1.17	67.36
Minimum (without mine)	1,174	0.45	0.54	0.73	1.39	1.24	1.1	0.72	0.57	0.61	0.58	0.53	0.38	8.84
Minimum (with mine)	1,173	0.45	0.54	0.73	1.39	1.24	1.1	0.72	0.57	0.61	0.58	0.53	0.38	8.84
Maximum (without mine)	1,174	28.67	75.67	81.45	99.65	133.85	100.34	36.98	27.03	3.75	3.47	3.86	11.31	606.03
Maximum (with mine)	1,173	28.66	75.63	81.41	99.6	133.78	100.29	36.96	27.02	3.75	3.47	3.86	11.3	605.73

Table 24: Average, Minimum and Maximum Naturalized Monthly Runoff Volumes for the Vygeboom Dam (million m^3/month) without and with the Mining Area

Month	Area (m^3)	Oct	Nov	Dec	Jan	Fen	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Average (without mine)	2,723	8.56	23.62	35.99	43.88	48.69	38.28	24.33	13.59	7.7	5.32	4.21	4.2	258.37
Average (with mine)	2,720	8.55	23.6	35.96	43.84	48.64	38.24	24.31	13.58	7.69	5.31	4.21	4.2	258.13
Minimum (without mine)	2,723	2.13	2.6	3.5	5.96	6.86	6.67	4.93	3.14	2.25	2.35	2.19	1.86	44.74
Minimum (with mine)	2,720	2.13	2.6	3.5	5.95	6.85	6.66	4.92	3.14	2.25	2.35	2.19	1.86	44.7
Maximum (without mine)	2,723	57.62	133.58	171.07	202.49	310.91	248.49	125.93	79.88	26.85	15.46	14.85	23.88	1,411.01
Maximum (with mine)	2,720	57.59	133.47	171.92	202.32	310.63	248.27	125.81	79.78	26.81	15.44	14.83	23.886	1,409.73

Flood Peaks and Volumes

Flood peaks estimated for the catchment node points in **Figure 32** are tabulated in **Table 25.**

Table 25: Flood Peak Estimates

Name	1 in 50 Year Flood Peaks (m^3/s)	1 in 100 Year Flood Peaks (m^3/s)	Regional Maximum Flood (m^3/s)
N1	10.5	12.9	108
N2	23.5	29.5	154
N3	28.7	36.1	161
N4	7.4	9.1	94
N5	59.9	74.0	108
N6	89.5	113.4	180
N7	110.9	135.8	172
N8	17.5	17.5	146
N9	17.5	21.6	106
N10	132.7	163.6	135
N11	16.6	20.4	127
N12	23.5	28.9	95
N13	13.9	17.2	134
N14	16.9	20.7	130
N15	67.7	84.1	175
N16	95.5	120.8	209
N17	130.2	167.3	267
N18	24.6	30.4	156
N19	43.5	53.6	173
N20	71.5	90.5	202
N21	19.0	23.5	162
N22	13.9	17.2	134
N23	32.9	40.6	52
N24	100.0	129.3	271

Flood Lines

The flood levels for the 1:50-year and 1:100-year flood peaks were determined and plotted in **Figure 34** (pre-mining river flood lines).

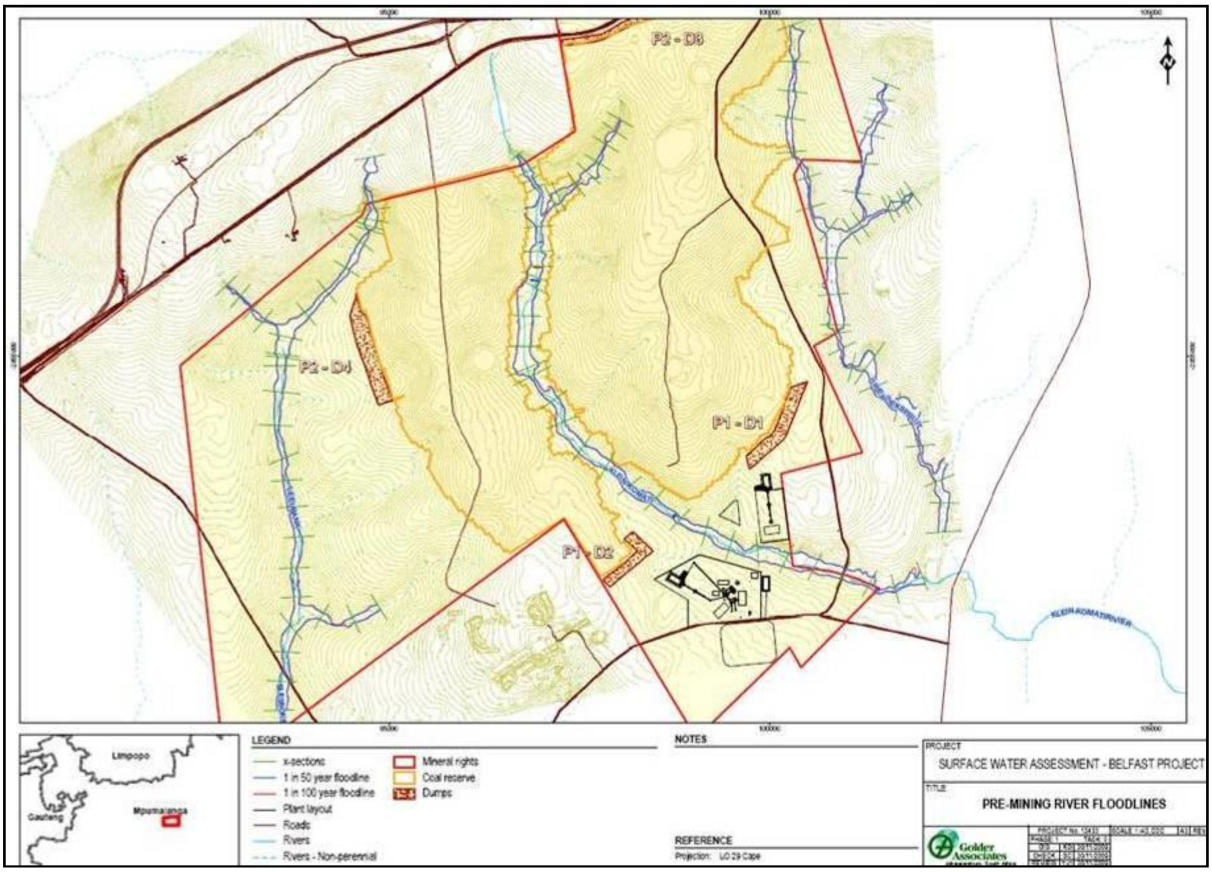

Figure 34: Pre-Mining Flood Lines

Drainage Density

Drainage density is defined by the catchment area divided by the hydraulic length. **Table 26** provides the densities for each of the identified catchments.

Table 26: Drainage Densities of Affected Catchments

Catchment Name	Drainage Density (km^2/km)
Leeuwbank	3.12
Klein Komati	2.73
Driehoek	3.38

Recharge

Recharge, in the light of the proposed opencast pits, is the volume of water that escapes from the evaporation zone and percolates through the spoil body or soil to the floor of the pit. Typical recharge values from other work undertaken in the Witbank Coal Fields were used to calibrate the model due to the Belfast Project being at an early stage and due to the lack of local data. The recharge values are provided in **Table 27** for different sources of water in opencast pits.

Table 27: Typical Water Recharge Characteristic for Opencast Mining

Sources Contributing Water	Water Sources into Opencast Pits	Suggested Average Values
Rain onto ramps and voids	20 – 100% of rainfall	70% of rainfall
Rain onto spoil heaps (runoff and seepage)	30 – 80% of rainfall	60% of rainfall
Rain onto levelled spoils (runoff)	3 – 7% of rainfall	5% of rainfall
Rain onto levelled spoils (seepage)	15 – 30% of rainfall	20% rainfall

Rain onto rehabilitated spoils (runoff)	5 -15% of rainfall	10% of rainfall
Rain onto rehabilitated spoils (seepage)	5 – 10% of rainfall	8% of rainfall

3.7.4 Surface Water Quality

At a regional scale, significant catchment development, including industrial growth, widespread mining activities, afforestation, agricultural activities and formal and informal urbanisation has impacted on the surface water resources of the Komati catchment areas. The Leeuwbank Spruit, Klein Komati Spruit and Driehoek Spruit are all tributaries of the Komati River, and downstream water users of this River include domestic use (Class 1), industrial use (Class 1), power generation, irrigation and livestock watering.

The water quality status assessment has been based on the routine monitoring conducted by Clean Stream. Surface water quality samples were taken for the three streams over the period September 2008 - September 2009. The locations of the sampling points are provide in **Figure 35** and described in **Table 28.**

Table 28: Sampling Locations

Sample No.	Description	Latitude	Longitude
BWQ 01	Dam in north-eastern corner	25º 45' 35" S	29º 59' 53" E
BWQ 02	Dam in eastern corner	25º 47' 56" S	30º 00' 20" E
BWQ 03	Stream draining towards the south-east	25º 50' 04" S	30º 01' 37" E
BWQ 04	Stream draining towards south	25º 49' 41" S	30º 00' 23" E
BWQ 05	Central stream draining towards BWQ 04	25º 48' 48" S	29º 58' 21" E
BWQ 06	Dam in northern corner	25º 46' 33" S	29º 57' 43" E
BWQ 07	Dam in north-western corner	25º 46' 51" S	29º 56' 40" E
BWQ 08	Dam in western corner	25º 48' 02" S	29º 56' 02" E
BWQ 09	Stream draining towards the south-west	25º 50' 24" S	29º 56' 01" E
BWQ 10	Dam to the northwest of Belfast NBC	25º 46' 10" S	29º 53' 17" E

The South African Water Quality Guidelines (SAWQG) (DWAF, 1996) was used as the target guideline criteria. These serve as the primary source of information for determining the water quality requirements of different users and for the protection and maintenance of the health of aquatic ecosystems. The most stringent applicable Target Water Quality Range (TWQR) amongst the user groups (i.e. most stringent user requirement) per identified variable was selected as the target concentration against which the current water quality status was compared. This was done in order to obtain an indication of how good or bad the water quality is for intended uses. The results therefore provide a perspective on what level of protection Resource Water Quality Objectives (RWQOs) should be set at. The SAWQG used for the assessment are listed in **Table 29** whilst the surface water quality results are provided in **Table 30** and **Table 31** respectively.

Table 29: Quality Guidelines Used to Assess Water Quality Status

Water Quality Variable	Most Stringent User	TWQR
Electrical Conductivity	Industrial: Category 1	15 mS/m
pH	Domestic: Class 0	6 – 9 pH units
Ammonia (as N)	Aquatic ecosystem	≤ 0.007 mg/l N
Chloride	Industrial: Category 1	20 mg/l
Magnesium	Domestic: Class 0	30 mg/l
Nitrate (as N)	Domestic: Class 0	6 mg/l N
Phosphorus (as P inorganic)	Aquatic Ecosystem	<0.005 mg/l
Sodium	Irrigation	70 mg/l
Sulphate	Industrial: Category 1	30 mg/l

Alkalinity	Industrial: Category	150 mg $CaCO_3$/ l

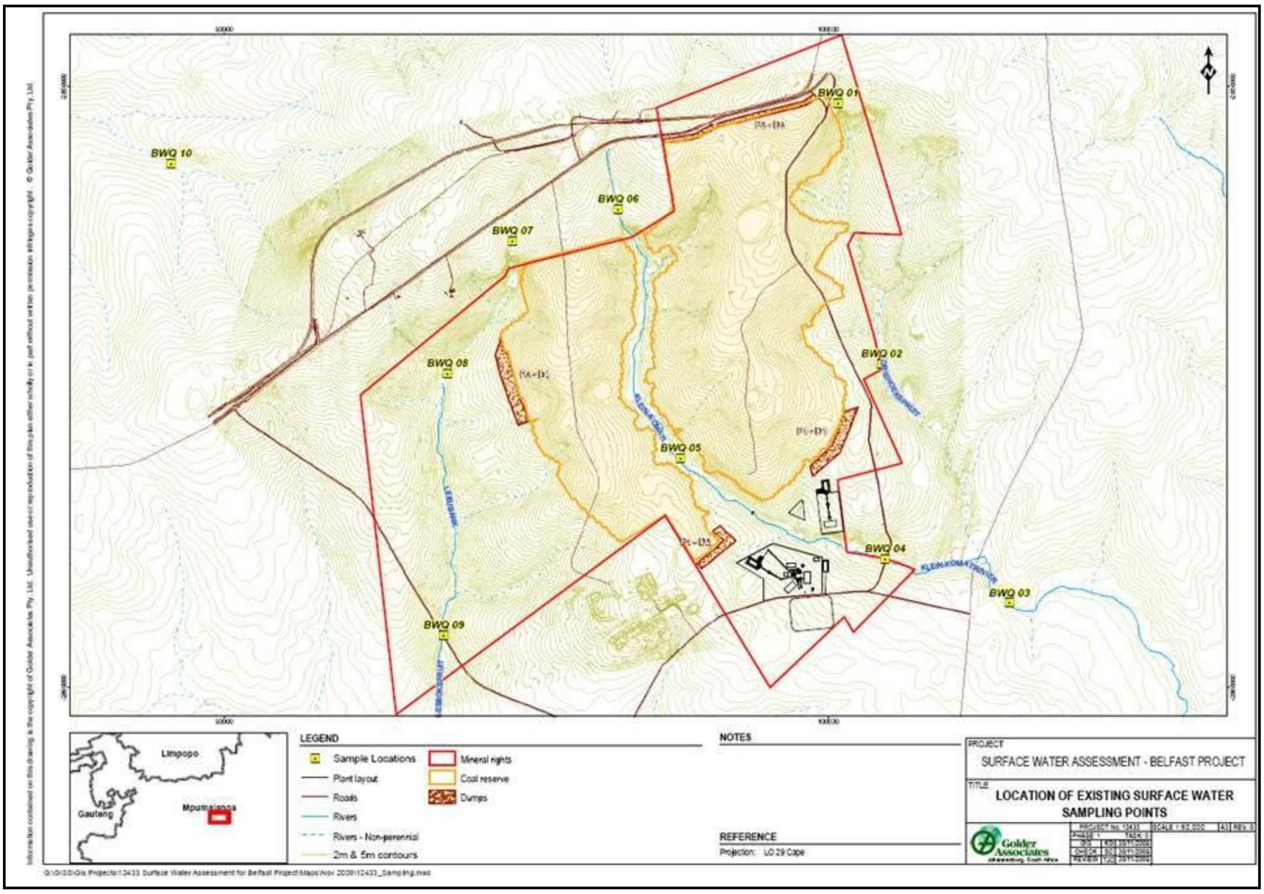

Figure 35: Surface Water Sampling Locations

Table 30: Surface Water Quality Results for September 2008– November 2008

Variables	Unit	BWQ 01	BWQ 01	BWQ 02	BWQ 03	BWQ 04	BWQ 05	BWQ 06	BWQ 07	BWQ 08	BWQ 09	BWQ 10
pH	-	6.57	6.57	6.08	7.60	7.45	6.36	8.45	7.96	6.89	7.74	8.24
Electrical Conductivity (EC)	mS/m	16.36	16.36	7.98	11.24	16.25	19.86	34.13	42.77	20.62	18.76	34.77
Total Dissolved Solids (TDS)	mg/l	143	143	103	101	109	125	205	283	139	131	204
T Hardness	mg/l	25.0	25.0	11.8	27.2	36.5	32.9	103.9	63.0	32.0	49.4	126.6
Calcium (Ca)	mg/l	5	5	2	5	6	5	20	10	5	10	26
Magnesium (Mg)	mg/l	3	3	2	4	5	5	13	9	5	6	15
Sodium (Na)	mg/l	12	12	6	7	11	14	14	35	14	12	15
Potassium (K)	mg/l	6	6	2	2	3	3	7	4	5	2	2
Alkalinity (MAlk)	mg/l	7	7	7	24	29	6	84	46	18	43	139
Chloride (Cl)	mg/l	25	25	12	11	24	41	50	92	41	16	18
Sulphate (SO_4)	mg/l	23	23	8	8	2	12	0	7	9	17	13
Nitrate (NO_3)	mg/l	0.49	0.49	0.64	0.10	0.15	1.03	0.83	0.63	0.10	1.93	0.33
Fluoride (F)	mg/l	0.48	0.48	0.48	0.49	0.48	0.48	0.67	1.62	0.48	0.48	0.48
Aluminium (Al)	mg/l	0.2	0.2	5.55	0.07	0.35	0.02	0.01	0.20	0.85	0.59	0.18
Iron (Fe)	mg/l	0.33	0.33	5.48	2.82	1.66	0.45	0.26	21.35	1.83	1.03	0.19
Manganese (Mn)	mg/l	0.19	0.19	0.21	0.04	0.01	0.57	0.01	0.02	0.11	0.02	0.01
Ammonia (NH_3)	mg/l	0.31	0.31	0.44	0.17	0.16	1.17	0.27	4.90	1.92	0.15	0.11
Total Hardness	mg/l	0.10	0.10	0.10	0.10	0.10	0.61	0.55	0.23	0.14	0.13	0.11
Phosphate (PO_4)	mg/l	28.67	28.67	42.33	29.33	35.67	23.00	46.33	21.33	46.00	36.67	25.67
Suspended Solids (SS)	-	12.00	12.00	139.67	39.33	119.33	300.00	18.67	5853.00	59.00	20.00	50.67
Sodium Absorption Ratio (SAR)	-	1.07	1.07	0.71	0.60	0.81	1.08	0.59	2.03	1.10	0.72	0.58

Table 31: Surface Water Quality Results for December 2008 – April 2009

Variables	Unit	BWQ 01	BWQ 02	BWQ 03	BWQ 04	BWQ 05	BWQ 06	BWQ 07	BWQ 08	BWQ 09	BWQ 10
pH	-	6.77	7.00	7.21	6.94	6.73	7.47	7.61	6.81	7.59	7.70
Electrical Conductivity (EC)	mS/M	10.25	8.01	9.94	12.79	14.41	28.33	26.20	11.95	15.56	23.22
Total Dissolved Solids (TDS)	mg/l	39.60	28.20	36.20	48.20	53.20	136.50	120.00	43.00	73.80	117.60
T Hardness	mg/l	23.36	18.28	27.94	30.82	33.20	95.20	64.90	26.65	48.20	94.34
Calcium (Ca)	mg/l	4.40	3.60	5.00	5.00	5.40	18.50	11.00	4.75	9.00	19.20
Magnesium (Mg)	mg/l	2.60	2.60	4.00	4.40	4.80	12.00	9.25	3.50	6.40	11.40
Sodium (Na)	mg/l	6.40	5.40	6.20	9.00	9.80	10.75	18.50	7.75	9.40	10.20
Potassium (K)	mg/l	3.60	2.20	1.60	2.00	2.20	5.50	2.25	2.75	1.60	1.40
Alkalinity (MAlk)	mg/l	19.20	19.60	26.80	23.20	22.20	78.75	43.00	19.75	47.20	100.60
Chloride (Cl)	mg/l	11.80	8.80	10.20	21.00	28.20	41.00	51.50	17.75	16.60	10.60
Sulphate (SO_4)	mg/l	8.20	1.20	1.80	3.60	1.60	0.00	1.00	4.50	2.80	4.20
Nitrate (NO_3)	mg/l	0.00	0.00	0.00	0.00	0.00	1.36	0.42	0.10	0.10	0.07
Fluoride (F)	mg/l	0.10	0.11	0.10	0.10	0.11	0.14	0.49	0.06	0.10	0.10
Aluminium (Al)	mg/l	0.63	0.23	0.08	0.57	0.08	0.00	0.16	0.55	0.16	0.63
Iron (Fe)	mg/l	1.07	2.71	0.93	1.57	1.57	2.10	0.40	0.73	0.86	0.78
Manganese (Mn)	mg/l	0.00	0.00	0.00	0.01	0.01	0.22	0.00	0.00	0.01	0.01
Ammonia (NH_3)	mg/l	0.05	0.00	0.00	0.03	0.03	0.36	0.03	0.04	0.00	0.02
Total Hardness	mg/l	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phosphate (PO_4)	mg/l	20.60	19.60	18.20	22.00	21.60	54.00	18.00	24.00	14.60	18.60
Suspended Solids (SS)	-	6.40	18.40	3.00	4.20	13.00	27.00	75.75	41.25	3.80	15.80
Sodium Absorption Ratio (SAR)	-	0.56	0.56	0.50	0.68	0.75	0.48	0.99	0.70	0.59	0.45

Electrical Conductivity (EC)

The EC in the Driehoek Spruit are within the TWQR guideline limit of 15mS/m. Mean EC values in the Klein Komati River downstream of the mine drops to below 10mS/m. EC values exceeds the TWQR were measured in the upper part of the catchments at BWQ 07 and BWQ 06. The EC concentrations decreases further downstream with the addition of low EC water as the water moves downstream.

pH

In general the observed values are compliant with the TWQR guideline limits.

Ammonia (NH3)

Mean concentrations of NH_3 are higher than the TWQR guideline limit of 0.007mg/l in all part of the catchment ranging from 0.05 mg/l to 0.1mg/l.

Chloride (Cl)

Concentrations of Cl in the Driehoek Spruit are within the TWQR guideline limit of 20mg/l. Concentrations in the lower part of the Klein Komati catchment and Leeuwbank Spruit catchment are reasonably good. However, high concentrations of Cl are observed in the upper part of these two catchments (BWQ6 and BWQ7). Cl concentrations decrease downstream on the Klein Komati and Leeuwbank Spruit due to the addition of low chloride concentration water.

Magnesium (Mg)

No specific trend is observed in Mg concentrations. The observed values are compliant with the TWQR guideline limits.

Nitrate (NO_3)

The concentration of NO_3 in all the streams is low and below the TWQR limit of 6mg/l. The highest readings were observed in the dams at the upstream section of the Klein Komati and Leeuwbank Spruit catchments.

Sodium (Na)

The recorded Na concentrations are below the domestic and irrigation TWQR guideline limit of 70 mg/l. Median concentrations range between 8 - 12 mg/l for the three streams.

Phosphates (PO_4)

The TWQR is based on the upper bound of the PO_4 concentration needed to ensure oligotrophic[10] conditions in the river system. The typical range of measured concentrations is 0.02mg/l to 0.05mg/l. This range of concentration indicates that the trophic[11] status could be between mesotrophic[12] and eutrophic[13].

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[10] Oligotrophic: Lacking in plant nutrients and having a large amount of dissolved oxygen throughout. Used of a pond or lake.

[11] Trophic: Of or involving the feeding habits or food relationship of different organisms in a food chain.

[12] Mesotrophic: Reservoirs and lakes which contain moderate quantities of nutrients and are moderately productive in terms of aquatic animal and plant life. Mesotrophic is intermediate between oligotrophic and eutrophic systems.

[13] Eutrophic: Having waters rich in mineral and organic nutrients that promote a proliferation of plant life, especially algae, which reduces the dissolved oxygen content and often causes the extinction of other organisms.

Sulphates (SO_4)

The concentrations of SO_4 in the Driehoek Spruit are within the TWQR guideline limit of 30mg/l. Concentrations in the lower part of the Klein Komati catchment and Leeuwbank Spruit catchment are reasonably good. However significant concentrations of SO_4 are observed in the upper part of these two catchments (BWQ6 and BWQ7), which could be attributed to upstream water uses impacting on the water quality within the upper part of the catchment. SO_4 concentrations decrease as the Klein Komati Spruit and Leeuwbank Spruit flow downstream.

Total Alkalinity

The median total alkalinity in the rivers ranges from 15 - 40mg $CaCO_3$/l. The concentrations are below the TWQR guidelines except for the upper catchment of the Klein Komati where mean values of 72mg/l were observed.

Conclusion

Overall, the water quality in the Driehoek Spruit can be described as being in a good condition. The monitoring stations near the two dams at the upstream section of the Klein Komati (BWQ6) and Leeuwbank (BWQ7) catchments revealed that the quality of water in these tributaries is in a relatively poor state when compared to the most sensitive users. The quality improves in the downstream section of these catchments where the water quality can be described as good. This would suggest that there could be a diffuse source of pollution upstream of these catchments.

3.8 Groundwater

A geohydrological investigation was undertaken by Groundwater Complete as part of the EIA. Results from this report are presented herewith and the full report is provided in Appendix H.

Based on information provided by the hydrocensus and water user survey, it is noted that groundwater from boreholes is mainly used for domestic supply, livestock watering and watering of gardens at farmsteads. Yields in the Karoo type aquifers are too low to sustain any mentionable irrigation schemes. In general, borehole yields reported during the user survey for the local aquifers in the proposed Belfast Project area correspond well with literature and more regional Karoo type aquifers with most yields being between 0.01 - 2l/s. The overall yields therefore indicate that the aquifers in the area generally do not represent major aquifers.

3.8.1 Groundwater Zone

Based on the geological profile descriptions, the unsaturated zone is composed of sandy soils (reddish-yellowish brown) underlain by sandstone, siltstone, shale and coal, followed by diamictite and basement rocks of the older Transvaal Supergroup. The unsaturated zone impacts on the aquifer in terms of both groundwater quality and quantity.

The thickness of the unsaturated zone was determined by subtracting the pre-mining static water levels in the study area from the topography. Water level measurements in boreholes of users in the area showed that the depth to water level, and thus the unsaturated zone, generally varies between ± 0.5 - 16 metres below surface (mbs).

3.8.2 Aquifers

Depth of Aquifer

The aquifer thickness in the coal mining environment is often taken as the difference between the estimated static water level of the aquifer and the base of the lowest mined coal seam. In the vicinity of the Belfast Project area, such an assumption cannot be made because of two reasons:

- Very few significant groundwater strikes were recorded in or near the coal seams – this was true for all of the boreholes drilled for monitoring purposes; and
- The main water strikes in the highest yielding boreholes occurred in faults or bedding plane fractures or between rock types of differing consistence and spatial distribution.

Additional to these facts, the nature of the fractured rock aquifers combined with the undulating topography of the Karoo sediments will result in very thick ‘aquifers’ in places where the coal is deep and in no ‘aquifer’ whatsoever where the coal reserve sub-outcrops or has been eroded away. In the boreholes drilled in the vicinity of the proposed Belfast Project area, few water-yielding fractures were intersected. Those that were intersected occurred from ± 11m to a maximum depth of 25m. It is thus considered more accurate or appropriate to calculate the aquifer thickness from the piezometric water level to the deepest water yielding fractures in the study area.

On the basis of the drilling results obtained during this investigation, the aquifer thickness in the region generally varies between approximately 3 - 22m. This ‘’thickness’’ can definitely increase in some areas where much deeper water strikes occur in older basement rock types.

Type of Aquifer

From the drilling results of 8 new monitoring boreholes as well as numerous other monitoring boreholes and geological exploration boreholes or areas used for domestic and livestock water supply, two possible aquifer types have been found present in the study area.

The first system is a shallow aquifer that occurs in the transitional soil and weathered bedrock zone or sub-outcrop horizon. This aquifer generally has a low yield with phreatic water levels sometimes occurring on un-weathered bedrock or clayey layers. Yields in this aquifer are low (generally less than 0.3 l/s) and the aquifer is not usable as a groundwater supply source on a continuous basis. Where consideration of the shallow aquifer system becomes important is during seepage estimations into open pit voids and mass transport simulations from mine-induced contamination sources because a lateral seepage component in the shallow water table zone in the weathered zone often occurs. According to the Parsons Classification system, the aquifer is usually regarded as a minor or even a non-aquifer[14] system. This aquifer is, however, poorly developed in the study area and only seepage moisture was intersected during drilling. It is concluded that this aquifer only develops during times of high rainfall (e.g. summer months) and is not used as a reliable source of groundwater supply.

Although groundwater seepage does occur in the weathered zone, the yields are very low and this zone cannot really be defined as an ‘aquifer’ according to the true meaning of the term. The main value and function of the shallow weathered zone ‘aquifer’ lies in the storage and transfer of moisture from rainfall to soil (laterally), vegetation (upwards) and the deeper aquifer (downwards).

The second aquifer system is the fractured Karoo rock-type aquifer where groundwater yields, although more heterogeneous, can be higher than the weathered zone aquifer. The aquifer occurs at depths of between 5 - 30mbs in the study area. This aquifer system usually displays semi-confined or confined characteristics with piezometric heads often significantly higher than the water-bearing fracture position. The aquifer forms in transmissive fractures in the consolidated and mostly impervious bedrock. The fractures may occur in any of the co-existing host rocks due to different tectonic, structural and depositional processes. Aquifer yields in this system vary from zero to approximately 2l/s in the Karoo rock types that occur in the Belfast Project area.

[14] By definition, an aquifer is a geological formation or group of formations that can yield groundwater in economical exploitable quantities.

Yields from this aquifer could be sufficient to supply drinking and sanitation water to mining operations but are too low to use as a source of process water supply. In the boreholes tested as well as surveyed during the hydrocensus, sustainable yields of between 0.1 – 2l/s were determined. According to the Parsons Classification system, the aquifer could be regarded as a minor, but often a sole aquifer system.

The drilling and testing of the monitoring boreholes in the area indicated that the shallow weathered zone aquifer is poorly developed and will mainly manifest during the wetter summer months when significant seepage in the shallow weathered zone occurs. Because of its shallow position and direct interaction with the surface, this aquifer has most characteristics of a primary type aquifer.

Aquifer Recharge and Discharge

Recharge in the Belfast Project area is estimated as between 1 – 3% of Mean Annual Precipitation (MAP). Where sandstone outcrop occurs, the effective recharge percentage can be slightly higher while in low-lying topographies where discharge generally occurs and thicker sediment deposition, the effective recharge will be lower. Based on this estimate, the average recharge to the pre-mined East block area is approximately 920m^3/d (337,000m^3/y), and approximately 510 m^3/d (188,000 m^3/y) to the West block.

3.8.3 Presence of Water Boreholes and Springs

A hydrocensus was conducted as part of this study around the proposed Belfast Project. As part of the hydrocensus, boreholes **(Figure 36**) and springs (**Figure 37**) were mapped within a 1km radius of the proposed mining areas.

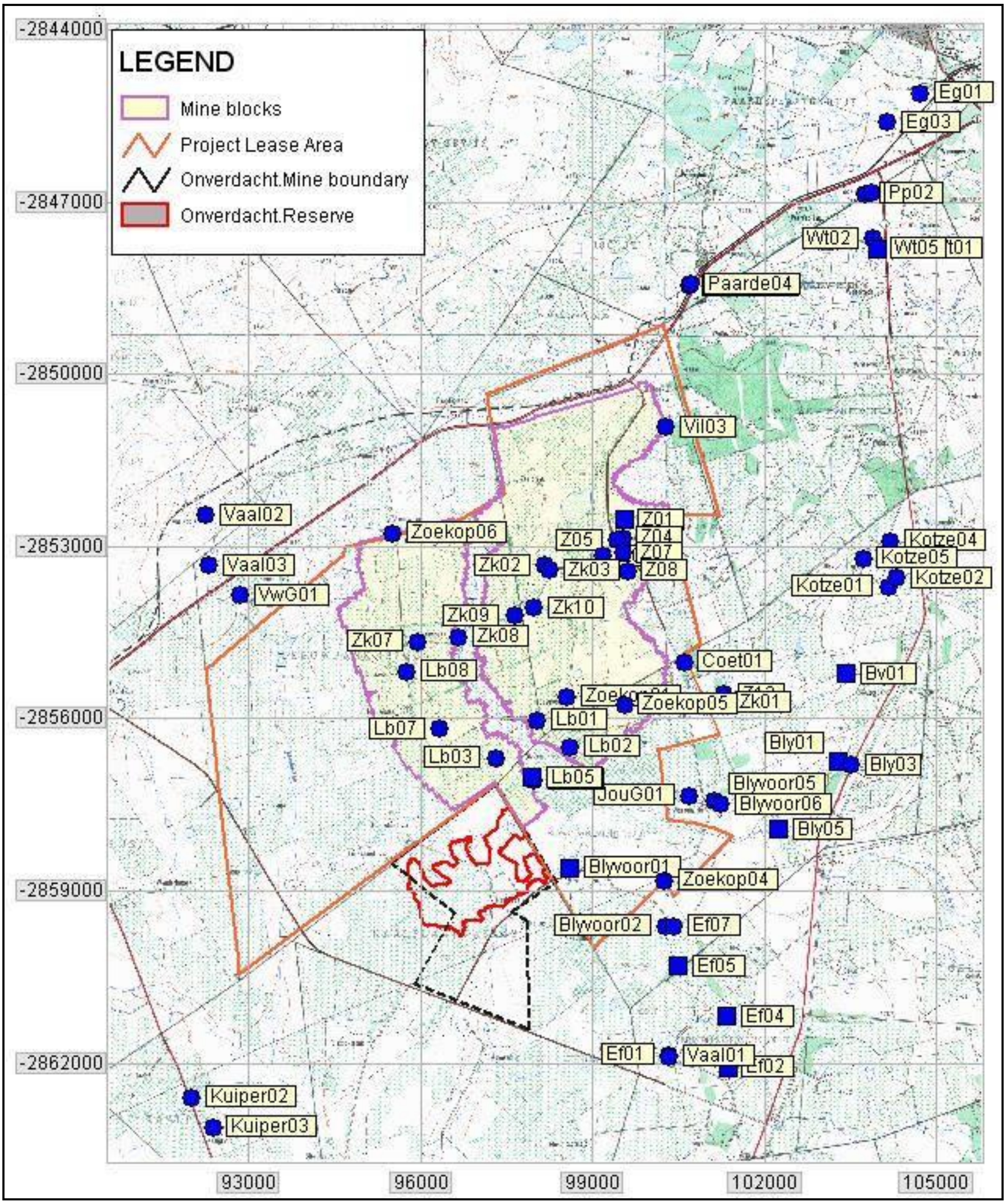


Figure 36: Location of Boreholes and Springs Identified During the Hydrocensus

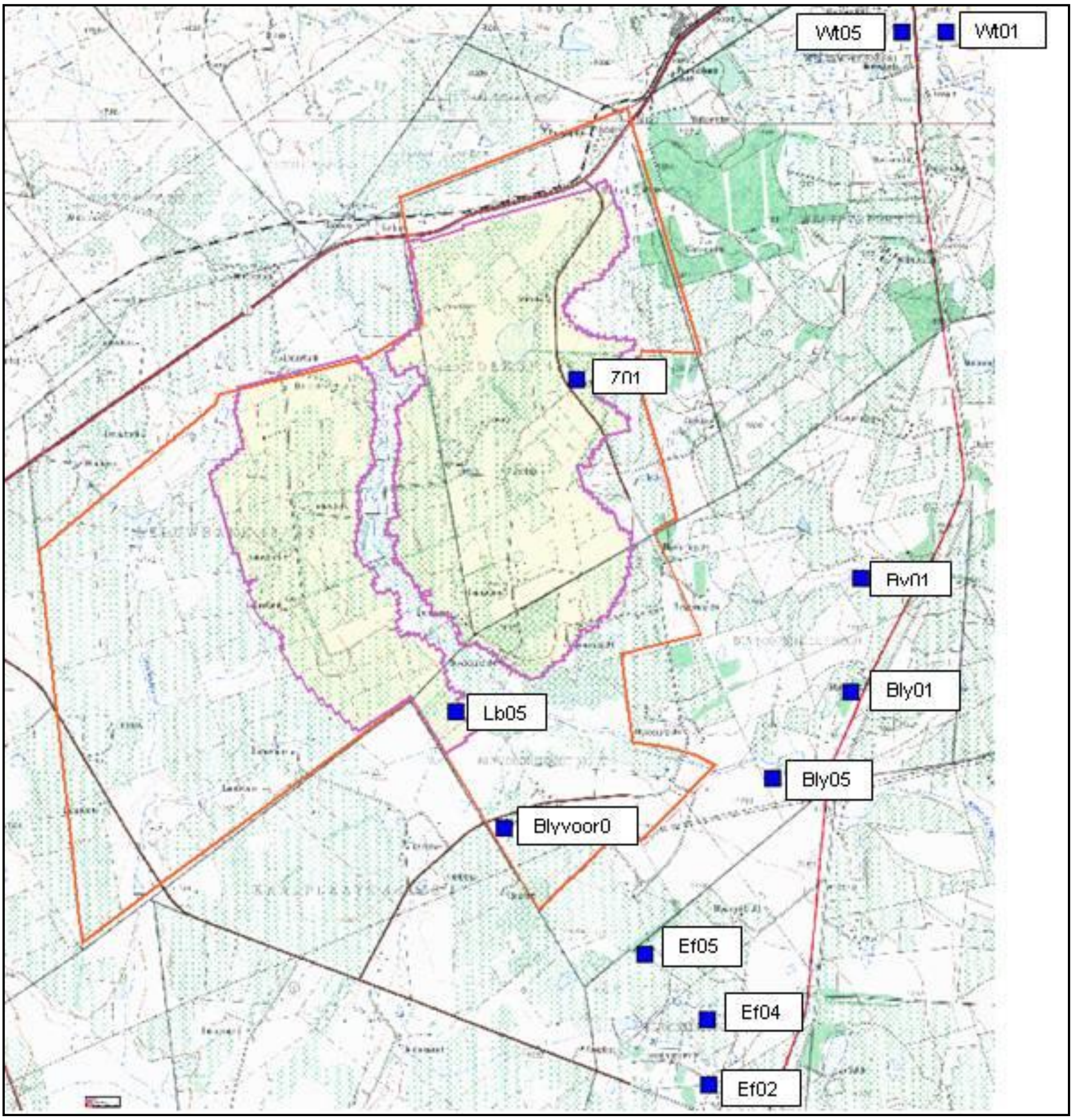


Figure 37: Location of Springs Identified During the Hydrocensus

3.8.4 Groundwater Quantity and Quality

Quantity

The groundwater monitoring boreholes in the proposed Belfast Project area have been sited mainly on geological structures such as dykes or faults around the planned opencast mining operation. Groundwater seepage will be away from the mine blocks in a southern, south-western and south eastern direction.

Drilling results indicate that most of the intersected aquifers (coal / shale and sandstone) have relative low groundwater yields. Yields vary from zero to less than 2l/s in the proposed new mining area with the most common groundwater intersections occurring in contact zones between Karoo Supergroup rocks such as coal and sandstone.

Regional static groundwater levels around the proposed Belfast Project area vary between 1 - 16mbs. Some groundwater levels measured during the hydrocensus were significantly deeper than the general trend as a result of groundwater abstraction from the boreholes.

Due to impacts from these groundwater abstraction areas as well as other potential impacts, the groundwater level does not always follow the trend of the surface topography. The highest static water level elevations are approximately 1,890metres above mean sea level (mamsl) and occur in the topographically higher region north-east of the East mining block (**Figure 38**). The lowest static water level elevations where no impact from abstraction occurs are at approximately 1,700mamsl south-west of the West mining block.

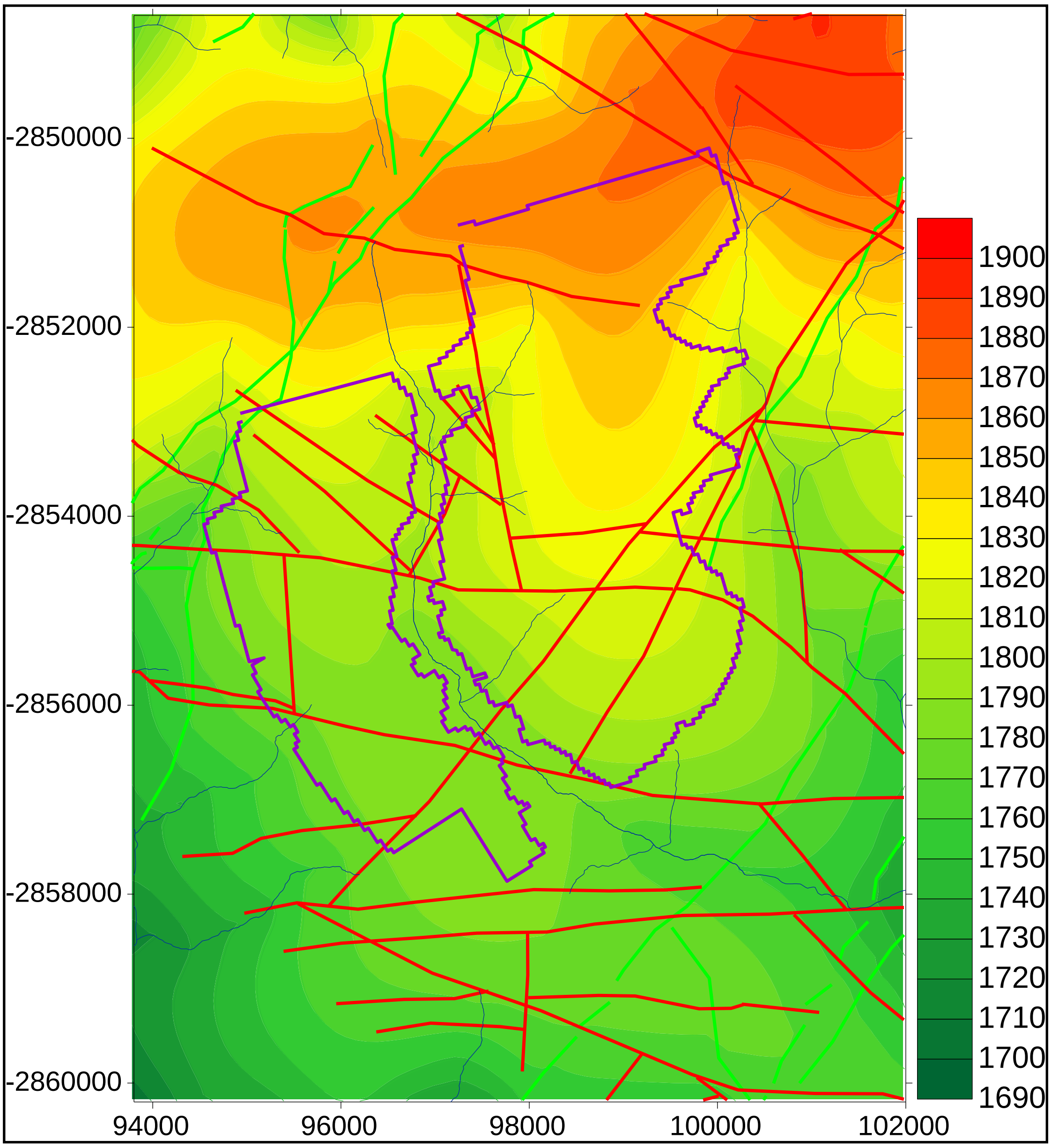


Figure 38: Steady State Groundwater Level Contour Map of the Belfast Project Area

Quality

The groundwater quality results obtained from Clean Stream are provided in **Table 32**. The overall water quality in the area can be described as good to marginal in terms of the Targeted Water Quality Guidline values for domestic use. Several localities did record high salinity, hardness, and metal concentrations.

Table 32: Groundwater Quality (Clean Stream, 2008)

Variable	Domestic Tolerated	Livestock Watering	Irrigation	Bly1	Bly2	Bly3	Bly4	Bly5	Bly6	Blyvoor 04	Blyvoor 05	Blyvoor 06	Bv1	Bv2	Ef2	Ef3	Ef4	Ef5	Ef6	Ef7	Ef8	Ef9	Kotze 01
pH	5.0 - 9.5	-	-	6.63	6.46	7.37	7.9	7.62	7.27	6.77	8.04	8.11	7.04	7.7	7.49	6.93	7.18	7.63	**4.56**	8.04	7.61	7.48	**3.87**
EC (mS/m)	150	500	40	7.41	11.62	2.38	10.14	11.25	8.71	8.05	10.85	11.31	4.16	6.9	6.61	4.55	2.68	**204.4**	38.8	8.9	11.51	9.84	40
TDS (mg/l)	1000	1000	260	29	47	10	45	50	34	78	74	90	21	28	21	16	7	**1433**	160	36	49	38	236
Ca (mg/l)	150	1000	-	3.28	5.18	0.74	4.7	4.7	3.18	0.85	5.76	5.75	1.97	2.61	2.8	1.1	0.5	**230.5**	8.7	4.88	3.72	3.53	23.06
Mg (mg/l)	100	500	300	3.22	4.29	0.99	4.13	4.05	2.8	0.38	4.42	4.48	1.63	2.13	2.26	0.72	0.58	**153.4**	7.76	3.25	3.6	3.34	15.72
Na (mg/l)	200	2000	70	3.02	5.25	1.85	6.02	8.2	6.24	6.09	4.41	4.29	3.21	5.2	2.99	2.29	1.25	17.11	6.57	4.05	7.41	5.37	6.96
K (mg/l)	50	-	-	1.99	4.21	1.09	1.42	1.84	1.55	1.29	1.6	1.58	0.34	0.95	1.41	1.29	0.36	19.49	29.09	2.1	1.26	2.23	4.71
M ALK (mg/l)	-	-	-	16.93	27.38	8.48	40.57	31.72	25.26	20.82	40.89	42.5	16.32	17.19	13.08	5.3	3.75	265.13	9.24	35	22.69	22.6	<0.1
Cl (mg/l)	200	1500	100	6.597	11.395	<0.1	2.942	11.966	5.044	9.446	1.798	1.856	0.35	6.264	<0.1	5.218	0.774	1.246	69.65	0.799	13.252	10.013	<0.1
SO_4 (mg/l)	400	1000	200	<0.1	<0.1	<0.1	0.912	<0.1	<0.1	<0.1	<0.1	<0.1	3.363	<0.1	<0.1	<0.1	<0.1	**851.9**	32.215	<0.1	5.465	<0.1	191.26
N NO_3 (mg/l)	10	100	-	0.834	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	1.162	1.283	0.128	<0.1	3.781	<0.1	<0.1	0.31	0.397	<0.1	0.855	<0.1	<0.1
F (mg/l)	1	2	2	<0.48	<0.48	<0.48	<0.48	0.547	<0.48	0.601	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48
Al (mg/l)	0.5	5	5	<0.01	<0.01	<0.01	0.183	0.27	0.032	0.187	<0.01	<0.01	0.329	**0.603**	<0.01	0.342	<0.01	<0.01	0.04	<0.01	0.221	0.028	<0.01
Fe (mg/l)	1	10	5	<0.01	**5.111**	<0.01	0.271	0.492	**1.33**	**4.306**	<0.01	<0.01	0.604	0.802	<0.01	0.636	0.021	<0.01	<0.01	0.012	0.825	0.796	<0.01
Mn (mg/l)	0.4	10	0.02	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.012	<0.01	<0.01	**0.882**	**3.612**	<0.01	<0.01	<0.01	**0.586**
N_Amonia (mg/l)	2	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**3.461**	<0.1	0.11	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	**5.525**	<0.1	<0.1	<0.1	<0.1
TotHardness (mg/l)	300	-	-	21.46	30.6	5.94	28.73	28.42	19.48	3.68	32.6	32.79	11.64	15.3	16.28	5.72	3.63	**1207.3**	53.69	25.56	24.11	22.55	122.32
PO_4 (mg/l)	2	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.272	<0.1	0.17	<0.1	<0.1	<0.1	<0.1
SAR	-	-	2	0.28	0.41	0.33	0.49	0.67	0.62	1.38	0.34	0.33	0.41	0.58	0.32	0.42	0.29	0.21	0.39	0.35	0.66	0.49	0.27

Table 32 continued

Variable	Domestic Tolerated	Livestock Watering	Irrigation	Kotze 02	Kotze 03	Kotze 04	Kotze 05	Kotze 06	Kotze 07	Kuiper 01	Kuiper 02	Kuiper 03	Lb1	Lb2	Lb3	Lb5	Lb6	Lb7	Lb8	Paarde 04	Paarde 05	Paarde 06	Pp1
pH	5.0 - 9.5	-	-	3.61	7.02	7.84	8.34	7.94	7.79	8.31	8.53	8.2	8.07	8.23	8.87	6.76	7.75	7.99	7.82	7.07	8.09	7.61	8.24
EC (mS/m)	150	500	40	44.9	43.3	9.77	19.22	187.3	176.3	54.9	38.7	12.84	23.72	25.06	34.3	9.13	17.97	12.57	7.33	2.48	32.7	23.94	40.8
TDS (mg/l)	1000	1000	260	222	266	68	120	1722	1654	336	210	82	114	124	181	25	81	48	26	22	170	128	182
Ca (mg/l)	150	1000	-	22.04	22.64	3.43	17.12	218.3	206.8	40.36	26.53	7.45	13.98	15.5	5.45	2.53	5.29	4.95	3.91	0.7	20.11	8.4	26.05
Mg (mg/l)	100	500	300	14.8	20.33	3.01	5.21	150.4	132.4	26.29	7.78	3.9	7	8.59	3.03	3.18	5.44	3.07	2.21	0.42	11.62	3.69	22.99
Na (mg/l)	200	2000	70	5.85	10.34	3.35	6.94	8.11	8.37	15.63	23.63	5.18	13.41	14.2	61.48	5.1	14.22	8.94	2.61	1.73	7.1	21.15	8.55
K (mg/l)	50	-	-	3.68	6.76	4.53	1.56	14	15.07	4.9	3.94	3.45	3.57	3.57	1.81	0.86	2.37	4.31	3.46	1.02	9.68	3.13	2.05
M ALK (mg/l)	-	-	-	<0.1	8.8	20.5	71.64	39.03	96.91	104.34	127.31	52.58	63.64	72.33	170.13	4.55	24.21	41.9	20.92	7.84	60.04	22.28	114.56
Cl (mg/l)	200	1500	100	<0.1	15.684	<0.1	9.824	0.336	1.497	18.779	33.777	2.789	12.785	10.259	4.205	5.239	37.354	0.911	<0.1	<0.1	21.29	37.752	52.691
SO_4 (mg/l)	400	1000	200	164.40	205.83	17.125	5.567	1177.4	998.33	156.47	18.041	<0.1	24.976	28.679	<0.1	<0.1	<0.1	<0.1	0.425	<0.1	45.164	29.918	<0.1
N NO_3 (mg/l)	10	100	-	<0.1	1.61	<0.1	0.405	<0.1	<0.1	1.016	0.42	0.304	<0.1	<0.1	1.084	4.561	1.125	0.508	0.547	0.784	1.737	0.263	0.471
F (mg/l)	1	2	2	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	0.572	<0.48	1.869	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48
Al (mg/l)	0.5	5	5	0.016	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fe (mg/l)	1	10	5	0.021	<0.01	0.022	<0.01	<0.01	<0.01	<0.01	<0.01	0.012	<0.01	<0.01	<0.01	<0.01	0.236	<0.01	<0.01	<0.01	<0.01	0.013	<0.01
Mn (mg/l)	0.4	10	0.02	0.571	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	2.514	<0.01	<0.01	0.011	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
N_Amonia (mg/l)	2	-	-	0.167	<0.1	0.123	0.143	0.151	0.518	0.143	0.129	0.141	0.133	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.126	0.128	<0.1	<0.1
TotHardness (mg/l)	300	-	-	115.98	140.25	20.96	64.2	1164.4	1061.6	209.04	98.29	34.66	63.73	74.09	26.09	19.41	35.64	25	18.86	3.46	98.07	36.14	159.72
PO_4 (mg/l)	2	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.109	<0.1	<0.1	0.139	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SAR	-	-	2	0.24	0.38	0.32	0.38	0.1	0.11	0.47	1.04	0.38	0.73	0.72	5.24	0.5	1.04	0.78	0.26	0.4	0.31	1.53	0.29

Table 32 continued

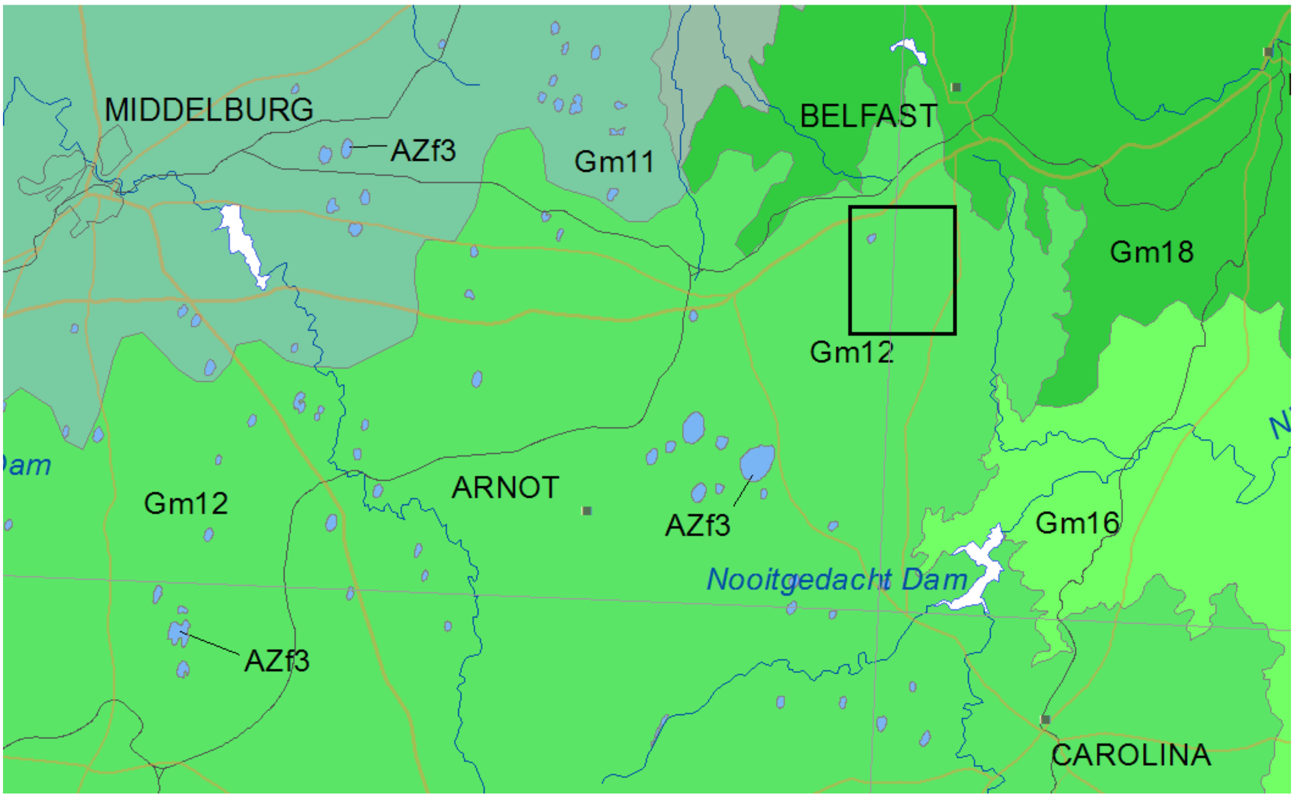
Variable	Domestic Tolerated	Livestock Watering	Irrigation	Pp2	Vaal1	Vaal2	Vaal3	Vil 01	Vil 02	Vil g01	Vw 01	Vw 02	Vw 03	Vw g01	Z1	Z2	Z3	Z4	Z5	Z6	Z7	Z8	Z9
pH	5.0 - 9.5	-	-	8.12	8.06	8.17	7.87	4.3	6.94	7.37	7.72	6.9	7.73	7.77	7.04	7.1	8.07	7.32	5.94	6.59	7.96	8.6	7.98
EC (mS/m)	150	500	40	8.76	12.49	18.14	12.37	21.23	11.69	3.72	12.56	11.57	17.78	17.32	11.66	6.94	129.6	10.95	8.29	3.64	8.1	7.69	10.56
TDS (mg/l)	1000	1000	260	39	55	82	56	112	64	24	84	64	96	138	35	25	774	39	24	30	28	25	41
Ca (mg/l)	150	1000	-	4.09	7.57	17.87	5.88	5.73	3.56	1.52	3.72	3.95	5.66	9.62	2.52	1.79	11.36	2.09	1.89	0.6	2.95	0.25	5
Mg (mg/l)	100	500	300	5.36	2.64	3.12	2.78	4.43	2.48	0.36	3.03	3.56	5.1	4.8	2.8	1.44	11.94	2.3	2.09	0.51	2.42	0.53	3.73
Na (mg/l)	200	2000	70	2.66	7.44	7.36	8.99	9.65	8.7	2.93	10	9.33	13.51	8.24	7.17	5.24	246	7.58	4.58	0.92	2.97	6.49	5.39
K (mg/l)	50	-	-	0.69	2.6	2.23	2.95	3.31	1.92	0.43	2.94	4.07	1.79	2.28	2.94	1.55	43	4.55	4.08	0.99	4.41	2.42	1.35
M ALK (mg/l)	-	-	-	41.13	38.49	60.73	33.83	<0.1	8.25	9.91	25.63	8.54	23.92	21.7	5.6	10.4	311.25	10.21	4.98	2.27	25.16	11.37	31.89
Cl (mg/l)	200	1500	100	<0.1	5.699	5.559	7.495	24.522	21.033	<0.1	19.756	23.82	37.37	14.52	8.346	7.559	196.125	8.022	2.105	1.986	<0.1	8.019	5.754
SO_4 (mg/l)	400	1000	200	<0.1	5.867	9.769	7.705	38.627	11.764	<0.1	<0.1	9.588	<0.1	<0.1	0.757	0.858	128.321	<0.1	<0.1	2.296	1.668	<0.1	<0.1
N NO_3 (mg/l)	10	100	-	1.787	<0.1	<0.1	<0.1	<0.1	1.098	1.357	0.139	0.46	0.471	7.998	7.1	<0.1	1.331	8.265	5.919	<0.1	<0.1	<0.1	<0.1
F (mg/l)	1	2	2	<0.48	<0.48	<0.48	<0.48	0.551	<0.48	<0.48	0.57	<0.48	<0.48	<0.48	<0.48	<0.48	1.18	<0.48	<0.48	<0.48	<0.48	<0.48	<0.48
Al (mg/l)	0.5	5	5	<0.01	<0.01	<0.01	<0.01	0.63	<0.01	<0.01	0.895	0.182	<0.01	<0.01	<0.01	0.028	67	<0.01	0.288	<0.01	<0.01	0.02	0.059
Fe (mg/l)	1	10	5	<0.01	0.016	0.019	0.035	<0.01	<0.01	<0.01	5.48	0.398	0.038	<0.01	<0.01	1.815	42.42	0.012	0.204	0.022	0.022	0.044	0.455
Mn (mg/l)	0.4	10	0.02	<0.01	<0.01	<0.01	<0.01	0.436	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.028	<0.01	0.221	0.018	<0.01	<0.01	0.058	0.012	<0.01
N_Amonia (mg/l)	2	-	-	<0.1	<0.1	<0.1	<0.1	0.39	0.129	0.2	0.189	0.218	0.154	0.119	<0.1	<0.1	0.101	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
TotHardness (mg/l)	300	-	-	32.26	29.77	57.45	26.12	32.55	19.1	5.3	21.76	24.51	35.12	43.77	17.8	10.42	77.53	14.68	13.34	3.61	17.32	2.81	27.85
PO_4 (mg/l)	2	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SAR	-	-	2	0.2	0.59	0.42	0.77	0.74	0.87	0.55	0.93	0.82	0.99	0.54	0.74	0.71	12.16	0.86	0.55	0.21	0.31	1.69	0.44

Table 32 continued

Variable	Domestic Tolerated	Livestock Watering	Irrigation	Z10	Z11	Z12	Zk1	Zk4	Zk5	Zk6	Zk7	Zoekop 01	Zoekop 02	Zoekop 03	Zoekop 04	Zoekop 05	Zoekop 06	Zoekop 07	Welt1	Grootpan 01	Leeuwbank 01	Gd 01	Gd 02
pH	5.0 - 9.5	-	-	7.91	8.22	8.01	8.56	7.32	5.67	7.52	7.76	8.79	7.49	7.52	7.48	8.17	8.14	6.91	6.96	7.7	7.78	6.77	6.37
EC (mS/m)	150	500	40	10.57	12.23	28.34	28.26	18.86	5.24	20.24	13.16	50.2	46.8	8.69	4.51	9.49	16.44	42.8	14.55	19.22	28.07	15.25	15.98
TDS (mg/l)	1000	1000	260	40	49	119	133	75	19	78	60	296	228	54	40	66	88	316	60	64	156	138	96
Ca (mg/l)	150	1000	-	5.07	5.63	12.79	5.97	4.9	1.27	5.69	2.51	2.69	5.95	2.81	1.77	4.44	10.78	6.23	5.82	8.33	10.63	4.88	3.77
Mg (mg/l)	100	500	300	3.77	4.71	17.51	1.09	4.81	0.66	5.63	3.1	0.98	7.15	1.89	0.89	2.65	4.78	8.24	3.45	7.25	11.76	3.85	2.61
Na (mg/l)	200	2000	70	5.29	5.66	7.14	46.81	14.05	1.75	13.69	7.64	101.4	28.35	6.06	3.13	4.24	6.33	16.13	6.98	10.99	15.21	7.06	12.43
K (mg/l)	50	-	-	0.93	2.18	2.39	2.26	3.1	1.73	4.79	7.63	2.65	32.37	2.46	1.37	3.01	3.21	52.32	7.02	2.35	2.45	2	4.67
M ALK (mg/l)	-	-	-	32.98	50.04	103.65	125.91	18.26	5.24	15	17.03	175.27	77.35	13.85	7.41	29.45	42.41	79.48	22.95	51.4	61.75	42.33	4.73
Cl (mg/l)	200	1500	100	4.466	<0.1	17.089	0.484	37.158	3.125	37.101	26.554	5.583	73.684	10.059	1.611	1.496	5.611	56.334	21.074	16.692	43.607	21.934	30.287
SO_4 (mg/l)	400	1000	200	<0.1	<0.1	<0.1	<0.1	<0.1	3.876	<0.1	<0.1	20.381	<0.1	<0.1	<0.1	<0.1	20.345	0.149	0.455	<0.1	<0.1	<0.1	4.306
N NO_3 (mg/l)	10	100	-	<0.1	<0.1	<0.1	<0.1	0.193	0.402	1.396	2.365	0.923	1.749	<0.1	2.211	0.139	<0.1	2.683	1.012	1.737	0.935	0.146	3.371
F (mg/l)	1	2	2	0.632	<0.48	<0.48	1.207	<0.48	<0.48	<0.48	<0.48	2.392	0.591	<0.48	<0.48	<0.48	0.506	0.762	<0.48	<0.48	<0.48	0.798	<0.48
Al (mg/l)	0.5	5	5	0.036	<0.01	<0.01	<0.01	<0.01	0.591	<0.01	<0.01	<0.01	<0.01	0.033	<0.01	0.055	<0.01	1.072	<0.01	0.037	<0.01	0.133	0.037
Fe (mg/l)	1	10	5	0.273	<0.01	<0.01	<0.01	0.696	<0.01	0.016	0.012	<0.01	2.492	2.01	<0.01	0.047	<0.01	1.598	0.136	0.792	0.016	18.06	0.041
Mn (mg/l)	0.4	10	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	0.018	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.012	0.515	<0.01	<0.01	<0.01	1.03	<0.01
N_Amonia (mg/l)	2	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	0.101	<0.1	<0.1	<0.1	7.755	<0.1	<0.1	<0.1	<0.1	0.606	<0.1	0.152	0.111	0.123	0.136
TotHardness (mg/l)	300	-	-	28.16	33.46	104.04	19.37	32.03	5.88	37.39	19.04	10.74	44.29	14.8	8.1	21.99	46.61	49.47	28.73	50.64	74.97	28.04	20.16
PO_4 (mg/l)	2	-	-	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.315	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
SAR	-	-	2	0.43	0.43	0.3	4.63	1.08	0.31	0.97	0.76	13.47	1.85	0.69	0.48	0.39	0.4	1	0.57	0.67	0.76	0.58	1.2

3.9 Flora

The Belfast Project is situated to in the Moist Sandy Highveld Grassland (Bredenkamp et.al.,1996). However, the area is situated closely to the transition between North-eastern Sandy Highveld Grassland and the Bankenveld to the east of the Belfast Complex. The vegetation of the area, as described by the latest and more detailed vegetation classification of South Africa, is described as the Eastern Highveld Grassland (Mapping unit Gm12) with scattered patches of the Eastern Temperate Freshwater Wetlands (Mapping unit AZf3) (**Figure 39**) (Mucina et.al., 2005).



Legend:
Gm11: Rand Highveld Grassland
Gm12: Eastern Highveld Grassland
AZf3: Eastern Temperate Freshwater Wetlands
Gm16: KaNgwane Montane Grassland
Gm18: Lydenburg Montane Grassland

Figure 39: Vegetation Map of the Belfast Complex and Surrounding Areas

The Eastern Highveld Grassland is situated on the plains between Belfast in the east and the eastern side of Johannesburg in the west and extending southwards to Bethal, Ermelo and west of Piet Retief (Mucina et.al., 2005). This vegetation is situated on the slightly too moderately undulating plains, including some low hills and pan depression. The vegetation is short dense grassland dominated by the usual highveld grass compositions (*Aristida, Digitaria, Eragrotis, Themeda, Tristachya* etc) with small, scattered, rocky outcrops with wiry, sour grasses and some woody species (*Acacia caffra, Celtis africana, Diospyros lycioides, Parinari capensis, Protea caffra, Protea welwitchii* and *Rhus magalismontana*) (Mucina et.al., 2005).

The conservation status of the Eastern Highveld Grassland is considered as endangered with a target area of 24% to be conserved. Only a small fraction of the Eastern Highveld Grassland is conserved in statutory reserves such as the Nooitgedacht Dam and Jericho Dam Nature Reserves, and in private reserves such as the Holkrans, Kransbank and Morgenstond private nature reserves. Approximately 44% of the Eastern Highveld Grassland is transformed, primarily by cultivations, plantations, mines, urbanisation and by the building of dams (Mucina et.al., 2005).

The Eastern Temperate Freshwater Wetlands (Mapping Unit AZf3) are found around water bodies with stagnant water bodies such as pans, lakes, periodically flooded vleis and edges of calmly flowing rivers, and embedded with the Grassland Biome with an altitude of between 750 - 2,000mamsl (Mucina et.al., 2005). The landscape features of this vegetation type consist of flat landscape or shallow depressions filled with temporary water bodies that support zoned systems of aquatic and hygrophilous vegetation of temporary flooded grasslands and ephemeral herblands (Mucina et.al., 2005).

Biogeographically important taxa, endemic to the highveld that may occur on site includes only one herb species, namely *Rorippa flutiatilis* var. *caledonica* (Mucina et.al., 2005). Endemic taxa of the marshy area include geophytic herbs such as *Disa zuluenis* and *Nerine platypetala*. One succulent herb, namely *Crassula tuberella* is also listed to be present.

An ecological investigation was undertaken by Golder and Associates as part of the EIA for the EMP. Results from this report are presented herewith and the full report is provided in Appendix F.

3.9.1 Vegetation Identified On Site

Disturbed Grassland

Grassland areas surveyed throughout the study area displayed a state to be expected from prolonged agricultural activity, involving heavy grazing. Some of the areas also seem to have been planted for grazing with species such as Oulands Grass (*Eragrostis curvula*) and Smutsfinger Grass (*Digitaria eriantha*). Due to the fact that many grass and other species can not be identified during the dry season both dry and wet season surveys were conducted. Likewise can geophytes and annual species or senesced species cannot be found during the dry season. Even so, there seems to be a dearth in indigenous herbaceous species present.

Presence of grass species of the genera *Cymbopogon, Hyparrhenia* and certain of the *Eragrostis* species such as *E. curvula* over large areas may indicate heavy grazing of the grassland patches. *Pennisetum clandestinum* (kikuyu) are dominant in some areas and there seems to be a very low presence of *Themeda triandra.* Recorded herbaceous species are mostly exotics such as *Amaranthus* sp., *Bidens pilosa, Cirsium vulgare, Hypochoerus radicata. Seriphium plumosum* is present in fairly low numbers.

Plant species previously recorded in the grid squares 2529DD and 2530CC number 213 species. Only two species, *Brachystelma dyeri* and *Khadia carolinensis* have an International Union for Conservation of Nature (IUCN) threat status, Vulnerable. Twenty three species are protected in terms of the Mpumalanga Nature Conservation Act (Act No. 10 of 1998) while two species, *Podocarpus latifolius* and *Pittosporum viridifolium* are protected in terms of the Department of Water Affairs and Forestry's, Natural Forest Act (Act No. 84 of 1998). None of the latter two are however expected to be found within the study area. According to Arnold et al (2002), 99 of the previously recorded plant species have some traditional use including human and animal medicinal or magical use.

Figure 40: Grassland Area Observed

Natural grassland areas throughout the study area must be regarded as disturbed and does not represent good quality natural grassland expected to be found in the Highveld. Plant species recorded during this survey include those plants also recorded are listed in **Table 33**. Invasive categories are indicated according to Regulation R280 of the Conservation of Agricultural Resources Act [CARA] (Act No. 43 of 1983).

Table 33: Plant Species Recorded in the Study Area during the Wet and Dry Season Survey.

Family	Species	Medicinal Use	Invasive Category
Amaranthaceae	*Amaranthus sp**		
Asparagaceae	*Asparagus laricinus*	MP, M	
Asteraceae	*Berkheya speciosa*	MP	
Asteraceae	*Bidens pilosa**	MP, MA, M, H	
Asteraceae	*Cirsium vulgare**	M, H	1
Asteraceae	*Helichrysum aureonitens*	MP, M	
Asteraceae	*H. pilosellum*	M, H	
Asteraceae	*H. rugulosum*	MP, MA, M	
Asteraceae	*Hypochoeris radicata**		
Asteraceae	*Senecio sp*		
Asteraceae	*Seriphium plumosum*		
Asteraceae	*Sonchus sp*		
Asteraceae	*Tagetes minuta**	MP, MA, M, H	
Asteraceae	*Tragopogon dubius**		
Asteraceae	*Vernonia microcephala*		
Asteraceae	*Xanthium strumarium**	MP, H	
Azollaceae	*Azolla pinnata**		
Cactaceae	*Opuntia sp*.*		1
Cyperaceae	*Bulbostylis hispidula*	MP	
Cyperaceae	*Cladium mariscus*	MP	
Cyperaceae	*Cyperus esculentus*	MP, M, H	
Cyperaceae	*C. oxicarpus*		

Family	Species	Medicinal Use	Invasive Category
Cyperaceae	*Cyperus sp*		
Cyperaceae	*Isolepis fluitans*		
Cyperaceae	*Kyllinga alba*	MP, M	
Cyperaceae	*Schoenoplectus paludicola*	MP	
Cyperaceae	*Schoenoplectus sp*		
Ebenaceae	*Diospyros lycioides*	MP, H	
Eriocaulaceae	*Eriocaulon sp*		
Fabaceae	*Acacia mearnsii**	MP	2
Fabaceae	*A. melanoxylon**		2
Fagaceae	*Quercus sp**		
Hypoxidaceae	*Hypoxis sp.*		
Juncaceae	*Juncus effusus*		
Juncaceae	*J. oxycarpus*		
Lemnaceae	*Lemna gibba**		
Lentibulariaceae	*Utricularia stellaris*		
Menyanthaceae	*Nymphoides sp*		
Fabaceae	*Acacia decurrens**		2
Myrtaceae	*Eucalyptus sp**		2
Oxalidaceae	*Oxalis sp*		
Pinaceae	*Pinus sp**		2
Poaceae	*Andropogon sp*		
Poaceae	*Aristida bipartita*		
Poaceae	*A. canescens*		
Poaceae	*A. congesta*	MP	
Poaceae	*Aristida sp*		
Poaceae	*Arundinella nepalensis*	MP	
Poaceae	*Cymbopogon excavatus*	MP, M, H	
Poaceae	*C. plurinodis*	MP	
Poaceae	*Cynodon dactylon*	MP, MA, M, H	
Poaceae	*Digitaria eriantha*	MP	
Poaceae	*Eragrostis chloromelas*	MP	
Poaceae	*E. gummiflua*	MA, M	
Poaceae	*E. plana*	MP, M	
Poaceae	*E. rotifer*		
Poaceae	*E. trichophora*		
Poaceae	*Eragrostis sp.*		
Poaceae	*Festuca scabra*		
Poaceae	*Heteropogon contortus*	MP, H	
Poaceae	*Hyparrhenia cymbaria*		
Poaceae	*H. filipendula*	MP, M	
Poaceae	*Imperata cylindrica*	MP, M	
Poaceae	*Leersia hexandra*	MP	
Poaceae	*Miscanthus junceus*		
Poaceae	*Monocymbium ceresiiforme*	M	
Poaceae	*Panicum maximum*	MP, M, H	
Poaceae	*P. natalense*		
Poaceae	*Panicum sp*		
Poaceae	*Paspalum dilatatum**	M, H	

Family	Species	Medicinal Use	Invasive Category
Poaceae	*Pennisetum clandestinum**	MP	
Poaceae	*Phragmites australis**	MP, M, H	
Poaceae	*Setaria sphacelata*	MP, H	
Poaceae	*Setaria sp.*		
Poaceae	*Sporobolus africanus*	MP	
Poaceae	*Stipagrostis zeyheri*		
Poaceae	*Themeda triandra*	MP, H	
Poaceae	*Tristachya leucothrix*		
Poaceae	*Setaria incrassata*		
Polygonaceae	*Persicaria sp*		
Rosaceae	*Pyracantha sp**		3
Salicaceae	*Populus canescens**	MP	2
Salicaceae	*Populus sp**		
Salicaceae	*Salix babylonica**	MP, MA	2
Scrophulariaceae	*Limosella maior*	M	
Typhaceae	*Typha capensis*	MP, MA, H	
Verbenaceae	*Verbena bonariensis**		

** denotes exotic species*
MP= Medicinal People; MA= Medicinal Animals; M= Magical; H= Harmful (Arnold et al, 2002)

Cultivated lands

Cultivated lands, used for the cultivation of maize, make up the majority of the study area. As such, these areas are of little conservation importance and with low ecological integrity. However, they still serve as important foraging area for birds and rodents. These animals in turn attract raptors and predators. Birds that use the cultivated lands for foraging include species such as the Vulnerable Blue Crane (*Anthropoides paradiseus*) and Southern Crowned Crane (*Balearica regulorum*) as well as species such as Francolin (*Francolinus shelleyi*) and Helmeted Guineafowl (*Numida meleagris*).

Wooded areas

Wooded areas consist mostly of exotic *Eucalyptus camaldulensis* planted in rows as windbreaks. Some areas also contain agro-forestry, consisting of small, poorly managed Eucalyptus plantations. Certain areas are covered with feral trees of both *Eucalyptus camaldulensis* and *Acacia mearnsii.* Occasional *Pinus* and *Quercus* are also found, mostly single trees. Uncontrolled invasion by exotic trees is not severe. The wooded areas serve as roosting and nesting habitat for several bird species. The ecological integrity is however regarded to be low.

3.9.2 Endangered or Rare Species

The presence of red data species are limited to the areas with less disturbed natural vegetation such as the rocky outcrops and wetter areas such as pans, floodplains and streams. These rocky outcrops and wetter areas can be considered as potential sensitive habitat for red data flora and faunal species.

3.10 Wetlands

The following sections have been extracted from the Ecology Assessment undertaken by Golder and Associates. The full report is provided in Appendix F.

A total of 22 sampling sites were selected to represent the aquatic and wetland ecosystems of the project area. Of these, eight sites were located on river ecosystems along the rivers and tributaries mentioned in Section 3.7. The remaining 14 sites were located in pans throughout the project area (**Figure 41**).

3.10.1 Wetland Delineation and Classification

The field procedure for the wetland delineation was conducted according to the Guidelines for delineating the boundaries of a wetland set out by the Department of Water Affairs and Forestry (DWAF, 2005). Due to the transitional nature of wetland boundaries, these are often not clearly apparent and the delineations should therefore be regarded as a human construct. The delineations are based on scientifically defensible criteria and are aimed at providing a tool to facilitate the decision making process regarding the assessment of the significance of impacts that may be associated with the proposed developments. According to DWAF (2005) the following general principles should be applied as the basis to undertaking wetland delineation:

> *"A wetland is defined as land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water and which under normal circumstances supports or would support vegetation typically adapted to life in saturated soil".*

The wetlands within the study area were delineated in accordance with the Guidelines for delineating the boundaries of a wetland set out by the DWAF (**Figure 42**). Due to limited field access some of the wetlands were not verified in the field and these are shown as "desktop delineations" in Figure 42 and were done based only on interpretation of aerial photographs and contours. These areas will be verified in the field during planned follow up surveys.

The detailed soils classification study undertaken by Viljoen and Associates (Appendix E) was taken into account when delineating the wetlands.

All wetlands in the study area can be described as palustrine[15] wetland types. Further classification indicates a total of 4 wetland types occur. These wetland types are discussed in **Table 34** and its relation to the topography of the area is indicated in. This classification is based on their hydro-geomorphic setting (D. C. Kotze, G. C. Marneweck, et al. 2004). The identified wetlands can be described as saturated concave or concave areas on a slope, on a hillside and within a basin. Water mainly comes from subsurface flow. A concave saturated wetland's outflow is via a poorly defined channel and concave areas on a slope drains diffusely to the drainage network downstream (Ewart-Smith, et al. 2006).

[15] Wetlands within this category include inland marshes and swamps as well as bogs, fens, tundra and floodplains. Palustrine systems include any inland wetland which lacks flowing water, contains ocean-derived salts in concentrations of less than 0.05%, and is non-tidal.

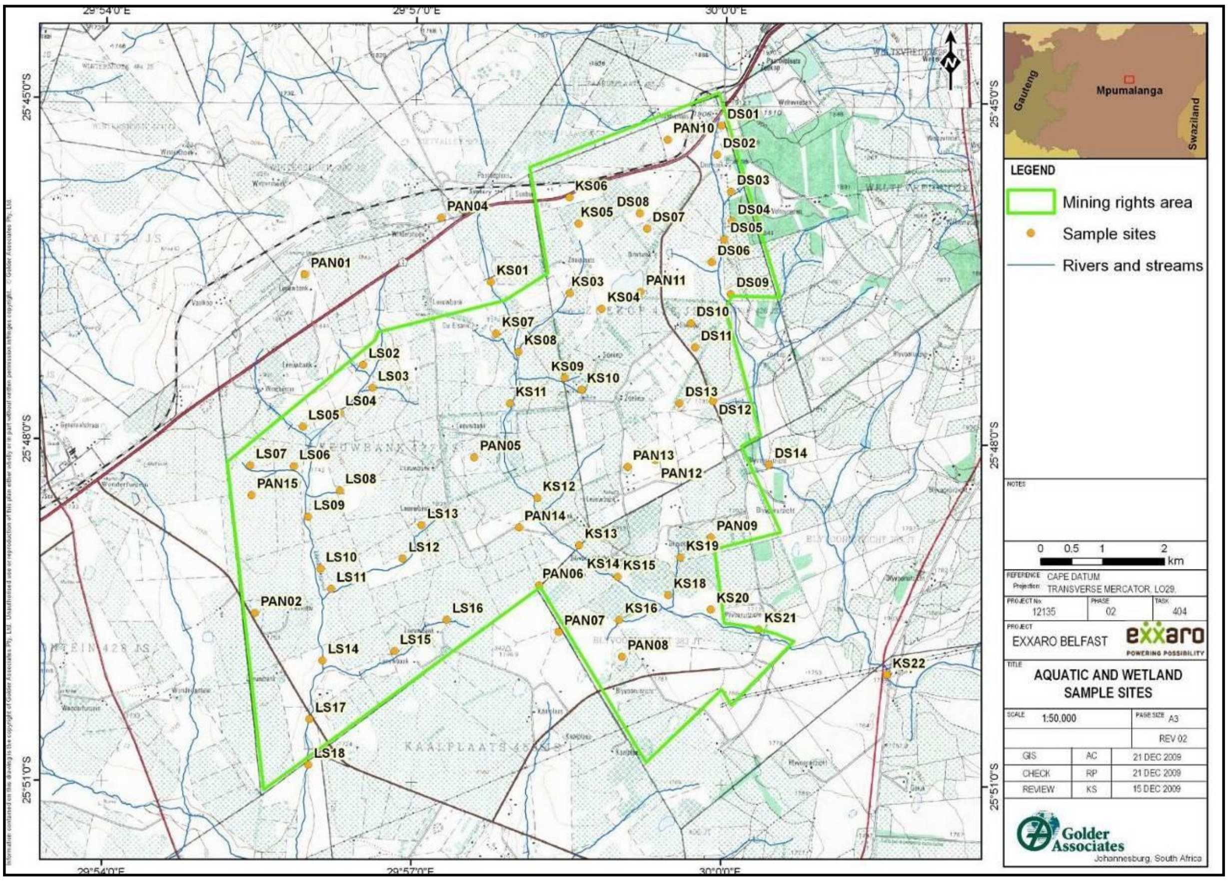


Figure 41: Location of the Identified Pans and Wetlands

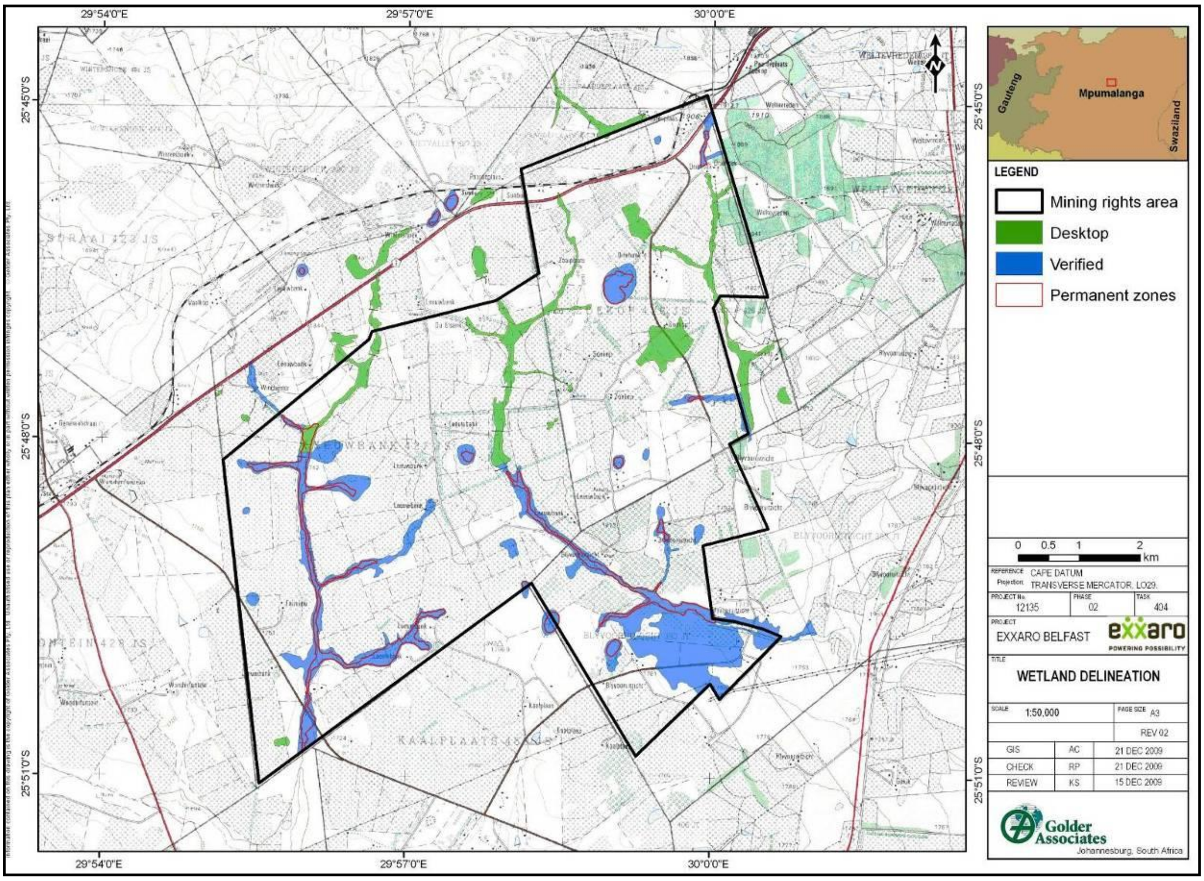
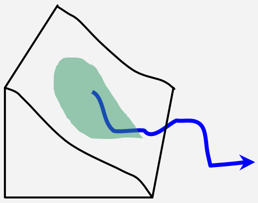
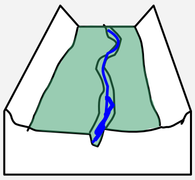
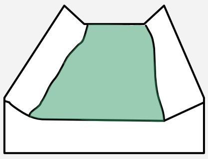
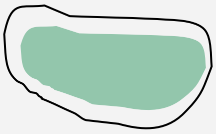


Figure 42: Wetland Delineation of the Belfast Project Area

Table 34: Wetland Hydro-Geomorphic Types found within the study area (modified from Brinson, 1993; Kotze, 1999; and Marneweck and Batchelor, 2002)

Hydro-Geomorphic Types	Description
Hillslope Seepage Feeding a Water Course. 	 Wetland 1
Valley Bottom with a Channel 	 Wetland 2
Valley Bottom without a Channel 	 Wetland 3
Depression (pan) 	 Pan

3.10.2 *Shannon Index of Diversity*

The Shannon Index of Diversity was used to assess the species diversity for some selected sites representing the wetlands in the different catchments of the study area. The value of Shannon diversity is usually found to fall between 1.5 and 3.5 and only rarely it surpasses 4.5. Shannon Mean Index lower than two is regarded as poor diversity, between two and three as reasonable, with scores higher than three regarded as good diversity. The poorest diversity was recorded in the Driehoek Spruit wetlands (DS01, DS02, DS05, DS12, DS13 and DS14) with average diversity status results encountered in the wetlands occurring in the Leeuwbank Spruit and the Klein Komati River. The highest diversity was recorded in the hillslope seep wetland at KS16. The lowest status was recorded at DS01 with a status of 0, this due to only Leersia hexandra recorded.

3.10.3 Present Ecological Status

The Present Ecological Status (PES) scores for the wetlands in the study area are provided in **Table 35.** Wetlands with similar characteristics and scores were grouped together to show similarities within the entire study area **(Figure 43**). The majority of the sites obtained a high category, meaning the wetlands were largely natural with some loss of natural habitat. Sites LS06 and 07, Pans 7; 9; 11-13 and 15 obtained a very high category rating. These wetlands are mostly unmodified. DS01 and 02; KS13, 14 and 15, DS12 and 13, Pans 6 and 14 were categorised as being moderately modified with some loss of natural habitat. Only one pan was placed within the low category. This pan is surrounded by cultivated land and is thus largely modified with a large loss of natural habitats and basic ecosystem functions. Wetland KS12 scored very low. This falls outside of the generally accepted range for wetlands, with these wetlands being seriously modified with extensive loss of basic ecosystem functions.

Table 35: Present Ecological Status for the Study Area

Wetland	Total	Mean	Category	Wetland	Total	Mean	Category
DS01; 02	33	3.00	Moderate	**Pan 1**	39	3.55	High
KS12	20	1.82	Very Low	**Pan 2**	41	3.73	High
KS13; 14; 15	30	2.73	Moderate	**Pan 3**	38	3.45	High
KS18; 20	41	3.73	High	**Pan4**	38	3.45	High
KS19	40	3.64	High	**Pan 5**	41	3.73	High
KS16	44	4.00	High	**Pan 6**	24	2.18	Moderate
LS05	40	3.64	High	**Pan 7**	45	4.09	Very High
LS06; 07	49	4.45	Very High	**Pan 8**	41	3.73	High
LS08	44	4.00	High	**Pan 9**	45	4.09	Very High
LS09; 10; 11	39	3.55	High	**Pan10**	34	3.09	High
LS12; 13	39	3.55	High	**Pan 11**	46	4.18	Very High
LS15; 16	42	3.82	High	**Pan 12**	54	4.91	Very High
LS14	36	3.27	High	**Pan 13**	46	4.18	Very High
LS17	41	3.73	High	**Pan 14**	33	3.00	Moderate
DS12; 13	27	2.45	Moderate	**Pan 15**	22	2.00	Low

Only two wetland systems were assessed using Wetland Index for Habitat Integrity (IHI). The third system couldn't be assessed thoroughly due to prohibited access. Both channelled valley bottom wetland systems attained a C category for present ecological status. The Leeuwbank Spruit system attained a present ecological state score of 65.5%, and the Klein Komati River system attained a score of 70.2%. Wetlands with habitat within a C category are moderately modified with some loss and change of natural habitat and biota. Basic ecosystem functions are still predominantly unchanged.

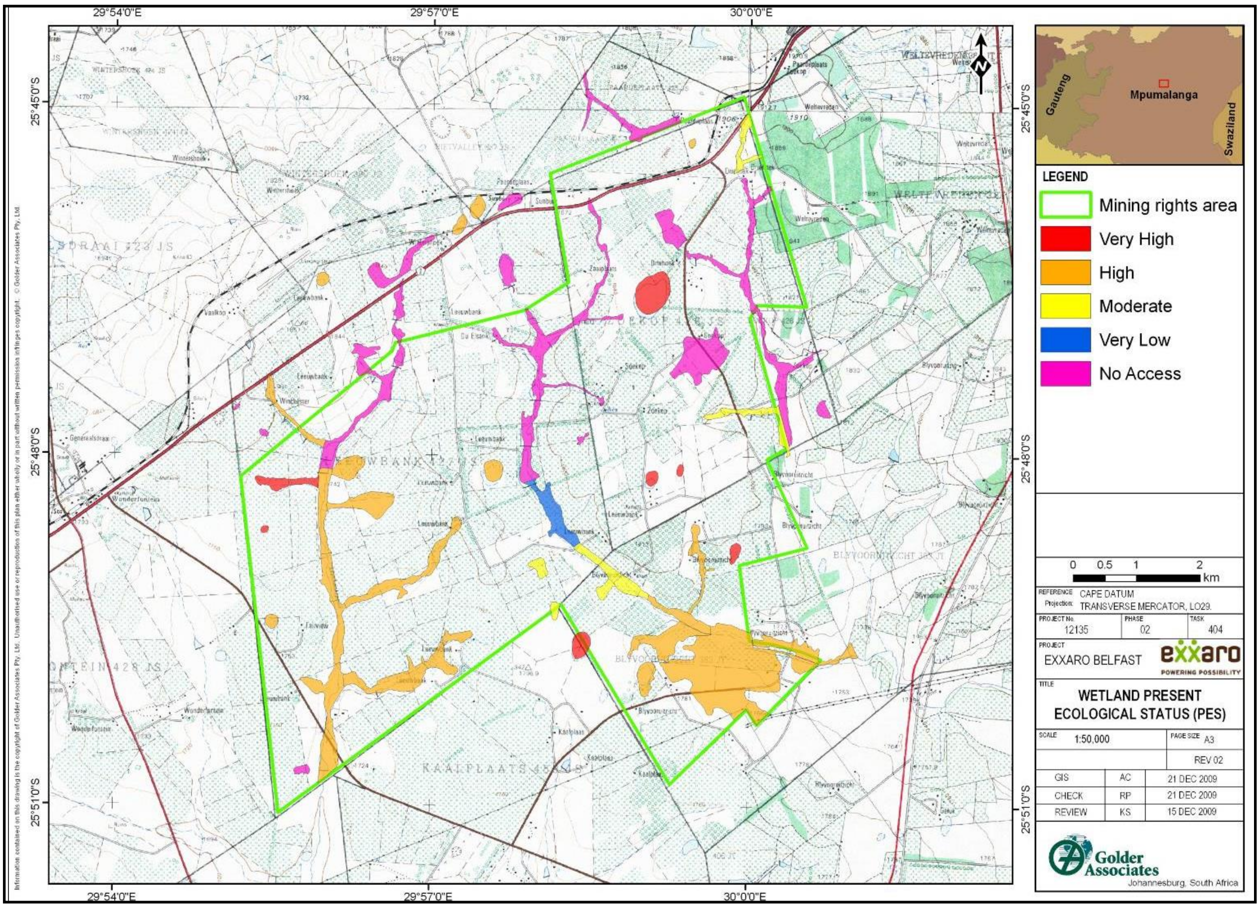


Figure 43: Present Ecological Status of Wetlands within the Study Area

3.10.4 Ecological Importance and Sensitivity

The Ecological Importance and Sensitivity (EIS) scores (**Figure 44**) for the different sites are shown in **Table 36:**. Wetlands with similar characteristics and scores were grouped together to show similarities within the entire study area. The majority of the wetlands within the study area were categorised as having moderate or high importance and sensitivity. The biodiversity of these wetlands ranges from less sensitive to very sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers (except in the case of pans). Six of the wetlands obtained a low / marginal rating. Wetlands within this range are not ecologically important and sensitive at any scale. The biodiversity of these wetlands are not sensitive to flow and habitat modifications. KS18 and 20 had a very high importance and sensitivity rating. This wetland is considered ecologically important and sensitive on a national level. The biodiversity of these wetlands is very sensitive to flow and habitat modifications and it plays a major role in moderating the quantity and quality of water of it major river system.

