KUYASA MINING

DELMAS COAL

ENVIRONMENTAL IMPACT ASSESSMENT

PROPOSED UPGRADE AND REHABILITATION OF THE MINE RESIDUE FACILITY AND POLLUTION CONTROL DAMS AND EXTENSION OF UNDERGROUND MINING OPERATIONS

DRAFT ENVIRONMENTAL IMPACT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT AMENDMENT

REFERENCE NUMBER/S
EIA: 17/2/3N-300

Report No.: JW127/15/D910-Rev 2

September 2016

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DOCUMENT APPROVAL RECORD

Report No.: JW127/15/D910-Rev 2

Action	Function	Name	Date	Signature
Prepared	Environmental Scientist	O Bamford	March 2015	
Prepared	Environmental Scientist	JC Pretorius	June 2015	
Updated	Environmental Scientist	O Bamford	September 2016	
Reviewed	Environmental Scientist	T Hopkins	7 September 2016	

RECORD OF REVISIONS AND ISSUES REGISTER

Date	Revision	Description	Issued to	Issue Format	No. Copies
July 2015	Rev A	Draft for internal review	B. Gumede M. van Zyl	Soft Copy	n/a
September 2016	Rev 1	Updated draft for review	M. van Zyl	Soft Copy	n/a
September 2016	Rev 2	Report for Public Review	Competent Authorities, commenting authorities and I&APS	Hard and Soft	Multiple

PURPOSE OF THIS DOCUMENT

Delmas Coal is an existing underground coal mine situated in Mpumalanga Province. Delmas Coal is owned by Delmas Coal (Pty) Ltd, a subsidiary of Kuyasa Mining (Pty) Ltd. Delmas Coal was opened in 1964 as a part of Ingwe Collieries. Delmas Coal was subsequently sold to Kuyasa Mining as one of the first black-owned mines. Both No. 2 and No. 4 seam coal is mined at Delmas Coals' North and South Shafts.

The project entails obtaining environmental authorisation for activities in terms of the provisions of the National Environment: Management Act (NEMA) for the upgrading and remediation of the Delmas Coal's Mine Residue Facility and pollution control (PC) dams. A new mining area has also been obtained and thus the Delmas Coal Environmental Management Programme (EMPR), as required in terms of the provisions of the Mineral and Petroleum Resources Development Act (MPRDA), will need to be updated to include the new mining area and any new associated surface infrastructure. Additional activities entail the compilation of a waste management licence application. Delmas Coal has appointed Jones and Wagener (Pty) Ltd (J&W), an independent company, to conduct an Environmental Impact Assessment (EIA) to evaluate the potential environmental and social impacts of the proposed project. The Environmental Assessment Practitioner (EAP) is Marius van Zyl.

The first phase of an EIA is the Scoping Phase. This was the phase during which public issues, concerns and suggestions were identified so that they could be evaluated by the EIA technical specialists during this next phase (the Impact Assessment Phase) of the EIA.

According to the EIA Regulations, Interested and Affected Parties (I&APs) must have the opportunity to comment on the proposed project and verify that all the issues raised during the Scoping Phase have been recorded. This was the main purpose of the Scoping Report (SR), which was available for comment for the period 11 August 2014 to 19 September 2014. Comments received on the Draft SR were considered in the Final SR which was made available for public comment from 27 February 2015 – 20 March 2015 and submitted to the lead authority, the MDARDLEA (formerly MDEDET) for approval to proceed with the EIA on 1 April 2015.

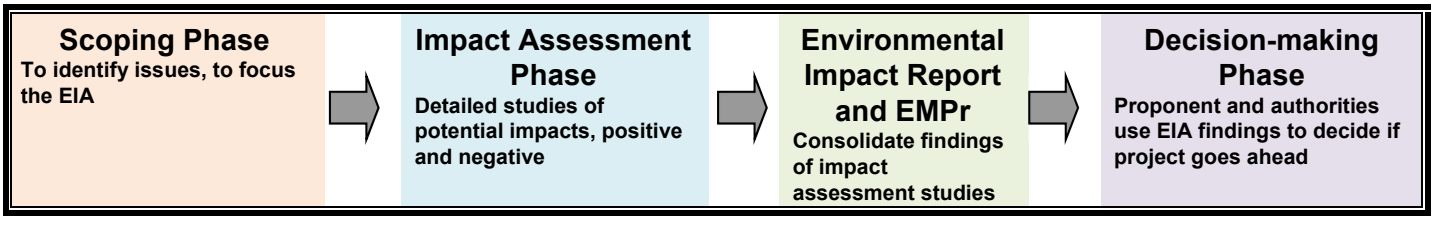
Once approval to proceed with the Impact Assessment phase was received this Draft Environmental Impact Report (EIR) and Environmental Management Programme Report (EMPR) amendment and a Draft Environmental Management Program (EMPr) were compiled. I&APs are being given the opportunity to comment on the findings of this report from 16 September 2016 to 26 October 2016. Once the public review period has come to an end, the Draft EIR and EMPr will be updated and will be submitted to the public for comment once more and will then be submitted to the lead authority, the MDARDLEA for a decision about the project. The EMPR amendment will be submitted to the Department of Mineral Resources (DMR), the lead authority for the EMPR approval.

Summary of what the Draft Environmental Impact Report and Environmental Management Programme Report Amendment Contains

This report contains the following for comment by stakeholders:

- The background and description to the proposed project, including alternatives;
- An overview of the EIA process, including the public participation process;
- A description of the existing environment in the project area;
- The impact assessment rating or ranking methodology;
- The potential environmental issues and impacts which have already been identified and assessed;
- The proposed mitigation measures to be implemented in the construction and operational phases of the project in order to minimise negative impacts and enhance positive impacts;
- A list of comments raised and responses to date (Issues Trail Report)
- Financial provisions;
- The environmental awareness plan;
- The proposed monitoring program and performance assessment; and
- The preferred or recommended alternatives.

AN EIA CONSISTS OF SEVERAL PHASES



YOUR COMMENT ON THE DRAFT ENVIRONMENTAL IMPACT REPORT AND DRAFT ENVIRONMENTAL MANAGEMENT PLAN REPORT

The Draft Environmental Impact Report and Environmental Management Programme Report Amendment is available for comment from 16 September 2016 to 26 October 2016 (40 days). This Draft Environmental Impact Report has been distributed to the key commenting authorities, all key stakeholders, all those that have requested a copy and those registered on the stakeholder database. Copies of the report are available at strategic public places in the project area (see below) and on the following website www.jaws.co.za.

List of public places where the Draft Environmental Impact Report and Environmental Management Programme Report Amendment is available:

CONTACT PERSON	LOCATION	CONTACT
Printed Copies		
Ms Lydia Mehlape	Delmas Public Library	013 665 1831
Ms Anna Potgieter	Leandra Public Library	017 683 1148
Ms Theodora Moloi	Devon Public Library	017 688 0028
Isabel Knox	Delmas Coal Reception	013 665-7000
Electronic Copies		
Sibongile Bambisa/ Anelle Lötter	www.jaws.co.za	012 667 4860

The report is also available electronically from the Public Participation office.

You may comment on the Report by:

- Completing the comment sheet enclosed with the report; and / or
- Writing a letter, or producing additional written submissions directly to the public participation office

DUE DATE FOR COMMENT ON THIS DRAFT ENVIRONMENTAL IMPACT REPORT 26 OCTOBER 2016

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SUMMARY OF THE ENVIRONMENTAL IMPACT REPORT / EMPR AMENDMENT

Overview of the Proposed Project

Delmas Coal Mine, located outside Delmas Town in the Mpumalanga Province is an existing underground mining operation. Delmas Coal is proposing to expand its current underground mining operations, upgrade its Pollution Control (PC) dams and rehabilitate its Mine Residue Facility consisting of a discard dump and slurry ponds.
Delmas Coal plans to include new coal reserves in the mining plan, these reserves are located to the south and south-west of its current sections. For the new mining expansion, the current mining right is being amended and an Environmental Management Programme Report (EMPR) amendment requires authorisation in terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002) (MPRDA).

In addition to the proposed mining expansion, Delmas Coal has embarked on a project to remediate and upgrade the Mine Residue Facility, Pollution Control (PC) dams and related infrastructure, including the surface water drains from the coal processing plant discharging into the PC dams. This stems from monitoring of the performance of the mine's contaminated water management systems which has confirmed that seepage from the Mine Residue Facility and PC dams have influenced the water quality of the Wilge River. In addition to this, the two (2) unlined PC dams periodically silt up and may discharge contaminated runoff into the natural environment due to capacity constraints when silted. The proposed upgrade and rehabilitation of the PC dams and Mine Residue Facility requires an Environmental Authorisation (EA) and licences in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), the National Environmental Management: Waste Act (Act 59 of 2008) (NEM:WA) and the National Water Act (Act 36 of 1998) (NWA). While a Water Use Licence (WUL) has already been obtained, in December 2015 for the proposed project, a Scoping and Environmental Reporting (S&EIR) process is being undertaken for the mining expansion and the upgrade of the PC Dams and Mine Residue Facility.

Purpose of this Report

Delmas Coal has appointed Jones & Wagener (Pty) Ltd Engineering and Environmental Consultants (J&W) as the independent Environmental Assessment Practitioner (EAP) to undertake the required S&EIR and EMPR amendment process in order to identify and evaluate potential environmental impacts and to recommend measures to avoid or reduce negative impacts and to enhance positive impacts. The Mpumalanga Department of Agriculture, Rural Development, Land & Environmental Affairs (MDARDLEA) is the competent authority in terms of the required EA as the project commenced before the promulgation of the new EIA Regulations and the implementation of the One Environmental Authorisation Process in December 2014.

J&W has also been appointed to undertake the Waste Management Licence (WML) application and IWULA processes in terms of the NEM:WA and NWA respectively, for the proposed project. The WML application will be submitted to the Department of Mineral Resources (DMR) due to the Mine Residue Facility being viewed as a residue stockpile in terms of the NEM:WA.
The water use licence was issued in December 2015.

Process

As part of the definition phase of the project, the environmental authorisations and licenses required for the proposed mining expansion and proposed upgrade facilities need to be obtained. In order to do so, a S&EIR and an EMPR amendment are being undertaken in line with the

provisions of the NEMA, as amended, the NEM:WA, and the MPRDA. The S&EIR process and specialist studies undertaken will also support the applications for the required licenses, such the Waste Management Facility License.

The EIA and EMPr are used by Delmas Coal and authorities to obtain an objective view of the potential environmental, social and cultural impacts that could arise during the construction, operation and closure of the proposed expansion and upgrading of mine infrastructure. Any significant negative impacts will be mitigated or avoided, where and if possible, while positive ones will be enhanced. The outcome of the S&EIR is the EIR and the EMPr, which provides the basis for sound decision-making by the decision-making authority or authorities.

The process is summarised in the illustration below.

Summary of the S&EIR process

Alternatives to be assessed

In terms of the EIA Regulations, consideration must be given to alternatives. Alternatives are different approaches and ways of meeting the need, purpose and objectives of a proposed activity. For this project, several alternatives have been considered as listed below:

- Mine Plan Alternatives
- PC dam alternatives
- Mine Residue Facility alternatives
- No-go alternatives for each of the above.

Each of the above sets of alternatives are outlined in more detail below:

Mine Plan Alternatives

Two mine plans/life of mine (LOM) alternatives have been developed for the proposed mining extension part of the project, based on inputs from stakeholders and design engineers.

Mine Plan Alternative (1): Bord and Pillar

As outlined in the scoping report the only feasible mining method being considered for the proposed expansion of the mining of the No. 2 and 4 seam at Delmas Coal is the continuation of the current underground mining by means of bord and pillar extraction.

This will entail the expansion of the underground workings within the mining rights area. Current mining practices will be followed and all current infrastructure will be utilised in the expansion of the mining area. The coal will still be conveyed via underground conveyor to North Shaft and either processed in the process plant or sold as run of mine (ROM) product. The only additional surface infrastructure required for the expanded underground workings is the refuge bay boreholes which are required for safety purposes.

Mine Plan Alternative (2): No-go Alternative:

The no-go alternative will occur if the underground mining expansion is not approved. The current land use of the area will remain the same as the proposed mining expansion will not impact the land use, however the geological impact of altering the geology will not be realised should the mining expansion not be approved. If the status quo is maintained, there will be a change to the socio-economic composition of the area with the termination of mining activities due to the mine reaching the end of its current Life of Mine (LOM) and the resultant loss of employment. Due to the end of the mining activities no importation, development or transfer of skills will occur to employees and other. It is anticipated that the current public infrastructure and services for the area will remain, except for the provision of health services to the Delmas Coal employees.

PC Dam Alternatives

There are two PC dam alternatives which were considered to curb and control the release of contaminated water into the natural water resources from the PC dams (excluding the no-go alternative). The alternatives which were considered are the following:

PC Dam Alternative (1): Upgrade both PC Dams *in situ*

The first alternative for the upgrade of the PC dams entails keeping the two existing PC dams in their current location but converting the top PC dam to a silt trap and enlarging and lining the bottom PC dam with a synthetic liner. The proposed PC dam silt trap will be able to provide sufficient settling time for particles larger than 0.2 mm up to flood events equal to the 1:10 year storm event.

This proposed silt trap PC dam will be upgraded to consist of four compartments with all four being utilised during normal operations. Compartments can be isolated for maintenance when required. The water emanating from the silt trap will report to the newly proposed lined secondary PC dam. The secondary PC dam will comprise of two lined earth embankment compartments. The proposed liner consists of a single composite liner with surface lining on top of the single composite liner. The surface lining consists of concrete and soil-crete filled geo-synthetic cells, which allows for the removal of silt by means of power washing and sludge pumps. The single composite liner is underlain by a leakage detection system. The flow to the two compartments can be regulated to allow for maintenance and to ensure sufficient storage capacity is maintained to accommodate a possible flood event. Excess water from the PC dam will be pumped for reuse in the processing plant

PC Dam Alternative (2): Upgrade both PC Dams and realign the secondary PC Dam

The second alternative for the upgrade of the PC dams also entails the conversion of the top PC dam to a silt trap as described in the alternative above, however entails the relocation of the secondary lined PC dam to a position North West of its current location, away from the Wilge River and towards the Mine Residue Facility. This will entail the excavation of a new facility at the new proposed location. The design, operation and maintenance applicable to the first alternative will also apply to this alternative with the only differentiating factor between the two alternatives being the location of the PC dam.

PC Dam Alternative (3): No-go Alternative

The no-go alternative will involve not upgrading either of the PC Dams *in situ* or in a new location. From a bio-physical perspective, should the upgrading of the PC dams not be conducted, the surface and groundwater surrounding Delmas Coal may continually be affected negatively as a result of the possible release of contaminated water into the surrounding natural resources and watercourses.

Mine Residue Disposal Facility Alternatives

Four alternatives were investigated for the proposed upgrading and rehabilitation of the Mine Residue Facility and upgrading of its associated infrastructure. The intention is to remediate and upgrade the Mine Residue Facility and related infrastructure (surface water drains and PC dams as described above) in order to reduce and control the release of contaminated water into the natural water resources.

The alternatives which were considered as a part of this S&EIR process are the following:

Mine Residue Facility Alternative (1): Upgrading the facility *in situ* for deposition of discard and slurry

The first alternative involves keeping the Mine Residue Facility in its current location and upgrading and/or replacing its surrounding groundwater drains and surface water infrastructure, where necessary, to improve its efficacy in capturing surface flow and sub-surface seep originating from the facility. In conjunction with this, remediation of the Mine Residue Facility will be undertaken with the aim to shape its slopes to an angle of at least 1:5 and provide a capping layer, as well as to establish the necessary surface water measures. The intention of this alternative is to continue operating the upgraded and remediated Mine Residue Facility for the deposition of coal discard and slurry on the coal discard and slurry pond section respectively. This alternative aims to maximise the available airspace of the facility but would require the development of a new facility in the event of the current facility reaching its maximum capacity. The capacity of the current Mine Residue Facility is however constrained by the stability of the underground workings underlying it. A stability assessment undertaken for the Mine Residue Facility, shows that the facility is nearing its full capacity and should not be used for the disposal of discard from the all the proposed future mining expansions.

Mine Residue Facility Alternative (2): Upgrading the facility *in situ* for deposition of discard only

The second alternative is entails the upgrading of the Mine Residue Facility within the existing footprint as indicated in Alternative 1 above, however using the air space above the slurry dams for the deposition of coal discard. This will therefore maximise the life of the facility within its existing footprint, but will mean that a new slurry handling facility will need to be developed on another footprint in future. This option has two limitations in that if Delmas Coal intends to continue washing coal and producing slurry it would require new slurry ponds and secondly the underground stability below the facility restricts the amount of coal discard that can be placed on the facility without risk of failure/subsidence.

Mine Residue Facility Alternative (3): Recovery of waste from the Mine Residue Facility and replacing reject material on the mined out footprint.

This alternative entails the recovery of discard from the Mine Residue Facility for the purpose of fuel for the KiPower Independent Power Producer (IPP) Plant Discard that is not suitable for use in the power station will be placed on the existing Mine Residue Facility footprint. The Mine Residue Facility will licensed as a new Waste Management Licence Facility. This option will also open up footprint to be used for disposal of coal slurry in the case that Delmas Coal may wash coal in the future, however will require a separate licensing process. The material disposed on this facility was analysed and it was determined that it has a sufficient calorific value to be utilised as a source of fuel for the proposed KiPower Independent Power Plant to be constructed on the adjacent Ikhwezi Colliery. Therefore, the Mine Residue Facility is proposed to be reworked from the western side where discard is removed will be upgraded to house future discard being produced, i.e., those fractions that cannot be re-used in the proposed KiPower Plant. As a result, the load of the facility on the underground workings is proposed to be reduced and the underground stability improved.

The intention is to progressively cap the Mine Residue Facility with the aim to shape its slopes to an angle of at least 1:5 and establish the necessary surface water measures. Reshaping and capping is intended to prevent any deterioration (erosion, spontaneous combustion, dust generation, etc.) of the existing facility

Mine Residue Facility Alternative (4): No-go alternative

Should none of the alternatives above be found to be viable or be approved, the current impact of the facility on groundwater and surface water resources will remain until the Mine Residue Facility is closed. If the facility is closed prior to reaching capacity or prior to the closure of the mine, a new facility (on a new footprint) may be required for the continuation of mining.

Environmental Sensitivities

The following key sensitives were identified for the project:

- **Geology**
    - The extension of the mining area will alter the geology of the area. No sensitivities exist for the no-go option.
    - In terms of geology the only foreseeable impacts for the PC Dam alternatives would be by means of deep excavations. PC dam Alternative will require excavations for the new location and thus Alternative 2 was deemed have a greater impact.
    - No geological impacts are anticipated for the Mine Residue Facility Alternatives.

- **Air Quality**
    - The impacts on air quality will be as a result of the prolonged usage of the plant area at North Shaft should the Life of Mine be extended. The plant area is where handling before transport is undertaken and thus dust is often liberated. The No-go alternative will result in the plant operations being closed and therefore emissions will cease.
    - In terms of the PC dam alternatives it is anticipated that the alternative of relocating the PC dam will have a greater sensitivity in terms of air quality due to the additional

earthworks and vegetation clearance associated to its construction in comparison with the alternative of upgrading the PC dam in its current location and the No-go alternative.

- The contribution that the activities associated with Alternative 3 (the recovery of waste from the of the Mine Residue Facility) will have on the ambient air quality will be the highest of the four Mine Residue Facility alternatives. The liberation of dust will increase as a result of this option due to the additional loading and hauling of large volumes of discard material in conjunction with the shaping of the current facility and earthworks related to the newly proposed facility. The No-go alternative where the facility is likely to be closed the soonest will contribute air-pollution for the least amount of time and is therefore rated as the preferred option in terms of air quality.

- **Terrestrial Biodiversity**

  - No impacts on biodiversity are foreseen for the Mine Plan Alternatives.
  - PC dam Alternative 1 is the most preferable alternative from a biodiversity impact perspective and will pose the least risk to the environment for the smallest footprint disturbed during the construction phase. Alternative 1 also has the smallest total area of wetland and natural habitat would be destroyed.
  - The No-go option is least preferred as the current impacts the dams have on the environment will persist.
  - In terms of the sensitivity of the Mine Residue Facility alternatives on terrestrial biodiversity the alternatives assessed had very similar impacts but ultimately Alternative 3 is most preferable due to the reduction of future seepage of contaminated water into natural habitats as a result of the reduction in size of the proposed new facility.

- **Geohydrology**

  - As the mine is a dry mine, the effect of the mining extension on the geohydrology is rated as minimal and thus has been equally rated with the No-go option.
  - In terms of geohydrology, both the PC dam alternatives have similar sensitivities due to the improvement anticipated as a result of the proposed upgrading and lining of the PC dam and silt trap. The position of the PC dam is the only differentiator between the options but irrespective of the position of the dam, both options will ensure an improvement to the current seepage and contamination of groundwater. The No-go option is least preferred as the current impacts the dams have on the environment will persist.
  - Mine Residue Facility Alternative 3 is the preferred option from a geohydrological sensitivity perspective as a result of the reduction of the footprint of the current unlined Mine Residue Facility due to the recovery and reuse of the discard. This will minimise the impact of the existing facility on the groundwater resource due to the reduction of possible future seepage into the groundwater. Progressive capping of the facility will also be undertaken for Alternative 3. These are the differentiating factors because three of the Mine Residue Facility alternatives (where upgrading will be undertaken) share the positive effect of the proposed remediation of the facility and the sub-surface cut off drains to limit seepage to the groundwater but only Alternative 3 adds further benefit to the improvement of the groundwater quality and the reduction of the contamination plume. The No-go

alternative is least preferred as it allows the current impact on the environment to persist.

- **Aquatic and Wetland Biodiversity**
    - Both alternatives were rated as equally preferred in terms of Aquatic and Wetland Biodiversity as mining will only be conducted underground and has been shown to be sufficiently below the surface water resources.
    - In terms of aquatic and wetland biodiversity PC dam, Alternative 1 is the preferred alternative due to the smaller surface area to be disturbed and vegetation to be cleared during construction thereof. The smaller footprint of Alternative 1 minimises the impact on water quality within the wetland and aquatic habitats caused by erosion and siltation. Furthermore, a smaller area of wetland habitat will be lost than with the relocation of the PC dam associated with Alternative 2. The No-go option is found to have the greatest impact as the current impacts the dams have on the environment will persist.
    - From a mine residue alternative perspective all three the alternatives make similar positive contributions towards the improvement of water quality that contributes to the wetland and aquatic habitats due to the remediation of the facility and the upgrades to the surface water management infrastructure. It is considered though that Mine Residue Facility Alternative 3 will show a more rapid improvement of the water quality, especially of the aquatic ecosystem due to the reduction of the footprint of the existing facility i.e. the source of contamination and the prevention and management of future groundwater seepage from the new facility.

- **Visual**
    - No visual impacts are anticipated for the Mine Plan Alternatives and the PC Dam alternatives.
    - For the Mine Residue Facility, the smaller the Facility, the smaller the visual impact. Therefore, Alternative 3 was preferred, with Alternative 2 being least preferred (the airspace above the slurry ponds will be used). Alternatives 1 and the No-go alternative were equally rated.

- **Social Impacts**
    - In terms of social impacts, the PC dam and Mine Residue Facility Alternatives were deemed to have minimal impacts.
    - For the mine plan alternatives, should the No-go alternative be selected, the mine will be forced to close and a loss of jobs will occur for the workers at the mine, as well as a reduced contribution to the local and regional economy. Should the mine plan Alternative 1 be selected, jobs and work will be secured for the longer term.

Preferred Alternatives

On the basis of the findings in this report, it is suggested that the proposed Mine Plan Alternative 1 be approved for the extension of the underground operations. Furthermore, that PC dam Alternative 1 and Mine Residue Facility Alternative 3 be approved for the upgrade and remediation of the PC dams and Mine Residue Facility.

A detailed alternative sensitivity analysis was conducted as can be seen in **Section 9**.

From the PC dam alternative impact rating for both alternatives, the greater majority of all the environmental aspects having been assessed had similar impact ratings with PC dam Alternative 1 ultimately posing the least risk to the environment due to it disturbing the smallest footprint, requiring the least vegetation clearing and habitat destruction and is therefore considered the preferred alternative.

In terms of the Mine Residue Facility alternative impact rating very similar impact ratings were experienced on all three upgrading alternatives for the greater majority of the environmental aspects assessed, with Mine Residue Facility Alternative 3 ultimately having similar environmental risks as the other two alternatives but posing the greatest advantage to the environment due to the reduction of the footprint of the current unlined facility. It is therefore considered the preferred alternative.

Way Forward

The way forward recommended by this study is as follows:

- Make this Draft Environmental Impact Report / Draft Environmental Management Plan Report and the Environmental Management Programme (EMPR) amendment available for public comment for a period of 40 days;
- Update the Draft Environmental Impact Report / Draft Environmental Management Plan Report and the Environmental Management Programme (EMPR) amendment with comments received from I&APs where required;
- Make the Final Environmental Impact Report / Final Environmental Management Plan Report and Environmental Management Programme (EMPR) amendment available for public comment for a period of 21 days and submit the final report to the to the competent authority for a decision on whether or not to grant Environmental Authorisation.
- Within 12 days of receipt of the Environmental Authorisation, the decision will be communicated to all stakeholders and the appeal process will be outlined.

KUYASA MINING
DELMAS COAL

DRAFT ENVIRONMENTAL IMPACT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT AMENDMENT REPORT NO: JW127/15/D910-Rev 2

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TERMS AND ABBREVIATIONS

LOM…… Life of Mine
QDS……..Quarter Degree Square
BA .....Basic Assessment
BID.....Basic Information Document
CMA.....Catchment Management Agency
CMU..... Catchment Management Unit
CRR .....Comments and Response Report
DAFF .....Department of Agriculture, Forestry and Fisheries
DEA .....Department of Environmental Affairs
DMR..... Department of Mineral Resources
DNAPL.....Dense Non-Aqueous Phase Liquids
DSR ..... Draft Scoping Report
DWAF .....Department of Water Affairs and Forestry
DWS ..... Department of Water and Sanitation
EA .....Environmental Authorisation
EAP.....Environmental Assessment Practitioner
EIA .....Environmental Impact Assessment
EIR..... Environmental Impact Report
EIS ..... Ecological Importance and Sensitivity
EMPR .....Environmental Management Programme Report (MPRDA)
EMPr..... Environmental Management Programme (NEMA)
FSL .....Full Supply Level
GDARD..... Gauteng Department of Agriculture and Rural Development
GIS..... Geographic Information System
GN ..... Government Notice
HDPE.....High-density polyethylene
HIA.....Heritage Impact Assessment
HPA .....Highveld Airshed Priority Area
I&APs.....Interested and Affected Parties
IEM .....Integrated Environmental Management
IPP ..... Independent Power Producer
IWULA .....Integrated Water Use Licence Application
IWWMP.....Integrated Water and Waste Management Plan
J&W .....Jones & Wagener (Pty) Ltd
km .....kilometres
m..... metres
m^3 .....cubic metres

mamsl ..... metres above mean sea level
MAR ..... Mean Annual Run-off
mbs ..... metres below surface
MDARDLEA ..... Mpumalanga Department of Agriculture, Rural Development, Land & Environmental Affairs
MOL ..... Minimum Operating Level
MPRDA ..... Mineral and Petroleum Resources Development Act
NEM:WA ..... National Environmental Management Waste Act
NEMA ..... National Environmental Management Act
NFEPA ..... National Freshwater Ecosystem Priority Areas
NSBA ..... National Spatial Biodiversity Assessment
NWA ..... National Water Act
PC ..... Pollution control
PES ..... Present Ecological State
R ..... Regulation
REC ..... Recommended Ecological Category
ROM ..... Run Of Mine
RWQO ..... Resource Water Quality Objectives
S&EIR ..... Scoping and Environmental Impact Report
SAHRA ..... South African Heritage Resources Agency
SIA ..... Social Impact Assessment
SOP ..... Standard Operating Procedure
SR ..... Scoping Report
SWSS ..... Surface Water Specialist Study
TDS ..... Total Dissolved Solids
TLB ..... Tractor Loader Backhoe
TSP ..... Total Suspended Particulates
WMA ..... Water Management Area
WML ..... Waste Management Licence
WUL ..... Water Use Licence

NATIONAL ENVIRONMENTAL MANAGEMENT ACT – ENVIRONMENTAL IMPACT REPORT CHECKLIST

ENVIRONMENTAL IMPACT REPORT CHECKLIST - GNR 543 OF GOVERNMENT GAZETTE NO 33306, 18 JUNE 2010		
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ENVIRONMENTAL IMPACT REPORT		
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31 (2) e	Public participation process	6.1.2, 6.1.5
31 (2) e (i)	Steps undertaken in accordance with the plan of study	6; 7;8
31 (2) e (ii)	Stakeholder database	Appendix D
31 (2) e (iii)	Issues and Response Report	Appendix D
31 (2) e (iv)	Copies of comments from stakeholders	Appendix D
31 (2) f	Description of the need and desirability of the proposed activity	3.4
31 (2) g	Description of the alternatives and the advantages and disadvantages that the proposed alternatives may have on the environment	8
31 (2) h	Description of the methodology used to determine the significance of potential environmental impacts	7
31 (2) i	Description and comparative assessment of all alternatives identified during the EIA process	0
31 (2) j	Summary of findings and recommendations of any specialist report or report on a specialist process	8; 0
31 (2) k	Description of environmental issues that were identified during the EIA 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	8
31 (2) l	Assessment of each identified potentially significant impact including cumulative impacts, nature of impact, extent and duration of impact, probability of impact occurring, degree to which the impact can be reversed, degree to which the impact may cause irreplaceable loss of resource, degree to which the impact can be mitigated	8
31 (2) m	Description of any assumptions, uncertainties and gaps in knowledge	11
31 (2) n	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	12.3
31 (2) o	An environmental impact statement	12
31 (2) o (i)	Summary of key findings of the environmental impact assessment	12.1
31 (2) o (ii)	Comparative assessment of the positive and negative implications of the proposed activity and identified alternatives	12.2