Table 36: Ecological Importance and Sensitivity Scores for the Study Area

Wetland	Total	Median	Category	Wetland	Total	Median	Category
DS01; 02	14	1.5	Moderate	**Pan 1**	13	1.0	Low/ Marginal
KS12	11	1.0	Low/ Marginal	**Pan 2**	17	2.0	Moderate
KS13; 14; 15	16	2.0	Moderate	**Pan 3**	18	1.5	Moderate
KS18; 20	28	3.5	Very High	**Pan 4**	13	1.0	Low/ Marginal
KS19	17	1.5	Moderate	**Pan 5**	24	3.0	High

Wetland	Total	Median	Category	Wetland	Total	Median	Category
KS16	23	3.0	High	**Pan 6**	14	1.5	Moderate
LS05	16	1.5	Moderate	**Pan 7**	28	3.0	High
LS06; 07	25	2.5	High	**Pan 8**	25	3.0	High
LS08	14	1.0	Low/ Marginal	**Pan 9**	20	1.5	Moderate
LS09; 10; 11	23	3.0	High	**Pan 10**	10	1.0	Low/ Marginal
LS12; 13	20	2.0	Moderate	**Pan 11**	19	2.0	Moderate
LS15; 16	21	2.5	High	**Pan 12**	18	1.5	Moderate
LS14	20	2.0	Moderate	**Pan 13**	22	2.5	High
LS17	20	2.5	High	**Pan 14**	14	1.5	Moderate
DS12; 13	17	2.0	Moderate	**Pan 15**	9	1.0	Low/ Marginal

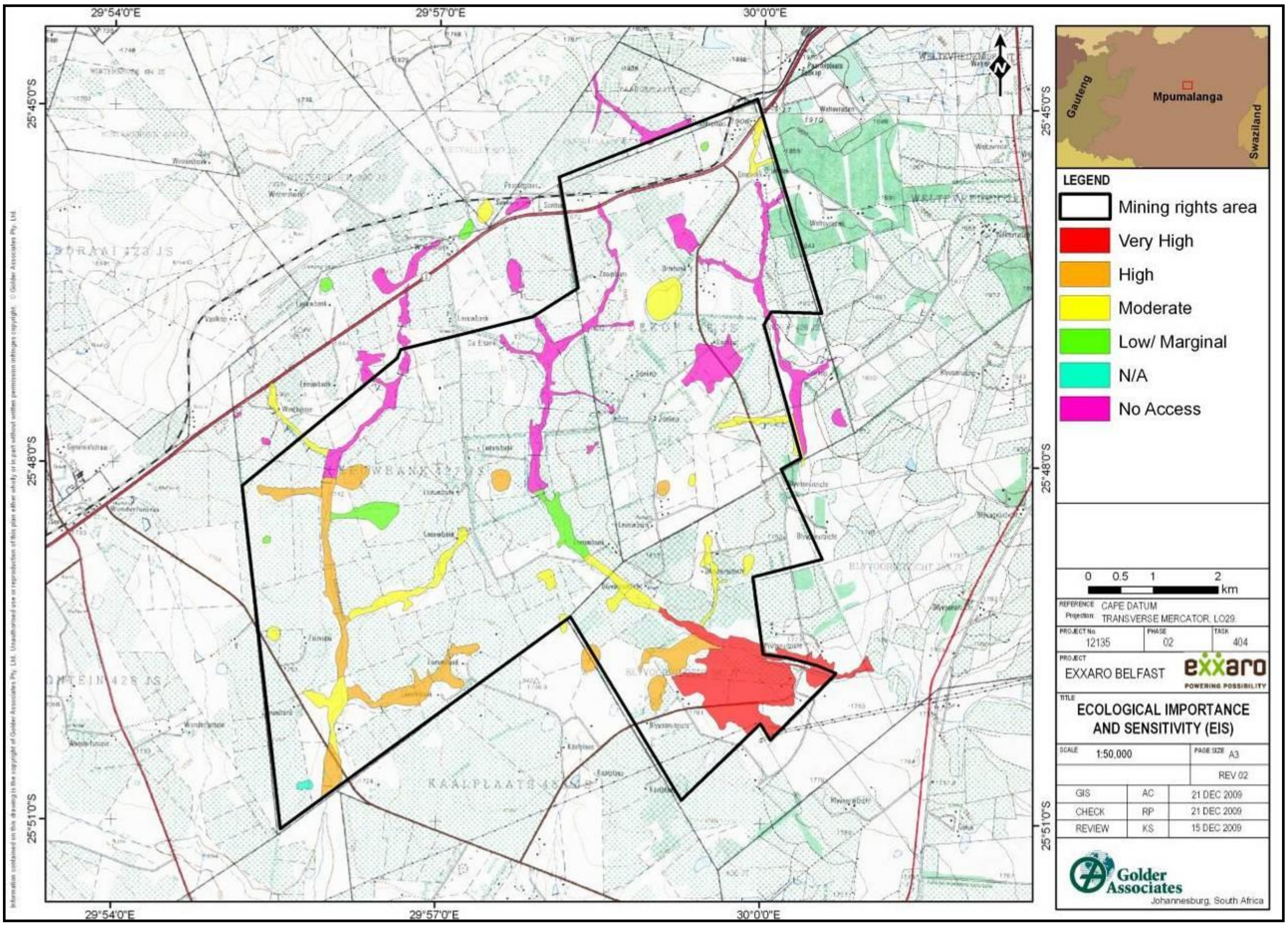


Figure 44: Ecological Importance and Sensitivity of Wetlands within the Study Area

3.10.5 Ecosystem Services Supplied by Wetlands (Wet-EcoServe)

The majority of the wetlands and pans in the study area attained a high score for natural services. Wetlands within this class are largely natural with few modifications. Wetlands that fell within the moderate class for natural services were LS12 and 13 and Pans 1, 6, 9, 10, 12 and 13. Wetlands within a moderate class are moderately modified with some loss of natural habitats.

The wetlands within the study area didn't significantly contribute to the human services, with the highest class attained only being moderate. Most of the wetlands fell within a low class. People have a low dependency on wetlands within this class and seldom benefit from them. Wetlands KS12 – 15 and 18, LS09, 10 and 14, and Pan 11 attained a moderate class score. People are moderately dependent on these wetlands and sometimes benefit from them. Some of the wetlands within the study area fell within the very low class for human services. This class is outside of the acceptable range for wetlands with people rarely relying on these wetlands and almost never benefit from them or utilise them. Wetlands within this class were LS08, DS12 and 13, and Pans 6, 10 and 14.

Of the river sites, sites KS01, KS03 and LS04 as well as the pan sites DS07 and DS08 were not accessible during the September and December 2009 surveys due to permission issues onto the farms. Pan sites DS07, PAN12, PAN01 and PAN10 were dry during 2009 surveys and were therefore not included in the assessment. These sites were only assessed in the December 2009 survey, except site PAN12, which had no surface water present.

3.10.6 Identification of potential wetland offsets

Exxaro contracted Golder Associates to carry out a specialist investigation into the identification of possible wetland offset (Appendix G) sites for the wetland ecosystems affected by the proposed NBC Belfast Coal project, most notably for those wetlands ascribed a high ecological importance and sensitivity which will be affected by the proposed Phase 2 plant. The study is divided into two phases, namely:

- Phase 1: Offset area identification; and
- Phase 2: Off-set management and monitoring plan.

The primary objective of Phase 1 is to identify possible offset sites for the Belfast Coal Project. This is divided into the following sub objectives:

- Calculate the areas of the characterised hillslope and valley bottom wetlands within the proposed Belfast coal reserve areas, as well as within the remaining mine lease area;
- Identify potential onsite set-aside pans, hillslope and valley bottom wetland areas within the proposed Belfast mine lease area;
- Define rehabilitation criteria for the onsite set-aside pans and hillslope and valley bottom wetland areas within the proposed Belfast mine lease area;
- Define a study area for the identification of possible offsite offset pans and hillslope and valley bottom wetland areas;
- Identify potential offsite offset pans and hillslope and valley bottom wetland areas within the defined study area that are similar in function, catchment area and may be located within priority areas, owned by Exxaro;
- Delineate pans within the study area;
- Conduct field surveys of the pans;
- Assess the field data and select possible offset sites; and
- Define rehabilitation criteria for the offsite offset pans and hillslope and valley bottom wetland areas.

The baseline and impact assessment identified that the proposed Belfast open cast mining activities will destroy a number of habitats (Golder report 12135-9383-2, 2011); the affected habitats include disturbed grasslands, non-natural wooded areas and a number of wetlands (**Figure 45**). With regards to the wetland habitats there are three main types of wetlands (total of 165.5 ha) that will be affected, namely:

- Hillslope seeps (45.5 Ha);
- Valley bottoms (channelled and non-channelled) (50.7 Ha), and
- Pans:
  - Open water pans (27.8 Ha);
  - Open water sedge pans (28.1 Ha); and
  - Grass pans (13.4 Ha).

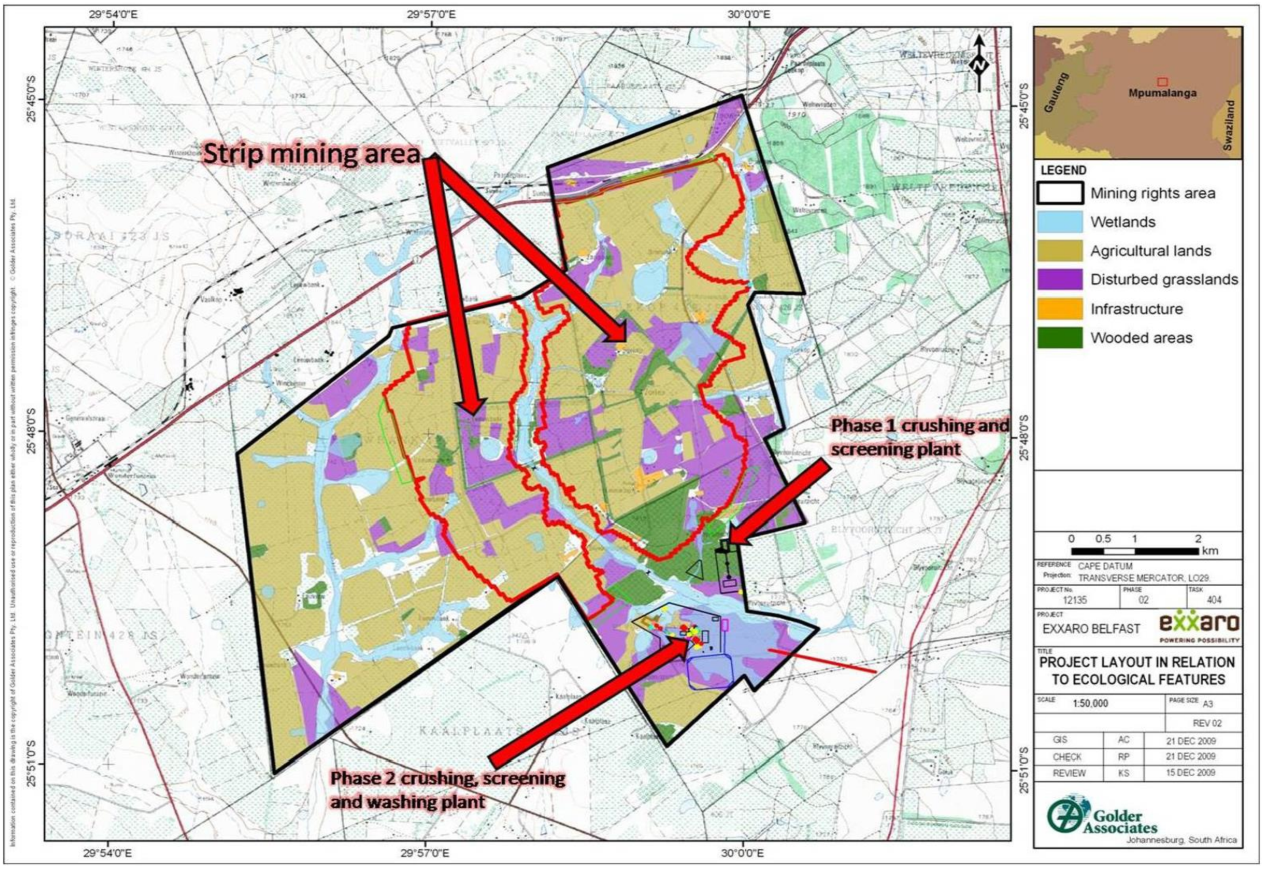


Figure 45: Proposed Exxaro Belfast mining area in relation to ecological biodiversity features

In terms of ecological function of the pans and wetlands within the Inkomati River catchment, the offsite area(s) would have to fall within the same National Freshwater Ecosystem Protected Area (NFEPA). The National Freshwater Ecosystem Protected Areas map (CSIR, 2011), indicating the condition of the river ecosystems and the location of any Freshwater Ecosystem Protected Areas (FEPAs) associated with the study area is presented in **Figure 46**. From the map, it can be seen that the proposed Belfast mine lease area and parts of the existing Strathrae mine lease area lie within a Freshwater Ecosystem Protected Area (FEPA). River FEPAs achieve biodiversity targets for river ecosystems and threatened/near threatened fish species, and were identified in rivers that are currently in a good condition (A or B ecological category. Their FEPA status indicates that they should remain in a good condition in order to contribute to national biodiversity goals and support sustainable use of water resources. The shading of the whole sub-quaternary catchment indicates that the surrounding land and smaller stream network need to be managed in a way that maintains the good condition (A or B ecological category) of the river reach (CSIR, 2011). The pans and wetland therefore would provide a vital role in contributing towards the ecological function of the streams and therefore need to be viewed in this context for the offset area identification. Pan and wetland offsets within the Strathrae mine lease area partially provide the same ecological function to the FEPA and may also improve the Upstream of the Vaalwaterspruit.

Upstream Management Areas, shown in very pale green, associated partially with the existing Strathrae mine lease area, are sub-quaternary catchments in which human activities need to be managed to prevent degradation of downstream river FEPAs and Fish Support Areas. Upstream Management Areas do not include management areas for wetland FEPAs, which need to be determined at a finer scale (CSIR, 2011).

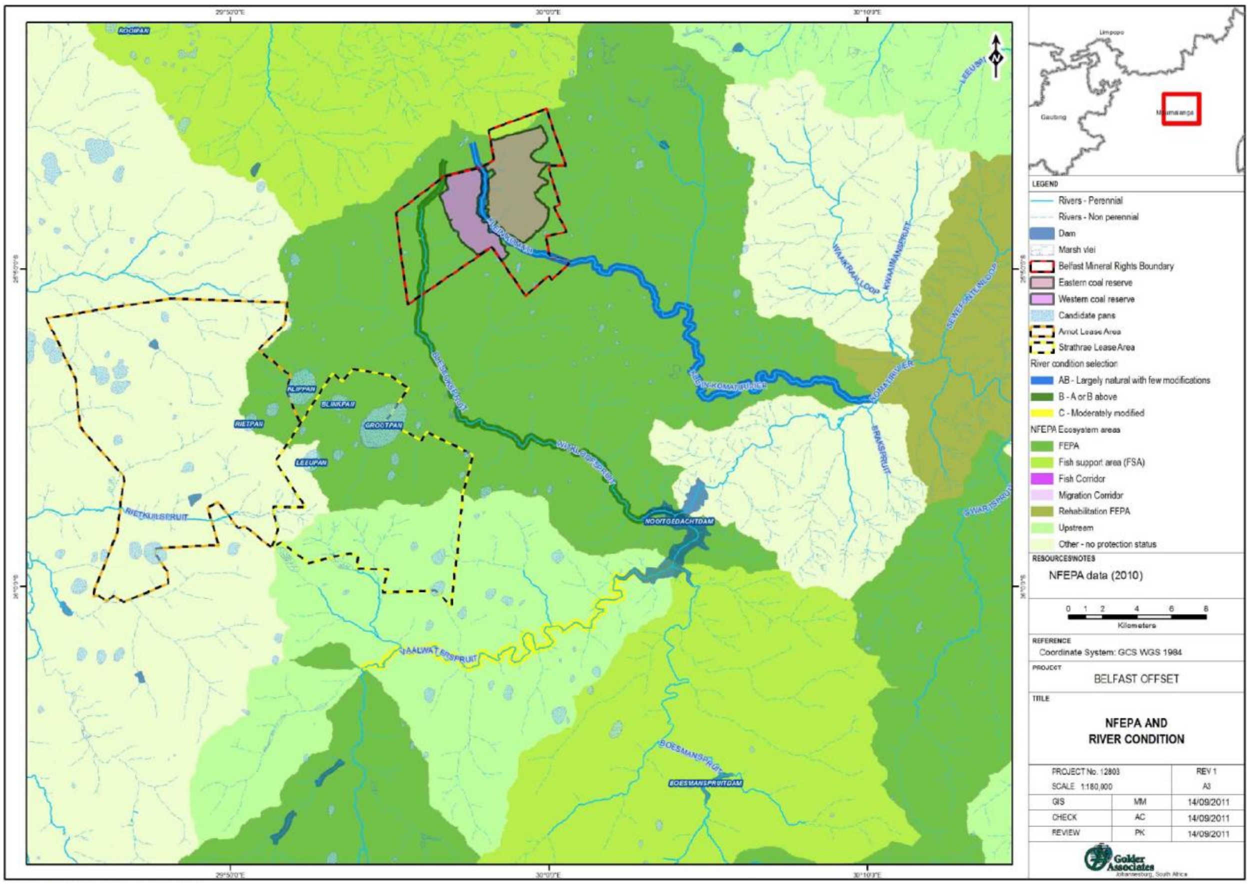


Figure 46: The National Freshwater Ecosystem Protected Areas (NFEPA) data and River Conditions associated with the proposed Belfast and existing Strathrae mine lease areas (CSIR, 2011)

Figure 47 indicates the pans and wetlands outside of the two proposed coal reserves within the Belfast mine lease area, that were used as onsite biodiversity set-asides in which improved ecological catchment management and planning as well as implementation of the Belfast EMPR mitigation, can result in improved baseline conditions.

Based on this elimination process, it was shown that the Exxaro Strathrae mine lease area is suitable for offsetting of the Belfast pans as it fills the various criteria for the Belfast pan functions and source zone for the Inkomati River system. The area is dominated by large Open water pans in close proximity to one another, with a large number of smaller pans of different types in-between them. The occurrence of observed Lesser flamingo (*Phoenicopterus minor*), African marsh terrapin (*Pelomedusa subrufa*), Grey crowned crane (*Balearica regularum*), breeding pairs of Wattled cranes (*Bugeranus carunculatus*), Blue crane (*Anthropoides paradisea*), and the Greater flamingo (*Phoenicopterus ruber*) at certain pans within the Pans cluster were considered to be of additional conservation importance.

The total area (hectares) of the wetlands in the proposed offsite offset area is 2502.85 ha. This is slightly over the recommended area of 1788.5 ha. These wetland areas will however have to be delineated in order to accurately quantify the actual wetland boundaries and types.

It is suggested that the mined out and remaining coal reserves within the Strathrae mine lease area are determined (**Figure 47**). Following this, the offset project area should be approved for potential offsetting by Exxaro. Once this approval is in place, engagement with the Department of Mineral Resources (DMR) is required in order to sterilize any remaining coal reserves within the Strathrae offset area from future mining activities and list the area as an offset protected area. Phase two can be initiated once the above has been achieved; this involves the development of a management plan for the identified off-set areas to ensure that the ecological integrity of the site is maintained or bettered to compensate for the loss in ecological habitat within the proposed Belfast coal reserves.

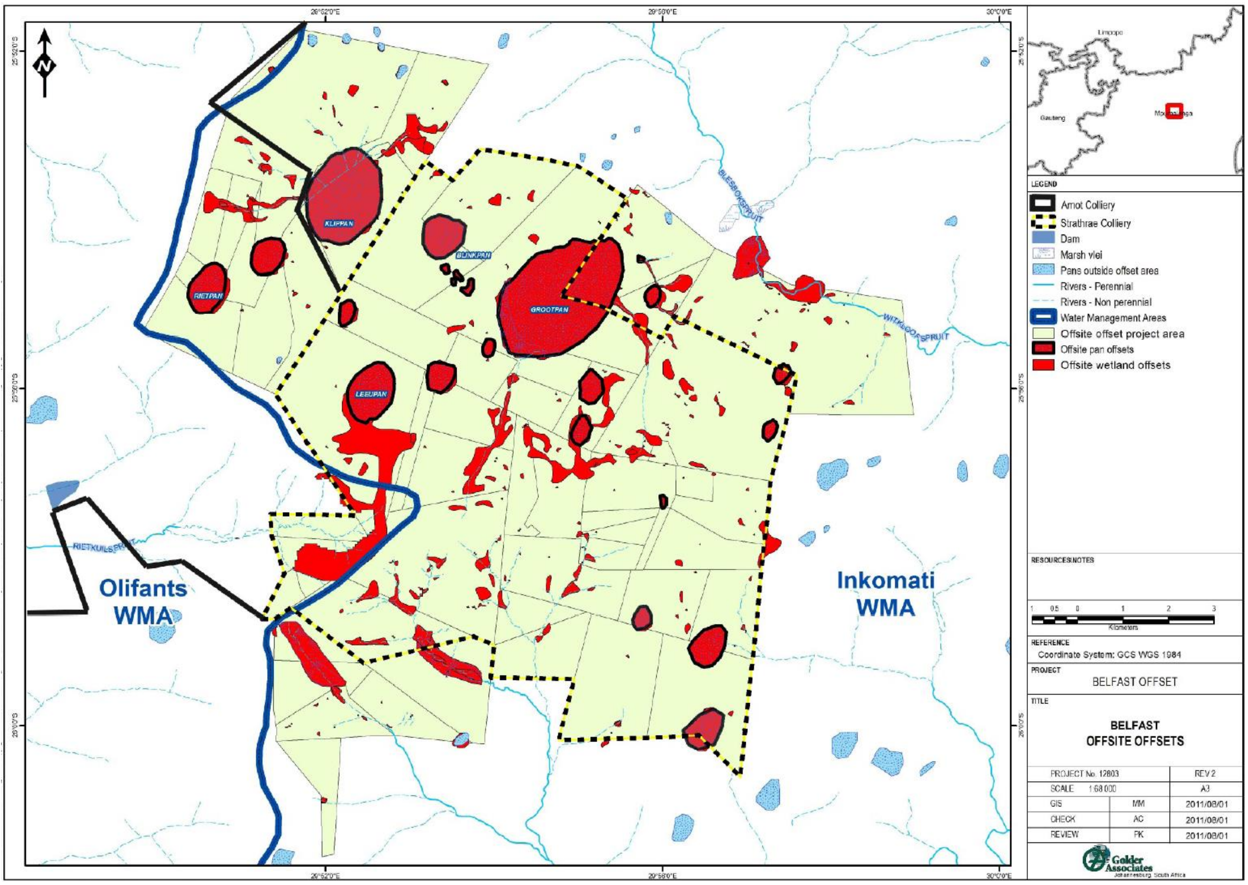


Figure 47: Summary of identified onsite set-aside pans and wetlands associated with the Strathrae mine lease area

The management plan will make provision for two Wetland Management Forums (WMFs) (legal stakeholder bodies that will be setup for the management and protection of the two biodiversity offset areas; Belfast mine lease area and the Strathrae mine lease area). These WMFs will include; Exxaro, affected landowners, the Mpumalanga Wetland Forum, Department of Water Affairs (DWA) and Mpumalanga Tourism and Parks Agency (MTPA). Their function will be to initiate a management and monitoring programme in order to monitor the management and any improvement the off-set areas (both the onsite set-aside and offsite offset areas), as well as develop and initiate a protection plan for the offsite offset area to prevent any further mining activities from impacting the offset pans and wetlands.

As mentioned previously, the success of the proposed project requires understanding that the mitigations outlined in the Belfast EMPR need to be met in terms of the management hierarchy, before biodiversity offsets (compensation mitigation) can be considered. In terms of this project, it is not possible to rehabilitate the lost pans and wetlands within the two proposed coal reserves at Belfast, thus offsetting these specific pans and wetlands was considered as an option in order for the development to continue. Therefore engagement is required with the various regulatory bodies (DWA, DMR and MTPA) in order to consider this option and offset sites that have been identified.

3.10.7 IHAS Habitat Availability Assessment

The Invertebrate Habitat Assessment System (IHAS) was applied at each of the sampling sites to assess the availability of habitats for aquatic macro-invertebrates (McMillan, 1998). The IHAS scores recorded during the September and December 2009 surveys are presented in **Table 37**.

Table 37: IHAS Scores Recorded at the River Sites during the September and December 2009 Surveys

Site	September 2009		December 2009	
	IHAS Score	Description	IHAS Score	Description
DS05	30	Poor	35	Poor
DS14	53	Poor	68	Good
KS13	0	-	67	Good
KS21	61	Adequate	44	Poor
KS22	58	Adequate	68	Good
LS18	69	Good	72	Good
- Site dry at time of survey				

The IHAS score is a measure of the habitat availability for aquatic macro-invertebrates. This availability may fluctuate depending on seasonality, biotopes present as well as amount of flow at any particular time. Habitat availability was poor at sites DS05 and DS14 during the September 2009 survey and at sites DS05 and KS21 during the December 2009 survey **(Table 37**). Limited flow and a lack of Stones-In-Current (SIC) habitats limited the habitat at site DS05, while at site DS14, limited flow and a lack of marginal vegetation habitats were the main limiting factors. The IHAS score at site KS21 decreased and this was attributed to the greater inundation of the channel and a lack of SIC habitats and adequate Gravel, Sand and Mud (GSM) habitat.

Based on the IHAS results, habitat availability during the September 2009 survey was adequate for aquatic macro-invertebrates at sites KS21 and KS22 (**Table 37**). Low flow conditions limited the habitat at these two sites. Habitat availability increased at site KS22 due to increased flow and marginal vegetation inundation. Habitat availability for aquatic macro-invertebrates was good at site LS18 during the September 2009 survey and at sites DS14, KS13, KS22 and LS18 during the December 2009 survey. A good composition of habitats and flow was recorded at site LS18 during the September 2009, thus resulting in a good IHAS score. Increased flow at all of these sites in the December 2009 survey resulted in increased habitat availability to the aquatic macro-invertebrates.

A graphical comparison of the IHAS scores (**Figure 48**) shows that the lowest scores were recorded at site DS05. This site was characterised by a single mono-habitat (aquatic vegetation with no flow), limiting habitat availability for a diversity of aquatic macro-invertebrates. Increase habitat availability was shown to be present at the downstream sites on each of the tributaries. This was considered to be natural of streams in the upper catchments of systems with wetland characteristics. As more tributaries confluence, increased flow and geomorphological processes would naturally result in greater habitat diversity due to erosion and sediment transport.

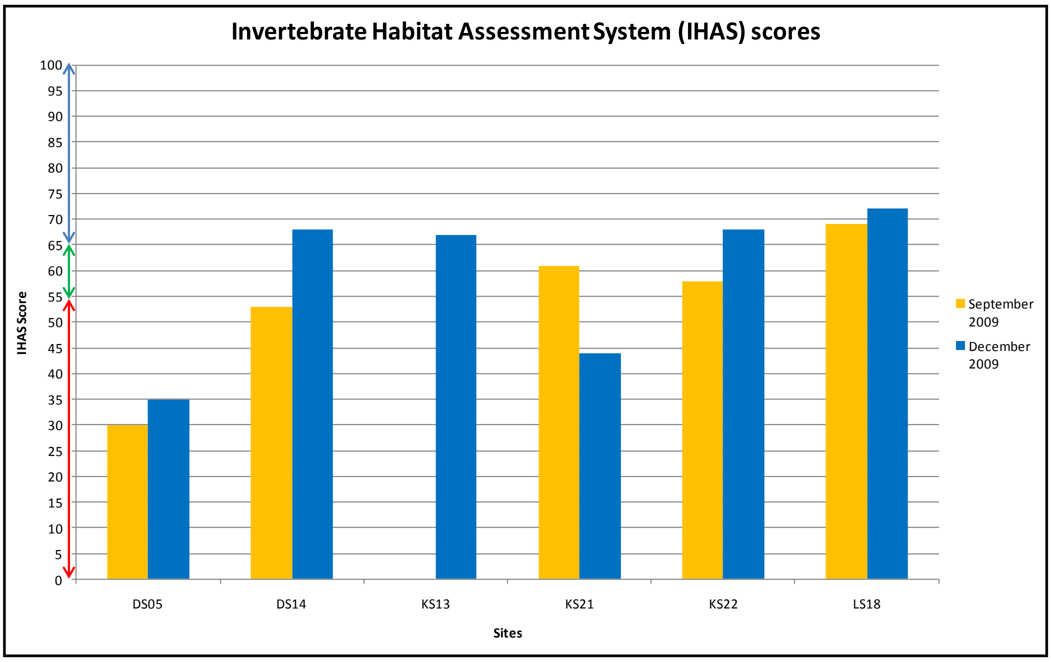


Figure 48: Comparative IHAS Scores Recorded During the September and December 2009 Surveys

3.10.8 Aquatic Macro-invertebrates

The results of the aquatic macro-invertebrate assessment for the river sites are summarized in **Figure 49 - Figure 51**. The highest South African Scoring System (SASS) score was recorded at site LS18 in both the September and December 2009 surveys, and the lowest at site DS05. These results show a direct correlation with the IHAS scores for the sites. Site KS21 and KS22 indicate the opposite results to the IHAS scores and thus indicates that habitat availability was not the primary reason for the increased SASS score at site KS21 and the decreased SASS score at site KS22 during the December 2009 survey. The Average Score Per Taxa (ASPT) values for these two sites indicate increased sensitivity of the taxa at site KS21 during the December 2009 survey and decreased sensitivity at site KS22. This suggests that water quality improvement at site KS21 in the December 2009 survey and decreased water quality at site KS22.

The highest taxa diversity was recorded at sites KS13 and LS18 during the December 2009 survey. The results of the aquatic macro-invertebrate diversity indicate that habitat and water quality limitations directly influence the taxa. These results are considered to be normal are a reflection of the complexity of the aquatic ecosystem to abiotic and biotic relationships. ASPT scores increased at all of the sites during the December 2009 survey except at site KS22. This indicates that the increased flow, observed at all of the sites improved the water quality conditions as increased taxa sensitivity was shown. However, at site KS22, this sensitivity decreased, thus suggesting that decreased water quality was present at this site during the December 2009 survey. It is possible that water with a poor quality flowed into this site from upstream, or that the increased flow caused a ‘catastrophic drift’ scenario, whereby sensitive taxa were dislodged by the flow and removed from the site to downstream areas.

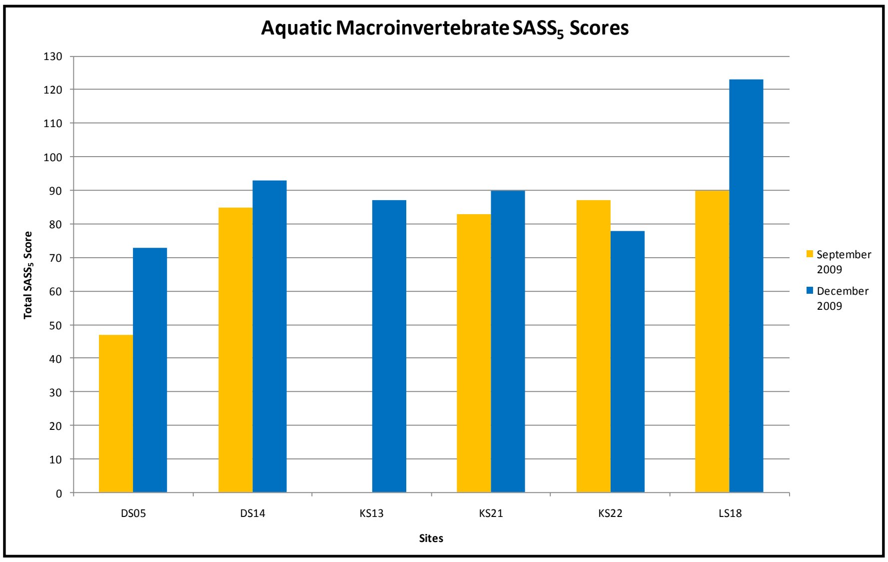


Figure 49: SASS5 Data for the September and December 2009 Surveys

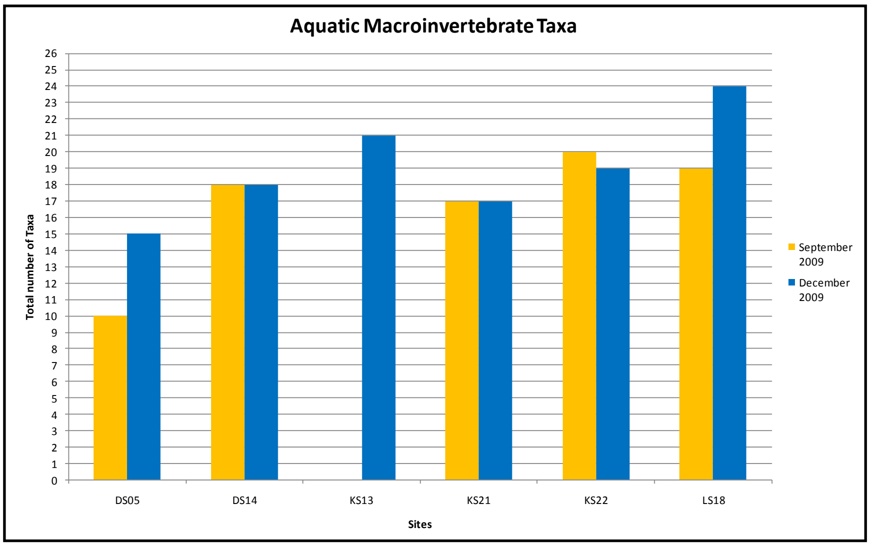


Figure 50: Number of Aquatic Macro-invertebrate Taxa at the River Sites During the September and December 2009 Surveys

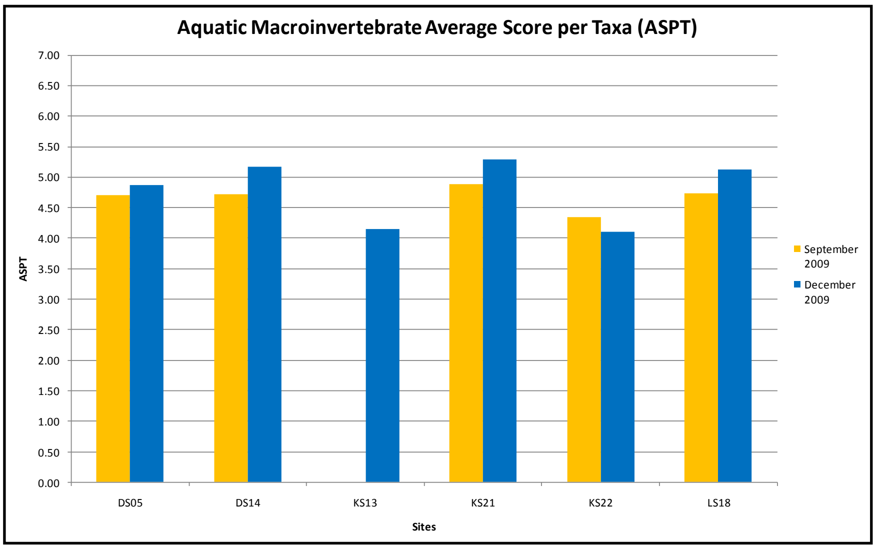


Figure 51: Average Score Per Taxa Values of the River Sites During the September and December 2009 Surveys

Based on the SASS interpretation guidelines for the lower Highveld eco-region, the biotic integrity, in terms of the ecological category of the different sites in the study area was derived. These are presented for the September (**Table 38** and December 2009 surveys (**Table 39**).

Table 38: Ecological Categories of the Sites for the September 2009 Survey, Based on SASS Interpretation Guidelines (Dallas, 2007)

Site	September 2009	
	Ecological Category	Description
DS05	D	Fair – Largely impaired; fewer families present then expected, due to loss of most intolerant forms. An extensive loss of basic ecosystem function has occurred.
DS14	B	Very Good – Minimally impaired; largely natural with few modifications. A small change in community structure may have taken place but ecosystem functions are essentially unchanged
KS13	-	-
KS21	B	Very Good – Minimally impaired; largely natural with few modifications. A small change in community structure may have taken place but ecosystem functions are essentially unchanged
KS22	B	Very Good – Minimally impaired; largely natural with few modifications. A small change in community structure may have taken place but ecosystem functions are essentially unchanged
LS18	B	Very Good – Minimally impaired; largely natural with few modifications. A small change in community structure may have taken place but ecosystem functions are essentially unchanged

- Site Dry at time of survey

Table 39: Ecological Categories of the Sites for the December 2009 Survey, Based on SASS Interpretation Guidelines (Dallas, 2007)

Site	December 2009	
	Ecological Category	Description
DS05	C	Good – Moderately impaired; community structure and function less than the reference condition. Community composition lower than expected due to loss of some sensitive forms. Basic ecosystem functions are still predominantly unchanged.
DS14	B	Very Good – Minimally impaired; largely natural with few modifications. A small change in community structure may have taken place but ecosystem functions are essentially unchanged
KS13	B	Very Good – Minimally impaired; largely natural with few modifications. A small change in community structure may have taken place but ecosystem functions are essentially unchanged
KS21	B	Very Good – Minimally impaired; largely natural with few modifications. A small change in community structure may have taken place but ecosystem functions are essentially unchanged
KS22	C	Good – Moderately impaired; community structure and function less than the reference condition. Community composition lower than expected due to loss of some sensitive forms. Basic ecosystem functions are still predominantly unchanged.
LS18	B	Very Good – Minimally impaired; largely natural with few modifications. A small change in community structure may have taken place but ecosystem functions are essentially unchanged

The results of the biotic integrity assessment indicated that sites KS21, KS22, DS14 and LS18 were in a B ecological category, described as having very good biotic integrity with few modifications. This also correlates with the IHAS data. Site DS05, indicated a D ecological category, thus having fair biotic integrity and being largely impaired.

During the December 2009 survey, the sites indicated similar results (**Table 39**). Improved biotic integrity was shown at site DS05 which improved from a D to a C ecological category. This increase was attributed to the improved flow and habitat availability at the site, which was seen in the SASS scores. A decrease in biotic integrity at site KS22, from a B to a C ecological category was attributed to the lower ASPT scores.

These results corresponded with the historical data for the Klein Komati River system in 1994 which was in a B ecological category with similar SASS and ASPT scores. Natural fluctuation due to flow and habitat availability is expected between the seasons and flow regimes.

3.11 Fauna

An ecological investigation was undertaken by Golder and Associates as part of the EIA for the EMP. Results from this report are presented herewith and the full report is provided in Appendix F.

The proposed mining area straddles four (4) quarter degree squares, namely:

- 2529 DB
- 2529DD
- 2530CA
- 2530CC

The presence of red data animal and plant species on the site is not yet known, however a detailed species inventory should be conducted as part of the future specialist studies. It is expected that various red data and endemic species will be present. Such species may include African Hedgehog (*Atelerix frontalis*), blue cranes (*Anthropoides paradiseu*s) within marshy areas along the streams and floodplains, flamingos (*Phoenicopterus* spp) and grass owls (*Tyto capensis*), and many more may potentially be present.

3.11.1 Arthropoda

No Arthropods were recorded during either the dry and wet season surveys.

3.11.2 Herpetofauna

Table 40 and **Table 41** indicate the species of herpetofauna that were previously recorded within the grid squares 2529DD and 2530CC and that may occur within the study area. None of the reptiles listed in **Table 40** has any level of Red Data status. The geckos and skinks listed in **Table 40** are all classified as Protected Game (indicated in as “Pro”) in terms of the Mpumalanga Nature Conservation Act. Snakes are partially protected (indicated in as “Part Pro”) in the sense that in terms of Section 33 of the Mpumalanga Nature Conservation Act (Act No. 10 of 1998) no snakes may be kept, possessed, sold donated, received or conveyed without a permit, they may however be killed. Thirteen Reptiles were previously recorded in the relevant grid squares, none of which are endemic to Mpumalanga, one is endemic to South Africa and four are endemic to Southern Africa. In terms of the Mpumalanga Tourism and Parks Agency Biobase report (Emery, Lotter and Williamson, 2002) is the conservation importance of the study area for reptiles assessed as low and medium.

Table 40: Reptiles Previously Recorded in the Grid Squares 2529DD and 2530CC (Mpumalanga Tourism and Parks Agency Herpetofauna Database)

Common name	Scientific Name	Conservation Status	Endemism
Common slug eater	*Duberria lutrix*	Part Pro	Southern Africa
Spotted bush snake	*Philothamnus semivariegatus*	Part Pro	Not Endemic
Bibron's blind snake	*Typhlops bibroni*	Part Pro	Southern Africa
Mole snake	*Pseudaspis cana*	Part Pro	Not Endemic
Blackheaded centipede-eater	*Aparallactus capensis*	Part Pro	Not Endemic
Cross-marked sand snake	*Psammophis crucifer*	Part Pro	Southern Africa
Herald snake	*Crotaphopeltis hotamboeia*	Part Pro	Not Endemic
Common eggeater	*Dasypeltis scabra*	Part Pro	Not Endemic
Rinkals	*Hemachatus haemachatus*	Part Pro	Southern Africa
Dwarf snake-eyed skink	*Panapsis wahlbergii*	Pro	Not Endemic
Spotted skink	*Trachylepis punctatissima*	Pro	Not Endemic
Van Son's thicktoed gecko	*Pachydactylus vansoni*	Pro	Not Endemic
Ocellated (spotted) dwarf gecko	*Lygodactylus ocellatus*	Pro	South Africa

Table 41: Amphibians Previously Recorded in the Grid Squares 2529DD and 2530CC (Mpumalanga Tourism and Parks Agency Herpetofauna Database)

Common Name	Scientific Name	Endemism	Mpumalanga Status
Common River Frog	*Amietia angolensis*	No	Common
Cape River Frog	*Amietia fuscigula*	Near (Namibia)	Uncommon
Guttural Toad	*Amietophrynus gutturalis*	No	Common
Mozambique Rain Frog	*Breviceps mossambicus*	No	Uncommon
Dainty Frog	*Cacosternum boettgeri*	No	Common
Bronze Dainty Frog	*Cacosternum nanum*	South Africa	Uncommon
Bubbling Frog	*Kassina senegalensis*	No	Common
Striped Grass Frog	*Ptychadena porosissima*	No	Rare
Rattling Frog	*Semnodactylus wealii*	South Africa	Uncommon
Striped Stream Frog	*Strongylopus fasciatus*	Near	Uncommon
Clicking Stream Frog	*Strongylopus grayii*	Near	Uncommon
Tremelo Sand Frog	*Tomopterna cryptotis*	No	Common
Natal Sand Frog	*Tomopterna natalensis*	Near	Common
Tandy's Sand Frog	*Tomopterna tandyi*	South Africa	Rare
Common Platanna	*Xenopus laevis*	No	Common

No amphibians, except for the Bullfrog (*Pyxicephalis adspersus*) are protected under the Mpumalanga Nature Conservation Act and none of the species has any Red Data threat status as all are classified as least concern. Two species are, however, regarded as rare, six are considered uncommon and seven are regarded as common. Fifteen Amphibians were previously recorded in the relevant grid squares, none of which are endemic to Mpumalanga, four are near endemic and three are endemic to South Africa.

In terms of the Mpumalanga Tourism and Parks Agency Biobase report (Emery, Lotter and Williamson 2002) is the conservation importance of the study area for amphibians mostly not assessed and a small part as low and medium.

3.11.3 Avifauna

According to Gibbon (2004) 397 bird species were previously recorded within the two grid squares (2529DD and 2530CC) in which the study area is situated. The Mpumalanga Nature Conservation Act lists all of them as protected game, except those 28 species that are regarded as game birds (those that are commonly hunted) or potential pest species. In terms of IUCN Red Data Listing four are listed as critical, one endangered, 13 as vulnerable and 21 near threatened. The Department of Environmental Affairs and Tourism (DEAT)[16] Threatened or Protected Species (TOPS) regulations lists three as endangered, eight as vulnerable and one protected. Both listings (i.e. IUCN and TOPS) are used in this assessment.

One of the endangered species, the Whitewinged Flufftail (*Sarothrura ayresii*) is poorly known, secretive birds living in wetland habitat. Its populations have suffered decline due to habitat destruction and degradation. It is, however, believed to be unlikely to be found within the study area, due to the wetlands within the study area not presenting suitable habitat to any of these species (Barnes, 2000). The Wattled Crane (*Grus carunculatus*), which may occur in the study area is classified as vulnerable both in terms of IUCN Red Listing and TOPS regulations. This is due to this bird's small population of an estimated 230 animals, vastly reduced range and the lowest reproductive potential of all crane species. Failure to address loss of wetland habitat on privately owned land will result in further decline and probably regional extinction (Barnes, 2000). The vulnerable Blue Crane (*Anthropoides paradisea*) and Southern Crowned Crane (*Balearica regulorum*) were both recorded during this survey. An interesting record, during this survey, was that of Blue Korhaan (*Eupodotis caerulensis*), classified as near threatened (IUCN, Red Data) and vulnerable in terms of the TOPS regulations. This study site is on the extreme northern edge of this bird's distribution range.

Bird species previously recorded were determined by means of an electronic search of Robert's Multimedia (Gibbon 2004) for the grid squares 2529DD and 2530CC. Species recorded are listed in Appendix F, indicating General Status, IUCN Red Data Status, Mpumalanga Conservation Act Protected Status and DEAT Threatened or Protected Species Status. Bird species recorded during the field survey include species recorded by the Wetland Team and are listed in **Table 42**.

In terms of the Mpumalanga Tourism and Parks Agency Biobase report (Emery, Lotter and Williamson 2002) the conservation importance of the study area for avifauna assessed as low and medium.

Table 42: Bird Species Recorded in the Study Site during the Dry Season Field Survey, August 2009

Common Name	Scientific Name	Common Name	Scientific Name
Egyptian goose	*Alopochen aegyptiacus*	Whitethroated swallow	*Hirundo albigularis*
Redbilled teal	*Anas erythrorhyncha*	Common Fiscal Shrike	*Lanius collaris*
Hottentot teal	*Anas hottentota*	Cape wagtail	*Motacilla capensis*
Cape shoveler	*Anas smithii*	Helmeted Guinea Fowl	*Numida meleagris*
Yellowbilled duck	*Anas undulata*	Reed cormorant	*Phalacrocorax africanus*
Blue Crane	*Anthroporoides pardiseus*	African spoonbill	*Platalea alba*
Grey heron	*Ardea cineria*	Spurwinged goose	*Plectropterus gambensis*
Blackheaded heron	*Ardea melanocephala*	Glossy ibis	*Plegadis falcinellus*
Purple heron	*Ardea purpurea*	Gymnogene	*Polyboroides typus*
Marsh owl	*Asio capensis*	Purple Swamphen	*Porphyrio porphyrio*
Southern Crowned Crane	*Balearica regulorum*	Brownthroated martin	*Riparia paludicola*
Hadeda Ibis	*Bostrychia hagedash*	Secretarybird	*Sagittarius serpentarius*
Great white egret	*Casmerodius albus*	African Pied Starling	*Spreo bicolor*
White stork	*Ciconia ciconia*	Cape Turtle Dove	*Streptopelia capicola*
Whitefaced duck	*Dendrocygna viduata*	Laughing Dove	*Streptopelia senegalensis*

[16] Now referred to as the Department of Water and Environmental Affairs (DWEA).

Common Name	Scientific Name	Common Name	Scientific Name
Blackshouldered Kite	*Elanus caeruleus*	Little Grebe	*Tachybaptus ruficollis*
Longtailed widow	*Euplectus progne*	Sacred ibis	*Threskiornis aethiopicus*
Blue Korhaan	*Eupodotis caerulensis*	Olive Thrush	*Tordis olivaceus*
Shelley Francolin	*Francolinus shelleyi*	Blacksmith lapwing	*Vanellus armatus*
Redknobbed coot	*Fulica cristata*	Wattled lapwing	*Vanellus senegallus*
Common Moorhen	*Galinula chloropus*	Pintailed Wydah	*Vidua macroura*
African snipe	*Gallinago nigripennis*		

3.11.4 Mammalia

Due to the intensive long standing agricultural activity, few mammal species, especially of the larger mammals, are expected to still occur in the study area. The fringes of wetland areas with denser grass cover may still provide good, undisturbed habitat for species such as rodents, Cape Clawless Otter and Serval. Signs of the presence of animals such as Aardvark, Porcupine, Yellow mongoose and Bushpig were also seen. Fifty eight mammal species can potentially occur in the area, including two endangered, two vulnerable and seven near threatened species.

The endangered (Mpumalanga Provincial Assessment) Cape Mole-rat (*Georychus capensis*) is endemic to South Africa and occurs subterranean in sandy soils in the Western Cape, Eastern Cape, KwaZulu-Natal, Mpumalanga and the Northern Cape. Populations are fragmented in an area of occurrence of more than 20,000km^2, but the area of occupancy is estimated between 11 - 500km^2. The Mpumalanga and KwaZulu-Natal populations appear to be genetically distinct and if found to be so, the extent of occurrence for these two populations will then be much smaller. The sub-populations are in continual decline, mainly due to habitat loss, induced by human activity (Friedman and Daly 2004). The other endangered species that could possibly occur in the area is the Oribi (*Ourebia ourebi*). It occurs in Sub-Saharan African Grasslands and the current occupancy area is estimated to be larger than 2,000km^2. Its habitat is currently very fragmented due to afforestation, agriculture and poor livestock farming. Populations are noted as declining (Friedman and Daly, 2004). Oribi is also considered Endangered in Terms of the TOPS regulations. It is, however, considered very unlikely to occur in the study site, due to the patches of grassland community not representing preferred habitat. In terms of the TOPS regulations of the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) of the DEAT one species is considered to be vulnerable, one endangered and six species are considered to be protected.

The Rough-haired Golden Mole (*Chrysospalax villosus*) and the Robust Golden Mole (*Amblysomus robustus*) were both classified as vulnerable (IUCN, 2009). Major threats listed for both these species are habitat alteration as a result of mining and power generation, ecologically unfriendly agricultural practices, urbanisation, tourism resorts and agro-forestry. Threats posed by mining of shallow coal deposits in the high-altitude grasslands and ineffective rehabilitation are specifically mentioned (IUCN, 2009a & 2009b).

Mammals recorded during this survey include species recorded by the survey team and are listed in **Table 43**. Mammals that may be found in the grid squares 2529DD and 2530CC study area are listed in Appendix F, including Red Data Status, Mpumalanga Protected Status and TOPS.

Table 43: Mammal Species Recorded During the Dry Season Survey

Common Name	Scientific Name
Grey Duiker	*Sylvicapra grimmia*
Yellow Mongoose	*Cynictis pennicillata*
Common Mole rat	*Cryptomys hottentotus*

Common Name	Scientific Name
Bush pig	*Potamochoerus porcus***
Water mongoose	*Atilax paludinosus***
Aardvark	*Orycteropus afer*
Cape Clawless otter	*Aonyx capensis***
Porcupine	*Hystrix africaeaustralis*
Caracal	*Caracal caracal**
Serval	*Leptailurus serval***
Mountain Reedbuck	*Redunca fulvorufula***
Recorded by landowners * Associated with water habitats**	

Trapping of small mammals was done during the wet season survey, using Sherman traps. This survey was however constrained by the low number of traps available (25) and short period available for trapping (four days). It should also be noted that trapping only provides proof of presence and is no indication of absence of species as some species are more prone to be caught than others.

Only one trap site could be done on Portion 10 of the farm Blyvooruitzicht 383 JT (GPS ref S25.83179 E29.98704) in the vicinity of the proposed site two of the plant. This is close to a large wetland area in natural grassland. Traps were placed in three transects, two of which contained 10 traps and one of five traps. Only two species were captured, namely Striped mouse (*Rhabdomys pumilio*) and the Lesser grey-brown musk shrew (*Crocidura silacea*). One Lesser grey-brown musk shrew and 12 striped mice were caught during 100 trap-nights, resulting in a catch ratio of 13%. One trap had evidence of a rodent that entered the trap without triggering it. In terms of the Mpumalanga Tourism and Parks Agency Biobase report (Emery, Lotter and Williamson 2002) the conservation importance for mammals partly assessed as Low and the rest of the area unassessed.

3.11.5 Ichthyofauna (Fish)

The observed fish species results are presented in **Table 44**. Of the 12 expected fish species, two indigenous fish species (*Barbus anoplus* and *Pseudocrenilabrus philander*) and one introduced fish species (*Micropterus salmoides*) were recorded during the September and December 2009 surveys. No fish were recorded at any of the pan sites.

B. anoplus (Chubbyhead Barb) has a wide distribution from the Highveld tributaries of the Limpopo to the highlands of KwaZulu-Natal, Transkei and the middle- and upper Orange River basins including the Karoo. It prefers cool waters and occurs in a wide range of habitats (Skelton 2001). This is a widespread and hardy species that prefers quiet well vegetated waters in lakes, swamps and marshes or marginal areas of larger rivers and slow-flowing streams (Skelton 2001). Recent work on this species by the South African Institute of Aquatic Biodiversity (SAIAB) indicates that this species may currently consist of numerous species (even two species may occur in the same river but in different habitats).

P. philander (Southern Mouthbrooder) is regarded as being tolerant species that are widespread throughout Southern Africa and is common (Skelton 2001). Only one individual was sampled at site KS21.

M. salmoides (Largemouth Bass) was introduced into South African water from North America between 1928 - 1938 and quickly became established in natural waters. Although this species is primarily piscivorous, it is a voracious predator that will take virtually any animal food it encounters including crabs, frogs, snakes and even small mammals. In many areas they have caused extensive damage to indigenous fish populations (Skelton 2001). This species competes with indigenous fish species for food and habitat. The destructive influence of this species is generally considered to be responsible for the elimination of some indigenous species of *Barbus* from South African tributaries (Davies and Day 1998). Although this species was only recorded at sites KS13 and KS21 in the Klein Komati River, its presence in the area is cause for concern and may be contributing towards a decline in indigenous fish diversity and abundances within the project area. It is suspected that the absence of fish at site KS22 during the December 2009 survey is likely due to the presence of Bass at the site. This is very important in terms of the planned Biodiversity Action Plan for the proposed project and needs to be addressed.

After thorough external examination, it was determined that all individuals were free of apparent diseases, parasites and body injuries during the September 2009 survey, but 3 individuals had external skin parasites at site LS18 during the December 2009 survey.

Table 44: Observed Fish Species Recorded During the September 2009 Survey

Scientific Name	Common Name	Fish Code	IUCN Status	September 2009					December 2009				
				DS14	KS13	KS21	KS22	LS18	DS14	KS13	KS21	KS22	LS18
Family Cichlidae													
Pseudocrenilabrus philander	Southern Mouthbrooder	PPHI	Unlisted			1					2		
Family Cyprinidae													
Barbus anoplus	Chubbyhead Barb	BANO	LC	43		37	29	6	128	1	2		64
Family Centrarchidae													
Micropterus salmoides	Largemouth Bass	MSAL	Exotic			1				25			
Total number of species				1	0	3	1	1	1	2	2	0	1
Total number of individuals				43	0	39	29	6	128	26	4	0	64
Total number of families				1	0	3	1	1	1	0	3	1	1

3.12 Air Quality

An air quality impact assessment was undertaken by Airshed Planning Professionals (Pty) Ltd for the proposed Belfast Project and appended hereto as Appendix D. The main objective of the study was to determine the significance of air pollution impacts from the proposed mining activities on the surrounding environment and on human health.

3.12.1 Regional Emission Sources

The Mpumalanga Highveld has frequently been the focus of air pollution studies for two reasons. Firstly, elevated air pollution concentrations have been noted to occur in the region. Secondly, various elevated sources of emission located in this region have been associated with the long-range transportation of pollutants and with the potential for impacting on the air quality of the adjacent and more distant regions (Piketh, 1994).

Sources identified as possibly impacting the air quality in the region include, but are not limited to:

- Industrial Sources: Anthropogenic sources of emissions in the vicinity of the proposed Belfast Project site include power generation from power stations such as Arnot (~24km south west) and Hendrina Power Station (~43km south west).
- Fugitive Dust Sources: Sources of fugitive dust identified to potentially occur in the study area include paved and unpaved roads; agricultural tilling operations; and wind erosion of sparsely vegetated surfaces.
- Mining Emission Sources: There are numerous coal mines located relatively close to the proposed mine site and these include Kopermyne Colliery (~29km west), Arnot Colliery (~24km south east) and Glisa Colliery (~10km north east) among others.
- Domestic Fuel Combustion: It is likely that households within the local communities / settlements utilise coal, paraffin and / or wood for cooking and / or space heating (mainly during winter) purposes.
- Biomass Burning: Within the project vicinity, crop-residue burning and wild fires (locally known as veld fires) may represent significant sources of combustion-related emissions. In addition to the impact of biomass burning within the vicinity of the proposed mining activity, long-range transported emissions from this source can be expected to impact on the air quality between the months August to October.
- Vehicle Tailpipe Emissions: Due to the close proximity of the proposed mine site to the N4 highway, it is highly likely that this highway will be a source of vehicle emissions.
- Informal Refuse Burning: Additional sources of emissions come from the waste sector and typically include informal refuse and tyre burning. The informal burning of refuse tips within former township areas and burning of waste at local municipal landfill sites represents a source of concern in all provinces.

Criteria pollutants identified as of major concern in the region include particulates, sulphur dioxide (SO_2) and nitrogen oxides (NO_X). Sources of SO_2 and NO_x that occur in the region include industrial emissions, blasting operations at mines and spontaneous combustion of discard coal dumps, veld burning, vehicle exhaust emissions and household fuel burning (Scorgie *et al*, 2004). The predicted highest and annual average concentrations of Particulate Matter (PM10)[17] in the study region for all the sources according to a cumulative study conducted to the National Economic Development and Labour Council (NEDLAC) study are estimated to be between 25µg/m³ and 75µg/m³ in the region. Annual average concentrations are estimated to be approximately 10µg/m³.

[17] Fine liquid or solid particles – such as dust, smoke, mist, fumes, or smog, found in air or emissions – with an aerodynamic diameter of less than 10µm.

The construction phase will initially comprise land clearing and site development operations at the proposed mine site and the associated infrastructure. The main pollutant of concern from construction operations is particulate matter, including PM10, PM2.5 and TSP liberated from vehicle entrainment on unpaved roads, drilling and blasting and wind erosion from the coal stockpiles.

A discussion of the emissions modeling and the scenarios used in the model as well as an impact assessment on air quality from the propopsed mining project is provided in Section 6.8.1.

3.13 Noise

A Noise Impact Assessment was undertaken by JH Consulting for the proposed Belfast Project. The sections included herewith are extracted from this report and the full report is provided in Appendix I.

The existing noise sources located within and surrounding the Belfast Project area include:

- Natural sounds of the area / bush.
- Livestock and agricultural activities.
- Local community and domestic noise.
- Remote vehicle and other transportation noise associated with serving the community.

A discussion on the predicted impact of noise during the mining phases and an assessment of these impacts is provided in Section 6.9.1.

3.14 Sites of Archaeological and Cultural Importance

A Heritage Impact Assessment was undertaken by Cultmatrix CC for the proposed Belfast Project and attached hereto in Appendix J.

The Belfast area has a long history of human use and occupation, initiated by Stone and Iron Age communities and culminating in permanent colonial settlement in the 1850's. It includes a range of heritage resources as defined in the National Heritage Resources Act (Act No. 25 of 1999):

- Places, buildings and structures, and equipment of cultural significance
- Places to which oral traditions are attached or that are associated with intangible heritage (i.e. ceremonies, memories, festivals, economic use etc)
- Historical settlements and townscapes
- Landscapes and natural features of cultural significance
- Graves and burial grounds
- Archaeological sites
- Sites related to the history of farm labour

Table 45 lists the heritage resources identified within the Belfast Project area whilst **Figure 52** indicates the location of the identified heritage resources described in **Table 45**. The site numbers utilised in **Table 45** and **Figure 52** refer to the farm portion on which the heritage resource occurs, namely:

- Numbers refer to farm portions;
- BV - Blyooruitzicht;
- L - Leeuwbank;
- Z - Zoekop;
- G - Grave;
- F - Farmstead
- H - Homestead; and
- N - Natural feature.

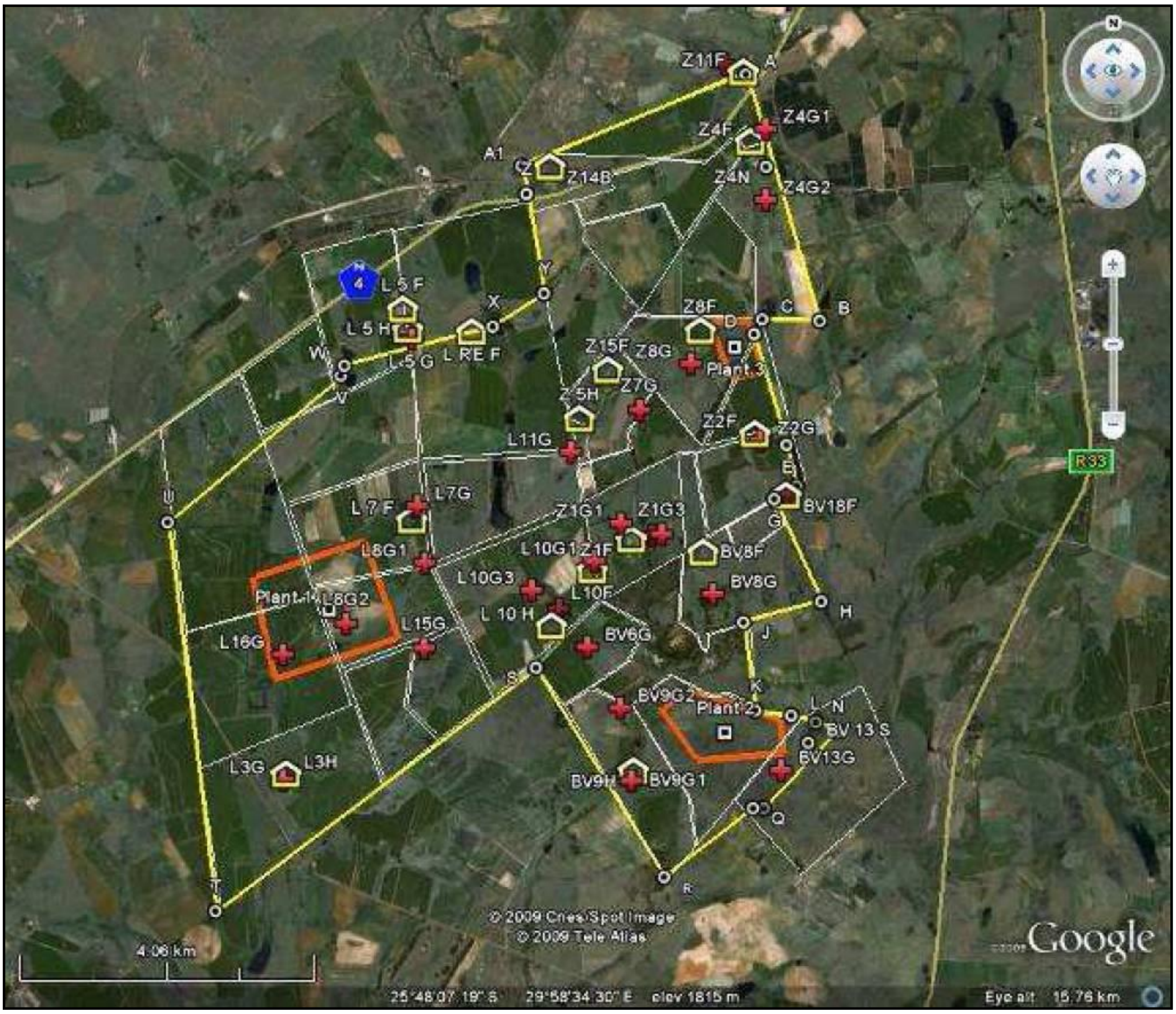
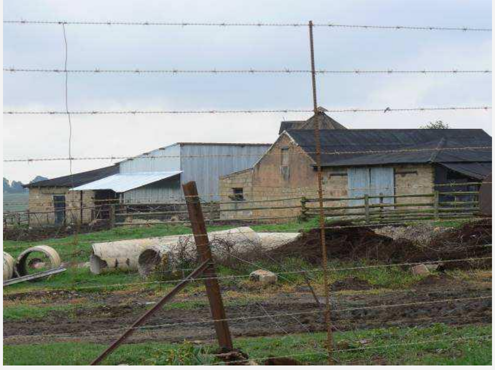


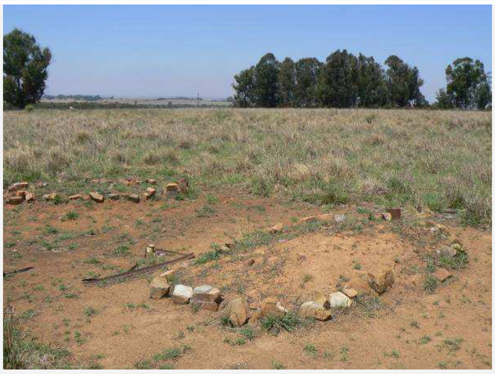
Figure 52: Google Earth image of the Identified Places of Heritage Significance

Table 45: Heritage Resources identified within the Belfast Project Area.

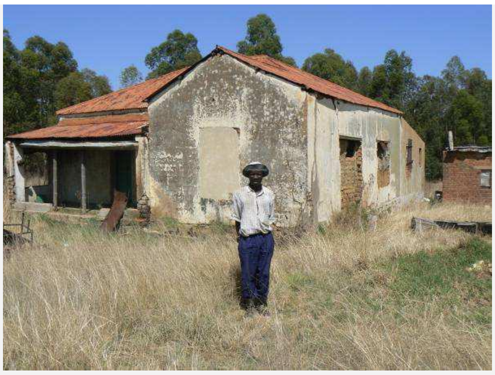
Site	Resource	Description	Coordinates
BV6G	Farm worker's grave	According to CJ Burger this is a single grave of a farm worker	25°49' 16.58"S 29°58' 36.93"E
BV8G	Mtsweni graves 5 graves with new headstones of members of Mtsweni Family.		25°48' 53.23"S 29°59' 38.78"E
BV9G1	White person's grave	According to WP Pretorius a single white person is buried here	25°50' 15.73"S 29°58' 58.72"E
BV9G2	Farm workers graves	According to WP Pretorius farm workers are buried here	25°49' 43.49"S 29°58' 53.12"E
BV13G	Farm workers graves	According to WP Pretorius farm workers are buried here	25°50' 11.10"S 30° 0' 12.45"E

BV13S	Remains of kraal and homestead	According to the 1969 topo map there used to be a kraal and homestead, now hardly visible	25°49' 51.23"S 30° 0' 26.38"E
BV18G	Coetzer grave	 Graves of Coetzer and his wife	25°48' 9.10"S 30° 00' 15.50"E
L3G	Farm workers graves (20)	 Graveyard with about 20 graves, some with headstones	25°50' 15.80"S 29°56' 6.40"E
L5F	Farmstead	 Historic Leeuwbank farmstead with some elements older than 60 years	25°46' 47.86"S 29°57' 6.33"E
L5G	Cemetery	 Graves of farm workers (ca 22)	25°47' 0.90"S 29°57' 10.80"E

L7F	Modern farmstead with some historic buildings	 Modern farmstead with established trees and some sandstone walls, kraals and buildings.	25°48' 24.11"S 29°57' 10.67"E
L7G	Graves	Small graveyard	25°48' 14.22"S 29°57' 13.25"E
L8G1	White persons graves	Graveyard with graves of white farmers and their families	25°48' 39.55"S 29°57' 16.78"E
L8G2	Farm workers graves	Graveyard of farm workers	25°49' 6.34"S 29°56' 37.92"E
L10G1	Swart and other farmers graves	 Fenced-in graveyard with graves of Swart and Senekal families. One grave (unmarked) is outside the fence.	25°48' 38.60"S 29°58' 40.50"E
L10G2	Single black grave	Single black grave	25°49' 0.75"S 29°58' 24.16"E
L10G3	Single black grave	Single black grave	25°48' 51.57"S 29°58' 9.50"E
L10F	Historic farmstead	 Well-preserved farmstead comprising sheds, kraals, sandstone main house, sandstone barn, 1950s house	25°48' 42.80"S 29°58' 39.40"E
L10H	Homesteads	Homesteads	25°49' 7.51"S 29°58' 19.19"E
L11G	Farm workers graves	Farm workers graves	25°47'50.55"S 29°58 '28.81"E

L15G	Roy Coetzer grave	Single grave, according to Jan Burger that of Roy Coetzer	25°49' 17.24"S 29°57' 16.53"E
L16G	Farm workers graves	Graveyard with farm workers' graves. The farmstead was demolished some years ago.	25°49' 20.01"S 29°56' 6.87"E
LREF	Modern farmstead	Modern farmstead	25°46' 57.78"S 29°57' 40.19"E
Z1G1	Farm workers graves	 Small graveyard of farm workers, hardly recognisable, identifiable by broken fence poles and mounds of rocks	25°48' 22.10"S 29°58' 53.50"E
Z1G2	Farm workers graves	 Farm workers' graveyard under trees, recognisable by mounds of rocks, hardly visible	25°48' 27.44"S 29°59' 8.81"E
Z1G3	Farm workers graves	 Small graveyard of about 5 graves of farm workers	25°48' 26.83"S 29°59' 13.61"E
Z2G	Single white grave	Single white grave	25°47' 45.48"S 30° 00' 2.35"E

Z2F	Old farmstead with sandstone ruins	 Old farmstead comprising dilapidated dwellings and ruins of sandstone outbuildings and kraals	25°47' 42.57"S 29°59' 59.36"E
Z4F	Modern farmstead with sandstone outbuildings	 Modern farmstead with one sandstone outbuilding, much altered	25°45' 34.70"S 29°59' 56.60"E
Z4G1	White person's grave	 Single grave of Van Deventer, broken headstone	25°45' 29.10"S 30° 00' 4.20"E
Z4G2	Farm workers graves	 Graveyard with some 20 graves of farm workers, some with headstones	25°45' 59.90"S 30° 00' 4.30"E
Z4N	Sandstone outcrops	Sandstone outcrop with small overhang. site could contain archaeological finds	25°45' 37.75"S 30° 00' 4.82"E

Z5H	Farmhouse	 1930s farm house, inhabited by farm worker, poor condition	25°47'36.00"S 29°58'33.00"E
Z7G	Farm workers graves	According to WP Pretorius farm workers are buried here	25°47' 32.07"S 29°59' 2.63"E
Z8G	Farm workers graves	 According to JH Gerrits children of farm workers are buried here. There are about four graves, hardly visible.	25°47' 11.70"S 29°59' 27.80"E
Z11F	Farmstead with sandstone buildings (local landmark)	 Sandstone farm house with outbuildings, visible from the N 4	25°45' 4.40"S 29°59' 53.10"E
Z11G	Farm workers graves	 Graves of farm workers (about 5), fairly recent	25°45' 0.60"S 29°59' 44.10"E

Z14B	Mission station complex (Victory Fellowship)	 Collection of modern buildings comprising hall, sheds, garages, kitchens, dormitories and dwellings	25°45' 45.54"S 29°58' 18.56"E

A discussion of the predicted impact on heritage resources during the mining phases and an assessment of these impacts is provided in Section 6.11.

3.15 Visual

A visual impact assessment was undertaken by Newtown Landscape Architects for the proposed Belfast Project and attached hereto as Appendix K.

As previously stated, the study area has a rolling topography with grasslands and cultivated land that is intersected by streams, wetlands and dams. Most of the area is used for the cultivation of maize as well as for grazing fields. There are clusters of exotic trees spread throughout this area and it seems like some of the groups of trees previously formed part of plantations. The vegetation of the area is characterised by the Eastern Highveld Grassland. This vegetation type mainly consists of short dense highveld grassland. There are also small, scattered rocky outcrops with wiry, sour grasses and some woody species. The landscape character is moderately to undulating plains and includes some hills and pan depressions.

The man-made landscape types that occurs on the study area includes the grazing areas, cultivated fields, built-up areas (residences), infrastructure such as dirt roads, power lines and the existing mining activities.

Landscape character types are landscape units refined from the regional physiographic and cultural data derived from 1:50 000 topographical maps, aerial photographs and information gathered on the site visit. Dominant landform / and use features (e.g. hills, rolling plains, valleys and urban areas) of similar physiographic and visual characteristics, typically define landscape character types. **Figure 53 – Figure 56** illustrate the landscape character of the proposed project area.

A discussion of the predicted impact on heritage resources during the mining phases and an assessment of these impacts is provided in Section 6.12.

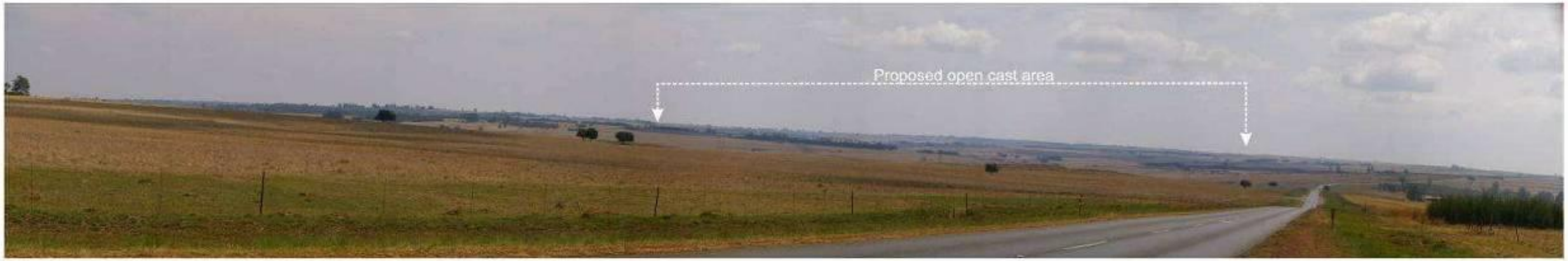
View 1: From the R33 road towards the proposed open cast mining area

View 2: From the R33 road (Blyvooruitzicht Farm) towards the proposed opencast mining area

View 3: From the R33 road towards the proposed open cast mining area and the proposed Plant 2 site

Figure 53: Landscape Character for the Belfast Project – View 1 – 3

View 3: From the R33 road (Geluk-Rossow Farm) towards the proposed open cast mining area and the proposed Plant 2 site



View 4: From the R33 road towards the open cast mining area

View 5: From the residential area and school located on the farm Eerstelingsfontein

Figure 54: Landscape Character for the Belfast Project – View 4 - 6

View 7: From the N4 Highway towards the proposed open cast mining area and the proposed Plant 2 site

View 8: From the N4 Highway towards the proposed site

Figure 55: Landscape Character for the Belfast Project – View 7 - 8

View 9: From local farm road towards the proposed open cast mining area and the Plant 2 site

View 10: From local farm road towards the proposed open cast mining area and the Plant 2 site

Figure 56: Landscape Character for the Belfast Project – View 9 - 10

3.16 Traffic

A traffic assessment was undertaken by Exxaro for the proposed Belfast Project. The sections included below are extracted from this report and the full report is provided in Appendix L.

3.16.1 Traffic Indicators on Provincial Roads

The traffic volumes given on provincial roads (**Figure 57**) were obtained from the Roads Authority's database. The figures are shown in black and are given as Average Daily Traffic (ADT) and are projected to 2006. Below the ADT on **Figure 57**, the amount of heavy vehicles is given as a percentage of the ADT. The traffic shown in red is the traffic as detailed before plus the envisaged traffic due to the coal haulage related to the Belfast Project.

3.16.2 Traffic Counts on National Routes

N4 Highway:

- During the design of the current upgrading of the N4 between Wonderfontein and Belfast, the traffic on the N4 was counted on the intersection of the N4 and Road P81-2 in November 2004. The traffic amounts to an ADT of 16,000 with 13% heavy vehicles.
- In 2005 traffic was counted between Road 1398 and Road 1433. The traffic amounts to an ADT of 12,000 with 18% heavy vehicles.

N11 Road:

- South of Pullenshope on the N11 is an existing traffic counting station. The traffic available is from 2003 and amounts to an ADT of 2,720 with 15.2% heavy vehicles.

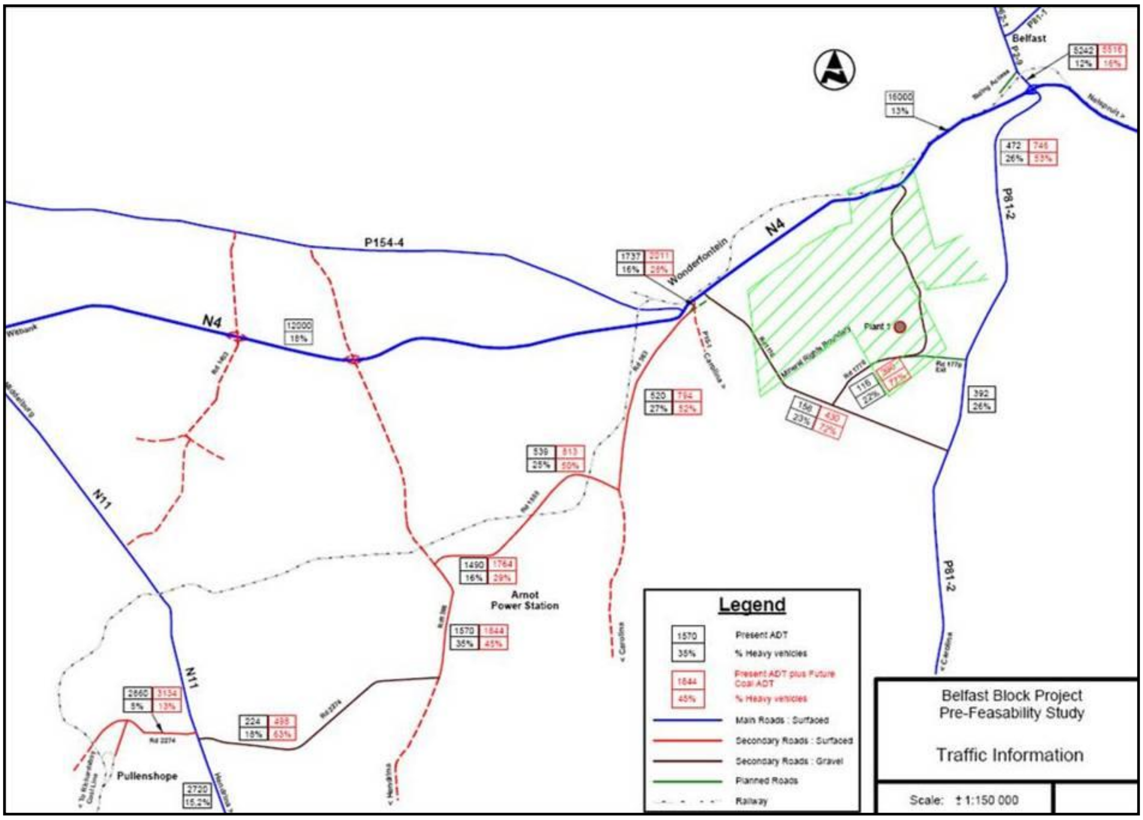


Figure 57: Traffic Volumes for Transportation Routes Surrounding the Belfast Project Area

3.17 Regional Socio-Economic Structures

A Social Impact Assessment was undertaken by Dr. Neville Bews Associates for the proposed Belfast Project. The sections included herewith are extracted from the Social and Labour Plan (SLP) for the Belfast Project, the Emakhazeni Local Municipality Integrated Development Plan (IDP) [2006 – 2001], and the Social Impact Assessment (SIA), the full report of which is provided in Appendix M.

The Belfast Project is situated in the Mpumalanga Province, within the municipal boundaries of the Nkangala District and Emakhazeni (formally Highlands) Local municipalities. These municipal boundaries, as depicted by the South African Municipal Demarcation Board, are illustrated in **Figure 58** and **Figure 59.**

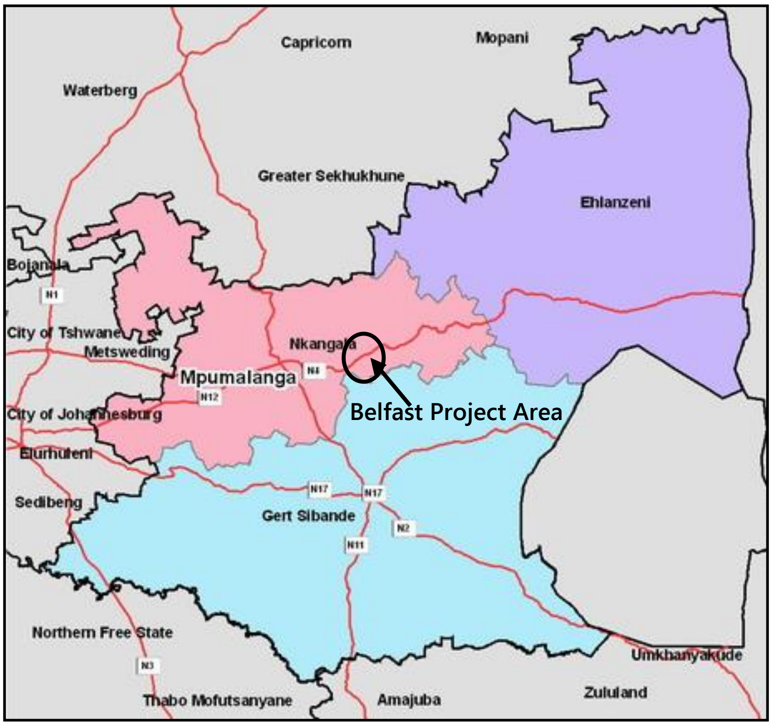


Figure 58: Mpumalanga Province Illustrating the Location of the District Municipalities[18]

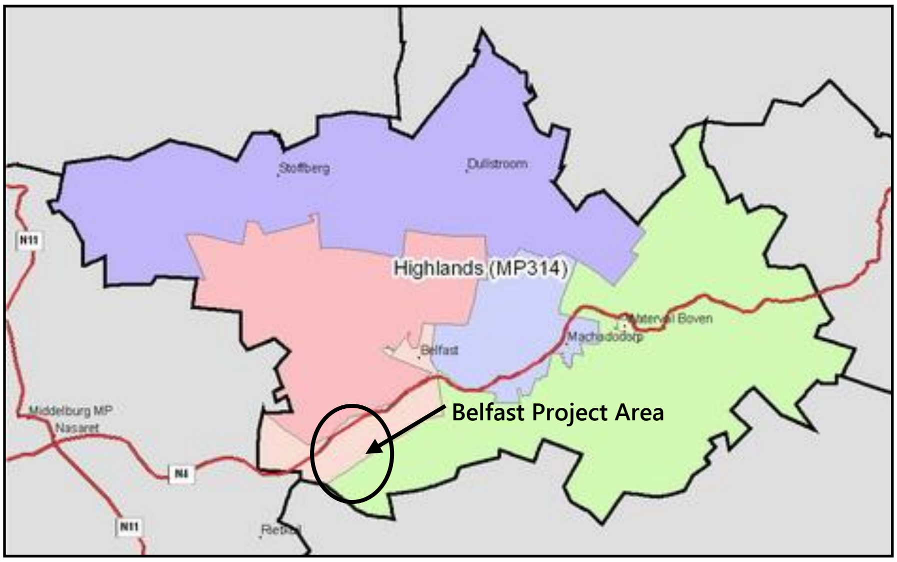


Figure 59: The Emakhazeni (formally Highlands) Local Municipality (MP314)[19]

[18] http://www.demarcation.org.za

3.17.1 Population Density

According to Statistics South Africa (StatsSA), the total population of the Emakhazeni Local Municipality (ELM) amounts to 43,007 people, which is approximately 4.2% of the total Nkangala District Municipality's population (1,020,589 people), and 1.3% of Mpumalanga's population (3,122,988 people). However, recent updates by the population division of the Social Services Department indicate that the population is currently standing at 59,000 people. These new population estimates were confirmed in the Water Services Development Plan (WSDP) study commissioned by the DWAF. Based on the 2001 figures the population of the ELM comprised of 51% males and 49% females, of which 87% were black Africans, 12.3% white, 0.4% Indian / Asian, and 0.3% coloured (StatsSA, 2001).

The population density is between 0 – 11 persons per square kilometre. The population density rises to 12 – 43 persons per square kilometre in the vicinity of Belfast and Waterval Boven (**Figure 60**). Settlements in the area are sparsely distributed with residential densities increasing towards towns in the area as well as rural settlements.

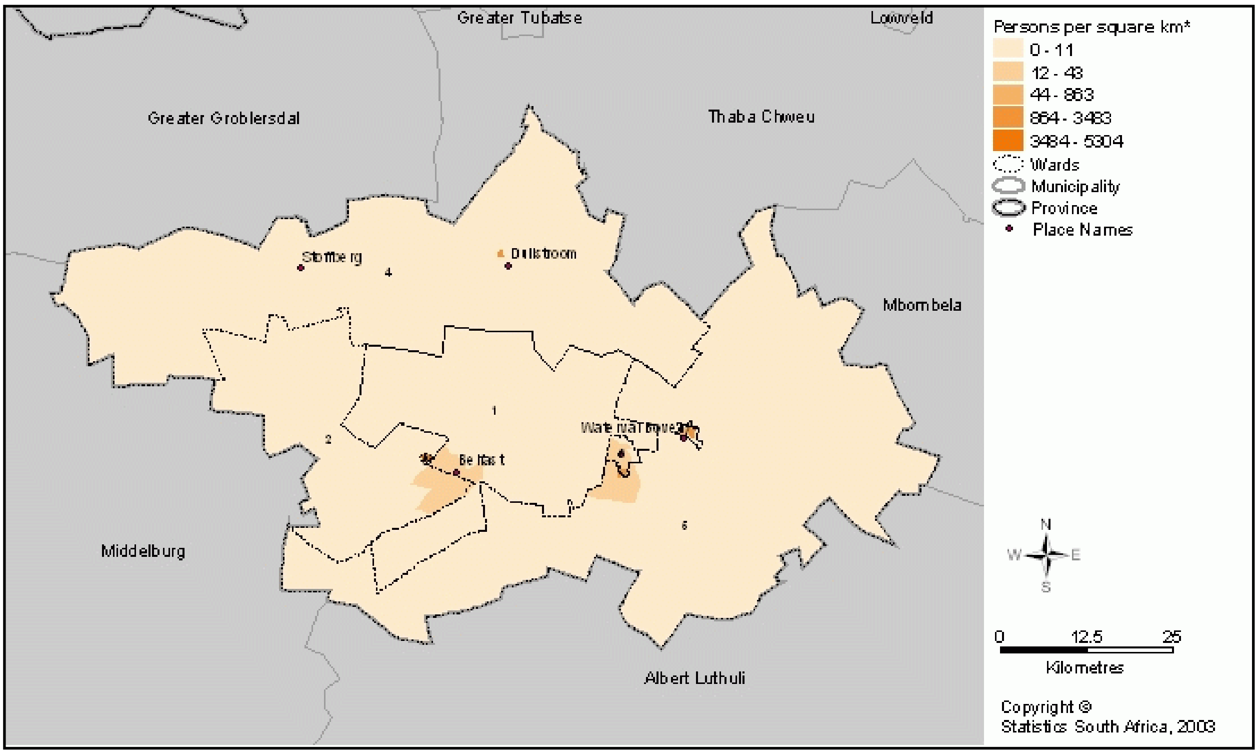


Figure 60: Population Density in the Emakhazeni Local Municipality (StatsSa, 2001)

3.17.2 Education

The adult population of the ELM was found to be relatively lower qualified compared to Mpumalanga, e.g. 16% had a Grade 12 qualification compared to 18% in Mpumalanga, while 5.6% had a tertiary qualification compared to 5.9% in Mpumalanga. This has implications in terms of the type of employment opportunities offered in the region, versus the education and skills levels.

Of concern is the fact that 30% of the young school going and student population (age 5 – 24) did not attend some form of educational institution. This could lead to exacerbated illiteracy and unemployment in future.

[19] http://www.demarcation.org.za

3.17.3 Employment

Mpumalanga is rich in coal reserves and consequently accommodates some of the countries largest power stations as well as Sasol's Secunda petroleum from coal facility. These operations, together with a steel and vanadium installation in Middleburg and paper mills near Ngodwana, form the basis of the province's industry.