MINERALS AND PETROLEUM RESOURCES DEVELOPMENT ACT REGULATIONS – ENVIRONMENTAL IMPACT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME CHECKLIST

ENVIRONMENTAL MANAGEMENT PROGRAMME CHECKLIST - GNR 527 OF GOVERNMENT GAZETTE NO 26275, 23 APRIL 2004		
Regulation	Description	Reference in report
ENVIRONMENTAL IMPACT REPORT		
50 (a)	Assessment of the environment likely to be affected by mining	5
50 (b)	Assessment of the environment likely to be affected by the identified alternative land use or developments	5
50 (c)	Assessment of the nature, extent, duration, probability and significance of the identified potential environmental, social and cultural impacts of the proposed mining operation	7;8
50 (d)	Comparative assessment of the identified land use and development alternatives and their potential environmental, social and cultural impacts	0
50 (e)	Mitigatory measures for each significant impact of the proposed mining operation	8
50 (f)	The engagement process of interested and affected persons followed during the course of the assessment and an indication of how the issues raised by interested and affected persons have been addressed	6
50 (g)	Identify knowledge gaps and report on the adequacy of predictive methods, underlying assumptions and uncertainties encountered in compiling the required information	11; Appendix E
50 (h)	Description of the arrangements for monitoring and management of environmental impacts	10
50 (i)	Inclusion of technical and supporting information as appendices	3; 8; 0; Appendix E

Regulation	Description	Reference in report
ENVIRONMENTAL MANAGEMENT PROGRAM		
51 (a)(i)	Environmental objectives and specific goals for- Mine closure	8.3
51 (a)(ii)	Environmental objectives and specific goals for- Management of identified environmental impacts emanating from the proposed mining operation	Appendix E
51 (a)(iii)	Environmental objectives and specific goals for- Socio-economic conditions as identified in the social and labour plan	Appendix E
51 (a)(iv)	Environmental objectives and specific goals for- Historical and cultural aspects	Appendix E
51 (b)(i)	Outline of the implementation programme which must include - Description of the appropriate technical and management options chosen for each environmental impact, socio-economic condition and historical and cultural aspects for each phase of the mining operation	Appendix E
51 (b)(ii)	Action plans to achieve the objectives and specific goals	Appendix E
51 (b)(iii)	Procedures for environmental related emergencies and remediation	10.3
51 (b)(iv)	Monitoring and environmental management programme performance assessment	10.5
51 (b)(v)	Financial provision in relation to the execution of the environmental management programme	10.4
51 (b)(vi)	Environmental awareness	10.6
51 (b)(vii)	Inclusion of technical and supporting information as appendices	Appendices C and D
51 (b)(viii)	Undertaking by the applicant to comply with the provisions of the Act and regulations thereto.	Appendix E

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50 YEARS EST. 1966

KUYASA MINING

DELMAS COAL

DRAFT ENVIRONMENTAL IMPACT REPORT AND ENVIRONMENTAL MANAGEMENT PROGRAMME REPORT AMENDMENT

REPORT NO: JW127/15/D910-Rev 2

1. INTRODUCTION

1.1 Background Information

Delmas Coal (Pty) Ltd (hereafter Delmas Coal) is an existing coal mine near the town of Delmas in the Mpumalanga Province (refer to **Figure 1-1** and **Figure 1-2**). Delmas Coal has been in existence since 1964 and was formerly owned by Ingwe Collieries. The mining right is being transferred to Delmas Coal. Coal is mined by means of bord and pillar. The coal is currently supplied to Eskom's Majuba Power Station for power generation and may, in future, supply coal the proposed KiPower Independent Power Producer (IPP) Plant.

Delmas Coal plans to expand its current underground mining operations to include new coal reserves in the mining plan, these reserves are located to the south and south-west of its current sections. For the new mining expansion, the current mining right is being amended and an Environmental Management Programme Report (EMPR) amendment requires authorisation in terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002) (MPRDA) prior to the commencement of the proposed mining activities.

The performance of the mine's contaminated water management systems has come under scrutiny and findings from water quality monitoring being conducted on a monthly basis in the Wilge River upstream and downstream of the Delmas Coal operations have confirmed that seepage from the Mine Residue Facility and PC dams have influenced the water quality of the Wilge River. In addition to this, the two (2) unlined pollution control (PC) dams periodically silt up and may discharge contaminated runoff into the natural environment due to capacity constraints when silted.

In an effort to curb the continuation of these occurrences, Delmas Coal has embarked on a project to upgrade and remediate the Mine Residue Facility, PC dams and related infrastructure, including the surface water drains from the coal processing plant discharging into the PC dams. The proposed upgrade and rehabilitation of these facilities requires an Environmental Authorisation (EA) in terms of the National Environmental Management Act (Act 107 of 1998) (NEMA), and licences in terms of the National Environmental Management: Waste Act (Act 59 of 2008) (NEM:WA) and the National Water Act (Act 36 of 1998) (NWA). Therefore, a Scoping and Environmental Impact

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ASSOCIATES: PJJ Smit PrEng BEng(Hons) MSAICE **M van Biljon** PrSciNat MSc(Hydrogeology) **RA Nortjé** PrEng MSc(Eng) MSAICE MIWMSA **C Cilliers** PrEng BEng(Hons) MSAICE **NW Nxumalo** PrEng MSc(Eng) MSAICE **J Breyl** PrEng BEng(Hons) AMSAICE **J Hex** PrSciNat MSc(Env Man) EAPASA
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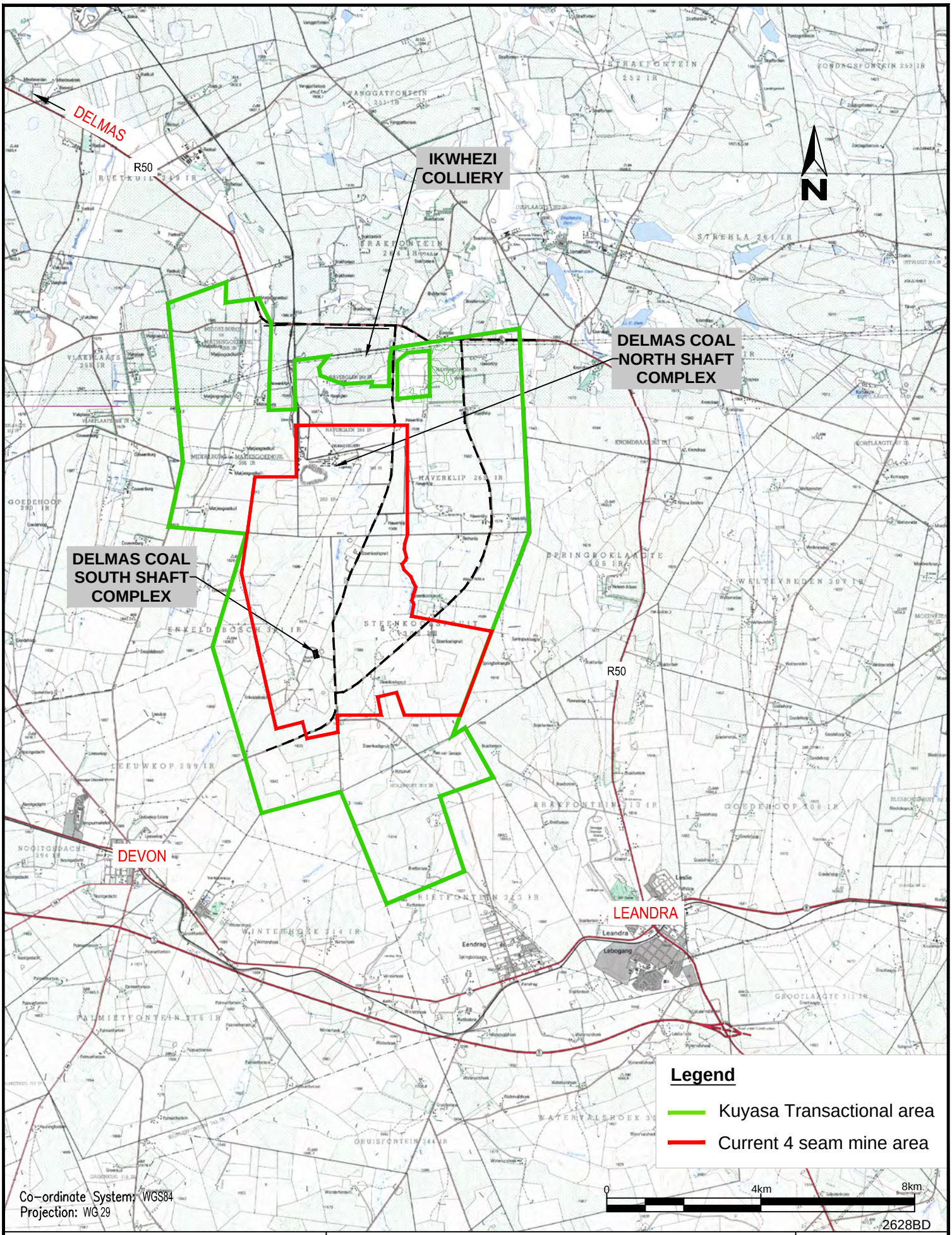
FINANCIAL MANAGER: HC Neveling BCom MBL CIMA Adv Dip MA

Report (S&EIR) process in terms of the NEMA, as well as an Integrated Water Use Licence Application (IWULA) process in terms of the NWA, needed to be followed.

Delmas Coal has appointed Jones & Wagener (Pty) Ltd Engineering and Environmental Consultants (J&W) as the independent Environmental Assessment Practitioner (EAP) to undertake the required S&EIR and EMPR amendment process in order to identify and evaluate potential environmental impacts and to recommend measures to avoid or reduce negative impacts and to enhance positive impacts. The Mpumalanga Department of Agriculture, Rural Development, Land & Environmental Affairs (MDARDLEA) is the competent authority in terms of the required EA as the project commenced before the promulgation of the new EIA regulations and the implementation of the One Environmental Authorisation Process in December 2014.

J&W has also been appointed to undertake the Waste Management Licence (WML) application and IWULA processes in terms of the NEM:WA and NWA respectively, for the proposed project. The WML application will be submitted to the Department of Mineral Resources (DMR) due to the Mine Residue Facility being viewed as a residue stockpile in terms of the NEM:WA. The IWULA was submitted in November 2014 and was granted by the Department of Water and Sanitation (DWS) in December 2015.

This document serves as the Environmental Impact Report (EIR) and EMPR amendment for the proposed extension of underground operations and the upgrade and rehabilitation of the PC dams and Mine Residue Facility at the Delmas Coal operations.



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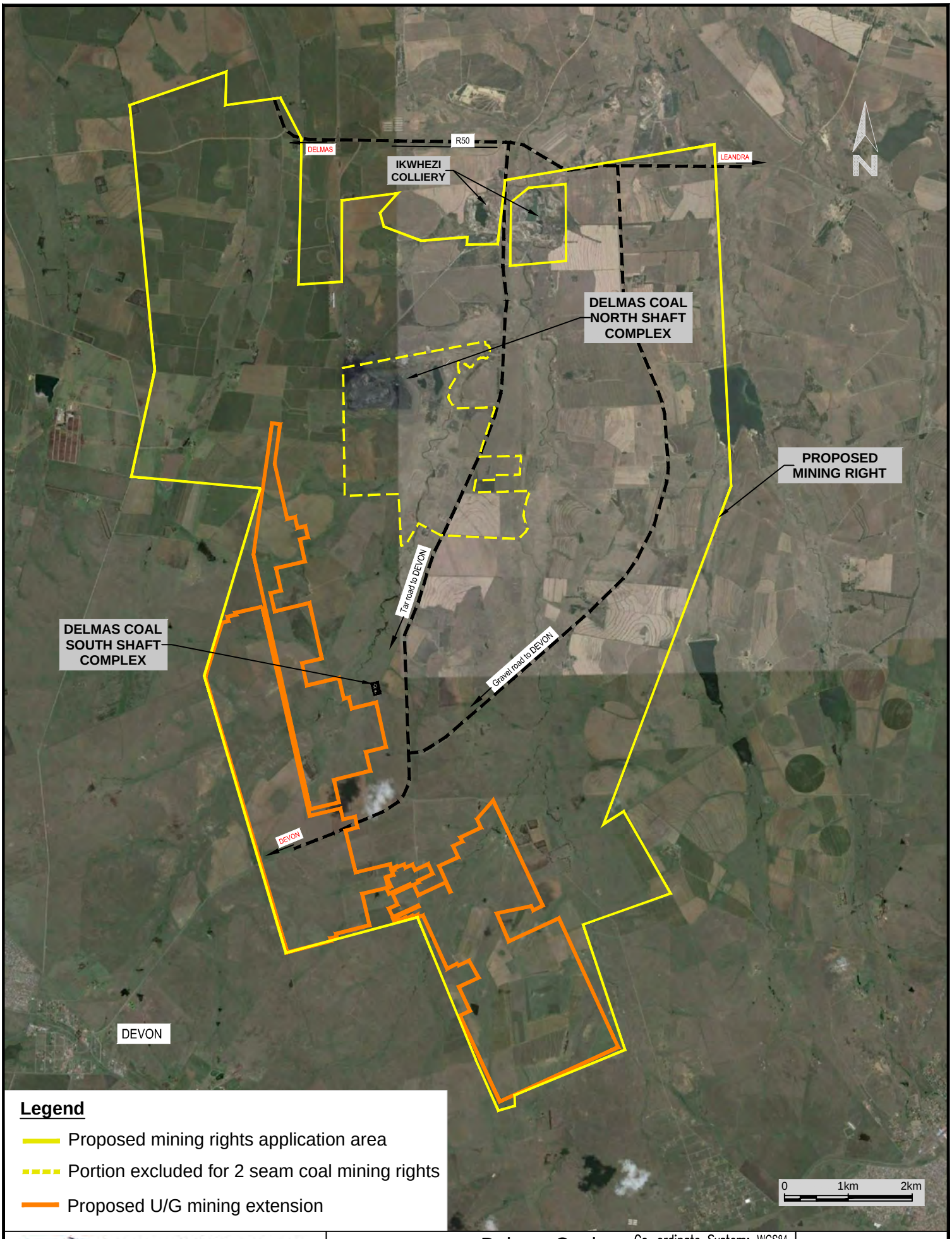
Delmas Coal (Pty) Ltd
EIR / EMPR
REGIONAL LOCALITY

Job No: D910-04

Figure 1.1



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Delmas Coal
EIR / EMPR
LOCALITY PLAN

Co-ordinate System: WGS84
Projection: WG 29

Job No: D910-04

Figure 1-2

1.2 Context of this Report

This report is the Draft Environmental Impact Report (DEIR) and Environmental Management Plan Report (EMPR) amendment, a key component of the environmental authorisation process for the proposed mining expansion and the upgrading of the PC dams and remediating of the Mine Residue Facility at Delmas Coal Mine. This report has been compiled in support of the section 102 application for additional mining rights and in order to align the existing 1997 EMPR with the new MPRDA regulations (GNR 527 of 2004 and GNR 543 of 2010). The DEIR and EMPR amendment was compiled after approval of the Final Scoping Report - see **Appendix A.3**. This report has been compiled in line with the requirements as stipulated in the NEMA, the 2010 Regulations and MPRDA regulations. (The Environmental Management Programme (EMPr) is attached as **Appendix E** to this DEIR and EMPR amendment.)

1.3 Project Team Details

1.3.1 Applicant Details

In the section below, the details of the applicant are listed. The environmental authorisation and licenses for Delmas Coal to construct and operate the proposed project will be in the name of this legal institution.

Name:	Mr Mpumelelo Saliwa (General Manager)
Company Represented:	Delmas Coal (Pty) Ltd
Address:	Private Bag X0002, Delmas, 2210
Telephone:	013 665 7000
Fax:	013 665 7016

1.3.2 Environmental Assessment Practitioner Details

In terms of the regulations, the proponent, Delmas Coal, must appoint an EAP to undertake the environmental assessment of an activity regulated in terms of the aforementioned Act. In this regard, Delmas Coal (Pty) Ltd appointed Jones & Wagener (Pty) Ltd to undertake the EIA for the proposed extension of mining and upgrading and rehabilitating of the Mine Residue Facility and PC dams, in accordance with the EIA Regulations promulgated in June 2010 in terms of the NEMA (Act 107 of 1998).

The details of the EAP representative are listed below.

Name:	Marius van Zyl
Company Represented:	Jones & Wagener (Pty) Ltd.
Address:	P O Box 1434, Rivonia, 2128
Telephone:	011 519 0200
Fax:	011 519 0201
E-mail:	vanzyl@jaws.co.za

1.3.2.1. Expertise of the EAP

Table 1-1 below summarises the expertise of the main J&W team members.

Table 1-1: EAP Team Members

Name	Highest Qualifications	Experience	Professional Registrations
Marius van Zyl	BSc Honours Biochemistry BSc Honours Environmental Management	31 years	Pr.Sci.Nat Member of International Association for Impact Assessment – South Africa & Institute of Waste Management Southern Africa
Olivia Bamford	BSc Honours Environment, Ecology and Conservation. (Env. Sci)	3 years	Member of the International Association for Impact Assessment
Anelle Lotter	National Diploma in Journalism	20 years	Member of the International Association of Public Participation (IAP2)

1.3.3 Competent Authority Details

The competent authority for this proposed project is the Mpumalanga Department of Agriculture, Rural Development, Land and Environmental Affairs (MDARDLEA) and the competent authority for the approval of the EMPR amendment is the Department of Mineral resources (DMR).

An EIA application form (see **Appendix A.1**) was submitted to the MDARDLEA (the then Mpumalanga Department of Economic Development, Environment and Tourism) on 16 September 2013. A reference number (**17/2/3N-300**) for the project was received from the competent authority on 25 September 2013 (**Appendix A.2**). The Draft Scoping Report was submitted to the Competent Authority on 29 August 2014. The FSR was submitted to the MDARDLEA and the DMR on 27 February 2015. The MDARDLEA was responsible for approving FSR (see approval letter attached as **Appendix A.3**) during the scoping phase of the project and will be responsible for making a decision on the application for Environmental Authorisation during the impact assessment phase. Applications to extend the project timeframes were made to the MDARDLEA in October 2015 and March 2016. The extensions were granted for the submission of the DEIR and EMPR amendment by the MDARDLEA (**Appendix A.4**).

1.4 Regional Setting

The regional location of the proposed project area is shown in **Figure 1-1** and is described in the section below.

1.4.1 Local Authority

Delmas Coal is situated within the Victor Khanye Local Municipality which is located in the Nkangala District Municipality.

1.4.2 Direction and distance to neighbouring towns

The distances to neighbouring towns from the proposed project are as follows:

Delmas	±19 kilometres (km)
Leandra	±14 km
Devon	±11 km
eMalahleni	±60 km.

1.4.3 Landowners potentially affected by the project

A differentiation is made between the ownership of the land on which the two shafts and their associated infrastructure are located and the ownership of the land on which the previous, existing and planned underground mining is located. Properties upon which the shafts and associated surface infrastructure (including the Mine Residue Facility and PC dams at North Shaft) are located are listed in **Table 1-2**. The properties which have already been undermined by Delmas Coal are listed **Table 1-3** and are shown in **Figure** 1-3**.** The properties associated with the proposed expansion of the underground operations are indicated in **Table 1-4** and are shown in **Figure 1-4.**

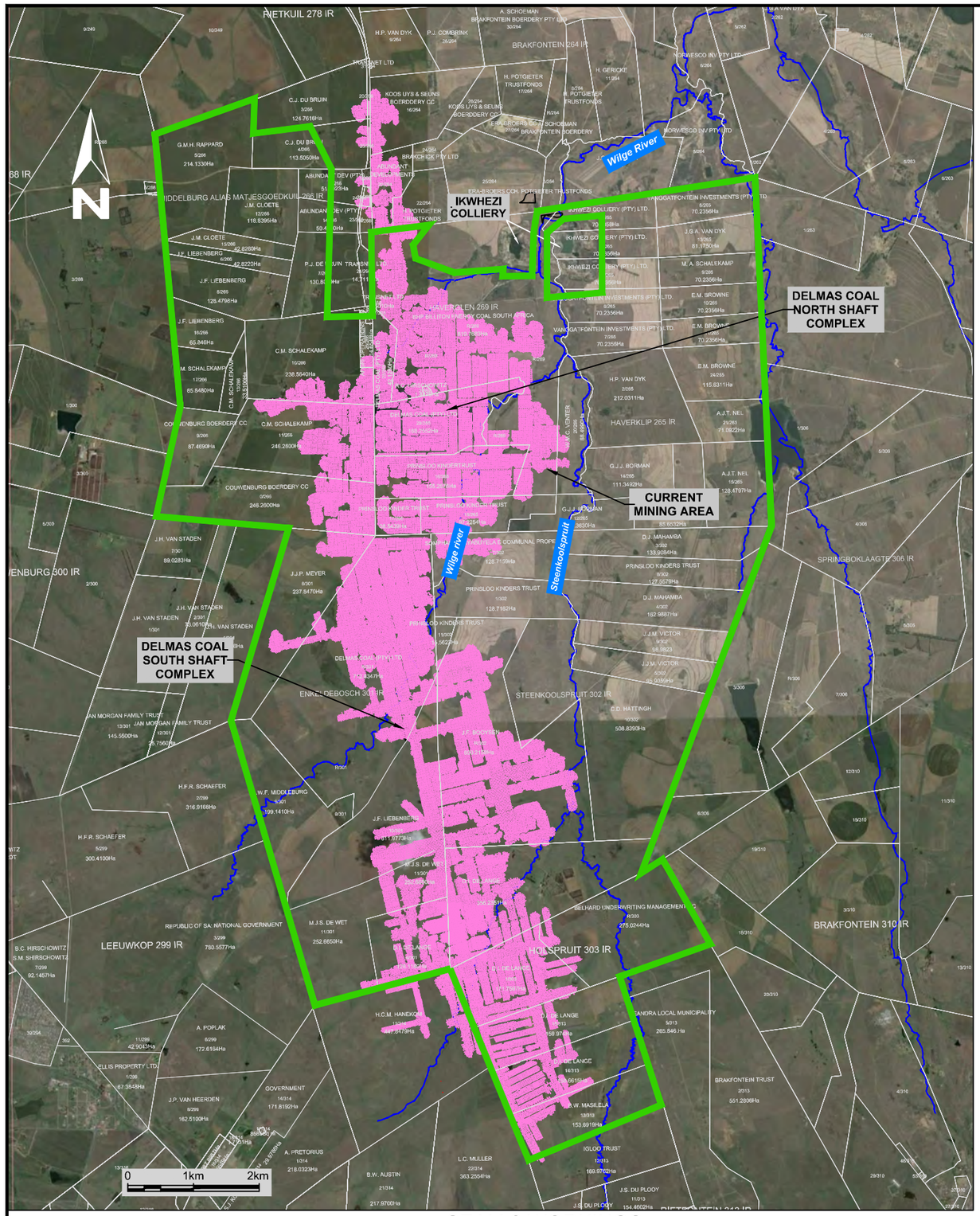
Table 1-2: Properties containing Delmas Coal surface infrastructure.

Portion	Farm	Size (Ha)	Surface Property Owner
North Shaft			
25	Haverklip 265 IR	42.1279	Delmas Coal (Pty) Ltd
29	Haverklip 265 IR	168.2552	Delmas Coal (Pty) Ltd
RE	Haverglen 269 IR	820.0324	South32 SA Coal Holdings in the process of being transferred to Delmas Coal (Pty) Ltd.
South Shaft			
10	Enkeldebosch 301 IR	42.8223	Kallie Madel Trust
RE	Enkeldebosch 301 IR	712.8347	Delmas Coal (Pty) Ltd

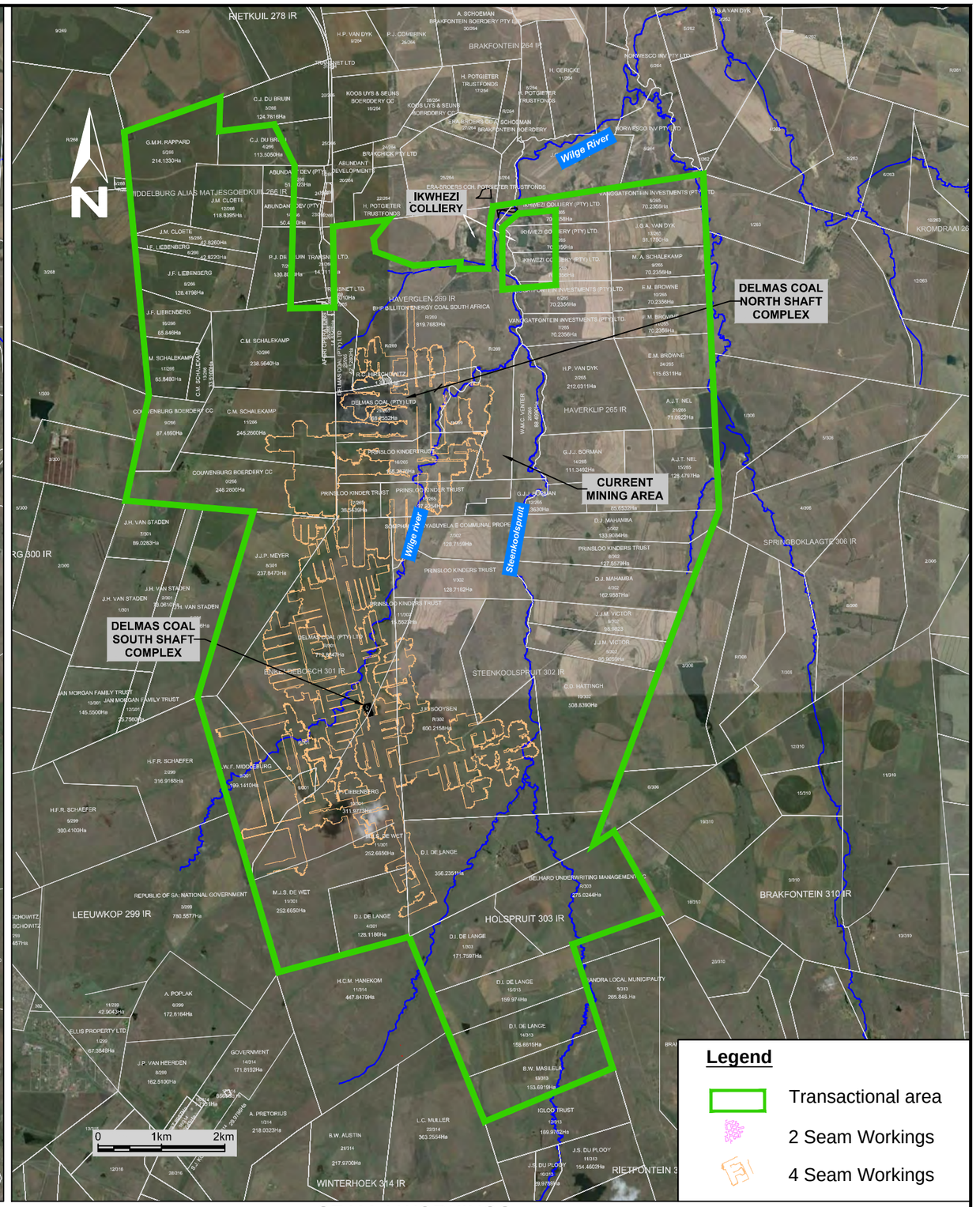
Table 1-3: Surface rights holders of past and present coal mining by Delmas Coal

Portion	Farm	Surface Property Owner	Coal seams mined
3	Matjiesgoedkuil 266 IR	C. J. Du Bruin	No. 2 seam coal
4	Matjiesgoedkuil 266 IR	C. J. Du Bruin	No. 2 seam coal
14	Matjiesgoedkuil 266 IR	Abundant Dev. (Pty)	No. 2 seam coal
18	Matjiesgoedkuil 266 IR	Abundant Dev. (Pty)	No. 2 seam coal
20	Matjiesgoedkuil 266 IR	Transnet Ltd.	No. 2 seam coal
25	Matjiesgoedkuil 266 IR	Transnet Ltd.	No. 2 seam coal
23	Matjiesgoedkuil 266 IR	Transnet Ltd.	No. 2 seam coal
24	Matjiesgoedkuil 266 IR	Transnet Ltd.	No. 2 seam coal