Notwithstanding the industrial development in Mpumalanga there has been a steady rise in unemployment in the province over the last few years. This has probably been aggravated by the current global economic downturn which, on a year-on-year basis between the second quarter of 2008 and the second quarter of 2009, has resulted in a loss of 360,000 jobs in South Africa. On an industry level 95,000 jobs were lost in manufacturing, 80,000 in agriculture and 27,000 in mining, all of which are important industries for the Mpumalanga economy. At a provincial level in Mpumalanga, 3,000 jobs were lost on a year-on-year basis between 2008 and 2009 but 39,000 jobs were lost on a quarter-to-quarter basis between Q1:2009 and Q2:2009.

At the time of the Stats SA Community Survey, 2007, levels of unemployment were at 13.9% in Emakhazeni, 19.3% in Nkangala and 19.5% across Mpumalanga. Although unemployment data provided in the Quarterly Labour Force Survey, Quarter 2, 2009 does not reach the municipal levels, data is available at a provincial level. This data indicates that the unemployment rate in Mpumalanga by the second quarter of 2009 had reached 26.5% (**Figure 61**). This is probably indicative of increasing levels of unemployment across both the district and local municipalities.

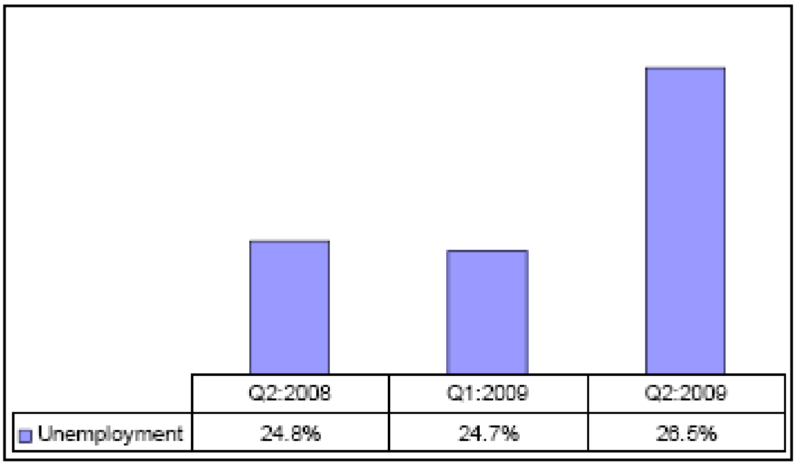


Figure 61: Unemployment in Mpumalanga Q2:2008 – Q2:2009

It must be also be noted that these unemployment figures are based on StatsSA's official definition of unemployment which excludes those people who had not taken active steps to seek work within the four week period leading up to the survey. In effect, this definition of unemployment excludes discouraged work-seekers from being counted amongst the unemployed and as such is considered by many to be a rather conservative estimate of actual levels of unemployment.

According to StatsSA, approximately 39% of population was economically active, while the overall unemployment amounted to 30%. The per capita income of employed people (age 15 – 65) was approximately R1,700 per month. Approximately 54.5% of the employed population earned less than R800 per month, which is considered as living below the poverty line. 21.4% earned between R801 and R1,600 per month, with 24.1% of the population earning more than R1,600 per month. The relatively low income levels are indicative of poverty and a high reliance on social assistance, specifically housing subsidies.

Employment according to the major types of industry in the area was as follows:

- 26% - agriculture and forestry;

- 5% - mines and quarries;
- 13% - private households;
- 14% - wholesale and retail; and
- 11% - community; social and personal services.

Much of the mining activities in Mpumalanga are found within the boundaries of the Nkangala District Municipality and mining makes up the largest portion of the Gross Geographic Production (GGP) of the district of Nkangala at over 30%. This is followed by manufacturing at just over 20%, and electricity at just under 15% (NDM Mining Indaba Report, 2006:16). Of this coal mining constitutes 82% of all mining activities in Nkangala and it is also pointed out in the NDM Mining Indaba Report (2006:17-18) that “out of the 56 mines in Mpumalanga about thirty-seven (37) are in the Nkangala area and that coal accounted for the greater portion of the remuneration paid by the mining sector in Nkangala”.

The economy of the ELM is largely reliant on agriculture as the dominant economic contributor in the area. There is also a potential for tourism, particularly tourism attached to the fly fishing industry. On an historical basis farming has resulted in the establishment of a number of small towns such as:

- Belfast and Siyathuthuka;
- Dullstroom and Sakhelwe;
- Machadodorp and Emthonjeni; and
- Waterval-Boven and Emgwenya.

These towns, due largely to the natural attractiveness of the area and activities such as fly fishing within the locality, have also draw a number of tourists to the region.

3.17.4 Access to Basic Services

The majority of households in the ELM use coal for cooking and heating (37%), while 34% of households use electricity and 23% use wood. In terms of fuel used for lighting purposes, approximately 72% of households use electricity. The provision of electricity for lighting purposes increased with 1,921 units between 1996 and 2001, indicating that good progress was made with the provision of electricity to all households in the area.

The majority of households (78%) have piped water inside their house or yard. The provision of water inside the house or on the stand increased with 1,133 units between 1996 and 2001. In terms of sanitation, the majority (69%) of households use flush toilets. The provision of flush / chemical toilets in houses increased with 1,811 units between 1996 and 2001.

Approximately 61% of the households reported that the local authority removed refuse at least once a week. Access to basic services in the ELM is therefore good and improvement is evident.

Approximately 87% of all households had access to a telephone or cell phone in the house or nearby. Only 10% of the households did not have access to a telephone, mainly in the rural areas.

The overall socio-economic picture of the ELM reflects that the area is affected by low education and skills levels, with most people employed in the primary and secondary sectors. Approximately 42% of the population stays in rural areas. Low income levels, high unemployment and poverty are some of the most serious issues to be dealt with from a socio-economic perspective.

4

Alternatives

Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives assist in identifying the most appropriate method of developing the project, taking into account location or site alternatives, activity alternatives, process or technology alternatives, or the no-go alternative.

In terms of the environmental regulations, it is a requirement that alternatives identified during the Scoping Phase of the Environmental Assessment Process be considered and comparatively assessed during the EIA Phase. According to the EIA Regulations (G.N. R385, 2006), alternatives are defined as:

> "Alternatives", in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to –
> a) The property on which or location where it is proposed to undertake the activity;
> b) The type of activity to be undertaken;
> c) The design or layout of the activity;
> d) The technology to be use in the activity, and
> e) The operational aspects of the activity

The following alternatives were identified during the Scoping Phase of the project for consideration and further investigation during the EIA Phase:

- Location or site alternatives.
- Pit layout alternatives.
- Plant location alternatives.
- Mining alternatives.
- Processing alternatives.
- Land use alternatives.
- No-go alternative – this alternative is mandatory in terms of the EIA Regulations and establishes a baseline against which the environmental impacts of the alternatives are rated against.

The following factors were considered during the assessment of feasible alternatives:

- Financial feasibility.
- Environmental impact.
- Socio-economic impact.
- Land use planning and future spatial development considerations.
- Future expansion of the development.
- Logistical feasibility – raw material supply, market proximity and utilities.
- Proximity to sources of human resources.

4.1 Location

Exxaro have applied for a mining right over the farms listed in Section 1 of this EIR and therefore no location alternatives have been identified. The location of the site has been determined through prospecting.

4.2 Mining Method – Opencast vs. Underground Methods

4.2.1 Opencast Mining

Various opencast mining methods were considered for this mine, with specific focus on normal strip mining operation and dragline mining operations. These are discussed in the following sections.

Dragline Operation

Draglines are by far the most commonly used overburden-removal equipment in surface coal mining. A dragline sits on the top of the overburden, digs the overburden material directly in front of it, and disperses the material over greater distances than a shovel (**Figure 62**). Compared with shovels, draglines provide greater flexibility, can work on higher benches, and move more material per hour.

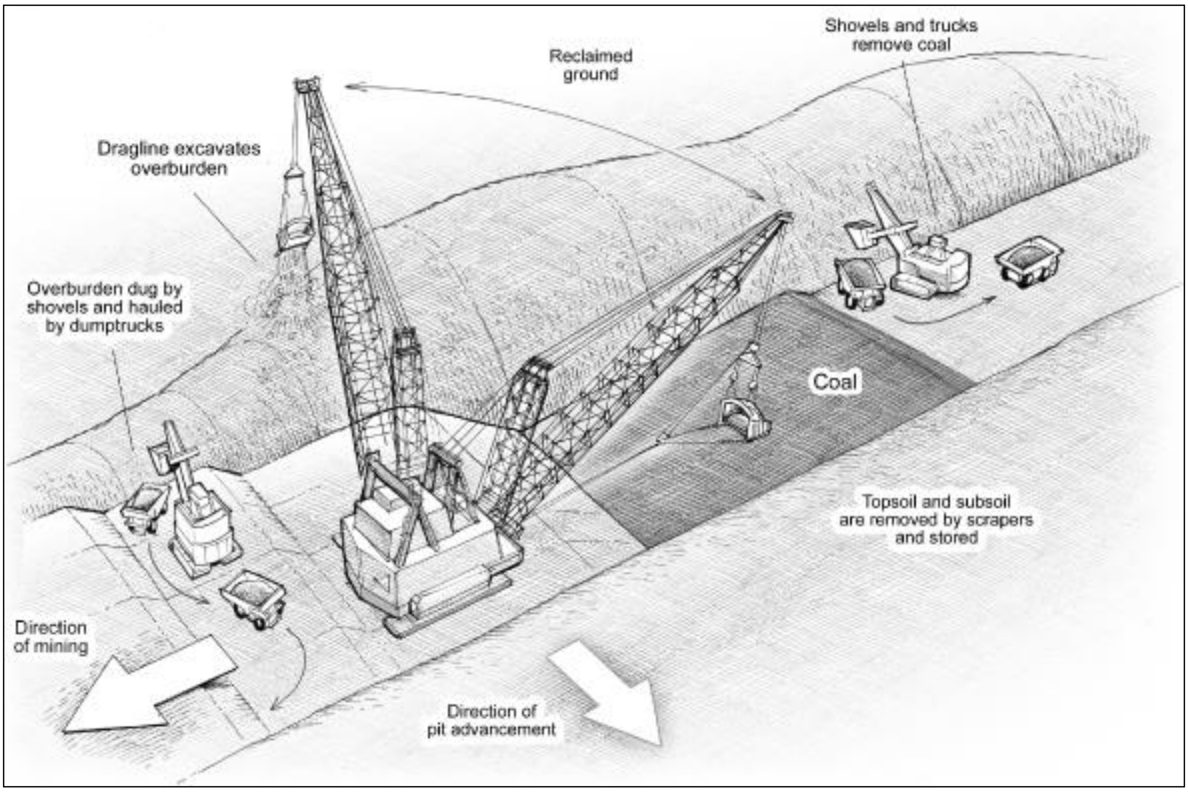


Figure 62: Example of a dragline operation[20]

The primary limitations of draglines are their boom height and boom length, which limits where the dragline can dump the waste material. Another primary limitation is their dig depth, which is limited by the length of rope the dragline can utilize. Inherent with their construction, a dragline is most efficient excavating material below the level of their base. While a dragline can dig above itself, it does so inefficiently and is not suitable to load piled up material.

Most mining draglines are not diesel-powered like most other mining equipment. Their power consumption is so great that they have a direct connection to the high-voltage grid at voltages of between 6.6 to 22kV. A typical dragline, with a 55 m^3 bucket, can use up to 6 megawatts during normal digging operations.

[20] Image sourced from the Annual Report Pursuant to Section 13 or 15(d) of the Securities Exchange act Of 1934 United States Securities and Exchange Commission. 28 February 2008.

In all but the smallest of draglines, movement is accomplished by "walking" using feet or pontoons, as caterpillar tracks place too much pressure on the ground, and have great difficulty under the immense weight of the dragline. Maximum speed is only at most a few metres per minute since the feet must be repositioned for each step. If travelling medium distances, (about 30-100km), a special dragline carrier can be brought in to transport the dragline. Above this distance, disassembly is generally required.

The dragline operation mining was dismissed as a mining method option after a workshop with one of the major dragline suppliers. The reason for discarding the dragline option is the inflexible nature of draglines as well as the high initial capital costs involved.

Strip Mining Operation

Strip mining is a form of surface mining where the ore is mined in a series of narrow strips, rather than over a large surface. When the first strip is mined a second strip is opened next to the first one. The overburden is removed from the second strip is moved into the first strip. This is repeated until the last strip is done and the overburden from the first strip is brought back to fill it.

Strip mining is a more environmentally friendly mining method as rehabilitation of the land starts once the first strip is mined by backfilling the first stripped area with overburden from the second stripped area. The backfilled strip is the covered with topsoil and seeded. By the end of the life of the mine only one strip is left to rehabilitate. This also reduces the financial provision required at mine closure as concurrent rehabilitation is taking place during the operational phase[21].

The environmental impacts of strip mining are as follow:

- **Soil destruction**. Strip mining eliminates existing vegetation and alters the soil profile, or the natural soil layers. Mining disturbs and may even destroy the beneficial micro-organisms in the topsoil. Soil also may be damaged if reclamation operations mix the topsoil with subsoils, diluting matter in the surface soil.
- **Land capability.** Strip mining also may degrade the productive capacity of land. Spoil placed on land that has not been properly prepared may erode and thereby cover topsoil or introduce toxic materials to the soil.
- **Change in topography.** Mining also may alter the natural topography of the area in ways that prevent a return to the previous land use, such as farming.
- **Water pollution**. Irresponsible strip mining can pollute streams and disrupt water supplies. The major pollutants and problems they cause are as follows:
    - pH
    - Acid mine drainage. Acid mine drainage is typically caused when or marcasite in the overburden is exposed to air and water during the MINING process. Rainwater mixes with the pyrite to form sulfuric acid which is washed into streams and ponds below the mine. Acid is one of the most damaging pollutants. It kills fish and other aquatic life, eats away metal structures, destroys concrete, increases the cost of water treatment for power plants and municipal water supplies, and renders water unfit for recreational use. Acid also may leach-out highly toxic metals or cause them to be released from soils. These toxic substances kill aquatic life and can contaminate water supplies causing serious adverse human health effects. Thousands upon thousands of miles of streams have been degraded by acid mine drainage and runoff.
    - Iron. Increased amounts of iron in streams which result from mining activity can be toxic to aquatic life and contribute to the "hardness" of water.
    - Manganese. Manganese is a metal that is soluble in acid once it has been unearthed by mining activity. It pollutes water supplies and corrodes other metals.

[21] Philip J Lloyd, 2002: Coal Mining and the Environment. Energy Research Institute, University of Cape Town

- Suspended solids. Also referred to as "TSS" (Total Suspended Solids) or sediment, suspended solids are solid material, both mineral and organic, that has been moved from its place of origin by air, water, ice, or gravity. Removing vegetation, blasting the overburden and using heavy equipment create erosion and introduce sediment into streams. Sediment loads are particularly high in mountainous and hilly terrains. Suspended solids reduce light penetration in water and alter a waterway's temperature. Fish production is hindered; spawning grounds are destroyed. Sediment increases the burden on treatment plants, and streams filled with sediment lose some of their capacity to carry runoff following storms, thus making the stream more prone to flooding. A sediment-laden stream flow can fill up a reservoir and severely reduce its useful life span.

- **Groundwater pollution.** Mining activity can also affect the quantity and quality of groundwater supplies. In many coal fields, the coal beds themselves serve as aquifers — underground supplies of water. The water in these aquifers flows — although when compared to surface water streams, groundwater flows at a very slow rate. The fact that groundwater flows, however, allows it to recharge or replenish many surface water systems. Surface mining operations will necessarily cut through the coal aquifer and also any aquifer above the coal seam that is being mined. Blasting activity may break up the impermeable layers of rock that hold water in these aquifers. These aquifers may be the source of water for many wells. Flow patterns in such aquifers may be changed, thereby adversely affecting water pressure in wells. Portions of aquifers and surface systems may be dewatered, reducing the availability of water for other uses, and perhaps interfering with prior existing water rights. Even where water losses from existing aquifers do not affect other users, disposal of excess water from those aquifers may cause environmental damage. It has yet to be demonstrated that a groundwater system destroyed by mining can be permanently restructured. If not conducted properly, coal development may leave behind barren landscapes vulnerable to continual erosion and disrupted groundwater systems. As a result, the value of these areas for agriculture and other uses may be greatly diminished
- **Fauna.** Fauna often suffers severely as a result of strip mining. In the short term, all species are either destroyed or displaced from the area of the mine itself. Mining also may have adverse, long-term impacts on fauna, including impairment of its habitat or native environment. Many animal species cannot adjust to the changes brought on by the land disturbance involved in coal mining. In cases where an important habitat (such as a primary breeding ground) is destroyed, the species may be eliminated. Unique habitats like cliffs, caves, and old-growth forests may be impossible to restore. Larger mines may disrupt migration routes and critical winter range for large game animals. Strip mining exposes heavy metals and compounds that can alter the pH or acid balance of runoff and leach into streams. Such pollution can impair the habitat of fish and other aquatic species, thereby reducing population levels. Even where species survive, toxic materials can lower reproduction and growth rates. Strip mining also causes increased turbidity and siltation of streams and ponds, greater variation in stream flow levels and water temperature, and stream dewatering, all of which contribute to the endangerment of aquatic species.

http://docs.google.com/Edit?docid=dfs4jc6c_24fbs44xcj - _ftn27

- **Flora**. When fill material is replaced following a strip mining operation, it is heavily compacted to prevent it from eroding or sliding. As a result, easily-planted grasses out-compete tree seedlings, whose growth is slowed by the compacted soil, and complete reforestation is unlikely. More effective reclamation techniques now exist and must be promoted.
- **Dust**. Opencast mining generates dust from its blasting and hauling activities.

It was decided to use the conventional strip mining operation utilising trucks and shovels as well as bulldozers as this is the most economically feasible option.

Underground Mining

Underground mining takes place when the coal seams are too deep to be able to afford to remove the overburden. Typically this occurs when the coal seam is more than 40m deep. The deposit is mined by extracting square “rooms” about 10m wide and leaving behind pillars to hold up the roof.

The environmental impacts of underground mining are considerable. These include:

- **Methane.** Methane is a “greenhouse gas” that is 21 times more potent in its greenhouse effect than carbon dioxide. All coal contains some methane. The deeper the mine, the higher is the amount of methane in the coal. As mining proceeds, the methane is released into the mine air and eventually discharged into the atmosphere. South Africa currently emits nearly 7 million tons per annum of carbon-dioxide equivalent from the underground coal mines.
- **Roof collapse.** A further impact is the collapse of the roof between the pillars in the long term. This can cause terminal damage to surface structures, and render the surface almost unusable.
- **Coal combustion.** Even worse is the risk that the coal remaining in the pillars may heat and eventually ignite. As the burning pillar collapses, the roof falls in, admitting air and allowing the combustion products to escape. The exact extent of this phenomenon is under investigation, but preliminary estimates suggest as much carbon dioxide is emitted from this source annually as from the generation of electricity in South Africa. Land over burning, worked-out mines is totally unusable.
- **Acid Mine Drainage.** The pillars also represent a large surface area, and sulphur compounds in the coal are slowly oxidized by exposure to air. As they oxidize, they generate acid, and the acid can leach out and so give rise to “acid mine drainage.”
- **Groundwater pollution.** Mining activity can also affect the quantity and quality of groundwater supplies. In many coal fields, the coal beds themselves serve as aquifers — underground supplies of water. The water in these aquifers flows — although when compared to surface water streams, groundwater flows at a very slow rate. The fact that groundwater flows, however, allows it to recharge or replenish many surface water systems. Underground mining operations will necessarily cut through the coal aquifer. Blasting activity and subsidence from underground mining may break up the impermeable layers of rock that hold water in these aquifers, even where the overburden is not being extracted. These aquifers may be the source of water for many wells. Flow patterns in such aquifers may be changed, thereby adversely affecting water pressure in wells. Portions of aquifers and surface systems may be dewatered, reducing the availability of water for other uses, and perhaps interfering with prior existing water rights. Even where water losses from existing aquifers do not affect other users, disposal of excess water from those aquifers may cause environmental damage. It has yet to be demonstrated that a groundwater system destroyed by mining can be permanently restructured. If not conducted properly, coal development may leave behind barren landscapes vulnerable to continual erosion and disrupted groundwater systems. As a result, the value of these areas for agriculture and other uses may be greatly diminished.

4.3 Pit Layout

The normal objective of any design is to size the project so as to create the economically most viable project within the given constraints of reserve size, CAPEX requirements, payback period and transport constraints. Although the total market volume is not seen as the only driver, cognisance is taken of the available market volume.

An annual production of 5,000,000 tonnes was used as the target. The initial aim of the project was to determine the best possible size for the whole operation from pit to market. This was achieved through a series of desktop comparisons of Net-Present-Value (NPV) over the Life-of-Mine (LoM). Different scenarios at operational sizes of 2, 3, 5, 7 and 10 Mtpa RoM were evaluated. The figure of 5 Mtpa RoM was found to be close to the optimum when NPV and other project factors (including the risk profile) were considered.

An important driver during mine design and layout was to make optimal use of the reserve, i.e. to get maximum mine life out of the reserve.

The objective of any design is to accurately size the project so as to create the most economically viable project within given constraints (e.g. reserve size, capital expenditure requirements, payback period, transport constraints). Although total market volume is not seen as the only driver in decision making, cognisance is taken of the available market volume when making such important decisions.

During the surface water investigation it was established that all the mine infrastructures were located outside the 1:50 and 1:100 year floodlines with the exception of two small sections of the East Block pit. These sections were located in the upper reach of the Driehoekspruit and Klein Komati. It was recommended that the mine plan be modified to prevent the pit from encroaching into the 1:100 year floodline. Exxaro modified the plant site layout.

Pit layout alternatives are therefore not further investigated as the current layout is dictated by the economical feasibility and the reserve.

4.4 Plant Location

Three plant locations were investigated at the pre-feasibility stage of the project (**Figure 63**).

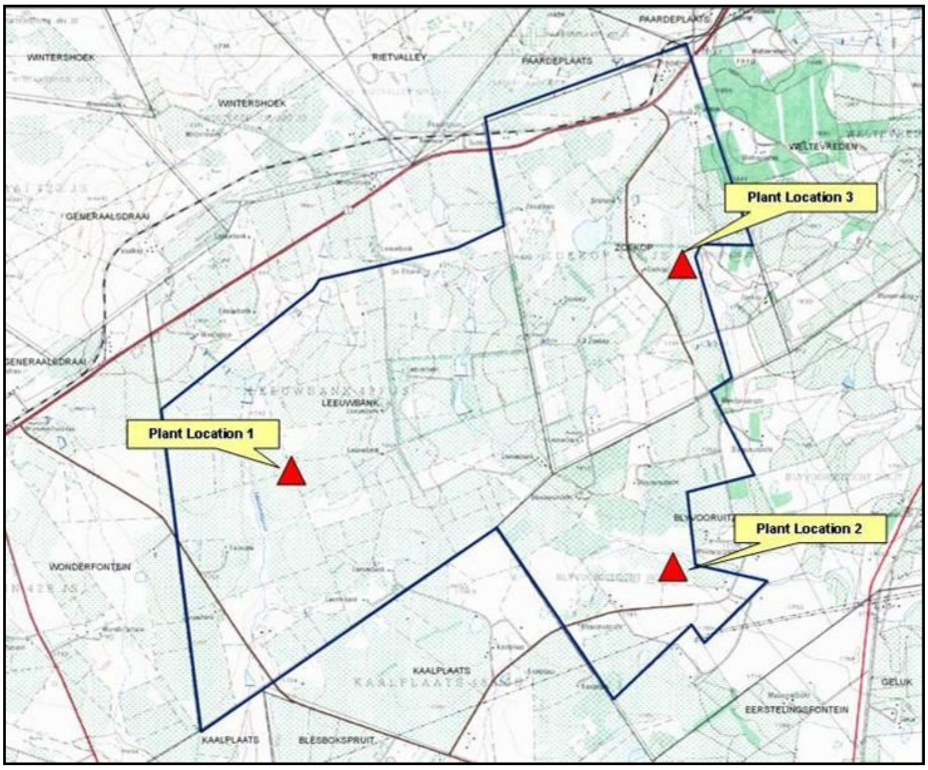


Figure 63: Location of the Proposed Plant Sites (Plant 1 – 3)

4.4.1 Plant Location 1

The first plant location is situated to the west of the mining area on portions 2, 7, 8 and 16 of the farm Leeuwbank **(Figure 64**).

According to the Heritage Impact Assessment, two burial sites are located at this location, namely L8G2 and L16G. These graves should be avoided if possible, restored and protected.

This site is affected by the occurrence of the grave sites as well as access constraints and has subsequently not been selected as a suitable site.

Figure 64: Plant Location 1 in relation to sites of archaeological and cultural interest

4.4.2 Plant Location 2

Plant Location 2 is situated to the south of the mining area on portion 10 of the farm Blijvooruitzicht, owned by Exxaro (**Figure 65**).

The advantages of Plant Location 2 are as follows:

- No heritage resources of significance.
- Located adjacent to a district road, thereby facilitating the transport of coal.
- Located adjacent to an existing colliery.

The plant area is restricted by:

- Coal reserves to the north and east
- Klein Komatierivier to the west
- Property boundary to the east
- Provincial road to the south
- Two pans to the west.

Based on these factors plant location 2 was selected during the pre-feasibility stage of the project.

Plant Location 2 however is placed within a highly ecologically sensitive area based on the presence of wetlands of high ecological sensitivity and importance as delineated by Golder Associates. In terms of this project, it is not possible to rehabilitate the lost pans and wetlands within the two proposed coal reserves at Belfast, thus offsetting these specific pans and wetlands was considered as an option in order for the development to continue.

The results of the study are provided in Section 3.10.6 Identification of potential wetland offsets. The success of the proposed project requires understanding that the mitigations outlined in the Belfast EMPR need to be met in terms of the management hierarchy, before biodiversity offsets (compensation mitigation) can be considered.

Figure 65: Plant Location 2 in relation to sites of archaeological and cultural interest

4.4.3 Plant Location 3

Plant Location 3: is situated to the east of the mining area on portion 8, owned by J. Geritts, and the Remaining Extent of the farm Zoekop, owned by Exxaro (**Figure 66**).

Figure 66: Plant Location 3 in relation to sites of archaeological and cultural interest

Placing the plant at this site would involve destroying the modern farmstead and there would be later impacts from the relocation of the District Road 1770.

This location is situated adjacent to the Highlands Organic farm. Concerns have been raised regarding the effects of particulates on vegetation.

Suspended particulate matter can produce a wide variety of effects on the physiology of vegetation that in many cases depend on the chemical composition of the particle. Heavy metals and other toxic particles have been shown to cause damage and death of some species as a result of both the phytotoxicity and the abrasive action during turbulent deposition (Harmens et al, 2005). Heavy loads of particle can also result in reduced light transmission to the chloroplasts and the occlusion of stomata (Harmens et al, 2005; Naidoo and Chirkoot, 2004, Hirano et al, 1995, Ricks and Williams, 1974), decreasing the efficiency of gaseous exchange (Harmens et al, 2005; Naidoo and Chirkoot, 2004, Ernst, 1981) and hence water loss (Harmens et al, 2005). They may also disrupt other physiological processes such as budbreak, pollination and light absorption/reflectance (Harmens et al, 2005). The chemical composition of the dust particles can also affect the plant and have indirect effects on the soil pH (Spencer, 2001).

Naidoo and Chirkoot conducted a study during the period October 2001 to April 2002 to investigate the effects of coal dust on Mangroves in the Richards Bay harbour. The investigation was conducted at two sites where 10 trees of the Mangrove species: Avicennia marina were selected and mature, fully expose, sun leaves tagged as being covered or uncovered with coal dust. From the study it was concluded that coal dust significantly reduced photosynthesis of upper and lower leaf surfaces. The reduced photosynthetic performance was expected to reduce growth and productivity. In addition, trees in close proximity to the coal stockpiles were in poorer health than those further away. Coal dust particles, which are composed predominantly of carbon were not toxic to the leaves; neither did they occlude stomata as they were larger than fully open stomatal apertures (Naidoo and Chirkoot, 2004).

In general, according to the Canadian Environmental Protection Agency (CEPA), air pollution adversely affects plants in one of two ways. Either the quantity of output or yield is reduced or the quality of the product is lowered. The former (invisible) injury results from pollutant impacts on plant physiological or biochemical processes and can lead to significant loss of growth or yield in nutritional quality (e.g. protein content). The latter (visible) may take the form of discolouration of the leaf surface caused by internal cellular damage. Such injury can reduce the market value of agricultural crops for which visual appearance is important (e.g. lettuce and spinach). Visible injury tends to be associated with acute exposures at high pollutant concentrations whilst invisible injury is generally a consequence of chronic exposures to moderately elevated pollutant concentrations. However given the limited information available, specifically the lack of quantitative dose-effect information, it is not possible to define a Reference Level for vegetation and particulate matter (CEPA, 1998).

4.4.4 Final Site Selection

During the final stages of the selection process, Plant Location 2 was selected as the preferred plant position. This position was selected based on the following considerations:

1. Proximity to the mining area, especially during the initial mining phase – keeping cost of transport of mined coal to a minimum.
2. Utilization of existing infrastructure such as roads, water supply system.
3. There are existing mining activities in the area (Umcebo Mining).
4. This property is currently owned by Exxaro. It can not safely be assumed that Exxaro will be able to purchase the additional required properties involved with the other positions. It is in fact currently not planned to purchase the Beestepan Boerdery and Highlands Organic Farming properties.

As indicated previously, the site of the proposed Plant 2 is a wetland of high ecological importance as delineated by the wetland specialist. Subsequently a wetland offset study was undertaken to identify possible wetland offset areas as mitigation for the loss of wetland habitats. This is further discussed in Section

4.5 Processing Methods

Processing coal improves the quality thereof, which in turn improves the efficiency of power plants. The properties of raw and washed coal can differ significantly and the beneficiation of the raw coal can improve its quality, thereby influencing the performance of power stations.

4.5.1 Washing

Beneficiation (washing) coal prior to utilisation offers the following benefits:

- Consistent quality of coal.
- Reduces amount of 'stone' being transported.
- Reduced ash load of the power plants.
- Reduced coal abrasiveness.
- Improves thermal efficiency of power generation process.
- Reduces greenhouse gases.
- Lowers sulphur content of coal.
- Lowers grade reserves to be exploited.

Negative aspects of washing coal include:

- Increased need for water.
- Cost of establishing and running a beneficiation plant.
- Increased moisture and need to dewater coal after processing.
- Production of discard and slurry that have the potential to pollute air and water.

4.5.2 Dense Medium Separation

The dense-medium separation (DMS) process uses a magnetite / water medium to separate coal and impurities (stone, shale etc.). The DMS is very efficient and capable of processing difficult to process coals. The density of the washing medium can be accurately controlled and thereby the quality of the washed product can be ensured.

4.5.3 Jigging

Jigging was used in South Africa in the past but has since been replaced by the more efficient DMS process.

4.5.4 Dry Beneficiation

Dry beneficiation offers the following advantages:

- It does not require water.
- The coal remains dry and therefore the heat value of coal is retained.
- No slurry is produced. This reduces the risk of groundwater pollution.
- Low capital and operating costs.

It must be noted that this method still produces discard, and therefore the risk of combustion is not prevented, nor is the risk of groundwater pollution from runoff water seepage through the discard dumps.

One of the dry beneficiation technologies currently being evaluated in South Africa is the FGX Compound Dry Cleaning Machine[22]. This machine uses a combination of vibration and air to move the coal over perforated table to separate the coal and stone. The air assists in the separation of the coal and provides and effective means of transporting dust to a cyclone and gas cleaning system.

Exxaro's NBC Mine is currently testing an FGX unit.

4.5.5 Optical Sorting

In optical sorting, a single particle layer of material is transported on a conveyor and allowed to fall past a sensor capable of discriminating between differing materials. The mineral bearing rock is then selectively extracted by using a precise pulse of pressurised air.

4.5.6 Dry Dense Medium

This process offers dry beneficiation and good efficiency at the same time. This process uses compressed air to fluidise a bed of dry magnetite powder, which then acts as a pseudo-dense medium in which the coal will float and stone or shale will sink.

4.5.7 Final Product Comparison

Table 46 compares the results from the various beneficiation methods. The DMS has the highest product yield, but the FGX, optical beneficiation and dry DM have the lower percentage of discard ash. These later methods also do not require water, which is an important consideration in South Africa where water is a scarce resource.

Table 46: Results obtained with the various beneficiation methods

Parameters	DMS	Jig	FGX	Optical		Dry DM
				1	2	
Feed % Ash	34.8	46.3	46.3	38.1	39.4	n.a.[23]
Product % Ash	26.5	34.4	30.6	24	30.9	n.a.
Discard % Ash	69.5	79.2	60.2	48.5	57.7	n.a.
Product Yield	80.82	73.40	46.8	42.31	68.18	n.a.
D59	1.974	2.19	1.797	1.631	2.003	n.a.
EPM	0.023	0.127	0.267	0.1393	0.2432	0.05
Organic Efficiency	99.8	97.7	68.6	61	82.1	n.a.
Sink in Float	0.30	6.2	7.3	13.68	7.9	n.a.
Float in Sink	0.63	3.1	17.6	11.46	14.35	n.a.
Total Misplaced	0.93	9.3	24.9	25.14	22.25	n.a.
% Near-dense (±0.1)	2.9	7.9	7.9	27.9	4.8	n.a.

4.6 Land Use

The predominant land use on this site consists of cultivated lands used for the production of maize, but also for potatoes and sunflower (from time to time). The land is also used for grazing, but is limited to areas where

[22] G.J. de Korte (CSIR): High-density processing of coal.

[23] n.a. No data available.

the soils are either too wet or too shallow and rocky to be ploughed. Various bush clumps of Eucalyptus and Wattles are present and are sold for commercial purposes.

The surrounding land uses are predominantly agricultural in nature. Adjacent to the project area is land that is being utilised for cherry farming (Highland Organics). On the south-west of the mining area lies the Onverwacht Colliery.

The ELM Environmental Management Framework (EMF) has partially zoned the area for agriculture (**Figure 67**). The remaining portions not identified for agricultural use remains unclassified.

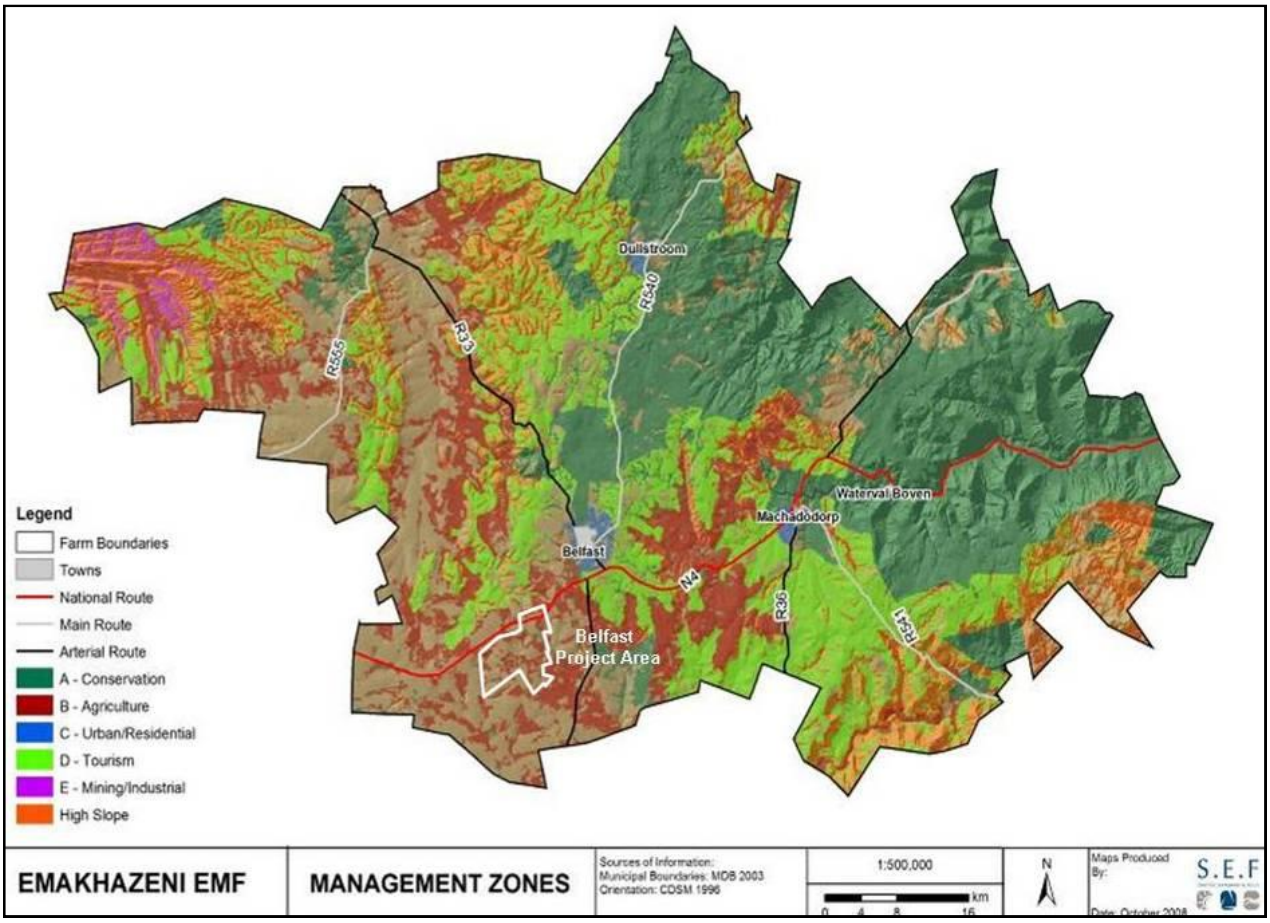


Figure 67: Emakhazeni Local Municipality Environmental Management Framework

4.6.1 Agriculture vs. Mining

Exxaro commissioned Golder Associates Africa (Pty) Ltd to undertake a Sustainable Development Investigation for two development scenarios. These scenarios are outlined as follows:

- Scenario 1 – Coal mining for the life of the mine (38 years), rehabilitation and farming for the remainder of the 100 year horizon
- Scenario 2 – Agricultural production for 100 years (current land use)

The 100 year period for each scenario was used to balance their long-term economic impacts and determine which Scenario represents the most sustainable development option.

The total economic impact of Scenario 1 was made up of the combined impact of agricultural activities for 4 years, construction of the mine for 3 years, mining operations for the life of the mine (38 years), decommissioning, rehabilitation and closure for 1 year, re-establishment of agriculture for 5 years and the impact of farming again for the remaining 50 years in the 100 year period. The results of the Investigation found that, in total, Scenario 1 had a total production impact of R121.5 billion, and a total GDP-R impact of R41.6 billion over the 100 year horizon. Scenario 1 will create 268 jobs annually when agriculture takes place, 1,271 jobs will be created during the construction phase of the mine, and 2,338 jobs will be created, indirectly, on an annual basis during the operational phase of the mine. After rehabilitation and reestablishment of agriculture (which will create another 1,815 jobs indirectly), the intention is that the land will revert back to agricultural production.

The results of the investigation found that Scenario 2 had a much smaller economic impact relative to Scenario 1. The total production impact of R3.620 billion over the 100 year period ensuring an increase of R1.455 billion in GDP-R (regional Gross Domestic Product). Scenario 2 also provided employment for 268 individuals per annum.

Should Scenario 1 be implemented, it will have significant macroeconomic impacts on the local and regional economies of the primary and secondary study areas. This is due to elevated production, GDP, and employment at a local, provincial and national level. Scenario 1 could also ensure coal supply to Eskom's coal-fired stations in the Mpumalanga Province for the duration of its lifetime and also provide significant export revenue for the Country. It is important to note that the economic impact of Scenario 1 may be overstated due to the strong assumption that the quality of agricultural production will be the same after rehabilitation. Mines have, historically, often not restored mine land to its pre-mining productivity for numerous reasons and this is especially the case with large open cast mines.

In light of the Country's recent 'energy crisis' and towards generating employment opportunities Scenario 1 is a viable option to stimulate economic growth and creation of employment. From a sustainable development, however, the need for more mining development in this particular (high potential) farming area may be antagonistic to the Government's efforts in addressing the country's rural development and food insecurity problems. Reduced crop yields and increased production costs post closure also reduce the attractiveness of Scenario 1 from a sustainable development perspective. Add to this the potential negative externalities such as the removal or degradation of important ecosystem goods and services and Scenario 2 perhaps presents a more sustainable development alternative over the 100 year period. In a policy context, the shift in land use from agriculture to mining and the potential impact on food security should be weighed up by the Country's policymakers.

4.7 No Project Option

The no-go alternative assumes the continuation of the current land use of the proposed mining area, implying the absence of any mining and associated infrastructures. The no-go scenario is used as a baseline to determine the significance of impacts associated with the proposed project.

The current land use is one of agriculture, where land is planted to crops or pastures. The no-mining option will result in the continuation of such land use. Although economically viable, the continuation of agriculture will not provide the level of short-term economic growth to the area that mining would offer, such as increased employment of residents in the area, greater economic input into the area allowing better development of the towns and surrounding areas, and greater socio-economic stability in the area. The mine will also promote sustainable local economic development, to give communities the skills required to remain economically viable and successful after mine closure.

Although the contribution of agriculture to total GDP has shown a declining trend since 2000, agriculture has an import role to play in the future development of and towards mitigating food insecurity in South Africa.

Taking into consideration the forward and backward linkages to other sectors in the economy, primary agriculture provides 1.6 jobs for every one job it creates (nationally) and creates 16% of the workforce in other sectors. The SA Yearbook (2009:47) notes that despite the declining contribution of agriculture to total

GDP, and that in much broader context agriculture is critical to the South African economy for the following reasons:

- Critical component to the food sector.
- Critical linkages with the broader economy.
- Critical for regional development.
- Major contributor to poverty alleviation, human development and the environment.
- Major driver of industrial development

While farming historically produced food products, the need for farmlands to produce ecosystem services is becoming an increasingly important role in farming. Society is increasingly demanding that farms supply services such as carbon sequestration, water security, food security, biodiversity conservation and flood mitigation due to the growing local, national and global scarcity of these services. Society recognizes that for the economy to continue to grow while maintaining the quality of life in society, it needs to invest in reducing the growing constraints being imposed by diminishing ecological processes, and their associated ecosystem services. Consequently, farm lands with functional ecological assets are increasingly being required to supply public goods and services.

Not mining the coal reserves available on NBC will prevent the use of a valuable coal reserve for the generation of electricity at a time where a much-publicised inability to generate enough electricity to sustain economic growth exists.

5

Public Participation

Public participation was conducted in accordance with the minimum requirements as set out in Chapter 6 of GN 543, promulgated in terms of the National Environmental Management Act (Act 107 of 1998). Public Participation is also required for the application for a Mining Right (in terms of the MPRDA, Act 28 of 2002) and for the application of an Integrated Water Use License (in terms of the National Water Act, 1998). Public participation for all three processes was conducted concurrently.

5.1 Scoping Phase Public Participation Period: 21 July 2009 – 21 August 2009

The Public Participation Process commenced on the 21st July 2009. Advertisements were placed in local and regional newspapers on the 23rd and 24th July 2009. Site notices were placed on site on the 23rd July. Public Participation Meetings were held on the 4th August 2009, where information regarding the proposed activity was presented. The lists of identified I&APs and stakeholders, as well as comments from registered Interested and Affected Parties (I&APs) are included in this section. Public Participation closed on the 21st August 2009.

5.1.1 Identified Interested and Affected Parties

The following groups of stakeholders were identified during the Scoping Phase Public Participation Process. Representatives of these groups were informed of the process and invited to the relevant stakeholder meetings.

1. National Authorities
   - Department of Environmental Affairs (Environmental Quality and Protection)
   - South African National Roads Agency Limited

2. Provincial Authorities
   - Department of Minerals and Resources
   - Department of Water Affairs
   - Mpumalanga Department of Agriculture, Rural Development and Land Administration
   - Mpumalanga Department of Roads and Transport
   - Mpumalanga Tourism and Parks Agency
   - South African Heritage Resources Agency
   - Nkomati Catchment Management Agency

3. Local Authorities
   - Emhakazeni Local Municipality

4. Research Groups, Non-Governmental Organisations and Conservation Groups
   - Birdlife South Africa
   - Ekangala Grassland Trust
   - Endangered Wildlife Trust and Highveld Grasslands Crane Conservation Project
   - Escarpment Environment Protection Group
   - Highlands Crane Group
   - South African National Biodiversity Institute and Working for Wetlands

- South African Wetlands Conservation Programme
- Wildlife and Environment Society of South Africa
- World Wildlife Fund
- Legal Resources Centre
- Water Research Commission

5. Local Businesses and Services Providers
   - Afgri Limited
   - Empivert (Pty) Ltd
   - Highland Organics (Pty) Ltd

Adjacent landowners and landowners within the proposed mining area were also identified and informed during the Public Participation Period. The following groups and individuals were also identified as stakeholders:

- Community representatives
- Local town councillors and local municipality representatives

Lists of identified stakeholders and I&APs as well as the contact person and contact details are included in Appendix C.

5.1.2 Background Information Document

All I&APs and stakeholders identified above were contacted telephonically to inform each person or group of the proposed project and Environmental Assessment Process. A Background Information Document containing information about the proposed activity and contact details of the consultant was forwarded to all identified I&APs and stakeholders. All stakeholders and I&APs were invited to comment and attend the Public Participation Meeting held on the 4th August 2009.

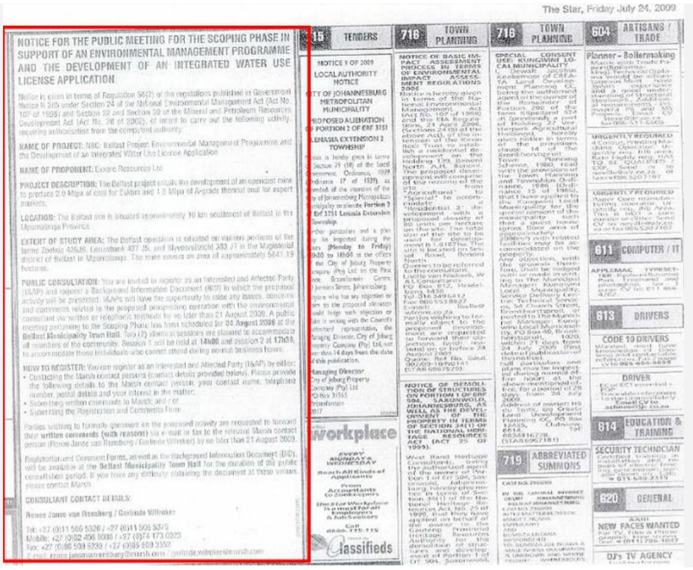
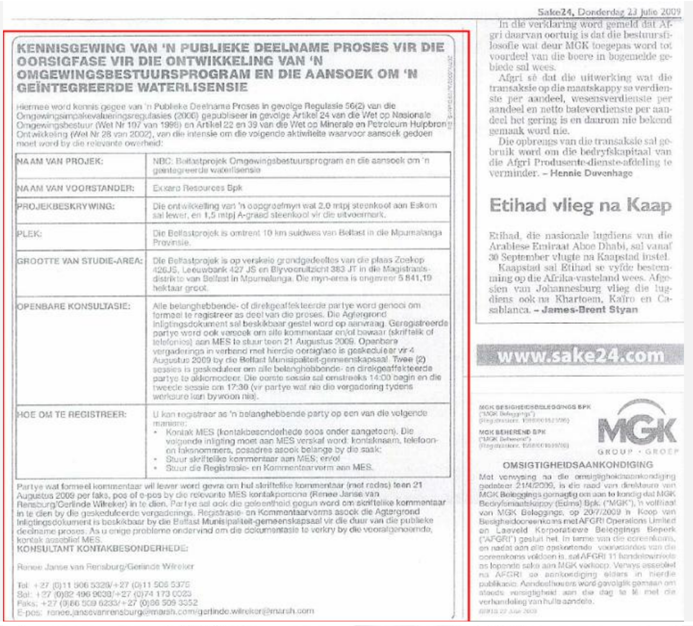
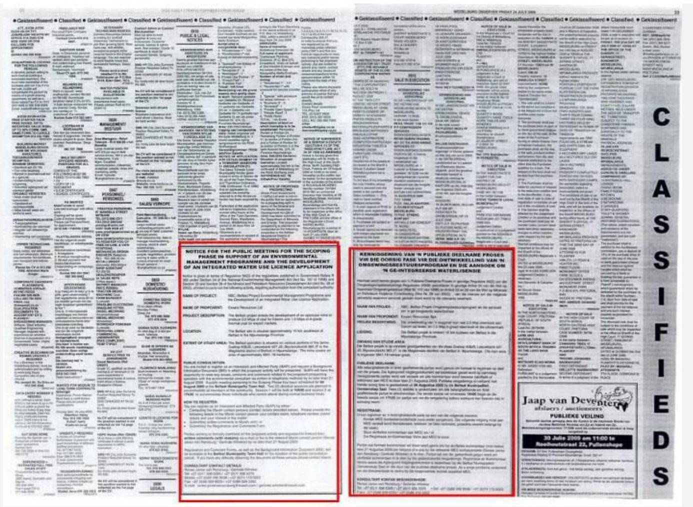
Hard copies of the BID were made available at the Emakhazeni Local Municipality (ELM) offices in Belfast from 23 July – 04 August 2009.

5.1.3 Newspaper Advertisements

English and Afrikaans advertisements were placed in local and regional newspapers on the 23rd and 24th July 2009, as shown in **Table 5-1.**

Table 47: Newspaper advertisements placed as part of the Scoping Phase

Newspaper	Date	Language	Copy of Advertisement

The Star	24 July 2009	English	
Die Beeld	23 July 2009	Afrikaans	
Middleburg Observer	24 July 2009	English and Afrikaans	

The Star, Friday July 24, 2009

NOTICE FOR THE PUBLIC MEETING FOR THE SCOPING PHASE IN SUPPORT OF AN ENVIRONMENTAL MANAGEMENT PROGRAMME AND THE DEVELOPMENT OF AN INTEGRATED WATER USE LICENSE APPLICATION

Sake24, Donderdag 23 Julie 2009

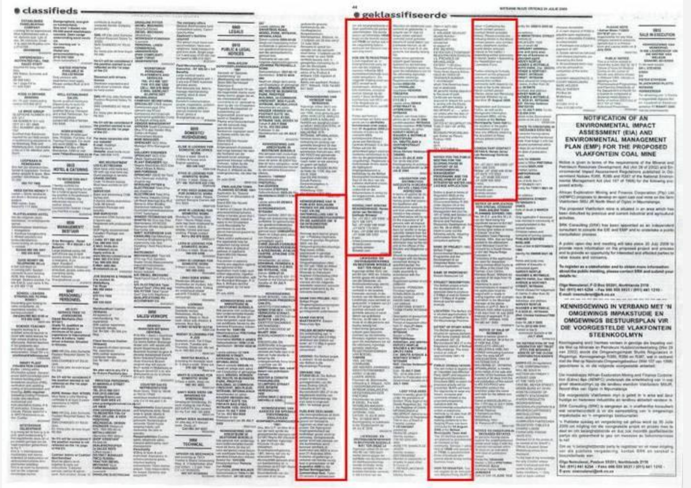
KENNISGEWING VAN 'N PUBLIEKE DEELNAME PROSES VIR DIE OORSIGFASE VIR DIE ONTWIKKELING VAN 'N OMGEWINGSBESTUURSPROGRAM EN DIE AANSOEK OM 'N GEÏNTEGREERDE WATERLISENSIE

Etihad vlieg na Kaap

www.sake24.com

OMSIGTIGHEIDSAANKONDIGING

CLASSIFIEDS

Witbank News	23 July 2009	English and Afrikaans	 NOTIFICATION OF AN ENVIRONMENTAL IMPACT ASSESSMENT (EIA) AND ENVIRONMENTAL MANAGEMENT PLAN (EMP) FOR THE PROPOSED VLAKFONTEIN COAL MINE KENNISGEWING IN VERBAND MET 'N OMGEWINGS IMPAKSTUDIE EN OMGEWINGS BESTUURSPLAN VIR DIE VOORGESTELDE VLAKFONTEIN STEENKOOLMYN

5.1.4 Site Notices

Seven site notices were placed at various locations within Belfast, and six notices were placed on the site. Notices were either A1 or A3 in size, in size and included information in both Afrikaans and English. The locations are indicated in the maps in **Figure 68** and **Figure 69**, and photographs of the notices are included in **Table 5-1**.

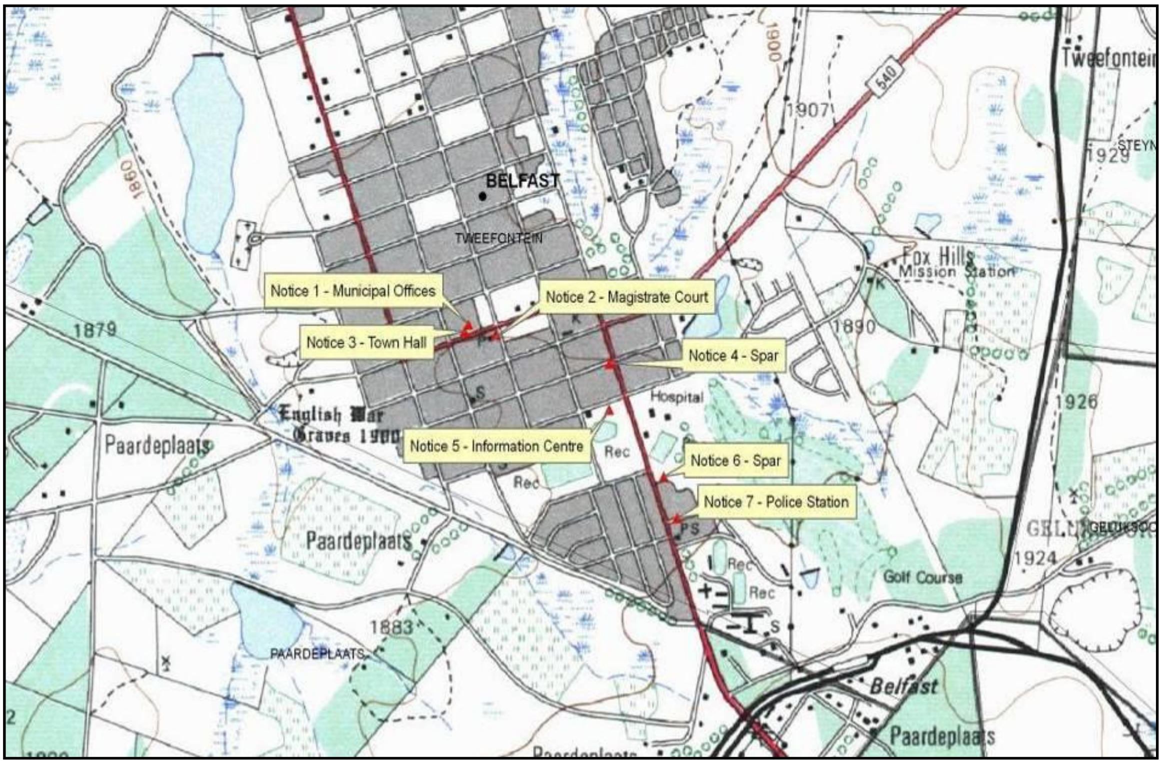


Figure 68- Location of the Site Notices in Belfast.

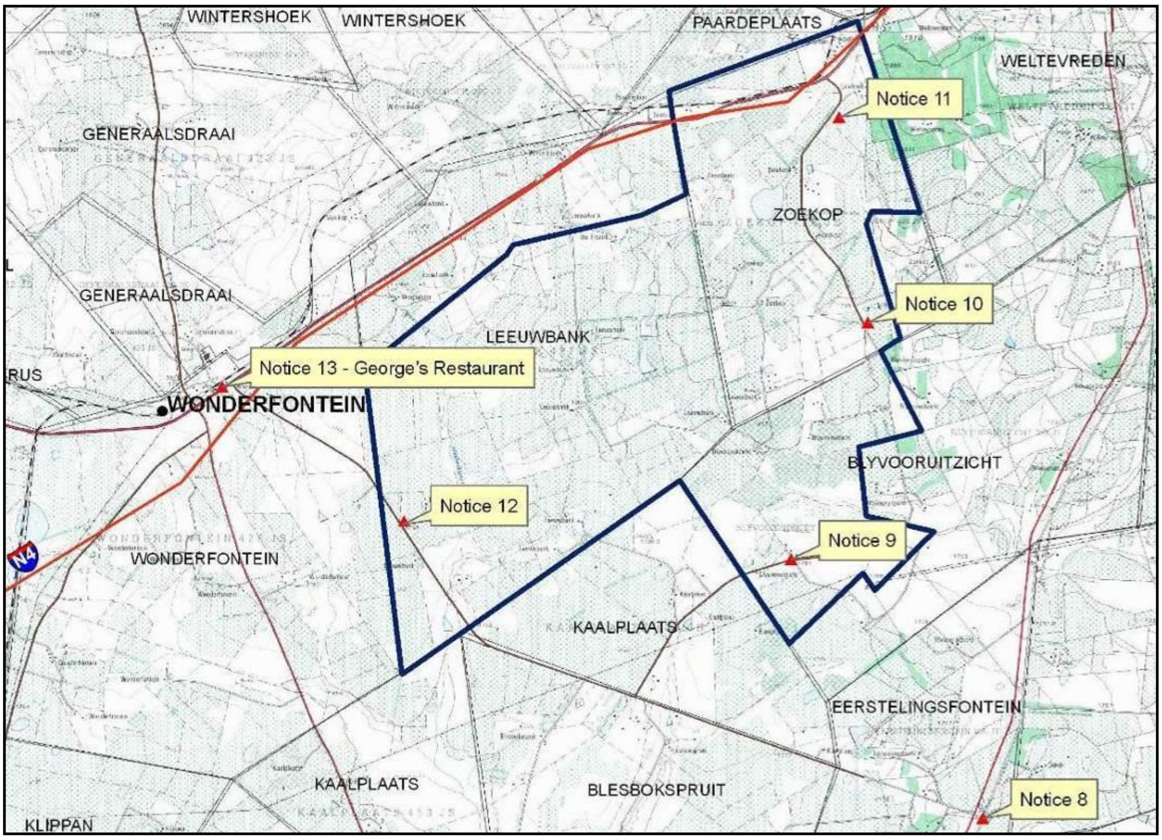
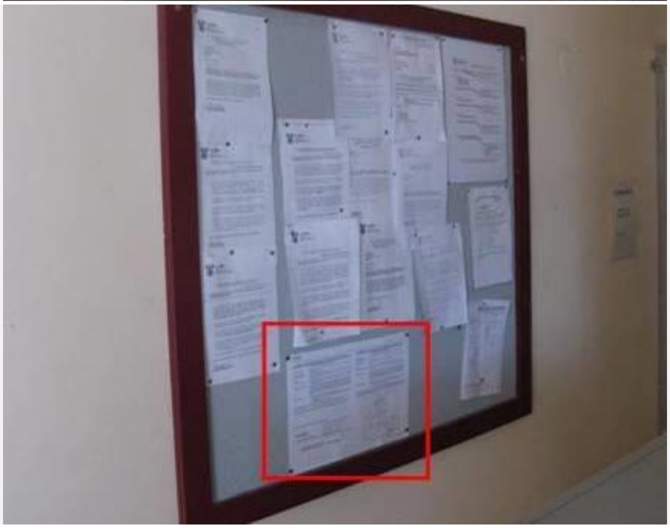


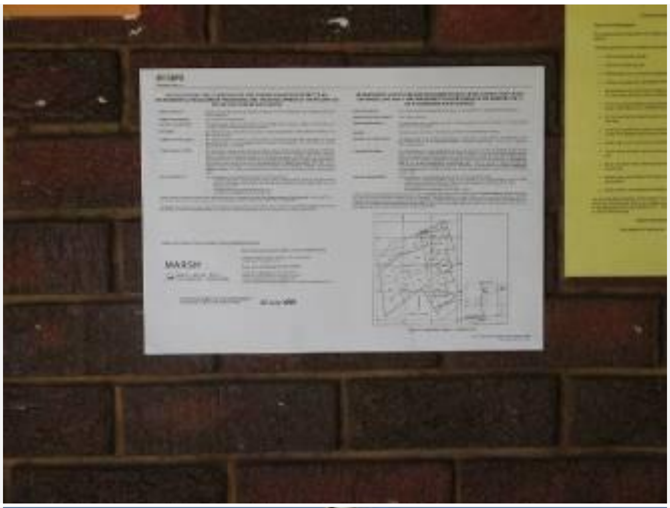
Figure 69 : Site Notices placed within the proposed Mining Area

Table 48: Photographs of A1 notices placed on the site and in Belfast

Notice	Location	Size	Photograph of the Notice
Notice 1	Cashier's Office, Emakhazeni Local Municipality, Belfast (inside and outside)	A1 (inside) and A2 (outside)	

			
Notice 2	Town Hall (Dr Beyers Hall), Belfast	A1 A2 A3	
Notice 3	Magistrates Court in Belfast	A3	

Notice 4	Highlands Spar, Belfast	A3	
Notice 5	Belfast Information Centre	A3	
Notice 6	New Spar Centre, Belfast	A3	

Notice 7	SAPS Office, Belfast	A3	
Notice 8	Turnoff towards Wonderfontein from the R33	A1	
Notice 9	Farm Boundary Fence Portion 9 of Blyvooruitzicht	A1	

Notice 10	Farm Boundary Fence Remaining Portion 2 of Zoekop	A1	
Notice 11	Farm Boundary Fence Remaining Portion 4 of Zoekop	A1	
Notice 12	Farm Boundary Fence Portion 16 of Leeuwbank	A1	

Notice 13	George's Restaurant, N14	A3	

5.1.5 Public Participation Meeting

The public meeting for the Scoping phase was held on the 4th August 2009 at the Funda Community Hall. Two repeated sessions were conducted at 14h00 and 17h30. The following items were presented to I&APs:

- The environmental process overview and legislative context;
- The listed activities to be applied for in terms of NEMA;
- The Integrated water use licensing process to be undertaken;
- The mining right application;
- The description and location of the project, as well as the mining process; and
- The aspects of the environment anticipated to be impacted upon.

Seventeen I&APs attended the meeting.. The meeting was recorded with a Dictaphone, video camera and photographs, and these can be made available on request.

Figure 70: Photos of the Public Participation Meeting

5.1.6 Review of the Scoping Report

The Scoping Report was made available for review at the Belfast Municipal Library from 10th August 2009 to 10th September 2009. The report was also made available electronically when requested.

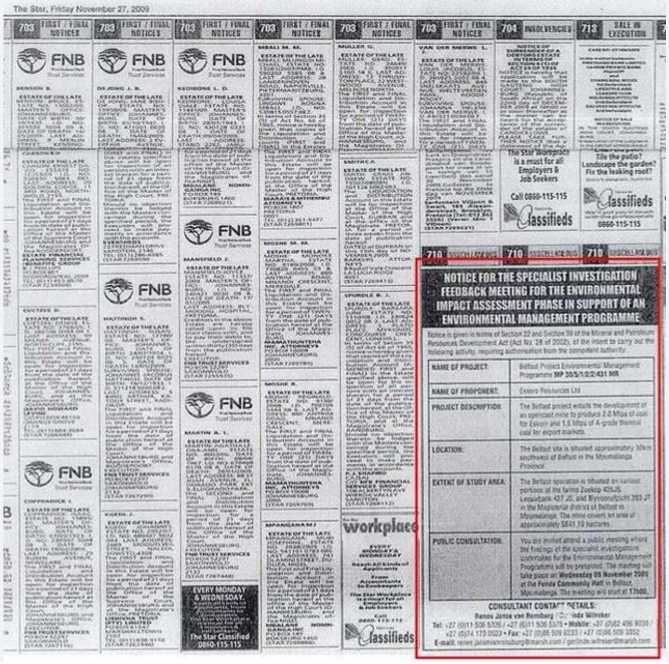
5.2 EIA Phase Public Participation Period – October 2009 to March 2010

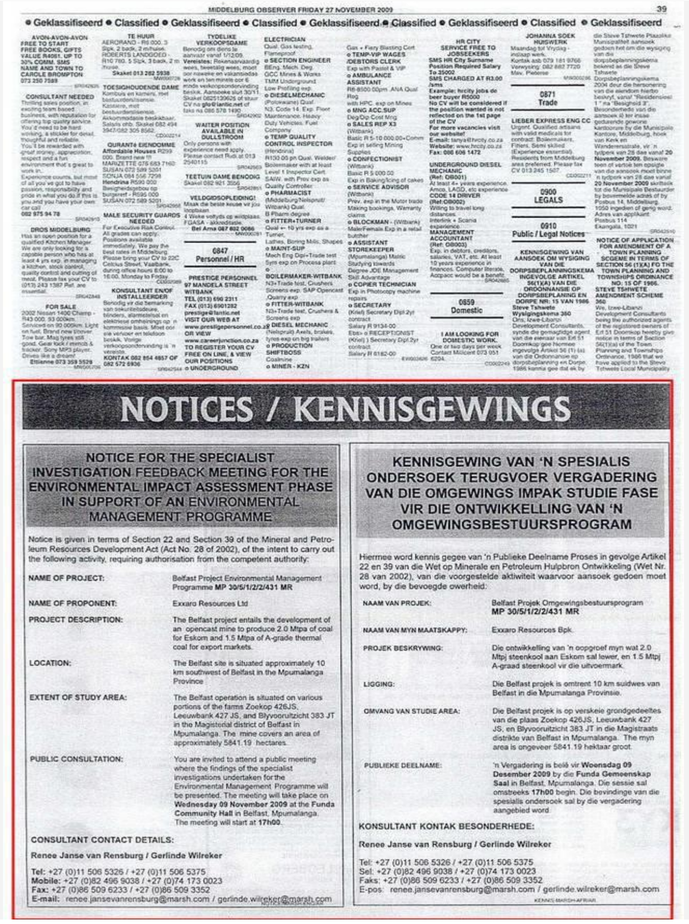
The EIA Phase Public Participation Process commenced in September 2009 and continued up until the end of March 2010. During this time, several meetings were held with various stakeholders and landowners and communication with I&APs was ongoing. Advertisements were placed in local and regional newspapers in November 2009 and March 2010 to advertise details of the project and for I&APs to again register and submit comments and concerns. The Environmental Management Programme Report was distributed to all registered I&APs.

5.2.1 Newspaper Advertisements

English and Afrikaans advertisements were placed in local and regional newspapers on the 27th November 2009, as shown in **Table 49**.

Table 49: Newspaper advertisements placed in November 2009 as part of the EIA Phase

Newspaper	Date	Language	Copy of Advertisement
The Star	27 November 2009	English	 The Star, Friday November 27, 2009 NOTICE FOR THE SPECIALIST INVESTIGATION FEEDBACK MEETING FOR THE ENVIRONMENTAL IMPACT ASSESSMENT PHASE IN SUPPORT OF AN ENVIRONMENTAL MANAGEMENT PROGRAMME NAME OF PROJECT: Belfast Project Environmental Management Programme MP 30/5/1/2/2/431 MR NAME OF PROPONENT: Exxaro Resources Ltd PROJECT DESCRIPTION: The Belfast project entails the development of an opencast mine to produce 2.0 Mtpa of coal for Eskom and 1.5 Mtpa of A-grade thermal coal for export markets. LOCATION: The Belfast site is situated approximately 10km southwest of Belfast in the Mpumalanga Province PUBLIC CONSULTATION: You are invited attend a public meeting where the findings of the specialist investigations undertaken for the Environmental Management Programme will be presented. The meeting will take place on Wednesday 09 December 2009 at the Fenda Community Hall in Belfast, Mpumalanga. The meeting will start at 17h00. CONSULTANT CONTACT DETAILS:
Die Beeld	27 November 2009	Afrikaans	 Sake24, Vrydag 27 November 2009 Sake-nuus Busa skop vas teen Zim-ooreenkoms Spaar is SA se Achilleshiel Koers steun nie sterk groei KENNISGEWING VAN 'N SPESIALISONDERSOEK-TERUGVOERVERGADERING VAN DIE OMGEWINGS-IMPAKSTUDIE-FASE VIR DIE ONTWIKKELLING VAN 'N OMGEWINGS-BESTUURSPROGRAM Takel mynbouwette pleks, sê Cronin CITY OF JOHANNESBURG

Middleburg Observer	27 November 2009	English and Afrikaans	

NOTICES / KENNISGEWINGS

NOTICE FOR THE SPECIALIST INVESTIGATION FEEDBACK MEETING FOR THE ENVIRONMENTAL IMPACT ASSESSMENT PHASE IN SUPPORT OF AN ENVIRONMENTAL MANAGEMENT PROGRAMME

Notice is given in terms of Section 22 and Section 39 of the Mineral and Petroleum Resources Development Act (Act No. 28 of 2002), of the intent to carry out the following activity, requiring authorisation from the competent authority:

NAME OF PROJECT: Belfast Project Environmental Management Programme **MP 30/5/1/2/2/431 MR**

NAME OF PROPONENT: Exxaro Resources Ltd

PROJECT DESCRIPTION: The Belfast project entails the development of an opencast mine to produce 2.0 Mtpa of coal for Eskom and 1.5 Mtpa of A-grade thermal coal for export markets.

LOCATION: The Belfast site is situated approximately 10 km southwest of Belfast in the Mpumalanga Province

EXTENT OF STUDY AREA: The Belfast operation is situated on various portions of the farms Zoekop 426JS, Leeuwbank 427 JS, and Blyvooruitzicht 383 JT in the Magisterial district of Belfast in Mpumalanga. The mine covers an area of approximately 5841.19 hectares.

PUBLIC CONSULTATION: You are invited to attend a public meeting where the findings of the specialist investigations undertaken for the Environmental Management Programme will be presented. The meeting will take place on **Wednesday 09 November 2009** at the **Funda Community Hall** in Belfast, Mpumalanga. The meeting will start at **17h00**.

CONSULTANT CONTACT DETAILS:

Renee Janse van Rensburg / Gerlinde Wilreker

Tel: +27 (0)11 506 5326 / +27 (0)11 506 5375
Mobile: +27 (0)82 496 9038 / +27 (0)74 173 0023
Fax: +27 (0)86 509 6233 / +27 (0)86 509 3352
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KENNISGEWING VAN 'N SPESIALIS ONDERSOEK TERUGVOER VERGADERING VAN DIE OMGEWINGS IMPAK STUDIE FASE VIR DIE ONTWIKKELLING VAN 'N OMGEWINGSBESTUURSPROGRAM

Hiermee word kennis gegee van 'n Publieke Deelname Proses in gevolge Artikel 22 en 39 van die Wet op Minerale en Petroleum Hulpbron Ontwikkeling (Wet Nr. 28 van 2002), van die voorgestelde aktiwiteit waarvoor aansoek gedoen moet word, by die bevoegde owerheid:

NAAM VAN PROJEK: Belfast Projek Omgewingsbestuursprogram **MP 30/5/1/2/2/431 MR**

NAAM VAN MYN MAATSKAPPY: Exxaro Resources Bpk.

PROJEK BESKRYWING: Die ontwikkelling van 'n oopgroef myn wat 2.0 Mtpj steenkool aan Eskom sal lewer, en 1.5 Mtpj A-graad steenkool vir die uitvoermark.

LIGGING: Die Belfast projek is omtrent 10 km suidwes van Belfast in die Mpumalanga Provinsie.

OMVANG VAN STUDIE AREA: Die Belfast projek is op verskeie grondgedeeltes van die plaas Zoekop 426JS, Leeuwbank 427 JS, en Blyvooruitzicht 383 JT in die Magistraats distrikte van Belfast in Mpumalanga. The myn area is ongeveer 5841.19 hektaar groot.

PUBLIEKE DEELNAME: 'n Vergadering is belê vir **Woensdag 09 Desember 2009** by die **Funda Gemeenskap Saal** in Belfast, Mpumalanga. Die sessie sal omstreeks **17h00** begin. Die bevindinge van die spesialis ondersoek sal by die vergadering aangebied word.

KONSULTANT KONTAK BESONDERHEDE:

Renee Janse van Rensburg / Gerlinde Wilreker

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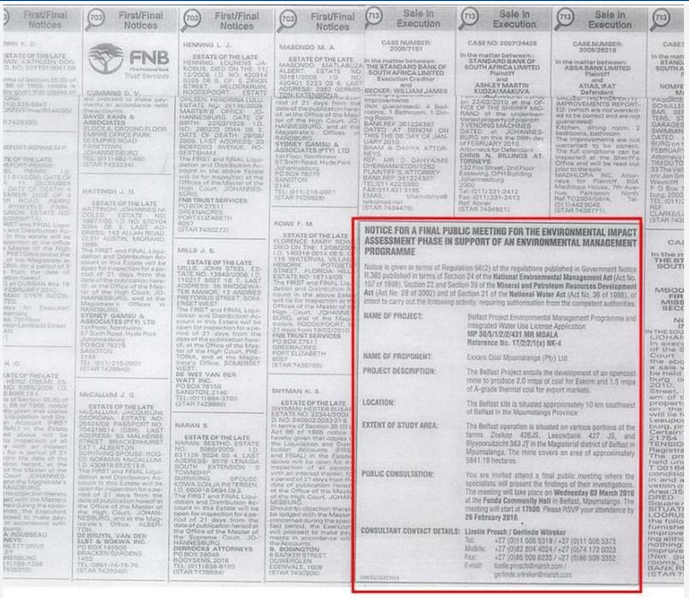
Table 50 shows copies of the newspaper advertisements which were placed in during February of 2010, to advertise details of the Public Feedback Meeting and to invite I&APs and submit comments during the EIA Phase.

Table 50: Newspaper advertisements placed in March 2010 as part of the EIA Phase

Newspaper	Date	Language	Copy of Advertisement
The Star	19 February 2010	English	

NOTICE FOR A FINAL PUBLIC MEETING FOR THE ENVIRONMENTAL IMPACT ASSESSMENT PHASE IN SUPPORT OF AN ENVIRONMENTAL MANAGEMENT PROGRAMME

Notice is given in terms of Regulation 56(2) of the regulations published in Government Notice R.385 published in terms of Section 24 of the **National Environmental Management Act** (Act No. 107 of 1998), Section 22 and Section 39 of the **Mineral and Petroleum Resources Development Act** (Act No. 28 of 2002) and of Section 21 of the **National Water Act** (Act No. 36 of 1998), of intent to carry out the following activity, requiring authorisation from the competent authorities.

NAME OF PROJECT: Belfast Project Environmental Management Programme and Integrated Water Use License Application **MP 30/5/1/2/2/431 MR MDALA** **Reference No. 17/2/2/1(e) NK-4**

NAME OF PROPONENT: Exxaro Coal Mpumalanga (Pty) Ltd

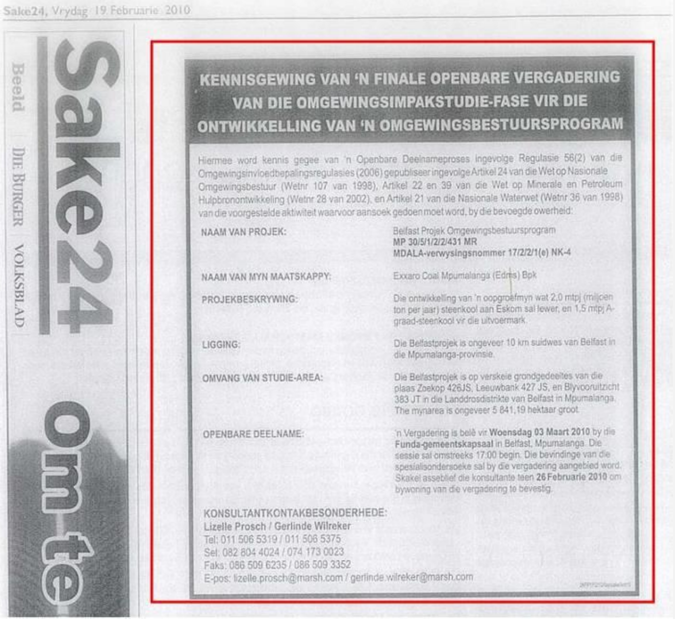
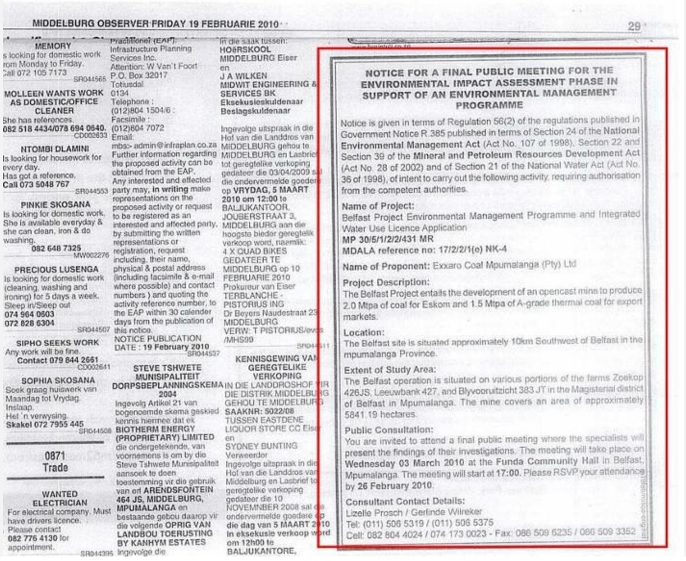
PROJECT DESCRIPTION: The Belfast Project entails the development of an opencast mine to produce 2.0 mtpa of coal for Eskom and 1.5 mtpa of A-grade thermal coal for export markets.

LOCATION: The Belfast site is situated approximately 10 km southwest of Belfast in the Mpumalanga Province

EXTENT OF STUDY AREA: The Belfast operation is situated on various portions of the farms Zoekop 426JS, Leeuwbank 427 JS, and Blyvooruitzicht 383 JT in the Magisterial district of Belfast in Mpumalanga. The mine covers an area of approximately 5841.19 hectares.

PUBLIC CONSULTATION: You are invited attend a final public meeting where the specialists will present the findings of their investigations. The meeting will take place on **Wednesday 03 March 2010** at the **Funda Community Hall** in Belfast, Mpumalanga. The meeting will start at **17h00**. Please RSVP your attendance by **26 February 2010**.

CONSULTANT CONTACT DETAILS: **Lizelle Prosch / Gerlinde Wilreker**
Tel: +27 (0)11 506 5319 / +27 (0)11 506 5375
Mobile: +27 (0)82 804 4024 / +27 (0)74 173 0023
Fax: +27 (0)86 509 6235 / +27 (0)86 509 3352
E-mail: lizelle.prosch@marsh.com / gerlinde.wilreker@marsh.com

Die Beeld	19 February 2010	Afrikaans	
Middleburg Observer	19 February 2010	English and Afrikaans	

Sake24, Vrydag 19 Februarie 2010

KENNISGEWING VAN 'N FINALE OPENBARE VERGADERING VAN DIE OMGEWINGSIMPAKSTUDIE-FASE VIR DIE ONTWIKKELLING VAN 'N OMGEWINGSBESTUURSPROGRAM

Hiermee word kennis gegee van 'n Openbare Deelnameproses ingevolge Regulasie 56(2) van die Omgewingsinvloedbepalingsregulasies (2006) gepubliseer ingevolge Artikel 24 van die Wet op Nasionale Omgewingsbestuur (Wetnr 107 van 1998), Artikel 22 en 39 van die Wet op Minerale en Petroleum Hulpbronontwikkeling (Wetnr 28 van 2002), en Artikel 21 van die Nasionale Waterwet (Wetnr 36 van 1998) van die voorgestelde aktiwiteit waarvoor aansoek gedoen moet word, by die bevoegde owerheid:

NAAM VAN PROJEK:	Belfast Projek Omgewingsbestuursprogram **MP 30/5/1/2/2/431 MR** **MDALA-verwysingsnommer 17/2/2/1(e) NK-4**
NAAM VAN MYN MAATSKAPPY:	Exxaro Coal Mpumalanga (Edms) Bpk
PROJEKBESKRYWING:	Die ontwikkelling van 'n oopgroefmyn wat 2,0 mtpj (miljoen ton per jaar) steenkool aan Eskom sal lewer, en 1,5 mtpj A-graad-steenkool vir die uitvoermark.
LIGGING:	Die Belfastprojek is ongeveer 10 km suidwes van Belfast in die Mpumalanga-provinsie.
OMVANG VAN STUDIE-AREA:	Die Belfastprojek is op verskeie grondgedeeltes van die plaas Zoekop 426JS, Leeuwbank 427 JS, en Blyvooruitzicht 383 JT in die Landdrosdistrikte van Belfast in Mpumalanga. The mynarea is ongeveer 5 841,19 hektaar groot.
OPENBARE DEELNAME:	'n Vergadering is belê vir **Woensdag 03 Maart 2010** by die **Funda-gemeentskapsaal** in Belfast, Mpumalanga. Die sessie sal omstreeks 17:00 begin. Die bevindinge van die spesialisondersoeke sal by die vergadering aangebied word. Skakel asseblief die konsultante teen **26 Februarie 2010** om bywoning van die vergadering te bevestig.

KONSULTANTKONTAKBESONDERHEDE:
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MIDDELBURG OBSERVER FRIDAY 19 FEBRUARIE 2010 29

NOTICE FOR A FINAL PUBLIC MEETING FOR THE ENVIRONMENTAL IMPACT ASSESSMENT PHASE IN SUPPORT OF AN ENVIRONMENTAL MANAGEMENT PROGRAMME

Notice is given in terms of Regulation 56(2) of the regulations published in Government Notice R.385 published in terms of Section 24 of the **National Environmental Management Act** (Act No. 107 of 1998), Section 22 and Section 39 of the **Mineral and Petroleum Resources Development Act** (Act No. 28 of 2002) and of Section 21 of the National Water Act (Act No. 36 of 1998), of intent to carry out the following activity, requiring authorisation from the competent authorities.

Name of Project:
Belfast Project Environmental Management Programme and Integrated Water Use Licence Application
MP 30/5/1/2/2/431 MR
MDALA reference no: 17/2/2/1(e) NK-4

Name of Proponent: Exxaro Coal Mpumalanga (Pty) Ltd

Project Description:
The Belfast Project entails the development of an opencast mine to produce 2.0 Mtpa of coal for Eskom and 1.5 Mtpa of A-grade thermal coal for export markets.

Location:
The Belfast site is situated approximately 10km Southwest of Belfast in the mpumalanga Province.

Extent of Study Area:
The Belfast operation is situated on various portions of the farms Zoekop 426JS, Leeuwbank 427, and Blyvooruitzicht 383 JT in the Magisterial district of Belfast in Mpumalanga. The mine covers an area of approximately 5841.19 hectares.

Public Consultation:
You are invited to attend a final public meeting where the specialists will present the findings of their investigations. The meeting will take place on **Wednesday 03 March 2010** at the **Funda Community Hall** in Belfast, Mpumalanga. The meeting will start at **17:00.** Please RSVP your attendance by **26 February 2010**.

Consultant Contact Details:
Lizelle Prosch / Gerlinde Wilreker
Tel: (011) 506 5319 / (011) 506 5375
Cell: 082 804 4024 / 074 173 0023 - Fax: 086 509 6235 / 086 509 3352

5.2.2 Stakeholder Meetings

Three meetings were held with various stakeholders and I&APs from October 2009 to date. The purpose of these meetings was to ensure that various groups were appropriately informed of the activity and Environmental Assessment Process, and given an opportunity to comment.

- One community meeting was held at the Morelig School – 11 October 2009.
- One specialist study feedback meeting was held at the Funda Community Hall – 9 December 2009.
- One public meeting with the specialists in attendance was held at the Funda Community Hall – 3 March 2010.

Community Meeting – October 2009

A meeting with the local community was held, the attendees were primarily of farm labourers and residents who may be affected by the mining activities. The meeting was held at the Morelig School near Wonderfontein on Sunday 11 October 2009. Community members were notified of the meeting verbally through assistance by local community leaders / representatives and farmers. The presentation was translated into Zulu through the aid of a translator, and all questions and answers were similarly aided by the translator. The following items were presented and discussed at the meeting:

- The environmental process overview and legislative context;
- The listed activities to be applied for in terms of NEMA;
- The Integrated water use licensing process to be undertaken;
- The mining right application;
- The description and location of the project, as well as the mining process; and
- The aspects of the environment anticipated to be impacted upon.

A total of 74 I&APs registered at the meeting. However many of the meeting attendees did not fill in the attendance register. It was estimated that approximately 150 people attended the meeting. The meeting was recorded with a Dictaphone, video camera and photographs, these can be made available on request.

Figure 71: Photos of the Public Participation Meeting

Public Participation Meeting – November 2009

Registered I&APs were invited to a Public Participation Meeting, held on the 10th December 2009 at the Funda Community Hall. The purpose of the meeting was to provide feedback on the EIA Process. Information packs including copies of the power point presentation were provided to all attendees. The following items were discussed at the meeting:

- Presentation of the specialist investigation findings and proposed mitigation measures
  - Air Quality Impact Assessment
  - Ground Vibration and Air Blast Study
  - Geohydrological Investigation
  - Surface Water Assessment
  - Heritage Impact Assessment
  - Social Impact Assessment
  - Soil, Land Use and Land Capability Assessment
  - Visual Impact Assessment
  - Noise Impact Assessment
  - Ecology Assessment

A total of 27 I&APs attended the meeting. All comments and issues raised by the I&APs were recorded and included in the minutes of the meeting. The meeting was recorded with a Dictaphone, video camera and photographs, which can be made available on request.

Figure 72: Photos of the Public Participation Meeting

Public Feedback Meeting – March 2010

Registered I&APs were invited to attend a feedback meeting for the specialists to present their findings to registered I&APS. This meeting was held at the Funda Community Hall in Belfast on Wednesday 03 March 2010 at 17h00. Ten I&APs attended the meeting. Information packs including the PowerPoint presentation were handed out to the meeting attendees. The following items were presented at the meeting:

- Presentation of the specialist investigation findings and proposed mitigation measures
  - Air Quality Impact Assessment
  - Ground Vibration and Air Blast Study
  - Geohydrological Investigation
  - Surface Water Assessment
  - Heritage Impact Assessment
  - Social Impact Assessment
  - Soil, Land Use and Land Capability Assessment
  - Visual Impact Assessment
  - Noise Impact Assessment
  - Ecology Assessment

Ten I&APs attended the meeting. The meeting was recorded with a Dictaphone, video camera and photographs, which can be provided on request.

Figure 73: Photos of the Public Participation Meeting

Additional Meetings

- **Authorities Meeting**
  Authorities and representatives of the Emakhazeni Local Municipality were invited to attend a meeting on 4th August 2009 at the Funda Community Hall. Only one representative of the ELM and SANRAL attended.

- **Consultation with Emakhazeni Local Municipality**
  In addition to ongoing consultation between Exxaro and the ELM, three (3) project specific meetings were held on 9 May 2009, 9 December 2009 and 18 May 2010.

Table 51: Summary of actions and dates for Public Participation Process

Dates	Event
Scoping phase	
21 July 2009 – 21 August 2009	Scoping Phase Public Participation Period
21 July 2009	Public Participation Process commencement
23 and 24 July 2009	Advertisements placed in local and regional newspapers
23 July	Site notices erected
4 August 2009	Public Participation Meetings
21 August 2009	Public Participation closed
23 July – 04 August 2009	Hard copies of the Background Information Document (BID) made available at the Emakhazeni Local Municipality (ELM) offices in Belfast
10 August 2009 – 10 September 2009	Scoping Report made available for review at the Belfast Municipal Library for I&AP review and comment
EIA Phase public participation	
October 2009 to March 2010	EIA Phase Public Participation Period
November 2009 and March 2010	Advertisements placed in local and regional newspapers (specialist meeting)
11 October 2009	Community meeting at the Morelig School near Wonderfontein
10 December 2009	Public Participation Meeting at the Funda Community Hall
03 March 2010	Public Feedback Meeting at the Funda Community Hall
04 August 2009	Authorities Meeting at the Funda Community Hall
09 May 2009, 09 December 2009 and 18 May 2010	Consultation with Emakhazeni Local Municipality

5.2.2 Review of the draft EIA Report

The draft EIA Report was made available for review from 30 September 2011. The closing date for comments was 8 November 2011, subsequently extended to 16 November 2011 to accommodate late comments from specific IA&Ps. I&APs were notified of the availability of the draft EIA Report as follows:

- SMS notification;
- Email notification; and
- Fax notification.

The report was posted at the Belast Library (25 Scheeper Street) in hard copy and electronic copies (CD's) were also provided to remove from library premises. The report was also made available electronically when requested.

Additional electronic copies of the document were requested and provided to the following I&APs / stakeholders:

- Department of Agriculture, Forestry and Fisheries (Directorate Land Use and Soil Management)
- Endangered Wildlife Trust - African Crane Conservation Programme
- Tans Africa Concessions (TRAC)
- South African National Roads Agency

Hard copies of the document were sent to the following stakeholders / authorities:

- Department of Water Affairs
- Mpumalanga Tourism and Parks Agency
- Mpumalanga Department of Economic Development, Environmenta and Tourism (DEDET Witbank Office)

- Department of Mineral Resources (Witbank office)

5.3 Comments & Responses

Many comments were received from I&APs, and there has been ongoing communication between the consultant and the I&APs. There was extensive consultation with Mr. Koos Pretorius, an adjacent landowner and a representative of the Escarpment Environment Protection Group, and Mr. Riaan Joubert, a farmer adjacent to the proposed mining project.

Due to the ongoing nature of the Public Participation Process for this project, the comments received have not been grouped according to Scoping and EIA Phases, but grouped together into one consolidated Comments and Response Register (Table 52).

Comments on the draft EIA Report were received from the following I&APs:

- Mr Koos Pretorius
- Trans Africa Concessions (TRAC)
- South African National Roads Agency (SANRAL)

The comments received from Mr Koos Pretorius concerning the draft EIA Report are extensive and these comments and the responses thereto have been appended as Appendix C.

Table 52: Issues and Response Register.

I&AP	Issues and Concerns	Response
General		
Koos Pretorius	– Indicated that he does not want a mine on his doorstep.	Comment noted
Information		
Bernard Green	– Requested more information on the project be made available for public review.	A Background Information Document containing information about the proposed activity and contact details of the consultant was forwarded to all identified I&APs and stakeholders. All stakeholders and I&APs were invited to comment and attend the Public Participation Meeting held on the 4th August 2009. Hard copies of the BID were made available at the Emakhazeni Local Municipality (ELM) offices in Belfast from 23 July – 04 August 2009. The public meeting for the scoping phase was held on the 4th August 2009 at the Funda Community Hall. Two repeated sessions were conducted at 14h00 and 17h30. The following items were presented to I&APs: ▪ The environmental process overview and legislative context; ▪ The listed activities to be applied for in terms of NEMA; ▪ The Integrated water use licensing process to be undertaken; ▪ The mining right application; ▪ The description and location of the project, as well as the mining process; and ▪ The aspects of the environment anticipated to be impacted upon. The Scoping Report was made available for review at the Belfast Municipal Library from 10th August 2009 to 10th September 2009. The report was also made available electronically when requested. The EIA Phase Public Participation Process commenced in September 2009, and continued until March 2010. During this time, several meetings were held with various stakeholders and landowners and communication with I&APs was ongoing. The assessment reports was distributed to all registered I&APs.
Judas Michael Nkosi	– Asked if assessments are undertaken of existing mines and the information used.	The cumulative impacts of each of the aspects are assessed as part of the Environmental Impact Assessment. This addressed the combined impacts of the new proposed mining project and the existing mining operations.
Koos Pretorius	– Requested all of the relevant data and calculations that were used as	All relevant data is included in the EIA Report.

	the basis of the compilation of the report.	
Koos Pretorius	– Requested more information to make informed comment.	A Background Information Document containing information about the proposed activity and contact details of the consultant was forwarded to all identified I&APs and stakeholders. All stakeholders and I&APs were invited to comment and attend the Public Participation Meeting held on the 4th August 2009. Hard copies of the BID were made available at the Emakhazeni Local Municipality (ELM) offices in Belfast from 23 July – 04 August 2009. The public meeting for the scoping phase was held on the 4th August 2009 at the Funda Community Hall. Two repeated sessions were conducted at 14h00 and 17h30. The following items were presented to I&APs: ▪ The environmental process overview and legislative context; ▪ The listed activities to be applied for in terms of NEMA; ▪ The Integrated water use licensing process to be undertaken; ▪ The mining right application; ▪ The description and location of the project, as well as the mining process; and ▪ The aspects of the environment anticipated to be impacted upon. The Scoping Report was made available for review at the Belfast Municipal Library from 10th August 2009 to 10th September 2009. The report was also made available electronically when requested. The EIA Phase Public Participation Process commenced in September 2009, and continued until March 2010. During this time, several meetings were held with various stakeholders and landowners and communication with I&APs was ongoing. The assessment reports was distributed to all registered I&APs.
Koos Pretorius	– Requested to have input on the quantification of all the treatment plant alternatives.	– At present Exxaro are investigating various options. All I&APs had the opportunity to comment and provide inputs through the formalised public participation process. – An EIA process will be undertaken prior to the construction of the treatment plant. All I&APs will have the opportunity to comment and provide inputs through the formalised public participation process.
Specialist Studies		
Koos Pretorius	– Requested that a sustainability investigation for the project be	– As a result of this request, Exxaro approved the appointment of Golder and Associates to undertake a Sustainability Assessment.

	undertaken.	– Refer to Appendix O.
Koos Pretorius	– Requested input on the specialist studies Terms of Reference (TOR). – Wished to consult with all the specialists and discuss the TOR to make requests for amendments to the TOR.	The Scoping Report was made available for review at the Belfast Municipal Library from 10th August 2009 to 10th September 2009. The report was also made available electronically when requested. The specialists ToRs were included in the scoping report. No comments were submitted.
Mining Operation		
E.Bolt	– Asked where the plant would be situated in relation to Belfast Town.	– The plant will be situated approximately 14km to the south-west of Belfast. – Refer to Section 2
Nhlanhla Gumede	– Asked what the lifespan of the operation would be.	The mining activities will continue for 30 years, and the mining progression will continue from the south to north of the pit areas, refer to Section 2 for details of the mining activities and maps showing the layout of the mine.
Riaan Joubert	– Queried the type of fencing that would be used.	A high security fence will be erected around the mine plant and stock fencing with safety warning signs will be erected around the mine area.
Cumulative Impacts		
Bernard Green	– Requested the importance of taking other mining operations into account when undertaking the impact assessment and ensuring that cumulative impacts are taken into account and that the authorities be made aware of this.	The cumulative impacts of each of the aspects are assessed as part of the Environmental Impact Assessment. This addressed the combined impacts of the new proposed mining project and the existing mining operations.
D.G. Hepworth	– Concerned about the impacts over the life of mine.	As part of the of the Environmental Impact Assessment, impacts associated with the construction phase, operational phase as well as the rehabilitation and closure phases of the mine have been assessed.
Koos Pretorius	– Indicated concern about the cumulative impacts on the environment, especially in light of the numerous mining right applications that were underway in	The cumulative impacts of each of the aspects are assessed as part of the Environmental Impact Assessment. This addressed the combined impacts of the new proposed mining project and the existing mining operations. Unfortunately too many variables exist to determine the future impact in the event that other new mining

	the area.	projects are initiated. It will be the responsibility of the mining companies (applicants) to consider the cumulative impacts of their new proposed operation through due consideration of the current state.
Communication		
Bernard Green	– Indicated that there has been a meeting with attorneys from the rate payers association who are considering a class action lawsuit because of the damages. Asked whether Exxaro was aware of this.	– Exxaro was not aware of this.
Bernard Green	– Concerned about the breach of trust. The Belfast EMP gives beautiful management measures, how can people be sure that these will be implemented? This reflects adversely on Exxaro's attitude towards rectification and compensation on losses.	– The development of the EMP is aimed at addressing impacts. Impacts are identified and management measures are proposed. If the mining right is granted Exxaro is legally bound to implement measures included in the EMP. This is checked by annual audits and findings presented to the DMR by independent consultants. – An "Issues and Complaints Register" shall be kept on site, containing contact details of any complainant, as well as details pertaining to the complaint itself. The issues must be addressed and a record of this kept on site.
E.Bolt	– Concerned about past track records and wants a guarantee that the management measures will be implemented.	The development of the EMP is aimed at addressing impacts. Impacts are identified and management measures are proposed. If the mining right is granted Exxaro is legally bound to implement measures included in the EMP. This is checked by annual audits and findings presented to the DMR by independent consultants.
Judas Michael Nkosi	– Indicated concern about the time and location of the public meeting and stated that it was difficult for communities to attend as a result. – Raised concern that communities are not being properly consulted with.	Subsequently, a community meeting was undertaken specifically for the farm labourers on Saturday, 11 October 2009. Transportation from various pick-up points was arranged.
Kleinbooi M Mahlanga	– Stated that legislation says that public participation must be undertaken with all labourers / farm dwellers prior to submission	Public participation was conducted in accordance with the minimum requirements as set out in Regulation 56 of GN 385, promulgated in terms of the National Environmental Management Act (Act 107 of 1998). Public Participation is also required for the application for a Mining Right (in terms of the MPRDA, Act 28 of 2002) and for the application of an Integrated Water Use License (in terms of the National Water Act, 1998). Public

	of prospecting applications. – Stated that in his opinion the notice period provided for the public meeting was too short. Requested that another meeting be arranged on a Saturday so that all relevant communities could attend. – Queried whether Exxaro / Marsh would accept a request to undertake a community meeting on a Saturday after 13h00. – Stated that it was essential that equal opportunities were provided to all groups for consultation and in order to comment on the process.	participation for all three processes was conducted concurrently in accordance with Regulation 56 of GN 385. The Public Participation Process commenced on the 21st July 2009. Advertisements were placed in local and regional newspapers on the 23rd and 24th July 2009. Site notices were placed on site on the 23rd July. Public Participation Meetings were held on the 4th August 2009, where information regarding the proposed activity was presented. Public Participation closed on the 21st August 2009. A Background Information Document containing information about the proposed activity and contact details of the consultant was forwarded to all identified I&APs and stakeholders. All stakeholders and I&APs were invited to comment and attend the Public Participation Meeting held on the 4th August 2009. Hard copies of the BID were made available at the Emakhazeni Local Municipality (ELM) offices in Belfast from 23 July – 04 August 2009. The public meeting for the scoping phase was held on the 4th August 2009 at the Funda Community Hall. Two repeated sessions were conducted at 14h00 and 17h30. The following items were presented to I&APs: ▪ The environmental process overview and legislative context; ▪ The listed activities to be applied for in terms of NEMA; ▪ The Integrated water use licensing process to be undertaken; ▪ The mining right application; ▪ The description and location of the project, as well as the mining process; and ▪ The aspects of the environment anticipated to be impacted upon. The Scoping Report was made available for review at the Belfast Municipal Library from 10th August 2009 to 10th September 2009. The report was also made available electronically when requested. The specialists ToRs were included in the scoping report. No comments were submitted. The EIA Phase Public Participation Process commenced in September 2009, and continued until March 2010. During this time, several meetings were held with various stakeholders and landowners and communication with I&APs was ongoing. Advertisements were placed in local and regional newspapers in November 2009 and March 2010 to advertise details of the project and for I&APs to again register and submit comments and concerns. The assessment reports was distributed to all registered I&APs.

		Three meetings were held with various stakeholders and I&APs from October 2009 to date. The purpose of these meetings was to ensure that various groups were appropriately informed of the activity and Environmental Assessment Process, and given an opportunity to comment. ▪ One community meeting was held at the Morelig School – 11 October 2009. ▪ One specialist study feedback meeting was held at the Funda Community Hall – 9 December 2009. ▪ One public meeting with the specialists in attendance was held at the Funda Community Hall – 3 March 2010.
Kleinbooi M Mahlanga	– Stated that the DME has indicated that people / communities must be informed of activities and what is taking place before prospecting takes place. Stated that this project had progressed past the prospecting phase and that people in the area with land claims and members of the community had not been consulted about prospecting activities.	Dealing with land claims is not in the mandate of the EAP apart from the identification of such claims. The land claims commission has been informed of the proposed mining project and consultation with the affected parties has to be undertaken by the commission.
Kleinbooi M Mahlanga	– Stated that a working relationship between mines and the local communities had to be established.	– The public participation process for the EIA process was the initiation for the establishment of a relationship between the mine and the local communities. – The mine must continue to communicate with the local communities throughout the life of the mine. This can be achieved through stakeholder meetings, an "Issues and complaints register", open days etc.
Kleinbooi M Mahlanga	– Queried when the mining phase of a project starts as he was of the opinion that this had occurred only after prospecting and again stated that communities had not been consulted during the prospecting phase of the project.	– The prospecting application can be made available by Exxaro on request.
Kleinbooi M Mahlanga	– Stated that according to the advertisement in the newspapers and on site notices that comments	– It is not a requirement of the MPRDA to make the scoping report available for public review. Timeframes in the MPRDA indicate that within 30 days of a mining right application being approved, a scoping report must be submitted to the Department of Mineral Resources. This unfortunately does not allow time for

	on the Scoping Report were requested by 21 August 2009. Indicated that in order to comment the Scoping Report had to be made available before then.	public review. – The scoping report (as prepared in terms of the National Environmental Management Act) was however made available for review after the public meeting to include the comments raised at the meeting. The scoping report was made available for a period of 30 days prior to submission to MDALA (now DEDET). – The same information was included in both the scoping reports.
Kleinbooi M Mahlanga	– Indicated that there is a significant lack of communication between the farmers and the communities and farm labourers.	– A community meeting was undertaking to specifically give the local community information about the project and to afford them an opportunity to comment on the proposed mine development.
Kleinbooi M Mahlanga	– Stated that he was not comfortable with the situation that one group, such as the white farmers, obtained better consultation than other groups, such as the farm labourers and surrounding communities.	– All communities and community leaders were invited to the all the public meetings. – A community meeting was specifically held for the farm labourers.
Kleinbooi M Mahlanga	– Indicated that people in the area are not being consulted, and that they should be consulted with to prevent conflict.	– All communities and community leaders were invited to the all the public meetings. – A community meeting was specifically held for the farm labourers.
Koos Pretorius	– Unhappy about the consultation process, as there is little availability of the public review of documents and that I&APs were not afforded the opportunity to influence specialist studies ToR.	Public participation was conducted in accordance with the minimum requirements as set out in Regulation 56 of GN 385, promulgated in terms of the National Environmental Management Act (Act 107 of 1998). Public Participation is also required for the application for a Mining Right (in terms of the MPRDA, Act 28 of 2002) and for the application of an Integrated Water Use License (in terms of the National Water Act, 1998). Public participation for all three processes was conducted concurrently in accordance with Regulation 56 of GN 385. The Public Participation Process commenced on the 21st July 2009. Advertisements were placed in local and regional newspapers on the 23rd and 24th July 2009. Site notices were placed on site on the 23rd July. Public Participation Meetings were held on the 4th August 2009, where information regarding the proposed activity was presented. Public Participation closed on the 21st August 2009. A Background Information Document containing information about the proposed activity and contact details of the consultant was forwarded to all identified I&APs and stakeholders. All stakeholders and I&APs were

invited to comment and attend the Public Participation Meeting held on the 4th August 2009.

Hard copies of the BID were made available at the Emakhazeni Local Municipality (ELM) offices in Belfast from 23 July – 04 August 2009.

The public meeting for the scoping phase was held on the 4th August 2009 at the Funda Community Hall. Two repeated sessions were conducted at 14h00 and 17h30. The following items were presented to I&APs:

- The environmental process overview and legislative context;
- The listed activities to be applied for in terms of NEMA;
- The Integrated water use licensing process to be undertaken;
- The mining right application;
- The description and location of the project, as well as the mining process; and
- The aspects of the environment anticipated to be impacted upon.

The Scoping Report was made available for review at the Belfast Municipal Library from 10th August 2009 to 10th September 2009. The report was also made available electronically when requested.

The specialists ToRs were included in the scoping report. No comments were submitted.

The EIA Phase Public Participation Process commenced in September 2009, and continued until March 2010. During this time, several meetings were held with various stakeholders and landowners and communication with I&APs was ongoing. Advertisements were placed in local and regional newspapers in November 2009 and March 2010 to advertise details of the project and for I&APs to again register and submit comments and concerns. The assessment reports was distributed to all registered I&APs.

Three meetings were held with various stakeholders and I&APs from October 2009 to date. The purpose of these meetings was to ensure that various groups were appropriately informed of the activity and Environmental Assessment Process, and given an opportunity to comment.

- One community meeting was held at the Morelig School – 11 October 2009.
- One specialist study feedback meeting was held at the Funda Community Hall – 9 December 2009.
- One public meeting with the specialists in attendance was held at the Funda Community Hall – 3 March 2010.

The ToRs were included in the scoping report. No comments were submitted on those ToRs even after

		requests from the EAP to do so.
Koos Pretorius	– Indicated his unhappiness about consultation. Felt that his concerns were not being addressed.	Comments raised at the public participation meetings as well as any written comments submitted by Mr. Pretorius are included and responded to in this register.
Koos Pretorius	– Felt that the communication with I&APs and their opportunity to comment on the proposed project was negatively impacted upon by the DMR timeframes.	– The EAP cannot influence the guidelines stipulated in the MPRDA. The EAP acknowledges that the timeframes of the MPRDA and NEMA differ. – The reports were all made available for review by the public in accordance with the regulations. – Based on this comment by Mr. Pretorius, an additional Public Consultation Report was submitted to the DMR on 8 January 2010. This register contained all comments received from the Public up until December 2009.
Koos Pretorius	– Raised a concern that so few farmers and community members were represented at the public meetings.	– The farmers and landowners were invited to each of the meetings. The list of landowners that where invited to take part in the public participation process are indicated in Appendix C.
Koos Pretorius	– Raised the concern that there had been complaints about the Glisa operation in the past that were never addressed and is concerned that the same will happen with the Belfast Operation is granted.	– An "Issues and Complaints Register" shall be kept on site, containing contact details of any complainant, as well as details pertaining to the complaint itself. The issues must be addressed and a record of this kept on site.
Koos Pretorius	– Stated that as the DMR submits the scoping report to other authorities he was concerned that these authorities would thus be assessing a Scoping Report that, in his view, was incomplete in terms of public comment.	– Based on this comment by Mr. Pretorius, an additional Public Consultation Report was submitted to the DMR on 8 January 2010. This register contained all comments received from the Public up until December 2009.
Nhlanhla Gumede	– Requests that interpreters be made available at the next public meetings. – Stated that not all people who were affected by the project could	– An interpreter was present at for the community meeting held on 11 October 2009.

	understand English and, as such, requested that the community focus group meetings should be facilitated by a qualified translator. – Indicated that important points of concern could be missed if this is not undertaken.	
Nhlanhla Gumede	– Requested that the handouts for the next round of meetings should be printed bigger.	– Comment noted.
Riaan Joubert	– Requested that Exxaro personally discuss his concerns with him as his dairy farm is adjacent to the proposed operation.	– Meeting between Mr. Joubert and Exxaro has taken place.
Climate		
Koos Pretorius	– Requested that the closest weather station be used.	– Meteorological data from the Rietvallei South African Weather Service (SAWS) station was used in the dispersion modelling for the proposed Belfast Project. The weather station is located ~6.5km to the north of the proposed site. – The Roodepoort local weather station was made use of to obtain much of the data in the respective specialist studies – Glisa Colliery (located ~8km to the northeast of the proposed Belfast Project site) also has an operational weather station. However, meteorological data from this weather station was not utilised as it is located further north from the proposed Belfast Project site. Exxaro has a weather station located on the other side of the N14. This data however, is of poor quality with calibration of the station not undertaken on a regular basis.
Koos Pretorius	– Indicated that weather conditions be incorporated into the noise and blasting reports.	Recommendation from the Ground Vibration and Air Blast Study include the following measures to minimise air blast intensity: – Blasting should not be undertaken in the early morning or late afternoon (during winter months) when temperatures are low. – Blasting should not be undertaken in foggy conditions; – Blasting should not be undertaken when there are low overcast clouds, and – Wind direction should be considered when blasting is undertaken.

Soil		
Koos Pretorius	– How many hectares of high potential soils are left in Mpumalanga on the Highveld? As a percentage (%) of the area?	An analysis of the soil quality of the province is represented in Figure 1. Approximately 50% of the province contains soils of low quality for agriculture production purposes. Only 23% of the provincial land area constitutes soils of high potential. (Source: DARDLA Research Unit)
Koos Pretorius	– Wanted to know how much compost would be required for rehabilitation.	– This can only be calculated at the time of rehabilitation after the soils have been tested for organic content.
Koos Pretorius	– What percentage of yield is dependant on soil structure?	– Yield is determined by a whole suite of inter-dependable soil chemical + physical + mechanical properties and it is not possible to put a percentage to soil structure's contribution to yield. Saturated & unsaturated water flow, nutrient availability, water holding capacity, etc. determine successful plant growth. – For example, the Craffott & Knot equation put emphasis on moisture + effective depth + clay content and can be used to determine agricultural potential and yield. Point is not only structure should be considered for yield determination – but it is a very important factor.
Koos Pretorius	– What is the agricultural potential of the soil post subsidence rectification and soil replacement compared to the current?	– For the post agricultural potential to be on par with the pre-mining agricultural potential consideration should be given to a whole suite of soil chemical, physical and mechanical properties(e.g. pH, EC, Ca, Mg, K, N, Na + ESP, effective depth, particle size distribution, bulk density, compaction, crust formation – to name but a few). It is possible with correct placement of soil to achieve the same (or very close to) agricultural potential. – Case Study (Viljoen & Associates): Reconstruction of Avalon & Hutton soil profiles post mining for sugarcane production Hillendale Mine Empangeni.
Koos Pretorius	– What will be the total loss in Rands of the post vs pre-mining potential of the soils?	– If enough effort has been put to reconstructing the post mining soils to pre-mining conditions minimal loss will occur. – (Hillendale mine proved this option was possible, but at a high cost – needs careful planning).
Koos Pretorius	– What will the impact be of the continuous soil movement to rectify subsidence on the topsoil being put back?	– Topsoil should only be replaced after subsidence has been stabilised to minimise continuous soil movement. Careful consideration & planning should be given to surface water control measures to ensure a free drainage system to prevent accumulation of water that could change physical and chemical soil properties. – Exxaro have good record of soil management e.g. Matla Operation.
Land Capability & Land Use		
Koos Pretorius	– Felt that the mining operation was not feasible in terms of land use	During the prospecting process Exxaro determined the quality and quantity of coal that can be mined; this data informed the feasibility of the mine. The landuse is not wholly contradictory to the surrounding mine uses

	for the area.	(collieries) on adjacent properties also mined by Exxaro.
Koos Pretorius	– Indicated that the area was set aside for agriculture in the ELM Environmental Management Framework (EMF).	– According to the EMF the Belfast Project falls in an area classified as "agriculture" (37%), with intermittent areas classified as "no natural areas remaining" (62%).
Koos Pretorius	– Requested that the land capability of the area be quantified for both pre- and post-mining situations.	A soil, land use, land capability assessment was undertaken for the Belfast Project by Viljoen & Associates. The predominant land use on this site consists of: ▪ Arable land (plantation and ploughed land) ▪ Wetlands (large areas along the two main rivers namely the Leeuwbank Spruit and the Klein Komati Rivers, as well as their tributaries and various pans and farm dams are present) ▪ Grazing (natural grazing along rocky outcrop areas and wetlands) Arable land is present in the form of ploughed land and plantations and is used for the production of maize, but also for potatoes and sunflower from time to time. Grazing in the form of pastures and natural grassland along wetlands and rocky outcrops also take place. Grazing is limited to areas where the soils are either too wet (i.e. wetlands) or too shallow and rocky (i.e. rocky outcrops) to be ploughed. Various bush clumps of Eucalyptus species and Wattles are present and are sold for commercial purposes. Wetlands also occur within the project area. This baseline information will be considered during the closer planning phases which will be refined closer to the end of life of mine.
Koos Pretorius	– What is the agricultural potential of the soil post settling of soil rectification and soil replacement compared to the current?	If done correctly during rehabilitation the agricultural potential of the post settling soil should be very close to the initial agricultural potential.
Nhlanhla Gumede	– Wanted to know what will happen to the agricultural activities within the mining area. Will only small portions at a time be mined or the whole area in one go?	Strip mining will take place. Only 200ha at a time will be exposed and strips will be backfilled as the mine progresses.
Surface Water		

Bernard Green	– Queried the source of process water as there is little water available in the area.	A water balance was developed of the integrated water system using Goldsim simulation software. The mine water balance is dynamic and depends on many factors including rainfall, the mine plan, floor contours, rehabilitation scheduling and standards as well as mine water requirements. Water will have to be managed either for use to meet the mine water requirements or treatment and discharge. The plant water demand varies over the years due to changes in tonnages. The annual average water demand fluctuates and peaks in 2039 at 1,850m^3/day when it operates at 455 ROM t/hr. The lowest plant demand during Phase 2 is reached in 2013 at about 1,500m^3/day. Fluctuations within a year are due to change of moisture in the ROM, discard and product. It is to be noted that the values are in accordance with the macro water balance value of 1,878m^3/day when the plant operates at a ROM feed of 480 t/hr. Process water will initially be taken from water infiltrating into the pits, boreholes or the river.
Bernard Green	– Wanted to know what the effect of dust on the quality of surface water would be and how this will affect animals drinking the water. – Wanted to know what effect the sediments in the water could have on the systems of his animals.	Dust could affect the water quality at certain concentrations as it can cause siltation. It will not affect drinking as the dust would settle out in the water.
Koos Pretorius	– Wanted to know why his property was not included in the hydrocensus.	The specialists indicated that they were not given access to his farm for the studies.
Koos Pretorius	– Requested that the cumulative effects on the Nooitgedacht Dam be included in the specialist studies.	The Komati river catchment is particularly sensitive due to abstraction of water from the Nooitgedacht Dam and Vygeboom Dam for power supply, therefore the impact on water availability at these dams was investigated. The impact is relatively low as a reduction of the MAR of 0.06% and 0.12% is expected at the Nooitgedacht Dam and Vygeboom Dam respectively.
Koos Pretorius	– Requested a rainwater balance for the area to be calculated.	A water balance was developed of the integrated water system using Goldsim simulation software. The mine water balance is dynamic and depends on many factors including rainfall, the mine plan, floor contours, rehabilitation scheduling and standards as well as mine water requirements. Water will have to be managed

		either for use to meet the mine water requirements or treatment and discharge. If the environmental water balance is considered, it is estimated that only approximately 3% of the mean annual precipitation (MAP) ends up as effective recharge to the aquifer(s). If the direct surface run-off is considered to be in the order of 20% of MAP, it means that the remainder of the MAP exists as water retained in and migrating horizontally through the soil profile, as well as water being lost to evapo-transpiration. It is also this soil moisture/water that is considered to have by far the most significant contribution to the water in the wetlands (channel flow, hill-slope etc.) and pans in the Belfast Project surface area. The water that 'feed' the pans in the Belfast project area is therefore considered as soil water rather than groundwater. This water remains within the soil layer due to a less permeable layer underlying the soil horizon. The water level drawdown due to mining will thus have a direct effect on the groundwater level but is not considered to having a significant adverse impact on the soil water and will therefore not cause severe decreases in water flow to the streams and pans. The pans within the two mine block boundaries will be mined away completely. The drawdown in water level will cause a decrease in the base-flow discharge to the tributaries / hill-slope wetlands. The biggest impacts in terms of base-flow discharge are the tributary (of the Klein-Komati River) and hill-slope wetlands that flows through from north to south between the two mine blocks. At maximum impact at the end of the life of mine a decrease in discharge of more than 70% is expected for the portion of the stream between the mine blocks. Discharge to the smaller tributaries surrounding the mining blocks will decrease between 10 and 40% towards mine closure. The mining is also expected to have an impact on the surrounding tributaries and hill-slope wetlands in terms of quality. At mine closure a maximum total salt load that can be released into the surrounding tributaries can vary between 22 and 80 kg/day. Fifty years post closure this figure can increase up to a maximum of 1800 kg/day.
Riaan Joubert	– In the meeting I asked if there will be trenches around the mining area or only fences. The answer was that only fences will be used. My concern is the normal runoff water that might be contaminated	Surface runoff contained in the mining area pertains to contaminated water that cannot be returned to the natural river system in its current state. In the event of treatment and release the mine will release the treated water as close to the natural stream affected initially. With clean and dirty water separation the mine will not capture clean water runoff and best practice guidelines are aimed at keeping the dirty water areas as small as possible.

	that will be coming onto my farm. I do understand that the contaminated water will be contained and treated, but the possibility still exists. The other concern I have is that there will be some surface runoff water that will be contained in the mining area and will be discharged at a different point, what will the effect be on my farm if it receives less water of that kind?	
Riaan Joubert	– What will be done if our water supplies run dry or even deteriorate in quality? The Klein Komati River is running through my farm. As there are going to be mining activities upstream to the river I want to know what will happen to the quantity and the quality of water reaching my farm.	It was agreed by Exxaro that in the event that water availability for existing use (quantity and quality) is compromised by the mining operation and this negatively affects surrounding water users, alternative resource will be made available by Exxaro.
Riaan Joubert	– Asked what water will then be used for dust suppression on external roads. – Concerned that pit water would be used in clean stormwater areas.	Pit water will only be used for dust suppression in the mining pit and on haul roads within the dirty water system, while raw water will be used for the on roads outside the dirty water system.
Groundwater		
Koos Pretorius	– Does Groundwater Consulting agree that the wetlands will fall within the cone of depression of the mine?	Yes, some wetlands will be within the cone of depression. It should also be remembered that the simulated cone of depression at maximum impact, is the absolute worst case scenario.
Koos	– Does not understand the	The tributaries and wetlands in the extent of the cone of depression will be affected in terms of discharge

Pretorius	groundwater studies cones of depressions and why it would not affect water supply to the north from the areas between the mine and the wetlands? If the cone of depression is to extend 100 m from the pit – then the wetlands are within that zone?	volume. Groundwater isn't the main component driving discharge to wetlands. The main driver is soil water with some surface run-off also contributing. The groundwater level drawdown will cause a decrease in discharge of 70% to the hill-slope wetlands and the tributary between the two mine blocks. A decrease in discharge of between 10 and 40% is expected in smaller tributaries and hill-slope wetlands in the immediate vicinity of the mining areas.
Koos Pretorius	– Indicated that the carbonaceous material that will be backfilled into the pits will never be covered by the water re-infiltrating into the spoils due to the difference in topography over the site. Hence water covering the material to prevent acid mine drainage is useless.	Under natural conditions, water entering the groundwater system will migrate vertically downwards until a more impervious layer that forms a perched aquifer is encountered. As the perched aquifer did not feature during drilling at the proposed Belfast Project it is likely that the majority of recharge water will migrate downwards into the saturated zone[24]. From there it will migrate in the direction of the hydraulic gradient[25] until it eventually enters surface water bodies (i.e. rivers or springs) from where it will discharge as surface water. Opencast mining will cause major changes in the properties of the aquifers in the positions of the opencast pits. In the open pit position, the structure of the aquifer will be damaged and hydraulic properties will change significantly. The major changes can be summarized as follows: ▪ The active void will have an infinitely high transmissivity and a storage coefficient of 1 and will act as a groundwater sink where it is developed below the depth of the static water level; ▪ The rehabilitated (backfilled) pit will have a transmissivity and storativity at least one to two orders of magnitude higher than the undisturbed aquifer host rock; ▪ Where semi-confined or confined aquifer conditions prevailed before mining, the 'aquifer' in the pit areas will change to unconfined; ▪ Effective recharge to the pit areas will also increase by an order of magnitude; and ▪ The water quality in the pit area will also change dramatically, from very high quality water to saline water. The salinity will be caused by release of saline (especially chloride and sodium) water as well as acid-base reactions as a result of exposure of pyrite-containing carbonaceous material in and around the coal horizon to oxygen and water. These reactions will cause significant deterioration of

[24] The area below ground in which all interconnected openings within the geologic medium are completely filled with water.

[25] The direction of groundwater flow due to changes in the depth of the water table.

		the water quality in the pit areas. The higher recharge rate to the pit areas will cause filling up of the rehabilitated and backfilled voids. The undisturbed surrounding aquifer will not be able to handle the higher recharge rate and the water will build up and flow out at the lowest surface elevation of the pit, resulting in the decanting of water from the pits.
Koos Pretorius	– Is Groundwater Consulting aware of the borehole at the farm of WP Pretorius that is delivering in excess of 20 000 l / hour?	Groundwater Consulting was made aware of such borehole by the hydrocensus personnel. It would have desirable to have seen the water level and quality information of the borehole but access was denied to the property on which the borehole is located.
Koos Pretorius	– Is there any evidence/prediction in the data that will predict such a high yielding borehole?	– There is no such evidence in the site-specific data. – The locality of the borehole to correlate the high reported yield to some geological structure such as fault zone or dyke/sill structure is currently unknown. A few major dykes and other geological structures have been indicated on the 1:250 000 scale geological map and the possibility of higher yield along these structures is always there. The geophysical survey were planned and executed based on these structures but did not intersect significant yields. – Such structures are targeted as potential higher yield areas but there is no scientific way to predict the yield of any borehole with any degree of confidence.
Koos Pretorius	– Looking at the figure the water can only go back till halfway up the hill and all of the water from the top will run down the bottom of the pit towards the south. All of the wetlands extend into the cone of depression at 1000m.	The wetlands within the indicated cone of depression will be affected by a decrease in discharge, but as indicated in the previous point, the main driver of wetland seepage is shallow soil water in the land profile and not groundwater. The effect will thus be limited.
Koos Pretorius	– Noticed that most of the water seeps through the soil, then the berm placed ahead of the mining voids will not be effective.	– *It is kindly requested that Mr. Pretorius clarifies this comment.*
Koos Pretorius	– Requested that a provision to treat the acid mine drainage be quantified and included in the Scoping Report for the full life-	– Water collected in the proposed mine pits should not be allowed to enter the aquatic and wetland ecosystems untreated. This water should be pumped and piped to a water treatment facility or storage dam for treatment before being allowed to be discharged or released into the aquatic ecosystems. – A water treatment plant to treat AMD will be constructed. The type of plant is still to be determined.

	cycle of the acid mine drainage.	
Koos Pretorius	– Stated that the decommissioning and closure phase should be implemented until acid mine drainage is completely eradicated.	At a regional scale, significant catchment development, including industrial growth, widespread mining activities, afforestation, agricultural activities and urbanisation has impacted on the surface water resources within the Komati catchment area. Monitoring is therefore vital in determining changes in water quality. Cumulatively these activities could have significant impacts on rivers and streams which then flow into neighbouring regions, affecting a wide area. The most significant impacts that were identified were for the post closure phase from leachates affecting adjacent streams and decant from filling of the mining blocks. The closure phase therefore needs to be properly managed to prevent adverse effects post closure. The most significant negative impact concerns groundwater. Prior to mitigation it has a high impact rating, but can be mitigated and its rating reduced to medium. Mitigation measures will be implemented to prevent decant from entering the receiving surface water environment and a monitoring program will be in place from the operational phase throughout the life-of-mine until after closure to monitor the occurrence of any adverse groundwater impacts.
Koos Pretorius	– The relevant data used in his calculations – which are site specific measured data and which is generic data?	Only recharge calculations are estimates, all groundwater levels, groundwater qualities and aquifer test data and acid-base-accounting were measured and analysed for the specific project.

Koos Pretorius	– What impact will the water from the adjacent wetlands have on the volume of water received into the pit?	– Little impact expected. It should be noted that the wetland is basically a discharge area or natural retention feature that receives water from the soil profile and shallow groundwater. The seepage rate from the wetlands to the mine is still controlled by the hydraulic properties of especially the weathered zone aquifer. – The hydraulic conductivity of the aquifer host rocks is the main determining factor for the extent of the COD but it also depends directly on the storage coefficient of the rocks and groundwater flow gradients. The hydraulic conductivity (transmissivity) was measured in pumping tests in monitoring boreholes on site. Water levels were measured on site and around to enable calculation of groundwater gradients. – There is no way to calculate the extent of the COD manually. The only way to get a best estimation is by using the numerical model with flow algorithms that take all the parameters like transmissivity, storage coefficient, groundwater gradient, recharge and stresses on the aquifer into account. All the gathered information mentioned above as well as the geology and structural information is therefore incorporated into the numerical model. A steady state model run is firstly conducted to calibrate the model as closely as possible to the natural steady state behaviour of the aquifer. – The proposed mine schedule is then used as well as the varying depth of the coal floor to simulate progressive drawdown of the water level to the bottom elevation of the coal floor. This is achieved by ‘draining’ all water from the aquifer down to the bottom of the coal floor on the same chronological sequence that the mine is planned. – The output of the model is water level or drawdown behaviour over the grid area of the model based on the distribution of flow parameters and stresses applied to the model ‘aquifer’ and simulated mining operation. – We also propose in the document that the model be updated and refined regularly over the life-of-mine as monitoring information and actual measured data accumulate over time.
Koos Pretorius	– What treatment of the water should be done?	– The objective is to treat water so that it is within the accepted standards for the intended use, be it discharge, domestic use, irrigation or whatever. With the problem being salinity and acidity, the only way of treatment currently available is a desalination plant (i.e. reverse osmosis).
Koos Pretorius	– Will there be anything in place to mitigate or treat this decant water.	– The decant water will be treated by a waste water plant. The type of plant is still under investigation.
Nhlanhla Gumede	– Indicated that around Wonderfontein there is a fountain (Wonderfontein) and wanted to know whether it would be affected	It is not anticipated that the Wonderfontein fountain will be affected.

	and what mitigation measures are planned.	
Riaan Joubert	– I also have two boreholes on my farm and various fountains. What will the impact on each of them be specifically, and what will be done if something does happen to them.	The impact is currently regarded as insignificant though continuous monitoring will be undertaken to confirm whether any impacts occur during the life of the project. It was agreed by Exxaro that in the event that water availability for existing use (quantity and quality) is compromised by the mining operation and this negatively affects surrounding water users, alternative resource will be made available by Exxaro.
Riaan Joubert	– Queried what impact mining activities would have on his existing boreholes on site.	
Riaan Joubert	– Queried what would be done if water supply at his farm was impacted upon and ran dry.	
Riaan Joubert	– Stated that the opportunity exists to drill additional boreholes on his property and he queried what effect mining activities would have on these new boreholes.	
Biodiversity		
Carolyn Ahshene-Verdoorn	– The area proposed for mining falls within Birdlife SA's important Bird area SA016 Steenkampsberg and IBA SA 015 Loskop Dam Nature Reserve. This area contains very important wetlands that form part of the Greater Wetland System in Mpumalanga. A number of important bird species occur in the area, including Wattled Crane, Southern Bald Ibis, White-winged	According to Gibbon (2004) 397 bird species were previously recorded within the two grid squares (2529DD and 2530CC) in which the study area is situated. The Mpumalanga Nature Conservation Act lists all of them as protected game, except those 28 species that are regarded as game birds (those that are commonly hunted) or potential pest species. In terms of IUCN Red Data Listing four are listed as critical, one endangered, 13 as vulnerable and 21 near threatened. The Department of Environmental Affairs and Tourism (DEAT)[26] Threatened or Protected Species (TOPS) regulations lists three as endangered, eight as vulnerable and one protected. Both listings (i.e. IUCN and TOPS) are used in this assessment. One of the endangered species, the Whitewinged Flufftail (*Sarothrura ayresii*) is poorly known, secretive birds living in wetland habitat. Its populations have suffered decline due to habitat destruction and degradation. It is, however, believed to be unlikely to be found within the study area, due to the wetlands within the study

[26] Now referred to as the Department of Water and Environmental Affairs (DWEA).

		Flufftail and these species are dependant on the maintenance of a healthy (unpolluted) wetland system.	area not presenting suitable habitat to any of these species (Barnes, 2000). The Wattled Crane (*Grus carunculatus*), which may occur in the study area is classified as vulnerable both in terms of IUCN Red Listing and TOPS regulations. This is due to this bird's small population of an estimated 230 animals, vastly reduced range and the lowest reproductive potential of all crane species. Failure to address loss of wetland habitat on privately owned land will result in further decline and probably regional extinction (Barnes, 2000). The vulnerable Blue Crane (*Anthropoides paradisea*) and Southern Crowned Crane (*Balearica regulorum*) were both recorded during this survey. An interesting record, during this survey, was that of Blue Korhaan (*Eupodotis caerulensis*), classified as near threatened (IUCN, Red Data) and vulnerable in terms of the TOPS regulations. This study site is on the extreme northern edge of this bird's distribution range. The following mitigation measures have been proposed: ▪ Red Data relocation actions of fauna should be implemented during the construction phase and land-clearing phases of the strip mining operations. ▪ Undertake Red data and sensitive species rescue and relocation operations (specifically the Conchostraca, Ostracoda and Copopoda groups in the pans) and reintroduce species once rehabilitation has taken place. ▪ Dam spills and introduction of exotic fish species should be prevented at all costs and if found, exotic species should be destroyed immediately. ▪ All breeding, spawning, nesting sites and critical life-stage habitats within the project area must be identified and protected from any negative impacts as a result of the project where possible. Any impacts must be rectified by rehabilitation of the altered or lost habitat in critical areas of the aquatic and wetland ecosystems. Rescue and relocate birds in similar habitats with active nests, owls (juveniles), moulting birds, etc. ▪ Limit of cattle from entering rivers and wetlands in the project area, and mitigate and manage local cattle impacts on erosion.
Koos Pretorius	–	Raised a concern regarding the biodiversity investigations as these should be conducted over a 12 month period to ensure completeness.	Dry and wet season terrestrial ecological baseline assessments, including a desktop study were conducted. Literature and other widely accepted resources were interrogated to determine fauna and flora that were previously recorded or that may potentially occur within the study area.
Koos Pretorius	–	Requested the EMF and C-Plan be used in the specialist studies.	These studies were considered.

Air Quality		
Bernard Green	– Wanted to know what effects the dust will have on vineyards, and animals, particularly chickens.	Limited reference data exists on the impacts of particulates on plants and animals. Most of the studies done on the effects of particulate matter on animals, particularly cattle, have concurred that the main impact of dusty environments is causing animal stress which is detrimental to their health. However, no threshold levels exist to indicate at what levels the negative effects begin to occur.
E.Bolt	– Asked to what extent Belfast would be affected by the fallout.	The predominant wind direction is from the north-west and will not blow emissions and particles towards Belfast. The impact is regarded as insignificant.
E.Bolt	– Wanted to know if the strength of the wind had been considered and what parameters were used to calculate the distance the dust would be transported.	Wind strength is one of the many parameters considered.
Kleinbooi M Mahlanga	– Wants to make sure that the sensitive receptors are communicated with regarding the PM10.	The air quality impact assessment indicates that the predicted dust fallout levels with and without measures are below the SANS residential target of 600 mg/m²/day. The main objective for the mine, as stated in the impact study, will be to ensure that monitored dust fallout levels at the sensitive receptor areas do not exceed the SANS residential target and that mitigation measures should be applied to further reduce dust impacts and ensure compliance with this target. The predicted mitigated PM10 concentrations (due to the Belfast Mine) at the closest sensitive receptors to the mine range from 33 µg/m³ to 74 µg/m³. This is within the current ambient daily SA Air Quality standards of 120 µg/m³ as well as the proposed daily SA standards of 75 µg/m³. Mitigation measures should thus be applied in cases where the ambient SA standards are exceeded to ensure that the PM10 ground level concentrations are within the SA PM10 Standards at all the sensitive receptors areas.
Koos Pretorius	– Concerned about blasting fumes and the effect on his family's health and on his cherry production.	Explosives currently used are required to be oxygen balanced. The creation of poisonous fumes such as nitrous oxides and carbon monoxide are particular undesirable. These fumes present themselves as red brown cloud after the blast detonated. It has been reported that 10 to 20 ppm has been mildly irritating. Exposure to 150 ppm or more (no time period given) has been reported to cause death from pulmonary edema. It has been predicted that 50% lethality would occur following exposure to 174 ppm for 1 hour. Anybody exposed must be taken to hospital for proper treatment. Factors contributing to undesirable fumes are typically: poor quality control on explosive manufacture, damage to explosive, lack of confinement, insufficient charge diameter, excessive sleep time, and specific types of ground can also contribute to fumes.

		Measures for the management of the anticipated impacts are included in the Environmental Management Plan.
Koos Pretorius	– Queried how many litres/m^2/hour will result in achieving the stipulated 75% control efficiency proposed in the mitigation.	The rate required to achieve the stipulated 75% control efficiency is 0.069l/m^2/hour (based on the assumption of 8 trucks/hour).
Koos Pretorius	– Raised the issue that Dust-A-Side is not an efficient form of dust suppression.	Exxaro will have a contractor on site maintaining the road with DAS on a daily basis. When DAS is appointed, a contractor will be used to monitor the application and effectiveness of the suppression in line with specific contract conditions.
Koos Pretorius	– Requested a copy of the Standard Operating Procedures for the use of Dust-A-Side.	To be supplied to Mr. Pretorius
Riaan Joubert	– According to your slide show/impact assessment findings dust will still be a problem to the people staying close by, even after mitigation measures will be put in place. What are the plans with people and animals residing in the dust area, especially the PM10 area?	The air quality impact assessment indicates that the predicted dust fallout levels with and without measures are below the SANS residential target of 600 mg/m^2/day. The main objective for the mine, as stated in the impact study, will be to ensure that monitored dust fallout levels at the sensitive receptor areas do not exceed the SANS residential target and that mitigation measures should be applied to further reduce dust impacts and ensure compliance with this target. The predicted mitigated PM10 concentrations (due to the Belfast Mine) at the closest sensitive receptors to the mine range from 33 µg/m^3 to 74 µg/m^3. This is within the current ambient daily SA Air Quality standards of 120 µg/m^3 as well as the proposed daily SA standards of 75 µg/m^3. Mitigation measures should thus be applied in cases where the ambient SA standards are exceeded to ensure that the PM10 ground level concentrations are within the SA PM10 Standards at all the sensitive receptors areas.
Riaan Joubert	– Clean air. According to the scoping report we are situated within the PM10 region, even after mitigation, as founded in specialist report. What will be done if any person or animal do get sick as a result from the mining activities.	Mitigation measures should be applied as soon as the mining operations commence in order to reduce cumulative impacts due to background pollution levels and mining impacts.
Riaan Joubert	– Concerned about the potential burning of coal stockpiles and the	Indicated that the dump will be compacted and monitored. If it is compacted it will not burn. There will be fly-overs with infrared cameras to monitor the temperature in the dump. There will be procedures in place in case

	co-disposal dump. – Queried what would be done to prevent discard dump burning and the odours associated therewith.	the dump does burn.
Riaan Joubert	– Queried what would be done if people or animals became ill as a result of PM10 as he is in the directly affected zone even after mitigation. – Queried what effect the mitigation measures for dust fallout and PM10 would have on him and his farm workers specifically.	The air quality impact assessment indicates that the predicted dust fallout levels with and without measures are below the SANS residential target of 600 mg/m²/day. The main objective for the mine, as stated in the impact study, will be to ensure that monitored dust fallout levels at the sensitive receptor areas do not exceed the SANS residential target and that mitigation measures should be applied to further reduce dust impacts and ensure compliance with this target. The predicted mitigated PM10 concentrations (due to the Belfast Mine) at the closest sensitive receptors to the mine range from 33 µg/m³ to 74 µg/m³. This is within the current ambient daily SA Air Quality standards of 120 µg/m³ as well as the proposed daily SA standards of 75 µg/m³. Mitigation measures should thus be applied in cases where the ambient SA standards are exceeded to ensure that the PM10 ground level concentrations are within the SA PM10 Standards at all the sensitive receptors areas.
Riaan Joubert	– Wanted to know what would happen to these receptors living within the areas of PM10 influence. – Queried what the mitigation plans regarding PM10 and dust fallout for people outside the mine boundary were.	– Dust and emissions management through: ○ Dust suppression by water and Dust-A-side; ○ Windbreaks; ○ Re-vegetation; ○ Reducing material drop height; ○ Enclosing the transfer point; ○ Dust monitoring at sensitive receptors.
Riaan Joubert	– What will be done regarding the smell? Since your activities are only +-300m away from our home and with discard and coal stockpiles that might start burning. In the meeting I was told that there will be fly-overs with infra red cameras which will indicate heating up of stockpiles, as well as proper compaction. I am still	– There are various mitigation measures for the spontaneous combustion of coal and these include: ○ Avoidance of particle segregation as segregation encourages air introduction. ○ Proper pile compaction as this will reduce air movement within the pile. ○ Proper pile height. For short –term storage without compaction, a maximum pile height of about 8 metres is recommended. ○ Sealing the pile with pile sealers and encrusting agents to minimise air ingress and movement within the pile. ○ Storage site should be free of debris including combustible materials such as timber ○ A solid pile base without uncompacted material is critical to prevent air infiltration. ○ Coals of different ranks and propensities should not be stacked together.

	concerned about what will be done, even if the chances are very slim, if the stockpiles or any other flammable material do start to burn?	○ Differently sized coals should not be stacked together unless fines content is sufficient to fill void spaces. ○ Shielding from the wind as a greater pile slope creates greater wind resistance, forcing air into the pile. Shielding the windward side of the pile will minimise air movement through the pile as spontaneous combustion typically occurs on the windward side of the pile. ○ Reducing initial coal temperature as higher initial coal temperatures reduce the amount of time required to reach critical temperatures where spontaneous combustion rapidly accelerates. It is not recommended to store coal above 35°C without compaction and a pile sealer. ○ Correct stockpile formation and maintenance practices can largely eliminate the potential for spontaneous combustion during storage. ○ However, if spontaneous combustion does occur even with the application of the above-mentioned mitigation measures, fire fighting measures that can be implemented include the use of the following: ○ Water can be effective at fighting coal fires. However, water alone is not recommended. The surface tension of water does not allow it to penetrate deep below the coal's surface and reach the fire unless large quantities are injected. ○ Wetting agents as these allow water to penetrate the material by reducing the surface tension of the water. They extinguish by cooling. ○ Micelle-encapsulating agents- these agents, when used with water, are the extinguishing media of choice for coal fires and for flammable liquids fires. They suppress fires by interrupting the free radical chain reaction of the fire tetrahedron. ○ Other agents such as CO_2 and N_2 have been tried as fire-suppression agents but have not proven effective. Reasons include their poor cooling ○ capacity and their general inability to maintain proper concentration levels in bunkers and silos. Accordingly, these agents require extended use —for hours or even days—depending on the quantity of the coal burning and the complexity of the fire. Independent testing has shown that the effectiveness of gases is a function of fuel geometry, the stage of the fire, the tightness of the enclosure and the duration of application – For spontaneous combustion within the mining area, the most effective form of control is by covering the area with soil so as to smother the combustion source.
Noise		
D.G. Hepworth	– Concerned about peak noise such as reverse hooters.	All vehicles will be fitted with appropriate sound suppression devices or silencers. At the maximum potential output of the mine and its crusher infrastructure, 3.0Mtpa, the hourly transport requirement for 1.5Mtpa to each of the two rail terminal destinations at Belfast and Pullenshope is assumed to be 10 collections,

		amounting to 20 vehicle movements per hour, daytime only, per 16 hour day, 365 days per year. The predicted noise levels generated by this truck activity alone meets the daytime criterion of 45 dB(A) at 55m from the proposed road extension eastwards to the R33 and the Belfast rail terminal, or from the transport route westwards to the Pullenshope rail terminal.
Koos Pretorius	– Indicated that noise travelled far in adverse weather conditions and that he will be able to hear the noise of the proposed operation.	The phase 1 crusher plant and the phase 2 washing plant are above ground with a predicted noise level of 79.4 dB(A) at 15m. The investigation shows that the proposed equipment will not have a significant impact on the noise climate of the nearest dwellings. In the worst case, with no mitigating measures, the predicted noise emission of the exposed crusher plant turns out to be virtually identical with the screened combined activity in the pit. The impact will therefore also be identical with the above pit situation and will therefore be NONE during daytime beyond a distance of 600m (1900m at night) and LOW at 330m (1050m at night) from the crusher plant alone or the active pit. These values represent the change of community response and reflect the distance from the plant/pit at which these responses can be expected to occur. For the opencast situation, the values represent the worst case, where equipment is always assumed to be located at the nearest point to the boundary within the pit. This will only happen while the pit is being excavated in that position, and this worst case noise level will therefore only be applicable close to this position for a short period while this is the case. As the excavations progress, different areas will be affected by this worst case noise level, and other areas will be exposed to lower levels of noise as extraction progresses to a more remote location, and deeper. Where continuously operating machinery is permanently installed at the same location on the surface, such as the crusher plant, the noise levels are fixed for the life of the mine, and therefore dominate the noise climate at these site boundaries. For the noisiest opencast operations, these are thus generating a noise impact varying from ‘LOW’ to ‘NONE’ at the prediction location, depending on their proximity to this location and the extent of the local noise shielding provided by the pit sides, positioning of temporary stockpiles, and local ground contours, all of which mitigate the noise impact to a greater or lesser extent. At the maximum potential output of the mine and its crusher infrastructure, 3.0Mtpa, the hourly transport requirement for 1.5Mtpa to each of the two rail terminal destinations at Belfast and Pullenshope is assumed to be 10 collections, amounting to 20 vehicle movements per hour, daytime only, per 16 hour day, 365 days per year. The predicted noise levels generated by this truck activity alone meets the daytime criterion of 45 dB(A) at 55m from the proposed road extension eastwards to the R33 and the Belfast rail terminal, or from the transport route westwards to the Pullenshope rail terminal.

Koos Pretorius	– Wanted to be consulted with regards to noise impacts.	Comment noted.
Riaan Joubert	– According to your Specialist Investigation Feedback Meeting the noise levels will have an impact in the region between 330m and 1900m depending on the time of day. As we are staying within those regions from the phase one crusher plant and the phase two crushing, screening and washing plant, we will be impacted on. What will be done to stop or reduce noise and what measures can I take if it dose indeed go beyond the predicted levels?	– The following comments assume 24 hour working of the mine and crushing/screening plant. If there is no mining and/or operation of the crushing/screening plant and/or loading and export transportation of the product from the mine, during the nighttime period (22:00-0600), then the situation is of course significantly better, as any nighttime noise is loaded in the assessment by 10dB. – If this is correct and the farm is within ±300m from the primary noise source, say, the phase 1 crushing/screening plant, then the daytime noise level impact will be LOW, but the nighttime impact will be HIGH to VERY HIGH, if the sources are on the boundary, which is of course the worst case as that would be the closest possible to the farm. – It should be possible to place, by design, the crusher and/or other noisy machinery as far from an occupied dwelling as possible. It may also be wise to consider at the design stage to put up temporary or even permanent berms around these items between the noisy items and the dwelling, to form a noise barrier, and there is usually plenty of material on such an opencast mine to do this. If this is feasible they should be high enough to prevent direct line of sight to the noisy unit. This may also help with the visual aspect. This principle also applies to the internal mine haul roads, the transport truck loading area and the export transport routes. – Depending on the terrain and transport (conveyor and trucks) it may be possible to locate the crusher at or even below ground level, which also provides significant noise attenuation.
Riaan Joubert	– Queried what will be done to mitigate noise on his farm as he stays very nearby to the proposed plant site.	– Noise management through: ○ All machinery used will be maintained in sound mechanical condition; ○ All vehicles will be fitted with appropriate sound suppression devices or silencers; ○ Monitor noise levels within mine site and at selected points outside the mining right area; ○ Crushing plant situated in mining pits where pit walls will act as a noise buffer.
Vehicle Activity		
Koos Pretorius	– Asked where the coal would be transported to and what the routes would be.	Export coal will be transported along the Eerstelingsfontein Road, past the Onverwacht Colliery, and along the D1110 to the N4 at Wonderfontein. The Eskom coal will be transported along the R33 to the Belfast siding. Exxaro is proposing to build a new road new road from the D1110 to the R33.
Michael Yorke-Hart	– A traffic impact assessment undertaken for the project and must be considered when developing the EMP.	The following possible risks are identified: – Right turning movements on the N4 resulting in reduced capacity together with a reduction in road safety standards. – Crossing of the N11 at a staggered intersection also resulting in reduced capacity together with a

Michael Yorke-Hart	– Indicated that one mine may not have much impact on regional traffic loading, but increasing numbers of vehicles can become problematic.	reduction in road safety standards. As a condition of the approval it is recommended that: – Traffic counts should be held. – A comprehensive traffic study should be conducted after receipt of the counts. – Consideration should be given to providing a direct link between Road 1110 and Road 383 and by so doing eliminating coal traffic from making use of the N4 Toll Road.
Michael Yorke-Hart	– Queried how the transportation of coal would be undertaken.	Export coal will be transported along the Eerstelingsfontein Road, past the Onverwacht Colliery, and along the D1110 to the N4 at Wonderfontein. The Eskom coal will be transported along the R33 to the Belfast siding. Exxaro is proposing to build a new road new road from the D1110 to the R33.
Michael Yorke-Hart	– Queried whether any N4 crossings were being investigated.	As a condition of the approval it is recommended that: – Consideration should be given to providing a direct link between Road 1110 and Road 383 and by so doing eliminating coal traffic from making use of the N4 Toll Road.
Michael Yorke-Hart	– Queried whether the traffic impact assessment had taken into account the impact of bulk transportation by super-loads and abnormal loads for the construction and operational phases, and indicated that super-loads require structural analysis of the roads proposed for use.	As a condition of the approval it is recommended that: – Traffic counts should be held. – A comprehensive traffic study should be conducted after receipt of the counts.
Michael Yorke-Hart	– Queried whether transportation by railway would make use of the railway siding north of the N4.	As a condition of the approval it is recommended that: – Consideration should be given to providing a direct link between Road 1110 and Road 383 and by so doing eliminating coal traffic from making use of the N4 Toll Road.
Michael Yorke-Hart	– Stated that the increasing issue around the cumulative impacts of transportation in the region should be factored into the EIA / EMP. The cumulative impact of coal transportation of numerous operations should be assessed	As a condition of the approval it is recommended that: – Traffic counts should be held. – A comprehensive traffic study should be conducted after receipt of the counts.

	from a traffic loading perspective.	
Riaan Joubert	– Concern raised about the transportation of coal and the routes proposed.	The following possible risks are identified: – Right turning movements on the N4 resulting in reduced capacity together with a reduction in road safety standards. – Crossing of the N11 at a staggered intersection also resulting in reduced capacity together with a reduction in road safety standards. As a condition of the approval it is recommended that: – Traffic counts should be held. – A comprehensive traffic study should be conducted after receipt of the counts. – Consideration should be given to providing a direct link between Road 1110 and Road 383 and by so doing eliminating coal traffic from making use of the N4 Toll Road.
Riaan Joubert	– In the previous public participation meeting that was held on 4 of August 2009, the coal was to be transported by railway up to the northern side which seems not to be the case anymore, if it was transported up to the northern side it would have had a lesser impact on our farm and ourselves.	Export coal will be transported along the Eerstelingsfontein Road, past the Onverwacht Colliery, and along the D1110 to the N4 at Wonderfontein. The Eskom coal will be transported along the R33 to the Belfast siding. Exxaro is proposing to build a new road new road from the D1110 to the R33. The following possible risks are identified: – Right turning movements on the N4 resulting in reduced capacity together with a reduction in road safety standards. – Crossing of the N11 at a staggered intersection also resulting in reduced capacity together with a reduction in road safety standards. As a condition of the approval it is recommended that: – Traffic counts should be held. – A comprehensive traffic study should be conducted after receipt of the counts. – Consideration should be given to providing a direct link between Road 1110 and Road 383 and by so doing eliminating coal traffic from making use of the N4 Toll Road.
Socio-Economic		
D.G. Hepworth	– Concerned that there is talking of socio economic impact, yet there is mention that it was not possible to get the fine detail. This is	A Social Impact Assessment was undertaken for the proposed Belfast Project and, based on the project description, the social based line study and analysis of data gathered, the following impacts were identified and assessed: ▪ Increase in Small, Medium and Micro Enterprise (SMME) opportunities;

	serious as the mine will affect many people and their livelihood.	▪ Job creation and income potential; ▪ Socio-economic impact; ▪ Access across site; ▪ Creation of expectations; ▪ Disturbance of cultural, spiritual and religious sites; ▪ Health; ▪ Increase in accidents; ▪ Increase in noise and vibration levels; ▪ Increased crime; ▪ Informal development and settlements; ▪ Infrastructure; ▪ Loss of employment after construction; ▪ Resettlement of displaced households; ▪ Risk of sexually transmitted diseases, HIV and AIDS; ▪ Social vulnerability; ▪ Visual impact and disturbance of sense of place; and ▪ 'Do nothing' alternative. With regard to these impacts it was found that the most critical are: ▪ Resettlement of households currently living on the land identified for mining; ▪ Health issues related to air and particularly water quality; and However, all of these impacts are limited and could be mitigated to acceptable levels. The 'do nothing' option on the other hand could eventually result in a shortage of coal needed for the coal fired power stations in the area, which in turn, may place the security of a stable electricity supply at risk, on a national level. Although, if the project does not proceed there would be a loss of job creation and the socio-economic benefit brought about through mining in the area, this could probably be balanced against the economic value that could be derived from agriculture in the area. The positive side of the 'do nothing' option is that the threat to water security, brought about through the project, would be reduced. This option must be considered against the threat that not proceeding would create in respect of the national electricity supply and the possibility of addressing the water issue through installation of a water purification plant. It was also established that although the project is likely to have some positive effect in respect of increased

		opportunities for SMMEs, job creation, income potential and socio-economic contribution in the area, these impacts are unlikely to be greatly significant.
Koos Pretorius	– Raised the concern over the acceptance of the Social and Labour Plan (SLP) by the DME and the public consultation undertaken during the compilation of the SLP.	– Comment noted. – The EAP was not involved in the Social and Labour Plan as this is part of the mining right application. – The applicant met with representatives of the local municipality as well as the ward councillors for the purpose of the SLP.
Koos Pretorius	– Requested that a full Census of the study area be undertaken.	Available census data was considered to be suitable for the purposes of the Environmental Impact Assessment.
Koos Pretorius	– Requested that the SLP be generated with input from the communities living in the area and not only with input from the local municipality.	The SLP is developed with the local municipality who represents the community in this regard.
Koos Pretorius	– Concerned about what will happen to the people currently living in the area and to their jobs and livelihoods.	*It is kindly requested that Mr. Pretorius clarifies this comment.*
Riaan Joubert	– Queried the extent of relocation (i.e. who, what, where and when).	Exxaro is currently in the process of obtaining valuations on certain of the properties and have requested that the valuer includes the approximate number of people living on these properties, this will give an indication of who resides on these properties but will not be that accurate. It does also not include the total affected area. Once the final Specialist studies have been completed we will be in a better position to draw up a scope of work for a RAP study to be done. Exxaro does not have a register of people facing relocation except for the properties that we have recently purchased.
Riaan Joubert	– The value of the property might decrease, our dairy production might decrease because of the noise, dust etc. What will the effects be and what will be the mitigation on that? – Queried what effects property	This is an issue outside of the SIA and needs to be addressed by an independent property evaluator. It is a highly specialised field that needs to take all sorts of issues into account.

	price declines would have on him and what mitigation measures would be put ion place to address this.	
Riaan Joubert	– Our current living environment for ourselves as well as for our employees will change dramatically. What will the mitigation measures be on this issue for us specifically?	This is a rather broad question, what is meant by the "living environment" and in respect of what will it change? Is it sense of place as that really encapsulates the living environment? If so the mitigation, measures are indicated in the SIA report as: – Mitigation objective: To limit the negative visual effects and the disturbance on the sense of place that the project may have on the environment. – Mitigation measures: ○ Consult with affected communities in an effort to identify and address issues relating to the sense of place. ○ Follow the mitigation measures suggested in the visual impact report. – It, however, probably entails much more than sense of place and the I&AP would need to refer to that part of the report that covers the "living environment" they have in mind when posing the question and that probably will be found in various specialist reports such as Noise & Vibration, Economic, Visual etc.
Riaan Joubert	– Queried whether he would still be able to farm in the current manner or whether he would need to change his farming methods.	It is not anticipated that farming methods will need to change.
Bernard Green	– Raised the concern that the SLP was not made available for public review.	The SLP is a confidential document that is subject to internal processes by the DMR and was not usually made available to the public for review by the DMR.
Fenter Kumalo	– Requested that the second phase of the project must consider local SMME's represented by organised business. – Requested that there must be a detailed database establishment process to avoid disgruntled SMME's and a confirmation of mine recognition of the SLP and	It was also established that although the project is likely to have some positive effect in respect of increased opportunities for SMMEs, job creation, income potential and socio-economic contribution in the area, these impacts are unlikely to be greatly significant. These comment will however be considered.

	enterprise development, particularly in the phase 2 of the project.	
Jonny Skosana	– Glad because the community is going to get jobs. Believes that the project is going to improve the standard of Belfast.	
Jonny Skosana	– Requested that local people should be considered first for employment opportunities.	
Koos Pretorius	– Raised the concern over the acceptance of the SLP by the DMR and the public consultation undertaken during the compilation of the SLP.	Stated that the SLP would be assessed by DMR and any feedback from the socio-economic impact assessment would be incorporated into the SLP together with any additional studies required by the DME until such time as the DMR was satisfied with the content of the document and accepted it as complete.
Nhlanhla Gumede	– Glad that Exxaro is initiating the project.	Comment noted
Phillemon Sidane	– The need for people to have jobs, food security in a sustainable manner cannot be over-emphasized. – Stated that it was essential that for the project to be sustainable, SMMEs and the local community have to benefit from the project in terms of direct and indirect employment opportunities.	It was also established that although the project is likely to have some positive effect in respect of increased opportunities for SMMEs, job creation, income potential and socio-economic contribution in the area, these impacts are unlikely to be greatly significant. These comment will however be considered.
Phillemon Sidane	– Requested that the socio-economic impacts associated with the project be adequately determined and addressed in the EIA.	A Social Impact Assessment was undertaken for the proposed Belfast Project and, based on the project description, the social based line study and analysis of data gathered, the following impacts were identified and assessed: ▪ Increase in Small, Medium and Micro Enterprise (SMME) opportunities; ▪ Job creation and income potential;

- Socio-economic impact;
- Access across site;
- Creation of expectations;
- Disturbance of cultural, spiritual and religious sites;
- Health;
- Increase in accidents;
- Increase in noise and vibration levels;
- Increased crime;
- Informal development and settlements;
- Infrastructure;
- Loss of employment after construction;
- Resettlement of displaced households;
- Risk of sexually transmitted diseases, HIV and AIDS;
- Social vulnerability;
- Visual impact and disturbance of sense of place; and
- 'Do nothing' alternative.

With regard to these impacts it was found that the most critical are:

- Resettlement of households currently living on the land identified for mining;
- Health issues related to air and particularly water quality; and

However, all of these impacts are limited and could be mitigated to acceptable levels. The 'do nothing' option on the other hand could eventually result in a shortage of coal needed for the coal fired power stations in the area, which in turn, may place the security of a stable electricity supply at risk, on a national level. Although, if the project does not proceed there would be a loss of job creation and the socio-economic benefit brought about through mining in the area, this could probably be balanced against the economic value that could be derived from agriculture in the area. The positive side of the 'do nothing' option is that the threat to water security, brought about through the project, would be reduced. This option must be considered against the threat that not proceeding would create in respect of the national electricity supply and the possibility of addressing the water issue through installation of a water purification plant.

It was also established that although the project is likely to have some positive effect in respect of increased opportunities for SMMEs, job creation, income potential and socio-economic contribution in the area, these

		impacts are unlikely to be greatly significant.
Blasting and Vibration		
Koos Pretorius	– Mentioned that there were dolomite intrusions in the area and that these would impact blasting.	Specialists will drill holes prior to mining and undertake test blasts. If dolerite intrusions are found they will be handled accordingly.
Koos Pretorius	– Concerned about the effects of blasting and vibrations on structures in the area.	Results from the evaluation presented in this report will show that influence will be experienced at the surrounding privately owned farms. This influence will however vary in intensity and the structures situated within the 500m boundary from mining area are the most significant influenced. Levels of ground vibration beyond 500m will be within acceptable levels with low probability of damage being induced to structures.
Koos Pretorius	– Wanted to know what standards are being used for dust monitoring, blasting and vibrations and whether these standards are applicable to the types of dwelling found in the area.	– United States Bureau of Mines (USBM) standards. – The USBM criteria make use of a frequency span between 1 and 100 Hz. It is accepted that structures with natural frequencies in this same range can also be applied under the criteria given by the USBM. The limits given by the USBM criteria are limits whereby cosmetic damage could be induced at specific frequencies. We at BM&C normally take the limit lines as fix and fast – do not cross – reason protection of the neighbour and the mine. Project and investigation results considered by the USBM project team included work done in America, Canadian, British, Germany, and Sweden. Structures directly mentioned is Interior Drywall / Gypsum board structures (normally wood framed – American style), Brick and masonry structures, Concrete and Brick structures, Masonry and concrete block walls (also found in American style houses as the basement). The USBM does not mention mud houses that are associated with typical rural building style in South Africa. The nearest reference is a study done in India where a house with mud plastered walls were part of the study. Ground vibration levels investigated suggested that a level of 10mm/s can be used for the spectrum of low to high frequencies of ground vibration.
Riaan Joubert	– Queried the effect of ground vibration on his existing boreholes.	– When ground vibrations are lower to than the set limits there should not be any influence on the structures. Limits will need to fixed specifically with regards to the type and condition of structures in this area. – The mine must provide the results recorded to the party where monitoring is done or to the community for that matter. The fact that this property owner does not see results is not good and must be avoided. The property owner can ask the mine for the results or even go to DMR and request that this be investigated why he does not receive any results with a seismograph on his property. I believe Exxaro will consider carefully not stepping into same format of withholding information. – An active monitoring process should be in place with sharing or the results. Yes it can happen that a result is greater than the specified level. In this case the mine must be notified of this as soon as possible

		and the reason for this investigated and remedial action put in place not to have a repeat. Each mine that do blasting must have records of there blasting. Dates and times can be correlated to actual events recorded on the seismographs. In some cases our reports reflect the blasting information with the resulting ground vibration and air blast events recorded at a specific point. – As long as levels are within recommended limits, repetition will not cause damage. As an example: how many mining offices in closer proximity to blasting than public houses and exposed to higher levels of ground vibration and still standing after years of blasting done? However the human perception must be taken into account and blasting mitigated around this perception. The best mitigation is to do it right from start onwards, steer away from processes that could lead to complaints from neighbours.
Bernard Green	– Queried whether any investigations had been undertaken in Belfast regarding the effects of the blasting in the area.	A Ground Vibration and Air Blast Study has been undertaken,
Koos Pretorius	– What will be the impact of weather on blasting?	Thunder has influence on the process: When thunder is to close blasting operations must be stopped and people removed from the bench for their own safety, Rain can cause problems with certain initiation systems, however blasting in the rain will minimise dust, blasting in the rain is uncomfortable and have secondary effects towards the surrounding receptors, rain also makes charging difficult as blast holes are filled with water, rain also makes travelling difficult, wind will create dust that is unpleasant for the blasting teams but work can be done, for obvious reasons work will need to be stopped if it is hailing. All in all weather will have some influence on the actual blast preparation and execution process but in most cases the process can be continued.
Koos Pretorius	– Whether a structural and photographic survey was done of all structures?	This will be undertaken prior to the initiation of the project and is included a a management measure.
Koos Pretorius	– What amounts of dust will be generated by the blasting on a per blast basis?	This value is difficult to determine as it is very dependant on different variables such as season, blast type, geology, weather and charge mass.
Michael Yorke-Hart	– Raised the concern about the proximity of blasting operations to the N4.	Mining activities will only reach the N4 towards the end of the life of the mine (approximately in 25 years). No mining will take place within 400m of the N4. There will be warnings in place to warn motorists of potential blasting.

Visual		
Koos Pretorius	– Indicated that he was not consulted about the visual impacts from his property.	A specialist study is required to assess the visual impacts arising from the proposed NBC Belfast Project. Based on the general requirements for a comprehensive Visual Impact Assessment (VIA), the following scope of work had been established: – Site Visit: A field survey will be undertaken and the study area scrutinized to the extent that the receiving environment could be documented and adequately described. – Description of the Landscape Character: The landscape character will be determined by aerial photographic interpretation as well as a field survey. – Description of the Scenic Value of the Landscape: The scenic value (beauty) of the landscape will be determined as a measurement of the union of ecological integrity (overall health of the landscape) and aesthetic appeal. Aesthetic appeal will be described using contemporary research in perceptual psychology and the opinion of the specialist as the basis for determining the scenic value of the landscape. – Description of the Sense of Place: The sense of place of the study area will be evaluated as to the uniqueness and distinctiveness of the landscape. The primary informants of these qualities are the spatial form, character and the natural landscape together with the cultural transformations and traditional associated with the historic and current use of the land of the study area. – Determine Visual Intrusion: Photographs taken from key viewing areas (adjacent landowner properties) will be digitally manipulated to simulate the physical presence and nature of the visual intrusion of the proposed project components. It is anticipated that five simulations may be required. – Determine Visibility and Visual Exposure: Visibility (from where can the development be seen) is determined by conducting a viewshed analysis. A semi-quantitative digital terrain model (DTM) which consists of features that normally occur on 1 : 50 000 topographical maps, such as roads and settlements, will be “draped” over contours (derived from 1 : 50 000 maps) to generate an analysis that determines all potential observation sites (the viewshed) from which a project component would be visible. Visual exposure is determined by the relative distance of the viewer from the proposed component. – Determine the Impact on the Visual Environment and the Sense of Place of the Study Area: Using visual intrusion, visibility and visual exposure criteria, along with criteria that determine the sense of place, the magnitude of the impact on the visual environment and sense of place will be predicted. The significance of the impact will then be qualified in terms of sensitivity (landscape and visual receptors), extent, duration and probability of the impact. The cumulative impact of visual impacts of the operational activities will also be identified and rated.

		– Mitigation Measures: Mitigation measures to reduce the visual impact and the impact on the sense of place will be proposed for all three phases of the project. A simulation of the proposed measures will be produced to determine the effectiveness of the proposed mitigation action. This assessment is included in the overall Environmental Impact Assessment and public consultation with regard to the visual impact of the operation is undertaken as part of the formalised public Participation process.
Koos Pretorius	– Indicated that no amount of mitigation measures would reduce the visual impact as seen from his property.	It was determined that the intensity of the visual impact of the proposed NBC Belfast Project would be MODERATE to HIGH and that the significance of this impact would be MODERATE to HIGH NEGATIVE. With successful mitigating measures the visibility of the mining activities can be reduced.
Riaan Joubert	– Concern raised about the visual impact mining may have on his property specifically due to it location near to the plant area.	– Mr. Riaan Joubert's farmstead is located just outside the mine boundary and is directly next to the proposed Phase 1: Crushing and Screening Plant. As reported in the Visual Impact Assessment Report the residential areas that directly surround the mining activities are considered sensitive viewers. It was also indicated in the Viewshed analysis (Figure 12) that the visibility of the mining activities will be high for viewers within 0 – 1.0km from the mining activities. It can thus be said that Mr. Riaan Joubert is considered to be a sensitive viewer and that the visibility of the mining activities could be highly visible which can lead to a high visual impact. This however depends on the direction in which the farmstead is facing with respect to important views from the front of the house. Specific mitigation measures can only be determined once the main view direction from the house is established. – If the farmstead is facing towards the west, southwest and south there is little that can be done to screen the proposed plant and mining activities one hundred percent. By implementing the correct mitigation measures the plant and mining activities can however be partially screened. If the property is facing towards the east the mining activities will be at the back of the viewers and the viewers will have a lovely view of the grasslands. If the farmstead is facing towards the north the viewers will have a partial view of the plant area and a view of the open cast mining area. This view can however be mitigated and screened by implementing the correct mitigation measures. – It is suggested that, depending in which direction the farmstead is facing, a vegetated berm be constructed at the boundary of the proposed property/ farmstead. The berms would be plantation or indigenous trees such as *Rhus lancea* or some other 'evergreen' trees/shrubs that will be high and dense enough to screen the view.

Safety		
Riaan Joubert	– We are staying ±300 m away from where all the mining, crushing and washing plant activities will be. Safety is a big concern for us as there will be lots of people in the surrounding area.	– No staff will be housed on site.
Mine closure		
Koos Pretorius	– Requested that a provision to treat the acid mine drainage be quantified and included in the EMPR for the full life-cycle of the acid mine drainage.	At a regional scale, significant catchment development, including industrial growth, widespread mining activities, afforestation, agricultural activities and urbanisation has impacted on the surface water resources within the Komati catchment area. Monitoring is therefore vital in determining changes in water quality. Cumulatively these activities could have significant impacts on rivers and streams which then flow into neighbouring regions, affecting a wide area. The most significant impacts that were identified were for the post closure phase from leachates affecting adjacent streams and decant from filling of the mining blocks. The closure phase therefore needs to be properly managed to prevent adverse effects post closure. The most significant negative impact concerns groundwater. Prior to mitigation it has a high impact rating, but can be mitigated and its rating reduced to medium. Mitigation measures will be implemented to prevent decant from entering the receiving surface water environment and a monitoring program will be in place from the operational phase throughout the life-of-mine until after closure to monitor the occurrence of any adverse groundwater impacts.
Koos Pretorius	– Stated that the decommissioning and closure phase should be implemented until acid mine drainage is completely eradicated.	A treatment plant will be built to treat acid mine drainage for the duration of the impact.
Koos Pretorius	– Concerned that the mitigation measures would not work.	The Environmental Management Plan is a live document and the effectiveness of the any mitigation measures is audited internally and independently. If it is determined that the mitigation measures prescribed is not effective to mitigate an impact to an acceptable standard additional / alternative measures must be implemented.
Koos Pretorius	– Concerned about what would happen to the decant water.	During the post-closure phase a desalination plant with a capacity of 7 900 m^3/d will be required to prevent water in the pit from decanting into the river.
Koos	– Queried whether a water	Yes, water reclamation is part of the closure cost and subsequently part of the financial model.

Pretorius	reclamation cost was involved in the sustainability report scenario 1?	
Koos Pretorius	– Concerned about subsidence of rehabilitated areas.	Soil subsidence occurs above high extraction underground mining areas. In rehabilitated opencast mining areas, however, the bulking factor play a role: due to the fact that the removed earth material (including unconsolidated rocks and less compacted soils) are placed back into the mined voids, it is expected that the rehabilitated surface area will be the same or higher than the pre-mining surface. No subsidence is thus expected.
Koos Pretorius	– If not – how should the impact post closure of subsidence be addressed?	Opencast roll-over mining with backfilling, check bulking factor, then there will be settlement with a risk of differential settlement that will have to be managed with rehabilitation measures after closure. Case Study: TownScape Planning Solutions: A border & pillar extraction post mining stability assessment was conducted in Secunda to determine availability of post mined land for residential development.

5.5 Conclusion

No fatal flaws were identified during the Public Participation Processes undertaken during the course of this Environmental Assessment. A summary of the key issues raised by the I&APs are as follows:

- Concerns regarding the environmental impacts of:
  - Dust and air pollution
  - Surface and groundwater pollution, including acid mine drainage
  - Noise
  - Blasting: concerns about structural damage to buildings and the impacts on livestock (cattle, poultry etc.)
  - Visual
- Concerns about the change of land use and land capability
- Concerns about surface subsidence after rehabilitation
- Concerns regarding the source of process water for the mine and the quantities required
- Concern regarding the wetlands in the area which act as habitat for important bird species
- Concerns about the potential burning of the coal stockpiles and co-disposal dump
- Request that the traffic impact study include previous available studies as well as take super-loads into consideration
- Requests that the cumulative impacts on the environment and infrastructure from other mining operations be taken into consideration when undertaking the EIA
- Requests that the local EMF and C-Plan be incorporated into the studies
- Concerns regarding the social impacts on:
  - Existing jobs and the impacts of job loss
  - Relocation: how this was going to take place, where people were going to be relocated to, if any compensation was going to be given etc.
- Raised the need for job creation within the area and the importance of involving local Small Medium and Micro Enterprises (SMMEs) in the project
- Concerns regarding land claims
- Request for more comprehensive consultation with local communities during the EIA phase
- Request for reports to be made available for public review
- Concerns with public consultation timeframes stipulated in the MPRDA
- Concerns that the management measures will not be implemented due to a perceived bad track record
- Concerns that the SLP is not involving the local communities and is only being undertaken at a municipal level
- Concerns regarding the feasibility of the project

6

Issues Identification, Impact Investigation & Sensitivity Analysis

This section discusses the impacts identified during the scoping phase as well as those identified by the interested and affected parties. Specialist studies were undertaken to investigate these impacts and to recommend management for the purpose of the impact assessment in Section 7.

6.1 Issues Identified

Table 53 lists the issues that were identified during the scoping phase and the studies that were undertaken as a result of this. The table also lists the issues that were identified by I&APs and any additional studies undertaken as a result of these issues if they were not already identified during the scoping phase.

Table 53: Issues identified during the scoping phase and by the I&APs

Scoping Phase			Public Participation			Cum[27]
Impacts	**Cause of impact**	**Studies undertaken**	**Impacts**	**Cause of impact**	**Studies undertaken**	
Status and Aesthetics						
Visual pollution	– Erection of buildings and infrastructure – Opencast pits – Mining infrastructure – Coal stockpiles and discard dumps – Overburden dumps	Visual Impact Assessment	Visual pollution	– Erection of buildings and infrastructure – Opencast pits – Mining infrastructure – Coal stockpiles and discard dumps – Overburden dumps	Visual Impact Assessment	
Light pollution	– Night time activities	Visual Impact Assessment				
Climate						
Climate Change	– Vehicle emissions	Air Quality Impact Study				
Topography						
Change in drainage patterns	– Building of infrastructure – Opencast pit	Surface Water Impact Assessment	Surface subsidence	– Settling of backfilled pits	Surface Water Impact Assessment addendum	
Flooding	– Increased impermeable surfaces – Destruction of wetlands	Surface Water Impact Assessment				
Geology						
Mineral depletion	– Mining activities					✓
Soil						

[27] Cum = Cumulative

Scoping Phase			Public Participation			Cum[27]
Impacts	Cause of impact	Studies undertaken	Impacts	Cause of impact	Studies undertaken	
Pollution	– Contamination from hydrocarbon spills	Soil Impact Assessment				
Topsoil loss	– Topsoil erosion from exposed soils	Soil Impact Assessment	Topsoil Loss	Topsoil erosion from exposed soils	Soil Impact Assessment	
Land use						
Loss of agricultural land	– Strip mining – Mining infrastructure		Change of land use and land capability	– Strip mining – Mining infrastructure		
Change of land use	– Strip mining – Mining infrastructure	Soil Impact Assessment	Local EMF and C-Plan be incorporated into the studies	– Ecological impact assessment – Closure plan	Soil Impact Assessment	
Surface Water						
Pollution	– Siltation from exposed soil – Coal sediment runoff from stockpiles and spoil heaps – Seepage from coal facilities – Post closure decant	Surface Water Impact Assessment	Pollution	– Siltation from exposed soil – Coal sediment runoff from stockpiles and spoil heaps – Seepage from coal facilities – Post closure decant	Surface Water Impact Assessment	✓
Flooding	– Increased impermeable surfaces – Destruction of wetlands	Surface Water Impact Assessment	Source of process water for the mine and the quantities required		Surface Water Impact Assessment	
Loss of wetlands	– Mining in East Pit and West Pit – Destruction of	– Ecological & Wetland Assessment	Loss of wetlands			

Scoping Phase			Public Participation			Cum[27]
Impacts	Cause of impact	Studies undertaken	Impacts	Cause of impact	Studies undertaken	
	wetland at area of proposed plant	– Wetland Offset identification				
Groundwater						
Pollution	– Acid drainage from coal stockpiles, discard dumps and spoil heaps – Hydrocarbon spills – Post-closure contamination	Groundwater Impact assessment	Acid Mine drainage	– coal stockpiles, discard dumps and spoil heaps		✓
Depletion	– Use of groundwater for processing activities – Aquifers decanting into open pits due to high water table	Groundwater Impact assessment	Source of process water for the mine and the quantities required	Surface Water Impact Assessment		✓
Flora						
Biodiversity loss	– Habitat destruction from construction and mining activities	Ecological Impact Assessment	Degradation of the wetlands in the area which act as habitat for important bird species			
Wetland destruction and degradation	– Mining footprint – Water pollution	Ecological Impact Assessment	Decreased productivity	Dust deposition on plants from mining activities	Air Quality Impact Assessment Addendum	✓
Fauna						
Biodiversity loss	– Biodiversity loss through destruction of flora and habitat	Ecological Impact Assessment				
Air Quality						

Scoping Phase			Public Participation			Cum[27]
Impacts	Cause of impact	Studies undertaken	Impacts	Cause of impact	Studies undertaken	
Pollution	– Vehicle entrainment on dust roads – Tailpipe emissions – Dust from blasting, mining and hauling – Dust from crushing activities – SO2 and smoke emissions from ignited waste dumps	Air Quality Impact Assessment	Pollution	– Dust and air pollution from mining activities – The potential burning of the coal stockpiles and co-disposal dump	Air Quality Impact Assessment	✓
Noise						
Pollution	– Vehicles – Building activities – Mining activities – Blasting – Processing	Noise Impact Study				
Vibrations						
Damage to structures	– Blasting	Environmental Impact Assessment: Ground Vibration and Air Blast Study	Damage to structures	– Blasting		
			Impacts on livestock	– Blasting – Noise from mining activities	Environmental Impact Assessment: Ground Vibration and Air Blast Study Addendum	
Socio-Economic						
Job creation	– Opening of mining operation	Social Impact Assessment	– Concerns that the SLP is not involving the local		Social Impact Assessment	

Scoping Phase			Public Participation			Cum[27]
Impacts	**Cause of impact**	**Studies undertaken**	**Impacts**	**Cause of impact**	**Studies undertaken**	
			communities and is only being undertaken at a municipal level – Raised the need for job creation within the area and the importance of involving local Small Medium and Micro Enterprises (SMMEs) in the project – Existing jobs and the impacts of job loss			
Traffic disruption	– Increased traffic flow	Recommendations for a comprehensive traffic study				
Road damage	– Increased flow of haul trucks	Recommendations for a comprehensive traffic study	Road damage	– Request that the traffic impact study include previous available studies as well as take super-loads into consideration	Recommendations for a comprehensive traffic study	✓
	– Roads damaged by haul vehicles	Recommendations for a comprehensive traffic study				✓
Health and safety	– Coal inhalation	Air Quality Impact Assessment	Health and safety	– Coal inhalation	Air Quality Impact Assessment	✓

Scoping Phase			Public Participation			Cum[27]
Impacts	Cause of impact	Studies undertaken	Impacts	Cause of impact	Studies undertaken	
	– Dust inhalation	Air Quality Impact Assessment		– Dust inhalation	Air Quality Impact Assessment	✓
	– Mining activities					
	– Risk of increased HIV	Social Impact Assessment				
Job loss	– Closing of mine at end of operation	Social Impact Assessment	Relocation: how this was going to take place, where people were going to be relocated to, if any compensation was going to be given etc	– Advancing mining operations	Social Impact Assessment	
			Concerns regarding land claims			
Other						
			Concerns regarding the feasibility of the project		Feasibility Study	
			Concerns regarding closure		Closure and rehabilitation plan	

6.2 Geology

Mpumalanga's coal mining industry supplies 80% of our South Africa's coal produce. According to the South African Mining Industry (2008), the electricity sector of South Africa consumed 61% of locally sold coal.

The mining of coal will result in a depletion of coal reserves and a destruction of geology when accessing the coal. Beside alternative energy sources, there are no measures that can prevent these impacts.

6.3 Soil Impact Investigation

People depend on soil for agriculture, and as such it is a valuable natural resource. Soils form continuously as the result of natural processes, and can therefore be regarded as a renewable resource. However, the soil-forming processes operate very slowly and the misuse or mismanagement of the soil may lead to damage or erosion, or can disrupt the processes by which the soil forms. If this happens the resource can be degraded or even lost and this is what should be prevented during topsoil stripping, stockpiling, replacement and rehabilitation.

Many human activities cause damage to soils. These include bad farming techniques, overgrazing, deforestation, urbanization, construction, soil stripping, wars, contamination, pollution, and fires. The most critical impact resulting is soil erosion. With growing populations, the need for productive soils is increasing. Soil loss in many developing countries is a major cause for concern and will become a major issue in the future. The process of soil loss can have a detrimental effect on other systems as it produces sediment that can cause siltation of river systems and reservoirs, set off flooding downstream, and contribute to pollution and damage to estuaries, wetlands, and coral reefs. Soils need to be managed carefully in order to remain in good condition.

6.3.1 Impact Assessment

The potential impacts and reasons / activities with proposed mitigation measures on the soil due to construction activities include:

Construction Phase

- Land transformation will lead to some losses of topsoil during construction and soil stripping.
- Usable soil may be lost due to inefficient stripping practices.
- Topsoil may be contaminated during as a result of surface runoff and seepage.
- Contamination of stockpiled soil may occur due to seepage or contact with dirty surface water.
- Soil stockpiles may be exposed to erosion by surface water and wind causing erosion.

Operational Phase

Usable soil may be lost due to inefficient stripping practices.

- Seepage from contamination sources may contaminate stockpiled soil or in situ soil that has not yet been stripped.
- Depending on the chemical composition of dust pollution, soil adjacent to the mining areas may be contaminated.
- Leakages or spillages from conveyor may contaminate adjacent soils.

- Surface runoff leads to soil erosion. Soil stockpiles will be exposed to erosion activities during operation of the tailings dam, return water dam and concentrator areas.
- Soil contamination can result from hydrocarbon spills from equipment, fuel tanks etc.
- Loss of soil with agricultural potential.

Decommissioning and Closure Phase

- Soil that has been used for rehabilitation purposes may be lost due to erosion caused by surface water runoff.
- The consumption of potable water during rehabilitation may lead to soil erosion if not done efficiently.
- Depending on the content of the dust pollution, soil adjacent to construction areas may be contaminated.
- The generation of hazardous and non-hazardous waste may pose a risk of soil contamination through seepage.
- Potential incidents such as failure may cause contamination of topsoil if spills take place.
- The use of stockpiled topsoil for rehabilitation purposes will have a positive visual impact.

Post-Closure Phase

- Soil erosion may occur due to surface water runoff across the rehabilitated construction sites.
- Seepage from all construction and mining areas may contaminate surrounding soil.
- Alteration of the natural surface topography due to re-profiling during construction after stripping will have an accumulation effect on the soils and careful consideration should be given to minimise compaction and ensure free drainage preferential surface water pathways.

6.3.2 Proposed Mitigation

The following management measures are proposed to mitigate the identified impacts.

Construction Phase

- It is recommended that all usable soil be stripped and stockpiled in advance of activities that might contaminate the soil. The stripped soil should be stockpiled upslope of areas of disturbance or development to prevent contamination of stockpiled soils by dirty runoff or seepage. All stockpiles should also be protected by a bund wall to prevent erosion of stockpiled material and deflect surface water runoff.

Operational Phase

- Implement live placement of soil where possible
- Improve organic status of soils
- Maintain fertility levels
- Curb topsoil loss
- It is recommended that all usable soil be stripped and stockpiled in advance of activities that might contaminate the soil. The stripped soil should be stockpiled upslope of areas of disturbance or development to prevent contamination of stockpiled soils by dirty runoff or seepage. All stockpiles should also be protected by a bund wall to prevent erosion of stockpiled material and deflect surface water runoff.
- Stockpiles can be used as a barrier to screen operational activities (to mitigate visual impacts). If stockpiles are used as screens, the same preventative measures described above should be

implemented to prevent loss or contamination of soil. The stockpiles should not exceed a maximum height of 6 m and it is recommended that the side slopes and surface areas be vegetated in order to prevent water and wind erosion. If used to screen construction operations, the surface of the stockpile should not be used as a roadway as this will result in excessive soil compaction.

Decommissioning and Closure Phase

- When stockpiled soils have been replaced during rehabilitation, the soil fertility should be assessed to determine the level of fertilisation required to sustain normal plant growth. The fertility remediation requirements need to be verified at time of rehabilitation. The topsoil should be uniformly spread onto the rehabilitated areas and care should be taken to minimise compaction that would result in soil loss and poor root penetration.
- When returning the soil to the rehabilitation site care should be taken to place soil in a manner that will allow for levelling of soil to take place in a single pass. The soil profile should not be built up using a repeated tipping and levelling action to increase the soil depth. Proper water control measures should be implemented to ensure a free draining rehabilitated landscape.

Post-Closure Phase

- When stockpiled soils have been replaced during rehabilitation, the soil fertility should be assessed to determine the level of fertilisation required to sustain normal plant growth. The fertility remediation requirements need to be verified at time of rehabilitation. The topsoil should be uniformly spread onto the rehabilitated areas and care should be taken to minimise compaction that would result in soil loss and poor root penetration.
- When returning the soil to the rehabilitation site care should be taken to place soil in a manner that will allow for levelling of soil to take place in a single pass. The soil profile should not be built up using a repeated tipping and levelling action to increase the soil depth. Proper water control measures should be implemented to ensure a free draining rehabilitated landscape.