Portion	Farm	Surface Property Owner	Coal seams mined
22	Matjiesgoedkuil 266 IR	Transnet Ltd.	No. 2 and 4 seam coal
26	Matjiesgoedkuil 266 IR	Afgri Operation Ltd.	No. 2 and 4 seam coal
10	Matjiesgoedkuil 266 IR	C. M. Schalekamp	No. 2 seam coal
11	Matjiesgoedkuil 266 IR	C. M. Schalekamp	No. 2 and 4 seam coal
0/RE	Matjiesgoedkuil 266 IR	Couwenburg Boerdery CC.	No. 2 and 4 seam coal
16	Brakfontein 264 IR	Koos Uys & Seuns Boerddery CC.	No. 2 seam coal
20	Brakfontein 264 IR	Abundant Developments	No. 2 seam coal
22	Brakfontein 264 IR	H. Potgieter Trustfonds	No. 2 seam coal
RE	Haverglen 269 IR	In the process of transfer to Delmas Coal	No. 2 and 4 seam coal
25	Haverklip 265 IR	Delmas Coal (Pty) Ltd	No. 2 seam coal
29	Haverklip 265 IR	Delmas Coal (Pty) Ltd	No. 2 and 4 seam coal
2	Haverklip 265 IR	Delmas Coal (Pty) Ltd	No. 2 and 4 seam coal
16	Haverklip 265 IR	Prinsloo Kinder Trust	No. 2 and 4 seam coal
17	Haverklip 265 IR	Prinsloo Kinder Trust	No. 2 and 4 seam coal
18	Haverklip 265 IR	Prinsloo Kinder Trust	No. 2 and 4 seam coal
20	Haverklip 265 IR	W.M.C. Venter	No. 2 seam coal
7	Steenkoolspruit 302 iR	Somphalali Siyabulela e Communal Property	No. 2 and 4 seam coal
11	Steenkoolspruit 302 iR	Prinsloo Kinders Trust	No. 2 and 4 seam coal
0/RE	Steenkoolspruit 302 iR	J.F. Booysen	No. 2 and 4 seam coal
10	Steenkoolspruit 302 iR	C. D. Hattingh	No. 2 and 4 seam coal
6	Steenkoolspruit 302 iR	D. I. Delange	No. 2 and 4 seam coal
6	Enkeldebosch 301 IR	J. J. P. Meyer	No. 2 and 4 seam coal
0/RE	Enkeldebosch 301 IR	Delmas Coal (Pty) Ltd	No. 2 and 4 seam coal
10	Enkeldebosch 301 IR	Kallie Madel Trust	No. 2 and 4 seam coal
11	Enkeldebosch 301 IR	M. J. S. De Wet	No. 2 and 4 seam coal
4	Enkeldebosch 301 IR	D. I. Delange	No. 2 and 4 seam coal
9	Enkeldebosch 301 IR	A. W. F. Middleburg	No. 4 seam coal
1	Holspruit 303 IR	D. I. Delange	No. 2 seam coal
0/RE	Holspruit 303 IR	Belhard Underwriting Management	No. 2 seam coal
15	Rietfontein 313 IR	D. I. Delange	No. 2 seam coal
14	Rietfontein 313 IR	D. I. Delange	No. 2 seam coal
13	Rietfontein 313 IR	B. W. Masilela	No. 2 seam coal
12	Rietfontein 313 IR	Igloo Trust	No. 2 seam coal
11	Winterhoek 314 IR	H.C. M. Hannekom	No. 2 seam coal



SEAM 2 WORKINGS



SEAM 4 WORKINGS

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Delmas Coal (Pty) Ltd
EIR / EMPR
PROPERTIES AFFECTED BY CURRENT MINING OPERATIONS

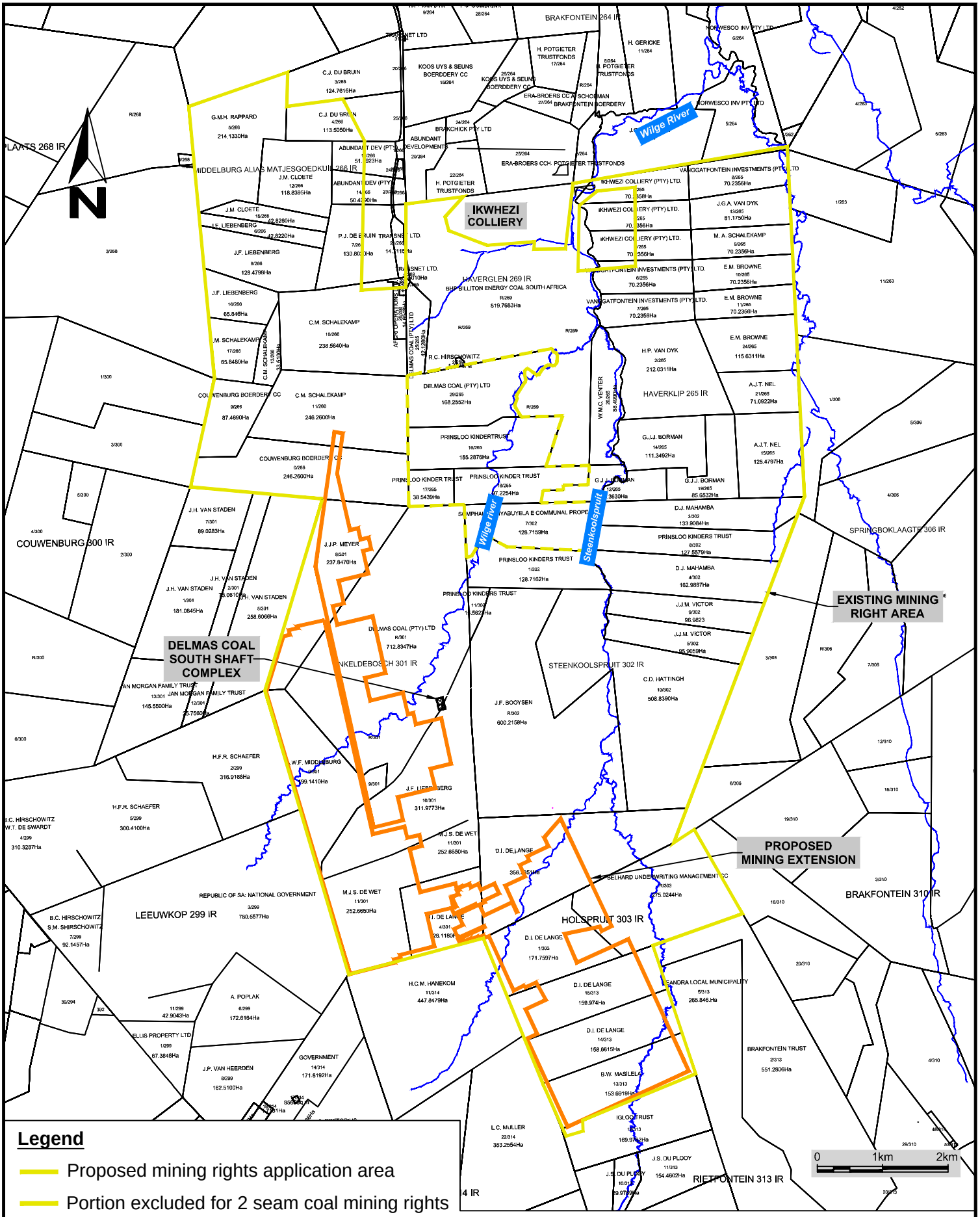
Co-ordinate System: Cape Lo29

Job No: D910-04

Figure 1-3

Table 1-4: Surface rights holders of the proposed underground mining extension

Portion	Farm	Size (Ha)	Surface Property Owner	Coal seams mined
11	Matjiesgoedkuil 266 IR	246.26	C. M. Schalekamp	No. 2 seam coal
0/RE	Matjiesgoedkuil 266 IR	246.26	Couwenburg Boerdery CC.	No. 2 seam coal
4	Enkeldebosch 301 IR	128.12	D. I. de Lange	No. 2 and 4 seam coal
8	Enkeldebosch 301 IR	237.85	J. J. P. Meyer	No. 2 and 4 seam coal
9	Enkeldebosch 301 IR	99.14	A. W. F. Middleburg	No. 2 and 4 seam coal
10	Enkeldebosch 301 IR	311.98	Kallie Madel Trust	No. 2 and 4 seam coal
11	Enkeldebosch 301 IR	252.67	M. J. S. de Wet	No. 2 and 4 seam coal
0/RE	Enkeldebosch 301 IR	712.83	Delmas Coal (Pty) Ltd	No. 2 and 4 seam coal
6	Steenkoolspruit 302 IR	356.24	D. I. de Lange	No. 4 seam coal
1	Holspruit 303 IR	171.76	D. I. de Lange	No. 4 seam coal
0/RE	Holspruit 303 IR	275.02	Belhard Underwriting Management CC	No. 4 seam coal
13	Rietfontein 313 IR	153.69	B. W. Masilela	No. 4 seam coal
14	Rietfontein 313 IR	158.661	D. I. de Lange	No. 4 seam coal
15	Rietfontein 313 IR	159.97	D. I. de Lange	No. 4 seam coal



Legend

- Proposed mining rights application area
- Portion excluded for 2 seam coal mining rights
- Proposed U/G mining extension

Co-ordinate System: WGS84
Projection: WG 29

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Delmas Coal (Pty) Ltd
EIR / EMPR

PROPERTIES PROPOSED TO BE UNDER-MINED BY THE MINING EXTENSION

Job No: D910-04

Figure 1-4

1.5 Objectives of this Report

This report addresses the requirements for the EIA Phase as outlined in the NEMA and the MPRDA. The aim of this DEIR and EMPR Amendment is to:

- Provide information to the authorities, as well as Interested and Affected Parties (I&APs), on the proposed project; including details on the:
  - Proposed project (project description);
  - Alternatives that are being considered;
  - Receiving environment; and
  - Assessing and ranking methodology; and
  - Presenting the outcomes of the assessments.
- Indicate how I&APs have been, and are still being, afforded the opportunity to contribute to the project, verify that the issues they raised to date have been considered, and comment on the findings of the impact assessments;
- Provide proposed mitigation measures in order to minimise negative impacts and enhance positive impacts; and
- Present the findings of the Impact Assessment Phase in a manner that facilitates decision-making by the relevant authorities.

1.6 Project Progress

A S&EIR process comprises of a Scoping Phase and an Impact Assessment Phase. The scoping phase of this project has been completed and the project is currently in the Impact Assessment Phase. The following activities have been completed:

- Pre-application consultation with relevant stakeholders and authorities MDARDLEA, DMR, Department of Environmental Affairs (DEA), DWS – Regional office; Department of Agriculture Forestry and Fisheries (DAFF); Mpumalanga Department Public Works Roads and Transport, Mpumalanga Department of Agriculture Rural Development and Land Administration, Mpumalanga Tourism and Parks Agency, Nkangala District Municipality, Victor Khanye Local Municipality);
- Completion and submission of the relevant application documentation;
- Placement of announcement advertisements;
- Compilation and distribution of a Background Information Document (BID);
- Hosting a public meeting;
- Compilation of a Draft and Final Scoping Report (SR);
- Placing the Draft and Final SR on public review;
- Approval of the Final SR;
- Compilation of a Draft EIR and EMPR amendment and Draft Environmental Management Programme (EMPr) (in terms of the NEMA); and
- Placing the Draft and Final EIR and EMPR amendment and EMPr on public review (current).

Further information on the process being followed is outlined in **Section** 6 of this report.

2. LEGAL REQUIREMENTS

2.1 Introduction: Authorisations and Licences Required

Environmental legislation in South Africa was promulgated with the aim of, at the very least, minimising and at the most preventing environmental degradation. The following environmental authorisations and licenses are required for Delmas Coal:

- An Environmental Authorisation (EA) in terms of the provisions of Government Notice Regulations (GNR) 543 of 18 June 2010, as contemplated in Chapter 5 of the National Environment Management Act, Act 107 of 1998, as amended, (NEMA, 1998) for the upgrading and remediating of the Mine Residue Facility and PC dams at Delmas Coal North Shaft, as well as the extension of the underground mining operations. This entails conducting a S&EIR process. The S&EIR for the proposed project was registered under the EIA Regulations dated 2010. The EIA Regulations were subsequently changed to the Regulations that were published on 8 December 2014. In terms of the transitional arrangements of the EIA Regulations, 2014 "*an application submitted in terms of the previous NEMA regulations and which is pending when these Regulations take effect, must despite the repeal of those regulations be dispensed with in terms of those previous NEMA regulations as if those previous NEMA regulations were not repealed*". Hence this application, despite the changes to the Regulations, were conducted for the activities listed below as per the EIA Regulations, 2010;
- An EMPR Amendment, as per the MPRDA Regulation No. 527 promulgated in April 2004 in terms of the MPRDA. In order for the EMPR to be amended, a S&EIR will have to be followed;
- An integrated WML for the new Mine Residue Facility associated with Delmas Coal in terms of the provisions of Section 20 of the NEM:WA. In order to obtain a WML for Delmas Coal, a S&EIR process had to be undertaken as well. This process supports the Waste Management Facility Licence Application Report (WMLAR), which will contain technical aspects related to the Delmas Coal.

An IWULA was submitted to the, then Department of Water Affairs now, DWS in 2011. The IWULA was supplemented by additional information and an Integrated Water and Waste Management Plan (IWWMP) in November 2014. A WUL was issued for Delmas Coal in December 2015.

The following Acts and Regulations are applicable to the proposed project:

2.2 Applicable Legislation

2.2.1 The Constitution of the Republic of South Africa (Act 108 of 1996)

Section 24 of the Constitution states that: Everyone has the right

(a) to an environment that is not harmful to their health or well-being; and

(b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that-

- prevent pollution and ecological degradation;
- promote conservation; and

- secure ecologically sustainable development and use of natural resources, while promoting justifiable economic and social development.

The current environmental laws in South Africa concentrate on protecting, promoting, and fulfilling the Nation's social, economic and environmental rights; while encouraging public participation, implementing cultural and traditional knowledge and benefiting previously disadvantaged communities.

2.2.2 National Environmental Management Act (No 107 of 1998)

The EIA for this proposed project is being conducted in terms of the 2010 EIA Regulations that were promulgated in terms of Section 24 (5) of the NEMA, as amended. The MDARDLEA is the competent authority responsible for issuing Environmental Authorisation for the proposed project. The DMR is responsible for approving the EMPR amendment. The DWS – Regional office; DAFF; DMR; Mpumalanga Department Public Works Roads and Transport, Mpumalanga Department of Agriculture Rural Development and Land Administration, Mpumalanga Tourism and Parks Agency, Nkangala District Municipality, Victor Khanye Local Municipality are key commenting authorities.

2.2.2.1. Environmental Impact Assessment Regulations: 543-546 of 18 June 2010

A Scoping and EIR process is applicable to all projects likely to have significant environmental impacts due to their nature or extent, activities associated with potentially high levels of environmental degradation, or activities for which the impacts cannot be easily predicted. In comparison, a Basic Assessment is required for projects with less significant impacts or impacts that can easily be mitigated. The difference between the processes relates to the nature of the proposed developments in terms of its potential impact on the environment, and this is reflected in the level of detail that information is collected in as well as the level of interaction with I&APs.

In terms of GNR 545, activity 5, a full Environmental Impact Assessment comprising both Scoping and Impact Assessment, is necessary for the proposed project. The various activities triggered by the NEMA are tabulated below in **Table 2-1**, **Table 2-2** and **Table** 2-3 (DEA, 2010).

Table 2-1: Activities requiring a Basic Assessment (Listing Notice 1, GN 544 of 18 June 2010).

Activity No	Description of Activity as per GNR 544	Activity or Infrastructure Triggering the Activity
Activity No: 11	The construction of: - canals; - dams 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.	The reconstruction of the pollution control dams and the pump station located at the pollution control dams will be closer than 32 metres from a wetland, which is part of a watercourse. New canals for the conveyance of impacted mine water will also be constructed closer than 32 metres from a wetland.

Activity No	Description of Activity as per GNR 544	Activity or Infrastructure Triggering the Activity
Activity No: 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[1]; 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.	During the reconstruction of the existing pollution control dams, more than 5 cubic metres of soil will be excavated or deposited within a wetland, which is part of a watercourse.
Activity No: 22	The construction of a road, outside urban areas, (ii) - where no reserve exists where the road is wider than 8 metres.	During rehabilitation and upgrading of the existing Mine Residue Facility and pollution control dams, construction roads wider than 8 metres will be required to ensure access of earthmoving equipment to the site and manoeuvrability.
Activity No: 39	The expansion of (i) canals; within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, where such expansion will result in an increased development footprint but excluding where such expansion will occur behind the development setback line	Existing surface water canals will have to be expanded during the rehabilitation and upgrading of the Mine Residue Facility, pollution control dams and surface water management systems. This will occur closer than 32 metres from a watercourse.
Activity No: 47	The widening of a road by more than 6 metres, or the lengthening of a road by more than 1 kilometre (i) where the existing reserve is wider than 13.5 metres; or excluding widening or lengthening inside urban areas	During the upgrade of the Mine Residue Facility and pollution control dams, the width of existing roads in the area will have to be increased by more than 6 metres to accommodate earthmoving equipment.