6.4 Surface Water Impact Investigation

Currently the major stresses facing the Inkomati WMA are:

- High water demands for Eskom. Eskom power stations receiving water from the Komati catchment were designed to use high quality (low sulphate) water. The continued supply of good quality water to Eskom is of strategic national importance and a key factor for the management of the catchment water resources
- Irrigation.
- Afforestation.
- Industry.
- Rapidly increasing domestic water demands.

The water shortages experienced in the area have led to competition for the available water resources among user sectors. A substantial portion of the population in the catchment does not have access to a basic level of services and a number of planned expansions to water uses have been put on hold. Furthermore the major dams in the study area change the flow regime and impact on the water quality.

Water management in the Upper Komati region is therefore very sensitive and attention has to be given to changes in flow and water quality.

6.4.1 Impact Assessment

Stream Flow Reduction

The DWA has recently completed the Inkomati Water Availability Assessment Study during which the hydrology of the Inkomati Basin was updated. The Leeubank falls within the X11C catchment whereas the Klein Komati and Driehoekspruit fall within the X11D catchment. The study produced a naturalised flow record for the 226 km^2 X11C and 572 km^2 X11D catchments. The maximum catchment area that is isolated by the mine was calculated to be 0.7km^2 and 2.5km^2 for the X11C and X11D catchments.

The impact of the mine on the flows can be assessed by removing the area isolated by the mine water management system from the quaternary catchments and looking at the impact on the naturalized hydrology. The minimum, average and maximum monthly flow volumes are given in Table 21 and Table 22 for the catchments with and without the mining area isolated.

The reduction in the naturalized MAR for the X11C catchment is from 11.35 million m^3/a to 11.32 million m^3/a, a reduction of 0.30%. This is in line with the fraction of the area that is isolated by the mining. The reduction in the naturalized MAR for the X11D catchment is from 47.49 million m^3/a to 47.29 million m^3/a, a reduction of 0.42%.

The reduction is therefore small for the proposed Belfast Operation. However if other mines are established in the catchment, an integrated approach should be followed by DWA.

The Komati river catchment is particularly sensitive due to abstraction of water from the Nooitgedacht Dam and Vygeboom Dam for power supply, therefore the impact on water availability at these dams was investigated. Results are shown in Table 23 and Table 24. The impact is relatively low as a reduction of the MAR of 0.06% and 0.12% is expected at the Nooitgedacht Dam and Vygeboom Dam respectively.

Estimated quality and quantity impacts on wetlands and pans

If the environmental water balance is considered, it is estimated that only approximately 3% of the mean annual precipitation (MAP) ends up as effective recharge to the aquifer(s). If the direct surface run-off is considered to be in the order of 20% of MAP, it means that the remainder of the MAP exists as water retained in and migrating horizontally through the soil profile, as well as water being lost to evapo-transpiration. It is also this soil moisture/water that is considered to have by far the most significant contribution to the water in the wetlands (channel flow, hill-slope etc.) and pans in the Belfast Project surface area.

The water that ‘feed’ the pans in the Belfast project area is therefore considered as soil water rather than groundwater. This water remains within the soil layer due to a less permeable layer underlying the soil horizon. The water level drawdown due to mining will thus have a direct effect on the groundwater level but is not considered to having a significant adverse impact on the soil water and will therefore not cause severe decreases in water flow to the streams and pans. The pans within the two mine block boundaries will be mined away completely.

The drawdown in water level will cause a decrease in the base-flow discharge to the tributaries / hill-slope wetlands. The biggest impacts in terms of base-flow discharge are the tributary (of the Klein-Komati River) and hill-slope wetlands that flows through from north to south between the two mine blocks. At maximum impact at the end of the life of mine a decrease in discharge of more than 70% is expected for the portion of the stream between the mine blocks. Discharge to the smaller tributaries surrounding the mining blocks will decrease between 10 and 40% towards mine closure.

The mining is also expected to have an impact on the surrounding tributaries and hill-slope wetlands in terms of quality. At mine closure a maximum total salt load that can be released into the surrounding tributaries can vary between 22 and 80 kg/day. Fifty years post closure this figure can increase up to a maximum of 1800 kg/day.

Water Quality

The following sources have been identified as potential point sources of surface water pollution:

- Pit decant.
- Pollution control dam spillage.
- Co-disposal return water dam spillage.
- Sewage treatment plant discharge.
- Desalination plant.

The following sources have been identified as potential diffuse sources of surface water pollution:

- Pollution control dam seepage.
- Co-disposal facility and return water dam seepage.
- Dust.
- Dirty water area runoff.

Table 54: Average, Minimum and Maximum Naturalized Monthly Runoff Volumes for Quaternary X11C (million m^3/month) without and with the Mining Area

Month	Area (m^3)	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Average (without mine)	230	0.38	1.26	1.86	2.24	2.31	1.4	0.73	0.35	0.24	0.21	0.18	0.19	11.35
Average (with mine)	229	0.38	1.26	1.85	2.23	2.3	1.4	0.73	0.35	0.24	0.21	0.18	0.19	11.32
Minimum (without mine)	230	0.07	0.09	0.12	0.23	0.21	0.18	0.12	0.09	0.1	0.09	0.08	0.06	1.44
Minimum (with mine)	229	0.07	0.09	0.12	0.23	0.21	0.18	0.12	0.09	0.1	0.09	0.08	0.06	1.44
Maximum (without mine)	230	4.48	12.15	13.47	16.33	22.11	16.4	6.17	4.4	0.57	0.53	0.59	1.82	99.02
Maximum (with mine)	229	4.47	12.11	13.43	16.28	22.04	16.35	6.15	4.39	0.57	0.53	0.59	1.81	98.72

Table 55: Average, Minimum and Maximum Naturalized Monthly Runoff Volumes for Quaternary X11D (million m^3/month) without and with the Mining Area

Month	Area (m^3)	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Average (without mine)	593	1.45	3.63	5.85	7.8	8.91	7.34	4.96	2.98	1.69	1.13	0.9	0.85	47.49
Average (with mine)	591	1.44	3.61	5.83	7.77	8.87	7.31	4.94	2.97	1.68	1.13	0.9	0.85	47.29
Minimum (without mine)	593	0.44	0.4	0.76	1.18	1.14	1.51	1.18	0.65	0.55	0.53	0.48	0.42	9.24
Minimum (with mine)	591	0.44	0.4	0.76	1.17	1.14	1.5	1.17	0.65	0.55	0.53	0.48	0.42	9.2
Maximum (without mine)	593	4.88	16.84	26.12	28.08	48.88	39.3	24.39	21.18	8.93	4.09	3.31	3.04	229.04
Maximum (with mine)	591	4.86	16.77	26.01	27.96	48.67	39.13	24.29	21.09	8.89	4.07	3.3	3.03	228.07

Table 56: Average, Minimum and Maximum Naturalized Monthly Runoff Volumes for the Nooitgedacht Dam (million m^3/month) without and with the Mining Area

Month	Area (m^3)	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Average (without mine)	1,174	2.41	7.82	10.97	12.67	13.27	8.3	4.49	2.25	1.52	1.37	1.15	1.17	67.39
Average (with mine)	1,173	2.41	7.82	10.96	12.66	13.26	8.3	4.49	2.25	1.52	1.37	1.15	1.17	67.36
Minimum (without mine)	1,174	0.45	0.54	0.73	1.39	1.24	1.1	0.72	0.57	0.61	0.58	0.53	0.38	8.84
Minimum (with mine)	1,173	0.45	0.54	0.73	1.39	1.24	1.1	0.72	0.57	0.61	0.58	0.53	0.38	8.84
Maximum (without mine)	1,174	28.67	75.67	81.45	99.65	133.85	100.34	36.98	27.03	3.75	3.47	3.86	11.31	606.03
Maximum (with mine)	1,173	28.66	75.63	81.41	99.6	133.78	100.29	36.96	27.02	3.75	3.47	3.86	11.3	605.73

Table 57: Average, Minimum and Maximum Naturalized Monthly Runoff Volumes for the Vygeboom Dam (million m^3/month) without and with the Mining Area

Month	Area (m^3)	Oct	Nov	Dec	Jan	Fen	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Average (without mine)	2,723	8.56	23.62	35.99	43.88	48.69	38.28	24.33	13.59	7.7	5.32	4.21	4.2	258.37
Average (with mine)	2,720	8.55	23.6	35.96	43.84	48.64	38.24	24.31	13.58	7.69	5.31	4.21	4.2	258.13
Minimum (without mine)	2,723	2.13	2.6	3.5	5.96	6.86	6.67	4.93	3.14	2.25	2.35	2.19	1.86	44.74
Minimum (with mine)	2,720	2.13	2.6	3.5	5.95	6.85	6.66	4.92	3.14	2.25	2.35	2.19	1.86	44.7
Maximum (without mine)	2,723	57.62	133.58	171.07	202.49	310.91	248.49	125.93	79.88	26.85	15.46	14.85	23.88	1,411.01
Maximum (with mine)	2,720	57.59	133.47	171.92	202.32	310.63	248.27	125.81	79.78	26.81	15.44	14.83	23.886	1,409.73

6.4.2 Proposed Mitigation

The following recommendations have been made:

- Stormwater structures will need to be installed to prevent clean water catchments from being contaminated and keep dirty water within the mine boundaries.
- The simulations show that a storage dam of a 460,000m3 capacity will be required for store excess water from the backfills.
- Once the storage capacity on the mine is being used, a desalination plant will need to be constructed with a capacity of 5 000m3/day.
- Construction of a desalination plant with a capacity of 7,900 m3/day will be required to prevent water in the pit from decanting into the river.
- The co-disposal facility will be rehabilitated with a cover so that the surface runoff is clean.
- The return water dam and plant areas will be removed and the area rehabilitated.
- The pits will be rehabilitated to be free draining with a standard 600mm thick cover.
- The waste dumps located adjacent to the pits will be removed and returned to the pits.

6.5 Wetland offset investigation

6.5.1 Impact Assessment

Pans and wetlands are located in the east and west pits where strip mining will result in the complete loss of ecological and hydrological functioning of the pans and wetlands. The construction of the Phase 2 crushing, screening and washing plant on the hillslope seep will result in destruction of the hillslope seep wetland.

6.5.2 Proposed Mitigation

It is noted that the mitigation measures outlined in the Belfast EMPR need to be met in terms of the management hierarchy:

- Avoidance;
- Minimisation;
- Reduction;
- Rehabilitation; and
- Compensation (e.g. biodiversity offsets)

Furthermore, the management hierarchy needs to be adequately considered before biodiversity offsets (compensation mitigation) can be considered. Due to the fact that the rehabilitation of the lost pans and wetlands within the two proposed coal reserves at Belfast would not be feasible, the only way for the project to continue is through offsetting these specific pans and wetlands.

The two coal reserves of the proposed Belfast NBC project were reduced in size in order not to destroy/impact the majority of the pans, and hillslope seeps and valley bottom wetlands associated with the Leeubankspruit, Klein-Komati River and the Driehoekspruit. These areas were used as onsite set-asides within the proposed mine lease area.

On site set-asides and rehaibilitation criteria

The onsite set-aside pans and wetlands would need to be managed in order to improve baseline conditions and mitigate any impacts associated with the proposed project. The rehabilitation criteria for these on site-set asides would include:

- Implementation of an Exxaro, land-owner, DWA and MTPA Wetland Management Forum (WMF) for the onsite set aside pans and wetlands;

- Limitation of agricultural impacts due to cattle overgrazing and trampling, and crop encroachment into the pan and wetland areas;
- Implementation of pan and wetland mitigation identified in the impact assessment phase for pans and wetlands that may be impacted from the proposed project, especially those directly outside of the two proposed coal reserve areas;
- Implementation of a fire-management programme;
- Implementation of an alien and exotic vegetation (declared Category 1, 2 and 3 listed alien and invader species) management programme;
- Revegetation of disturbed areas and areas of pan catchment and wetland loss; and
- Implementation of a pan and wetland biomonitoring programme.

These criteria for the onsite set-aside pans and wetlands will form the basis for the implementation and management plan for the offset programme.

Offsite offset identification, rehabilitation and protection criteria

For the pans and hillslope seeps and valley bottom wetlands that will be lost within the two proposed coal reserves, offsite offsets would have to be identified. The identification criteria for the offsite area investigation included the following:

- Ecoregions: The offsite area(s) would have to fall within the same or similar Level I Ecoregion;
- Geomorphic provinces: The offsite area(s) would have to fall within the same or similar geomorphic provinces;
- Vegetation zones: The offsite area(s) would have to fall within the same or similar vegetation zones;
- Water Management Areas: The offsite area(s) would have to fall within the Inkomati Water
- Management Area (WMA: 05);
- MBCP: The offsite area(s) would have to fall within the same biodiversity conservation management areas;
- NFEPA: The offsite area(s) would have to fall within the same Freshwater Ecosystem Protected Areas (FEPAs); and
- Exxaro-owned land: The offsite area(s) would have to fall within or near an existing mining area, owned by Exxaro for easy of management and implementation of the offset project.

The offsite off-set pans and wetlands would need to be managed in order to improve baseline conditions and mitigate any impacts associated with the proposed project. The rehabilitation criteria for these offsite setasides would include:

- Implementation of an Exxaro, land-owner and MTPA wetland management forum for the offsite setaside pans and wetlands;
- Limitation of agricultural impacts due to cattle overgrazing and trampling, and crop encroachment into the pan and wetland areas;
- Implementation of wetland mitigation and rehabilitation for pans and wetlands that may be impacted by existing mining impacts;
- Implementation of a fire-management programme;
- Implementation of an alien and exotic vegetation management programme; and
- Implementation of a pan and wetland biomonitoring programme.

These criteria for the offsite offset pans and wetlands will form the basis for the implementation and management plan for the offset programme.

Identified potential offset cluster

Based on this elimination process, it was shown that the Exxaro Strathrae mine lease area is suitable for offsetting of the Belfast pans as it fills the various criteria for the Belfast pan functions and source zone for the Inkomati River system. The area is dominated by large Open water pans in close proximity to one another, with a large number of smaller pans of different types in-between them. The occurrence of obsereved Lesser flamingo (*Phoenicopterus minor*), African marsh terrapin (*Pelomedusa subrufa*), Grey crowned crane (*Balearica regularum*), breeding pairs of Wattled cranes (*Bugeranus carunculatus*), Blue cranse (Anthropoides paradisea), and the Greater flamingo (*Phoenicopterus ruber*) at certain pans within the Pans cluster were considered to be of additional conservation importance.

A map indicating the similar candidate pans within the Strathrae cluster as well as the remaining pans that will be included in the offset programme are shown in **Figure 74**. The total area (hectares) of the wetlands in the proposed offsite offset area is 2502.85 ha. This is slightly over the recommended area of 1788.5 ha. These wetland areas will however have to be delineated in order to accurately quantify the actual wetland boundaries and types.

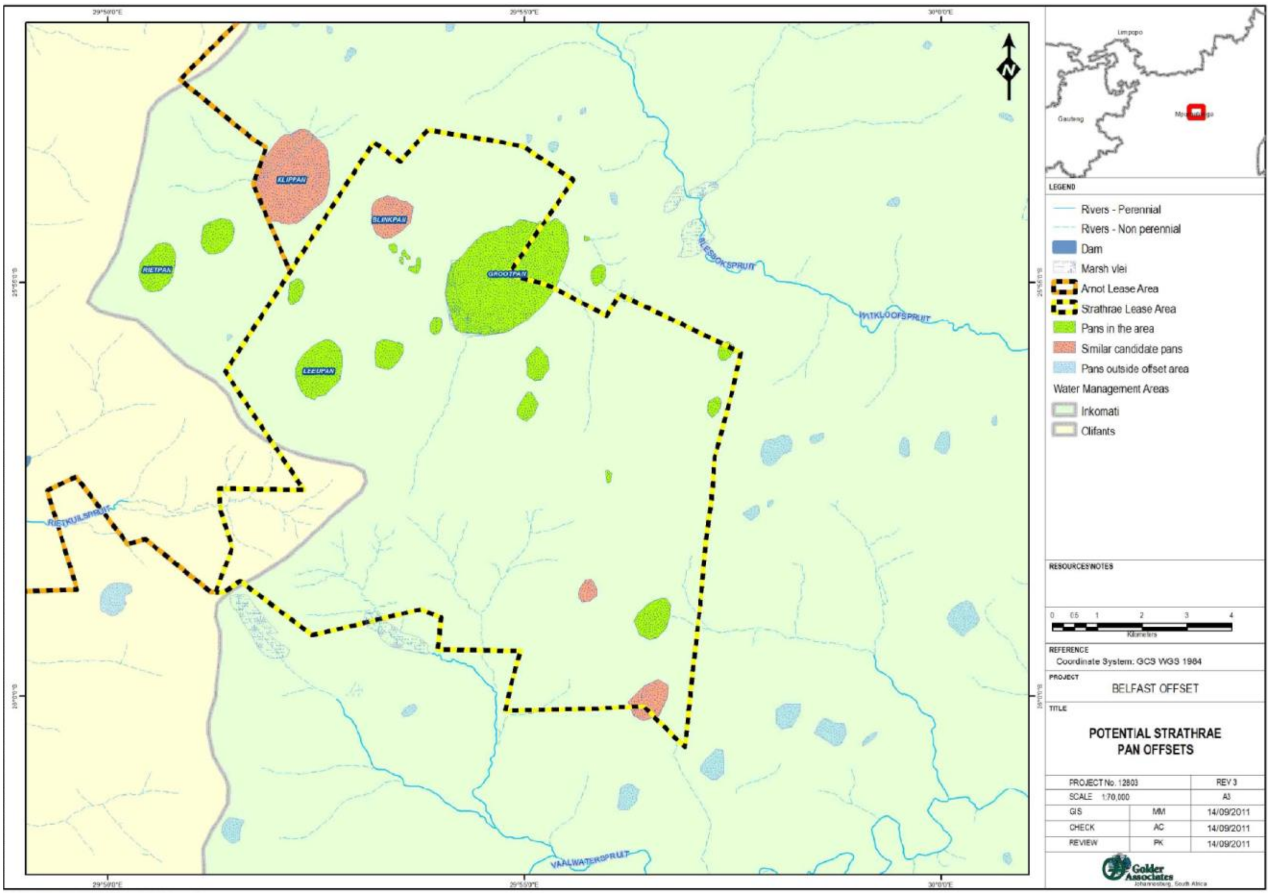

Figure 74: Candidate pans that are within the Strathrae mine lease area and those that are similar in characteristics to the Belfast pans (statistical analyses)

To be noted is that current Exxaro mining activities at Arnot and Strathrae need to be considered in the stragegy for the offset areas, as some of the pans and wetlands may already be impacted. These impacts would have to be mitigated as part of the offset programme.

Critical offset cluster criteria

In order to successfully implement the offset project on the identified cluster, Exxaro would need to determine the current mined-out coal reserves as well as any potential remaining coal reserves. This will have to be done in order to determine the potential for offsetting this cluster of pans and wetlands and securing them from future mining activities.

Exxaro would also have to engage with the surrounding landowners in order to successfully include all of the suggested pans within this cluster. This process would have to be facilitated by DWA and MTPA in order for the correct biodiversity planning and stakeholder engagement processes to be initiated. Once formalised, the rehabilitation and protection criteria can be structured.

Rehabilitation and protection criteria

The offsite off-set pans and wetlands would need to be managed in order to improve baseline conditions and mitigate any impacts associated with the proposed project. The rehabilitation criteria for these offsite setasides would include:

- Implementation of an Exxaro, land-owner and MTPA pan and wetland management forum for the offsite set-aside wetlands;
- Limitation of agricultural impacts due to cattle overgrazing and trampling, and crop encroachment into the pan catchments and wetland areas;
- Implementation of pan and wetland mitigation and rehabilitation for pans and wetlands that may be impacted by existing mining impacts;
- Create and maintain linkages between the pans and wetlands for increased habitat connectivity;
- Implementation of a fire-management programme;
- Implementation of an alien and exotic vegetation management programme; and
- Implementation of a pan and wetland biomonitoring programme.

These criteria for the offsite offset pans and wetlands will form the basis for the implementation and management plan for the offset programme. The protection criteria will include a plan to obtain protected status for each pan and wetland type within the MBCP as a driver for motivation within the National Protected Areas Act. No further mining activities will be allowed to occur on these wetlands and pans or within the catchments of the pans. This may require engagement with various government and provincial departments (DMR, DEAT, DWA and MTPA).

6.6 Groundwater Impact Investigation

6.6.1 Impact Assessment

Aquifers

Proposed mining at the Belfast project will penetrate the aquifers and the physical structure of the aquifers will be destroyed.

Under natural conditions, water entering the groundwater system will migrate vertically downwards until a more impervious layer that forms a perched aquifer is encountered. As the perched aquifer did not feature during drilling at the proposed Belfast Project it is likely that the majority of recharge water will migrate downwards into the saturated zone[28]. From there it will migrate in the direction of the hydraulic gradient[29] until it eventually enters surface water bodies (i.e. rivers or springs) from where it will discharge as surface water.

[28] The area below ground in which all interconnected openings within the geologic medium are completely filled with water.

[29] The direction of groundwater flow due to changes in the depth of the water table.

Opencast mining will cause major changes in the properties of the aquifers in the positions of the opencast pits. In the open pit position, the structure of the aquifer will be damaged and hydraulic properties will change significantly. The major changes can be summarized as follows:

- The active void will have an infinitely high transmissivity and a storage coefficient of 1 and will act as a groundwater sink where it is developed below the depth of the static water level;
- The rehabilitated (backfilled) pit will have a transmissivity and storativity at least one to two orders of magnitude higher than the undisturbed aquifer host rock;
- Where semi-confined or confined aquifer conditions prevailed before mining, the ‘aquifer’ in the pit areas will change to unconfined;
- Effective recharge to the pit areas will also increase by an order of magnitude; and
- The water quality in the pit area will also change dramatically, from very high quality water to saline water. The salinity will be caused by release of saline (especially chloride and sodium) water as well as acid-base reactions as a result of exposure of pyrite-containing carbonaceous material in and around the coal horizon to oxygen and water. These reactions will cause significant deterioration of the water quality in the pit areas.

The higher recharge rate to the pit areas will cause filling up of the rehabilitated and backfilled voids. The undisturbed surrounding aquifer will not be able to handle the higher recharge rate and the water will build up and flow out at the lowest surface elevation of the pit, resulting in the decanting of water from the pits at the 3 locations indicated in **Figure 75**.

A decant rate for the West Block is estimated at approximately 2,000 m^3/day to the north-west and south-east while decant is estimated from the East Block at 3,600 m^3/day on its south-western boundary. The time to decant in both of the mine blocks is less than 1 year. It was concluded from acid-base accounting result on coal and overburden material that acid formation in the proposed Belfast project area is very likely to occur. This tendency of the coal and overburden to turn acidic, combined with the fact that the majority of the backfill material will remain under oxidizing conditions, will result in a poor quality water – most probably acidic – decanting from the Belfast project mine blocks.

Unfortunately, there is nothing to be done on the geometry of the coal reserve or the acid neutralizing capacity of the backfill material and it is imperative for the Belfast Project to take proper and timeous action to manage the poor quality decant that will start to occur nearly directly after mine closure.

During the study it was identified that the northern decant point on the western block could be prevented by modifying the pit boundary. The mining plan was amended to prevent decant on the northern point. This will ensure that decanting only occurs at the southern points of both the east and west blocks.

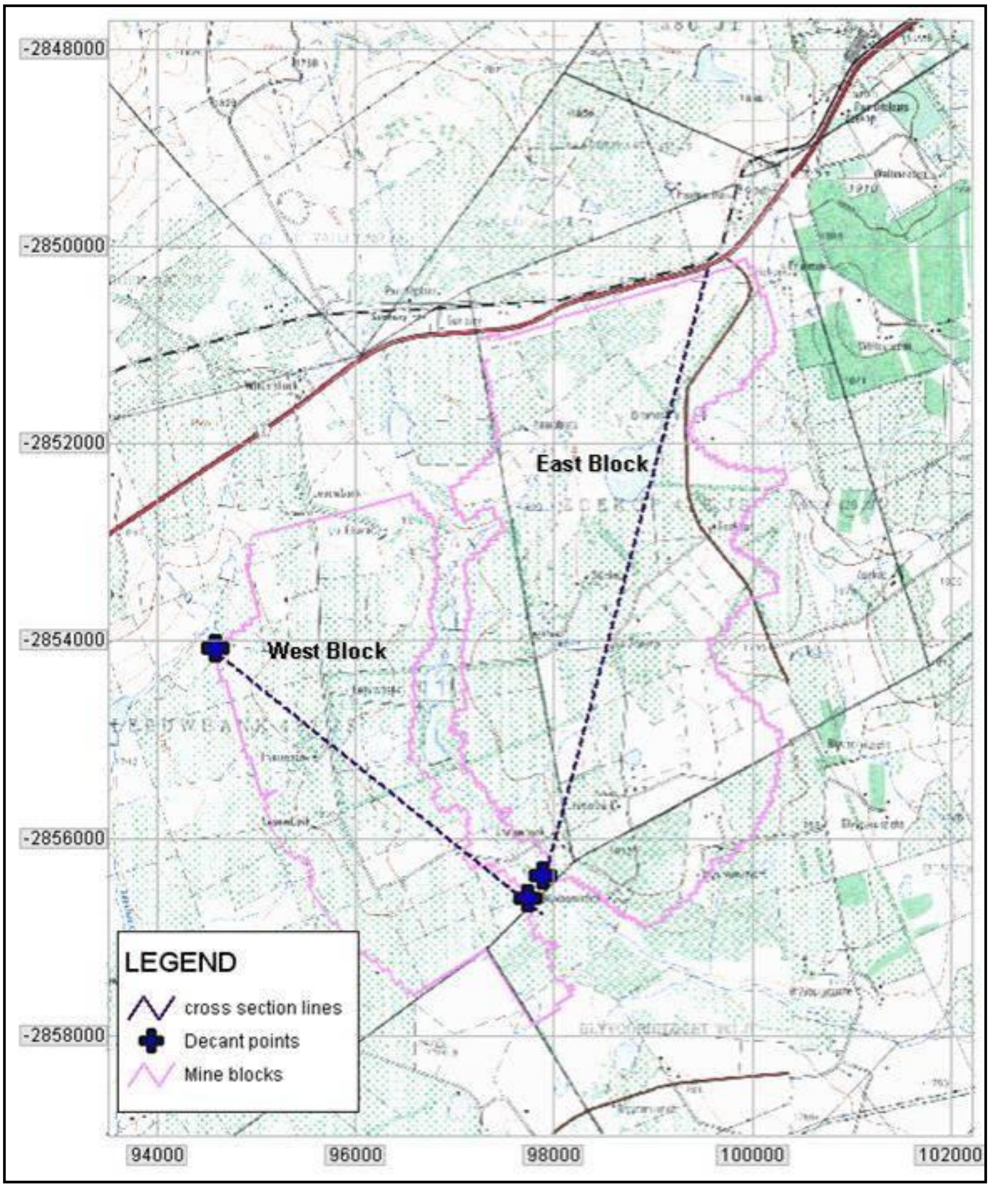

Figure 75: Anticipated Decant Points

Groundwater Drawdown

Water level impacts have been simulated with the numerical model at three stages, namely 5 years into the operation, 10 years into the operation and at the end of the operation when maximum impacts occur. The simulated drawdown from steady state water levels are indicated in the figures below.

A maximum simulated water level drawdown of 22 meters is visible towards the eastern boundary of the East block. The tributaries and wetlands in the extent of the cone of depression will be affected in terms of discharge volume. No water level drawdown is simulated for the West Block since the mine schedule does not include any mining in the West Block for the first 5 years. The cone of depression is estimated to be limited to around 300 meters from the pit.

Ten years after mining has commenced, the cone of depression will have increased in size. The maximum drawdown is still 22 meters in the East Block. Mining has started at the West Block and the maximum simulated drawdown in the West Block is approximately 17 meters. It is indicated that the depression cone will be measurable at a maximum distance of approximately 500 meters from the pit.

According to the model simulations a maximum possible drawdown (worst case) of more than 26 meters can be expected in the East block, while a maximum possible drawdown of more than 28 meters was simulated for the West block. The simulated drawdown in the East block is less than in the West block simply because the pit will be shallower or the water levels deeper resulting in a smaller difference in depth between the groundwater level and base of the coal seam.

The maximum estimated drawdown was simulated to be in the northern part of the proposed pits, as this is where the maximum difference between the water level and coal seam exists. In some areas in the mine blocks a rise in water level is visible during the operation phase. In these areas the coal seam is higher than the static water levels. Mining will therefore not cause drawdown in these areas. The recharge in the mining areas increases during the operational phase of mining to approximately 12% of the mean annual precipitation, which is in the order of 700 mm/a. The increase in recharge will cause a rise in water levels in the areas where the coal seam is higher than the static water levels.

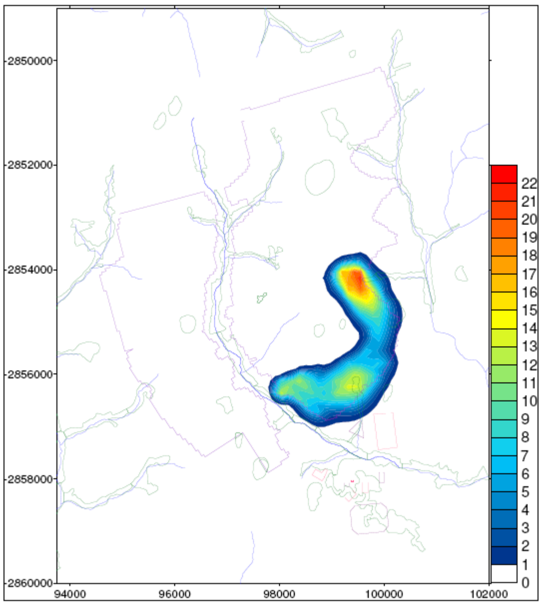

Figure 76: Simulated drawdown 5 years after mining has started

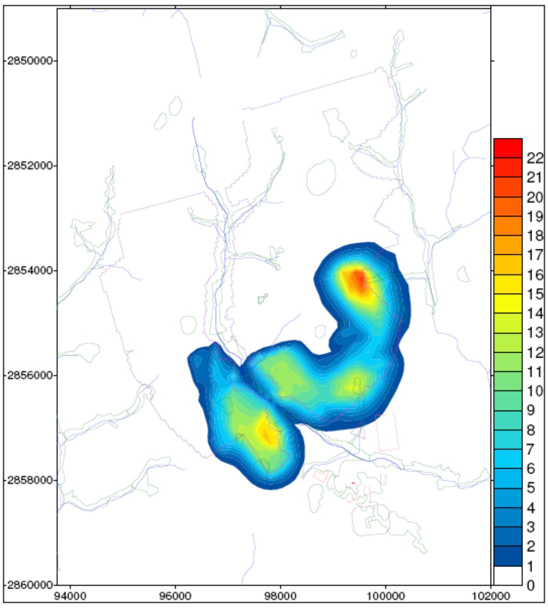

Figure 77: Simulated drawdown 10 years after mining has started

The transmissivity and storativity increases in the mined areas. A transmissivity of 30 m^2/day and storage coefficient of 0.35 was used in the post closure numerical model. The drains which were used to simulate the mine blocks have been removed in the post closure model. The model was then run for a period of 50 years.

The groundwater level has not recovered 50 years after mine closure as indicated in Figure 79. The main reason for the lack of full recovery of the pit water level is the higher transmissivity of the backfill material in the rehabilitated pits that will result in southwards flow of water through the spoils and the fact that decant will occur in the south of the mined-out blocks.

The decant onto surface in the south will occur at lower elevations than the pit floor elevation in the northern portion of the mine. The water level in the northern part of the mine blocks will thus never recover fully after mining.

The maximum difference between the steady state water levels and the 50 years post closure water levels is just over 26 meters in the East block. These higher differences are observed in the northern regions of the mining blocks where maximum drawdown was caused during the operational phase. The larger extent of the depression cone is caused by the higher transmissivity and storage coefficient applied to the post-closure model.

It follows from the simulated drawdown contours that the geometry of the depression cone at 150 years after mine closure is similar to the cone 50 years after closure. The reason is that the water level will never recover in the northern portions of the two backfilled pits. The much higher transmissivity of the backfill material will result in a flat water level in the pits and the water level will recover only to the decant elevation.

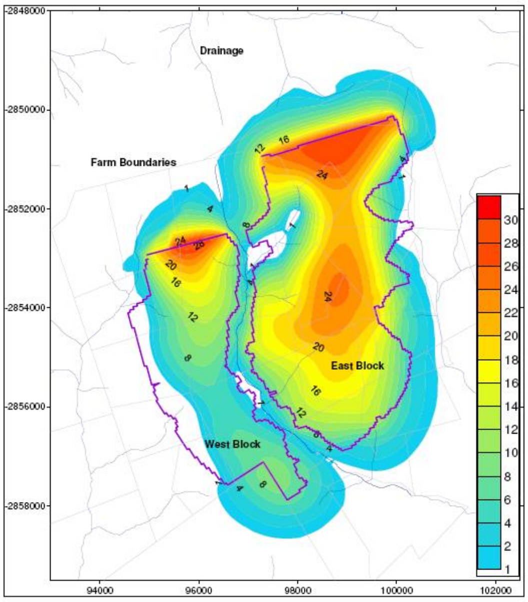

Figure 78: Simulated maximum possible cone of depression at the end of mining

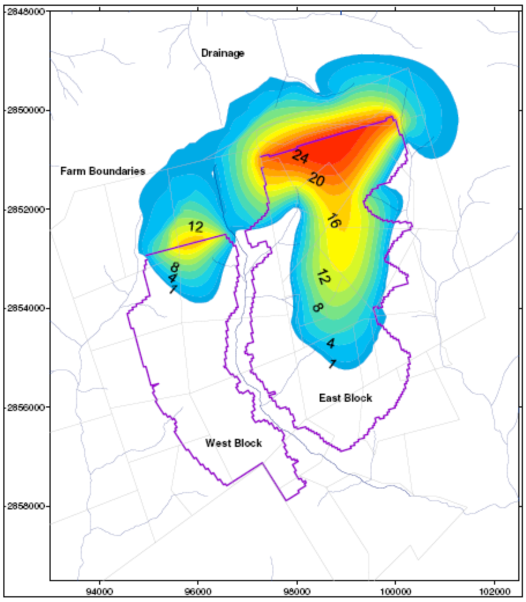

Figure 79: The extent of the cone of depression 50 years after mine closure

The natural groundwater gradient and other influences such as groundwater abstraction or nearby mine voids / quarries would have significant impacts on the natural drainage rate and direction.

Pollution Plumes

During active opencast mining and until a new groundwater equilibrium has been reached, the opencast pits act as groundwater sinks and groundwater will move radially inwards towards the pits. This means that during this period poor quality leachate generated by acid mine drainage will move towards the mine voids and cannot drain towards the immediate surroundings.

Mining at the proposed Belfast project occurs from south to north, which is upgradient. Where progressive backfilling has occurred at lower elevations the water level can somewhat recover and cause leachate to move away from the backfilled areas.

The significance of pollution plume migration and the coinciding affect on the groundwater quality of downstream regions is more significant because groundwater users occur downgradient. Poor quality leachates are likely to affect surface water quality in the tributaries of the Leeubank stream to the west of the West block and the Klein Komati River to the east of the West block as well as tributaries west, east and south of the East block.

Groundwater contamination starts moving away from the mine during the operational and decommissioning phases because the mining progresses upgradient. In the downgradient areas, where mining has finished and the areas were backfilled (roll over mining method), the groundwater level can start to recover. The contamination can therefore start to move downgradient during the operational phase. At active mining areas the mine acts as a groundwater sink area and flow with associated mass transport is radially inwards towards the mined area. Therefore, no pollution movement is possible away from the active mining until the water level has recovered to near pre-mining levels.

Due to the fact that the decanting point is lower than the majority of the pit area, little carbonaceous material will be covered before decanting starts. A large portion of the pits will therefore be exposed to oxygen. Contamination in the form of acid mine drainage will thus occur.

The surface water tributaries surrounding the two opencast areas and the mine related infrastructure areas (plants, co-disposal site, workshop and RWD) will be affected by plume movement. The plume will move towards the west, east and south from the pit areas. The plumes will extend a maximum distance of approximately 500 m from the pits and sources.

During active opencast mining and until a new groundwater equilibrium has been reached, the opencast pits act as groundwater sinks and groundwater will move radially inwards towards the pits. This means that during this period poor quality leachate generated by acid mine drainage will move towards the mine voids and cannot drain towards the immediate surroundings.

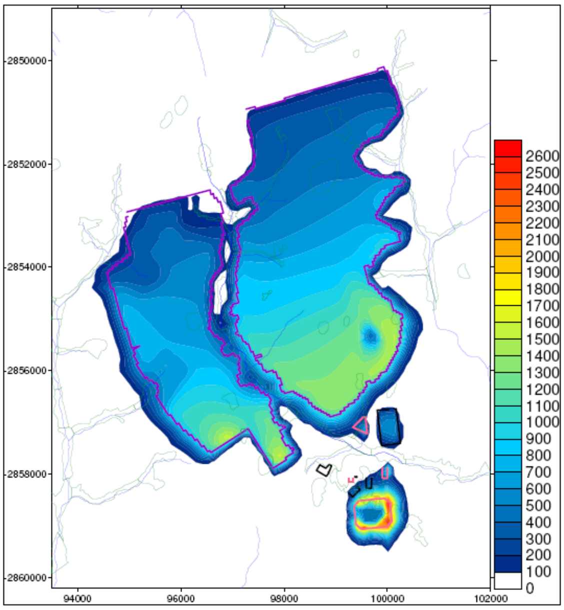

Figure 80: Simulated TDS source concentration contours at mine closure

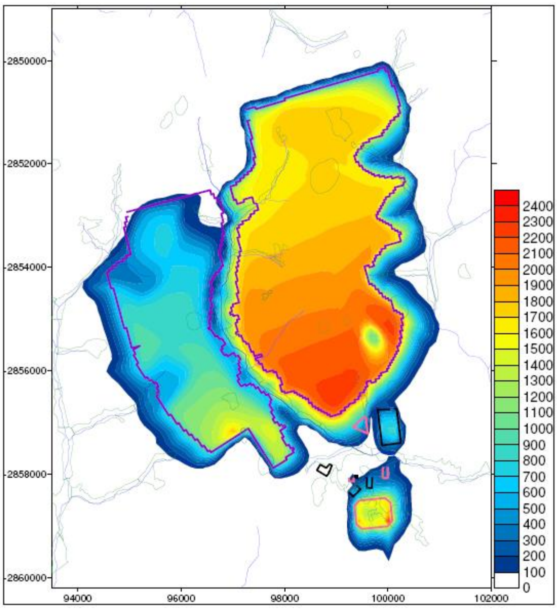

Figure 81: Simulated TDS concentration contours 50 years after mine closure

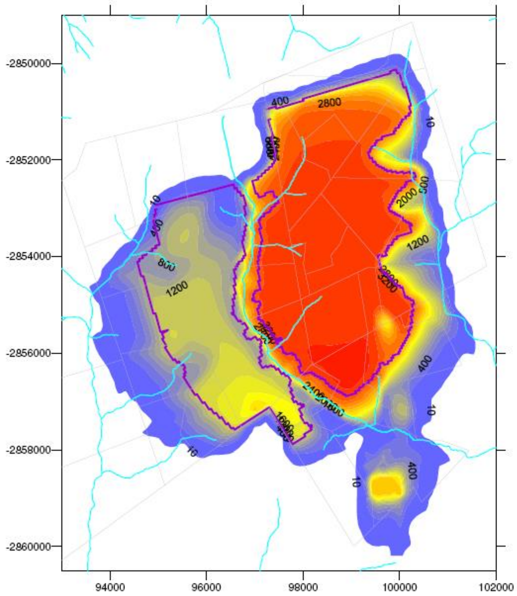

Figure 82: Simulated TDS concentration contours 150 years after mine closure

Aquifer Recharge

After mine closure, however, recharge is usually significantly higher to the backfilled mine void compared to the pre-mining aquifer and after filling up, the discharge is usually higher than before the disruption by mining. The effective recharge is especially higher for opencast mining and can be as much as 5 - 15 times the natural recharge without the affect of mining. With all proposed mining in the Belfast area being opencast operations, the recharge pattern will thus be changed dramatically.

The major changes can be summarized as follows:

- The active void will have an infinitely high transmissivity and a storage coefficient of 1 and will act as a groundwater sink where it is developed below the depth of the static water level;
- The rehabilitated (backfilled) pit will have a transmissivity and storativity at least one to two orders of magnitude higher than the undisturbed aquifer host rock;
- Where semi-confined or confined aquifer conditions prevailed before mining, the 'aquifer' in the pit areas will change to unconfined;
- Effective recharge to the pit areas will also increase by an order of magnitude; and
- The water quality in the pit area will also change dramatically, from very high quality water to saline water. The salinity will be caused by release of saline (especially chloride and sodium) water as well as acid-base reactions as a result of exposure of pyrite-containing carbonaceous material in and around the coal horizon to oxygen and water. These reactions will cause significant deterioration of the water quality in the pit areas.

Opencast mining usually causes a significant increase in aquifer recharge percentage. Surface water features like dams (tailings, slurry, process water, storm water, return water etc.) will also usually increase the recharge to the aquifer but compacted or concrete surfaces and roads will decrease the recharge.

6.6.2 Proposed Mitigation

Unfortunately, there is nothing to be done on the geometry of the coal reserve or the acid neutralizing capacity of the backfill material and it is imperative for the Belfast Project to take proper and timeous action to manage the poor quality decant that will start to occur nearly directly after mine closure.

The following mitigation measures are proposed:

- A stormwater management system will be constructed to ensure that clean surface water does not come into contact with dirty water or coal bearing material. Clean runoff water will be diverted away from dirty areas.
- No construction of any water management measures, such as the storm water management berms or the haul roads will be undertaken with carbonaceous material.
- All dams will be lined in an effort to minimize the seepage of poor quality leachate.
- Drains and cut-off trenches (storm water management system) around the proposed opencast pits will be implemented before commencing with pit development to prevent clean run-off water from entering the pit.
- Opencast areas will be rehabilitated as soon as available to reduce the availability of oxygen and volume of infiltration thereby reducing the generation of AMD.
- Refilling of the voids will be according to sequential layering of carbonaceous material with highest pollution potential at the bottom of the pit.
- Dewatering of the backfilled spoils will pump water back to the storage dam before being treated by the desalination plant. The excess mine water that will have to be managed post-closure was based on the following assumptions:
  - The co-disposal facility will be rehabilitated with a cover so that the surface runoff is clean.
  - The return water dam and plant areas will be removed and the area rehabilitated.
  - The pits will be rehabilitated to be free draining with a standard 600mm thick cover.
  - The waste dumps located adjacent to the pits will be removed and returned to the pits.
  - A desalination plant will be constructed to treat the excess water.

The rehabilitated opencast areas can be contained or reduced to a large extent by lowering the decant elevation. This can be achieved by leaving a deeper void (at least 5-10 meters below surface) at the decant point and pumping at a rate that keeps the water level down below the surface. The same can be achieved by a dewatering borehole drilled or built into the backfill material at the decant point.

Monitoring data will be used to update the current numerical model simulation for more accurate predictions of groundwater flow and quality and action plans will be formulated and implemented if adverse impacts are identified.

A monitoring program will be in place from the operational phase throughout the life-of-mine until after closure to monitor the occurrence of any adverse groundwater impacts. The monitoring results will be reported regularly and records of monitoring and audit reports will be available for inspection by the regional director if necessary.

6.7 Biodiversity

The entire study site is situated within one vegetation type, the Eastern Highveld Grassland. The conservation status of this vegetation type is Endangered and the conservation target is 24%. By 2006 some 44% was already transformed primarily by cultivation, plantations, mining, urbanisation and building of dams.

With reference to the Mpumalanga Biodiversity Conservation Plan (MBCP) terrestrial biodiversity assessment, the project falls mostly on areas classified as No Natural Habitat Remaining with small areas classified as Least Concern. The areas classified as No Habitat Remaining are areas in which natural vegetation has been lost. It includes all land transformed by urban / industrial development and cultivation. Biodiversity is irreversibly changed, reduced to levels that are virtually dysfunctional. These landscapes have only residual or negative effects on the functioning of natural ecosystems. The areas classified as Least Concern have biodiversity value in the form of natural vegetation cover. Although they are not currently required in order to meet biodiversity targets, they do contribute significantly to functioning ecosystems, including ecological connectivity.

A relatively small portion of the project falls within an area classified as Important and Necessary. Biodiversity in this category is relatively intact. It represents the areas which most efficiently contribute to meeting biodiversity targets and minimise landuse conflict. If biodiversity is lost from these areas, larger areas will be required elsewhere for targets to be met.

There is a small section of the site that falls within an area Classified as Highly Significant. Highly significant areas are those where biodiversity has been heavily compromised and very few options remain to meet biodiversity targets. Natural vegetation cover in these areas should be maintained or restored. Any significant habitat loss may cause these areas to become irreplaceable. Approved developments or changes in land use must be compatible with conservation objectives, e.g. well managed livestock grazing. If development is unavoidable, such land uses must be made sufficiently dispersed and/or small scale, so as to be biodiversity friendly. Decisions on landuse changes will require a biodiversity specialist study as part of the EIA.

According to the Mpumalanga Biodiversity Conservation Plan (MBCP), the study area falls within an area that is rated as being highly significant and Important and Necessary for the aquatic assessments. This assessment is based on its high biodiversity value and unique wetland systems outside any formal Protected Areas network. The Klein-Komati River wetland system falls within the highly significant rating as per the MBCP.

6.7.1 Impact Assessment

The identified impacts on the terrestrial ecosystems are as follows:

- Loss of plant communities. Plant communities occurring in the grassland portions of the mining area will be lost due to the disturbance caused by total clearing of the land for the construction of mine infrastructure and open pit mining activity.
- Loss of plant red data species. Red data floral species that may occur in sites to be disturbed will be destroyed by project activities.
- Reduction of plant diversity. Sites cleared of vegetation will destroy species restricted to that particular site of operation. Due to the extent of this project, sites where plants with limited habitat preference occur, such as on wetland fringes, those plants will be destroyed, thereby diminishing species diversity in the mining area.
- Loss of faunal communities. Faunal communities will be lost due to the destruction of vegetation and soil structure that provide the habitat for the fauna occurring in the region.
- Loss of faunal red data species. Many of the faunal red data species potentially occurring in the mining area have limited tolerance for disturbance due to specific habitat requirements that will be de destroyed by the removal of plants and soil.
- Reduction of faunal diversity. Sites cleared of vegetation will destroy animal species restricted to that particular site of operation. Due to the extent of this project, sites where animals with limited habitat preference occur, such as on wetland fringes, those animals will be destroyed, thereby diminishing species diversity in the mining area.
- Increase in dust. Wind driven dust that settle on the vegetation will have effects such as reduced vigour of growth due to reduced transpiration of plants and reduced reproductive capacity caused by dust settling on the leaves and flowers.
- Increase in invasive species. Sites disturbed by the mining activity will be prone to infestation by a variety of invasive exotic species, thereby diminishing natural biodiversity and limiting natural ecosystem processes.
- Loss of grazing land. Grazing land serves as habitat for the faunal species of the area, including red data species. Animals that are dormant, burrowing, and territorial females with young in nests will not move away.

- Loss of crop fields. Crop fields serve as habitat for the faunal species of the area, including red data species. Animals that are dormant, burrowing, and territorial females with young in nests will not move away.
- Increased human activity. Increased human movement, vehicular traffic, heavy machinery and noise will drive sensitive species such as birds, including the Vulnerable Blue and Crowned cranes away.
- Cumulative impact. Cumulative impacts are those impacts that are caused by a combination of activities in a region and that result in an incremental build-up of lasting impacts that will destroy the natural environment

6.7.2 Proposed Mitigation

Based on the conclusion and highlighted impacts of the project, the following main recommendations were made:

- Dust suppression.
  - Reduce dust generating areas by tarring road surfaces, avoid large areas of cleared vegetation and revegetate cleared areas.
  - Rehabilitate exposed areas immediately after completion of activity.

- Invasive species.
  - Implement an invasive species eradication program immediately after disturbance of the environment starts in order to prevent or limit numbers of invasive plants and invasive species.
  - Implement a rehabilitation program immediately after mining activity ceases on disturbed sites and continue rehabilitation and monitoring throughout the mining period.

- Loss of grazing land.
  - Catch and release, in another suitable area, small mammals and herpetofauna.
  - Increased human activity.
  - Impose speed limits and restrict human and vehicular movement to specific demarcated areas.

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- Loss of plant communities.
  - Relocate and maintain a representative sample of plant species in a nursery for use in rehabilitation during the life of the project.

- Loss of red data plant species.
  - Conduct Red data rescue operations for flora that may be lost or degraded during construction and operational phases;
  - Construct a nursery for sensitive or Red data floral species which should be managed by a sub-contracted horticulturist; and
  - Search for red data species and relocate them to a nursery during the active growth season. Use relocated species in the rehabilitation program.

- Reduction of plant diversity.
  - Search for species with restricted distribution and relocate them to a nursery during the active growth season. Use relocated species in the rehabilitation program.

- Loss of faunal communities.
  - Catch and release small mammals and herpetofauna in other suitable habitat close by.

- Loss of faunal red data species.
  - Conduct Red data rescue operations for fauna that may be lost or degraded during construction and operational phases;
    - Catch and release red data small mammals and herpetofauna in other suitable habitat close by.

- Reduction in faunal diversity.
  - Catch and release small mammals and herpetofauna in other suitable habitat close by.

- Loss of grazing land.
  - Rehabilitate land with an objective to restore biodiversity to a predetermined state or to a land use which conforms to the generally accepted principle of sustainable development

- Loss of croplands.
  - Rehabilitate land with an objective to restore biodiversity to a predetermined state or to a land use which conforms to the generally accepted principle of sustainable development.

- Cumulative impacts.
  - Rehabilitate on a continuous basis for the full duration of the project and continue there-after until such time as other activities can be resumed.

  - Conduct long-term bi-annual biomonitoring of ecosystems including water quality, habitats, riparian vegetation, diatoms, aquatic macroinvertebrates, fish, as well as terrestrial fauna and flora.

- Develop and implement a Biodiversity Action Plan (BAP) for the project area.

6.8 Wetlands, Rivers and Pans

Current South African legislation, as indicated at the outset of this report, requires that the necessary aquatic ecosystem impact assessment be conducted and mitigation measures assessed so as to reduce or prevent the degradation of aquatic habitats and biotic populations due to alterations in the river that may impact on migration and ecosystem functioning.

6.8.1 Impact Assessment

The assessments of potential impacts of the proposed Exxaro Belfast coal mining project on the aquatic ecosystems are discussed according to the ecological impacts on water quality, habitat (loss and alteration) and biotic communities (aquatic macroinvertebrates, fish, vegetation and other aquatic-dependant fauna).

Most of the impacts identified relate to increased dust and sediment. When the latter settles in the aquatic ecosystems, the water becomes turbid thus reducing the photosynthetic capacity of the water flora. Even the dust settling on the plants reduces the photosynthetic capacity. Thus less food and habitat becomes available. The suspended matter could also smother the small invertebrates, thus triggering hardier species to dominate. Some particles carry an electric charge, adsorbing nutritive substances, subsequently making it unavailable for plants and organisms (Davies and Day 1998).

Water quality

Water quality of the aquatic ecosystems, both the river sites and pans, will be impacted on in two aspects; instream impacts as well as from bank disturbances.

Fluctuations in the in situ water quality parameters (pH, Electrical Conductivity (EC), TDS, DO, and temperature) may occur during the construction phase, the mining operational phase as well as during the decommissioning and mine closure phase. These will have impacts on the aquatic ecosystem biotic communities and vegetation.

The impacts on the water quality may occur due to the fact that the following proposed activities will impact the adjacent pans and wetlands, the upper catchments, headwaters and tributaries of the Leeuwbankspruit, the Klein Komati River and the Driehoekspruit within the project area, as well as the downstream river ecosystems outside of the project area:

- Dust generation and transportation due to the clearing of vegetation prior to construction, the construction phase, the mining operation phase and the decommission and closure phase, which will settle on the riparian vegetation and in-stream habitats, leading to:
  - Reduced photosynthesis and transpiration in flora
  - An increase in fine-particulate sediments into the water
  - A decrease in visibility and light penetration
  - An increase in potential EC and TDS
  - Fluctuation changes in the pH values
  - Fluctuations in the surface water quality monitoring parameters
  - This impact will be greatly increased during the drier months of April through to September

- Increased soil sediment loads and coal sediments via surface water runoff into the adjacent pans and wetlands as well as the tributaries and rivers within the project area and downstream aquatic ecosystems, via the clearing of vegetation prior to construction, the construction activities and the removal of topsoil, coal seams 2, 3, 4 and 5 as well as the parting geological layers between the seams during the mining operation processes, leading to:
  - Reduced photosynthesis and transpiration in the in-stream aquatic macrophytes
  - An increase in fine-particulate sediments into the water
  - A decrease in visibility and light penetration
  - An increase in potential EC and TDS
  - Fluctuation changes in the pH values
  - Fluctuations in the surface water quality monitoring parameters

  This impact will be greatly increased in the wet months of October to March and during flood events

- Loss of catchment water yield in the three river ecosystem catchments within the project area, due to the proposed mining operations, leading to
  - A reduction in dilution factor from a reduction in ground water recharge at the springs, eyes and fountains in the pans, wetlands and tributaries of the three river catchments
  - A reduction in dilution factor from a reduction in natural surface water runoff recharge in the wetlands and tributaries of the three river catchments
  - Fluctuations in the surface water quality monitoring parameters
  - This impact will be greatly increased during the drier months of April through to September

- Regional water quality conditions indicate existing high suspended solid concentrations for the majority of the monitoring localities, coupled with elevated suspended metal concentrations. Neutral pH levels indicate that the metal concentrations are not in solution. Increases in this due to the proposed project impacts may result in:
  - Increased possibility for microbial growth
  - Decreased sunlight for photosynthesis leading to decreased food production
  - Interference with the feeding mechanisms of filter feeding organisms
  - Reduced gill functioning and foraging efficiency (due to visual disturbances)

  - Reduced growth in fish

- Contamination of groundwater resources as a result of mining activities reaching the underlying water table; Contamination of spring, eye and fountain source zones of the pans, wetlands and tributaries of the three river catchments within the project area;
  - Acid mine drainage entering aquatic ecosystems
  - Heavy metal toxicity
  - Fluctuations of in situ water quality parameters
  - Fluctuations in surface water monitoring parameters.

- Contamination of the wetlands and tributaries of the three river catchments as a result of mine water release from dewatering of the mine pits, leading to:
  - Acid mine drainage entering aquatic ecosystems
  - Heavy metal toxicity
  - Fluctuations of in situ water quality parameters
  - Fluctuations in surface water monitoring parameters
  - Oil from generators and vehicles may also enter the systems
  - Bank disturbances, resulting in increased sediment input from erosion

- Cumulative impact from existing agriculture impacts, surrounding mining activities as well as the proposed Exxaro Belfast project, leading to
  - Increased erosion, flooding, sedimentation and bank instability
  - Fluctuations *in situ* water quality parameters
  - Fluctuations in surface water monitoring parameters

Habitat impacts

The impacts on the habitat may occur due to the fact that the following proposed activities will impact the adjacent pans and wetlands, the upper catchments, headwaters and tributaries of the Leeuwbank, the Klein Komati and the Driehoekspruit within the project area, as well as the downstream river ecosystems outside of the project area:

- Macro-channel habitat loss or alteration: The largest impact on the macro-channel and riparian vegetation is expected to occur during the construction period. The following proposed activities will impact on the macro-channel and riparian vegetation:
  - Removal/destruction of aquatic ecosystem (especially pans within the proposed coal footprint areas);
  - Riparian vegetation removal;
  - Bank disturbances;
  - Drainage pattern changes; and
  - River diversion.
  - These activities may result in possible bank destabilization, increased erosion potential and exotic vegetation encroachment.

- In-stream channel habitat loss or alteration: Dust that enters the in-stream channel will impact on the following habitats:
  - Decreased visibility due to clouding of water column;
  - Decreased light penetration;
  - Siltation of fine sediment substrates, gravel substrates and inter-substrate spaces; and
  - Decrease in habitat availability.
  - This impact will be greatly increased during the drier months of April through to September.

- Soil sediment loads and coal sediments entering the aquatic ecosystems via surface water runoff into the adjacent pans and wetlands as well as the tributaries and rivers within the project area and downstream aquatic ecosystems, leading to:
  - An increase in fine-particulate sediments into the water;
  - A decrease in visibility;
  - A decrease in light penetration;
  - Increased siltation; and
  - Decreased habitat availability.
  - This impact will be greatly increased in the wet months of October to March and during flood events.

- Loss of catchment water yield in the three river ecosystem catchments within the project area, due to the proposed mining operations, leading to:
  - A reduction in ground water recharge;
  - A reduction in natural surface water runoff recharge; as well as
  - A reduction in stream flow, discharge and velocity of flow; and
  - A reduction in hydraulic biotopes and in-stream habitat availability.
  - This impact will be greatly increased during the drier months of April through to September.

- Bank disturbances, resulting in increased sediment input from erosion.

- Cumulative impact from existing agriculture impacts, surrounding mining activities as well as the proposed Exxaro Belfast project, leading to increased erosion, flooding, sedimentation and bank instability.

- Aquatic macroinvertebrate habitat availability: Due to likely impacts on sedimentation, siltation and reduction of flow, the following impacts may occur on the aquatic macroinvertebrate habitat availability:
  - Loss or reduction of habitats, whereby certain flow habitats are lost or reduced (Stones-in-Current, Vegetation in current); certain habitats may be silted up or have sediment deposited over them (Stones, gravel, aquatic macrophytes), thus not being available for colonisation for certain aquatic macroinvertebrates taxa.
  - Adult stages, breeding and survival, whereby the adult stages have reduced habitat available for breeding due to marginal vegetation and aquatic macrophytes being covered in dust, exotic vegetation encroachment and bank instability.

- Ichthyofaunal habitat availability: Due to likely impacts on sedimentation, siltation and reduction of flow, the following impacts may occur on the fish habitat availability:
  - Loss or reduction of habitats, whereby certain flow habitats are lost or reduced (fast shallow and slow shallow biotopes, cover from suitable water column and marginal vegetation); certain habitats may be silted up or have sediment deposited over them (Stones, gravel, aquatic macrophytes and marginal vegetation).
  - Breeding and spawning areas may also be lost due to siltation, in-stream modifications, flow reductions or water quality changes.

Biotic changes

- Riparian and marginal vegetation, aquatic macrophyte and diatom diversity and abundances: Changes to the vegetation community structure of the aquatic ecosystems may take place due to the likelihood that the following may occur as a result of the abovementioned impacts:
  - Fluctuations in water chemistry may directly impact on the ability of certain vegetation species to survive.

- Toxicity of water may be lethal to sensitive vegetation.
- Increased possibility for microbial growth and algal blooms.
- Sedimentation of marginal vegetation habitats and aquatic macrophytes.
- Shifts in aquatic macrophyte communities, favouring tolerant or invasive species.
- Decreased sunlight for photosynthesis leading to decreased food production.
- Shifts in marginal vegetation communities, favouring non-flow dependants species, tolerant species or exotic species.
- Shifts in riparian vegetation communities, favouring pioneer species, disturbance tolerant species or exotic species.
- Shifts in diatom communities, favouring tolerant species.
- Exotic riparian vegetation encroachment.

- Aquatic macroinvertebrate diversity and abundance: Changes to the aquatic macroinvertebrate community structure may take place due to the likelihood that the following may occur as a result of the abovementioned impacts:
  - Fluctuations in water chemistry may directly impact on the ability of certain taxa to survive.
  - Toxicity of water may be lethal to sensitive taxa.
  - Increased possibility for microbial growth.
  - Decreased sunlight for photosynthesis leading to decreased food production.
  - Interference with the feeding mechanisms of filter feeding organisms.
  - Reduced gill functioning and foraging efficiency (due to visual disturbances).
  - Flow dependant taxa may decrease or be lost due to reduced flows.
  - Taxa requiring specific habitats may decrease or be lost due to siltation of substrates, aquatic macrophytes and marginal vegetation habitats.
  - Adult stages of certain taxa may fail to find suitable breeding habitats due to settlement of dust on the marginal vegetation and aquatic macrophytes, thus reducing the abundance or presence of certain taxa.

- Ichthyofaunal diversity and abundance: Changes to the fish community structure may take place due to the likelihood that the following may occur as a result of the abovementioned impacts:
  - Reduced growth in fish.
  - Fluctuations in water chemistry may directly impact on the ability of certain fish species to survive.
  - Toxicity of water may be lethal to sensitive species.
  - Increased possibility for microbial growth.
  - Decreased sunlight for photosynthesis leading to decreased food production.
  - Reduced gill functioning and foraging efficiency (due to visual disturbances).
  - Flow dependant species may decrease or be lost due to reduced flows.
  - Fish species requiring specific habitats may decrease or be lost due to siltation of the water column, substrates, aquatic macrophytes and marginal vegetation habitats.
  - Certain species may decrease in abundance due to loss of food sources (aquatic macroinvertebrates, aquatic macrophytes).
  - Exotic species competition or invasion, already identified as an impact within the Klein-komati.
  - Decrease in abundance of certain species that rely on specific habitats for breeding and spawning.

6.8.2 Proposed Mitigations

Mitigations for the identified impacts were developed. These arise from an attempt to avoid, minimise, rectify, reduce or compensate for a specific impact. No mitigation was also accounted for in the development of the mitigations.

The following mitigations were identified in the impact assessment:

- Adhere to properly managed strip mining procedures.
- Construction of bridges, roads and other river crossing structures to be minimised and planned, designed and constructed in consultation with the aquatic and wetland ecologists.
- Create a buffer around the catchment of the pans outside the coalpit footprint area and create an adequate buffer zone around the riparian zone of the aquatic ecosystems and prevent any activities occurring within these buffer zones.
- Implement good construction practices, whereby waste, degradation or destruction of the aquatic ecosystems is minimised or prevented.
- Limit river and or wetland diversions, additional river and or wetland crossings, and invasive construction into river and or wetlands throughout the project area and only have entrances and road access to sites from existing roads and infrastructure.
- Plan the location of river and wetland crossing structures and its design to minimise the impact on wetlands in consultation with the river and wetland ecologists.
- Prevent ground water and surface water recharge points from shifting locations due to mining activities.
- Prevent the indiscriminate use of groundwater or surface water within the project area.
- Vehicle and construction activity near the wetland and aquatic ecosystems should be kept to a minimum.

Soil

- Storage of top soils, subsoils, overburden and coal in a way to prevent erosion, runoff and seepage into wetland ecosystems.
- Rehabilitate any erosion or scouring immediately to prevent further impacts, rehabilitate strip mine areas and pits adequately.

Fauna

- Red Data relocation actions of fauna should be implemented during the construction phase and land-clearing phases of the strip mining operations.
- Undertake Red data and sensitive species rescue and relocation operations (specifically the Conchostraca, Ostracoda and Copopoda groups in the pans) and reintroduce species once rehabilitation has taken place.
- Dam spills and introduction of exotic fish species should be prevented at all costs and if found, exotic species should be destroyed immediately.
- All breeding, spawning, nesting sites and critical life-stage habitats within the project area must be identified and protected from any negative impacts as a result of the project where possible. Any impacts must be rectified by rehabilitation of the altered or lost habitat in critical areas of the aquatic and wetland ecosystems. Rescue and relocate birds in similar habitats with active nests, owls (juveniles), moulting birds, etc.
- Limit of cattle from entering rivers and wetlands in the project area, and mitigate and manage local cattle impacts on erosion.

Flora

- Preservation of riparian zones, marginal vegetation and the macro channel banks of rivers.
- Red Data relocation actions of flora should be implemented during the construction phase and land-clearing phases of the strip mining operations.
- Set up of a nursery to house, maintain and grow indigenous unique, scarce and protected and Red Data floral species. This nursery should be contracted out to be maintained and managed by a horticulturalist.
- Reintroduce lost vegetation species once rehabilitation has taken place;
- Revegetate all cleared land, strip mine areas and construction areas as quickly as possible.
- Avoid large-scale vegetation clearing, and clear only areas necessary for immediate construction.

- Rehabilitate the wetlands, pans and the buffer zones within the proposed mining rights area, outside of direct strip mining activities, on a continual basis during the operation phase of the project and during the closure phase. This will manage the impacts that are likely to occur from the immediate surrounding mining activities.
- Minimise the amount of activity allowed within the created buffer zone of the pans, wetlands and river ecosystems.
- Exotic vegetation removal actions for introduced or encroaching exotics as a result of the project.
- Leave large trees and natural areas for offices, plant site gardens around dams and other infrastructure.

Pollution prevention

- Vehicles and generators must be kept away from wetlands, river and pans, all equipment must be properly maintained to prevent oils and fuels from accidently entering the aquatic ecosystems.
- Untreated mine water should not enter the aquatic and wetland ecosystem.
- Strip mining areas should not be left exposed or be contaminated with mine water or chemicals, treat all contaminated water to approved standards before release in the environment.
- Any sediment spills and chemical or mine water contamination into the wetland and aquatic ecosystem must be cleaned up immediately.
- Prevention of contaminated water entering the aquatic and wetland ecosystem. All contaminated water; both groundwater and surface water sourced, should be adequately contained or treated before being allowed to enter the aquatic ecosystem. Failure to do so will result in high impacts to the receiving environment.
- Prevention of runoff from site entering aquatic ecosystem. Suitable stormwater management, erosion prevention and runoff control measures should be constructed and managed so as to prevent any runoff into the aquatic ecosystems.
- Prevent mine dewatering discharge into sensitive aquatic ecosystems, or wetlands.
- Prevent any oils from entering the aquatic ecosystem. No oils or fuels from vehicles, machinery or generators should be allowed to enter the aquatic ecosystems, if accidentally allowed to enter, immediate clean-up action must be initiated to prevent further spread into the aquatic ecosystem.
- Parking lots and fuel storage areas should be correctly bermed and storm water management systems constructed for protection from surface water runoff into the wetland and aquatic ecosystem.
- Controlled release of treated mine water.
- Construction of silt traps, runoff storage dams and water clarification treatment plants for silted / sedimented water.
- Containment of all groundwater and surface water and the treatment thereof before release into the aquatic ecosystems.
- Remove water to storage dam for treatment or disposal. Water collected in the proposed mine pits should not be allowed to enter the aquatic and wetland ecosystems untreated. This water should be pumped and piped to a water treatment facility or storage dam for treatment before being allowed to be discharged or released into the aquatic ecosystems.
- Avoid aquifer water transfer and seepage within the proposed coal footprint and strip mining areas.

Dust

- Wetting of dirt roads with water on a daily basis or sealing with dust sealant.
- Wetting of soil and coal stockpiles, and cleared areas during the drier months.
- Placing speed limits on all dirt roads within the project area (e.g. set a maximum speed limit of 20 km/hr.
- Use of wind buffering structures around exposed mining sites or open strip areas.
- Land not used for strip mining should not be cleared and all mining areas should be rehabilitated immediately.

Rehabilitation

- Correct restructuring of geology, soils and specific layers within the mining footprint area so as to mimic the natural groundwater drainage and lateral movement.
- Implement natural revegetation of exposed areas, using indigenous vegetation that was found in the baseline assessments in consultation with specialists.
- Rehabilitate any bank disturbances along the aquatic and wetland ecosystems.
- Rehabilitate strip mine areas and pits adequately and correctly.
- Rehabilitate the wetland and aquatic ecosystems in and around any river diversions on a continual basis during the construction, operation and closure phase.

Monitoring

The reduction of the identified impacts requires the monitoring and management of all aspects of the aquatic ecosystems during the construction, operation and closure phases. Local or unforeseen impacts can therefore be mitigated immediately and the effects monitored and rehabilitation implemented. This will result in a reduction in impact.

- Map and monitor groundwater and surface water recharge points;
- Monitor the water quality of the boreholes, springs, eyes and fountain source zones within the project area during the construction, operation and closure phases on a quarterly basis and mitigate immediately, should any contamination occur;
- Monitor groundwater recharge locations and seepage areas throughout the project;
- Institute a long-term riparian vegetation biomonitoring programme to monitor the success of vegetation rehabilitation. Mitigate further impacts;
- Institute a long-term habitat biomonitoring programme to monitor the success of habitat rehabilitation; Mitigate further impacts;
- Monitor the habitat availability of water birds and mammals within the project area on a bi-annual (wet and dry season) basis and mitigate any further impacts immediately, this should be done during the construction, operation and closure phases;
- Monitor sediment loads and water quality and metals concentrations in the adjacent and downstream aquatic ecosystems on a quarterly basis;
- Monitor the terrestrial, wetland and aquatic ecosystems of the pans and buffer zones within the coal footprint area, but not yet mined,on a a bi-annual (wet and dry season) basis and mitigate any further impacts immediately, restrict access to pans and the buffer zones;
- Monitor the channels banks of wetland and aquatic ecosystems and pans within the project area and mitigate any further impacts immediately, restrict access to the buffer zones;
- Monitoring any river diversions during construction and operation phases and mitigate any further impacts immediately;
- Monitor the health of the wetland and riparian systems and channel banks within the project area and mitigate any further impacts immediately, this should be done during the construction, operation and closure phases, long-term biomonitoring of the riparian systems and macro channel habitats
- Monitor the habitat availability of the aquatic macroinvertebrates and fish within the project area on a bi-annual basis and mitigate any further impacts immediately, this should be done during the construction, operation and closure phases;
- Monitor the species composition of the wetland and riparian and marginal vegetation, aquatic macrophytes and diatoms species within the project area on a bi-annual basis and mitigate any further impacts immediately. This should be done during the construction, operation and closure phases; and
- Institute a long-term biomonitoring programme of the project aquatic ecosystems and mitigate any further impacts.

6.9 Air Quality

6.9.1 Emissions Modelling

Emissions inventories provide the source input required for the simulation of ambient air concentrations. Emission rates were quantified for each hour of the year as a result of wind erosion and materials handling for the proposed construction and operational phases. In addition, fugitive emissions from vehicle entrainment, crushing and screening, drilling, blasting, excavation and grading were also quantified.

The following scenarios were included in the dispersion modelling:

- Scenario 1a- Phase 1: Construction Phase (2011) assuming unmitigated emissions.
- Scenario 1b- Phase 1: Construction Phase (2011) assuming mitigated emissions for the unpaved roads (75% control efficiency), drilling (99% control efficiency) and crushing and screening (use of high moisture ore emission factors).
- Scenario 2a- Phase 2: Operational Phase (2016) assuming unmitigated emissions.
- Scenario 2b- Phase 2: Operational Phase (2016) assuming <u>mitigated</u> emissions for the unpaved roads (75% control efficiency), drilling (99% control efficiency) and crushing and screening (use of high moisture ore emission factors).

The detailed outputs of the air dispersion model are contained in Appendix D, including PM10 and dust fallout predictions. The main sources of emissions, per scenario, were identified as follows:

Scenario 1a

- Unpaved roads were predicted to be the main contributing source to PM10 and second most significant source of Total Suspended Particulate (TSP) emissions (45.2% and 29.1% respectively).
- The second most significant source of PM10 and the most significant source of TSP emissions was crushing and screening (31.1% and 62.4% respectively).

Scenario 1b

- With mitigation measures in place, unpaved roads were still predicted to be the main contributing sources to PM10 and TSP emissions (31.1% and 42.6% respectively).
- The second most significant source of PM10 and TSP emissions was blasting (29% and 21.2% respectively).

Scenario 2a

- Without the application of mitigation measures, unpaved roads were predicted to be the main contributing source to PM10 and TSP emissions (70% and 51.9% respectively).
- The second most significant source of PM10 and TSP emissions was crushing and screening (18.6% and 43.4% respectively).

Scenario 2b

- Unpaved roads were predicted to be the main contributing source to PM10 and TSP emissions (57.5% and 68.9% respectively).
- Crushing and screening was predicted to be the third most significant source of PM10 and second most significant source of TSP (14.4 % and 11.5% respectively).

From the proposed operations, the main construction activities likely to result in noticeable impacts of PM10 and TSP include vehicle entrainment from unpaved roads, drilling and blasting and wind erosion from the coal stockpiles.

6.9.2 Impact Assessment

Numerous receptor areas (Figure 83) were identified during the impact study. Additional sensitive receptors may be identified once operations begin and these will be addressed as necessary.

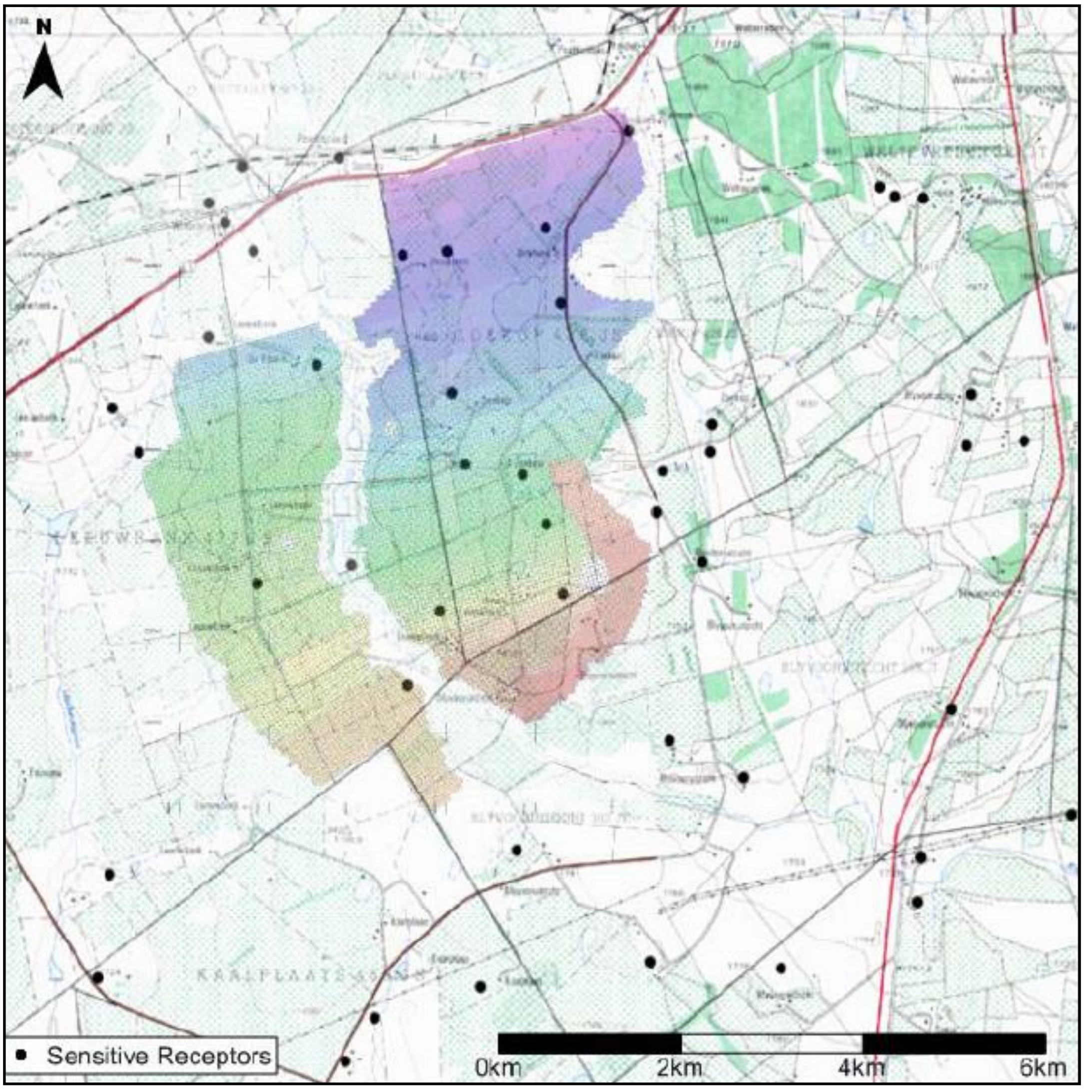

Figure 83: Identified Sensitive Receptor Areas

In addition to being the most significant sources of emissions (PM10 and TSP), the unpaved roads and crushing and screening activities were also predicted to be the most impacting sources at the receptor sites for most of the modelled scenarios.

Scenario 1: Proposed 2011 Construction Phase (Phase 1)

- The predicted unmitigated daily average PM10 ground level concentrations exceeded the proposed South African (SA) Standard of 75 µg/m³ at the farmstead located to the south east of the proposed mine site and at the Jan Burger farmstead. However, with mitigation measures in place for the most significant contributing sources to PM10 emissions (unpaved roads and crushing and screening), the predicted impacts at all the sensitive receptor areas were within the proposed SA Standards. Over an annual average, the predicted unmitigated impacts indicated exceedances of the proposed standard at Jan Burger farmstead and at the farmstead located to the south east of the proposed mine site. The application of mitigation measures to unpaved roads, drilling and crushing and screening, resulted in the predicted impacts complying with the proposed SA standard (40µg/m³) at all the sensitive receptor areas.

- The predicted maximum daily dust fallout levels were well within the South African National Standards (SANS) residential target of 600 mg/m²/day at all the sensitive receptor areas for all the modelled scenarios.

Scenario 2: Proposed 2016 Operational Phase (Phase 2)

- The predicted unmitigated daily and annual ground level concentrations were predicted to exceed the proposed SA Standard of 75 µg/m³ and 40 µg/m³ respectively at all the sensitive receptor areas. The application of mitigation measures to the unpaved roads and crushing and screening, however, resulted in the predicted impacts complying with the proposed SA Standards at the receptor sites.
- When the unmitigated predicted concentrations for the operational phase were evaluated against the proposed allowable exceedance of 4 times a year for the proposed South African Standard of 75 µg/m³, predictions at all the receptor sites were in excess of 4 days over the 1 year period (2008). However, the predicted concentrations at the receptor sites indicated frequencies of exceedances of less than 4 days for the mitigated proposed 2016 operations.
- The predicted unmitigated and mitigated maximum daily dust fallout levels did not exceed the SANS residential target of 600 mg/m²/day at the receptor sites.

Uncontrolled Emissions	75% Control efficiency and controlled crusher emissions
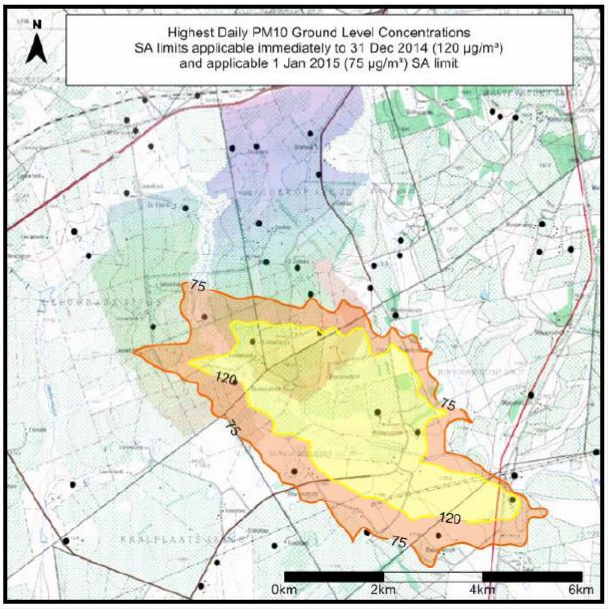	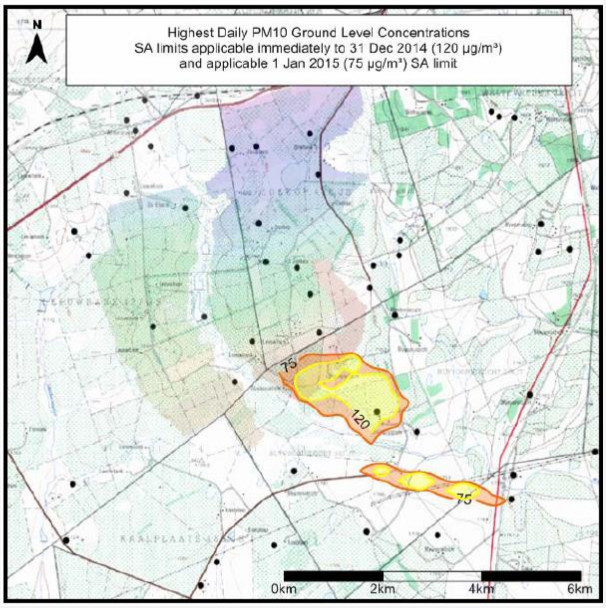
Figure 84: Highest daily PM10 ground level concentrations due to construction operations (2011)	**Figure 85: Highest daily PM10 ground level concentrations due to construction operations (2011)**

Uncontrolled Emissions	75% Control efficiency and controlled crusher emissions

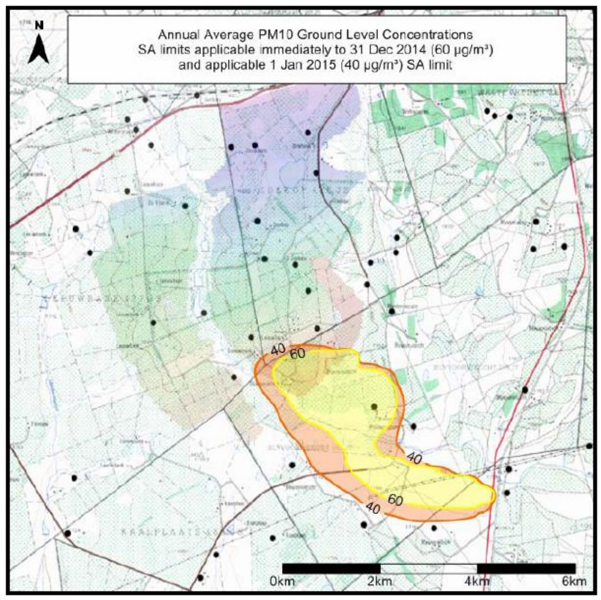

Figure 86: Annual average PM10 ground level concentrations due to construction operations (2011)

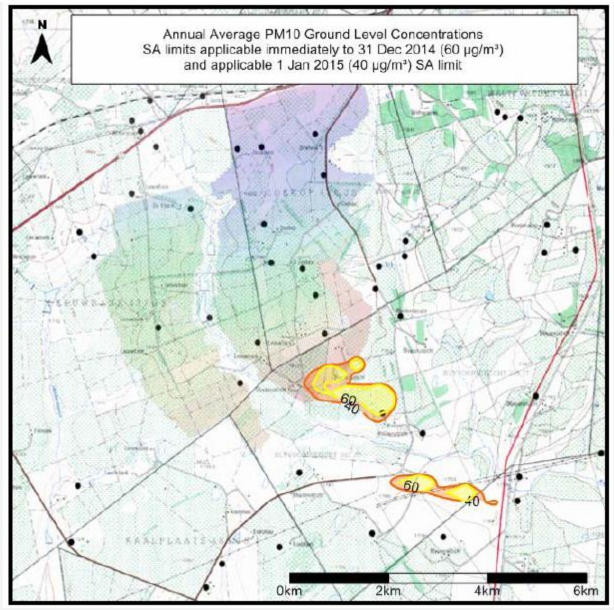

Figure 87: Annual average PM10 ground level concentrations due to construction operations (2011)

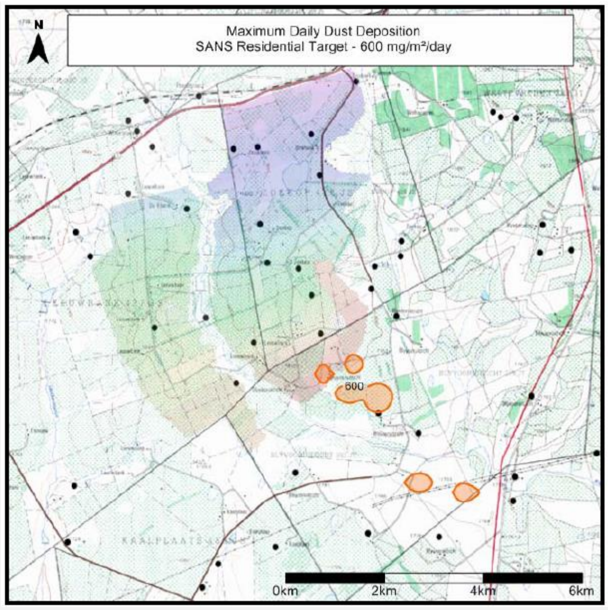

Figure 88: Maximum daily dust deposition due to construction operations (2011)

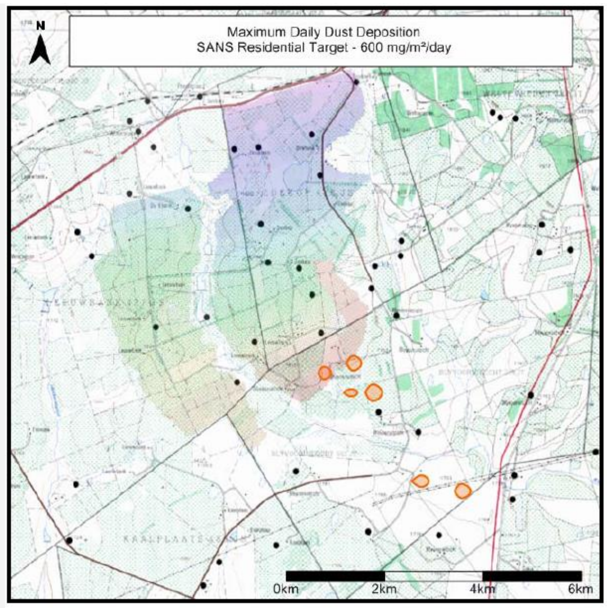

Figure 89: Maximum daily dust deposition due to construction operations (2011)

Uncontrolled Emissions	75% Control efficiency and controlled crusher emissions
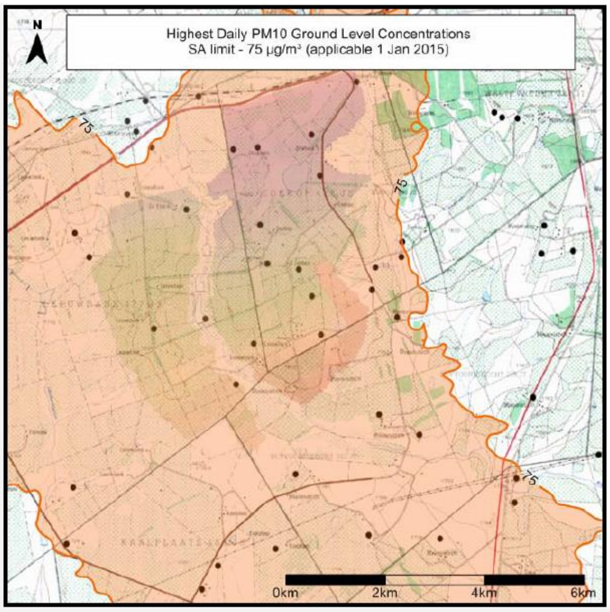	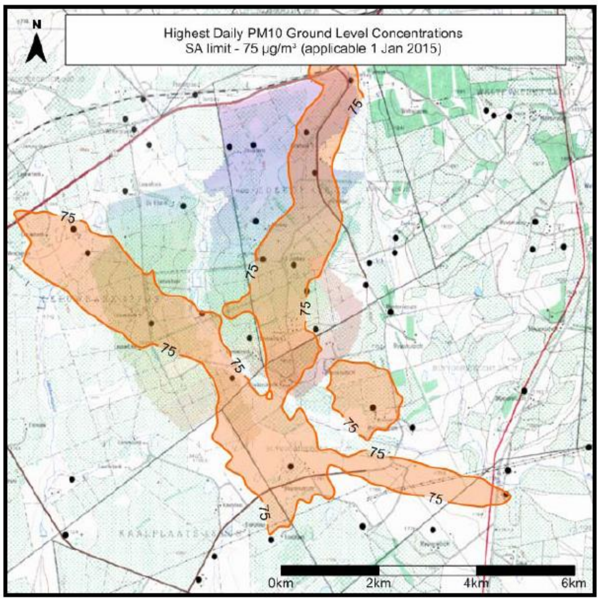
Figure 90: Highest daily PM10 ground level (2016)	**Figure 91: Highest daily PM10 ground level concentrations (2016)**
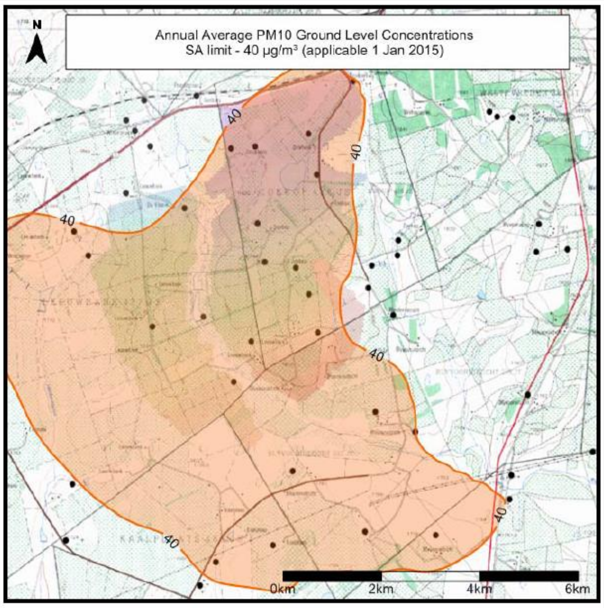	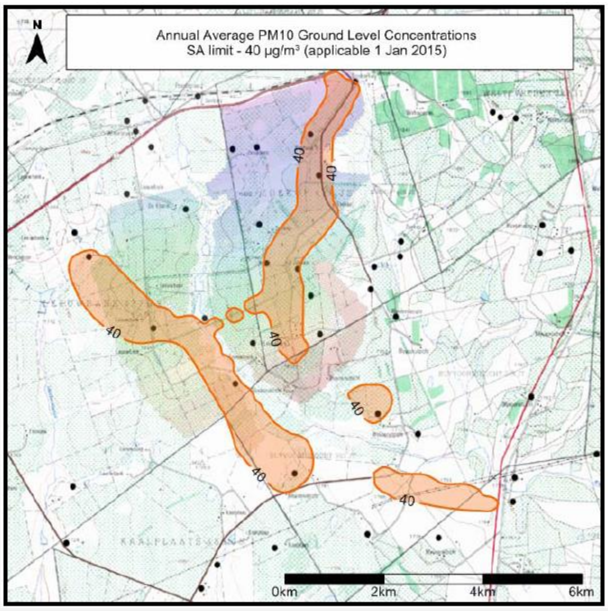
Figure 92: Annual average PM10 ground level concentrations due to operations (2016)	**Figure 93: Annual average PM10 ground level concentrations due to operations (2016)**

Uncontrolled Emissions

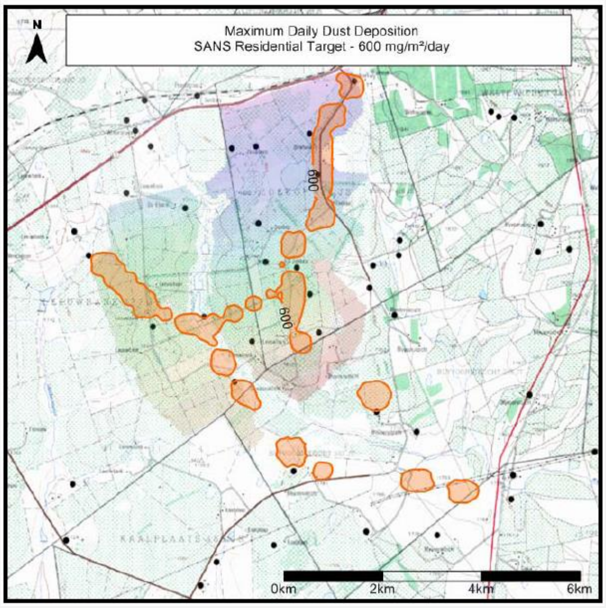

Figure 94: Maximum daily dust deposition due to operations (2016)

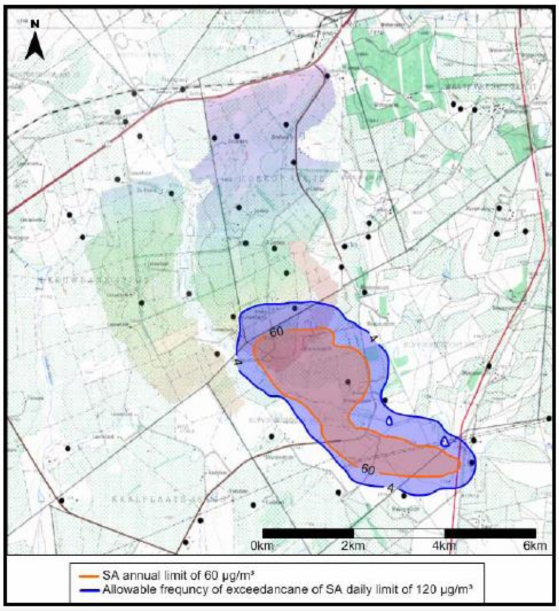

Figure 96: Area of non-compliance of the SA standard for construction phase (2011)

75% Control efficiency and controlled crusher emissions

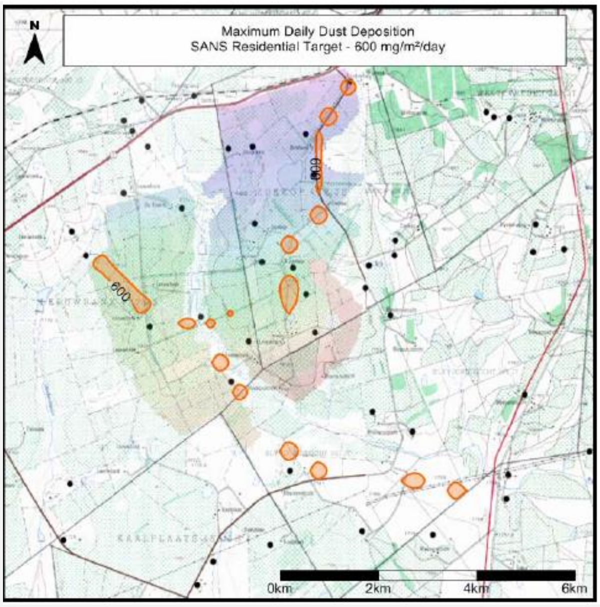

Figure 95: Maximum daily dust deposition due to operations (2016)

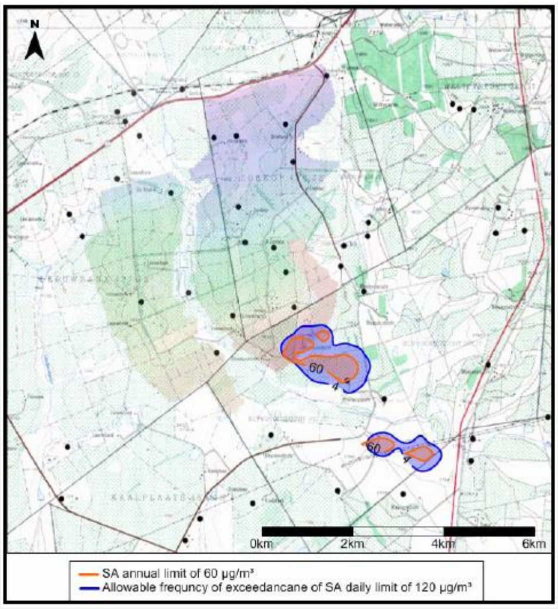

Figure 97: Area of non-compliance of the SA standard for construction phase (2011)

Uncontrolled Emissions	75% Control efficiency and controlled crusher emissions

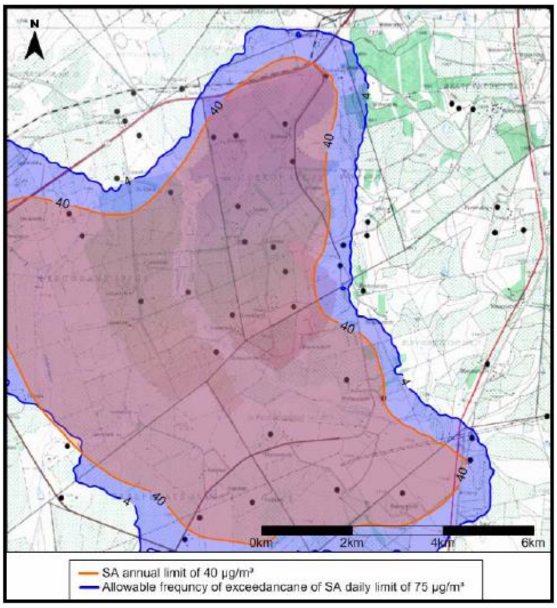

Figure 98: Area of non-compliance of the SA standard for operation phase (2016)

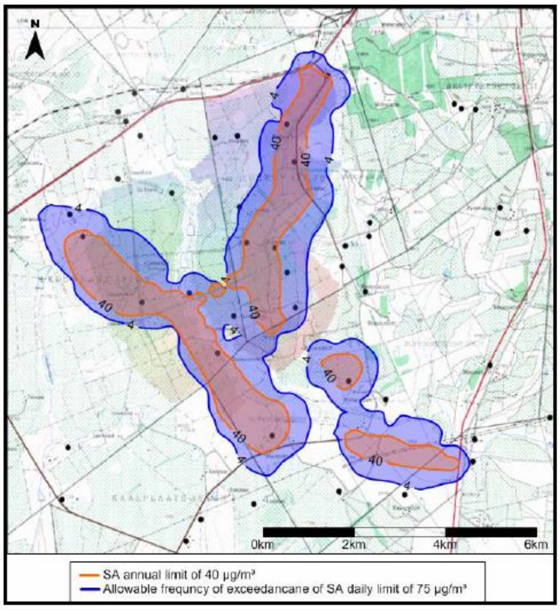

Figure 99: Area of non-compliance of the SA standard for operation phase (2016)

The main conclusion from the Air Quality Impact Assessment (Appendix D) is that without the application of suitable mitigation measures to the main contributing sources to PM10 and TSP emissions, i.e. the unpaved roads and crushing and screening, the proposed construction and operational mining activities will result in exceedances of the proposed SA Standards at the various sensitive receptors in the vicinity of the mine. Application of mitigation measures will lead to a significant reduction in predicted impacts at the sensitive receptor areas and compliance with the proposed ambient SA PM10 Standards.

In order to accurately update the air dispersion model and to monitor the air quality within the proposed mining area the establishment of an air quality monitoring programme is recommended. The location of the dust fallout buckets required for such monitoring have preliminary been identified as depicted in Figure 100.

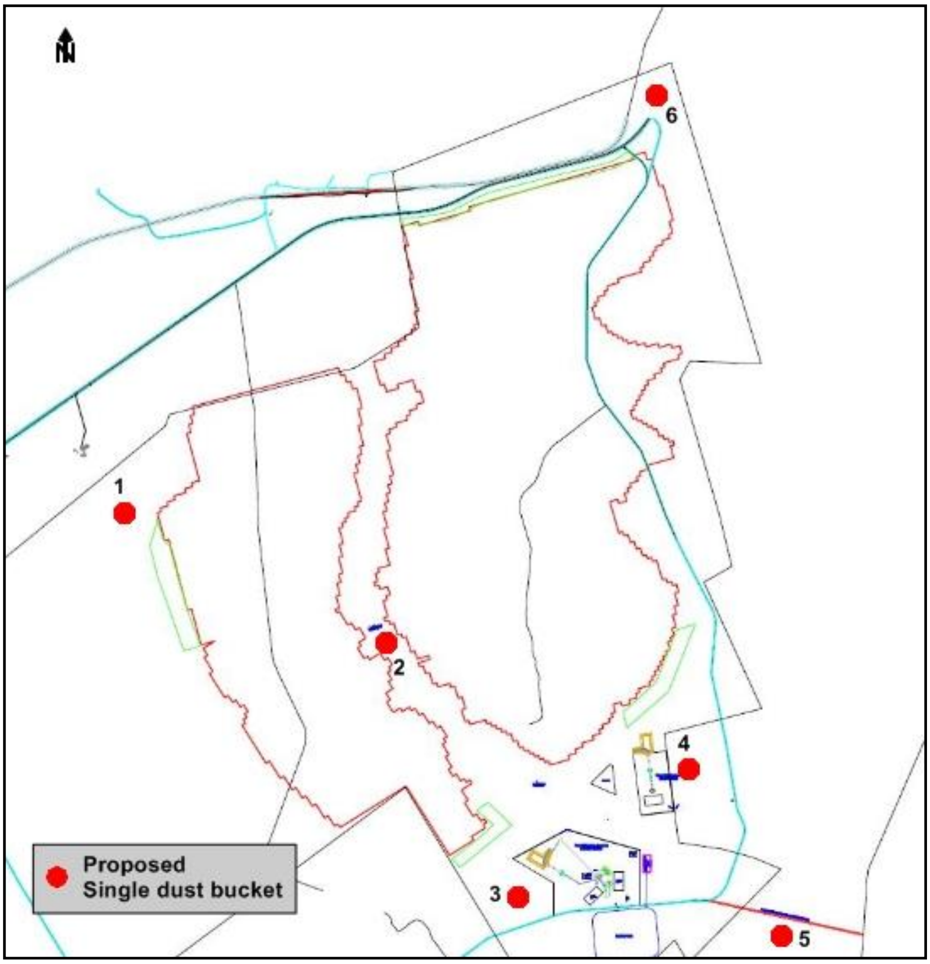

Figure 100: Proposed Location of Dust Fallout Monitoring Equipment for the Belfast Project

6.9.3 Proposed Mitigation

Based on the conclusion and highlighted impacts of the project, the following main recommendations were made:

- Proposed construction and operational phases
  - Vehicle entrainment on unpaved haul roads – 75% control efficiency through water suppression, with ~90% control efficiency through the application of chemical surfactants or surface paving.
  - Vehicle entrainment on in-pit haul roads – these roads change depending on the area to be mined and hence it is not practical to apply chemicals. It is recommended that a minimum of 75% control efficiency is achieved through affective water sprays.
  - Crushing and screening operations - enclosure of crushing operations is very effective in reducing dust. The Australian NPi indicates that a telescopic chute with water sprays would ensure 75% control efficiency and enclosure of storage piles where tipping occur would reduce the emissions by 99%. In addition, chemical suppressants or water sprays on the primary crusher and dry dust extraction units with wet scrubbers on the secondary and tertiary crushers and screens will assist in the reduction of the cumulative dust impacts.

- Closure Phase

  It is assumed that all mining activities and processing operations will have ceased by the closure phase of the project. The potentials for impacts during this phase will depend on the extent of demolition and rehabilitation efforts during closure.

- Unpaved haul roads: Chemical suppression (for the main access road) and water suppression (main haul roads and in-pit roads) can be utilised to control unpaved road emissions. It is therefore recommended that mitigation measures be applied to the proposed unpaved haul roads when these operations commence. Wet suppression and chemical suppression can also be used in conjunction to control unpaved road emissions. One of the main benefits of chemical stabilisation in conjunction with wet suppression is the management of water resources. A cost-effective chemical control programme should be developed evaluating the costs and benefits arising from various chemical stabilization practices on site specific roads.
- Crushing and Screening: The control efficiency of pure water suppression provides an effective control mechanism achieving on average 62% efficiency by doubling the moisture content.

6.10 Noise

6.10.1 Impact Assessment

Noise, in any given environment, is experienced as disturbing or unacceptable if one or a combination of the following conditions emerges:

- If the ambient noise level (regardless of the origin or number of sources) significantly exceeds the value regarded as typical or acceptable for the type of district under consideration; and
- If a new development or any specific activity created noise that raises the ambient level by more than a certain increment above the initial level, even if the total level is still below the so-called acceptable level.

Table 58 provides an indication of the noise level and typical human perception of common noise sources.

Table 58: Typical Noise Levels and Human Perception of Common Noise Sources

Noise Level (dba)	Source	Subjective Description
160 – 170	Turbo jet engine	Unbearable
130	Pneumatic chipping and riveting (operators position)	Unbearable
120	Large diesel-powered generator	Unbearable
110	Circular saw, blaring radio	Very noisy
90 – 100	Vehicle on highway	Very noisy
80 – 90	Corner of busy street, voice - shouting	Noisy
70	Voice - conversational level	Quiet
40 – 50	Average home – suburban areas	Quiet
30	Average home – rural areas, voice – whisper	Quiet
0	Threshold of normal hearing	Very quiet

According to the SANS 0103: 2004, the measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication, and the surrounding land uses, the Belfast Project is considered to be within a rural district (Table 59).

The mining operation will be next to the N4, close to the R33 and various other secondary and farm roads. Sufficient buffering between the mine and roads will be required to decrease the various noise related impacts. The anticipated day time and night time impact zones associated with noise generation for the proposed project are provided in Figure 101 and Figure 102 respectively.

As various farm homesteads are localized within the area surrounding the proposed mining area, the continuous assessment of environmental noise with respect to annoyance needs to be conducted in order to determine the impacts of noise on the surrounding environment.

Table 59: Acceptable Rating Levels for Noise in Districts (SANS 10103:2004)

Type of District	Equivalent Continuous Rating Level ($l_{req.t}$) for Noise dba					
	Outdoors			Indoors, with Open Windows		
	Day-night $L_{r,dn}$[a]	Day-time $L_{req,d}$[b]	Night-time $L_{req,d}$[b]	Day-night $L_{r,dn}$[a]	Day-time $L_{req,d}$[b]	Night-time $L_{req,d}$[b]
Residential Districts						
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30
c) Urban districts	55	55	45	45	45	35
Non Residential Districts						
d) Urban districts with some workshops, with business premises, and with main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
e) Industrial districts	70	70	60	60	60	50

[a] The values given in column 2 and 5 are equivalent continuous rating levels and include corrections for tonal character, impulsiveness of the noise and time of day.

[b] The value given in columns 3, 4, 6 and 7 are equivalent continuous rating levels and include corrections for tonal character and impulsiveness of the noise.

Day Time: 06h00 – 22h00 Night Time: 22h00 – 06h00

Predicted Impact of General Site Operation Noise

The anticipated day time and night time impact zones are provided in Figure 101 and Figure 102 respectively.

The phase 1 crusher plant and the phase 2 washing plant are above ground with a predicted noise level of 79.4 dB(A) at 15m. The investigation shows that the proposed equipment will not have a significant impact on the noise climate of the nearest dwellings. In the worst case, with no mitigating measures, the predicted noise emission of the exposed crusher plant turns out to be virtually identical with the screened combined activity in the pit. The impact will therefore also be identical with the above pit situation and will therefore be NONE during daytime beyond a distance of 600m (1900m at night) and LOW at 330m (1050m at night) from the crusher plant alone or the active pit as shown in Table 60.

Table 60: Distances from the screened active pit or exposed crusher plant for a certain response intensity and noise impact for various increases over the ambient daytime and night-time noise.

Exceedance db	Noise Impact	Distance - Day	Distance – Night
0	None	600m	1900m
3	Very low	420m	1320m
$3 \leq 5$	Low	330m	1050m
$5 \leq 7$	Moderate	260m	830m
$7 \leq 10$	High	190m	600m
$10 \leq 15$	Very high	110m	330m

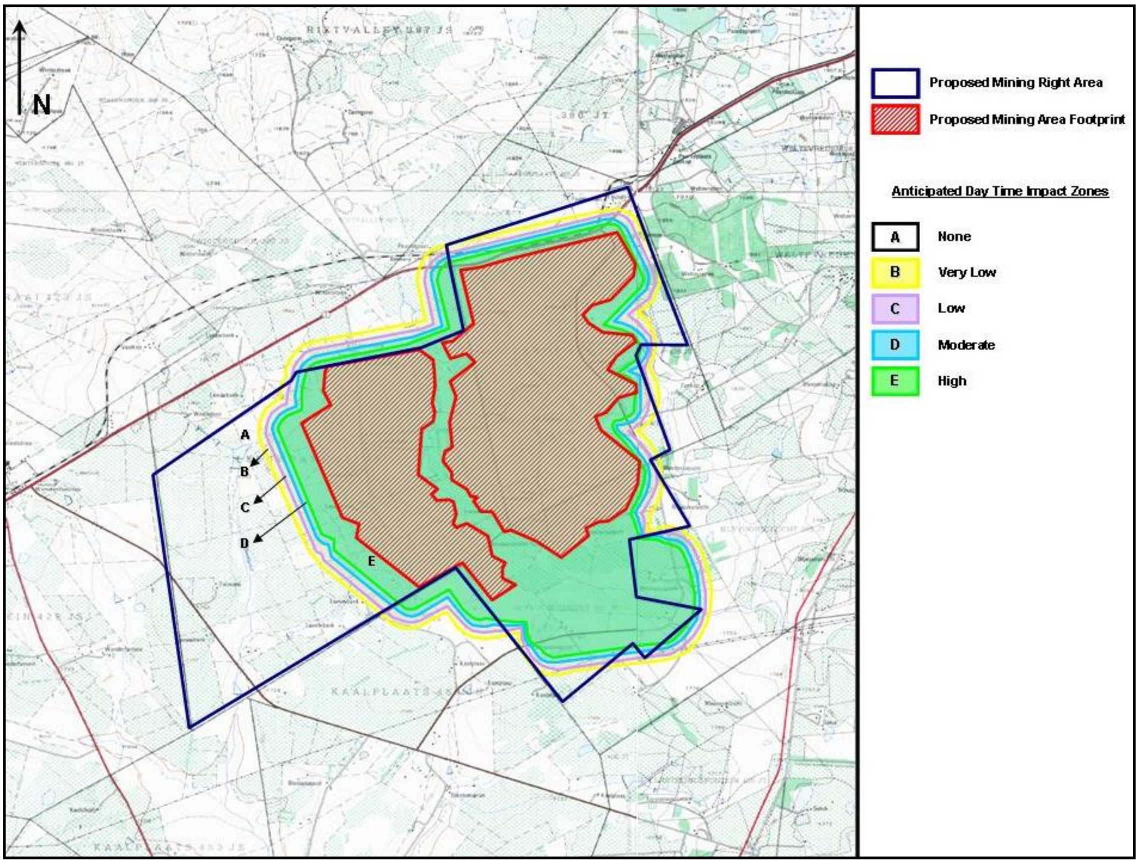

Figure 101: Anticipated Day Time Noise Impact Zones

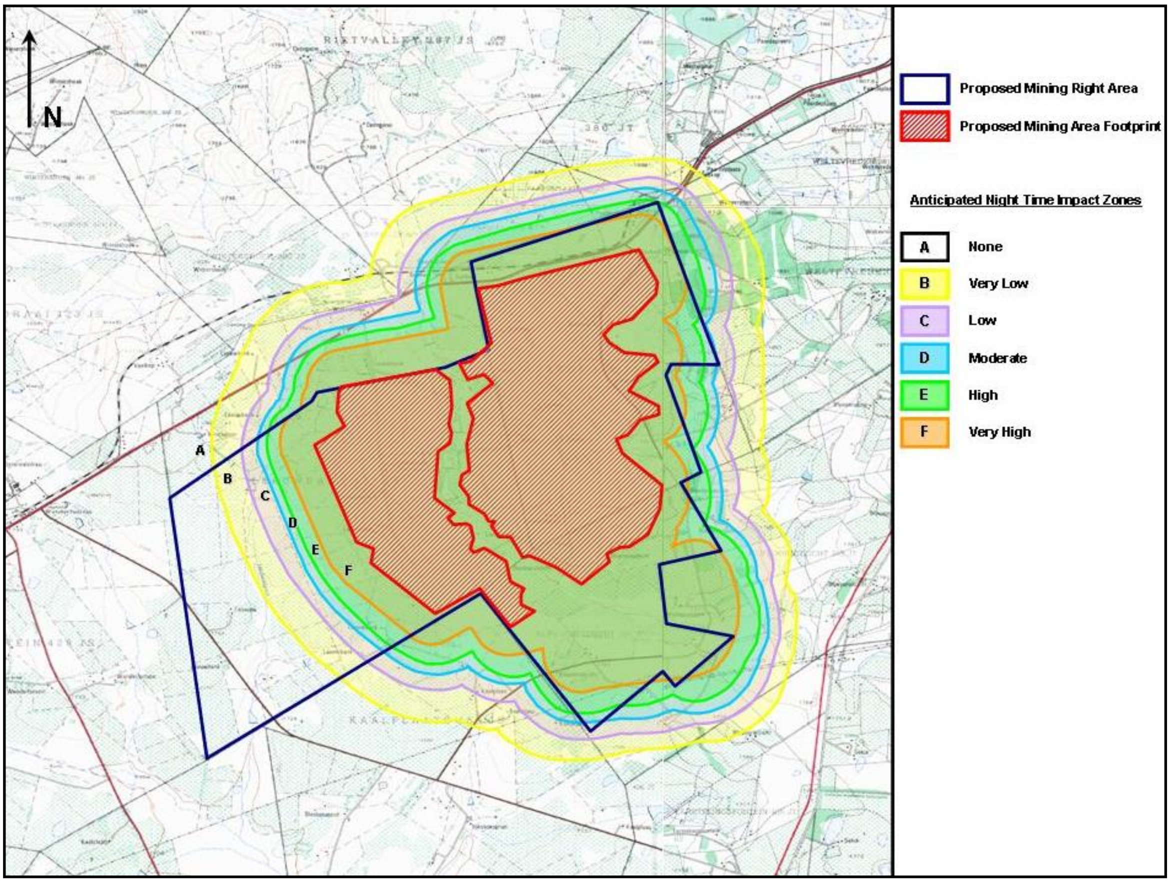

Figure 102: Anticipated Night Time Noise Impact Zones

It must be noted that the mining operation will progress from South to North and that the noise zones shown in Figure 101 and Figure 102 will move accordingly.

These values represent the change of community response and reflect the distance from the plant/pit at which these responses can be expected to occur. For the opencast situation, the values represent the worst case, where equipment is always assumed to be located at the nearest point to the boundary within the pit. This will only happen while the pit is being excavated in that position, and this worst case noise level will therefore only be applicable close to this position for a short period while this is the case.

As the excavations progress, different areas will be affected by this worst case noise level, and other areas will be exposed to lower levels of noise as extraction progresses to a more remote location, and deeper. Where continuously operating machinery is permanently installed at the same location on the surface, such as the crusher plant, the noise levels are fixed for the life of the mine, and therefore dominate the noise climate at these site boundaries. For the noisiest opencast operations, these are thus generating a noise impact varying from 'LOW' to 'NONE' at the prediction location, depending on their proximity to this location and the extent of the local noise shielding provided by the pit sides, positioning of temporary stockpiles, and local ground contours, all of which mitigate the noise impact to a greater or lesser extent.

Table 61: Summary of worse case impacts of noise

Phase	Impact: Noise						
	Nature	Extent	Duration	Intensity	Probability	Significance	
						M*	No M**
Construction	Noise	Local to site	Short term	Very Low, Negative	Probable	Very Low	Low
Operation	Noise	Local to site	Long term	Low, Negative	Probable	None	Very Low
Decommissioning	Noise	Local to site	Short term	Very Low, Negative	Probable	None	Very Low
Residual	None	n/a	n/a	n/a	n/a	n/a	n/a
Latent	None	n/a	n/a	n/a	n/a	n/a	n/a

* M = with mitigation measures

** No M = without mitigation measures

Predicted Impact of Delivery Truck Noise

At the maximum potential output of the mine and its crusher infrastructure, 3.0Mtpa, the hourly transport requirement for 1.5Mtpa to each of the two rail terminal destinations at Belfast and Pullenshope is assumed to be 10 collections, amounting to 20 vehicle movements per hour, daytime only, per 16 hour day, 365 days per year. The predicted noise levels generated by this truck activity alone meets the daytime criterion of 45 dB(A) at 55m from the proposed road extension eastwards to the R33 and the Belfast rail terminal, or from the transport route westwards to the Pullenshope rail terminal. It is not expected that dwellings will be within that corridor.

Table 62: Summary of major sources of noise associated with mining operations, and possible remedial measures.

Source	Remedial measures
Mobile equipment noise	Select vehicle routes carefully by internalising the roads Fit efficient silencers and enclose engine compartments Damp mechanical vibrations Maintain equipment conscientiously

Source	Remedial measures
	Erect berm, screen or barrier at permanent sites and haul roads
Fixed plant noise	Carefully select permanent plant site Reduce noise at source by acoustic crusher, etc. Isolate source by acoustic enclosure, etc.

Effects of Noise on Humans

The nature and magnitude of the response to noise from blasting operations will depend critically on the blasting regime chosen, the nature of the rock to be blasted, the size and depth of the charge, the type of explosive, the local topography, and the detonation sequence. As mentioned in section 2.7 above, there are at present no reliable national or international guidelines to accurately predict human or livestock response to blast noise. The closest habitations around the site are at distances of approximately 2.5km from the nearest point of blasting. Impulsive noise levels are likely to be a maximum of approximately 75 dB(A) at the nearest dwellings in the worst case that blasting is at the surface in the early stages of pit development.

Neither the air blast nor the ground vibration are likely, in the author's experience of mining operations of this type, to have any damaging effect on humans, livestock, or buildings in the vicinity, if they are designed and carried out with due regard to good blasting practice and with the desire to obtain cost-effective results in operational terms. However, both air blast and ground vibration may give rise to secondary noise in a building, such as the rattling of windows and other loose objects, and this is often interpreted as a far more serious occurrence than it really is. An additional complication is that the blast will in general contain frequencies below those which can be heard by the human ear i.e. below 20Hz. These low frequencies also contain sufficient energy to give rise to secondary noise, just as with ground vibration, making it characteristically difficult to differentiate between what is attributable to airborne blast and what is attributable to ground borne vibration. The maximum A-weighted sound level from most blasts, as reported above is, in fact, not much greater than the maximum A-weighted sound level from other machinery such as loading, tipping, and permanent plant operations.

Humans are extremely sensitive to vibration and can detect levels of ground vibration of less than 0.1 mm/s, which is less than 1/100th of the levels which could cause even minor cosmetic damage to a building. Complaints and annoyance regarding ground vibration are therefore much more likely to be determined by human perception than by noticing minor structural damage. However, these effects, and the startling effect of sudden impulses of both sound and vibration are often perceived as intrusion of privacy and could be a source of considerable annoyance to the local community. For this reason, and because of the absence of information on either the likely community response to blast noise or the likely levels of blast overpressure or audible noise, the noise impact for blasting operations should be considered MODERATE. However, minimization of the number of times when blasting occurs, and previous notification of blasting activities at predetermined times on stated days, and careful design of the blasting regime to reduce the levels of both airborne blast noise and groundborne vibration will contribute significantly to the minimisation of the overall impact of blasting on the surrounding community.

Effect of Operating Noise and Blast Noise on Livestock

Very little information exists on the response of livestock, or indeed wildlife, to noise, blast noise, and ground vibration. There is no evidence whether or not these will be adversely affected by the noise of operations and how, or how much, they will be affected. The impact on livestock of operating noise is considered VERY LOW, whereas the impact of blast noise, because its occurrence is sudden and unpredictable and its effects also unpredictable is probably MODERATE.

6.10.2 Proposed Mitigations

Methods of mitigation to reduce any potential noise impact, including placement of dam earthworks, berms, barriers, and operational and administrative procedures, plant maintenance, and on-site monitoring to ensure that any agreements entered into regarding operating times are adhered to, are discussed. It is especially effective to group noisy activities such as crushing and loading at the same location and to surround those activities with the stockpiles if feasible, as these are the noisiest surface activities and the most likely to be propagated to sensitive receivers.

- Maintenance of equipment and operational procedures: Proper design and maintenance of silencers on diesel-powered equipment, systematic maintenance of all forms of equipment, training of personnel to adhere to operational procedures that reduce the occurrence and magnitude of individual noisy events.
- Placement of material stockpiles: Where possible earthworks and material stockpiles should be placed so as to protect the boundaries from noise from individual operations and especially from haul roads, which for greatest effect should be placed directly behind them. If a levee is constructed, it should be of such a height as to effectively act as a noise barrier, if line of sight calculations show this to be practicable.
- Equipment noise audits: Standardised noise measurements should be carried out on individual equipment at the delivery to site to construct a reference data base and regular checks carried out to ensure that equipment is not deteriorating and to detect increases which could lead to increase in the noise impact over time and increased complaints.
- Environmental noise monitoring: This should be carried out regularly at bi-annual intervals at specific positions to detect deviations from predicted noise levels and enable corrective measures to be taken where warranted.
- Crusher Plant: It is specifically recommended that the crusher plant, (which operates continuously), wherever it is located, should be in a position where it may be surrounded on all sides by solid earth berms preferably sufficiently high that line of sight is prevented as far as possible from all boundaries of the site and any affected parties outside the site to activities in the crusher plant.

6.11 Blast and Vibration

6.11.1 Impact Assessment

A detailed blast and vibration investigation was undertaken by Blast Management and Consulting and is provided in Appendix N. The aspects of blasting operations such as ground vibration, air blast, fly rock and fumes were evaluated.

The evaluation of effects yielded by blasting operations spanned a great variety of structures in the area. Structure locations as wide as 3,500m from the mining area were considered. The structure types ranged from highly modern communication towers to typical rural building constructions. There was also a significant quantity of sand stone brick walled structures in the area. A significant quantity of dams is found in the area of different sizes. Dam walls in the area are typically built from soil.

Results from the evaluation presented the report showed that influence will be experienced at the surrounding privately owned farms. This influence will however vary in intensity and the structures situated within the 500m boundary from mining area are the most significant influenced.

The structures within the 500m boundary constitute 7% of the total structures evaluated and considered. A total of 115 structures / locations were considered and 8 fall within the boundary. One structure location at very close proximity to the mine boundary showed excessive high levels. This structure is located just outside in the northern part on the mining area.

Specific considerations was also given to people's perception and in cases even outside the 500m it is sure that people will experienced some effects from the blasting operations. However levels will still be within accepted ranges for not inducing damage to structures. The western side of the pit areas is the least affected by restricting influences where the northern sides and north eastern sides of the mining areas are most restricted with structures in these areas.

Ground Vibration

Explosives are used to break rock through the shock waves and gasses yielded from the explosion. Ground vibration is a natural result from blasting activities. The far field vibrations are inevitable, but un-desirable by products of blasting operations. The shock wave energy that travels beyond the zone of rock breakage is wasted and could cause damage and annoyance. The level or intensity of these far field vibration is however dependant on various factors. Some of these factors can be controlled to yield desired levels of ground vibration and still produce enough rock breakage energy.

Factors influencing ground vibration are the charge mass per delay, distance from the blast, the delay period and the geometry of the blast. These factors are controlled by planned design and proper blast preparation.

Ground vibration is a direct result of blasting operations. The amplitude is related to the distance between source and receptor and charge mass per delay.

Levels of ground vibration beyond 500m will be within acceptable levels with low probability of damage being induced to structures. Levels expected for ground vibration beyond 500m is 18.4mm/s and decreasing significantly from there onwards. Air blast levels expected at the 500m is 126dB and decreasing from that point onwards. Safe distances for fly rock if any are set at 500m and thus structures and communities beyond 500m should not be compromised.

Air Blast

Air blast or air-overpressure is pressure acting and should not be confused with sound that is within audible range (detected by the human ear). Sound is also a build up from pressure but is at a completely different frequency to air blast. Air blast is normally associated with frequency levels less than 20 Hz, which is the threshold for hearing. Air blast is the direct result from the blast process although influenced by meteorological conditions the final blast layout, timing, stemming, accessories used, covered or not covered etc. all has an influence on the outcome of the result.

The three main causes of air blasts can be observed as:

- Direct rock displacement at the blast; the air pressure pulse (APP);
- Vibrating ground some distance away from the blast; rock pressure pulse (RPP); and
- Venting of blast holes or blowouts; the gas release pulse (GRP).

The recommended limit for air blast currently applied in South Africa is 134dB. Based on work carried out by Siskind et.al (1980), monitored air blast amplitudes up to 135dB are safe for structures.

Table 63: Damage limits for air blasts

Level	Description
120dB	Threshold of pain of continuous sound
>130dB	Resonant response of large surfaces (roofs, ceilings). Complaints start
150dB	Some windows break
170db	Most windows break

180db	Structural damage

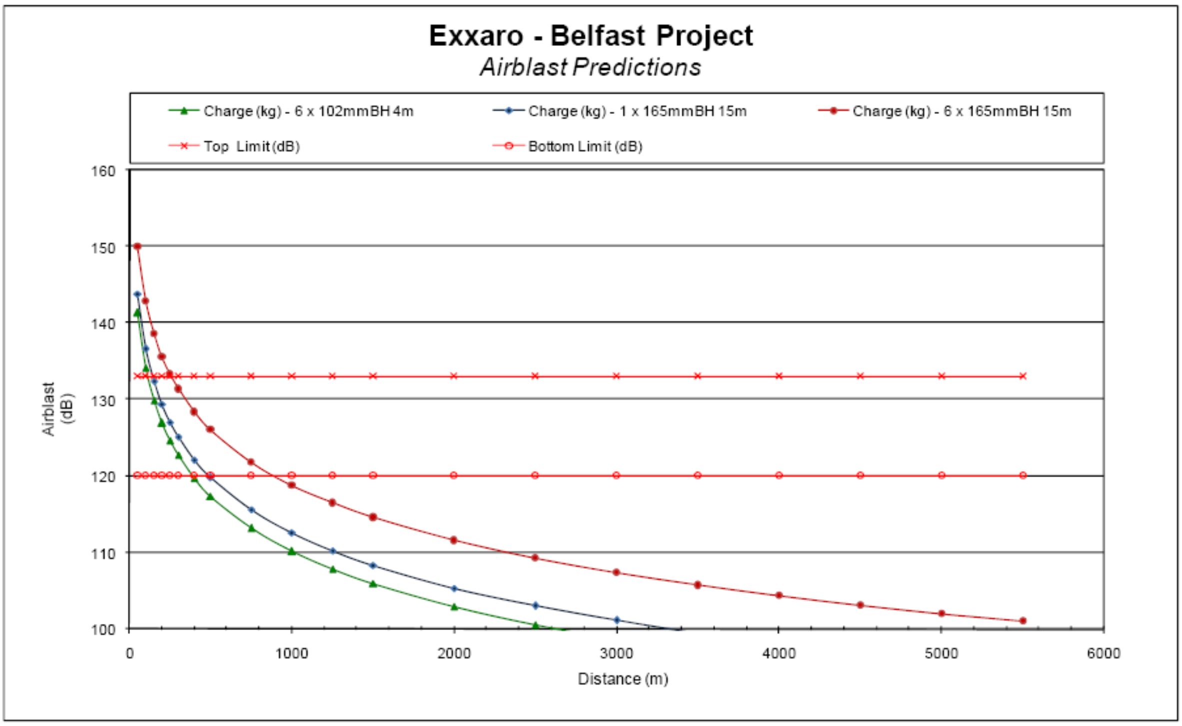

Figure 103: Airblast Predictions

Fly Rock

Blasting practices require some movement of rock to facilitate the excavation process. The extent of movement is dependent on the scale and type of operation. For example, blasting activities within large coal mines are designed to cast the blasted material much greater distances than practices in a quarrying or hard rock operation. This movement should be in the direction of the free face, and therefore the orientation of the blasting is important. Material or elements travelling outside of this expected range may be considered to be fly rock.

The following list is typical causes of fly rock:

- Burden to small;
- Burden to large;
- Stemming length to short;
- Out of sequence initiation of blastholes;
- Drilling inaccuracies;
- Incorrect blasthole angles; and
- Over charged blastholes.

Noxious Fumes

Explosives currently used are required to be oxygen balanced. The creation of poisonous fumes such as nitrous oxides and carbon monoxide are particular undesirable. These fumes present themselves as red brown cloud after the blast detonated. It has been reported that 10 to 20 ppm has been mildly irritating. Exposure to 150 ppm or more (no time period given) has been reported to cause death from pulmonary edema. It has been predicted that 50% lethality would occur following exposure to 174 ppm for 1 hour. Any body exposed must be taken to hospital for proper treatment.

Factors contributing to undesirable fumes are typically: poor quality control on explosive manufacture, damage to explosive, lack of confinement, insufficient charge diameter, excessive sleep time, and specific types of ground can also contribute to fumes.

6.11.2. Proposed Mitigations

Ground Vibrations

- Control of ground vibration is primarily achieved by changing the charge mass per delay by means of initiation method or order i.e. changing of timing of the blast.
- Changing the type of initiation system for instance using electronic initiation and setting up to detonate single hole firing instead of multiple blastholes.
- Reducing the charge mass per delay can be achieved by changing the charging configuration – different drill size and patterns or blasthole depths.
- Apart from the charging configuration the blast orientation can also add to excessive ground vibration at a specific point. Ground vibration amplitudes behind a blast are greater than on the side or in front. Topography and geology will also influence the outcome of ground vibration results. The fact is that control on ground vibration depends on proper planning and design of a blast.

Air Blast

- Avoid using surface detonating cord and, if it has to be used, cover it adequately.
- Do not initiate spilled explosives on surface when the blast is done.
- Avoid using boulder blasting methods where lay-on charges are used.
- Reduce the surface area subject to heave - smaller blasts.
- Reduce the degree of surface heave by minimising the total charge and using a low charge weight per delay.
- Use an appropriate sequence of detonation and consider the orientation of the working face in relation to sensitive areas; if the direction of blast initiation is away from or at right angles to, rather than towards a sensitive location, reductions of 10-15dB and 6dB respectively may be possible.
- Avoid gas venting through local rock weaknesses (also a cause of fly rock) by accurate drilling and placement, and regular face surveys, ensuring that the trace velocity between holes is significantly less than the speed of sound, i.e. the delay between holes is more than 5 ms/m; this will avoid airblasts from individual holes reinforcing each other.
- Avoid resonance with floors, which can increase the acoustic response (shaking and rattling) of nearby buildings, by using delays of less than 25-40ms.
- Avoid blasting in adverse weather conditions which include:
    - Significant temperature inversions;
    - Moderate to strong winds towards sensitive areas;
    - Foggy, hazy or smoky conditions with little or no wind;
    - A still cloudy days with a low cloud ceiling;
    - Periods when the surface temperature is falling in the middle of the day;
    - Periods when strong winds accompany the passage of a cold front; and
    - Before mid-morning or after sunset on clear calm days.

Fly Rock

Strict controls of blast loading practices should include the following:

- Minimum confinement of explosives with respect to both stemming heights (minimum height of 30 times the blasthole diameter) and front row burdens are to be maintained at all times.

- Downloading of front row blast holes if minimum burden requirements are not met.
- Free faces should be checked to ensure there are no areas which are under burdened..
- Accurate loading of charge weights ensuring holes are not overloaded.
- Depth to the top of the explosive column to be checked with explosive product to be removed from overloaded holes prior to adding stemming material.
- Appropriate stemming material (10% of blasthole diameter aggregate size) to be used.

The processes which control air blast levels and fly rock are the same and therefore, the restrictions imposed to blasting activities based on regulatory compliance requirements will in turn act as a safety control, restricting the extent of rock displacement.

Noxious Fumes

Control actions on fumes will include the use the proper quality explosives and proper loading conditions. Quality assurance will need to be achieved from the supplier with quality checks on explosives from time to time. Further action is to prevail from loading blastholes at long periods prior to blasting. Excessive sleeping of charged blastholes will add to fumes generation and should be prevented. Additional measures could include placing stemming plugs at the bottom of the hole and loading emulsion from the bottom up will excluded mixing of drill chippings with the explosives in initiation area. The checking of blastholes for water will ensure that charging crew charges blasthole from the bottom (which should be a standard practise) and displaces the water. This will also ensure proper initiation of the blasthole.

6.12 Heritage Impact Assessment

The heritage impact assessment undertake for the Belfast Project was undertaken in order to assess the places, buildings, objects and structures of cultural significance found within the boundaries of the area that is likely to be impacted upon directly and indirectly by the proposed project development in order to identify sensitive and less sensitive features that will in the end inform the location of the mine and its associated infrastructure. The colour code utilised in Table 45 reflects the overall sensitivity of individual heritage features in terms of high (red), medium (blue) and low (green).

The site numbers utilised in Table 45 refer to the farm portion on which the heritage resource occurs, namely:

- Numbers refer to farm portions;
- BV - Blyooruitzicht;
- L - Leeuwbank;
- Z - Zoekop;
- G - Grave;
- F - Farmstead
- H - Homestead; and
- N - Natural feature.

For example BV6G refers to a grave on portion 6 of the farm Blyvooruitzicht.

Table 64: Heritage Resources Identified within the Belfast Project Area.

Site	Resource	Significance (1)	Condition (2)	Sensitivity (1 x 2)	Management Action
BV6G	Farm worker's grave	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
BV8F	Modern farmstead	1	3	3	Photo document before demolition
BV8G	Mtsweni graves (5)	3	3	9	Avoid if possible, restore, protect and interpret, otherwise relocate
BV9G1	White person's grave	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
BV9G2	Farm workers graves	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
BV9H	Farm workers homestead	1	2	2	Photo document before demolition
BV13G	Farm workers graves	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
BV13S	Remains of kraal and homestead	1	1	2	None
BV18G	Coetzer graves	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
BV18F	Farmstead	1	2	2	Photo document before demolition
L3G	Farm workers graves (20)	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
L3H	Mtsweni homestead	1	2	2	Photo document before demolition
L5F	Farmstead	2	2	4	Record to monitor for damage caused by blasting etc.
L5H	Homestead	1	2	2	Photo document before demolition
L5G	Cemetery	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
L7F	Modern farmstead with some historic buildings	1	3	3	Document before any demolition
L7G	Graves	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
L8G1	White persons graves	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
L8G2	Farm workers graves	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
L10G1	Swart and other farmers graves	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
L10G2	Single black grave	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
L10G3	Single black grave	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
L10F	Historic farmstead	3	3	9	Avoid and preserve at all costs, otherwise relocate
L10H	Homesteads	1	2	2	None

L11G	Farm workers graves	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
L15G	Roy Coetzer grave	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
L16G	Farm workers graves	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
LREF	Modern farmstead	1	3	3	Photo document before demolition
Z1F	Modern farmstead	1	2	2	Document before any demolition
Z1G1	Farm workers graves	3	1	3	Avoid if possible, restore, protect and interpret, otherwise relocate
Z1G2	Farm workers graves	3	1	3	Avoid if possible, restore, protect and interpret, otherwise relocate
Z1G3	Farm workers graves	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
Z2G	Single white grave	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
Z2F	Old farmstead with sandstone ruins	1	1	1	Document before any demolition
Z4F	Modern farmstead with sandstone outbuildings	1	2	2	Document before any demolition
Z4G1	White person's grave	3	1	3	Avoid if possible, restore, protect and interpret, otherwise relocate
Z4G2	Farm workers graves	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
Z4N	Sandstone outcrops	2	2	4	Avoid
Z7G	Farm workers graves	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
Z8F	Modern farmstead	1	2	2	Document before any demolition
Z8G	Farm workers graves	3	1	3	Avoid if possible, restore, protect and interpret, otherwise relocate
Z11F	Farmstead with sandstone buildings (local landmark)	3	2	6	Avoid and preserve at all costs, otherwise relocate
Z11G	Farm workers graves	3	2	6	Avoid if possible, restore, protect and interpret, otherwise relocate
Z14B	Mission station complex (Victory Fellowship)	2	2	4	Avoid if possible, restore, protect and interpret, otherwise relocate
Z15F	Modern farmstead	1	2	2	Document before any demolition
Z15H	Old farm house	2	1	2	Document before demolition

The most significant individual heritage resources identified during the impact assessment, based on a combination of age, condition and historical importance, are:

- Site L10F: Jan Burger farmstead [Avoid and preserve if possible];
- Site Z11F: Farmstead next to the N4 (local landmark) [Avoid and preserve if possible]; and
- All graves and graveyards [Avoid if possible, preserve, protect and interpret, otherwise relocate to Belfast].

6.12.1 Plant Site Assessment

There will be direct and indirect impacts on heritage resources from the following development sources:

- The open pit;
- The proposed Phase 1 and Phase 2 plants;
- The construction of mine-related infrastructure (i.e. paved and unpaved haul roads, power reticulation systems, pipe lines, conveyor belts, etc); and
- The potential relocation of District Road 1770.

Direct impacts comprise alteration, destruction and demolition, whilst indirect impacts comprise gradual deterioration in the long term due to noise, vibrations, dust, vandalism, etc. Regarding the open pit locations and boundaries, there are no real alternative locations and boundaries. Even if heritage resources located just outside the boundaries would be preserved, there would be long-term adverse indirect impacts. The proposed plant location has no heritage resources of significance, is close to an existing road, and is close to an existing plant from a neighbouring colliery, thus making it suitable from a heritage resource impact perspective.

6.12.2 Proposed Mitigation

Based on the findings of the heritage impact assessment, the following recommendations are proposed:

- The mitigation and management measures proposed (Appendix J) should be applied for both the entire area and for each identified site prior to development taking place;
- Should any unknown human remains be disturbed, exposed or uncovered during preparations for the proposed project, these should immediately be reported to Cultmatrix CC. Burial remains should not be disturbed or removed until inspected by a registered archaeologist;
- Site clearing and preparation activities must be monitored for the occurrence of any other archaeological material (i.e. Stone Age tools, Iron Age artefacts, historic waste disposal sites, etc) and similar chance finds, and a registered archaeologist should be asked to inspect the area when this has reached an advanced stage in order to verify the presence or absence of any such material;
- All preserved farmsteads and homesteads, whether under the control of Exxaro or whether in private ownership, should be monitored for damage (e.g. cracking of walls) caused by blasting work;
- A Heritage Conservation Management Plan (HCMP) should be developed in order to ensure that that preserved sites under the control of Exxaro will be maintained; and
- The relocation of District Road 1770 should be subject to a separate heritage impact assessment study.

6.13 Visual

6.13.1 Impact Assessment

As previously mentioned the proposed site has a rolling topography with a combination of grassland, agricultural fields, streams and groups of trees. The visibility towards the proposed opencast area, discard dump and the process plant will thus vary depending on the position of the viewer and the landscape character of the specific view. Most of the viewers from the surrounding farms and from dwellings within the study area will either have a view of the opencast area, plant and discard or of all the mining components.

Sensitive Viewer Locations

The sensitivity of visual receptors and views are dependent on the location and context of the viewpoint, the expectations and occupation or activity of the receptor or the importance of the view (which may be determined with respect to is popularity or numbers of people affected, its appearance in guidebooks, on tourist maps, and in the facilities provided for its enjoyment and references to it in literature or art). The most sensitive receptors may include:

- Users of all outdoor recreational facilities including public rights of way, whose intention or interest may be focused on the landscape;
- Communities where the development results in changes in the landscape setting or valued views enjoyed by the community; and
- Occupiers of residential properties with views affected by the development.

Other receptors include:

- People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value);
- People travelling through or past the affected landscape in cars or other transport methods; and
- People at their place of work.

Views from residences and tourist facilities / routes are typically more sensitive, since views from a residence or a tourist facility are considered to be frequent and of long duration. This will include the views from the surrounding farmsteads as well as dwellings within the proposed mine boundary. Although the N4 is a route frequented by tourists, this road is not considered highly sensitive but rather moderately sensitive as the road passes existing mines and industrial activities and because of the amount of mining trucks already travelling on the road. Other roads in the area such as the R33 and the local farm roads are also considered to be moderate sensitive viewpoints.

Non - Sensitive Viewer Locations

The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in their views. Non sensitive viewer locations will include views from the existing mining activities and from roads surrounding the mine area.

Visual Receptors

The potential sensitivity of visual receptors is detailed in Table 65.

Table 65: Potential Sensitivity of Visual Receptors

High	Moderate	Low
Views from surrounding farmsteads and dwellings	The N4, R33 and local farm roads	Views from mining activities as well local mining roads

High	Moderate	Low
Users of all outdoor recreational facilities including public rights of way (tourist routes), whose intention or interest may be focused on the landscape. Communities where the development results in changes in the landscape setting or valued views enjoyed by the community. Occupiers of residential properties with views affected by the development**.**	People engaged in outdoor sport or recreation (other than appreciation of the landscape, as in landscapes of acknowledged importance or value). People travelling through or past the affected landscape in cars, on trains or other transport routes. Occupiers of informal residential areas with views affected by the development.	The least sensitive receptors are likely to be people at their place of work, or engaged in similar activities, whose attention may be focused on their work or activity and who therefore may be potentially less susceptible to changes in the view (i.e. office and industrial areas). Roads going through the area
Sections that are placed in bold are applicable to the proposed mine.		

Visual impacts would result from the construction, operation, decommissioning and closure phase of the proposed Belfast Project. Specifically, impacts would result from the plant and associated discard dumps and the opencast mining activities being seen from sensitive viewpoints (i.e. impacts of views from residences) and the negative effects (relating primarily to visibility and intrusion) on the scenic quality and sense of place of the landscape of the proposed site.

From the viewsheds (Figure 104 and Figure 105) it is clear that the proposed opencast mine area as well as the plant area (discard dump and plant) will be highly visible for residents located within 2.5 km of the boundary of the plant and opencast mine area. Residents located further away will either have no view of the mining activities or will have a partially screened view. People travelling along the N4 will have a clear view towards the opencast area and partially screened views towards the plant. It is therefore advised to stockpile the overburden along the N4 mine boundary in order to screen the view from travellers. It is, however, suggested that the proposed berms be vegetated in order to be more visually pleasing and to aid in dust control.

As the proposed mining activities will be contrasting to the existing landscape character and present land-use within this specific area it will be highly intrusive to the specific site, but not to the entire area as there are existing mining activities within the proposed area. With successful mitigating measures the visibility of the mining activities can be reduced.

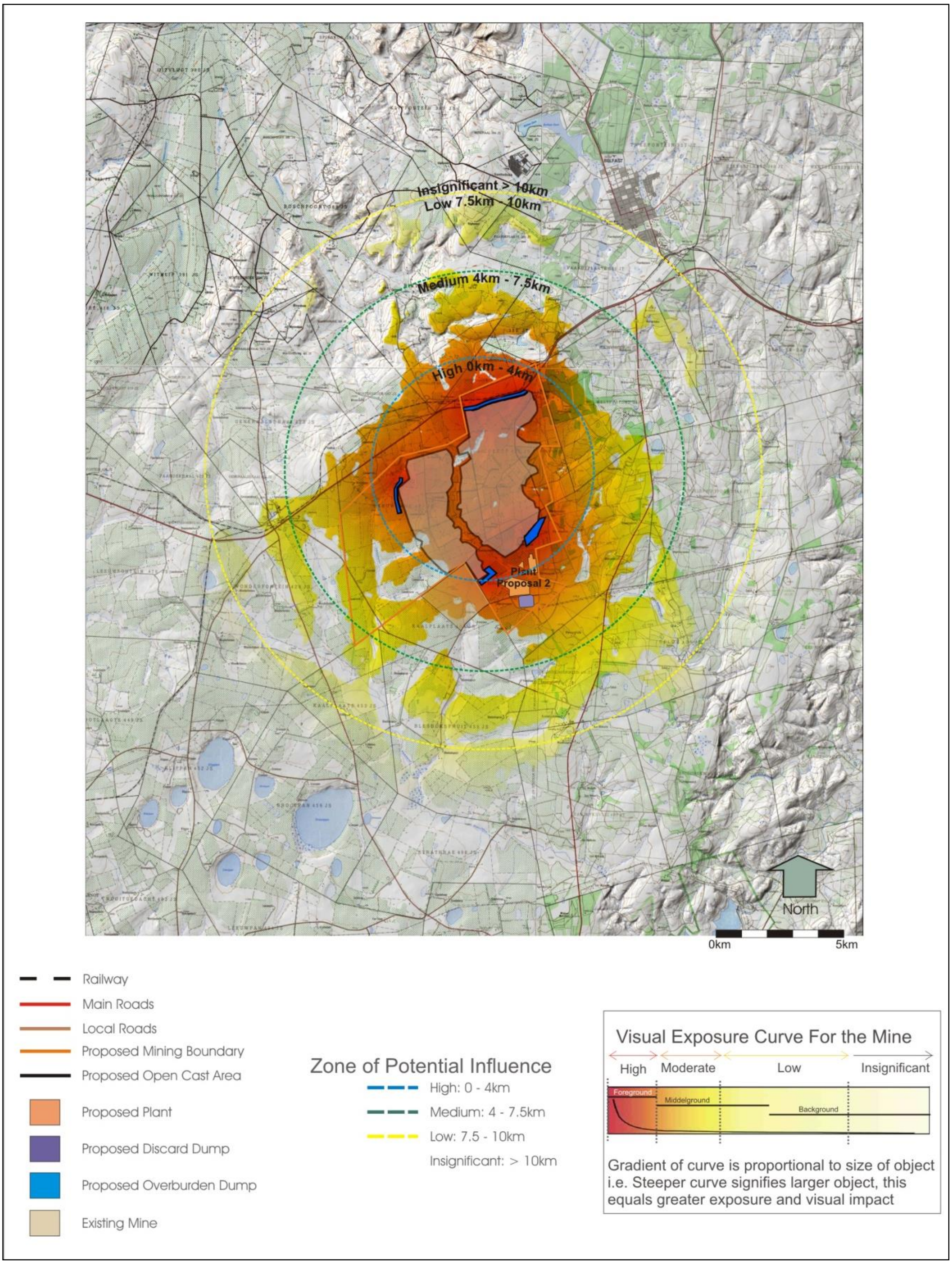

Figure 104: Viewshed of the Belfast Project opencast mining area

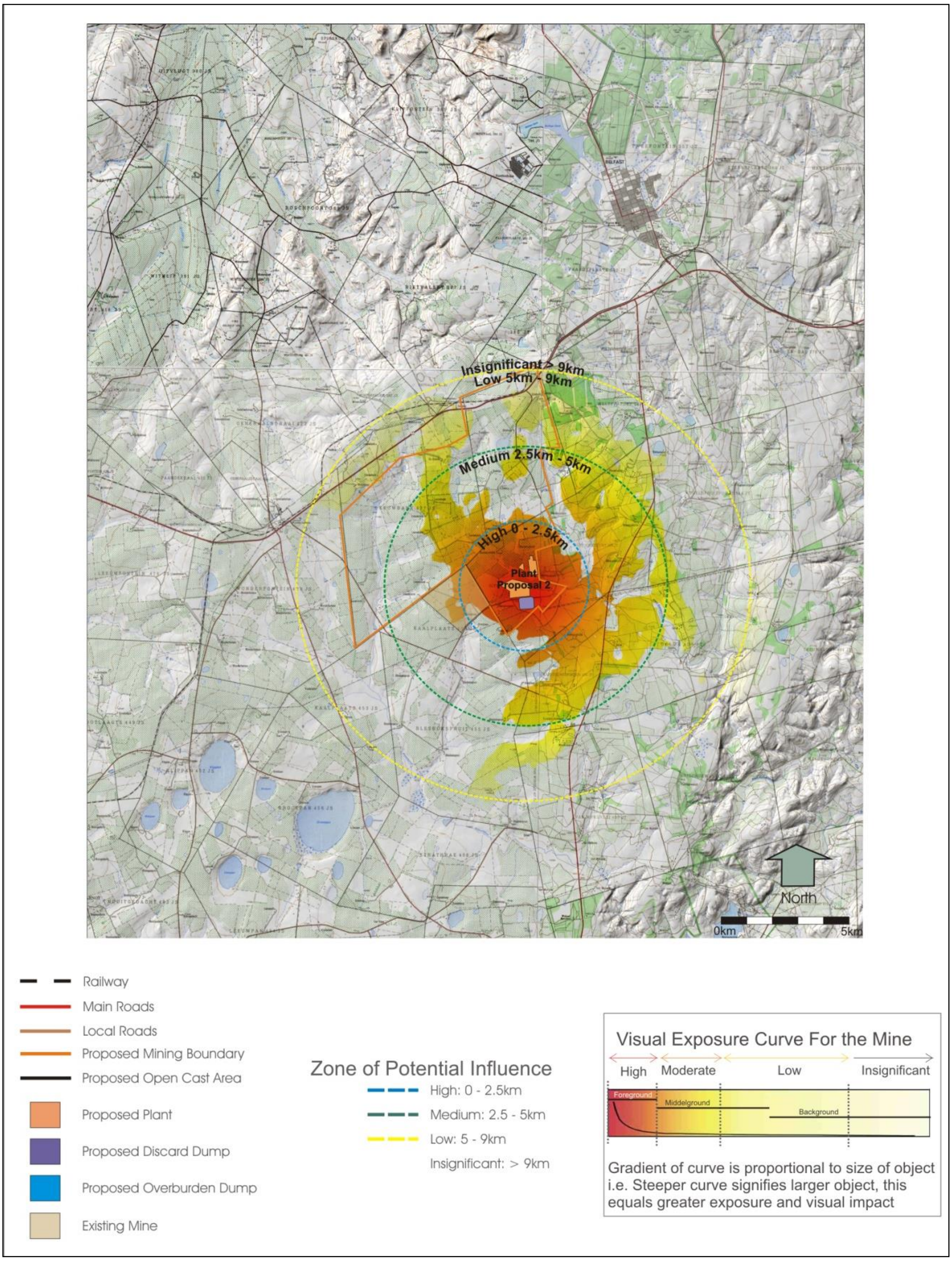

Figure 105: Viewshed of the Belfast Project plant area

6.13.2 Proposed Mitigations

The following recommendations have been made:

- Site Development
  - During construction the minimum amount of existing vegetation and topsoil should be removed.
  - The vegetation forms a visual screen for some viewers located close to the proposed site.

  - Ensure, wherever possible, all existing natural vegetation is retained and incorporated into the site rehabilitation.

- Earthworks
  - Dust suppression techniques should be in place at all times during the construction, operational, the decommissioning and closure phases.
  - Only the footprint and a small ‘construction buffer zone’ around the proposed development should be exposed. In all other areas, the natural vegetation should be retained.
  - If possible topsoil and subsoil that will not be used should be placed along the boundaries of the mining areas to act as visual screens. It suggested that this be implemented especially along the N4 to screen views from tourist travelling on the N4. The berms should also be placed in such a way that it screen views from sensitive viewers located within the first 4km of the proposed plant and open cast area. These berms are to be landscaped.
  - If topsoil is placed on certain spots for the use of rehabilitation these areas should be selected in order for the topsoil to still act as a visual screen and to be practical when it comes to rehabilitation.

- Landscaping
  - Natural vegetation should be retained wherever possible.
  - The boundaries of the mining area should be extensively landscaped around and on the berms to create a visual buffer. The vegetation could be used to screen nearby views toward the mining area.
  - An ecological approach to rehabilitation and vegetative screening measures should be adopted.

- Access Roads
  - During construction, operation, decommissioning and closure of the development, access roads will require an effective dust suppression management programme, such as regular wetting and/or the use of non-polluting chemicals that will retain moisture in the road surface.

- Lighting
  - Light pollution should be seriously and carefully considered and kept to a minimum wherever possible as light at night travels great distances.
  - Security and aesthetic flood lighting should only be used where absolutely necessary and carefully directed, preferably away from sensitive viewing areas.
  - Wherever possible, lights should be directed downwards so as to avoid illuminating the sky.
  - Install light fixtures that provide precisely directed illumination to reduce light “spillage” beyond the immediate surrounds of the complex – this is especially relevant where the edge of the complex is exposed to residential properties.
  - Avoid high pole top security lighting along the periphery of the site and use only lights that are activated on movement at illegal entry to the site.
  - Use security lighting at the periphery of the site that is activated by movement and are not permanently kept on.

6.14 Traffic

6.14.1 Traffic Risks Identified

The following possible risks are identified:

- Right turning movements on the N4 resulting in reduced capacity together with a reduction in road safety standards.

- Crossing of the N11 at a staggered intersection also resulting in reduced capacity together with a reduction in road safety standards.

6.14.2 Traffic Recommendation

- Traffic counts should be held.
- A comprehensive traffic study should be conducted after receipt of the counts.
- Consideration should be given to providing a direct link between Road 1110 and Road 383 and by so doing eliminating coal traffic from making use of the N4 Toll Road.

6.15 Social Impact Assessment

A SIA (refer to Appendix M) was undertaken for the proposed Belfast Project and, based on the project description, the social based line study and analysis of data gathered, the following impacts were identified and assessed.

- Increase in Small, Medium and Micro Enterprise (SMME) opportunities;
- Job creation and income potential;
- Socio-economic impact;
- Access across site;
- Creation of expectations;
- Disturbance of cultural, spiritual and religious sites;
- Health;
- Increase in accidents;
- Increase in noise and vibration levels;
- Increased crime;
- Informal development and settlements;
- Infrastructure;
- Loss of employment after construction;
- Resettlement of displaced households;
- Risk of sexually transmitted diseases, HIV and AIDS;
- Social vulnerability;
- Visual impact and disturbance of sense of place; and
- 'Do nothing' alternative.

With regard to these impacts it was found that the most critical are:

- Resettlement of households currently living on the land identified for mining;
- Health issues related to air and particularly water quality; and

However, all of these impacts are limited and could be mitigated to acceptable levels. The 'do nothing' option on the other hand could eventually result in a shortage of coal needed for the coal fired power stations in the area, which in turn, may place the security of a stable electricity supply at risk, on a national level. Although, if the project does not proceed there would be a loss of job creation and the socio-economic benefit brought about through mining in the area, this could probably be balanced against the economic value that could be derived from agriculture in the area. The positive side of the 'do nothing' option is that the threat to water security, brought about through the project, would be reduced. This option must be considered against the threat that not proceeding would create in respect of the national electricity supply and the possibility of addressing the water issue through installation of a water purification plant.

It was also established that although the project is likely to have some positive effect in respect of increased opportunities for SMMEs, job creation, income potential and socio-economic contribution in the area, these impacts are unlikely to be greatly significant.

6.16 Sensitivity Analysis

As part of the impacts analysis, a sensitivity and impacts investigation was conducted. The specialists findings were used to visually represent the major impacts of the mining activities on sensitive receptors, as well as to show the most sensitive areas of the site that will be affected.

6.16.1 Impacts Analysis

Maps were generated to illustrate the extent of the following impacts on sensitive receptors:

- Groundwater contamination
- Cone of depression which may affect availability of groundwater after the closure
- Extent of PM10 at ground level
- Vibration from blasting events
- Noise from mining activities

The mining activities will continue for 30 years, and the mining progression will continue from the south to north of the pit areas. As a result, impacts such as vibration will affect the receiving environment only within a specified zone from the blast site. However, for the purposes of illustrating impacts over the life of mine, the maps have included all such possible extent of the impacts.

A composite impact map was created by overlaying all of the identified impacts, to illustrate where the worst possible impacts will be found.

Groundwater Contamination

A Total Dissolved Solids concentration of 100mg/Lwas used as an indicator to illustrate the movement of the groundwater and potential contaminants out of the mined pits. The map below shows the total area of affected groundwater at mine closure, with increased concentrations in the earliest mined sections of the pits, and decreasing concentrations towards the edge of the light red area in the map.

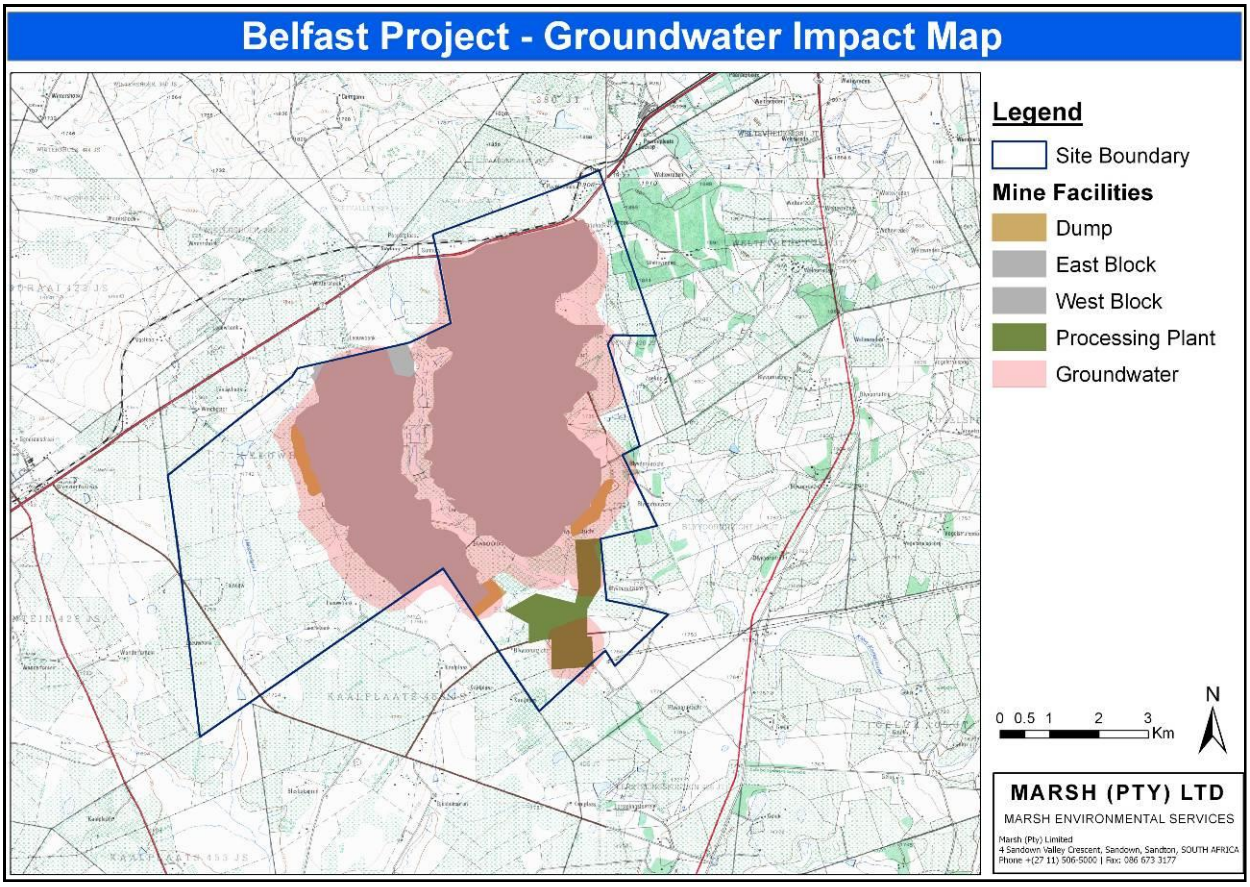

Figure 106: Map showing the extent of groundwater contamination (indicated by a level of 100g/L of Total Dissolved Solids) at mine closure.

The implications of such movement of contaminated groundwater out of the pit areas are that few boreholes outside of the mine boundary will be affected during the life of the mine. As noted in this Chapter, the plume of contaminated groundwater will continue to increase in the 150 years following mine closure.

Dust (PM10)

Dust particles of 10µg or smaller (PM10) are considered as a potential significant impact due to the potential health impacts associated with inhalation of such particles. Movement of PM10 is dependent on the climatic conditions and topography of the area. The specialist's modelled isopleths indicate the areas that will most likely be affected by PM10. The following map shows the impact zone for the highest daily PM10 levels during the operational phase of the mine. The construction phase was omitted from the sensitivity analysis, as the operational phase PM10 levels more accurately reflect the dust impacts during the life of mine.

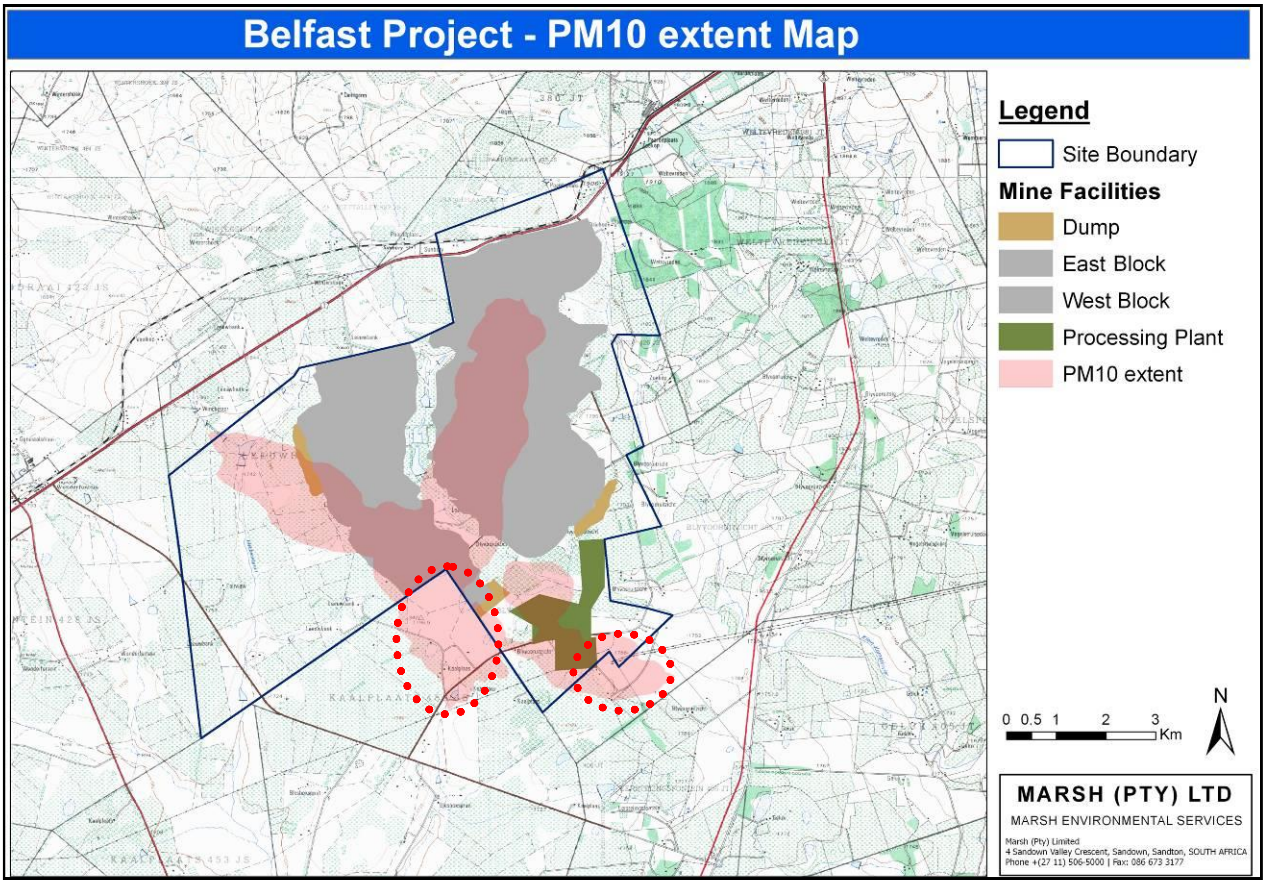

Figure 107: Map showing ground levels of PM10 during the operational phase of the mine. Adjacent landowners impacted upon are indicted by .

The majority of the ground level PM10 will occur over the mining area and the pits. Neighbouring landowners to the south of the mining area will be most affected by the dust.

Vibration

The air blast and ground vibration from the mining activities are unlikely to have any damaging effect on humans, livestock, or buildings in the vicinity, provided the blasts are appropriately designed. However, both air blast and ground vibration may give rise to secondary noise in a building, such as the rattling of windows and other loose objects.

The following map shows the areas that will be affected at some point during the life of mine. The influence of blasting may be felt up to 500m from the blast point; as a result a 500m buffer has been applied to the pits. It should be noted that not all areas highlighted will be affected simultaneously or continuously.

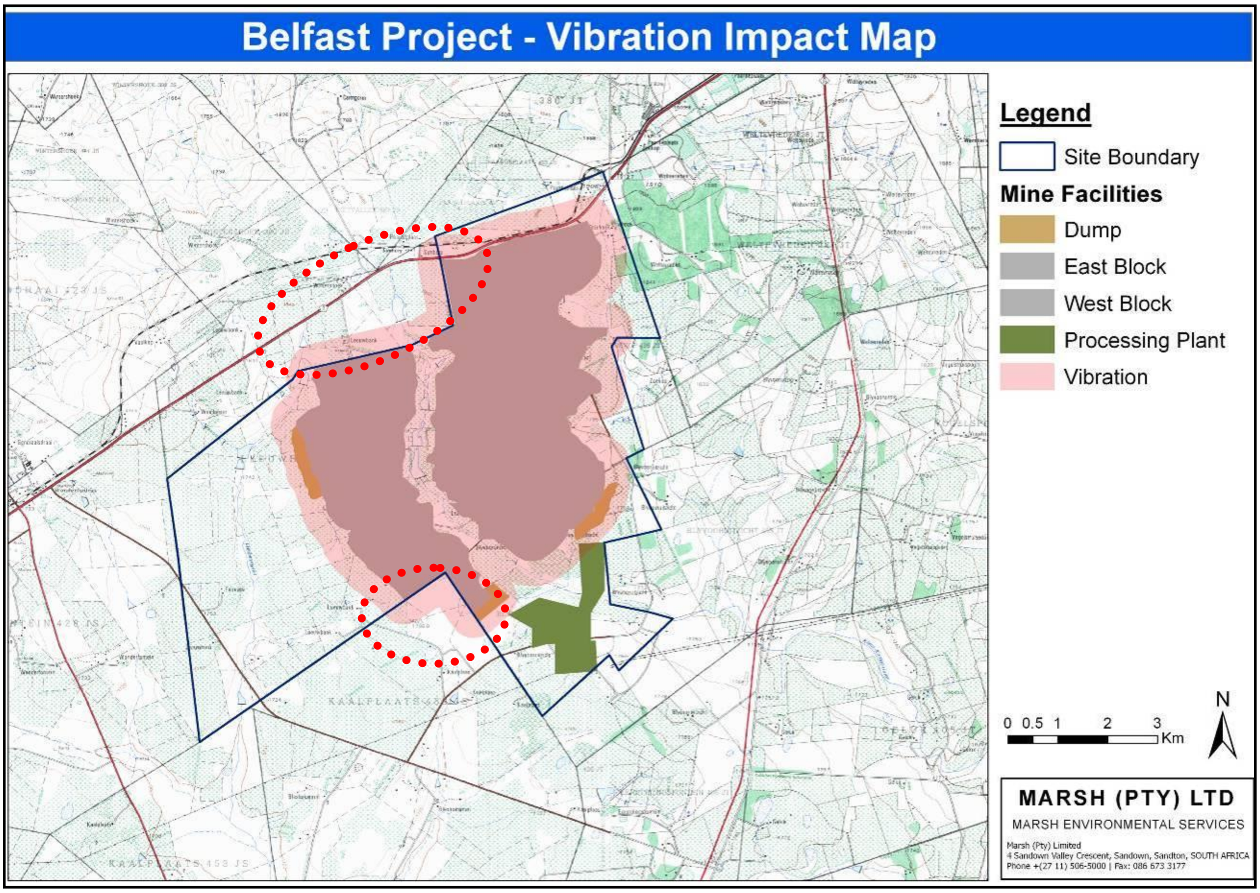

Figure 108: Map showing the extent pf the vibration impacts for the life of mine. Adjacent landowners impacted upon are indicted by .

Neighbouring landowners will not be impacted upon by vibration from blasting, except where the blasts are at the extreme edge of the pit; landowners affected by this at some point during the life of mine include those to adjacent to the mining area in the north and south. Heritage sites within the buffer may be at risk due to the blasting.

Noise

The specialist study indicates that no noise will experienced by receptors more than 600m in the day and 1900m at night from the mining activity. To indicate worst case scenario and to illustrate receptors who may be affected at some point during the life of mine by noise, a 1900m buffer was applied to the pits.

Neighbouring landowners will not be impacted upon by noise due to mining of the pits, except where the mining occurs at the extreme edge of the pit; landowners affected by this at some point during the life of mine include those to adjacent to the mining area in the north, south and east. Noise from the processing plant will affect landowners in the southern region of the mining area.

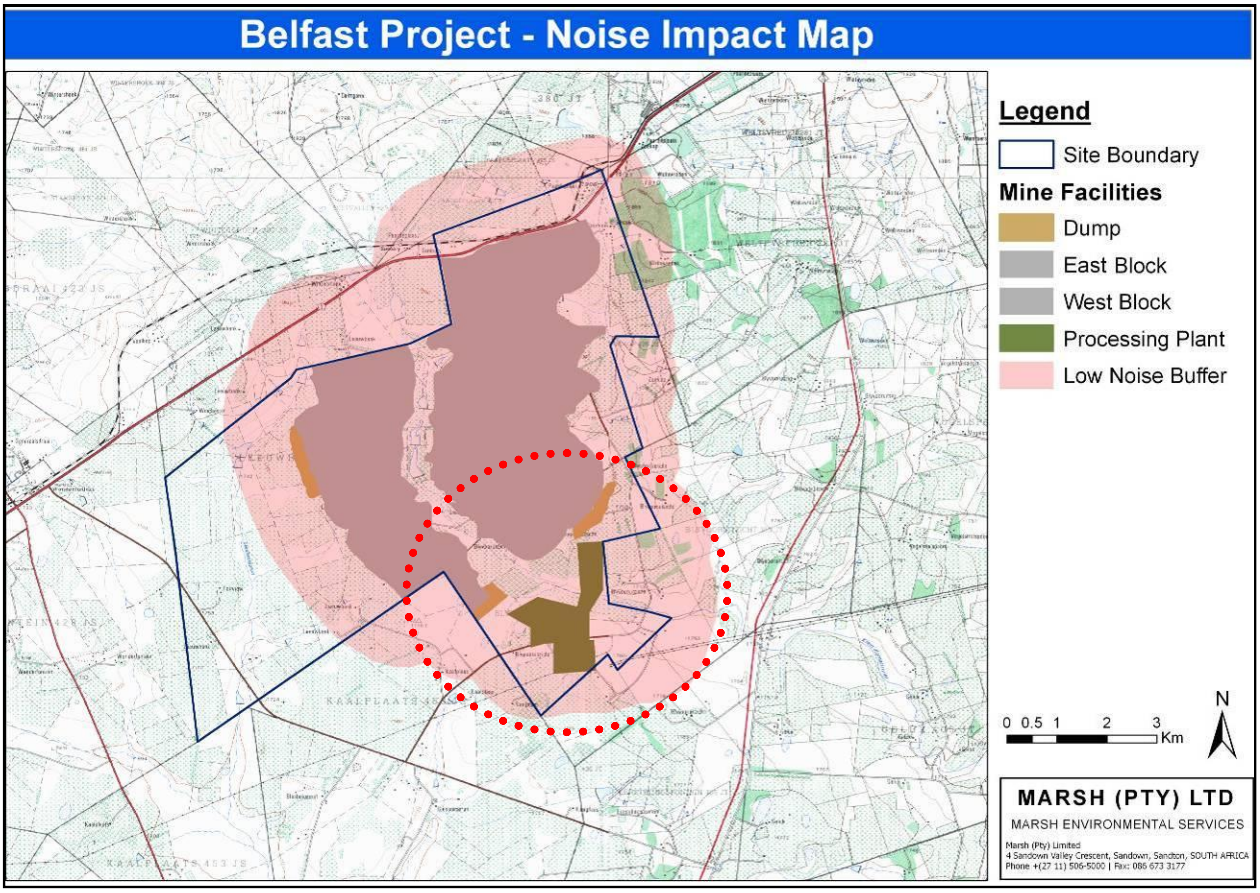

Figure 109: Map showing worst case scenario noise impacts for the life of mine. Adjacent landowners impacted upon continuously by the processing plant are indicted by

Composite Impact

Each of the above identified impacts on sensitive receptors was overlaid to generate a single composite map to indicate where the highest concentrations of impacts could be expected. The following map shows that the majority of the impacts on groundwater, air quality, vibration and noise will occur over the pit areas. Other areas outside of the mining boundary will also be affected and have been numbered on the map in order of the number of impacts that affects a specific area.

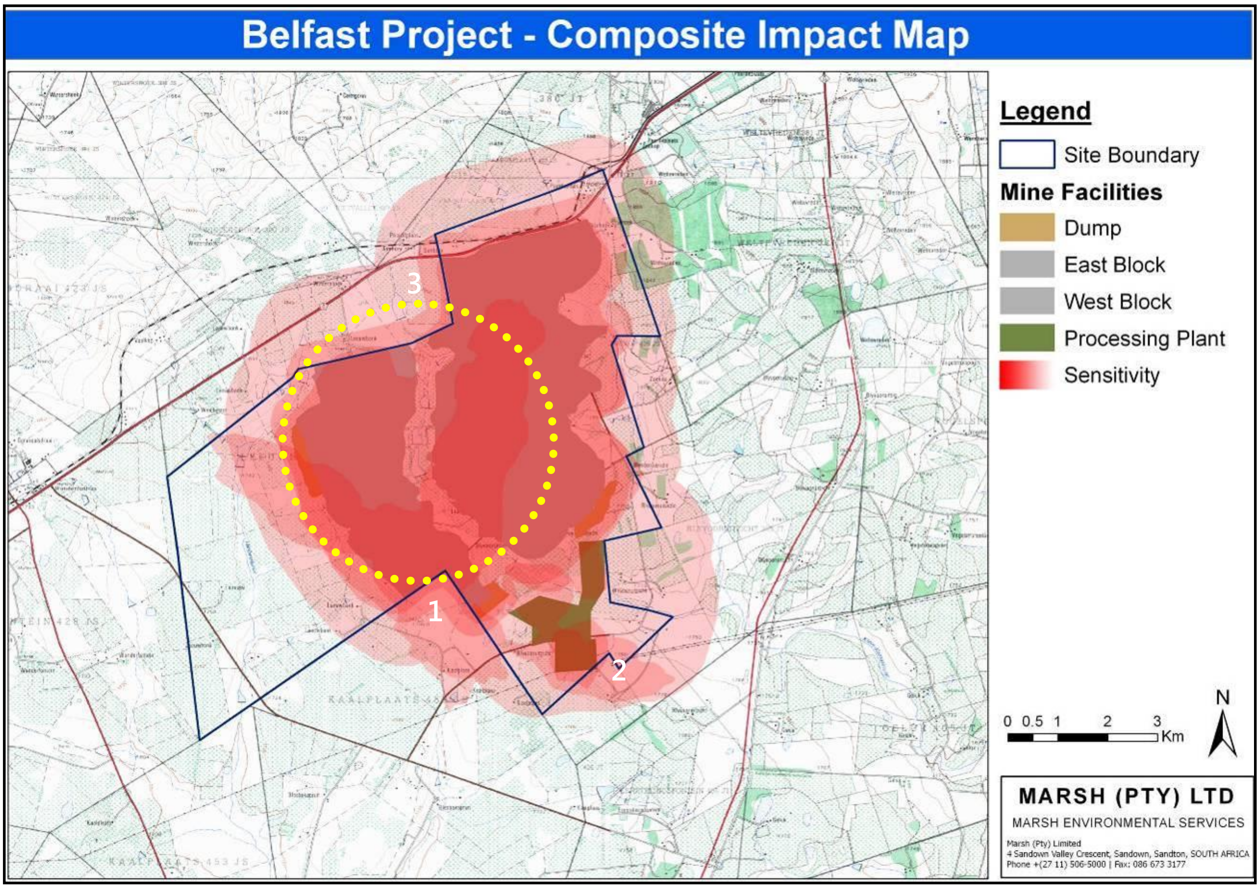

Figure 110: Composite Environmental Impact Map – increasing areas of impact are shown by the darker red areas. Affected areas are indicated by and most affected areas are numbered in order of number of impacts that affects a specific area.

The numbers in the map above show the following impacts. They are ranked according to number of impacts affecting a certain area.

1. This area will be affected by groundwater contamination, reduced air quality, vibration and noise.
2. This area will be impacted upon by reduced air quality and noise. (This is listed as second as dust and noise impacts will be experienced almost continuously during the life of mine due to the processing plant.)
3. This area will experience noise and vibration impacts, as well as some groundwater contamination near to the mining boundary. (This is listed third as noise and blasting will only be experienced when the mining activities reach the edge of the pit towards the end of life of mine).

This map shows that the majority of sensitive receptors and neighbouring landowners (outside of those areas numbered above) will experience some noise, at some point during the mining activities, mostly at night.

6.16.2 Sensitivity Analysis

Maps were generated to illustrate the extent of the following sensitivities on the site:

- Agricultural potential
- Terrestrial sensitivity
- Wetland and river systems
- Heritage sites

Identified sensitive areas within the proposed pits and processing plant areas will be completely destroyed. These maps illustrate the loss of sensitive areas on the site. The extent of the sensitivities for each parameter over the mining right area and surrounding areas is shaded in red. The extents of the sensitivities were extracted from the various specialist studies that were undertaken for the area.

A composite impact map was created by overlaying all of the identified impacts, to illustrate where the worst possible impacts will be found.

Agricultural Potential

The majority of the site consists of high and high to medium agricultural potential soils. The majority of the site is also considered arable land and is used for agricultural purposes. The construction of the pits will result in the loss of agricultural land and the remainder of the mining area will not be farmed. The following map indicates the extent of high and high to medium agricultural potential soils on the site.

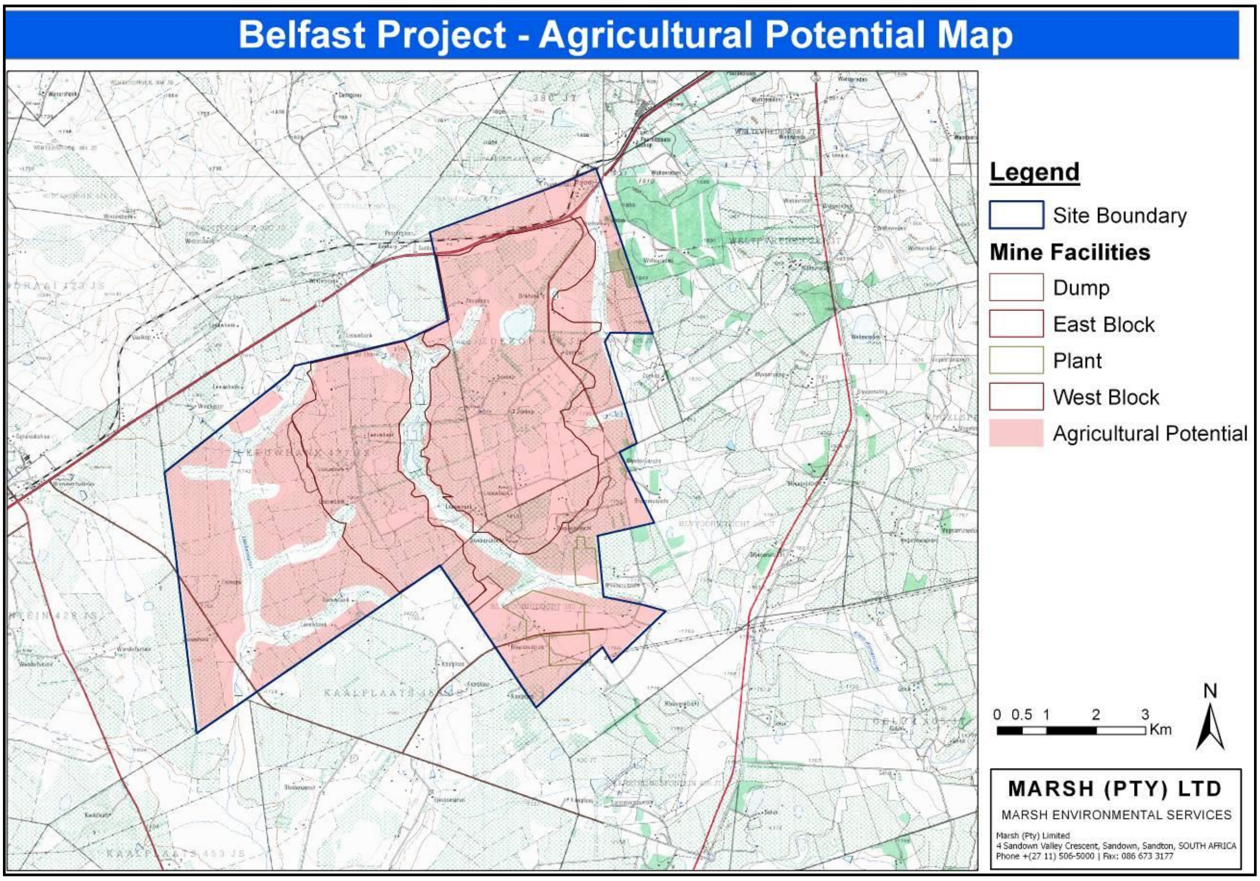

Figure 111: Map showing the arable land on the site.

Terrestrial Sensitivity

The following map illustrates the extent of highly significant habitat on the site as well as important and necessary sites. These areas may include red data species or grasslands. No protected or irreplaceable sites were found on the site. This is likely due to the extent of agriculture on the site. The remainder of the site consist of areas with no natural habitat or habitat with a sensitivity of low-none.