[1] The drilling of the refuge bay boreholes in wetlands are excluded as actions/infrastructure triggering this listed activity due to the removal of less than 5 m^3 from the watercourse and no deposition of material that took place during the drilling of the boreholes.

Table 2-2: Activities requiring a Scoping and Environmental Impact Assessment Process (Listing Notice 2, GN 545 of 18 June 2010)

Activity No	Description of Activity as per GNR 545	Activity or Infrastructure Triggering the Activity
Activity No: 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.	The existing Mine Residue Facility and pollution control dams of Delmas Coal are to be remediated and upgraded. The Mine Residue Facility and pollution control dam(s) require a Section 21(g) water use license for the disposal of waste in terms of the provisions of the National Water Act. As Section 21(g) controls the release of pollution and effluent, Activity 5 of GNR 545 is triggered. A Water Use Licence was granted in 2015 by the DWS.

Table 2-3: Activities triggered in terms of Listing Notice 3 (Government Notice Regulation R546 of 18 June 2010 for a Basic Assessment)

Activity No	Description of Activity as per GNR 546	Activity or Infrastructure Triggering the Activity
Activity No: 14	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for: (1) purposes of agriculture or afforestation inside areas identified in spatial instruments adopted by the competent authority for agriculture or afforestation purposes; (2) the undertaking of a process or activity 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 the activity is regarded to be excluded from this list; (3) the undertaking of a linear activity falling below the thresholds in Notice 544 of 2010.	For the reconstruction of the pollution control dam an area of more than 5 hectares, containing indigenous vegetation, may have to be cleared. A construction camp and lay-down area will also be required.

2.2.3 National Water Act, 1998 (Act No. 36 of 1998)

The NWA guides the management of water in South Africa as a common resource. The Act aims to regulate the use of water and activities which may impact on water resources through the categorisation of 'listed water uses' encompassing water extraction, flow attenuation within catchments as well as the potential contamination of water resources, where DWS is the administering body in this regard.

Section 21 of the NWA defines various water uses, while Section 22 requires that a person may only use water if licensed in terms of the NWA. The "use" of water does not

necessarily mean the consumptive use thereof, but as can be seen from **Table 2-4** below covers the aspects that have or could have an impact on a water course and that have been authorised in the 2015 WUL.

Table 2-4: Water uses in terms of Section 21 of the National Water Act (NWA) requiring licensing in terms of the provisions of Section 22 of NWA.

Water Use	Description of Water Use	Delmas Coal activity requiring a Water Use Licence
Section 21(a)	Taking water from a water resource	Abstraction of water from the South shaft borehole for circulation at South Shaft and use in the underground workings, as well as abstraction of water from Pit G at Ikhwezi Colliery for uses at the processing plant and in the offices and change house.
Section 21(b)	Storing water	56m^3 reservoir for the storage of water from the South Shaft borehole, before the water is used within the change house, offices and workshop at the South Shaft Complex
Section 21(c) & (i)	(c) Impeding or diverting the flow of water in a watercourse, and (j) Altering the bed, banks, course or characteristics of a watercourse	Existing buildings and roads within wetlands and within 500 m of wetlands. Infrastructure at North and South Shaft were constructed within wetlands and/or within 500 m of wetlands.
Section 21(g)	Disposing of waste in a manner which may detrimentally impact on a water resource	The storage of the impacted mine water within the plant dams, the PC dams, the Mine Residue Facility, the stockpiles, the south shaft dam, the underground dam and within Ikhwezi Colliery Pit G. A 21(g) licence is also required for the use of 3 septic tanks to contain sewage waste and for the use of water containing waste to suppress dust around the mining area.
Section 21(j)	Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people	Abstraction of steady state seepage from the underground workings for the safe continuation of mining

2.2.4 National Environmental Management: Waste Act (Act 59 of 2008)

A new era of an integrated waste management system in South Africa through the NEM:WA has been established. The NEM:WA came into effect in July 2009. Provisions have been made in the form of legislative and regulatory tools to facilitate and ensure implementation of the Act by all spheres of government. To this end, the Minister of the Department of Water and Environmental Affairs published a Waste Management Activity List in July 2009 which had clear thresholds on waste activities that need authorisation prior to commencement. The published Waste Management Activity List effectively replaced Schedule 1 of the NEMA and all waste related activities listed in EIA lists.

Subsequently the list of waste management activities was updated in November 2013 by GN 921 and GN 926. GN 921 lists the updated activities, but the storage of waste is now dealt with through a set of norms and standards, as included in GN 926. According to GN 921 a listed activity can either trigger a Basic Assessment, a full Scoping and EIA process or adherence to the norms and standards as per GN 926. List of Waste Management Activities which have, or are likely to have a detrimental effect on the environment was further amended in May 2014 with the deletion in Category A of activity

3 (8). Listed below, in **Table 2-5**, are the waste management activities triggered by the proposed Delmas Coal project. The triggering of listed activities in Category B, indicated that a S&EIR process must be conducted for the project.

Table 2-5: Waste Activities requiring a full Scoping and EIA process.

Activity Numbers	Description of each Listed Activity:
Category B: 4(3)	The recovery of waste including the refining, utilisation or co-processing of waste at a facility with a capacity to process in excess of 100 tons of general waste per day or in excess of 1 ton of hazardous waste per day, excluding recovery that takes place as an integral part of an internal manufacturing process within the same premises. More than 1 ton of coal discard will be recovered for use in the KiPower IPP.
Category B: 4(7)	The disposal of any quantity of hazardous waste to land. The disposal of discard and slurry on the Mine Residue Facility.
Category B: 4(10)	The construction of a facility for a waste management activity listed in Category B of this schedule (not in isolation to associated activity). Construction of the proposed new Mine Residue Facility.

2.2.5 National Environmental Management: Air Quality Act (Act 39 of 2004)

The object of this Act is -

- To protect the environment by providing reasonable measures for -
- The protection and enhancement of the quality of air in the RSA;
- The prevention of air pollution and ecological degradation; and
- Securing ecologically sustainable development while promoting justifiable economic and social development.

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. In the case of Delmas Coal, no activities requiring an Atmospheric Emissions Licence will be undertaken, but migratory measures are proposed to ensure compliance with ambient air quality standards.

2.2.6 The National Heritage Resources Act (No. 25 of 1999)

The National Heritage Resources, 1999 (Act No. 25 of 1999) legislates the necessity for cultural and heritage impact assessment in areas earmarked for development, which exceed 0.5 ha. The Act makes provision for the potential destruction to existing sites, pending the archaeologist's recommendations through permitting procedures. Permits are administered by the South African Heritage Resources Agency (SAHRA). Should the proposed activities impact on heritage resources, application to SAHRA would be required to obtain the necessary permits. A Heritage Impact Assessment was not conducted for this project as the reconstruction of the pollution control dams and the remediation of the Mine Residue Facility is being carried out on a brownfield site, and the mine extension will not impact on any surface resources. A grave yard is located on the eastern edge of the Mine Residue Facility but will not be impacted on by the construction activities. Mitigatory measures to protect the graveyard are proposed in the EMPr Amendment.

2.2.7 National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)

The purpose of the Biodiversity Act is to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA and the protection of species and ecosystems that warrant national protection. As part of its implementation strategy, the National Spatial Biodiversity Assessment was developed. Should protected species and ecosystems be impacted on by the proposed substation upgrade or power line deviation, this Act may be applicable and the necessary measures should be taken for implementation.

2.2.7.1. National Spatial Biodiversity Assessment

The National Spatial Biodiversity Assessment (NSBA) classifies areas as worthy of protection based on their biophysical characteristics, which are ranked according to priority levels.

2.2.8 Protected species – Provincial Ordinances

Provincial ordinances were developed to protect particular plant species within specific provinces. The protection of these species is enforced through permitting requirements associated with provincial lists of protected species. Permits are administered by the provincial departments responsible for environmental affairs.

2.2.9 Mine Health and Safety Act (Act No 85 of 1993)

This Act makes provisions that address the health and safety of persons working at the proposed substation and power line. The Act addresses amongst others the:

- Safety requirements for the operation of plant machinery;
- Protection of persons other than persons at work against hazards to health and safety, arising out of or in connection with the activities of persons at work;
- Establishment of an advisory council for occupational health and safety; and
- Provision for matters connected therewith.

The law states that any person undertaking upgrades or developments for use at work or on any premises shall ensure as far as is reasonably practicable that nothing about the manner in which it is erected or installed makes it unsafe or creates a risk to health when properly used.

2.2.10 Mineral and Petroleum Resources Development Act (Act 28 of 2002)

The Mineral and Petroleum Resources Development Act (MPRDA) is the central Act governing mining in South Africa. The MPRDA repealed the Minerals Act, 50 of 1991 when it came into effect on 1 May 2004. The preamble to the MPRDA affirms the State's obligation to protect the environment for the benefit of present and future generations, to ensure ecologically sustainable development of mineral and petroleum resources and to promote economic and social development.

Broadly speaking, the MPRDA seeks to fulfil the obligation of the State to protect the environment and to ensure ecologically sustainable development through a system requiring a person who wishes to conduct mining operations to prepare and have approved an EMPR and to manage the environmental impacts of its mining operations in accordance with the provisions contained in such an EMPR. The legislative bases relating to the management of the environmental impact of mining operations are set out

in Chapter 4 (sections 39 to 47) of the MPRDA. The formal and substantive requirements with respect to the management of the environmental impacts of mining operations (particularly with respect to EMPRs) are substantiated in Part III of Chapter 2 of the Mineral and Petroleum Resources Development Regulations (MPRDR) promulgated in terms of Government Notice Regulation (GNR) 527 of 23 April 2004 (as amended).

3. PROJECT DESCRIPTION

3.1 Project Location

Delmas Coal is located in the Mpumalanga Province, approximately 20 km south-east of the town of Delmas. Delmas Coal consists of two shaft areas containing mining and associated infrastructure, these areas are the North Shaft and South Shaft complexes. North Shaft is located on Portions 25 and 29 of the farm Haverklip 265 IR and remainder of the farm Haverglen 269 IR. The South Shaft is located on Portion 10 and remaining extent (RE) of the farm Enkeldebosch 301 IR. The Delmas Coal underground operations covers an extensive area below and between the two shafts.

3.1.1 Mineral Rights Holder

Delmas Coal has submitted an application to the Department of Mineral Resources (DMR) to apply for ownership of the mineral rights currently within a transactional area that belongs to Ingwe Collieries Limited. The transactional area is an area that Delmas Coal was permitted to mine in as a result of the mining rights being in the process of transfer from South32 Coal Holdings Limited [2](CSA) to Delmas Coal. As is indicated in **Figure 1-1**, Delmas Coal owns a smaller No. 4 seam mining rights area (indicated as the current 4 seam mining area) within the Kuyasa Transactional area. The mining rights being applied for are shown in **Figure 1-2**, indicated as the proposed mining rights. For No. 4 seam coal, there is an area that is excluded from the application (as indicated in the figure). The proposed mining extension, of both No. 2 and 4 seam coal, falls within the proposed mining rights boundary. The proposed mining right application has been submitted to the DMR for approval.

3.2 Background

The Delmas Coal mine commenced mining in 1964. The mine was bought by Kuyasa Mining in 2002. The mine consisted of the North Shaft, South Shaft and Salomon Shaft, where processing of coal took place at North Shaft and from there was taken by rail to the relevant clients. The Salomon Shaft has since been decommissioned and the shaft has been closed. Delmas Coal now mines coal near South Shaft and transports it by means of underground conveyor to North Shaft for processing and/or stockpiling before being distributed.

Delmas Coal now seeks to extend the life of the mine by acquiring additional coal reserves. In order to do so, the 1997 EMPR must be updated, to meet the latest environmental performance requirements and legislation and include the new mining areas and upgraded infrastructure.

Coal mining may adversely affect water quality and the impacted water can pose a risk when entering the receiving environment. Delmas Coal is, however, a dry mine that does not produce large amounts of water during mining. The mine does, however, have surface stockpiles that are exposed to surface water and a Mine Residue Facility and PC dams in close proximity to the processing plant that require remediation and upgraded surface water infrastructure to manage potential contamination of the environment. These facilities at North Shaft have been in operation for many years prior to it being owned by Kuyasa Mining. The lining of the Mine Residue Facility or the PC dams was not required in terms of legislation when these facilities came into operation.

[2] Formerly BHP Billiton Energy Coal South Africa

3.3 Proposed Project

The following are aspects proposed to be upgraded and/or extended as a part of this project:

- Proposed underground mining extension;
- Upgrading of the PC dams
- Upgrading of the Dirty water systems at the plant;
- Proposed reshaping/upgrading of the Mine Residue Facility.

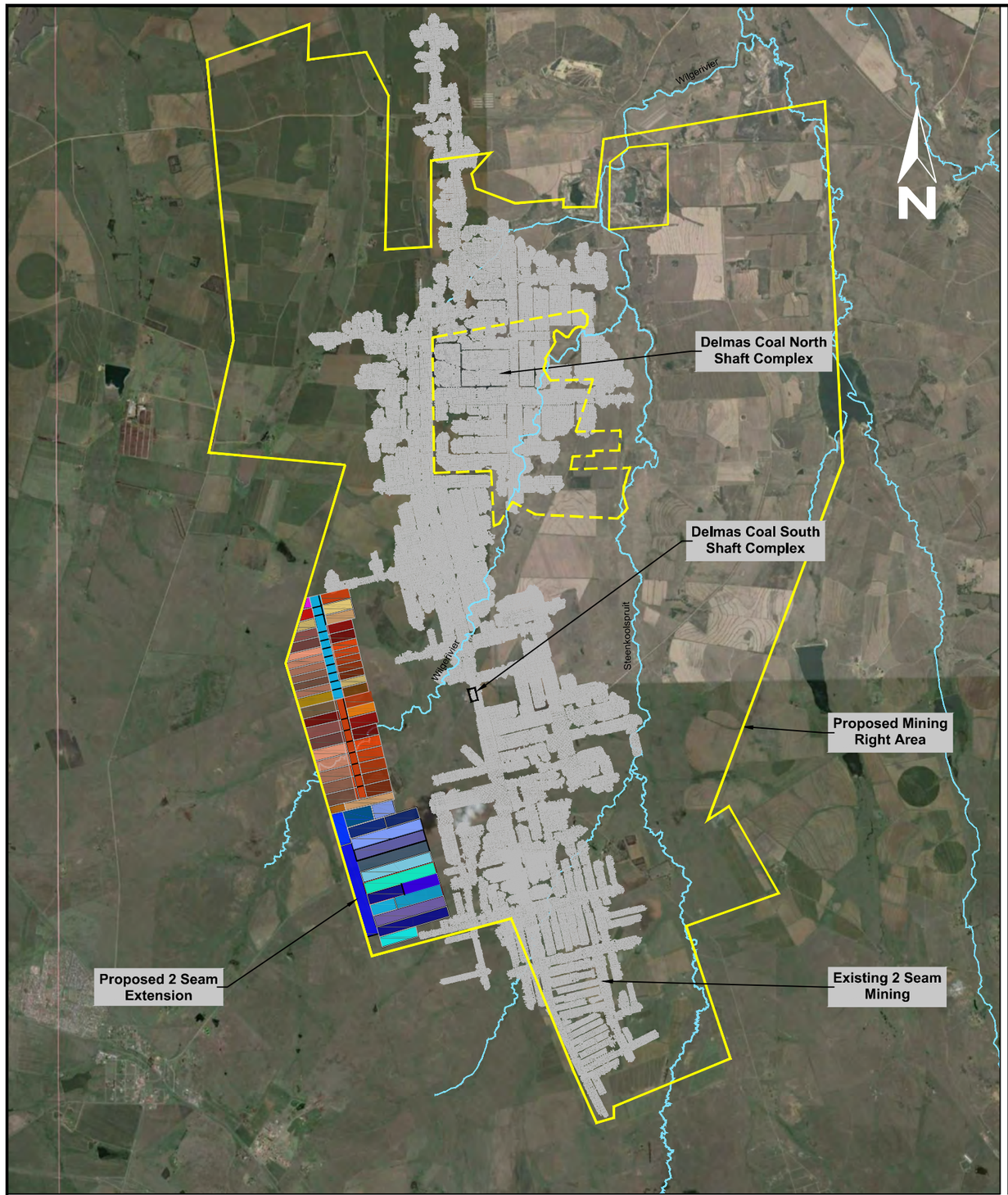
Each of the above aspects are described in detail below.

3.3.1 Proposed underground mining extension

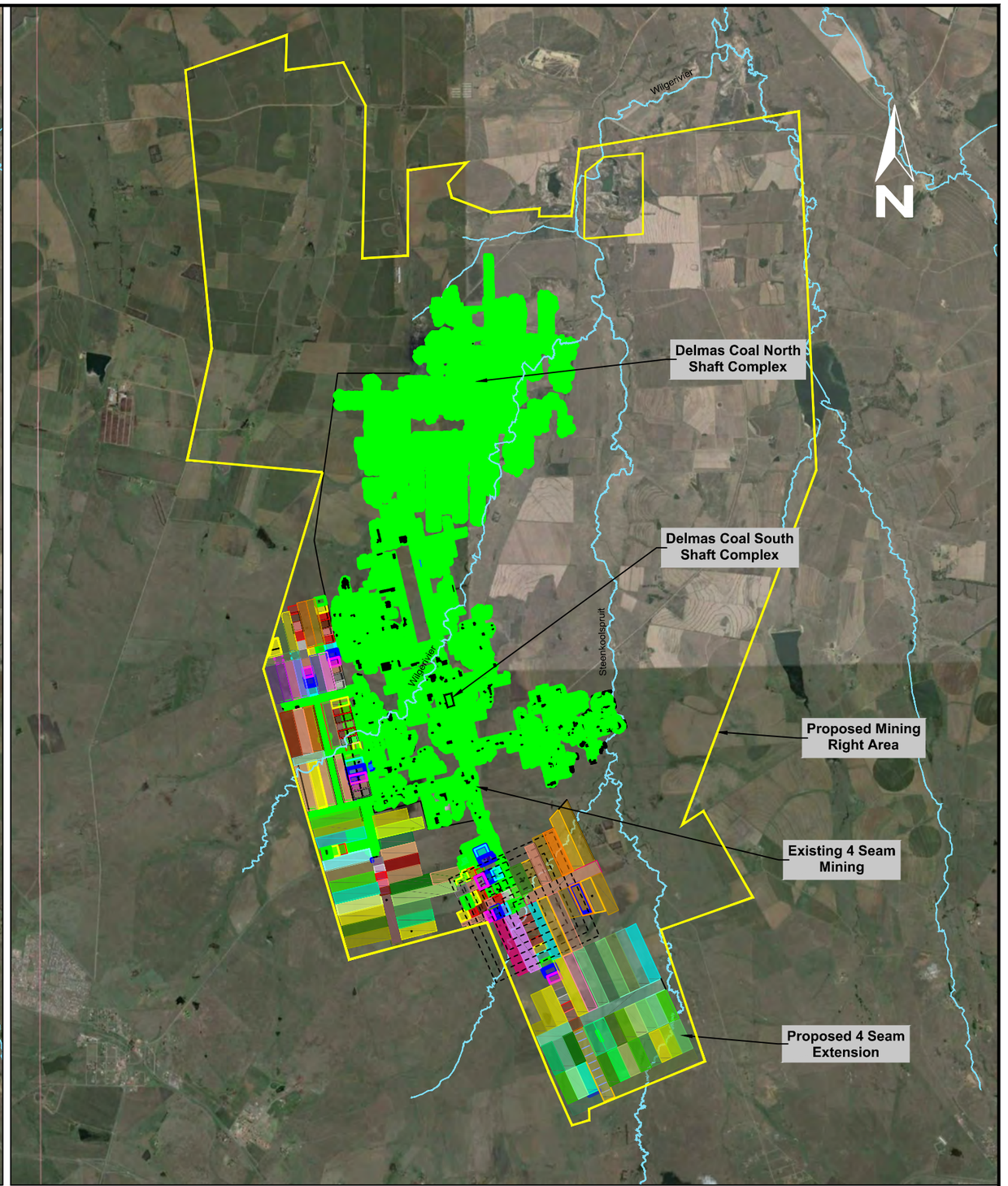
Delmas Coal has identified mineable coal reserves adjacent to their existing underground operations. The identified coal reserves to be mined are No. 2 and 4 seam coal and are located to the south and southwest of the current underground workings and within the existing mining rights area see **Figure 3-1.**

Delmas Coal proposes to mine the extension by underground, bord and pillar methods. Access to the proposed extension will be via the South Shaft and therefore no new shafts will be sunk. Coal that is mined at South Shaft is already transported by underground conveyor to the North Shaft coal processing plant. The new mining reserves will be transported in the same manner. No. 2 seam coal will be washed in the processing plant prior to storage on the North Shaft stockpiles. Both No. 2 seam and No. 4 seam will be transported by rail to the relevant power stations using the existing railway lines.

Associated with the proposed extension of the Delmas Coal underground mining operations, is the drilling of refuge bay boreholes from surface into refuge bays/chambers on both No. 2 and 4 seams. These refuge bays are required to provide shelter to underground workers in the event of an emergency situation underground. The boreholes are utilised to provide ventilation to the refuge bays and to provide food and water to persons in the chamber until such time that they could be rescued. Some refuge bays have already been constructed for existing mining operations that will also service the mining extension and there will be a few additional refuge bays constructed for the mining extension. **Figure 3-2** indicates various existing and proposed refuge bays required for the mining extension.



SEAM 2 UNDERGROUND



SEAM 4 UNDERGROUND

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Delmas Coal (Pty) Ltd
EIR / EMPR

PROPOSED MINING EXTENSIONS IN RELATION TO EXISTING MINING

Job No: D910-04

Figure 3-1

North Shaft
Mine Offices
& Processing Plant

Mine Residue Facility
Discard Dump

Primary Pollution
Control Dam

Secondary Pollution
Control Dam

N

Wilge River

Steenkoolspruit

Delmas Coal
South Shaft

Devon

R29

N17

Legend

- Proposed UG Mining Extension
- Proposed Refuge Bays
- Proposed Mining Right Area
- Portion Excluded For 2 Seam Coal Mining Rights
- 1:100 Year floodlines
- 1:50 Year floodlines

Google Image
Scale 1 : 50 000 (A3)

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Delmas Coal (Pty) Ltd
EIR / EMPR

LOCATIONS OF REFUGE BAYS AT DELMAS COAL

Job No: D910-04

Figure 3-2

3.3.2 Upgrading of the PC dams

3.3.2.1. Primary PC dam (PC dam silt trap)

In order to reduce and control the release of contaminated water into the natural water resources, Delmas Coal initiated a project to reconstruct the PC dams. It is also required to upgrade existing related water infrastructure (discussed below) in order to reduce the discharge of polluted water into the receiving environment but rather into the upgraded PC Dams.

The smaller, Primary PC Dam captures polluted run-off and process water from the plant before the water is decanted into the Secondary PC dam. Currently the Primary PC dam captures silt and sediment in the dam and thus limits the ability of the dam to retain sufficient water in the storm water management systems. It is proposed to convert the PC dam to a formalised reinforced concrete silt trap –see **Figure 3-3**.The waste water that is received by both PC dams has been classified as a Type 3 waste (see **Appendix D** of the Design Report, which is attached as **Appendix B** of this report). The silt trap's barrier design must therefore comply with the performance requirements of a Class C barrier system – see **Table 3-1**.

The proposed silt trap has been designed to provide sufficient settling time for particles larger than 0.2 mm up to flood events equal to the 1:10 year storm event. The proposed silt trap will consist of four compartments with all four being utilised during normal operations. Provision has been made for the removal of silt from the compartments from time to time during operation and maintenance. The silt can then be removed with a front end loader (typically a TLB), and placed onto the drying slab adjacent to the silt trap. Once the silt has dried out sufficiently, it can be loaded onto a truck and disposed of on the residue disposal facility. During maintenance (or cleaning of the silt trap), inflows can be diverted into one half (e.g. two compartments) of the silt trap, enabling access to the other half. The concrete floor of the silt trap will be protected by casting steel rail sections into the floor. The water emanating from the silt trap will report to the reconstructed synthetically lined PC Dam, currently termed the Secondary PC Dam. A detailed design report, is included in **Appendix B** of this DEIR/EMPR amendment.

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Delmas Coal (Pty) Ltd
EIR / EMPR

PROPOSED PC DAM SILT TRAP AND CUT-OFF DRAINS

Job No: D910-04

Figure 3-3

3.3.2.2. Lined PC dam (Secondary PC dam)

The Secondary PC dam is the larger of the two existing PC dams. It captures all run-off waste water from the plant and any overflow from the Primary PC dam. The Secondary PC dam was constructed as a part of the North Shaft infrastructure when the mine was opened. The requirements to line the dam were not present at the time of the construction of the dam and thus it is not lined with any synthetic liner systems that are required for current legislation.

The PC Dam is located at the topographical low of the North Shaft area. It is proposed to reconstruct the Secondary PC dam to a large, lined facility. **Figure 3-4** shows option 1 or alternative 1 of the proposed new PC Dam design (see **Section 4** of this report for all alternatives assessed). Like the primary PC dam, the impacted mine water collected in the existing PC dams was assessed as a Type 3 waste. This new facility must therefore be provided with a Class C single composite barrier system (refer to the waste classification report in **Appendix B** of the Design Report (**Appendix B** of this report) for more details in this regard).

The material specifications for the composite liner system is provided in **Table 3-1**. All membranes will be double textured to aid veneer cover stability.

Table 3-1: Liner material specifications for a Class 3 barrier system

Layer Description	Layer thickness	Material/treatment
Geomembrane cover protection and ballast	150 mm	Concrete/Soilcrete filled geocells with geotextile cushion
Geomembrane	1.5 mm	HDPE double-textured geomembrane
Compacted clay liners	300 mm	Selected clay, compacted to 98% Proctor at +1% to +3% OMC in 2 layers of 150 mm each borrowed from site
Leakage detection layers	150 mm	Graded filter sand/geocomposite
Base preparation layer	150 mm	Spoils rip and re-compacted to 95% Proctor density at -2% to +2% OMC

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EIR / EMPR
PROPOSED LINED PC DAM

Job No: D910-04

Figure 3-4

The reconstructed PC dam will comprise of two lined earth embankment compartments – see **Figure** 3-4**.** The proposed liner consists of a single composite liner with surface lining on top of the single composite liner. The surface lining (protection layer) consists of concrete and soil-crete filled geo-synthetic cells, which allows for the removal of silt by means of power washing and sludge pumps. The single composite liner is underlain by a leakage detection system. The flow to the two compartments can be regulated to allow for maintenance and to ensure that sufficient storage capacity is maintained to accommodate a possible flood event. A total freeboard height of 1.2 m has been designed for to cater for a 1:50 year flood event. Excess water from the PC dam will be pumped for reuse in the coal processing plant. Factors considered in the design of the PC dam included dam sizing, the liner system and flood calculations.

The Lined PC Dam will be constructed with a leakage detection layer, which will discharge into a sump from where leakage water will be pumped back into the Lined PC Dam.

During construction of the lined PC dam, a temporary access road will be constructed to provide access to the construction site. This road is proposed to extend from the current substation, past the ventilation shaft – see **Figure 3-4**. The road will be 5 m wide, allowing for one-way traffic during the construction phase. After construction, the access road will be extended to the north, past the Lined PC dam's wall. It will then continue in a southerly direction, along the dam's toe line to the pump station. This 5 m wide road will provide access for operation and maintenance of the pump station itself. Ample turning space for large vehicles will be provided at the pump station. This road will be maintained and inspected on a regular basis.

Some key parameters pertaining to proposed lined PC dam are shown in **Table** 3-2 below:

Table 3-2: Proposed PC dam details

Capacity (FSL)	196 000 m^3 (2 x 98 000 m^3 compartments)
Freeboard	1.2 m above full supply level.
Liquid stored	Contaminated surface runoff and seepage from the Mine Residue Facility.
Construction	Lined earth embankment dam.
Leakage control	Single composite barrier system (liner) with leakage detection.
Overflow	Spillway leading to existing Wilge River.

3.3.3 Upgrade of dirty water management system

Clean and dirty water management areas are indicated in drawing **D706-00-001** in **Appendix E** of the Design Report (**Appendix B** of this EIR / EMPR amendment). The coal processing plant, coal stockpile areas, workshop areas and Mine Residue Facility are regarded as dirty areas, whilst the offices, parking areas and other open areas are generally regarded as clean surface water run-off areas.

Surface runoff from dirty areas is currently collected in damaged or inadequate concrete lined dirty water drains. These drains feed into the primary and secondary PC dams. Runoff from clean areas, such as the open area upstream of the secondary PC dam, is currently flowing into the dirty water system, which needs to be rectified.

The southern boundary cut-off drain, which skirts the southern boundary of the residue disposal facility is proposed to be upgraded. This cut-off drain will replace the existing southern boundary drain, which has been washed away or damaged in several places, and will include an HDPE barrier to prevent the movement of shallow groundwater beyond the site's boundary. Refer to **Figure 3-3** for the location of the proposed drain.

Another drain will be constructed on the northern boundary of the site as indicated on **Figure 3-3**, for the product area that currently lies outside of the dirty water management area and drains.

3.3.4 Pump and pipeline route from the PC Dam to plant

A new pipeline will be required from the proposed lined PC dam to the processing plant adjacent to the Mine Residue Facility. The water returned to the plant will be used for general plant use and coal washing purposes. The pipeline route is shown from chainage 0 m to 960 m in drawing **D706-00-031**, in **Appendix C** of the Design Report in **Appendix B** of this EIR/EMPR amendment.