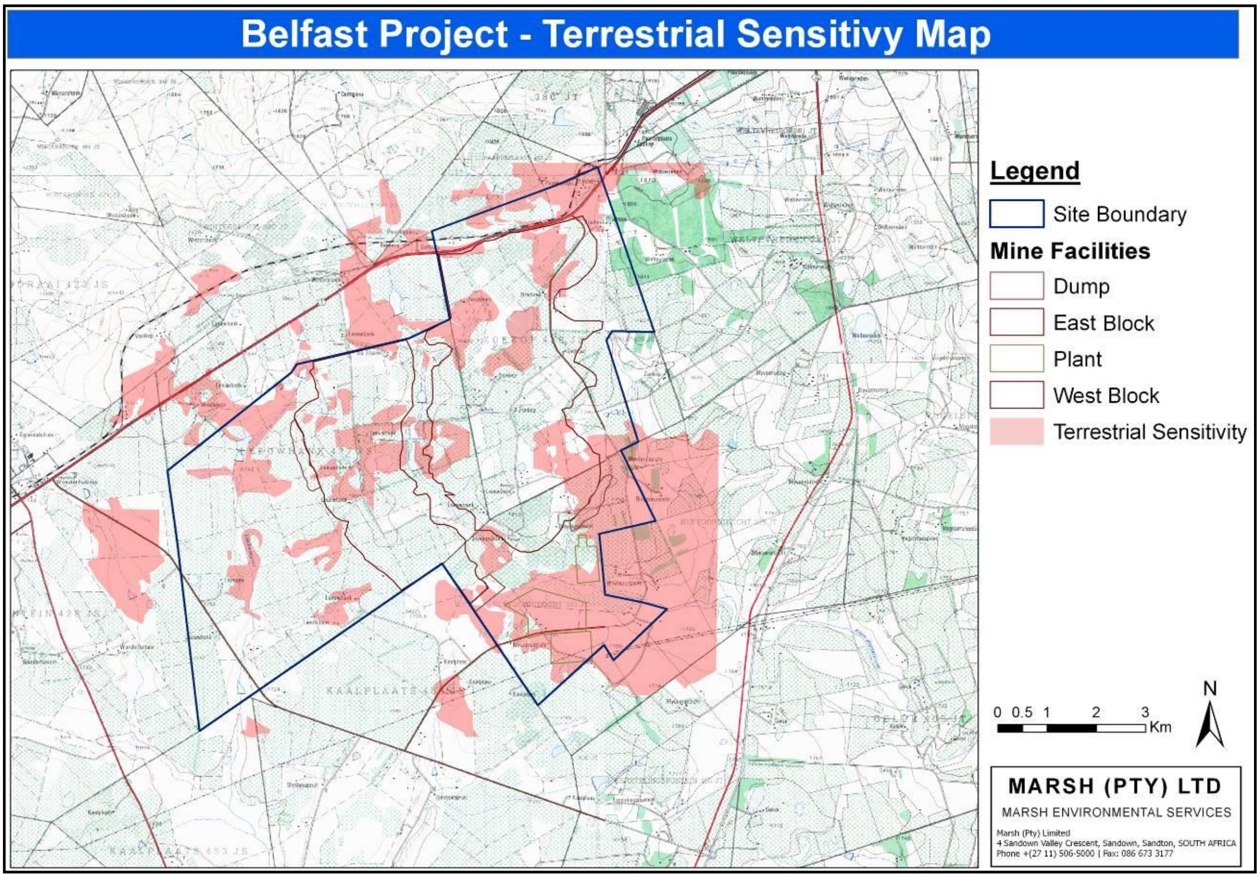

Figure 112: Map showing the highly significant habitat and important and necessary site in the mining area.

Wetlands and River Systems

The following map shows the wetlands and aquatic systems on the site. Wetlands in the pit areas and in the region of the processing plant will be destroyed during the construction and operational phases of the mine and aquatic systems adjacent to the pit areas will be significantly impacted upon.

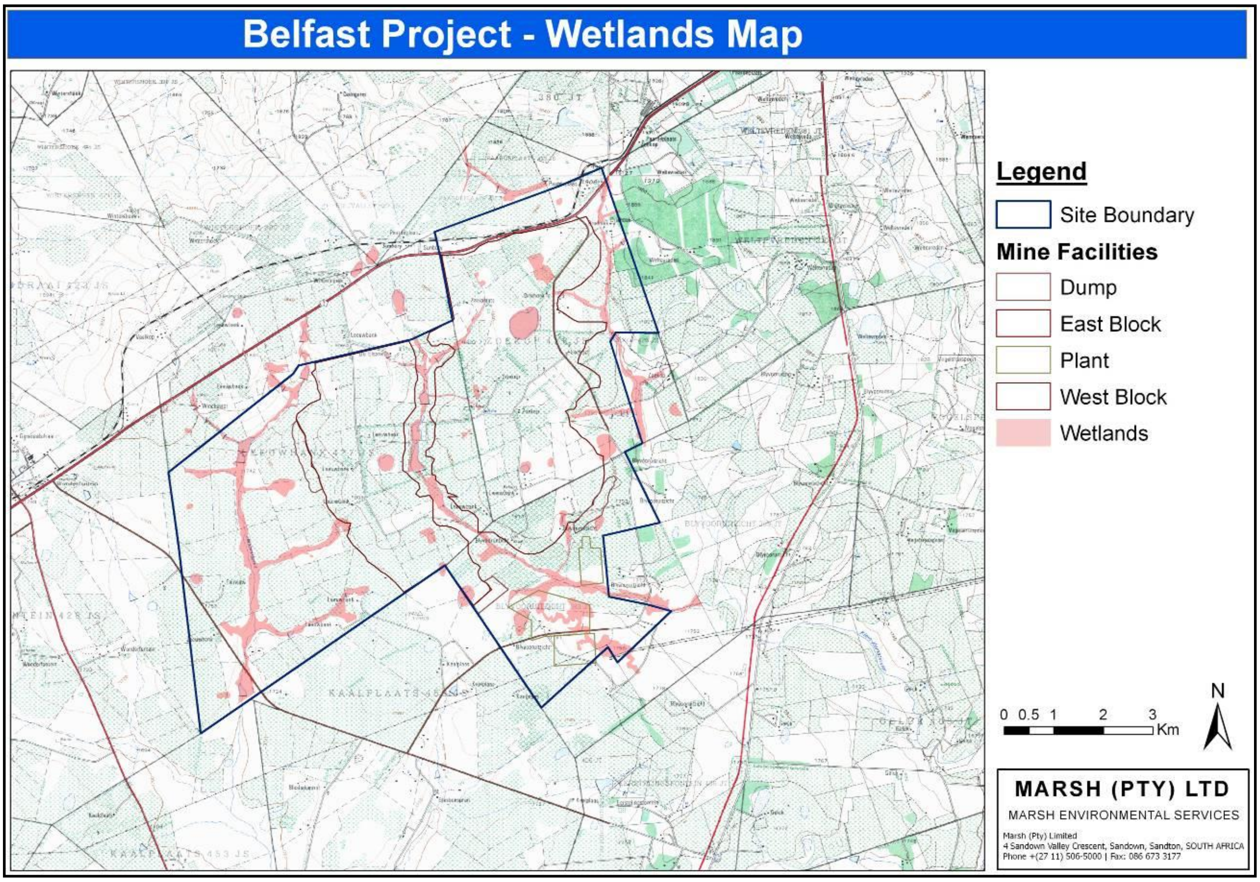

Figure 113: Map showing the wetlands and streams on the site.

Heritage Sites

A total of 23 heritage sites were identified within the mining area. The following maps indicate the locality of each of these identified sites, with nine sites falling within the proposed pit areas and one within a proposed dump. No heritage sites were identified within the proposed processing plant area. Without appropriate mitigation measures to relocate such structures, artefacts or graves, these sites will be lost. Other heritage sites in the mining area can be protected through the Heritage Management Plan as they may not be affected by the mining activities.

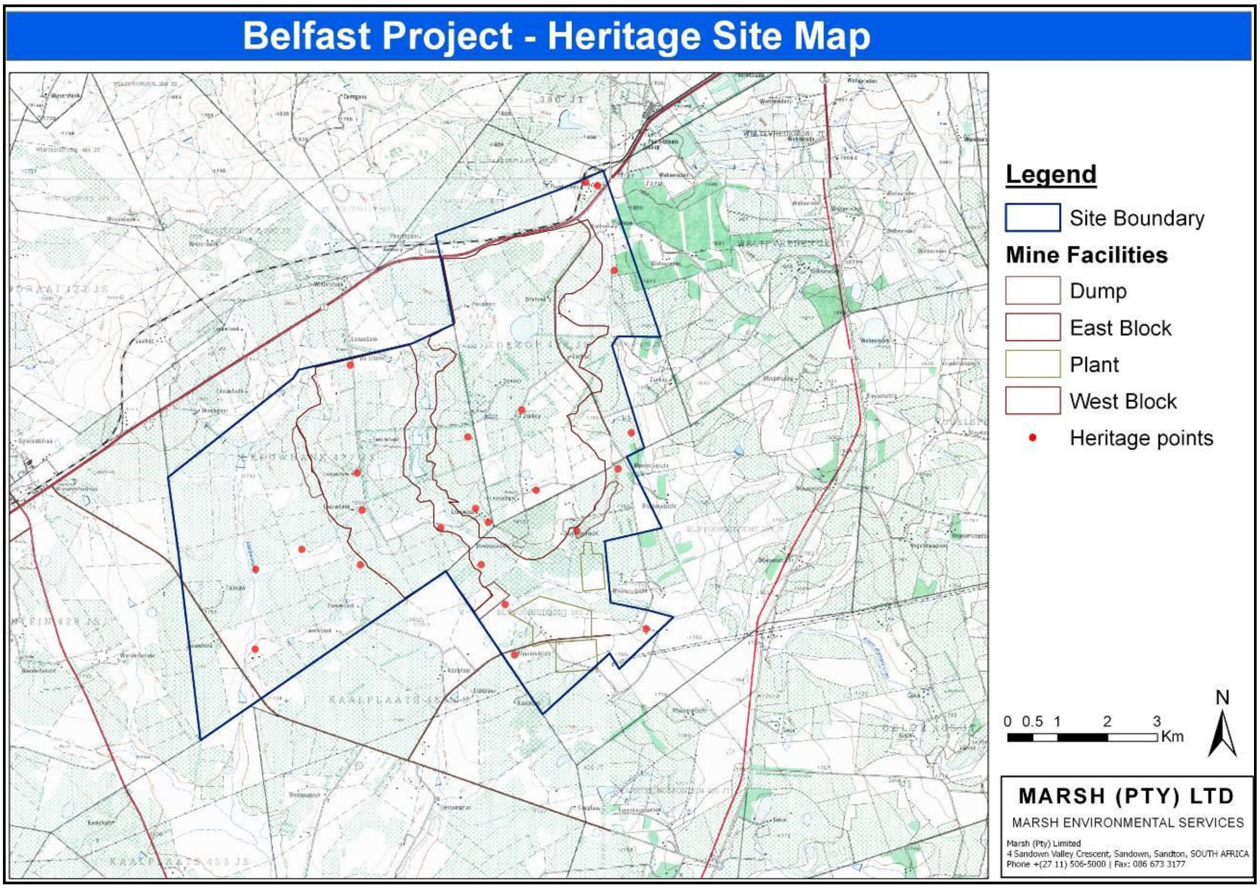

Figure 114: Map showing the identified heritage sites in the mining area.

Composite Sensitivity

Each of the above identified sensitivities on the site was overlaid to generate a single composite map to indicate where the highest sensitivities could be expected. The following map shows that the most sensitive areas will be directly impacted upon by the mining activities and processing plant, these areas have been numbered on the map in order of the number of sensitivities associated with the specific area / site.

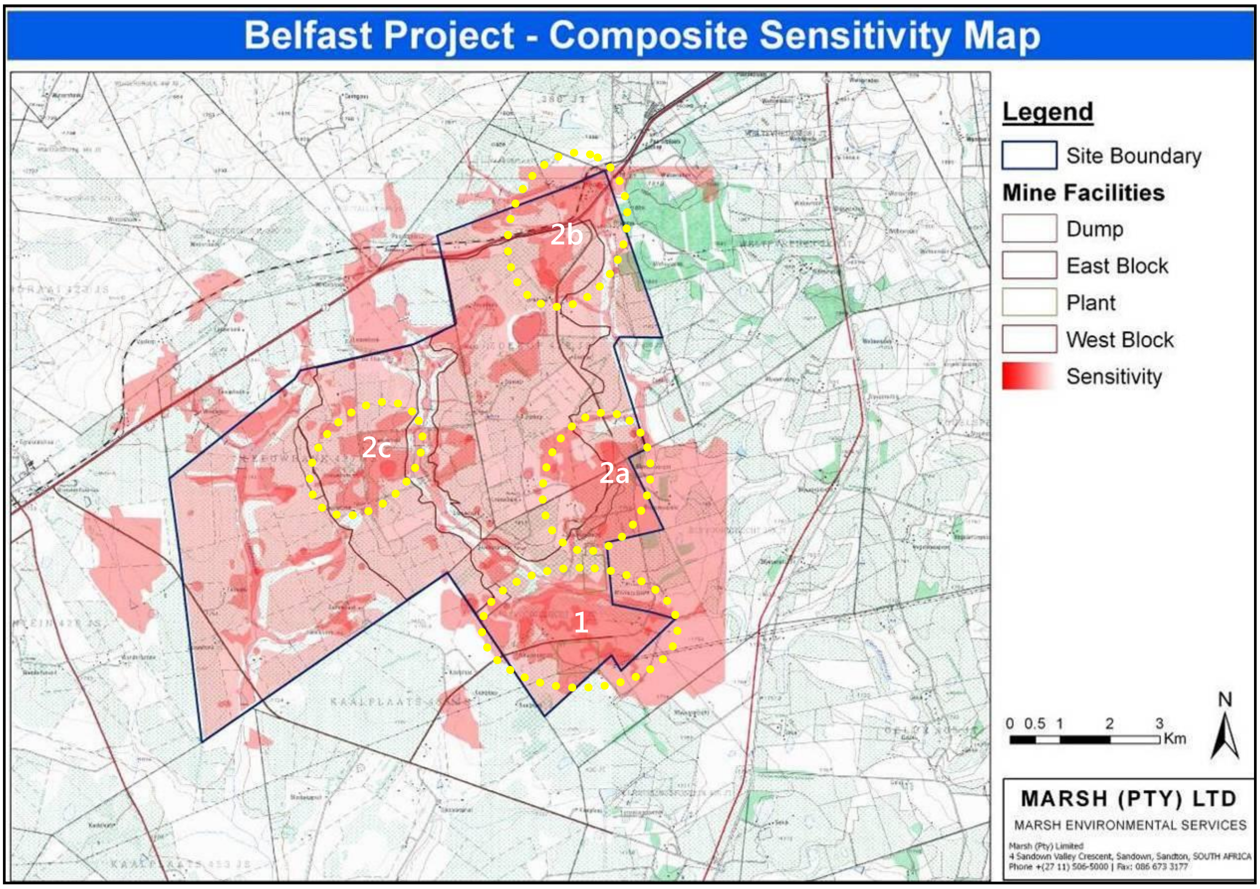

Figure 115: Composite Environmental Sensitivity Map – increasing areas of sensitivity are shown by the darker red areas. Significantly affected areas are indicated by and most affected areas are numbered in order of the number of sensitivities associated with the specific area / site.

The numbers in the map above show the following sensitivities. They are ranked according to number of sensitive aspects in a certain area.

1. This area is predominantly a large wetland system, and is considered to have highly significant habitat. This area also has medium to high potential agricultural soil, as well as several heritage sites. It is considered as the most sensitive area on the site and is earmarked for the location of the processing plant.
2. These areas include wetlands, medium to high potential agricultural soil and highly sensitive terrestrial habitat. Some heritage sites are also noted in these areas. These areas are at risk due to the construction and operational phases of the mine. These are considered slightly less sensitive than area 1, due to the extensive wetland system located in area 1.

7

Impact Assessment

7.1 Introduction

The significance of potential environmental impacts has been determined through a description of impacts identified during the study, the methodology for rating the impacts as well as a comparative assessment of all alternatives identified. The assessed impacts were originally identified in the Scoping Report. It is acknowledged that assigning significance is a subjective process used to determine environmental impacts associated with the proposed activities. Recognising this, the inputs of the various specialist studies as well as feedback from stakeholders has served to provide a guideline in an attempt to provide an objective assessment of impacts.

In line with Guideline 5: Assessment of Alternatives and Impacts (DEAT, 2006), the key factors which have been considered in evaluating the significance of impacts identified include:

- Environmental standards, guidelines and objectives.
- Level of public concern.
- Scientific and professional evidence.

7.2 Methods Used to Undertake the Impact Assessment

Based on the environmental analysis and the comments received during the Public Participation Period, perceived environmental impacts are identified and rated in terms of its potential of impact status, extent, duration, probability, and intensity. The purpose of this impact identification is to rate the identified impacts and to further determine mitigation measures. The methodology of impact assessment and rating is adopted from the DEAT 2002, Information Series[30].

The evaluation of impacts is conducted in terms of the criteria detailed in Table 66 to Table 70.
Impact significance is regarded as the sum of the impact extent, duration, probability and intensity and a numerical rating system will be applied to evaluate impact significance; therefore an impact magnitude and significance rating is applied to rate each identified impact in terms of its overall magnitude and significance (Table 71).

In order to adequately assess and evaluate the impacts and benefits associated with the project it was necessary to develop a methodology that would scientifically achieve this and to reduce the subjectivity involved in making such evaluations. To enable informed decision-making it is necessary to assess all legal requirements and clearly defined criteria in order to accurately determine the significance of the predicted impact or benefit on the surrounding natural and social environment.

7.3 Thresholds of Significance

7.3.1 Impact Status

[30] DEAT (2002) Impact Significance, Integrated Environmental Management, Information Series 5, Department of Environmental Affairs and Tourism (DEAT), Pretoria.

The nature or status of the impact is determined by the conditions of the environment prior to construction and operation. A discussion on the nature of the impact will include a description of what causes the effect, what will be affected and how it will be affected. The nature of the impact can be described as negative, positive or neutral (Table 66).

Table 66: Status of Impact

Rating	Description	Quantitative Rating
Positive	A benefit to the receiving environment	+
Neutral	No cost or benefit to the receiving environment	N
Negative	A cost to the receiving environment	-

7.3.2 Impact Extent

The extent of an impact is considered as to whether impacts are either limited in extent of if it affects a wide area or group of people. Impact extent can be site specific (within the boundaries of the development area); local, regional or national and / or international (Table 67).

Table 67: Extent of Impact

Rating	Description	Quantitative Rating
Low	Site Specific; Occurs within the site boundary	1
Medium	Local; Extends beyond the site boundary; Affects the immediate surrounding environment (i.e. up to 5 km from Belfast Project Site boundary)	2
High	Regional; Extends far beyond the site boundary; Widespread effect (i.e. 5 km and more from Belfast Project Site boundary)	3
Very High	National and / or international; Extends far beyond the site boundary; Widespread effect	4

7.3.3 Impact Duration

The duration of the impact refers to the time scale of the impact or benefit (Table 68).

Table 68: Duration of Impact

Rating	Description	Quantitative Rating
Low	Short term; Quickly reversible; Less than the project lifespan; 0 – 5 years	1
Medium	Medium term; Reversible over time; Approximate lifespan of the project; 5 – 30 years	2
High	Long term; Permanent; Extends beyond the decommissioning phase; >30 years	3

7.3.4 Impact Probability

The probability of the impact describes the likelihood of the impact actually occurring (Table 69).

Table 69: Probability of Impact

Rating	Description	Quantitative Rating
Improbable	Possibility of the impact materialising is negligible; Chance of occurrence	1

Rating	Description	Quantitative Rating
	<10%	
Probable	Possibility that the impact will materialise is likely; Chance of occurrence 10 – 49.9%	2
Highly Probable	It is expected that the impact will occur; Chance of occurrence 50 – 90%	3
Definite	Impact will occur regardless of any prevention measures; Chance of occurrence >90%	4

7.3.5 Impact Intensity

The intensity of the impact is determined to quantify the magnitude of the impacts and benefits associated with the proposed project (Table 70).

Table 70: Intensity of Impact

Rating	Description	Quantitative Rating
Maximum Benefit (+)	Where natural, cultural and / or social functions or processes are positively affected resulting in the maximum possible and permanent benefit	5
Significant Benefit (+)	Where natural, cultural and / or social functions or processes are altered to the extent that it will result in temporary but significant benefit	4
Beneficial (+)	Where the affected environment is altered but natural, cultural and / or social functions or processes continue, albeit in a modified, beneficial way	3
Minor Benefit (+)	Where the impact affects the environment in such a way that natural, cultural and / or social functions or processes are only marginally benefited	2
Negligible Benefit (+)	Where the impact affects the environment in such a way that natural, cultural and / or social functions or processes are negligibly benefited	1
Neutral	Where the impact affects the environment in such a way that natural, cultural and / or social functions or processes are not affected	0
Negligible (-)	Where the impact affects the environment in such a way that natural, cultural and / or social functions or processes are negligibly affected	1
Minor (-)	Where the impact affects the environment in such a way that natural, cultural and / or social functions or processes are only marginally affected	2
Average (-)	Where the affected environment is altered but natural, cultural and / or social functions or processes continue, albeit in a modified way	3
Severe (-)	Where natural, cultural and / or social functions or processes are altered to the extent that it will temporarily cease	4
Very Severe (-)	Where natural, cultural and / or social functions or processes are altered to the extent that it will permanently cease	5

7.3.6 Impact Significance

The impact magnitude and significance rating is utilised to rate each identified impact in terms of its overall magnitude and significance (Table 71).

Table 71: Impact Magnitude and Significance Rating

Impact	Rating	Description	Quantitative Rating
Positive (+)	High	Of the highest positive order possible within the bounds of impacts that could occur	12 to 16
	Medium	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. Other means of achieving this benefit are approximately equal in time, cost and effort	6 to 11
	Low	Impacts is of a low order and therefore likely to have a limited effect. Alternative means of achieving this benefit are likely to be easier, cheaper, more effective and less time-consuming	1 to 5
No Impact	No Impact	Zero impact	0
Negative (-)	Low	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts, mitigation is either easily achieved or little will be required, or both. Social, cultural, and economic activities of communities can continue unchanged	1 to 5
	Medium	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is both feasible and fairly possible. Social cultural and economic activities of communities are changed but can be continued (albeit in a different form). Modification of the project design or alternative action may be required	-6 to 11
	High	Of the highest order possible within the bounds of impacts that could occur. In the case of adverse impacts, there is no possible mitigation that could offset the impact, or mitigation is difficult, expensive, time-consuming or a combination of these. Social, cultural and economic activities of communities are disrupted to such an extent that these come to a halt	12 to 16

7.4 Environmental Impact Assessment

Table 72 to Table 74 summarises the impacts for each individual phase of the project, namely the construction, operational and decommissioning / closure phases. The tables summarise the identified / expected impacts of a proposed activity during each project phase both before and after the proposed mitigations measures.

A description of the terms used in Table 72 to Table 77 is detailed below:

- Issue**:** Refers to the general physical, biophysical or socio-economic environmental component in question.
- General Impact: Refers to the broad-spectrum or category of the expected impact being pollution, degradation, loss; etc.
- Specific Impact**:** Refers to the actual activity that will cause the expected impact.
- Aspect / Cause: Refers to the physical, biophysical or socio-economic environmental components as investigated in the EIA.
- Status**:** As per the description in Table 66.

- Extent (E): As per the description in Table 67.
- Duration (D): As per the description in Table 68.
- Probability (P): As per the description in Table 69.
- Intensity (I): As per the description in Table 70.
- Significance (S): As per the description in Table 71.

Table 72: Construction Phase Impacts.

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
CLIMATE	CONTRIBUTION TO CLIMATE CHANGE	CARBON AND OTHER GREENHOUSE GASSES INTO THE ATMOSPHERE.	CONSTRUCTION ACTIVITIES.	NEGATIVE (-)	-1	-1	-4	-1	-7	– ENSURE VEHICLE EXHAUST SYSTEMS FUNCTION CORRECTLY. – ENSURE REGULAR MAINTENANCE AND MONITORING OF EXHAUST EQUIPMENT IS UNDERTAKEN. – ENSURE ENERGY REDUCTION PRACTICES ARE DEVELOPED AND IMPLEMENTED.	-1	-1	-3	-1	-6
			LAND-BASED VEHICLE ACTIVITY.	NEGATIVE (-)	-2	-1	-4	-1	-8		-2	-1	-3	-1	-7
			USE OF BACKUP DIESEL GENERATORS DURING CONSTRUCTION ACTIVITIES.	NEGATIVE (-)	-1	-1	-2	-1	-5		-1	-1	-2	-1	-5
GEOLOGY	DESTRUCTION OF GEOLOGY.	ESTABLISHING THE BOX-CUT	REMOVAL OF OVERBURDEN LAYERS FOR MINE INFRASTRUCTURE DEVELOPMENT.	NEGATIVE (-)	-1	-3	-4	-4	-12	– LIMIT IMPACTS. – LIMIT FOOTPRINT SIZE.	-1	-3	-4	-4	-12
SOILS	DISTURBANCE OF TOPSOIL.	SOIL DISTURBANCE, LOSS OF NUTRIENTS, LOSS OF TOPSOIL COVER, LOSS OF IN SITU STRUCTURE AND PHYSICAL / CHEMICAL PROPERTIES.	CLEARING OF VEGETATION FOR INFRASTRUCTURE DEVELOPMENT.	NEGATIVE (-)	-1	-3	-4	-4	-12	– STRIP AND STOCKPILE TOPSOIL AND SUBSOILS APPROPRIATELY. – COMMENCE REHABILITATION OF AFFECTED AREAS TIMEOUSLY. – APPLICATION OF SOIL HANDLING AND REMOVAL PRACTICES (INCLUDING VEGETATIVE COVER). – APPLICATION OF SOIL PLACEMENT AND STORAGE PRACTICES. – FERTILISATION AS NEEDED. – RE-USE TOPSOIL AND SUBSOILS DURING ONGOING REHABILITATION – EROSION CONTROL AND PREVENTION. – IMPLEMENTATION OF GOOD HOUSE-KEEPING PRACTICES. – RAPID SPILLAGE CLEAN-UP (I.E. HYDROCARBON, OIL, WATER, ETC.).	-1	-2	-4	-4	-11
			CLEARING OF VEGETATION FOR MINING PREPARATION.	NEGATIVE (-)	-1	-3	-4	-4	-12		-1	-2	-4	-3	-10
			REMOVAL OF TOPSOIL FOR INFRASTRUCTURE DEVELOPMENT.	NEGATIVE (-)	-1	-3	-4	-4	-12		-1	-2	-4	-4	-11
			REMOVAL OF TOPSOIL FOR MINING DEVELOPMENT.	NEGATIVE (-)	-1	-3	-4	-4	-12		-1	-2	-4	-3	-10
			INFRASTRUCTURE CONSTRUCTION FOOTPRINT.	NEGATIVE (-)	-1	-3	-4	-4	-12		-1	-2	-4	-4	-11
			ESTABLISHMENT OF PLANT FOUNDATIONS.	NEGATIVE (-)	-1	-3	-4	-4	-12		-1	-2	-4	-4	-11
			CONSTRUCTION OF SURFACE WATER MANAGEMENT SYSTEM.	NEGATIVE (-)	-1	-3	-4	-4	-12		-1	-2	-4	-4	-11
			ROM STOCKPILE PAD CONSTRUCTION.	NEGATIVE (-)	-1	-3	-4	-4	-12		-1	-3	-4	-3	-11
			STOCKPILING OF SOILS.	NEGATIVE (-)	-1	-3	-4	-3	-11		-1	-2	-4	-3	-10
			SPILLAGES.	NEGATIVE (-)	-1	-1	-4	-4	-10		-1	-2	-3	-3	-9
LAND CAPABILITY AND LAND USE	CHANGE OF LAND CAPABILITY. AND LAND USE.	LAND CAPABILITY WILL BE REDUCED TO “MINING LAND” STATUS.	DISRUPTION OF ECOSYSTEM DUE TO MINING RELATED ACTIVITIES AND INFRASTRUCTURE.	NEGATIVE (-)	-1	-3	-3	-5	-12	– EFFECTIVE SOIL HANDLING AND REMOVAL PRACTICES. – EFFECTIVE SOIL PLACEMENT AND STORAGE PRACTICES. – FERTILISATION AS NEEDED. – SOIL AMELIORATION.	-1	-3	-3	-3	-10
		LOSS OF NATURAL HABITAT (I.E. A CHANGE OF LAND USE FROM WILDERNESS TO MINING).	MINING INFRASTRUCTURE AND PREPARATION.	NEGATIVE (-)	-1	-3	-3	-5	-12	– LIMITING THE FOOTPRINT OF THE MINING OPERATION TO THE MINING RIGHT AREA. – PREVENTION OF DUST AND SPILLAGE OF ROCK MATERIAL. – APPROPRIATE MAINTENANCE OF THE ROAD WAYS.	-1	-3	-3	-4	-11

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
NATURAL VEGETATION / PLANT LIFE	DESTRUCTION OF LOCAL ECOLOGICAL INTEGRITY, DECIMATION OF VEGETATION ON SITE, PERIPHERAL IMPACTS RELATING TO HUMAN PRESENCE AND MINING RELATED ACTIVITIES.	POTENTIAL LOSS / DEGRADATION OF LOCAL PRISTINE VEGETATION / HABITAT.	LAND TRANSFORMATION THOUGH MINE RELATED AND ASSOCIATED INFRASTRUCTURE DEVELOPMENT.	NEGATIVE (-)	-1	-3	-4	-4	-12	– LIMIT MINING INFRASTRUCTURE AND OPERATIONAL FOOTPRINT SIZE. – USE EXISTING ROADS WHERE POSSIBLE. – CLEAR MINIMUM VEGETATION. – MAXIMISE SITE VEGETATION RETENTION AREAS. – ERECTION OF FENCES. – PRESERVATION OF VEGETATION. – FIRE PREVENTION. – ONGOING REHABILITATION.	-1	-3	-4	-4	-12
		ALTERATION OF NATURAL ECOLOGICAL PROCESSES / ECOSYSTEM FUNCTIONING.	CREATION OF ATYPICAL / NON-NATURAL HABITAT, PRESENCE OF HUMANS FOR PROLONGED PERIODS.	NEGATIVE (-)	-1	-3	-4	-4	-12		-1	-3	-3	-4	-11
		CHANGES IN VEGETATION DYNAMICS.	FIRES, WATER, VEGETATION TRANSFORMATION.	NEGATIVE (-)	-1	-3	-4	-4	-12		-1	-3	-3	-4	-11
		IMPACTS ON SENSITIVE ENVIRONMENTS (I.E. RECEIVING WATER BODY / WETLANDS).	DIRECT / INDIRECT IMPACTS, PHYSICAL OR CUMULATIVE, PLANT COLLECTION.	NEGATIVE (-)	-1	-3	-4	-4	-12		-1	-3	-3	-4	-11
ANIMAL LIFE	DESTRUCTION OF LOCAL ECOLOGICAL INTEGRITY, DECIMATION OF FAUNAL HABITAT ON SITE, PERIPHERAL IMPACTS RELATING TO HUMAN PRESENCE AND MINING RELATED ACTIVITIES.	POTENTIAL LOSS / DEGRADATION OF LOCAL PRISTINE FAUNAL HABITAT AND / OR COMMUNITIES.	LAND TRANSFORMATION THOUGH MINE RELATED AND ASSOCIATED INFRASTRUCTURE DEVELOPMENT.	NEGATIVE (-)	-2	-3	-4	-5	-14	– ENSURE POCKETS OF VEGETATION REMAIN IN ORDER TO ENSURE A MEASURE OF ECOLOGICAL CONNECTIVITY. – LIMIT IMPACTS TO THE MINING RIGHT AREA.	-2	-3	-4	-4	-13
		ROAD DEATHS OF ANIMALS ON ACCESS ROADS.	RECKLESS DRIVING AND NIGHT-TIME DRIVING ON ACCESS ROADS.	NEGATIVE (-)	-2	-2	-2	-3	-9	– VEHICLES TO MAINTAIN SPEED LIMITS TO AVOID COLLISION WITH ANIMALS. – VEHICLES ARE TO YIELD TO ANIMALS.	-2	-2	-2	-3	-9
		ALTERATION OF NATURAL ECOSYSTEM FUNCTIONING.	LAND TRANSFORMATION THOUGH MINE RELATED AND ASSOCIATED INFRASTRUCTURE DEVELOPMENT.	NEGATIVE (-)	-2	-3	-3	-2	-10	– LIMIT NIGHT DRIVING, EXCEPT IN CASE OF EMERGENCIES. – ENSURE POCKETS OF VEGETATION REMAIN IN ORDER TO ENSURE A MEASURE OF ECOLOGICAL CONNECTIVITY. – LIMIT FAUNAL IMPACTS TO THE MINING RIGHT AREA.	-2	-3	-2	-2	-5

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
SURFACE WATER	IMPACT ON SURFACE WATER QUALITY.	INCREASED TDS, POSSIBLE EROSION (WIND AND WATER).	STRIPPING OF VEGETATION AS PART OF CONSTRUCTION ACTIVITIES.	NEGATIVE (-)	-3	-1	-4	-3	-11	– LIMIT AREAS TO BE STRIPPED FOR CONSTRUCTION PURPOSES. – MINIMISE WIND AND WATER EROSION. – IMPLEMENT SLOPE STABILISATION. – IMPLEMENTATION OF SURFACE WATER MANAGEMENT STRUCTURES. – DEVELOP A DETAILED DIGITAL TERRAIN MODEL (DTM) OF THE AREA.	-3	-1	-3	-3	-10
WETLANDS	DESTRUCTION OF WETLANDS AND WETLAND ECOLOGY	DESTRUCTION OF HILLSLOPE SEEPS, VALLEY BOTTOM WETLANDS AND PANS	COAL MINING IN LEASE AREA AND CONSTRUCTION OF PLANT AND ASSOCIATED INFRASTRUCTURE IN THE PANS AND WETLANDS LOCATED IN THE PROJECT AREA	NEGATIVE (-)	-3	-3	-4	-5	-15	– ESTABLISH ON SITE SET ASIDES AND IMPLEMENT REHABILITATION CRITERIA STIPULATED IN OFFSET REPORT. – UNDERTAKE OFFSITE OFFSET, REHABILITATION AND PROTECTION AND IMPLEMENT REHABILITATION AND PROTECTION CRITERIA STIPULATED IN OFFSET REPORT. – DETERMINE CURRENT MINED OUT COAL RESERVES AND ANY POTENTIAL REMAINING COAL RESERVES. – ENGAGE WITH THE SURROUNDING LANDOWNERS IN ORDER TO SUCCESSFULLY INCLUDE ALL OF THE SUGGESTED PANS WITHIN THIS CLUSTER.	-2	-3	-4	-5	-14
GROUNDWATER	DEPLETION OF AQUIFER.	LOWERING OF GROUNDWATER LEVEL.	DEWATERING OF THE AQUIFER TO ENSURE DRY MINING CONDITIONS AND PIT SLOPE STABILITY.	NEGATIVE (-)	-2	-3	-4	-3	-12	– MINIMISE ABSTRACTION ACTIVITIES TO ONLY THOSE THAT ARE REQUIRED FOR SAFE ESTABLISHMENT OF THE MINING OPERATION. – MONITOR GROUNDWATER ABSTRACTION LEVELS.	-2	-2	-4	-3	-11
			GROUNDWATER ABSTRACTION FOR POTABLE AND PROCESS WATER DEMAND.	NEGATIVE (-)	-2	-2	-4	-3	-11		-2	-2	-3	-3	-10
	POLLUTION.	GROUNDWATER QUALITY DETERIORATION.	BIOLOGICAL CONTAMINATION OF LOCALISED AQUIFER DUE TO DOMESTIC AND SEWAGE EFFLUENT DISPOSAL AND HYDROCARBON CONTAMINATION.	NEGATIVE (-)	-2	-2	-2	-3	-9	– IMPLEMENT RECOMMENDED WASTE MANAGEMENT PROCEDURES AND ESTABLISH REQUIRED SYSTEMS. – MANAGE POTENTIAL POLLUTANTS ON SURFACE TO PREVENT GROUNDWATER POLLUTION.	-2	-2	-1	-3	-8
AIR QUALITY	FUGITIVE DUST AND PARTICULATE MATTER	REDUCTION IN AMBIENT AIR QUALITY FROM FUGITIVE DUST EMISSIONS.	CONSTRUCTION AND GRADING OF HAUL ROADS.	NEGATIVE (-)	-2	-1	-3	-2	-8	– REDUCE EXTENT OF CONSTRUCTION OPERATION TAKING PLACE BY UNDERTAKING ACTIVITIES IN PHASES. – USE OF WINDBREAKS, CHEMICAL AND WATER DUST SUPPRESSION. – NO TOPSOIL STRIPING IN HIGH WIND CONDITIONS. – ROCK CLADDING OF STOCKPILES / DUMPS ON PREVAILING WIND FACING SLOPES.	-2	-1	-2	-2	-7
			CIVIL SITE PREPARATION.	NEGATIVE (-)	-2	-1	-2	-2	-7		-2	-1	-1	-2	-6
			CONSTRUCTION OF MINING OPERATIONS.	NEGATIVE (-)	-2	-1	-3	-2	-8		-2	-1	-2	-2	-7
			PRE-STRIPPING OF TOPSOIL.	NEGATIVE (-)	-2	-2	-4	-2	-10		-2	-1	-3	-2	-8
			OVERBURDEN AND WASTE ROCK DUMPING.	NEGATIVE (-)	-2	-2	-4	-2	-10		-2	-2	-3	-2	-9

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
			CONSTRUCTION OF PLANT AND OTHER INFRASTRUCTURE.	NEGATIVE (-)	-2	-1	-4	-2	-9	– RE-VEGETATION OF AREAS AS SOON AS POSSIBLE. – REDUCTION OF DROP HEIGHT AS FAR AS IS PRACTICABLE. – REDUCTION OF SPEED OF VEHICLES TO LIMIT DUST GENERATION.	-2	-1	-2	-2	-7
			MATERIAL TRANSFER OPERATIONS.	NEGATIVE (-)	-2	-2	-4	-2	-10		-2	-1	-2	-2	-7
			WIND EROSION FROM EXPOSED STORAGE PILES.	NEGATIVE (-)	-2	-2	-4	-2	-10		-2	-1	-2	-2	-7
			VEHICLE ENTRAINED DUST FROM BOTH PAVED AND UNPAVED ROAD SURFACES.	NEGATIVE (-)	-2	-1	-4	-2	-9		-2	-1	-2	-2	-7
			REMEDIATION AND REHABILITATION ACTIVITIES.	NEGATIVE (-)	-2	-1	-2	-2	-7		-2	-1	-1	-2	-6
		DUST EMISSIONS RESULTING IN RESPIRATORY AND CARDIOVASCULAR AILMENTS.	UNDERTAKING ACTIVITIES IN HIGH DUST AREAS.	NEGATIVE (-)	-2	-2	-2	-3	-9	– ENSURE ADEQUATE PERSONAL PROTECTIVE EQUIPMENT (PPE) IS WORN BY INDIVIDUALS IN HIGH DUST GENERATING AREAS. – CONDUCT HEALTH CHECKS PRIOR TO INITIATING WORK AND AT REGULAR INTERVALS THEREAFTER.	-2	-1	-1	-3	-7
		REDUCED VISIBILITY, SOILING OF BUILDINGS, MATERIALS AND ENVIRONMENT.	UNDERTAKING ACTIVITIES IN HIGH DUST AREAS.	NEGATIVE (-)	-2	-1	-2	-2	-7	– IMPLEMENT DUST CONTROL VIA SUPPRESSION METHODS – MINIMISE TRAVEL IN HIGH WIND SITUATIONS. – ESTABLISH WIND BREAKS AROUND INFRASTRUCTURE TO MINIMISE SOILING.	-2	-1	-1	-2	-6
NOISE AND VIBRATION	NOISE POLLUTION	INCREASED AMBIENT NOISE LEVELS.	CONSTRUCTION ACTIVITIES (MINE AND OTHER INFRASTRUCTURE).	NEGATIVE (-)	-2	-1	-3	-2	-8	– ALL MACHINERY USED DURING CONSTRUCTION WILL BE MAINTAINED IN SOUND MECHANICAL CONDITION. – PPE WILL BE WORN BY ALL PERSONNEL OPERATING IN HIGH NOISE AREAS (I.E. EAR PLUGS). – ON-SITE GENERATORS SHOULD BE CLAD IN SUITABLE MATERIAL OR HOUSED IN STRUCTURES THAT WOULD REDUCE THEIR NOISE IMPACTS. – GENERATORS WILL BE FITTED WITH APPROPRIATE SILENCERS. – ALL VEHICLES WILL BE FITTED WITH APPROPRIATE SOUND SUPPRESSION DEVICES OR SILENCERS. – KEEP WITHIN THE APPLICABLE SPEED LIMITS.	-1	-1	-2	-2	-6
			USE OF DIESEL GENERATORS.	NEGATIVE (-)	-2	-1	-3	-2	-8		-1	-1	-2	-2	-6
			INCREASE TRAFFIC FLOW (ON-SITE).	NEGATIVE (-)	-1	-1	-3	-2	-7		-1	-1	-2	-2	-6
			PERIODIC BLASTING AS PART OF TOPSOIL AND OVERBURDEN STRIPPING ACTIVITIES.	NEGATIVE (-)	-2	-1	-3	-2	-8		-2	-1	-3	-1	-7

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
	VIBRATION	NUISANCE DISRUPTION TO SENSITIVE FAUNA, EMPLOYEES AND COMMUNITIES.	BLASTING OF WASTE MATERIAL AND ORE.	NEGATIVE (-)	-2	-1	-4	-2	-9	– COMPLAINTS BY I&APS WILL BE RECORDED IN AN ISSUES AND COMPLAINTS REGISTER AND ADDRESSED THROUGHOUT THE DURATION OF THE EXISTENCE OF THE OPERATION. – BLASTING ACTIVITIES WILL BE DESIGNED BY A SUITABLY QUALIFIED ENGINEER.	-1	-1	-2	-2	-6
		IMPACT ON BUILDING FOUNDATION STABILITY.	BLASTING OF WASTE MATERIAL AND ORE.	NEGATIVE (-)	-2	-1	-3	-3	-9	– FOUNDATIONS OF BUILDINGS CLOSE TO THE OPEN-PIT AREA ARE TO BE ABLE TO WITHSTAND THE EFFECTS OF THE GROUND VIBRATIONS.	-2	-1	-2	-2	-7
ARCHAEOLOGY AND HERITAGE	IMPACT OF THE MINING DEVELOPMENT ON GRAVES, FARMSTEADS, AND HERITAGE RESOURCES.	IMPACT OF MINING DEVELOPMENT ON THE GRAVES, FARMSTEADS AND HERITAGE RESOURCES SITUATED OUTSIDE OF BELFAST PROJECT SITE.	CONSTRUCTION AND ESTABLISHMENT OF MINE AND INFRASTRUCTURE.	NEGATIVE (-)	0	0	0	0	0	– NO MITIGATION REQUIRED.	0	0	0	0	0

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
ARCHAEOLOGY AND HERITAGE	IMPACT OF THE MINING DEVELOPMENT ON GRAVES, FARMSTEADS, AND HERITAGE RESOURCES.	IMPACT OF MINING DEVELOPMENT ON THE GRAVES, FARMSTEADS AND HERITAGE RESOURCES DIRECTLY IMPACTED BY THE MINING OPERATION.	CONSTRUCTION AND ESTABLISHMENT OF MINE AND INFRASTRUCTURE.	NEGATIVE (-)	-1	-3	-3	-4	-13	– RELOCATION OF GRAVE(S). – WHERE FARMSTEADS CANNOT BE PRESERVED, THOSE WITH BUILDINGS OLDER THAN 60 YEARS SHOULD BE DOCUMENTED IN TERMS OF SECTION 34 OF THE NATIONAL HERITAGE RESOURCES ACT [NHRA] (ACT NO25 OF 1999). – APPLICATIONS FOR DEMOLITION PERMITS (SECTION 34 OF NHRA) MUST BE MADE TO THE MPUMALANGA PROVINCIAL HERITAGE RESOURCES AUTHORITY FOR OBTAINING DEMOLITION PERMITS. A PHOTOGRAPHIC RECORD SHOULD BE MAINTAINED. – SITE CLEARANCE ACTIVITIES ARE TO BE DOCUMENTED PHOTOGRAPHICALLY. – PRESERVED FARMSTEADS AND HOMESTEADS, WHETHER UNDER THE CONTROL OF EXXARO OR WHETHER IN PRIVATE OWNERSHIP, SHOULD BE MONITORED FOR DAMAGE (E.G. CRACKING OF WALLS) CAUSED BY BLASTING WORK AT THE OPERATING MINE. – SHOULD ANY UNKNOWN HUMAN REMAINS BE DISTURBED, EXPOSED OR UNCOVERED DURING THE CONSTRUCTION AND / OR OPERATIONAL PHASE OF THE PROJECT, THESE SHOULD IMMEDIATELY BE REPORTED TO A REGISTERED ARCHAEOLOGIST. BURIAL REMAINS SHOULD NOT BE DISTURBED OR REMOVED UNTIL INSPECTED BY AN ARCHAEOLOGIST. – SITE CLEARING AND PREPARATION ACTIVITIES MUST BE MONITORED FOR THE OCCURRENCE OF ANY OTHER ARCHAEOLOGICAL MATERIAL (I.E. STONE AGE TOOLS, IRON AGE ARTEFACTS, HISTORIC WASTE DISPOSAL SITES ETC) AND SIMILAR CHANCE FINDS AND AN ARCHAEOLOGIST SHOULD BE ASKED TO INSPECT THE AREA WHEN THIS HAS REACHED AN ADVANCED STAGE IN ORDER TO VERIFY THE PRESENCE OR ABSENCE OF ANY SUCH MATERIAL.	-1	-1	-1	0	-3

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
WASTE	CONTAMINATION OF SOIL, SURFACE WATER AND GROUNDWATER; HEALTH RISKS AS A RESULT OF EXPOSURE TO HAZARDOUS SUBSTANCES.	CONTAMINATION OF SURFACE WATER AND GROUNDWATER.	LEACHING OF HAZARDOUS SUBSTANCES FROM CONSTRUCTION EQUIPMENT AND STORAGE AREAS	NEGATIVE (-)	-3	-3	-4	-4	-14	– EQUIPMENT MUST BE REGULARLY INSPECTED FOR LEAKS. – STORAGE AREAS MUST BE LINED AND / OR SECURED BY AN ADEQUATE BUND WALL.	-3	-3	-2	-4	-12
		CONTAMINATION OF SOIL AND GROUNDWATER	GENERATION AND DISPOSAL OF GENERAL WASTE TO LANDFILL.	NEGATIVE (-)	-3	-3	-3	-4	-13	– RE-USE OF WASTE, WHERE POSSIBLE. – RECYCLING OF WASTE MATERIAL ON AND OFF SITE. – WASTE REMOVAL TO LICENSED SITE.	-3	-3	-2	+3	-5
		CONTAMINATION OF SOIL.	TEMPORARY STORAGE OF HAZARDOUS WASTE ON UNLINED AND / OR UNBUNDED AREAS,; HAZARDOUS WASTE SPILLS.	NEGATIVE (-)	-1	-2	-3	-3	-9	– STORAGE OF HAZARDOUS WASTES IN PURPOSE BUILT STORES (IMPERMEABLE FLOORS, BUNDING ETC.). – LABELLING OF CONTAINERS. – WASTE REMOVAL TO A LICENSED WASTE SITE.	-1	-1	-1	-1	-4
		CONTAMINATION OF GROUNDWATER.	DISPOSAL OF HAZARDOUS WASTES ON GENERAL LANDFILLS.	NEGATIVE (-)	-2	-3	-3	-5	-13	– CONTACTOR CONTROL TO ENSURE CORRECT DISPOSAL PROCEDURES IS FOLLOWED. – TRACEABILITY (DOCUMENTATION) AND RECONCILIATION OF WASTE DISPOSED.	-2	-3	-1	-2	-8
		LITTER (AESTHETIC IMPACTS, INGESTION BY ANIMALS).	WASTE NOT PLACED IN DESIGNATED WASTE BINS / CONTAINERS.	NEGATIVE (-)	-1	-1	-2	-2	-6	– PROVISION OF WASTE BINS (COLOUR CODED FOR DIFFERENT WASTE TYPES). – MANAGEMENT AND EDUCATION OF PEOPLE.	-1	-1	-1	-1	-4
		ODOUR (UNPLEASANT ODOURS AND THE PROLIFERATION OF PESTS AS A RESULT OF WASTE).	WASTE NOT DISPOSED OF TIMEOUSLY OR KEPT IN CLOSED CONTAINERS.	NEGATIVE (-)	-1	-2	-2	-2	-7	– FREQUENT REMOVAL OF WASTE BINS. – OPERATE ACCORDING TO THE GENERATED WASTE CODE OF PRACTISE (COP).	-1	-1	-1	-2	-5
		INFECTIONS FROM MEDICAL AND OTHER WASTE.	UNSUITABLE HANDLING AND DISPOSAL OF MEDICAL WASTE (I.E. SHARPS AND BANDAGES) AND OTHER WASTES.	NEGATIVE (-)	-2	-3	-3	-4	-12	– PROVISION OF SUITABLE MEDICAL WASTE DISPOSAL / STORAGE CONTAINERS. – CONTRACTOR CONTROL TO ENSURE CORRECT DISPOSAL PROCEDURES IS FOLLOWED. – DISPOSAL TO AUTHORISED SITES ONLY.	-2	-1	-1	-1	-5

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		HEALTH RISKS OF STAFF AND PUBLIC FROM EXPOSURE TO HAZARDOUS WASTES.	HANDLING OF HAZARDOUS WASTE WITHOUT SUITABLE PPE BY STAFF OR PUBLIC.	NEGATIVE (-)	-2	-3	-3	-4	-12	– PROVISION OF SUITABLE WASTE CONTAINERS AND PPE FOR WASTE HANDLING ACTIVITIES (MEDICAL AND OTHER). – CONTRACTOR CONTROLS TO ENSURE CORRECT DISPOSAL PROCEDURES ARE FOLLOWED. – DISPOSAL TO AUTHORISED SITES ONLY.	-1	-1-	-1	-3	-6
VISUAL	VISUAL IMPACT	CHANGE IN LAND-USE AND CURRENT VIEWS.	CONSTRUCTION VEHICLE MOVEMENT (SEQUENTIAL IMPACT).	NEGATIVE (-)	-2	-1	-3	-1	-7	– FLEET DESIGN AND OPTIMISATION.	-1	-1	-2	-1	-5
			TEMPORARY STRUCTURES (INCLUDING TEMPORARY RESIDENTIAL FACILITIES AND CONTRACTORS CAMP).	NEGATIVE (-)	-1	-1	-3	-1	-6	– ALL BUILDINGS AND STRUCTURES SHALL BE FINISHED IN A COLOUR (OR A SURFACE WHICH WEATHERS TO A COLOUR) IN SHADES OF GREEN, BROWN OR GREY WITH A MAXIMUM REFLECTANCE VALUE OF 37% (EXCLUDING FITTINGS).	-1	-1	-1	-1	-4
		CHANGE IN LAND-USE AND CURRENT VIEWS.	ENTRANCES, SIGNS AND BOUNDARY TREATMENT.	NEGATIVE (-)	-2	-2	-4	-1	-9	– LIMIT SIGNAGE (NUMBER AND SIZE)..	-2	-2	-3	-1	-8
			MATERIAL STORAGE (TOPSOIL STOCKPILES AND MATERIAL STOCKPILES).	NEGATIVE (-)	-2	-2	-4	-1	-9	– RESTRICTION OF THE HEIGHT OF MINERALOGICAL WASTE STRUCTURES. – ONGOING REHABILITATION AND RE-VEGETATION OF MINERALOGICAL WASTE STRUCTURES.	-2	-2	-3	-1	-8
		LIGHT POLLUTION.	LIGHTING OF CONSTRUCTION OPERATIONS DURING NIGHT TIME.	NEGATIVE (-)	-2	-2	-4	-3	-14	– APPROPRIATE LIGHT FITTING INSTALLATION. – INSTALLATION OF SHIELDING. – LIMIT LIGHT INTENSITY.	-2	-2	-4	-2	-10
SOCIAL	EMPLOYMENT (MINE SPECIFIC).	CREATION OF MINE SPECIFIC EMPLOYMENT OPPORTUNITIES .	CONSTRUCTION AT THE BELFAST PROJECT.	POSITIVE (+)	+3	+3	+4	+3	+13	– SITE-SPECIFIC CONSTRUCTION EMPLOYING UNSKILLED, SEMI-SKILLED, SKILLED LABOUR WITHIN THE PROJECT AREA.	+3	+3	+4	+5	+15
	EMPLOYMENT (DIRECTLY AFFECTED AREA).	CREATION OF EMPLOYMENT OPPORTUNITIES NOT DIRECTLY RELATED TO THE MINE ITSELF.	CONSTRUCTION AT THE BELFAST PROJECT.	POSITIVE (+)	+3	+1	+4	+3	+11	– FOCUS ON SHORT-TERM EMPLOYMENT OPPORTUNITIES NEAR COMMUNITIES, PRECEDED BY EXTENSIVE COMMUNITY LIAISON TO SUPPORT EMPLOYMENT ACROSS COMMUNITY MEMBERS.	+3	+1	+4	+5	+13

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
	HIV AND AIDS (MINE SPECIFIC).	INCREASED INFECTION RATES.	CONSTRUCTION AT THE BELFAST PROJECT (PERMANENT EMPLOYEES).	NEGATIVE (-)	-1	-2	-4	-5	-12	– IMPLEMENT AN HIV/AIDS PLAN OF ACTION. – IMPLEMENT CONDOM PROGRAMMING, INFORMATION AND ATTITUDINAL CHANGE, GENDER RELATIONS AND POWER OVER SEXUAL DECISION-MAKING, LIFE SKILLS EDUCATION, TESTING, ANTI-RETROVIRAL (ARV) EDUCATION, AND RECREATIONAL ACTIVITIES FOR ON-SITE EMPLOYEES. – CONDUCT EDUCATION WITHIN THE CONTEXT OF A BROADER WELLNESS PROGRAMME.	-1	-2	-4	-1	-8
			CONSTRUCTION AT THE BELFAST PROJECT (CONTRACTOR EMPLOYEES).	NEGATIVE (-)	-3	-3	-4	-4	-14	– CONSTRUCTION FIRMS REQUIRED TO ENGAGE IN ENHANCED HIV/AIDS RESPONSE. – CONTRACTING LOCAL PARTNER NGOS SKILLED IN HIV/AIDS PREVENTION AND RESPONSE.	-3	-3	-2	-3	-11
ECONOMIC	LEVELS OF ECONOMIC ACTIVITY.	INCREASE IN GROSS GEOGRAPHIC PRODUCT (GGP).	INCREASE IN BUSINESS ACTIVITY / SALES AND DEMAND FOR CONSUMER SERVICES.	POSITIVE (+)	+4	+2	+4	+5	+15	– ENCOURAGE PROCUREMENT OF DOMESTIC UPSTREAM AND DOWNSTREAM SERVICES TO THE VALUE CHAIN, WHERE POSSIBLE.	+4	+2	+4	+5	+15
	EMPLOYMENT.	EMPLOYMENT OPPORTUNITIES.	REDUCTION IN UNEMPLOYMENT.	POSITIVE (+)	+3	+2	+4	+4	+13	– ENCOURAGE EMPLOYMENT PRACTICES BENEFICIAL TO LOCAL / DOMESTIC LABOUR, AS FAR AS POSSIBLE. – ENCOURAGE BUSINESS NETWORKING / SOURCING FROM LOCAL / DOMESTIC SERVICE PROVIDERS, AS FAR AS POSSIBLE.	+3	+2	+4	+4	+13
	LIVING CONDITIONS.	POVERTY ALLEVIATION.	INCREASE IN SPENDING POWER.	POSITIVE (+)	+3	+2	+4	+4	+13	– MAXIMISE ON MULTIPLIER EFFECT. – DEVELOP AND IMPLEMENT COMMUNITY TRUST INITIATIVES.	+3	+2	+4	+5	+14
	SKILLS.	IMPROVEMENT OF SKILL LEVELS.	PROVISION OF TRAINING PROGRAMMES RELATED TO WORK.	POSITIVE (+)	+4	+3	+3	+2	+12	– PROCURE TRAINING SERVICE PROVIDERS TO SKILL / RE-SKILL LOCAL LABOURERS. – ROTATION OF LABOUR TO FACILITATE MULTI-SKILLING, IF AND WHERE POSSIBLE.	+4	+3	+3	+3	+13
	HEALTH (REGIONAL).	IMPACT OF HIV/AIDS ON THE HEALTH CARE SYSTEM.	TRANSITORY WORK FORCE AND SEX TRADE.	NEGATIVE (-)	-3	-2	-3	-3	-11	– IMPLEMENT THE SOCIAL AND LABOUR PLAN (SLP).	-2	-1	-2	-2	-7

Table 73: Operational Phase Impacts.

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
CLIMATE	CONTRIBUTION TO CLIMATE CHANGE.	CARBON AND OTHER GREENHOUSE GASSES INTO THE ATMOSPHERE.	MINING OPERATION.	NEGATIVE (-)	-1	-3	-3	-4	-11	– ENSURE VEHICLE EXHAUST SYSTEMS FUNCTION CORRECTLY. – ENSURE REGULAR MAINTENANCE AND MONITORING OF EXHAUST EQUIPMENT IS UNDERTAKEN. – ENSURE ENERGY REDUCTION PRACTICES ARE DEVELOPED AND IMPLEMENTED.	-1	-3	-2	-2	-8
			LAND-BASED VEHICLE ACTIVITY.	NEGATIVE (-)	-1	-3	-3	-4	-11		-1	-3	-2	-2	-8
GEOLOGY	DESTRUCTION OF GEOLOGY	TOTAL REMOVAL OF TARGET ORE BODY AND OVERLYING MATERIAL.	COAL WILL BE REMOVED, PROCESSED AND STOCKPILED, WHILE OVERBURDEN MATERIAL WILL BE REMOVED AND TEMPORARILY STOCKPILED AS OVERBURDEN DUMPS.	NEGATIVE (-)	-1	-4	-4	-5	-14	– NONE POSSIBLE – GEOLOGY WILL BE PERMANENTLY DESTROYED. – LIMIT IMPACTS OF GEOLOGY TO THE MINING RIGHT AREA ONLY.	-1	-4	-4	-5	-14
SOILS	EXPANSION OF DISTURBED AREAS	SOIL RESOURCE MANAGEMENT (COMPACTION, EROSION, DENUTRIFICATION.)	COAL STOCKPILING	NEGATIVE (-)	-1	-2	-4	-4	-11	– STRIP AND STOCKPILE TOPSOIL AND SUBSOILS APPROPRIATELY. – COMMENCE REHABILITATION OF AFFECTED AREAS TIMEOUSLY. – APPLICATION OF SOIL HANDLING AND REMOVAL PRACTICES (INCLUDING VEGETATIVE COVER). – APPLICATION OF SOIL PLACEMENT AND STORAGE PRACTICES. – FERTILISATION AS NEEDED. – RE-USE TOPSOIL AND SUBSOILS DURING ONGOING REHABILITATION – EROSION CONTROL AND PREVENTION. – IMPLEMENTATION OF GOOD HOUSE-KEEPING PRACTICES. – RAPID SPILLAGE CLEAN-UP (I.E. HYDROCARBON, OIL, WATER, ETC.).	-1	-2	-3	-3	-9
			EROSION BY WIND AND WATER.	NEGATIVE (-)	-1	-2	-4	-4	-11		-1	-2	-3	-3	-9
			SPILLAGE FROM CONVEYORS AND / OR ROADS.	NEGATIVE (-)	-1	-3	-3	-4	-10		-1	-1	-3	-1	-6
	DISTURBANCE OF TOPSOIL.	SOIL DISTURBANCE, LOSS OF NUTRIENTS, LOSS OF TOPSOIL COVER, LOSS OF IN SITU STRUCTURE AND PHYSICAL / CHEMICAL PROPERTIES.	CLEARING OF VEGETATION FOR BOX-CUT DEVELOPMENT.	NEGATIVE (-)	-1	-3	-4	-4	-12		-1	-2	-4	-4	-11
			REMOVAL OF TOPSOIL FOR BOX-CUT DEVELOPMENT.	NEGATIVE (-)	-1	-3	-4	-4	-12		-1	-2	-4	-4	-11
			CONSTRUCTION OF SURFACE WATER MANAGEMENT SYSTEM.	NEGATIVE (-)	-1	-3	-4	-4	-12		-1	-2	-4	-4	-11
			STOCKPILING OF SOILS.	NEGATIVE (-)	-1	-3	-4	-3	-11		-1	-2	-4	-3	-10
LAND CAPABILITY AND LAND USE	CHANGE OF LAND CAPABILITY AND LAND USE.	LAND CAPABILITY WILL BE REDUCED TO "MINING LAND" STATUS.	DISRUPTION OF ECOSYSTEM DUE TO MINING RELATED ACTIVITIES AND INFRASTRUCTURE.	NEGATIVE (-)	-1	-3	-3	-5	-12	– EFFECTIVE SOIL HANDLING AND REMOVAL PRACTICES. – EFFECTIVE SOIL PLACEMENT AND STORAGE PRACTICES. – FERTILISATION AS NEEDED. – SOIL AMELIORATION. – ONGOING REHABILITATION. – TOP DRESSING OF PERMANENT FEATURES.	-1	-3	-3	-2	-9

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		LOSS OF NATURAL HABITAT (I.E. A CHANGE OF LAND USE FROM WILDERNESS TO MINING).	MINING INFRASTRUCTURE AND ACTUAL MINING OPERATIONS.	NEGATIVE (-)	-1	-3	-3	-5	-12	– LIMITING THE FOOTPRINT OF THE MINING OPERATION TO THE MINING RIGHT AREA. – PREVENTION OF DUST AND SPILLAGE OF COAL, OVERBURDEN AND ROCK MATERIAL. – APPROPRIATE MAINTENANCE OF THE ROAD WAYS.	-1	-3	-3	-4	-11
NATURAL VEGETATION / PLANT LIFE	DESTRUCTION OF LOCAL ECOLOGICAL INTEGRITY, DECIMATION OF VEGETATION ON SITE, PERIPHERAL IMPACTS RELATING TO HUMAN PRESENCE AND MINING RELATED ACTIVITIES.	POTENTIAL LOSS / DEGRADATION OF LOCAL VEGETATION / HABITAT.	LAND TRANSFORMATION THOUGH MINE RELATED ACTIVITIES.	NEGATIVE (-)	-2	-3	-4	-4	-13	– LIMIT MINING INFRASTRUCTURE AND OPERATIONAL FOOTPRINT SIZE. – USE EXISTING ROADS WHERE POSSIBLE. – CLEAR MINIMUM VEGETATION. – MAXIMISE SITE VEGETATION RETENTION AREAS. – ERECTION OF FENCES (LIMITED LAND USE). – PRESERVATION OF VEGETATION. – FIRE PREVENTION. – ONGOING REHABILITATION, PREVENT UNNECESSARY CLEARING OF VEGETATION. – ALIEN INVASIVE CONTROL.	-1	-3	-3	-3	-10
		ALTERATION OF NATURAL ECOLOGICAL PROCESSES / ECOSYSTEM FUNCTIONING.	CREATION OF ATYPICAL / NON-NATURAL HABITAT, PRESENCE OF HUMANS FOR PROLONGED PERIODS.	NEGATIVE (-)	-2	-3	-4	-4	-13		-1	-3	-3	-3	-10
		CHANGES IN VEGETATION DYNAMICS.	FIRES, WATER, VEGETATION TRANSFORMATION.	NEGATIVE (-)	-2	-3	-3	-3	-11		-2	-3	-2	-3	-9
		IMPACTS ON SENSITIVE ENVIRONMENTS (RECEIVING WATER BODY / WETLANDS).	DIRECT / INDIRECT IMPACTS, PHYSICAL OR CUMULATIVE, WOOD HARVESTING, AND PLANT COLLECTION.	NEGATIVE (-)	-2	-3	-4	-4	-13		-2	-3	-3	-3	-11
ANIMAL LIFE	DESTRUCTION OF LOCAL ECOLOGICAL INTEGRITY, DECIMATION OF FAUNAL HABITAT ON SITE, PERIPHERAL IMPACTS RELATING TO HUMAN PRESENCE &	POTENTIAL LOSS / DEGRADATION OF LOCAL PRISTINE FAUNAL HABITAT AND / OR COMMUNITIES.	LAND TRANSFORMATION THOUGH MINE RELATED AND ASSOCIATED INFRASTRUCTURE DEVELOPMENT.	NEGATIVE (-)	-1	-3	-4	-4	-12	– ENSURE POCKETS OF VEGETATION REMAIN IN ORDER TO ENSURE A MEASURE OF ECOLOGICAL CONNECTIVITY. – LIMIT IMPACTS TO THE MINING RIGHT AREA.	-1	-2	-4	-2	-9
		ROAD DEATHS OF ANIMALS ON ACCESS ROADS.	RECKLESS DRIVING AND NIGHT-TIME DRIVING ON ACCESS ROADS.	NEGATIVE (-)	-2	-2	-4	-3	-11	– VEHICLES TO MAINTAIN SPEED LIMITS TO AVOID COLLISION WITH ANIMALS. – VEHICLES ARE TO YIELD TO ANIMALS.	-2	-2	-1	-1	-6

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
	MINING ACTIVITIES	ALTERATION OF NATURAL ECOSYSTEM FUNCTIONING.	LAND TRANSFORMATION THOUGH MINE RELATED AND ASSOCIATED INFRASTRUCTURE DEVELOPMENT.	NEGATIVE (-)	-1	-2	-4	-4	-11	– ENSURE POCKETS OF VEGETATION REMAIN IN ORDER TO ENSURE A MEASURE OF ECOLOGICAL CONNECTIVITY. – LIMIT FAUNAL IMPACTS TO THE MINING RIGHT AREA.	-1	-2	-3	-2	-8
ARCHAEOLOGY AND HERITAGE	IMPACT OF THE MINING DEVELOPMENT ON GRAVES, FARMSTEADS, AND HERITAGE RESOURCES.	IMPACT OF MINING DEVELOPMENT ON THE GRAVES, FARMSTEADS AND HERITAGE RESOURCES SITUATED OUTSIDE OF BELFAST PROJECT SITE.	MINING ACTIVITIES.	NEGATIVE (-)	0	0	0	0	0	– NO MITIGATION REQUIRED	0	0	0	0	0

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
ARCHAEOLOGY AND HERITAGE	IMPACT OF THE MINING DEVELOPMENT ON GRAVES, FARMSTEADS, AND HERITAGE RESOURCES.	IMPACT OF MINING DEVELOPMENT ON THE GRAVES, FARMSTEADS AND HERITAGE RESOURCES DIRECTLY IMPACTED BY THE MINING OPERATION.	MINING ACTIVITIES.	NEGATIVE (-)	-1	-3	-3	-4	-13	– RELOCATION OF GRAVE(S). – WHERE FARMSTEADS CANNOT BE PRESERVED, THOSE WITH BUILDINGS OLDER THAN 60 YEARS SHOULD BE DOCUMENTED IN TERMS OF SECTION 34 OF THE NATIONAL HERITAGE RESOURCES ACT [NHRA] (ACT NO25 OF 1999). – APPLICATIONS FOR DEMOLITION PERMITS (SECTION 34 OF NHRA) MUST BE MADE TO THE MPUMALANGA PROVINCIAL HERITAGE RESOURCES AUTHORITY FOR OBTAINING DEMOLITION PERMITS. A PHOTOGRAPHIC RECORD SHOULD BE MAINTAINED. – SITE CLEARANCE ACTIVITIES ARE TO BE DOCUMENTED PHOTOGRAPHICALLY. – PRESERVED FARMSTEADS AND HOMESTEADS, WHETHER UNDER THE CONTROL OF EXXARO OR WHETHER IN PRIVATE OWNERSHIP, SHOULD BE MONITORED FOR DAMAGE (E.G. CRACKING OF WALLS) CAUSED BY BLASTING WORK AT THE OPERATING MINE. – SHOULD ANY UNKNOWN HUMAN REMAINS BE DISTURBED, EXPOSED OR UNCOVERED DURING THE CONSTRUCTION AND / OR OPERATIONAL PHASE OF THE PROJECT, THESE SHOULD IMMEDIATELY BE REPORTED TO A REGISTERED ARCHAEOLOGIST. BURIAL REMAINS SHOULD NOT BE DISTURBED OR REMOVED UNTIL INSPECTED BY AN ARCHAEOLOGIST. – SITE CLEARING AND PREPARATION ACTIVITIES MUST BE MONITORED FOR THE OCCURRENCE OF ANY OTHER ARCHAEOLOGICAL MATERIAL (I.E. STONE AGE TOOLS, IRON AGE ARTEFACTS, HISTORIC WASTE DISPOSAL SITES ETC) AND SIMILAR CHANCE FINDS AND AN ARCHAEOLOGIST SHOULD BE ASKED TO INSPECT THE AREA WHEN THIS HAS REACHED AN ADVANCED STAGE IN ORDER TO VERIFY THE PRESENCE OR ABSENCE OF ANY SUCH MATERIAL.	-1	-1	-1	0	-3

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
GROUNDWATER	DEPLETION OF AQUIFER.	LOWERING OF GROUNDWATER LEVEL.	DEWATERING OF THE AQUIFER TO ENSURE DRY MINING CONDITIONS AND PIT SLOPE STABILITY.	NEGATIVE (-)	-3	-3	-4	-5	-15	– WATER TO BE USED IN A CLOSE CYCLE AS MUCH AS POSSIBLE. – MINIMISE ABSTRACTION ACTIVITIES TO ONLY THOSE THAT ARE REQUIRED FOR SAFE ESTABLISHMENT OF THE MINING OPERATION. – MONITOR GROUNDWATER ABSTRACTION LEVELS.	-3	-3	-2	-5	-13
			GROUNDWATER ABSTRACTION FOR POTABLE AND PROCESS WATER DEMAND.	NEGATIVE (-)	-3	-3	-4	-5	-15		-3	-3	-2	-5	-13
GROUNDWATER	POLLUTION.	GROUNDWATER QUALITY DETERIORATION.	BIOLOGICAL CONTAMINATION OF LOCALISED AQUIFER DUE TO DOMESTIC AND SEWAGE EFFLUENT DISPOSAL AND HYDROCARBON CONTAMINATION.	NEGATIVE (-)	-3	-3	-2	-5	-13	– IMPLEMENT RECOMMENDED WASTE MANAGEMENT PROCEDURES AND ESTABLISH REQUIRED SYSTEMS. – MANAGE POTENTIAL POLLUTANT ON SURFACE TO PREVENT GROUNDWATER POLLUTION.	-3	-3	-1	-3	-10
		ACID MINE DRAINAGE.	GROUNDWATER IMPACTS AS A RESULT OF ACID MINE DRAINAGE AND DECANTING WATER FROM THE PITS.	NEGATIVE (-)	-3	-3	-4	-4	-14	– MINIMIZE SEEPAGE, PREVENT CONTACT BETWEEN CLEAN AND DIRTY AREAS, AND RECYCLE CONTAMINATED WATER AS MUCH AS POSSIBLE. – ALL CONTAMINATED WATER WILL BE CONTAINED FOR RE-USE AND EVAPORATION.	-3	-3	-3	-4	-13
SURFACE WATER	IMPACT ON SURFACE WATER QUALITY.	INCREASED TDS, POSSIBLE EROSION (WIND AND WATER).	STRIPPING OF VEGETATION AS PART OF ON-GOING PIT ESTABLISHMENT AND INSTABILITY OF STOCKPILES.	NEGATIVE (-)	-3	-2	-4	-4	-13	– LIMIT AREAS TO BE STRIPPED FOR PIT DEVELOPMENT PURPOSES. – MINIMISE WIND AND WATER EROSION. – IMPLEMENT SLOPE STABILISATION. – IMPLEMENTATION OF SURFACE WATER MANAGEMENT STRUCTURES. – DEVELOP A DETAILED DTM OF THE AREA.	-3	-2	-2	-2	-9
		SPILLAGE OF WATER FROM THE MINE DURING EXTREME RAINFALL EVENTS.	INSUFFICIENT STORAGE ON SITE FOR THE 1:50 YEAR EVENTS.	NEGATIVE (-)	-3	-1	-3	-3	-10		-2	-2	-1	-2	-7

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		SURFACE WATER CONTAMINATIO N.	– SLUDGE FROM WASHING PLANT. – SLUDGE AND WATER EFFLUENT FROM SEWAGE WORKS. – IMPACT FROM WORKSHOP AREA, INCLUDING AREAS OF STORAGE OF DIESEL, FUEL, LUBRICANTS AND CLEANING MATERIALS. – SURFACE WATER RUNOFF FROM ROADS AND MINING AREAS AFFECTED BY OIL SPILLS OR OTHER CONTAMINATED MATERIAL. – ACCIDENTAL FUEL AND OTHER HAZARDOUS, TOXIC, CHEMICAL SPILLS. – ONGOING CHEMICAL CONTAMINATION (E.G. FERTILISER APPLICATION DURING REHABILITATION). – LEACHATE FROM MINING INFRASTRUCTURE (I.E. SLIMES DAM, WASTE ROCK OVERBURDEN DUMP AND RETURN WATER DAMS (RWDS)). – WATER PUMPED FROM OPEN PIT FOR DEWATERING PURPOSES.	NEGATIVE (-)	-3	-2	-3	-4	-12	– SLUDGE WILL BE MANAGED IN TERMS OF LEGAL REQUIREMENTS FOR ITS HAZARD CLASSIFICATION. – SEWAGE SLUDGE WILL BE CLASSIFIED AND MANAGED ACCORDINGLY. – HYDROCARBONS WILL BE CONTAINED WITHIN ENGINEERED AREAS AT POINT SOURCES AND MANAGED ACCORDINGLY. – REMEDIATION KITS TO BE MADE AVAILABLE ON SITE FOR DIESEL AND OTHER HYDROCARBON RELATED SPILLS. – SLIMES DAM DESIGN HAS BEEN UNDERTAKEN TO MITIGATE SEEPAGE IMPACTS. – WASTE ROCK IS PREDICTED TO BE INERT AND THEREFORE NO FURTHER MITIGATION IS PROPOSED.	-3	-2	-1	-2	-8
	REDUCTION OF SURFACE WATER YIELD.	REDUCED CATCHMENT TO ECOLOGICAL SYSTEMS.	DEVELOPMENT OF MINING INFRASTRUCTURE AND OPENCAST PIT AREAS..	NEGATIVE (-)	-3	-2	-3	-3	-11	– FOLLOW GENERAL PRINCIPLE TO ALLOW CLEAN RUNOFF TO FLOW BACK TO THE ENVIRONMENT.	-3	-2	-2	-2	-9

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
AIR QUALITY	FUGITIVE DUST AND PARTICULATE MATTER	REDUCTION IN AMBIENT AIR QUALITY FROM FUGITIVE DUST EMISSIONS.	– SOIL STRIPPING. – DRILLING AND BLASTING. – LOADING AND HAULING. – DUMPING. – MATERIAL TRANSFER OPERATIONS. – WIND EROSION FROM EXPOSED STORAGE (STOCKPILES & MINE RESIDUE DEPOSITS) PILES. – VEHICLE ENTRAINED DUST FROM BOTH PAVED AND UNPAVED ROAD SURFACES. – PROCESS FUGITIVE EMISSIONS (CRUSHING AND SCREENING OPERATIONS). – REMEDIATION AND REHABILITATION. – ACTUAL COAL MINING ACTIVITIES.	NEGATIVE (-)	-2	-2	-4	-3	-11	– REDUCE EXTENT OF CONSTRUCTION OPERATION TAKING PLACE BY UNDERTAKING ACTIVITIES IN PHASES. – USE OF WINDBREAKS, CHEMICAL AND WATER DUST SUPPRESSION. – NO TOPSOIL STRIPING IN HIGH WIND CONDITIONS. – ROCK CLADDING OF STOCKPILES / DUMPS ON PREVAILING WIND FACING SLOPES. – RE-VEGETATION OF AREAS AS SOON AS POSSIBLE. – REDUCTION OF DROP HEIGHT AS FAR AS IS PRACTICABLE. – REDUCTION OF SPEED OF VEHICLES TO LIMIT DUST GENERATION.	-2	-2	-3	-3	-10
		REDUCED VISIBILITY, SOILING OF BUILDINGS AND MATERIALS.	MINING OPERATION CAUSING ELEVATED DUST LEVELS.	NEGATIVE (-)	-2	-2	-4	-3	-11	– ENSURE ADEQUATE PPE IS WORN BY INDIVIDUALS IN HIGH DUST GENERATING AREAS. – CONDUCT HEALTH CHECKS PRIOR TO INITIATING WORK AND AT REGULAR INTERVALS THEREAFTER.	-2	-2	-2	-2	-8
		DUST EMISSIONS RESULTING IN RESPIRATORY AND CARDIOVASCULAR AILMENTS.		NEGATIVE (-)	-2	-2	-2	-3	-9	– IMPLEMENT DUST CONTROL VIA SUPPRESSION METHODS – MINIMISE TRAVEL IN HIGH WIND SITUATIONS. – ESTABLISH WIND BREAKS AROUND INFRASTRUCTURE TO MINIMISE SOILING.	-2	-2	-1	-2	-7
NOISE AND VIBRATION	NOISE POLLUTION	INCREASED AMBIENT NOISE LEVELS.	MINING OPERATION (EARTH MOVING, MINERAL PROCESSING PLANT, SPECIFICALLY CRUSHING).	NEGATIVE (-)	-1	-2	-4	-3	-10	– ALL MACHINERY USED DURING CONSTRUCTION WILL BE MAINTAINED IN SOUND MECHANICAL CONDITION – PPE WILL BE WORN IN AREAS WHERE NOISE LEVELS ARE EXPECTED TO BE INCREASED.	-1	-2	-3	-2	-8

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
			INCREASE TRAFFIC FLOW (ON-SITE).	NEGATIVE (-)	-1	-2	-4	-3	-10	– ALL VEHICLES WILL BE FITTED WITH APPROPRIATE SOUND SUPPRESSION DEVICES OR SILENCERS. – VEHICLES WILL BE REGULARLY MONITORED AND MAINTAINED. – KEEP WITHIN THE APPLICABLE SPEED LIMITS.	-1	-2	-3	-2	-8
		NUISANCE DISRUPTION TO SENSITIVE FAUNA, EMPLOYEES AND COMMUNITIES.	PERIODIC BLASTING AS PART OF TOPSOIL AND OVERBURDEN STRIPPING ACTIVITIES, AS WELL AS COAL MINING ACTIVITIES.	NEGATIVE (-)	-1	-2	-4	-3	-10	– PLACEMENT OF WASTE STRUCTURES (SLIMES DAM, SAND DUMP) HAS BEEN DESIGNED SUCH AS TO CREATE A NOISE BARRIER. – PPE WILL BE WORN AT ALL TIMES DURING OPERATIONAL ACTIVITIES.	-1	-2	-3	-2	-8
	VIBRATION	NUISANCE DISRUPTION TO SENSITIVE FAUNA, EMPLOYEES AND COMMUNITIES.	BLASTING OF WASTE MATERIAL AND ORE.	NEGATIVE (-)	-2	-2	-4	-3	-11	– COMPLAINTS BY I&APS WILL BE RECORDED IN AN ISSUES AND COMPLAINTS REGISTER AND ADDRESSED THROUGHOUT THE DURATION OF THE EXISTENCE OF THE BELFAST PROJECT. – BLASTS WILL BE DESIGNED AND EXECUTED BY A SUITABLY QUALIFIED ENGINEER.	-2	-2	-3	-2	-9
		IMPACT ON BUILDING FOUNDATION STABILITY.	BLASTING OF WASTE MATERIAL AND ORE.	NEGATIVE (-)	-2	-2	-4	-3	-11	– FOUNDATIONS OF BUILDINGS CLOSER TO THE OPEN-PIT AREA ARE TO BE ABLE TO WITHSTAND THE EFFECTS OF THE GROUND VIBRATIONS.	-2	-2	-3	-2	-9
VISUAL	VISUAL IMPACT.	CHANGE IN LAND-USE AND AVAILABLE VIEW.	MINING VEHICLE MOVEMENT (SEQUENTIAL IMPACT).	NEGATIVE (-)	-2	-2	-4	-2	-10	– FLEET DESIGN AND OPTIMISATION.	-2	-2	-3	-2	-9
			BUILDINGS AND OTHER STRUCTURES (INCLUDING RESIDENTIAL STRUCTURES, PROCESS PLANT AND OFFICES).	NEGATIVE (-)	-2	-2	-4	-2	-10	– ALL BUILDINGS ARE TO BE MAINTAINED REGULARLY.	-2	-2	-3	-2	-9
			ENTRANCES, SIGNS AND BOUNDARY TREATMENT.	NEGATIVE (-)	-2	-2	-4	-2	-10	– LIMIT SIGNAGE (NUMBER AND SIZE).	-2	-2	-3	-2	-9
			MATERIAL STORAGE (TOPSOIL STOCKPILES AND MATERIAL STOCKPILES).	NEGATIVE (-)	-2	-2	-4	-2	-10	– RESTRICTION OF THE HEIGHT OF MINERALOGICAL WASTE STRUCTURES. – ONGOING REHABILITATION AND RE-VEGETATION OF MINERALOGICAL WASTE STRUCTURES.	-2	-2	-3	-2	-9
		LIGHT POLLUTION.	LIGHTING OF MINING OPERATIONS DURING NIGHT TIME.	NEGATIVE (-)	-2	-2	-4	-2	-10	– APPROPRIATE LIGHT FITTING INSTALLATION. – INSTALLATION OF SHIELDING. – LIMIT LIGHT INTENSITY.	-2	-2	-3	-2	-9

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
WASTE	CONTAMINATION OF SOIL, SURFACE WATER AND GROUNDWATER; HEALTH RISKS AS A RESULT OF EXPOSURE TO HAZARDOUS SUBSTANCES.	CONTAMINATION OF SURFACE WATER AND GROUNDWATER.	LEACHING OF HAZARDOUS SUBSTANCES FROM CONSTRUCTION EQUIPMENT AND STORAGE AREAS	NEGATIVE (-)	-3	-3	-4	-4	-14	– EQUIPMENT MUST BE REGULARLY INSPECTED FOR LEAKS. – STORAGE AREAS MUST BE LINED AND / OR SECURED BY AN ADEQUATE BUND WALL.	-3	-3	-2	-4	-12
		CONTAMINATION OF SOIL AND GROUNDWATER	GENERATION AND DISPOSAL OF GENERAL WASTE TO LANDFILL.	NEGATIVE (-)	-3	-3	-3	-4	-13	– RE-USE OF WASTE, WHERE POSSIBLE. – RECYCLING OF WASTE MATERIAL ON AND OFF SITE. – WASTE REMOVAL TO A LICENSED SITE.	-3	-3	-2	+4	-4
		CONTAMINATION OF SOIL.	TEMPORARY STORAGE OF HAZARDOUS WASTE ON UNLINED AND / OR UNBUNDED AREAS,; HAZARDOUS WASTE SPILLS.	NEGATIVE (-)	-1	-2	-3	-3	-9	– STORAGE OF HAZARDOUS WASTES IN PURPOSE BUILT STORES (IMPERMEABLE FLOORS, BUNDING ETC.). – LABELLING OF CONTAINERS. – WASTE REMOVAL TO A LICENSED HAZARDOUS WASTE DISPOSAL SITE.	-1	-1	-1	-1	-4
		CONTAMINATION OF GROUNDWATER.	DISPOSAL OF HAZARDOUS WASTES ON GENERAL LANDFILLS.	NEGATIVE (-)	-2	-3	-3	-5	-13	– CONTACTOR CONTROL TO ENSURE CORRECT DISPOSAL PROCEDURES IS FOLLOWED. – TRACEABILITY (DOCUMENTATION) AND RECONCILIATION OF WASTE DISPOSED.	-2	-3	-1	-2	-8
		LITTER (AESTHETIC IMPACTS, INGESTION BY ANIMALS).	WASTE NOT PLACED IN DESIGNATED WASTE BINS / CONTAINERS.	NEGATIVE (-)	-1	-1	-2	-2	-6	– PROVISION OF WASTE BINS (COLOUR CODED FOR DIFFERENT WASTE TYPES). – MANAGEMENT AND EDUCATION OF PEOPLE.	-1	-1	-1	-1	-4
		ODOUR (UNPLEASANT ODOURS AND THE PROLIFERATION OF PESTS AS A RESULT OF WASTE).	WASTE NOT DISPOSED OF TIMEOUSLY OR KEPT IN CLOSED CONTAINERS.	NEGATIVE (-)	-1	-2	-2	-2	-7	– FREQUENT REMOVAL OF WASTE BINS. – OPERATE ACCORDING TO THE GENERATED WASTE COP.	-1	-1	-1	-2	-5
		INFECTIONS FROM MEDICAL AND OTHER WASTE.	UNSUITABLE HANDLING AND DISPOSAL OF MEDICAL WASTE (I.E. SHARPS AND BANDAGES) AND OTHER WASTES.	NEGATIVE (-)	-2	-3	-3	-4	-12	– PROVISION OF SUITABLE MEDICAL WASTE DISPOSAL / STORAGE CONTAINERS. – CONTRACTOR CONTROL TO ENSURE CORRECT DISPOSAL PROCEDURES IS FOLLOWED. – DISPOSAL TO AUTHORISED SITES ONLY.	-2	-1	-1	-1	-5

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
		HEALTH RISKS OF STAFF AND PUBLIC FROM EXPOSURE TO HAZARDOUS WASTES.	HANDLING OF HAZARDOUS WASTE WITHOUT SUITABLE PPE BY STAFF OR PUBLIC.	NEGATIVE (-)	-2	-3	-3	-4	-12	– PROVISION OF SUITABLE WASTE CONTAINERS AND PPE FOR WASTE HANDLING ACTIVITIES (MEDICAL AND OTHER). – CONTRACTOR CONTROL TO ENSURE CORRECT DISPOSAL PROCEDURES IS FOLLOWED. – DISPOSAL TO AUTHORISED SITES ONLY.	-1	-1-	-1	-3	-6
SOCIAL	EMPLOYMENT (MINE SPECIFIC).	CREATION OF MINE SPECIFIC EMPLOYMENT OPPORTUNITIES.	CONSTRUCTION AT THE BELFAST PROJECT.	POSITIVE (+)	+3	+3	+4	+2	+12	– SITE-SPECIFIC CONSTRUCTION EMPLOYING UNSKILLED, SEMI-SKILLED, SKILLED LABOUR WITHIN THE PROJECT AREA.	+3	+3	+4	+5	+15
	EMPLOYMENT (DIRECTLY AFFECTED AREA).	CREATION OF EMPLOYMENT OPPORTUNITIES NOT DIRECTLY RELATED TO THE MINE ITSELF.	CONSTRUCTION AT THE BELFAST PROJECT.	POSITIVE (+)	+3	+1	+2	+2	+11	– FOCUS ON SHORT-TERM EMPLOYMENT OPPORTUNITIES NEAR COMMUNITIES, PRECEDED BY EXTENSIVE COMMUNITY LIAISON TO SUPPORT EMPLOYMENT ACROSS COMMUNITY MEMBERS.	+3	+1	+3	+5	+12
	HIV AND AIDS (MINE SPECIFIC).	INCREASED INFECTION RATES.	CONSTRUCTION AT THE BELFAST PROJECT (PERMANENT EMPLOYEES).	NEGATIVE (-)	-1	-2	-4	-5	-12	– IMPLEMENT AN HIV/AIDS PLAN OF ACTION. – IMPLEMENT CONDOM PROGRAMMING, INFORMATION AND ATTITUDINAL CHANGE, GENDER RELATIONS AND POWER OVER SEXUAL DECISION-MAKING, LIFE SKILLS EDUCATION, TESTING, ARV EDUCATION, AND RECREATIONAL ACTIVITIES FOR ON-SITE EMPLOYEES. – CONDUCT EDUCATION WITHIN THE CONTEXT OF A BROADER WELLNESS PROGRAMME.	-1	-2	-4	-1	-8
			CONSTRUCTION AT THE BELFAST PROJECT (CONTRACTOR EMPLOYEES).	NEGATIVE (-)	-3	-3	-4	-4	-14	– CONSTRUCTION FIRMS REQUIRED TO ENGAGE IN ENHANCED HIV/AIDS RESPONSE. – CONTRACTING LOCAL PARTNER NGOS SKILLED IN HIV/AIDS PREVENTION AND RESPONSE.	-3	-3	-2	-3	-11
ECONOMIC	LEVELS OF ECONOMIC ACTIVITY.	INCREASE IN GGP.	INCREASE IN BUSINESS ACTIVITY / SALES AND DEMAND FOR CONSUMER SERVICES.	POSITIVE (+)	+4	+2	+4	+5	+15	– OPTIMISE ECONOMIC LIFESPAN OF THE MINE. – ENCOURAGE PROCUREMENT OF DOMESTIC UPSTREAM AND DOWNSTREAM SERVICES TO THE VALUE CHAIN, WHERE POSSIBLE.	+4	+3	+4	+5	+16

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
	EMPLOYMENT.	EMPLOYMENT OPPORTUNITIES (NATIONAL).	REDUCTION IN UNEMPLOYMENT.	POSITIVE (+)	+3	+2	+4	+4	+13	– ENCOURAGE EMPLOYMENT PRACTICES BENEFICIAL TO LOCAL / DOMESTIC LABOUR, AS FAR AS POSSIBLE.	+3	+2	+4	+4	+13
		EMPLOYMENT OPPORTUNITIES (LOCAL AND REGIONAL).	REDUCTION IN UNEMPLOYMENT.	POSITIVE (+)	3	2	4	4	+13	– ENCOURAGE BUSINESS NETWORKING / SOURCING FROM LOCAL / DOMESTIC SERVICE PROVIDERS, AS FAR AS POSSIBLE.	3	2	4	4	+13
	LIVING CONDITIONS.	POVERTY ALLEVIATION.	INCREASE IN SPENDING POWER.	POSITIVE (+)	+3	+2	+4	+4	+13	– MAXIMISE ON MULTIPLIER EFFECT. – DEVELOP AND IMPLEMENT COMMUNITY TRUST INITIATIVES.	+3	+2	+4	+4	+13
ECONOMIC	ENABLING ENVIRONMENT.	INFRASTRUCTURE.	DEVELOPMENT OF ROADS, ELECTRICITY, HOUSES, SOCIAL, HEALTH AND EDUCATIONAL FACILITIES.	POSITIVE (+)	+3	+3	+2	+3	+11	– INFRASTRUCTURE MAINTENANCE INITIATIVES SHOULD ENCOURAGE AND FACILITATE THE USE OF LOCAL MATERIALS AND LABOUR INTENSIVE PRACTICES, IF AND WHERE POSSIBLE. – INFRASTRUCTURE SHOULD BE ACCESSIBLE TO LOCAL ECONOMIC ACTIVITIES, IF AND WHERE POSSIBLE.	+4	+3	+2	+3	+12
	SKILLS.	IMPROVEMENT OF SKILL LEVELS.	PROVISION OF TRAINING PROGRAMMES RELATED TO WORK.	POSITIVE (+)	+4	+3	+3	+2	+12	– PROCURE TRAINING SERVICE PROVIDERS TO SKILL / RE-SKILL LOCAL LABOURERS. – ROTATION OF LABOUR TO FACILITATE MULTI-SKILLING, IF AND WHERE POSSIBLE.	+4	+3	+3	+3	+13
	HEALTH (REGIONAL).	IMPACT OF HIV/AIDS ON THE HEALTH CARE SYSTEM.	TRANSITORY WORK FORCE AND SEX TRADE.	NEGATIVE (-)	-3	-2	-2	-3	-10	– IMPLEMENT THE SOCIAL AND LABOUR PLAN (SLP).	-3	-2	-2	-2	-9
	ECONOMIC ACTIVITY.	ENTREPRENEURSHIP.	GROWTH OF THE INFORMAL SECTOR.	POSITIVE (+)	+3	+2	+3	+3	+11	– HARNESS INFORMAL ECONOMIC ACTIVITIES TO SUPPLY THE MINE AND WORKERS WITH SELECTED GOODS AND SERVICES TO PREDETERMINED AND NEGOTIATED MINIMUM STANDARDS, E.G. FRESH FRUIT, MEAT, ETC. – ROTATE CONTRACTS TO SMALL SCALE SERVICE PROVIDERS ON A RASTER BASIS TO ENCOURAGE FAIR TRADE PRACTICES AND BUSINESS DIVERSIFICATION	+3	+3	+3	+4	+13
	GOVERNANCE.	INCREASE COMMITMENT FOR GOVERNMENT IN THE AREA.	GOVERNMENT INVOLVES COMMUNITIES AND DRIVES / FUNDS COMMUNITY PROJECTS AS SPECIFIED IN THE LOCAL ECONOMIC DEVELOPMENT (LED) PLAN.	POSITIVE (+)	+3	+2	+2	+3	+10	– ONGOING ENGAGEMENT BETWEEN MINE MANAGEMENT AND GOVERNMENT TO ENSURE ECONOMIC AND SOCIAL ISSUES PROMPTLY IDENTIFIED AND ADDRESSED	+3	+2	+2	+3	+10

Table 74: Decommissioning and Closure Phase Impacts.

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
GEOLOGY AND SOILS	IMPROVEMENT IN THE SOIL STATUS AND RECLAMATION OF SOIL AREAS WITH NO EFFECT ON GEOLOGY	REHABILITATION, SOIL REPLACEMENT AND RE-VEGETATIONS	REHABILITATION INCLUDING SOIL PLACEMENT, SOIL FERTILISATION, SLOPING / CONTOURING AND RE-VEGETATION.	POSITIVE (+)	+1	+3	+3	+2	+9	– FOLLOW THE RECOMMENDATIONS IN THE EMP AND REHABILITATION PLAN FOR FINAL REHABILITATION PROCEDURES.	+1	+3	+3	+2	+9
LAND CAPABILITY AND LAND USE	RE-VEGETATION OF NATURAL AREAS (I.E. ROADS) AND THE VEGETATION AND TOPDRESSING OF DUMPS AND REHABILITATED AREAS.	RE-USE OF REHABILITATED AREAS FOR NATURAL VEGETATIVE GROWTH AND FARMING ESTABLISHMENT.	REHABILITATION INCLUDING SOIL PLACEMENT, SOIL FERTILISATION, SLOPING / CONTOURING AND RE-VEGETATION.	POSITIVE (+)	+1	+3	+3	+4	+11	– FOLLOW THE RECOMMENDATIONS IN THE EMP AND REHABILITATION PLAN FOR FINAL REHABILITATION PROCEDURES.	+1	+3	+4	+4	+12
NATURAL VEGETATION / PLANT LIFE	RE-VEGETATION OF NATURAL AREAS (I.E. ROADS) AND THE VEGETATION AND TOPDRESSING OF DUMPS AND REHABILITATED AREAS.	RE-ESTABLISHMENT OF VEGETATIVE HABITATS.	REHABILITATION INCLUDING SOIL PLACEMENT, SOIL FERTILISATION, SLOPING / CONTOURING AND RE-VEGETATION.	POSITIVE (+)	+1	+3	+3	+2	+9	– FOLLOW THE RECOMMENDATIONS IN THE EMP AND REHABILITATION PLAN FOR FINAL REHABILITATION PROCEDURES. – DISMANTLE AND REMOVE ALL NON-ESSENTIAL INFRASTRUCTURE. – ENSURE MONITORING OF VEGETATION AND REHABILITATION IS UNDERTAKEN ON A REGULAR BASIS. – MAINTAIN FENCING AROUND MINING AREA UNTIL CLOSURE IS GRANTED. – IMPLEMENT AN ALIEN / INVASIVE SPECIES ERADICATION PROGRAMME.	+1	+3	+4	+4	+12
		ALTERATION OF NATURAL ECOLOGICAL PROCESSES / ECOSYSTEM FUNCTIONING.	CREATION OF ATYPICAL / NON-NATURAL HABITAT, PRESENCE OF HUMANS FOR PROLONGED PERIODS.	NEGATIVE (-)	-3	-3	-2	-3	-11		-2	-2	-1	+3	-2
		CHANGES IN VEGETATION DYNAMICS.	FIRES, WATER, ALIEN SPECIES CONTROL, VEGETATION TRANSFORMATION.	NEGATIVE (-)	-2	-2	-2	-3	-9		-2	-2	-1	+3	-2
		INTRODUCTION OF SPECIES NOT ASSOCIATED WITH THE REGION.	AESTHETIC DEVELOPMENTS (I.E. MINE GARDENS) AND INVASIVE SPECIES.	NEGATIVE (-)	-2	-3	-4	-3	-12		-2	-3	-3	+3	-5

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
ANIMAL LIFE	EFFECT OF IMPACTS BEYOND THE PROJECT BOUNDARY.	POTENTIAL LOSS / DEGRADATION OF LOCAL PRISTINE FAUNAL HABITAT AND /OR COMMUNITIES	LAND TRANSFORMATION THOUGH REHABILITATION ACTIVITIES.	NEGATIVE (-)	-2	-3	-4	-5	-14	– FOLLOW THE RECOMMENDATIONS IN THE EMP AND REHABILITATION PLAN FOR FINAL REHABILITATION PROCEDURES.	-1	-3	-2	+3	-3
		ROAD DEATHS OF ANIMALS ON ACCESS ROADS.	RECKLESS DRIVING AND NIGHT-TIME DRIVING ON ACCESS ROADS.	NEGATIVE (-)	-1	-3	-4	-3	-11	– VEHICLES TO MAINTAIN SPEED LIMITS TO AVOID COLLISION WITH ANIMALS. – VEHICLES ARE TO YIELD TO ANIMALS.	-1	-1	-1	+3	0
ANIMAL LIFE	EFFECT OF IMPACTS BEYOND THE PROJECT BOUNDARY.	ALTERATION OF NATURAL ECOSYSTEM FUNCTIONING / DISRUPTION OF NATURAL MIGRATION ROUTES.	LAND TRANSFORMATION THOUGH MINE RELATED AND ASSOCIATED INFRASTRUCTURE DEVELOPMENT.	NEGATIVE (-)	-3	-3	-4	-2	-12	– FOLLOW THE RECOMMENDATIONS IN THE EMP AND REHABILITATION PLAN FOR FINAL REHABILITATION PROCEDURES.	-1	-3	-4	3	-5
		IMPACT OF CHEMICAL COMPOUNDS FROM CONSTRUCTION ON ANIMALS	RELEASE OF HAZARDOUS / BIO-ACCUMULATING CHEMICALS INTO THE ENVIRONMENT.	NEGATIVE (-)	-2	-3	-2	-2	-9	– FOLLOW THE RECOMMENDATIONS IN THE EMP AND REHABILITATION PLAN FOR FINAL REHABILITATION PROCEDURES. – ELIMINATE THE LEACHING OF CHEMICALS.	-2	-3	-1	-1	-7
SURFACE WATER	EROSION OF SLOPES.	UNSTABLE LAND FORM RESULTING IN INCREASED EROSION.	ESTABLISH FINAL SLOPES AS PER POST-CLOSURE PROFILE.	NEGATIVE (-)	-2	-2	-3	-4	-11	– FOLLOW THE RECOMMENDATIONS IN THE EMP AND REHABILITATION PLAN FOR FINAL REHABILITATION PROCEDURES. – ENSURE SLOPES ARE DEVELOPED AT ANGLES[31] THAT WILL ACHIEVE THE RECOMMENDED SLOPE PROFILE. – VEGETATE ALL CONTOURED AREAS AND SLOPES.	-1	-1	-1	0	-3
	SUSTAINABILITY OF SLOPED AREAS.	EROSION OF SIDE SLOPES OF REHABILITATED AREAS.	SIDE SLOPES TOO STEEP RESULTING IN EROSION AND POTENTIAL DANGER TO ANIMALS ATTEMPTING TO ACCESS PIT AREA FOR WATER REQUIREMENTS.	NEGATIVE (-)	-1	-3	-3	-3	-10	– FOLLOW THE RECOMMENDATIONS IN THE EMP AND REHABILITATION PLAN FOR FINAL REHABILITATION PROCEDURES. – ENSURE SLOPED AREAS ARE FREE FROM EROSION.	-1	-3	-3	0	-7
	DECANT	WATER QUALITY DETERIORATION DOWNSTREAM.	DECANT FROM THE OPENCAST AREAS TO THE STREAMS.	NEGATIVE (-)	-4	-3	-4	-5	-16	– WATER TREATMENT OF DECANT WATER THROUGH OPERATION OF A WATER TREATMENT PLANT.	-1	-3	-4	-2	-10

[31] Angles are recommended to be 18° by the DME.

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
GROUNDWATER	RECHARGE OF AQUIFER.	RECOVERY OF GROUNDWATER LEVEL.	RAINFALL RECHARGE.	POSITIVE (+)	+2	+3	+5	+5	+15	– FOLLOW THE RECOMMENDATIONS IN THE EMP AND REHABILITATION PLAN FOR FINAL REHABILITATION PROCEDURES. – DUE TO THE EXTREMELY SLOW MOVEMENT OF GROUNDWATER THIS PROCESS, ALBEIT POSITIVE, WILL OCCUR OVER THE LONG TERM.	+2	+3	+5	+5	+15
	POLLUTION.	GROUNDWATER QUALITY DETERIORATION.	POLLUTION OF THE NEIGHBOURING AQUIFERS FORM THE OPENCAST AREAS POST CLOSURE (POLLUTION PLUME MOVEMENT).	NEGATIVE (-)	-2	-3	-3	-3	-11	– FOLLOW THE RECOMMENDATIONS IN THE EMP AND REHABILITATION PLAN FOR FINAL REHABILITATION PROCEDURES. – AFTERCARE POST REHABILITATION TO ENSURE FREE DRAINAGE.	-2	-3	-2	-1	-8
AIR QUALITY	FUGITIVE DUST AND PARTICULATE MATTER	REDUCTION IN AMBIENT AIR QUALITY FROM FUGITIVE DUST EMISSIONS.	MATERIAL TRANSFER OPERATIONS.	NEGATIVE (-)	-2	-51	-3	-3	-9	– FOLLOW THE RECOMMENDATIONS IN THE EMP AND REHABILITATION PLAN FOR FINAL REHABILITATION PROCEDURES. – ESTABLISH WIND BREAKS TO MINIMISE DUST IMPACTS. – RE-VEGETATE ALL EXPOSED SURFACES. – REDUCE VEHICLE TRAVELLING SPEED TO MINIMISE DUST LIBERATION.	-1	-1	-1	-1	-4
			WIND EROSION FROM EXPOSED AREAS BEING REHABILITATED.	NEGATIVE (-)	-2	-1	-2	-1	-6		-1	-1	-1	0	-3
			VEHICLE ENTRAINED DUST FROM BOTH PAVED AND UNPAVED ROAD SURFACES.	NEGATIVE (-)	-2	-1	-3	-3	-9		-1	-1	-2	-1	-5
			FUGITIVE EMISSIONS FROM REHABILITATION ACTIVITIES.	NEGATIVE (-)	-2	-1	-3	-3	-9		-1	-1	-2	-1	-5
			REMEDIATION AND REHABILITATION ACTIVITIES.	POSITIVE (+)	+1	+1	+3	+2	+7		+1	+1	+3	+2	+7
NOISE AND VIBRATION	NOISE POLLUTION	INCREASED AMBIENT NOISE LEVELS.	INCREASE TRAFFIC FLOW DUE TO REHABILITATION ACTIVITIES.	NEGATIVE (-)	-1	-2	-4	-3	-10	– FOLLOW THE RECOMMENDATIONS IN THE EMP AND REHABILITATION PLAN FOR FINAL REHABILITATION PROCEDURES. – REDUCTION OF VEHICLES DURING CLOSURE PHASE. – ALL VEHICLES WILL BE FITTED WITH APPROPRIATE SOUND SUPPRESSION DEVICES OR SILENCERS. – VEHICLES WILL BE INSPECTED ON A REGULAR BASIS. – ALL MACHINERY UTILISED IN THE DECOMMISSIONING PHASE WILL BE IN SOUND MECHANICAL CONDITION.	-1	-1	-2	-1	-5
			DISMANTLING AND DECOMMISSIONING ACTIVITIES.	NEGATIVE (-)	-1	-1	-4	-3	-9		-1	-1	-3	-1	-6
			FINAL REHABILITATION ACTIVITIES.	NEGATIVE (-)	-1	-1	-4	-3	-9		-1	-1	-1	-1	-4

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
ARCHAEOLOGY AND HERITAGE	IMPACT OF MINE CLOSURE AND REHABILITATION ON GRAVES, FARMSTEADS, AND HERITAGE RESOURCES.	IMPACT OF MINE CLOSURE AND REHABILITATION ON THE GRAVES, FARMSTEADS AND HERITAGE RESOURCES DIRECTLY IMPACTED BY THE MINING OPERATION.	MINE CLOSURE AND REHABILITATION ACTIVITIES.	NEGATIVE (-)	-1	-1	-1	-1	-4	– FOLLOW THE RECOMMENDATIONS IN THE EMP AND REHABILITATION PLAN FOR FINAL REHABILITATION PROCEDURES. – MAINTENANCE OF FENCING AROUND IDENTIFIED SITES.	-1	-1	-1	+2	-1
WASTE	CONTAMINATION OF SOIL, SURFACE WATER AND GROUNDWATER; HEALTH RISKS AS A RESULT OF EXPOSURE TO HAZARDOUS SUBSTANCES.	USAGE OF LANDFILL AREAS.	GENERATION AND DISPOSAL OF GENERAL WASTE (E.G. RUBBLE) TO LANDFILL	NEGATIVE (-)	-2	-3	-3	-2	-10	– FOLLOW THE RECOMMENDATIONS IN THE EMP AND REHABILITATION PLAN FOR FINAL REHABILITATION PROCEDURES. – RECYCLING OF WASTE OFF SITE. – USE OF RUBBLE WASTE FOR BACKFILLING PURPOSES. – ENSURE RUBBLE IS NOT CONTAMINATED BY HAZARDOUS MATERIALS. – OFF-SITE DISPOSAL OF WASTE CONTAMINATED BY HAZARDOUS MATERIAL.	-2	-3	-3	-1	-9
			GENERATION AND DISPOSAL OF HAZARDOUS WASTE TO LANDFILL (E.G. OIL-CONTAMINATED RUBBLE)	NEGATIVE (-)	-2	-2	-2	-3	-9		-2	-2	-2	-2	-8
			BURIAL OF WASTE ON SITE.	NEGATIVE (-)	-2	-3	-1	-2	-7		-1	-1	-1	-1	-4
VISUAL	VISUAL IMPACT	CHANGE IN LAND-USE AND CURRENT VIEWS.	MINING RELATED INFRASTRUCTURE AND BUILDINGS.	NEGATIVE (-)	-2	-2	-4	-6	-10	– FOLLOW THE RECOMMENDATIONS IN THE EMP AND REHABILITATION PLAN FOR FINAL REHABILITATION PROCEDURES. – AT CLOSURE, ALL BUILDINGS AND INFRASTRUCTURE THAT ARE NOT RE-USED AND HANDED OVER MUST BE DEMOLISHED AND FOOTPRINTS REHABILITATED TO RE-ESTABLISH VEGETATION COVER. – ALL PERMANENT MINE RESIDUE STOCKPILES MUST BE RE-VEGETATED TO ESTABLISH AT LEAST A 60% VEGETATION COVER.	-2	-3	-4	+4	-5
			MATERIAL STORAGE (TOPSOIL STOCKPILES AND MATERIAL STOCKPILES).	NEGATIVE (-)	-2	-2	-4	-2	-10		-2	-3	-4	+4	-5
SOCIAL	EMPLOYMENT (MINE SPECIFIC).	CREATION OF MINE SPECIFIC EMPLOYMENT OPPORTUNITIES.	REHABILITATION AND CLOSURE ACTIVITIES AT THE BELFAST PROJECT.	POSITIVE (+)	+3	+3	+4	+2	+12	– FOLLOW THE RECOMMENDATIONS IN THE EMP AND THE SOCIAL AND LABOUR PLAN FOR FINAL REHABILITATION PROCEDURES.	+3	+3	+4	+5	+15

ISSUE	GENERAL IMPACT	SPECIFIC IMPACT	CAUSE / ASPECT	STATUS	IMPACT SIGNIFICANCE PRIOR TO MITIGATION					MITIGATION MEASURES	IMPACT SIGNIFICANCE POST MITIGATION				
					E	D	P	I	S		E	D	P	I	S
	EMPLOYMENT (DIRECTLY AFFECTED AREA).	CREATION OF EMPLOYMENT OPPORTUNITIES NOT DIRECTLY RELATED TO THE REHABILITATIO N ACTIVITIES.	REHABILITATION AND CLOSURE ACTIVITIES AT THE BELFAST PROJECT.	POSITIVE (+)	+3	+1	+2	+2	+8	– RETIREMENT PACKAGES AND SKILLS RE-TOOLING AS REQUIRED. – FOCUS ON SHORT-TERM EMPLOYMENT OPPORTUNITIES NEAR COMMUNITIES, PRECEDED BY EXTENSIVE COMMUNITY LIAISON TO SUPPORT EMPLOYMENT ACROSS COMMUNITY MEMBERS.	+3	+2	+2	+3	+10
ECONOMIC	EMPLOYMENT.	DECLINE IN EMPLOYMENT OPPORTUNITIES .	INCREASE IN UNEMPLOYMENT.	NEGATIVE (-)	-3	-2	-4	-4	-13	– FOLLOW THE RECOMMENDATIONS IN THE EMP AND THE SOCIAL AND LABOUR PLAN FOR FINAL REHABILITATION PROCEDURES. – IDENTIFY DOWNSTREAM ACTIVITIES AND LOCAL-BASED PROJECTS FOR FUTURE EMPLOYMENT OF MINE PERSONNEL.	-3	-1	-3	-3	-10

7.5 Impact Weighting and Residual Impacts after Mitigation

Table 75 to Table 77 below present an averaged impact rating for each of the environmental parameters as well as the rating that could be achieved after mitigation measures has been implemented.

The final column in the table reflects a percentage of mitigation that could be achieved though the implementation of the prescribed mitigation and management measures. Though averaging the impact ratings, a broad overview is established with regard to the environmental aspects that would be impacted on most significantly.

Table 75: Average Impact Rating for the Construction Phase.

Issue	Average Rating Prior to Mitigation	Average Rating Post Mitigation	Percentage (%) Mitigation that could be Achieved
Climate	-7	-6	10
Geology	-12	-12	0
Soils	-12	-11	10
Land Capability & Land Use	-12	-11	13
Natural Vegetation / Plant Life	-12	-11	6
Animal Life	-11	-9	18
Surface Water	-11	-10	9
Groundwater	-11	-10	9
Air Quality	-9	-7	19
Noise & Vibration	-8	-6	22
Archaeology & Heritage	-7	-2	77
Visual	-9	-7	22
Waste	-11	-6	43
Social	-1	2	550
Economic	8	10	13

Table 76: Average Impact Rating for the Operational Phase

Issue	Average Rating Prior to Mitigation	Average Rating Post Mitigation	Percentage (%) Mitigation that could be Achieved
Climate	-11	-8	27
Geology	-14	-14	0
Soils	-11	-10	15
Land Capability & Land Use	-12	-10	17
Natural Vegetation / Plant Life	-13	-10	20
Animal Life	-11	-8	32
Surface water	-12	-8	28
Ground Water	-14	-12	14
Air Quality	-10	-8	19
Noise & Vibration	-10	-8	19
Archaeology & Heritage	-7	-2	77
Visual	-10	-9	10
Waste	-11	-6	44
Social	-1	2	367
Economic	10	10	6

Table 77: Average Impact Rating for the Decommissioning and Closure Phase

Issue	Average Rating Prior to Mitigation	Average raTing post Mitigation	Percentage (%) Mitigation that could be Achieved
Geology & Soils	9	10	11
Land Capability & Land Use	-6	1	-113
Natural Vegetation / Plant Life	-6	1	-113
Animal Life	-12	-4	-67
Surface Water	-12	-7	-46
Groundwater	2	4	75
Air Quality	-5	-2	-62
Noise & Vibration	-9	-5	-46
Archaeology & Heritage	-4	-1	-75
Visual	-10	-5	-50
Waste	-9	-7	-19
Social	10	13	25
Economic	-13	-10	-23

7.5.1 Impact Weighting

All environmental parameters cannot be considered to be equal. For example, while the mining operation may look unattractive and is regarded as a visual disturbance it cannot be regarded as significant as the effect of the mining operation on the availability and pollution of groundwater. The pollution of groundwater may have health effects on future water users while the fact the mine look unattractive remains a static impact only perceived by people. Therefore the following methodology has been developed for the weighting of the impact to enable an understanding of not only the significance, but the importance of specific impacts on the environment.

Two principles are applied in the prioritisation of environment aspects. These two principles are adopted from the South African Environmental Management Act[32], and include:

- That people have the right to an environment that is not harmful to their health or well-being; and
- That environmental management must place people and their needs at the forefront of its concern, and serve their physical, psychological, developmental, cultural and social interests equitably.

Based on these principles impacts relating to socio-economic development is regarded to have the highest importance. Impacts relating to the physical environment, including aspect such as groundwater, land capability, etc. as second priority, and then followed by the biophysical and visual environment.

Divisional factors have been allocated for the environmental parameters in the EMP in order to reflect a weighted average which will reflect environment parameter importance (Table 78).

Table 78: Divisional Factors Applied in the EMP

Environmental Aspect	Divisional Factor
Social and Economic	1
Soils	
Land Capability & Land Use	
Groundwater	

[32] National Environmental Management Act (Act 107 of 1998)

Environmental Aspect	Divisional Factor
Air Quality	
Surface Water	
Archaeology & Heritage	
Geology	2
Natural Vegetation / Plant Life	
Animal Life	
Climate	
Noise & Vibration	
Waste	
Visual	3

Based on this divisional factor application, weighting the average rating impact for each environmental parameter, post mitigation is as detailed in Table 79 – Table 81.

Table 79: Weighting of the Average Rating Impact Post Mitigation for the Construction Phase

Issue	Average Rating Post mitigation	Percentage (%) Mitigation that could be Achieved	Divisional Factor	Weighted Rating
Climate	-6	10	2	-3
Geology	-12	0	2	-6
Soils	-11	10	2	-5
Land Capability & Land Use	-11	13	2	-5
Natural Vegetation / Plant Life	-11	6	3	-4
Animal Life	-9	18	3	-3
Surface Water	-10	9	2	-5
Groundwater	-10	9	2	-5
Air Quality	-7	19	2	-4
Noise & Vibration	-6	22	3	-2
Archaeology & Heritage	-2	77	1	-2
Visual	-7	22	3	-2
Waste	-6	43	2	-3
Social	2	550	1	2
Economic	10	13	1	10

Table 80: Weighting of the Average Rating Impact for the Operational Phase

Issue	Average Rating Post mitigation	Percentage (%) Mitigation that could be Achieved	Divisional Factor	Weighted Rating
Climate	-8	27	2	-4
Geology	-14	0	2	-7
Soils	-10	15	2	-5
Land Capability & Land Use	-10	17	2	-5
Natural Vegetation / Plant Life	-10	20	3	-3
Animal Life	-8	32	3	-3

Issue	Average Rating Post mitigation	Percentage (%) Mitigation that could be Achieved	Divisional Factor	Weighted Rating
Surface Water	-8	28	2	-4
Groundwater	-12	14	2	-6
Air Quality	-8	19	2	-4
Noise & Vibration	-8	19	3	-3
Archaeology & Heritage	-2	77	1	-2
Visual	-9	10	3	-3
Waste	-6	44	2	-3
Social	2	367	1	2
Economic	10	6	1	10

Table 81: Weighting of the Average Rating Impact for the Decommissioning and Closure Phase

Issue	Average Rating Post mitigation	Percentage (%) Mitigation that could be Achieved	Divisional Factor	Weighted Rating
Geology & Soils	9	0	2	5
Land Capability & Land Use	1	113	2	0
Natural Vegetation / Plant Life	1	113	3	0
Animal Life	-4	67	3	-1
Surface Water	-7	46	2	-3
Groundwater	4	43	2	2
Air Quality	-2	62	2	-1
Noise & Vibration	-5	46	3	-2
Archaeology & Heritage	-1	75	1	-1
Visual	-5	50	3	-2
Waste	-7	19	2	-4
Social	13	20	1	13
Economic	-10	23	1	-10

The purpose of the application of weighting of impacts post mitigation is to determine if the mitigation and management measures proposed, are sufficient as relating to the impacts themselves. Based on this weighting, there are no impacts that rank as a high negative significance post mitigation indicating that all impacts can be mitigated sufficiently (Table 82).

Table 82: Summarised Weighted Impact Ratings Post Mitigation

Impact	Rating	Construction phase	Operational phase	Decommissioning phase:
Positive	HIGH	– N/A	– N/A	– Social
Positive	MEDIUM	– Economic	– Economic	– N/A
Positive	LOW	– Social	– Social	– Groundwater
No Impact	NO IMPACT	– N/A	– N/A	– Land capability and land use, natural vegetation / plant life
Negative	LOW	– Climate, soils, land capability and land use, natural	– Climate, soils, land capability and land use, natural	– Animal life, surface water, air quality, noise and vibration, archaeology

		vegetation / plant life, animal life, groundwater, surface water, air quality, noise and vibration, archaeology and heritage, visual, and waste	vegetation / plant life, animal life, surface water, air quality, noise and vibration, archaeology and heritage, visual, and waste	and heritage, visual, and waste
Negative	MEDIUM	– Geology	– Geology and groundwater	– Economic
Negative	HIGH	– N/A	– N/A	– N/A

7.6 Cumulative Impacts

The impact significance rating process undertaken above suggests that there will be no impacts of high significance on the receiving environment after mitigation. The accumulation of impacts on the site could however lead to the point of undesired or unintended cumulative impacts (occurring off-site) that need to be mitigated. The potential significance of cumulative impacts are presented below, the significance of which is considered prior to mitigation and management measures and monitoring programmes.

Table 83: Cumulative impact ratings

Issue	Average Rating Post Mitigation		
	Construction Phase	Operational	Closure
Geology	-6	-7	5
Soils	-5	-5	5
Natural Vegetation / Plant Life	-4	-3	0
Surface Water	-5	-4	-3
Groundwater	-5	-6	2
Air Quality	-4	-4	-1
Social	2	2	13
Economic	10	10	-10

7.6.1 Soils and Geology

The cumulative impact on soils in the region can increase considering the extent of development, including industrial growth, widespread mining activities, afforestation, agricultural activities and urbanization. The impacts will result in soil erosion, siltation of local streams, loss of arable areas and the loss of topsoil for rehabilitation purposes. The cumulative impact on soils is of high significance and will occur on a regional scale. Impacts will extend beyond mine closure and are almost certain to occur. The severity is therefore of high significance in the absence of adequate mitigation measures.

7.6.2 Water Resources

At a regional scale, significant catchment development, including industrial growth, widespread mining activities, afforestation, agricultural activities and urbanisation has impacted on the surface water resources within the Komati catchment area. Monitoring is therefore vital in determining changes in water quality. Cumulatively these activities could have significant impacts on rivers and streams which then flow into neighbouring regions, affecting a wide area. The most significant impacts that were identified were for the post closure phase from leachates affecting adjacent streams and decant from filling of the mining blocks. The closure phase therefore needs to be properly managed to prevent adverse effects post closure.

7.6.3 Air Quality

Operations, processing and transportation from the proposed mine added to other air pollution sources such as industrial, fugitive dust, mining emissions, domestic fuel combustion, biomass burning and tailpipe emissions will contribute to possible cumulative impact on air quality in the region. Elevated PM10 concentrations are predicted to occur in the region where annual average concentrations are estimated to be about 10 $\mu g/m^3$. Chemical suppressants or water sprays on the primary crusher and dry dust extraction units with wet scrubbers on the secondary and tertiary crushers will assist in the reduction of cumulative dust impacts.

7.6.4 Noise

Cumulative impacts for noise are based on anticipated increases in ambient noise levels. The proposed Belfast Project is considered a causative source of noise pollution that will contribute to the increase of the ambient noise levels in the area, especially during the night time.

The proposed site is regarded as rural with generally low ambient noise levels typical to rural environments with the main source of noise being the N4 highway to the north of the site. Existing noises are deemed to be of low significance increasing to an overall medium cumulative significance during operation of the mine. Mobile equipment and fixed plant noise as well as blasting are anticipated to be the major sources of noise associated with the proposed mine. Cumulative noise impacts are expected to be significantly reduced on closure of the mine.

7.6.5 Biodiversity

The reduction of viable natural land in the region for ecological functionality and environmental processes is brought about by human settlement, industrial and mining activities, agricultural activities and transport. Terrestrial ecosystems found within the site are generally considered to be of low ecological value, transformed mostly as a result of agricultural activities. Due to the nature of the proposed activities impacts must either be minimized or rectified as impact avoidance is not considered to be feasible. Rehabilitation on a continuous basis for the full duration of the project and after closure is proposed to minimize the potential cumulative impacts.

7.6.6 Wetlands

Cumulative impacts from existing agricultural impacts, surrounding mining activities as well as the proposed Exxaro Belfast Project on wetlands can lead to increased erosion, flooding, sedimentation and bank instability and shifts in hydrological wet zones, habitat losses or alterations and habitat availability changes. Cumulative impacts have been assessed to be high and mitigation should focus on minimization through good construction practices, properly managed strip mining procedures and progressive and immediate rehabilitation upon completion. Monitoring of wetlands should be undertaken during all phases. The rehabilitation and protection criteria for the off-site offset pans and wetlands are required to improve baseline conditions and mitigate impacts on wetlands and pans associated with the project.

7.6.7 Traffic

Agriculture is the dominant activity affecting traffic. The presence of mining in the region sees additional vehicles (primarily trucks) employed for coal transport impacting on the roads. It is currently assumed that 137 loaded and an equal number of unloaded trucks will cause a significant cumulative impact on the road network during daylight hours. If mining increases in the area as a result of the mine, there will be a negative cumulative impact on the local roads and measures will need to be taken for road maintenance, safety and dust suppression. It is acknowledged that a full traffic study needs to be conducted in order to determine the full significance of additional traffic in the area as a result of the proposed mine.

7.6.8 Socio-economic

The Beeld Newspaper (17/04/2009, Elise Tempelhoff) reports that some Mpumalanga farmers have collaborated to prevent authorities from approving new applications for coal and other mines in the area. Farming organisations were established in five areas including Belfast, Delmas, Ermelo, Carolina and Standerton in order to prevent loss of agricultural land in these areas. Based on the average provincial yield of between four and five tonnes per hectare, it was assumed the average yield of the Delmas area is 5.5 t/ha, but this figure could be significantly higher in areas with such a high agricultural potential as in the project area. Due to the high agricultural potential of this region, the overall impact of mining is considered to be of high significance.

The results of the Social Accounting Matrix modelling exercise found that a total production impact of R121.5 billion and a total GDP-R impact of R41.6 billion over the 100 year horizon could be anticipated. The mine will also, indirectly, generate 1271 jobs during construction and 2338 jobs per annum during the operational phase of the mine. After rehabilitation and re-establishment of agriculture (which will create another 1815 jobs), the intention is that the land will revert back to some form of agricultural production. In terms of employment, skills development and local economic development, the proposed Exxaro Belfast Project will have a medium cumulative impact.

8

Impact summary

8.1 Summary of Identified Impacts

Based on the impact assessment undertaken in Section 7, an impact summary can be provided for the following alternatives:

- Mining scenario
- Agricultural scenario

Table 84: Summary of Impacts Identified for the Mining Scenario

Impact	Rating	Construction phase	Operational phase	Decommissioning Phase
Positive	HIGH	▪ N/A	▪ N/A	▪ Social
Positive	MEDIUM	▪ Economic	▪ Economic	▪ N/A
Positive	LOW	▪ Social	▪ Social	▪ Groundwater
No Impact	NO IMPACT	▪ N/A	▪ N/A	▪ Land capability and land use ▪ Natural vegetation / plant life
Negative	LOW	▪ Climate ▪ Soils ▪ Land capability and land use ▪ Natural vegetation / plant life ▪ Animal life ▪ Groundwater ▪ Surface water ▪ Air quality ▪ Noise and vibration ▪ Archaeology and heritage ▪ Visual ▪ Waste	▪ Climate ▪ Soils ▪ Land capability and land use ▪ Natural vegetation / ▪ Plant life ▪ Animal life ▪ Surface water ▪ Air quality ▪ Noise and vibration, ▪ Archaeology and heritage ▪ Visual ▪ Waste	▪ Animal life ▪ Surface water ▪ Air quality ▪ Noise and vibration ▪ Archaeology and heritage ▪ Visual ▪ Waste
Negative	MEDIUM	▪ Geology	▪ Geology ▪ Groundwater	▪ Economic
Negative	HIGH	▪ N/A	▪ N/A	▪ N/A

For the mining operation as a whole, it is Exxaro Resources' intention that the Belfast Project comply with all South African environmental legislation. The Belfast Project will adhere to the principles of the NEMA. Mitigation of the following negative impacts identified during the EIA process is mandatory in terms of the Environmental Management Plan.

The anticipated social impacts associated with the Belfast Project were assessed to be positive overall significance. In terms of job creation the project is anticipated to contribute significantly to employment within the study area, with short-term employment opportunities extending to nearby communities assisting in poverty alleviation. The economic value associated with the project is significant when considering the localised reduction of unemployment and an associated increase in spending power and localised entrepreneurship opportunities. The development of infrastructure around the mine and contribution to skills development are also regarded to contribute positively. The influx of negative social elements arising from the project should be managed in accordance with a Social and Labour plan.

The most significant negative impact concerns groundwater. Prior to mitigation it has a high impact rating, but can be mitigated and its rating reduced to medium. Mitigation measures will be implemented to prevent decant from entering the receiving surface water environment and a monitoring program will be in place from the operational phase throughout the life-of-mine until after closure to monitor the occurrence of any adverse groundwater impacts.

Based on this impact assessment, there are no impacts that rank as a high negative significance post mitigation, indicating that all impacts can be mitigated sufficiently.

9

Environmental Management and Closure Costing

This section provides the determination of the cost of each of the measures to modify, remediate, control or stop any actions, activities or processes leading to or causing pollution. The Chapter includes costs associated with the mitigation measures required during the operational phase of the mine as well as the costs for mine closure.

9.1 Management Measure Costing

The following table provides cost estimates for the implementation of the environmental management measures during the Construction and Operational Phases of the proposed mining project. The following should be noted:

- The costs included in this table are estimates only for the purposes of expressing the potential financial impact which may result from the implementation of this plan.
- The table includes costs associated with the implementation of environmental mitigation during the construction and operational phases only.
- The measures costed have been provided for as part of the mine’s capital expenditure and operational expenditure financial models. Additional financial provision for the implementation of the environmental management plan has therefore not been made in order to eliminate double counting.

Table 85: Management Measure Costings

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
General	1.1	All tendering and successful contractors will be made aware of the contents of the latest EMP and any penalties arising from non-compliance to stipulated management and monitoring measures.	All Phases	Annually	SHE Manager	Checklist sign-off	Discretionary penalties for non-compliance to be imposed by the ECO	N/A	Discretionary penalties for non-compliance to be imposed by the ECO	N/A
	1.2	The Environmental Compliance Officer (ECO) and SHE Manager will induct all contractors, sub-contractors and personnel working on the project on the contents of the EMP and any penalties arising from non-compliance to stipulated management and monitoring measures.	All Phases	Annually	SHE Manager ECO	Induction register	SHE manager annual salary: R501,645.00 Environmental officer annual salary: R395,747.00 (6% annual escalation to be applied)	R 1,848,627.52	SHE manager annual salary: R501,645.00 Environmental officer annual salary: R395,747.00 (6% annual escalation to be applied)	R 79,715,132.17
	1.3	The contractor shall ensure that drivers of delivery vehicles are informed of all procedures and restrictions required, to comply with the EMP. Such drivers shall be supervised during off-loading, by a person knowledgeable of the requirements.	All Phases	Ongoing	Contractor Security	Checklist sign-off	Discretionary penalties for non-compliance to be imposed by the ECO	N/A	Discretionary penalties for non-compliance to be imposed by the ECO	N/A
	1.4	The ECO shall clearly identify the areas that must be protected C5 from disturbance by the contractor's activities at the commencement of the contractor's contract.	All Phases	Ongoing	ECO	Weekly inspection by ECO	Remediation cost of R360/m^2 will be incurred by the contractor for disturbance of protected or no-go areas	N/A	Remediation cost of R360/m^2 for disturbance of protected or no-go areas.	N/A
	1.5	The contractor shall restrict all his activities, materials, equipment and personnel to within the area/s specified.	All Phases	Ongoing	Contractor	Weekly inspection by ECO	Remediation cost of R360/m^2 will be incurred by the contractor for disturbance of protected or no-go areas	N/A	Remediation cost of R360/m^2 for disturbance of protected or no-go areas	N/A

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
Community Relations	2.1	An "Issues and Complaints Register" shall be kept on site, containing contact details of any complainant, as well as details pertaining to the complaint itself.	All Phases	Ongoing	ECO	Monthly review and action	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
	2.2	The EMP shall be made available to I&APs upon request for their perusal.	All Phases	Ongoing	ECO	-	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
Access	3.1	The site layout shall include access points for deliveries and services, and future works. Minimising disturbance to neighbours shall be considered at all times.	All Phases	Ongoing	Security ECO	Random inspections	Discretionary penalties for non-compliance to be imposed by the ECO depending on severity of incident	N/A	Discretionary penalties for non-compliance to be imposed by the ECO depending on severity of incident	N/A
	3.2	Exxaro shall ensure that access to the site, including associated infrastructure and equipment, is off-limits to the public at all times during all phases.	All phases	Ongoing	Security ECO	Security check-in register Weekly inspections	Cost of securing construction work will be borne by the contractor.	N/A	Capital Expenditure: Fencing around plant: R160/m X 9000m = R1,440,000.00 Operational Expenditure (30yr): Maintenance of Farm Fencing 140000m X R2.50 = R350,000.00 X 30 = R10,500,000.00	R 11,940,000.00
	3.3	Additional areas restricted to the public shall be clearly marked using appropriate signage.	All Phases	Ongoing	Contractor Security ECO	Perimeter inspections of signage				
	3.4	Access to the site and works area shall use existing roads as far as practically possible.	All Phases	Ongoing	All personnel	Random inspections	Remediation cost of R360/m^2 will be incurred by the contractor for disturbance of protected or no-go areas	N/A	Remediation cost of R360/m^2 for disturbance of protected or no-go areas	N/A
	3.5	Damage to the existing	Constructio	Ongoing	Contractor	Monthly road	100% of repair cost	N/A	100% of repair cost as	R 15,000,000.00

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
		access roads as a result of malicious damage by Exxaro and not as a consequence of bad maintenance shall be repaired to the satisfaction of the Site Manager and the Local Council.	n Phase		Mine Manager	inspections	as stipulated by Council to be borne by contractor = approx R 500 000 per kilometre		stipulated by Council to be borne by contractor = approx R 500 000 per kilometre	
	3.6	Whilst on site the Contractor shall control the movement of all vehicles (including suppliers), such that they remain on designated routes.	All Phases	Ongoing	Contractor Site Manager	Random inspections	Discretionary penalties for non-compliance to be imposed by the ECO depending on severity of incident	N/A	Discretionary penalties for non-compliance to be imposed by the ECO depending on severity of incident	N/A
	3.7	The vehicles of the Contractor and his suppliers as well as of the mine shall not exceed a speed of 60 km/hr, unless demarcated otherwise.	All phases	Ongoing	Contractor Security	Random traffic monitoring	Discretionary penalties for non-compliance to be imposed by the ECO depending on severity of incident	N/A	Discretionary penalties for non-compliance to be imposed by the ECO depending on severity of incident	N/A
	3.8	Markers and pegs shall be erected and maintained along the boundaries of the working areas, access roads, haul roads or paths before commencing any work. If proved insufficient for control, these shall be replaced by fencing.	All Phases	Ongoing	Site Manager Contractor	Monthly inspections	Cost of markers and pegs: R70 per peg Cost of fencing: R50/m	N/A	Operational Phase: Fencing and Signage Fencing around plant: R160/m Farm fences: R50/m Signage: Maintenance for the above: R2.5 per annum.	Refer to Item 3.3
	3.9	The movement of any vehicles and / or personnel outside of designated working areas shall not be permitted without the written authorisation of the Site Manager.	All Phases	Ongoing	Site Manager	Daily inspections	Discretionary penalties for non-compliance to be imposed by the ECO depending on severity of incident	N/A	Discretionary penalties for non-compliance to be imposed by the ECO depending on severity of incident	N/A
	3.1	Traffic safety measures (e.g. traffic warning signs), to the satisfaction of the Site Manager, shall be considered in controlling entry / exit onto public roads.	All Phases	Ongoing	Site Manager	Monthly inspections	Cost of traffic safety measures for construction phase will be borne by the contractor.	N/A	Capital Expenditure: Establish traffic safety measures - R200,000.00 Operational Phase: Maintenance R5,000.00	R 650,000.00

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
									per annum - R150,000.00	
Document Control	4.1	Obtain and maintain validity of all legally required permits / registrations / licences.	All phases	Annually	SHE Manager	Monthly inspections	Not applicable	N/A	Provision of R5m to be made during life of mine for fines resulting from non-compliances	Refer to Item 4.2
					Environmental Officer					
	4.2	Confirm the validity of all permits / registrations / licences which include, but are not limited to:	All phases	Annually	SHE Manager	Monthly inspections	Cost of legal non-compliance will be borne by the contractor.	N/A	Provision for consulting fees of R500,000.00 p/a for obtaining and maintaining permits / licenses / registrations. Provision of R5m to be made during life of mine for fines resulting from non-compliances	R 20,000,000.00
		– Mining Right.			Environmental Officer	Annual applications / renewals				
		– All health and safety certificates required for mining operations.								
		– Explosive magazine license.								
		– Integrated Water Use License.								
		– Any permits / registrations / licences which are due to expire will be renewed prior to the expiry date.								
	4.3	Develop a spreadsheet which documents all the waste generated by the mine. The spreadsheet must list the waste, the nature of the waste, the quantities produced and indicate how the waste is legally disposed of. Legally acceptable disposal must be justified by the appropriate valid waste disposal permits.	All phases	Ongoing	SHE Manager	Completion of spreadsheet monthly	All external contractors will be responsible to for waste disposal at their own cost.	N/A	Maintaining spreadsheet: N/A Waste disposal costs: Refer to Item 19 SHE Manager and ECO salary provision applies.	N/A refer to item 1.2 and 19

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
		Confirm validity of, and keep a copy of all valid waste disposal permits / registrations / licences of all sub-contractors (where applicable). Such permits / registrations / licences include, but are not limited to:			Environmental Officer	3-monthly inspection of licenses				
		– Used oil.								
		– Oil contaminated waste / oil filters.								
		– Scrap metal.								
		– Old tyres.								
		– Batteries.								
		– Hydrocarbons.								
		– Medical waste.								
		If a sub-contractors' disposal permit / registration / licence has expired, the Mine must request a copy of the new permit. If the sub-contractor cannot produce a valid permit / registration / licence contracts with this company must be terminated.								
	4.4	Update the documentation listed below:	All phases		Mine Manager	Review as required	SHE Manager and ECO salary provision applies.	N/A refer Item 1.2	SHE Manager and ECO salary provision applies.	N/A refer Item 1.2
		– Water Balance Diagram		Annually	SHE Manager					
		– Financial Provision		Annually	Environmental Officer					
		– Mining Work Program		Annually						
		Closure Plan		When required						
		– Environmental Performance Auditing		Every 2 years						
		– Environmental Management Programme		As required						

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
		– Social and Labour Plan		As required						
		– Results from all monitoring campaigns		Monthly						
	4.5	Ensure the mine has access to all environmental legislation applicable to the mining operation. These must be updated as legislation changes.	All phases	Ongoing	Environmental Officer	Bi-annual legislation survey and updating of legal register	SHE Manager and ECO salary provision applies.	N/A refer Item 1.2	SHE Manager and ECO salary provision applies.	N/A refer Item 1.2
	4.6	Maintain a record of the groundwater quality and quantity.	Monthly	Ongoing	Environmental Officer	Complete spreadsheet and obtain laboratory results	Not applicable	N/A	Capital Expenditure: Establishment of 20 monitoring boreholes: R40,000.00 per borehole: R800,000.00	R 7,640,000.00
	4.7	Maintain a record of the surface water quality and quantities.	Monthly	Ongoing	Environmental Officer	Complete spreadsheet and obtain laboratory results	Recording of data: Not applicable	N/A	Operational Phase: Water analysis costs (30 samples every quarter (30yrs): R1,200.00 X 30 = R36,000.00 X R1,080,000.00 Annual consultant monitoring cost: R192,000.00 per annum X 30yrs = R5,760,000.00 Recording of data: Not applicable	
Document Control	4.8	Maintain a spreadsheet containing complaints received and actions taken.	Monthly	Ongoing	Environmental Officer	Complete spreadsheet monthly	SHE Manager and ECO salary provision applies.	N/A refer Item 1.2	SHE Manager and ECO salary provision applies.	N/A refer Item 1.2
CLIMATE										
Carbon and greenhouse gas	5.1	Visually monitor all haul trucks for tailpipe emissions.	All Phases	Daily	Security	Capture observations in a log book	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
emissions.	5.2	Vehicles with excessive emissions will be noted in a book and reported to the contractor. The same vehicle will not be allowed back onto the property until the vehicle has been serviced and tailpipe emissions are controlled effectively.	All Phases	Daily	Environmental Officer	-	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
GEOLOGY										
Removal of overburden	6.1	Ensure that only overburden is removed and not the mined resource.	Construction Phase Operational Phase	Daily	Site manager Mine Manager Environmental Officer	Inspections of overburden dumps	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
Mining of coal reserve	6.2	Ensure coal mining is done in accordance with the MWP and the EMP.	Operational Phase	Ongoing	Mine Manager Environmental Officer Contractor	Daily inspections	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
SOILS										
Soil disturbance, loss of nutrients, loss of topsoil cover, loss of in situ structure and physical / chemical properties	7.1	Strip and stockpile top- and subsoils The top 50cm of topsoil will be removed from the area where surface infrastructure is to be developed. The topsoil will be stored in a berm along the perimeter of the site. Care will be taken to ensure that the berm is not located within any surface water channel. The berm will not exceed 6m in height.	Construction Phase Operation Phase	Ongoing	Mine Manager Environmental Officer	Weekly inspections and measurements of berms / dumps	Costs for stripping and stockpiling to be borne by contractor		Earthmoving: R 200/m^3	R 478,000.00
	7.2	Commence rehabilitation of mined areas and other	All Phases	Ongoing	Environmental Officer	Monthly monitoring of rehabilitation	Not applicable	N/A	Re-vegetation: R90/m^2	R 474,000.00

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
		affected areas timeously.				activities				
						Conduct alien invasive species audits on rehabilitated areas when required (i.e. twice a year)				
	7.3	Vegetate berms by seeding.	All Phases	Ongoing	Environmental Officer	Monitor re-vegetation progress	Not applicable	N/A	Re-vegetation: R90/m^2	R 8,100,000.00
						Conduct alien invasive species audits on berms				
	7.4	Re-use topsoil and subsoils during rehabilitation.	All Phases	Ongoing	Environmental Officer	Weekly inspections	Not applicable	N/A	Not applicable	N/A
	7.5	Implement erosion control and prevention methods.	All Phases	Bi-monthly	Environmental Officer	Visual inspections	Costs for erosion protection measures will be borne by the contractor during the construction phase	N/A	Erosion protection measures (30yrs): R20,000.00 per annum	R 600,000.00
	7.6	Ensure that spills are addressed timeously (refer to Item 18.1).	All Phases	Ongoing	Environmental Officer	Supervision of spill clean-up	Cleanup costs: determined based on extent of spill Removal costs to be borne by contractor during the construction phase: determined based on extent of spill and transportation and landfill space	N/A	Cleanup costs: determined based on extent of spill Removal costs: determined based on extent of spill and transportation and landfill space	N/A refer to item 18
LAND CAPABILITY AND LAND USE										
Land capability will be reduced to mining land status	8.1	Ensure effective soil handling and removal practices.	All Phases		Environmental Officer	Monitor soil placement and storage	SHE Manager and ECO salary provision applies.	N/A refer Item 1.2	SHE Manager and ECO salary provision applies. Fertiliser requirements p/a: R14,200,000.00	R 14,200,000.00
		Ensure effective soil placement and storage			Contractor	Soil testing as required to determine				

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
		practices.				fertiliser requirements				
		Monitor fertiliser requirements (rehabilitation).		Annually						
		Monitor fertiliser applications (rehabilitation).		Monthly						
Loss of natural habitat	8.2	Limiting the footprint of the mining operation to the approved mining right area.	All Phases	Monthly	Environmental Officer	Random inspections of mining footprint	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
		Prevention of dust liberation and spillage of rock material.		Daily	Contractor	Utilise dust suppression mechanisms	Cost of dust suppression measures to be borne by the contractor during the construction phase	N/A	Dust mitigation: Capital Expenditure - R146,668.00 Operational Expenditure - R430,348.00 p/a	R 13,057,108.00
		Ensure appropriate maintenance of the road ways.		Weekly	Security	Scheduled inspections of roadways				
NATURAL VEGETATION AND PLANT LIFE										
Potential loss / degradation of local vegetation	9.1	Minimise vegetation disturbance by removing only necessary vegetation.	Construction Phase Operational Phase	Ongoing	Environmental Officer	Weekly inspections	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
	9.2	Maximise vegetation retention areas.	All Phases	Ongoing	Environmental Officer Mine Planner	Mine schedule review				
	9.3	Remove vegetation in areas of infrastructure development only.	Construction Phase	Ongoing	Environmental Officer	Weekly inspections	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
Alteration of natural ecological processes / ecosystem functioning	9.4	Rehabilitate mined areas and other affected areas timeously.	All Phases	Ongoing	Environmental Officer Contractor					
	9.5	Pre-strip box-cuts only when required to ensure vegetation	Construction Phase	Ongoing	Environmental Officer	Monthly inspections				

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
		cover is maintained as long as possible.	Operational Phase		Contractor					
Impacts on sensitive environments (receiving water body / wetlands)	9.6	Use existing roads where possible.	All Phases	Ongoing	Environmental Officer	Random inspections				
					Contractor					
	9.7	Erection of fencing around no-go vegetation areas.	All Phases	Ongoing	Environmental Officer	Random inspections	Cost of erection of farm fencing to be borne by the contractor.	N/A	Maintenance of farm fences: R2.50/m X 18,000m = R45,000.00 X 30 = R135,000.00	R 135,000.00
					Contractor					
	9.8	Prevent uncontrolled fires and burning within the project area.	All Phases	Ongoing	Environmental Officer	Undertake controlled burns as necessary	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
					Contractor	Ensure combustible material is removed from the site timeously				
					Security					
Changes in vegetation dynamics	9.9	The perimeter of the mining and plant areas will be monitored for signs of spread of alien and invasive vegetation. All alien and invasive vegetation observed will be removed as per the Alien and Invasive Vegetation Eradication Plan.	All Phases	Ongoing	Environmental Officer	Undertake annual audit of site to identify areas of alien / invasive vegetation growth	Cost of control of alien invasives to be borne by the contractor during the construction phase	N/A	Alien Invasive Vegetation Eradication Programme: R50,000 / annum Removal of alien species: operational	R 1,500,000.00
					Contractor					
ANIMAL LIFE										
Alteration of natural ecological	10.1	Ensure pockets of vegetation remain in order to ensure a measure of ecological	All Phases	Ongoing	Environmental Officer	Inspections of vegetated areas	Remediation cost of R360/m^2 will be incurred by the	N/A	Remediation cost of R360/m^2 will be incurred by the	N/A

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
processes / ecosystem functioning		connectivity.			Contractor	Undertake faunal audit every 2 years	contractor for disturbance of protected or no-go areas		contractor for disturbance of protected or no-go areas	
	10.2	Pre-strip box-cuts only when required to ensure ecological connectivity is maintained as long as possible.	All Phases	Ongoing	Environmental Officer Contractor	Monthly inspections	Not applicable	N/A	Not applicable	N/A
Loss of animal life	10.3	Vehicles are to yield to animals, where possible.	All Phases	Ongoing	Environmental Officer	Personnel to report all animal deaths to the Environmental Officer	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
		Vehicles are to operate within the applicable speed limits.			Contractor					
		Limit night driving where possible.			Vehicle operators					
GROUNDWATER										
Lowering of groundwater levels	11.1	Monitor groundwater boreholes within the mine site and at selected points outside the mining right area.	All Phases	Monthly	Environmental Officer	Monitor water levels	Not applicable	N/A	Not applicable	N/A refer to item 4.6
Groundwater quality deterioration	11.2	Monitor groundwater quality at boreholes within the mine site and at selected points outside the mining right area.	All Phases	Ongoing	Environmental Officer	Monitor water quality (i.e. every 6 months) Obtain laboratory results				
	11.3	Maintain water quality database on site	All Phases	Ongoing	Environmental Officer	Update monthly	SHE Manager and Eco salary provision applies.	N/A	SHE Manager and Eco salary provision applies.	N/A refer to item 4.6
	11.4	Monitor acid mine drainage and decant points.	Operational Phase Decommissioning / Closure Phase	Monthly	Environmental Officer	Monthly sampling of groundwater and decant Obtain laboratory results Maintain database on	Not applicable	N/A	Refer to Item 4.7	R 3,300,000.00

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
						site				
	11.5	No construction of any water management measures, such as the storm water management berms or the haul roads will be undertaken with carbonaceous material.	Construction Phase	Ongoing	Environmental Officer		Not applicable	N/A	SHE Manager and Eco salary provision applies.	N/A
	11.6	All dams will be lined in an effort to minimize the seepage of poor quality leachate.	Construction Phase	Ongoing	Environmental Officer		Not applicable	N/A	Lining: R55 per m^2	To be determined
	11.7	The final surface needs to be free-draining to minimize recharge.	Operational Phase Decommissioning / Closure Phase	Ongoing	Environmental Officer		SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
	11.8	Construct a water treatment plant to treat AMD.	Operational Phase Decommissioning / Closure Phase	Ongoing	Environmental Officer		Not applicable	N/A	Allowed for in closure costing	N/A
SURFACE WATER										
Erosion activities (wind and water)	12.1	Limit areas to be stripped for construction and operational purposes to minimise erosion potential.	Construction Phase Operational Phase	Ongoing	Environmental Officer Mine Planner	Inspect stripped areas for signs of erosion	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
	12.2	Minimise erosion by water by constructing a stormwater management system.	All Phases	Ongoing	Environmental Officer	Inspect stripped areas for signs of erosion	Not applicable	N/A	No additional costs are associated with this measure, proposed mitigation is factored	N/A

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
					Mine Planner	Monitor stormwater management system for potential problem areas			into design.	
	12.3	Stabilise berms and pit slopes and vegetate to minimise erosion.	All Phases	Ongoing	Environmental Officer Contractor	Weekly inspections	Re-vegetation: R90/m^2	N/A	Re-vegetation: R90/m^2	N/A refer to Item 7.3
	12.4	Investigate the integrity of berm and pit slopes.	All Phases	Monthly	Environmental Officer Contractor	Monthly inspections	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
	12.5	Inspect stormwater management system during heavy rainfall periods to ensure integrity of the system is maintained.	All Phases	Ad hoc	Environmental Officer	Ad hoc inspections as required in the rainy season (i.e. October to April)	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
Decrease in water Quality (i.e. increased TDS, SS, etc)	12.6	Monitor surface water within the mine site and at selected points outside the mining right area.	All Phases	Monthly	Environmental Officer	Monthly sampling of surface water Obtain laboratory results Maintain database on site Undertake annual microbiological testing for surface water points	Not applicable	N/A	Monthly monitoring costs 10 monitoring points (10 samples every quarter): R2.880,000.00 Recording of data: Not applicable	N/A refer to Item 4.7
	12.7	Maintain water quality database on site	All Phases	Ongoing	Environmental Officer	Update monthly	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
	12.8	Implement water management systems and ensure that dirty water is diverted from clean water systems.	All Phases	Ongoing	Environmental Officer	Weekly inspections	Not applicable	N/A	No additional costs are associated with this measure, proposed mitigation is factored into design.	N/A refer to Item 12.2
Wetlands	12.9	Where possible, ensure that all wetlands are fenced off from the mining area.	Operational Phase	Ongoing	Environmental Officer	Monthly fence inspections	Cost of erection of farm fencing to be borne by the contractor.	N/A	Maintenance of farm fences: R2.50/m (18,000m of farm fencing of 30yrs)	N/A refer to Item 9.7
AIR QUALITY										
Reduction in ambient air quality from fugitive dust emissions	13.1	Make use of windbreaks to minimise impact of dust movement.	All Phases	Ongoing	Environmental Officer Mine Planner	Monitor effectiveness of wind breaks	Not applicable	N/A	Lump Sum Provision	R 500,000.00
	13.2	Utilise dust suppression mechanisms (i.e. water or chemicals) on haul roads.	All Phases	Ongoing	Environmental Officer	Monitor effectiveness of suppression mechanisms on a random basis	Cost of dust suppression measures to be borne by the contractor during the construction phase	N/A	Dust mitigation: Capital Expenditure - R 146,668.00 Operational Expenditure - R430,348.00	N/A refer to Item 8.2
	13.3	Re-vegetate stripped areas as soon as possible.	All Phases	Ongoing	Environmental Officer	Monitor effectiveness of vegetation re-establishment	Re-vegetation: R90/m^2	N/A	Re-vegetation: R90/m^2	N/A refer to Item 7.2
	13.4	Reduce drop height as far as is practicable.	All Phases	Ongoing	Environmental Officer	Random inspections	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
	13.5	Limit the dust when ore is been loaded from the feed bin to the haul trucks by enclosing the transfer point between conveyor from feed bin and haul trucks with a rubber chute. Replace rubber chute as and when required.	All Phases	Ongoing	Environmental Officer	Random inspections	Not applicable	N/A	Measure incorporated in design cost.	N/A
	13.6	Ensure all vehicles travel within the applicable speed limit for haul roads (on and off	All Phases	Ongoing	Environmental Officer Security	Random inspections	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
		site)								
	13.7	Monitor dust fallout within mine site and at selected points outside the mining right area.	All Phases	Monthly	Environmental Officer	Monthly sampling of dust fallout Obtain laboratory results Maintain database on site	Cost of Dust monitoring to be borne at the contractor during the construction phase	N/A	Capital expenditure: Dust buckets: R1,400.00 per unit (20 Units) Operational Expenditure: Monitoring: R178,000.00 per annum	R 5,340,000.00
NOISE AND VIBRATION										
Increased ambient noise levels	14.1	All machinery used will be maintained in sound mechanical condition. If noise levels from any vehicle or machinery are considered to be increasing, the contractor will be instructed to service the vehicle before it is allowed back on to site.	All Phases	Ongoing	Environmental Officer Security	Random inspections	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
	14.2	On-site generators should be clad in suitable material or housed in structures that would reduce their noise impacts. Generators will be fitted with appropriate silencers.	All Phases	Ongoing	Environmental Officer Contractors	Random inspections and noise monitoring	Costs for noise suppressors for generators to be borne by the contractor during the construction phase.	N/A	Noise suppressors for generators	To be determined
	14.3	All vehicles will be fitted with appropriate sound suppression devices or silencers.	All Phases	Ongoing	Environmental Officer Contractors	Random inspections	Costs for noise suppressors for vehicles to be borne by the contractor during the construction phase.	N/A	Noise suppressors for vehicles	To be determined
	14.4	Monitor noise levels within mine site and at selected points outside the mining right area where vehicles travel.	All Phases	Monthly	Environmental Officer	Monthly sampling of noise levels Obtain testing results	SHE Manager and ECO salary provision applies. Equipment cost:	R 20,000.00	SHE Manager and ECO salary provision applies.	N/A

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
						Maintain database on site	R20,000.00			
	14.5	PPE will be worn at all times.	All Phases	Ongoing	Environmental Officer Contractors	Daily inspections of personnel in high noise areas	Costs for PPE will be borne by the contractor for the construction phase.	N/A	PPE: R400,000.00 per annum (30yrs)	R 12,000,000.00
Impact on building	14.6	Blasts will be designed and executed by a suitably qualified engineer.	Construction Phase Operational Phase	Ongoing	Environmental Officer Mine Planner Contractor	Ad hoc blast monitoring of all blast events Obtain testing results Maintain database on site	Not applicable	N/A	Not applicable	N/A
	14.7	Monitor buildings within the mine site for evidence of structural damage due to blasting. Complaints received from the public must be assessed on an ad hoc basis.	Construction Phase Operational Phase	Ongoing	Environmental Officer Mine Planner Contractor	Random inspections of buildings after blast events	Not applicable	N/A	Consultant fee: R200,000.00 per annum	R 6,000,000.00
Adverse weather conditions	14.8	Blasting will not be undertaken during adverse weather conditions (i.e. fog / mist, low cloud cover, rain, high winds, etc)	Construction Phase Operational Phase	Ongoing	Environmental Officer Mine Planner Contractor	Review weather conditions with Environmental Officer and blasting engineer prior to blast events	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
ARCHAEOLOGY AND HERITAGE										
Possible alteration and demolition of identified sites by open pits and proposed	15.1	Where farmsteads cannot be preserved, those with buildings older than 60 years should be documented in terms of Section 34 of the National heritage Resources Act [NHRA] (Act No25 of 1999).	All Phases	Ongoing	Environmental Officer	Map farmsteads including the development of plans showing elevations and maintain a photographic record of sites	Not applicable Relocation of graves: R5m	R 5,000,000.00	Consulting services: R250,000.00 Ad Hoc: R500,000.00 (30yrs)	R 750,000.00

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
plant position	15.2	Applications for demolition permits (Section 34 of NHRA) must be made to the Mpumalanga Provincial Heritage Resources Authority for obtaining demolition permits. A photographic record should be maintained.	All Phases	Ad Hoc	Environmental Officer	Compile and submit application as required Maintain photographic record of all demolished sites				
	15.3	Site clearance activities are to be documented photographically.	All Phases	Ad Hoc	Environmental Officer	Maintain photographic record on site				
	15.4	Preserved farmsteads and homesteads, whether under the control of Exxaro or whether in private ownership, should be monitored for damage (e.g. cracking of walls) caused by blasting work at the operating mine.	Construction Phase Operational Phase	Bi-Annually	Environmental Officer	Visual inspections	Not applicable	N/A	Refer to Item 14.7	R 6,000,000.00
Unearthing of human remains and / or archaeological material	15.5	Should any unknown human remains be disturbed, exposed or uncovered during the construction and / or operational phase of the project, these should immediately be reported to a registered archaeologist. Burial remains should not be disturbed or removed until inspected by an archaeologist.	Construction Phase Operational Phase	Ad Hoc	Environmental Officer Mine Manager Contractor	Visual inspection	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A refer to Item 15.1
	15.6	Site clearing and preparation activities must be monitored for the occurrence of any other archaeological material (i.e. Stone Age tools, Iron Age artefacts, historic waste disposal sites etc) and similar chance finds and an archaeologist should be asked to inspect the area when this has reached an advanced stage in order to verify the	Construction Phase Operational Phase	Ad Hoc	Environmental Officer Mine Manager Contractor	Visual inspection	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A refer to Item 15.1

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
		presence or absence of any such material.								
VISUAL										
Visual pollution	16.1	Remove vegetation only as required for construction or mining purposes when required. Retain natural vegetation in all other areas for as long as possible.	Construction Phase Operational Phase	Ongoing	Environmental Officer Mine Planner	Visual inspections	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
	16.2	Where possible, keep bigger tree groups and plantations. Ensure, wherever possible, all existing natural vegetation is retained and incorporated into the site rehabilitation.	All Phases	Ongoing	Environmental Officer Mine Planner		SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
	16.3	Implement dust suppression methods as previously detailed in Air Quality section.	All Phases	Ongoing	Environmental Officer		Cost of dust suppression measures to be borne by the contractor during the construction phase	N/A	Dust mitigation: Capital Expenditure - R 146,668.00 Operational Expenditure - R430,348.00	N/A refer to item 8.2
	16.4	Utilise topsoil, subsoil and overburden along mining boundaries to act as visual screens.	Construction Phase Operational Phase	Ongoing	Environmental Officer Mine Planner	Visual inspections	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
	16.5	Landscape the boundaries of the mining area around and on the berms to create a visual buffer as far as possible.	Construction Phase Operational Phase	Ongoing	Environmental Officer Mine Planner	Visual inspections	Not applicable	N/A	Landscaping Provision	R 1,000,000.00
Light Pollution	16.6	Install light fixtures that provide precisely directed illumination to reduce light "spillage" beyond the immediate surrounds of the complex.	All Phases	Ongoing	Environmental Officer Mine Planner	Visual inspections	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
	16.7	Install lights that are activated on movement at entry to the site.	All Phases	Ongoing	Environmental Officer Mine Planner	Visual inspections	Not applicable	N/A	Install light fixtures	R 10,000.00
	16.8	Use security lighting at the periphery of the site that is activated by movement and are not permanently kept on.	All Phases	Ongoing	Environmental Officer Mine Planner	Visual inspections	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
SOCIAL										
Social and Labour Plan	17.1	Implement the approved Social and Labour Plan.	All Phases	Ongoing	Mine Manager Human Resources	Annual review of SLP and audit of implementation	Not applicable	N/A	Total allocation (30yrs)	R 5,000,000.00
Increase in SMME opportunities	17.2	Establish a local SMME recruitment preference policy.	All Phases	Ongoing	Mine Manager Environmental Officer Human Resources	Annual review				
	17.3	Work in close cooperation with provincial and district authorities as well as NGOs to ensure that small business operators receive appropriate training such as technical skills and financial and business management training, particularly during the operational phase of the project, where possible.	All Phases	Ongoing	Mine Manager Human Resources	Ad hoc meetings and training				
Job creation and income potential	17.4	Establish a labour policy to facilitate the employment of locals where feasible. This should be done in conjunction with provincial and district authorities.	All Phases	Ongoing	Mine Manager Human Resources	Annual review				
	17.5	Create opportunities for the employment of women and the disabled.	All Phases	Ongoing	Mine Manager Human Resources	Annual review				
	17.6	Where possible use labour-	Constructio	Ongoing	Mine Manager	Annual				

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
		intensive methods of construction.	n Phase		Human Resources	review-				
Job creation and income potential	17.7	Develop a community labour agreement with targets for employment and for career progression.	All Phases	Ongoing	Mine Manager Human Resources	Annual review				
	17.8	Remunerate beyond the minimum wage rate for the Belfast area and invest in local staff.	All Phases	Ongoing	Mine Manager Human Resources	Annual review				
HYDROCARBON SPILLS										
Hydrocarbon Spills	18.1	All personnel are to report any size hydrocarbon spill observed to the Environmental Officer or SHE Manager as soon as it is observed.	All Phases	Ad hoc	Environmental Officer Contractor	Random inspections Maintain a detailed photographic record of all spills reported / observed	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
	18.2	Large spills (e.g. a ruptured tank where the quantity hydrocarbon fluid spilled covers an area larger than $1m^2$).	All Phases	Ad hoc	Environmental Officer	Random inspections	Spill cleanup costs will be borne by the contractor during the construction phase	N/A	Spill cleanup and cleaning material: R50,000.00 per annum (excluding emergency incidents)	R 1,500,000.00
	18.3	Small spills or leaks (e.g. spills of leaks from storage containers, vehicles, or machinery where the quantity hydrocarbon fluid spilled covers an area less than $1m^2$).	All Phases	Ad hoc	Environmental Officer	Random inspections				
WASTE MANAGEMENT										
Waste Management	19.1	No on-site burying / dumping of waste materials, vegetation, litter or refuse shall occur. All solid waste shall be disposed of at suitable licensed disposal sites.	All Phases	Weekly	Environmental Officer Contractor	Random inspections	Fines for dumping of waste: First offence R400/m^3 thereafter dismissal from the site	N/A	Waste Management: R500,000.00 per annum (30yrs)	R 15,000,000.00
	19.2	Bins shall be provided in	All Phases	Weekly	Environmental	Random				

Aspect and Impact	Item	Management and Mitigation Measures	Phase	Schedule of Actions	Responsible Person	Monitoring Requirements	Construction Phase	Cost over 2 years	Operational Phase	Cost over 30 years
		sufficient number and capacity to store all solid waste produced on a daily basis. These bins must be kept closed and emptied regularly (minimum daily) such that they are not overfilled			Officer Contractor	inspections				
	19.3	A general side-wide litter clean-up shall occur at least once a week.	All Phases	Weekly	Environmental Officer Contractor	Random inspections	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
	19.4	Waste shall be collected from site by a licensed contractor and removed to an appropriate waste disposal facility.	All Phases	Weekly	Environmental Officer Contractor	Random inspections	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A
	19.5	Wherever possible, materials shall be recycled via a “Greens waste site”. To this end, containers for glass, paper, metals, plastics, organic waste and hazardous wastes (e.g. oil rags, paint containers, thinners) shall be provided in sufficient quantity on the site.	All Phases	Weekly	Environmental Officer Contractor	Random inspections	SHE Manager and ECO salary provision applies.	N/A	SHE Manager and ECO salary provision applies.	N/A

9.2 Closure Costing

The closure cost estimate is aligned to the Guideline Document for the Evaluation of the Quantum of Closure Related Financial Provision Provided by a Mine, by the DME (January, 2005).

9.2.1 Legislation

Section 41 and 45 of the MPRDA and Regulations 53 and 54 promulgated in terms of the MPRDA deal with financial provision for mine rehabilitation and closure:

Section 41(1): Requires that an applicant must before the Minister approves the EMP in terms of section 39(4) make the prescribed "financial provision" for the rehabilitation or management of negative environmental impacts.

Section 41(2): If a holder of a mining right fails to rehabilitate / manage, is unable to undertake such rehabilitation or to manage any negative impact on the environment, the Minister may upon written notice to such holder, use all or part of the financial provision to rehabilitate or manage the negative environmental impact in question.

Section 41(3): Require the holder to undertake an annual assessment of his or her environmental liability and increase his or her financial provision to the satisfaction of the Minister.

Section 45: Allows the Minister to recover cost in the event of urgent remedial measures.

Regulation 54: Requires that the quantum of financial provision to be approved by the Minister must be based on the requirements of the approved EMP and shall include detailed itemisation of all actual costs required for:

- Premature closure regarding:
  - The rehabilitation of the surface of the area;
  - The prevention and management of pollution of the atmosphere;
  - The prevention and management of pollution of water and the soil; and
  - The prevention of leakage of water and minerals between subsurface formations and the surface.
- Decommissioning and final closure of the operation; and
- Post closure management or residual latent environmental impacts.

9.2.2 Closure Costing

The closure costing for the proposed Belfast Project was developed by Exxaro and Golder and Associates (refer to Appendix Q). Table 86 provides the anticipated closure costing at the end of the life of mine for the Belfast Project in a summarised format, whilst Table 87: provides the detailed closure costing calculations. For the purposes of the calculations, closure is scheduled for 2049.

Table 86: Summarised Closure Costing for the Proposed Belfast Project (December 2009)

Item	Closure component	Total
Infrastructure and related aspects		
1	Infrastructure Aspects	R15,207,158.43
2	Mining Aspects	R78,055,500.00
3	General Surface Reclamation	R5,192,500.00
4	Water Management	R5,500,00.00

Sub-Total 1 (Infrastructure and Related Aspects)		**R103,955,158.48**
5	Post Closure Aspects (including water treatment)	R161,819,652.50
Sub-Total 2 (Post Closure Aspects)		**R161,819,652.50**
Additional allowances		
6.1	Preliminary and General	R12,474,619.01
6.2	Contingencies	R10,395,515.84
Sub-Total 3 (Additional Allowances)		**R22,870,134.85**
	GRAND TOTAL (Sub-Total 1 + 2 + 3)	**R288,644,945.78**

The criteria utilised to determine the water treatment costs as included in Item 5 of Table 86, are as follows:

- Allowance is made to install 4 (2 per pit) abstraction boreholes / wells on the southern side of the pits to abstract water for treatment.
- Allowance is made for a 6 Ml/day water treatment facility.
- The water treatment facility will be developed in 2Ml/day modular units that will be expanded over time to the full 6 Ml/day treatment capacity.
- The provision allows for the construction of the treatment facilities as well as the indefinite treatment of water.

Table 87: Detailed Closure Costing Calculation for the Proposed Belfast Project (December 2009).

Closure Component		Scheduled Closure (2049)						
		Quantity	Unit	Unit Rate Code	Unit Rate	Unit	Total Cost	Notes
1	**Infrastructural Areas**							
1.1	Dismantling and demolition of beneficiation plant complex	1	sum	11.2	R13,467,158.43	sum	R13,467,158.43	Demolition of all concrete and steel structures
Sub-total for dismantling of processing plant and related structures							**R13,467,158.43**	
1.2	Demolition of steel buildings and structures							Included at processing plant and related structures
Sub-total for demolition of steel buildings and structures							**R0.00**	
1.3	Demolition of reinforced concrete buildings and structures							Included at processing plant and related structures
Sub-total for demolition of reinforced concrete buildings and structures							**R0.00**	
1.4	Rehabilitation of access and haul roads							
1.4.1	Deep rip haul roads to alleviate compaction	20	/ha	8.9	R12,500.00	/ha	R250,000.00	8km x 25m
1.4.2	Shaping and levelling	20	/ha	7.1	R50,000.00	/ha	R1,000,000.00	500mm
1.4.3	Establish vegetation	20	/ha	7.3	R12,500.00	/ha	R250,000.00	
1.4.5	Remove culvert crossings	2	sum	11.2	R50,000.00	sum	R100,000.00	2 stream crossings
Sub-total for rehabilitation of access and haul roads							**R1,600,000.00**	
1.5	Demolition and rehabilitation of electrified railway lines							Not applicable
Sub-total for rehabilitation of electrified railway lines							**R0.00**	
1.6	Demolition and rehabilitation of non-electrified railway lines							Not applicable
Sub-total for demolition and rehabilitation on non-electrified railway lines							**R0.00**	
1.7	Demolition of offices, workshops and residential buildings							Included at processing plant and related structures
Sub total for demolition of offices, workshops and residential buildings							**R0.00**	
1.8	River diversions							Not applicable
							R0.00	
1.9	Fencing	7000	/m	9.3	R20.00	/m	R140,000.00	Assume 7km
Sub-total for fencing							**R140,000.00**	

Closure Component		Scheduled Closure (2049)						
		Quantity	Unit	Unit Rate Code	Unit Rate	Unit	Total Cost	Notes
SUB-TOTAL FOR INFRASTRUCTURAL AREAS							**R15,207,158.43**	
2	**Mining Areas**							
2.1	Open pit reclamation including final voids and ramps							
2.1.1	In-fill of eastern final void	1417500	$/m^3$	8.8	R32.00	$/m^3$	R45,360,000.00	Only eastern pit final void @ closure. 1.5 cuts remaining, 75m deep on 10% (280m) of the face. 5km haul distance (bulk haul)
2.1.2	Import topsoil on in-filled final void and other remaining disturbed areas	320000	$/m^3$	8.4	R32.00	$/m^3$	R10,240,000.00	Assume 400mm on 80ha (5% of eastern pit area). Assume 1-2km haul distance.
2.1.3	Shaping and levelling	80.00	/ha	7.2	R75,000.00	/ha	R6,000,000.00	Assume 5% of eastern pit area (750mm)
2.1.4	Establish vegetation on in-filled final voids	80.00	/ha	7.3	R12,500.00	/ha	R1,000,000.00	Assume 5% of eastern pit area
Sub-total for opencast rehabilitation including final voids and ramps							**R62,600,000.00**	
2.2	Sealing of shafts, adits and inclines							Not applicable
Sub-total for sealing shafts, adits and inclines							**R0.00**	
2.3	Reclamation of overburden and spoils							
2.3.1	Ripping of overburden stockpile footprint areas	10	/ha	7.7	R6,000.00	/ha	R60,000.00	Assume 10ha
2.3.2	Establish vegetation on ripped areas	10	/ha	7.3	R12,500.00	/ha	R125,000.00	Assume 10ha
Sub-total for rehabilitation of overburden and spoils							**R185,000.00**	
2.4	Rehabilitation of processing waste deposits and evaporation ponds (non-polluting potential)							
2.4.1	Rehabilitate Surface Water Dam (RWD) - lined							Assume 2ha with HDPE liner
2.4.2	Remove silt in dam and dispose	7500	$/m^3$	8.3	R25.00	$/m^3$	R187,500.00	Assume 500mm in 1.5ha basin
2.4.3	Remove liner and dispose	20000	$/m^2$	8.11	R5.00	$/m^2$	R100,000.00	Assume 2ha
2.4.4	Remove contaminated material from underneath liner and dispose	1500	$/m^3$	8.3	R25.00	$/m^3$	R37,500.00	Assume 200mm on 50% of 1.5ha
2.4.5	Breach wall and reshape to at least 1:5 (V:H)	600	m	6.9	R200.00	m	R120,000.00	Assume 600m
2.4.6	Rip disturbed footprint area	2	/ha	7.7	R6,000.00	/ha	R12,000.00	2ha

Closure Component		Scheduled Closure (2049)						
		Quantity	Unit	Unit Rate Code	Unit Rate	Unit	Total Cost	Notes
2.4.7	Establish vegetation on ripped areas	2	/ha	7.3	R12,500.00	/ha	R25,000.00	2ha
2.4.8	Rehabilitate plant raw water dam - lined							Assume 1ha with HDPE liner
2.4.9	Remove liner and dispose	10000	/m^2	8.11	R5.00	/m^2	R50,000.00	1ha
2.4.10	Breach wall and reshape to at least 1:5 (V:H)	400	m	6.9	R200.00	m	R80,000.00	Assume 400m
2.4.11	Rip disturbed footprint area	1	/ha	7.7	R6,000.00	/ha	R6,000.00	1ha
2.4.12	Establish vegetation on ripped areas	1	/ha	7.3	R12,500.00	/ha	R12,500.00	1ha
2.4.13	Rehabilitate bio-filter dam – lined							Assume 1ha with HDPE liner
2.4.14	Remove liner and dispose	10000	/m^2	8.11	R5.00	/m^2	R50,000.00	1ha
2.4.15	Breach wall and reshape to at least 1:5 (V:H)	400	m	6.9	R200.00	m	R80,000.00	Assume 400m
2.4.16	Rip disturbed footprint area	1	/ha	7.7	R6,000.00	/ha	R6,000.00	1ha
2.4.17	Establish vegetation on ripped areas	1	/ha	7.3	R12,500.00	/ha	R12,500.00	1ha
Sub-total for rehabilitation of processing waste deposits and evaporation ponds (non-polluting potential)							**R779,000.00**	
2.5	Rehabilitation of processing waste deposits and evaporation ponds (polluting potential)							
2.5.1	Rehabilitate top surface of Co-disposal site							Assume 25ha (500x500), and only top surface to rehabilitate at closure
2.5.2	Plug outlet & seal penstock	1	sum	6.3	R20,000.00	sum	R20,000.00	Nominal allowance
2.5.3	Construct 2m parapet wall to around top perimeter	28000	/m^3	8.2	R18.00	/m^3	R504,000.00	2m parapet wall @ 14m3/m x 2000m
2.5.4	Import material and construct breaker layer (300mm)	87500	/m^3	8.4	R32.00	/m^3	R2,800,000.00	25ha x 350mm (allowed 50mm extra in quantities)
2.5.5	Import material and construct store and release cover on top surface (600mm)	237500	/m^3	8.4	R32.00	/m^3	R7,600000.00	25ha x 950mm (allowed 50mm extra in quantities)
2.5.6	Construct chutes to discharge water from the top	8	sum	11.2	R330,000.00	sum	R2,640,000.00	Assume 8 concrete lined chutes
2.5.7	Routing of possible seepage to planned water treatment facility	1	sum	11.2	R500,000.00	sum	R500,000.00	Nominal allowance

Closure Component		Scheduled Closure (2049)						
		Quantity	Unit	Unit Rate Code	Unit Rate	Unit	Total Cost	Notes
2.5.8	Establish vegetation	25	/ha	7.5	R17,100.00	/ha	R427,500.00	25ha top area
Sub-total for rehabilitation of processing waste deposits and evaporation ponds (polluting potential)							**R14,491,500.00**	
2.6	Reclamation of subsided areas							Not applicable
Sub-total for rehabilitation of subsided areas							**R0.00**	
SUB-TOTAL FOR MINING AREAS							**R78,055,500.00**	
3	**General Surface Reclamation**							**Assume 250mm on 6ha**
	Removal and disposal of fugitive material	6	/ha	7.6	R80,000.00	/ha	R480,000.00	
	Deep rip of engineered bases of stockyard	4	/ha	8.9	R12,500.00	/ha	R50,000.00	500mm
	Shaping and levelling where infrastructure had been removed	45	/ha	7.1	R50,000.00	/ha	R2,250,000.00	
	Off site disposal of demolition waste	10000	/m^3	2.5.2	R158.00	/m^3	R1,580,000.00	
	Rip disturbed footprint areas to alleviate compaction	45	/ha	7.7	R6,000.00	/ha	R270,000.00	
	Establish vegetation	45	/ha	7.3	R12,500.00	/ha	R562,500.00	
SUB-TOTAL FOR GENERAL SURFACE RECLAMATION							**R5,192,500.00**	
4	**Water Management**							
	Rehabilitate disturbed stream area	5.5	sum	11.2	R1,000,000.00	sum	R5,500,000.00	R1mill per km for approx 5.5km
	Off-site offsets for damaged sensitive areas						R0.00	Assumed to be conducted during operation period
SUB-TOTAL FOR WATER MANAGEMENT							**R5,500,000.00**	
SUB-TOTAL 1 (FOR INFRASTRUCTURE AND RELATED ASPECTS)							**R103,955,158.43**	
5	**Post-Closure Aspects**							
5.1	Surface water quality monitoring	5.00	/yr	10.1	R240,000.00	/yr	R1,200 000.00	Assumed 5 year monitoring period
5.2	Groundwater quality monitoring	5.00	/yr	10.2	R80,000.00	/yr	R400,000.00	Assumed 5 year monitoring period
5.3	Reclamation monitoring of reclaimed areas	188.50	/ha	10.3	R2,250.00	/ha	R424,125.00	Assumed over a 5 year period, over the entire disturbed footprint area

Closure Component		Scheduled Closure (2049)						
		Quantity	Unit	Unit Rate Code	Unit Rate	Unit	Total Cost	Notes
5.4	Care and maintenance of reclaimed areas	188.50	/ha	10.4	R14,000.00	/ha	R2,639,000.00	Assumed over a 5 year period, over the entire disturbed footprint area
5.5	Install boreholes to abstract seepage water for treatment	4	no	6.3	R20,000.00	sum	R80,000.00	Assume 2x boreholes per pit
SUB-TOTAL FOR POST-CLOSURE ASPECTS							**R4,743,125.00**	
5.6	Contingencies for post-closure aspects	1.00	sum	11.2	R474,312.50	sum	R474,312.50	Assumed 10 percent of above post-closure aspects
5.7	Ongoing water treatment	1	sum	6.4	R156,602,215.00	sum	R156,602,215.00	Water treatment facility and ongoing treatment of water
SUB-TOTAL FOR CONTINGENCIES FOR POST-CLOSURE ASPECTS							**R157,076,527.50**	
SUB-TOTAL 2 (FOR POST CLOSURE ASPECTS)							**R161,819,652.50**	
6	**Additional Allowances**							
6.1	Preliminary and general	1.00	sum	11.2	R12,474,619.01	sum	R12,474,619.01	Assumed 12 percent of sub-total 1
6.2	Contingencies	1.00	sum	11.2	R10,395,515.84	sum	R10,395,515.84	Assumed 10 percent of sub-total 1
SUB-TOTAL 3 (FOR ADDITIONAL ALLOWANCES)							**R22,870,134.85**	
GRAND TOTAL (FOR SUB-TOTAL 1 + 2 + 3)							**R288,644,945.78**	

10

Conclusions and Recommendations

10.1 Conclusion

Based on the information contained in this report, it is the opinion of the EAP that the negative environmental impacts resulting from the Belfast Project can be mitigated to within acceptable limits. Should the project be approved, it is recommended that the following be undertaken in addition to measures contained in the project EMP in order to further limit the potential impact on the receiving environment (based on the overall composite sensitivity map in Section 4):

- The management measures detailed in the EMP must be adhered to.
- Legal requirements must be fulfilled.
- Exxaro must operate to adhere to the NEMA principles.
- Exxaro must operate following industry Best Practice guidelines.
- Exxaro must adopt a proactive and transparent approach to engaging and informing the local community regarding environmental and social aspects of the project, in addition to maintaining the issues and response register.

10.2 Recommendations

The above recommendations are not exhaustive, and all recommendations made by project specialists in the respective specialist reports should be adhered to in the interest of environmental best practice unless all practical measures have been exhausted with which to implement the specific mitigating action. The significant environmental impacts identified by the specialists, stakeholders and the environmental assessment practitioner can be mitigated to acceptable standards provided that the mitigation measures proposed are implemented during the construction, operational and closure phases of the project.

10.2.1 Wetland Offsets

The total area (hectares) of the wetlands in the proposed offsite offset area is 2502.85 ha. This is slightly over the recommended area of 1788.5 ha. These wetland areas will however have to be delineated in order to accurately quantify the actual wetland boundaries and types.

In order to successfully implement the offset project on the identified cluster, Exxaro would need to determine the current mined-out coal reserves as well as any potential remaining coal reserves. This will have to be done in order to determine the potential for offsetting this cluster of pans and wetlands and securing them from future mining activities.

Exxaro would also have to engage with the surrounding landowners in order to successfully include all of the suggested pans within this cluster. This process would have to be facilitated by DWA and MTPA in order for the correct biodiversity planning and stakeholder engagement processes to be initiated. Once formalised, the rehabilitation and protection criteria for the identified off-site offsets can be structured.

10.2.2 Monitoring

Monitoring is required in order to check compliance with agreed-upon standards or objectives and targets and assists in establishing trends and patterns on environmental indicators. Monitoring further assists in predicting non-compliance and describes remedial measures to address non-compliance. Monitoring programmes will be implemented by Exxaro for this purpose and will commence prior to construction and continue post closure.

There are a number of environmental and social aspects which require monitoring during the various phases of the project. Monitoring plans are recommended throughout the life-of-mine.

Soil Monitoring

Progressive monitoring of the stripping, stockpiling, shaping of spoil surfaces and replacing of topsoil will ensure successful post mining land and soil reclamation. A rehabilitation plan should be compiled and contain the following information:

- Location of soil types than can be stripped and stockpiled together;
- Stripping depths of different soil types;
- The location, dimensions and volume of planned stockpiles for different soil types.

Progressive soil monitoring should take place on at least a quarterly basis and should involve the following:

- Inspection of stripping depths;
- Inspection of stockpiles to check degradation and/or pollution;
- Inspection of spoil surfaces before replacing soil to ensure that pre mined topography is emulated;
- Random inspection of soil thickness on rehabilitated sections;
- Fertility analysis and amelioration procedures prior to re-vegetation;
- Evaluating and readjusting the rehabilitation plan.

Ecological Monitoring

A long-term biannual bio-monitoring plan of ecosystems including water quality, habitats and terrestrial fauna and flora, riparian vegetation, diatoms, aquatic macroinvertebrates and fish needs to be compiled. It is recommended that this be supplemented by a Biodiversity Action Plan for the project area once the seasonal baseline dataset is complete.

Surface Water Monitoring

A water monitoring plan should be designed so as to allow for remedial action and provide for sustainable water management. In terms of surface water monitoring, sediment loads, water quality and metals concentration in the adjacent and downstream aquatic ecosystems should be monitored on a quarterly basis.

Groundwater Monitoring

A monitoring programme must be put in place from the operational phase until after closure to monitor the occurrence of any adverse groundwater impacts. Monitoring data will be used to update the current numerical model simulation for more accurate predictions of groundwater flow and quality and action plans will be formulated and implemented if adverse impacts are identified.

Air Quality Monitoring

It is recommended that a dust fallout monitoring network, consisting of 6 single buckets be implemented for the operational phase positioned at the largest contributing sources and at receptors. It is further recommended that site inspections and air quality progress reporting be undertaken at regular intervals (at least quarterly) when mining operations begin with annual environmental audits being conducted. A budget should be drawn to provide a clear indication of the capital and annual maintenance costs associated with dust control measures and dust monitoring plans.

Noise Monitoring

Environmental noise monitoring should be carried out regularly at bi-annual intervals at specific positions to detect deviations from predicted noise levels and enable corrective measures to be taken where warranted. Monitoring of blast, ground vibration and human response to noise should be undertaken to ensure that accepted levels are in fact acceptable and are being adhered to, and to modify the blasting design as required.

Blast Monitoring

It is recommended that a process of monitoring of blasting operations must be applied for all blasting to be done in the mine operation to ensure that levels are within levels at all times. Third party monitoring should be considered for all ground vibration and air blast monitoring work to bring about unbiased evaluation of levels and influence from an independent group.

Traffic

Traffic counts should be undertaken and a comprehensive traffic study should be conducted after receipt of the counts. Consideration should be given to providing a direct link between Road 1110 and Road 383 and by so doing eliminating coal traffic from making use of the N4 Toll Road.

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