The pipeline will be a buried HDPE line running northwards along the crest of the PC dam, where after it will turn west towards the incline conveyor and be constructed parallel to this structure into the plant. In the event that insufficient water is available in the lined PC dam, water will be provided from either Pit G of Ikhwezi Colliery or in the future from the KiPower Power Plant water supply pipeline.

Generally accepted minimum and maximum flow velocities in non-gravity flow general service pipelines in industrial applications are 0.7 m/s and 1.5 m/s respectively. The minimum velocity is the velocity needed to prevent sedimentation build-up in the pipeline, while the maximum velocity minimizes pipe erosion, piping friction losses and associated pumping costs. Detailed calculations pertaining to the maximum flows are outlined in the Design Report (**Appendix B**).

A pump will be required to maintain the flow of maximum efficiency from the PC dam to the processing plant. The pump selections will be made during the detailed design phase of the project, and will be selected to pump at or near maximum efficiency under normal (average) conditions. All pump installations will include a standby pump set.

The operation of the pump systems will run independently from each other as they are not integrated in any way. The leakage detection sump pumps will be operated as requested, while the larger pump station will operate for a continuous 12 hours per day. Technical specifications will be developed during the detailed design phase of the project.

3.3.5 Mine Residue Facility

The Mine Residue Facility or discard dump and slurry ponds at Delmas Coal is used for the disposal of coal fines and slurry from the processing plant, as well as discard material from the coal processing plant and other mining related waste over its years since construction. From auger holes drilled into the Mine Residue Facility it was determined that a clay lining was used in the construction of the mine facility.

The residue disposal facility has, however, over the years been seeping into nearby surface water and groundwater resources. The facility has been undermined (both No. 2 seam and No. 4 seam coal) – see **Figure 3-1**.

In an effort to reduce and mitigate the seepage from the facility, taking into consideration future loading requirements of the Mine Residue Facility, and the resultant stability of the facility it is proposed to rehabilitate or upgrade the Mine Residue Facility and upgrade its associated infrastructure.

Several options for the upgrading and rehabilitating the facility have been considered and are assessed in detail as part of **Section 4.4.** The following are possible alternatives being investigated for the proposed upgrading or remediating the Mine Residue Facility:

- Use of the facility within the existing footprint and upgrading the drains and surrounding infrastructure. The airspace above the slurry dams will be used for the

deposition of slurry and therefore the full capacity of the Mine Residue Facility will be reached sooner;

- Use of the facility within the existing footprint and upgrading the drains and surrounding infrastructure, however using the air space above the slurry dams for the deposition of discard. This will mean that in the future a new slurry handling facility will need to be developed on another foot print;
- Recovery of discard from the Mine Residue Facility for the purpose of fuel for the KiPower IPP Plant. Discard that is not suitable for use in the power station will be placed on the existing Mine Residue Facility footprint – see **Figure 3-5**. This is the preferred option.

  In all instances the Mine Residue Facility will be capped once it reaches its capacity. Progressive capping will be undertaken should the facility be mined.

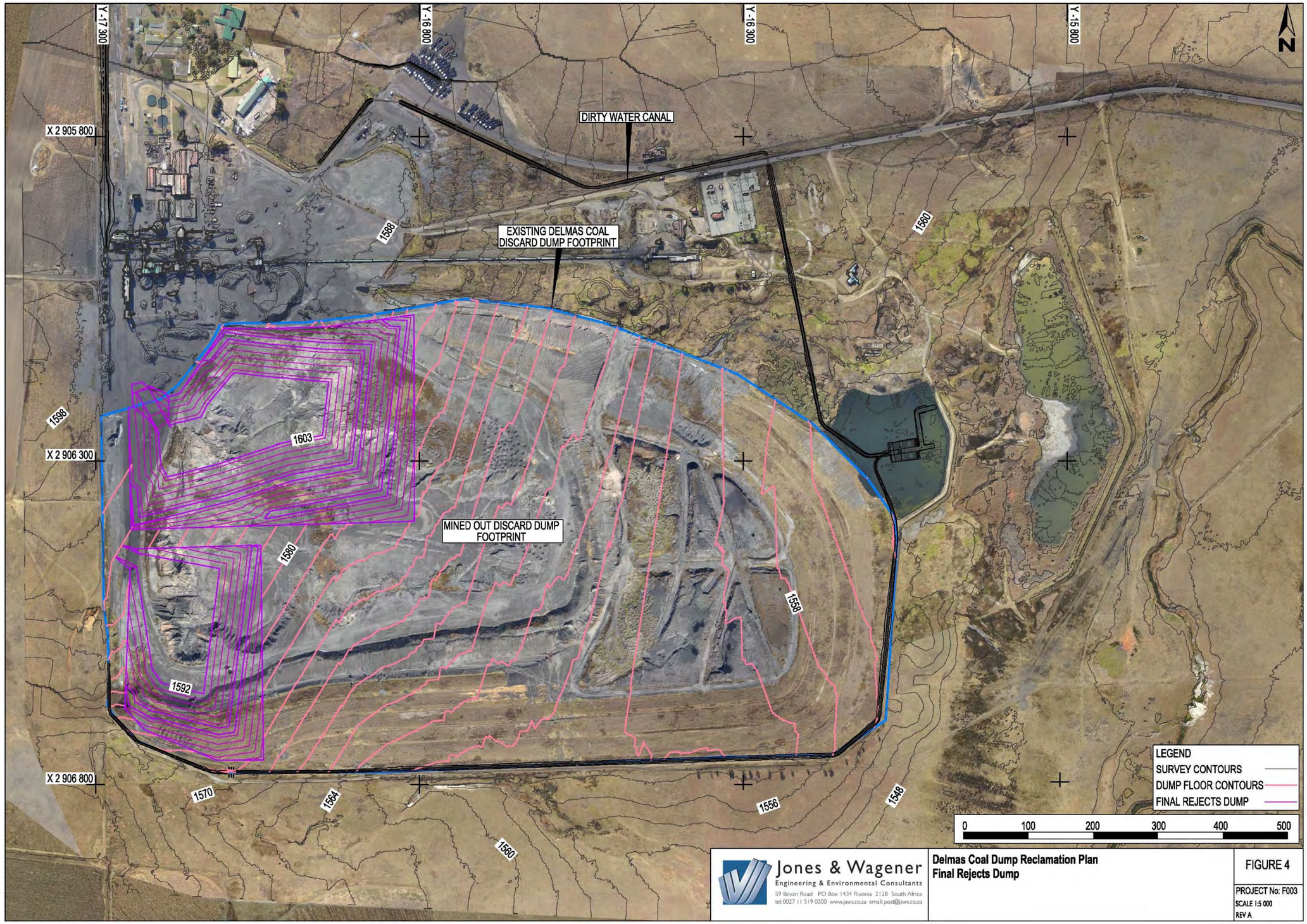

Figure 3-5: Final proposed layout of the Mine Residue Facility (Option 3)

3.4 Need and Desirability

South Africa is primarily reliant on electricity generation from coal-fired power stations. Renewable and alternative energy sources, including nuclear energy cannot yet meet the demands of the country's electricity needs. Coal mining is therefore crucial to South Africa for the supply of coal to meet the energy needs of our developing economy. Delmas Coal's provision of coal to Eskom plays a role in sustaining the energy needs of the country and contributes to the economy positively. In addition, Kuyasa Mining intends to construct and operate a 600 MW mouth of mine power plant, which will obtain low grade coal from Delmas Coal. The utilisation of the low calorific coal and discard coal in the KiPower Power Plant will have a positive impact on the environment namely:

- Energy will be recovered from a low grade resource that has traditionally been discarded as a waste. The resource will be positively used. The energy spent to have mined the material is therefore not wasted;
- The conversion of the low grade coal to energy and ash will have a lesser potential impact on the water environment than the discard. The pollution potential of the ash is significantly less than that of the discard coal.

The use of fossil fuels for electricity generation is a major contributor to greenhouse gas emissions and is regarded by some as an unsustainable practice in the long run. Coupled with that, coal mining in general impacts heavily on the natural and social environment. Therefore, it is essential that coal mining must be conducted as efficiently and sustainably as possible in order to reduce its environmental impact as part of the value chain of fossil fuel usage for electricity generation.

It was identified that Delmas Coal is encountering issues of seepage from the Mine Residue Facility and siltation of the PC dams that may allow for overflow of impacted mine water into the nearby Wilge River. The surface water drains around the Mine Residue Facility will therefore be upgraded to intercept polluted surface water run-off and shallow seepage. The residue facility itself is proposed to be reclaimed as an energy source and the existing facility is proposed to be re-used to dispose of that material not suitable as an energy source

The proposed project will therefore ensure that the mine will reduce its current effects on the receiving environment in order for the mine to extend it's years of operation in an environmentally sustainable manner. In addition to the water management issues, air quality will also be addressed at the mine in order to improve the ambient air quality around the mine.

The proposed underground mining extension will allow for continued coal supply to the ever increasing power needs of the country.

The upgrades, reconstruction and remediation of the Mine Residue Facility and PC dams as well as the additional mining will have the following benefits:

- The proposed PC dam reconstruction will minimise the risk of contaminated runoff overflowing to the surrounding environment and will contribute to improved surface water management;
- The proposed recovery of waste from the Mine Residue Facility will reduce size of facility (with progressive capping) and the upgraded canals and silt trap will ensure dirty water is managed within the dirty water system and therefore reduces the size of the impact, the facility has on receiving environment;
- Interventions at the coal processing plant and recovering waste and progressive capping Mine Residue Facility during the proposed upgrading process to reduce

spontaneous combustion will improve the ambient air quality in the vicinity of the North Shaft of the mine; and

- The proposed underground mining will extend the life of mine and therefore extend the duration of employment for current employees, which amounts to approximately 600 direct jobs, which contributes positively to the economic welfare of the Delmas area and the country.

3.5 Existing Infrastructure / Operations

3.5.1 Buildings

The mine comprises two building complexes, North and South Shaft. North Shaft contains the offices, conference venue, equipment workshops, laboratories, change house, kitchen, stores, assembly area, general and hazardous waste area, diesel tanks, three dams for storage of raw water (North Shaft Dams 1, 2 and 3), North Shaft Plant Golf Course tank; South Shaft Balancing Tank; conservancy (sewage) tanks, ROM coal and product stockpiles, coal processing plant, incline shaft electrical substation, railway line and load out area, surface water management berms and V-drains, silt traps, discard dump and slurry ponds and two unlined PC dams, termed the Primary and Secondary PC dams – see **Figure 3-6**.

South Shaft comprises of offices, a change house, offices sewage treatment works; general and hazardous waste storage area, a workshop and assembly area, diesel storage tanks, change house dam, concrete dam, South Shaft Dam for the storage of raw water, South Shaft borehole, a silo for the storage of dust-a-side; and a vertical shaft. All coal mined in the South Shaft area is transferred underground to the North Shaft area by means of an underground conveyor. At the North Shaft Complex, the conveyor daylights, and is conveyed to the North Shaft plant for washing and processing – see **Figure 3-7**.

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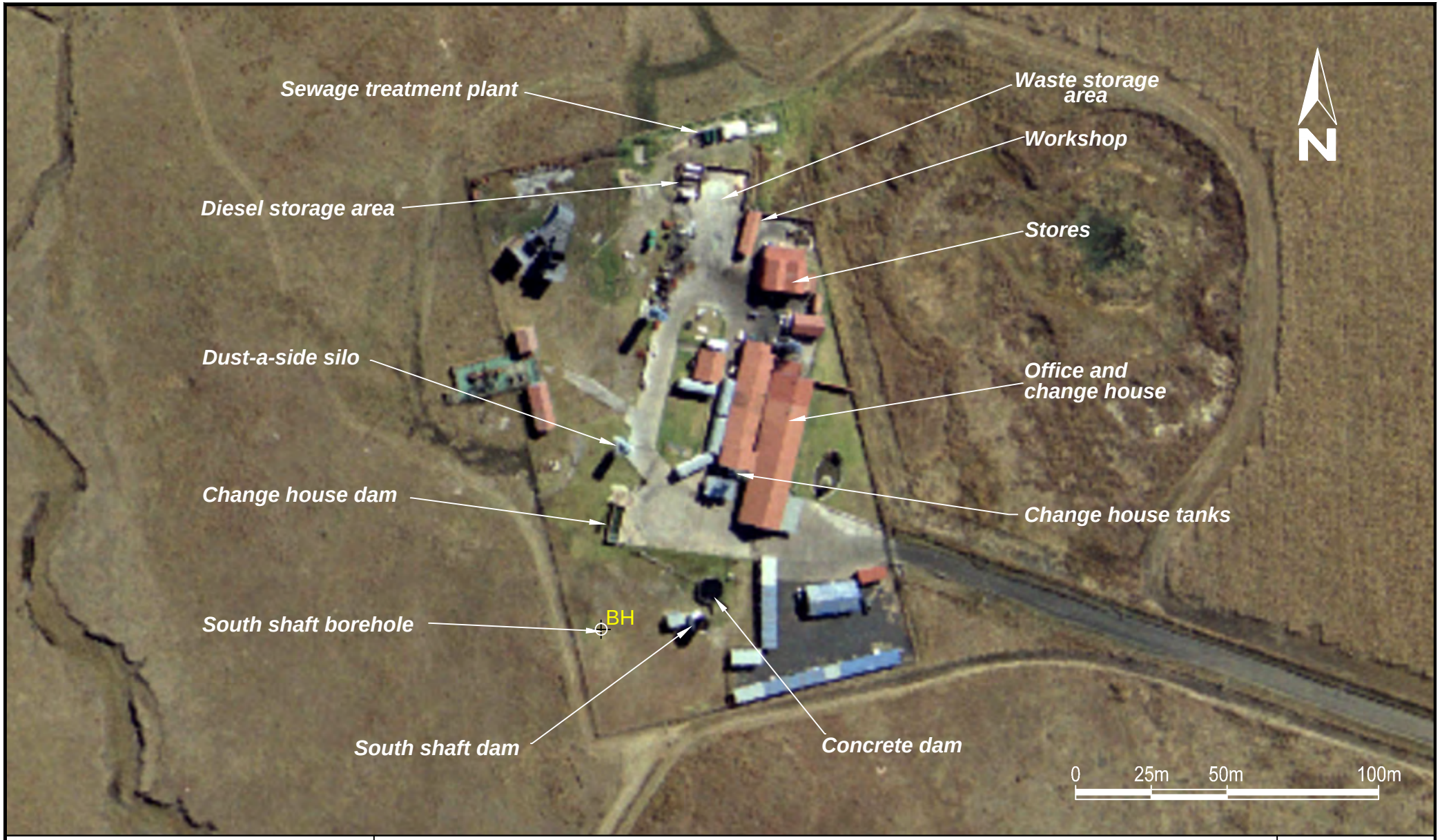
EIR / EMPR

EXISTING INFRASTRUCTURE AT THE NORTH SHAFT COMPLEX

Job No: D910-04

Figure 3-6



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Delmas Coal (Pty) Ldt

EIR / EMPR

EXISTING INFRASTRUCTURE AT THE SOUTH SHAFT COMPLEX

Job No: D910-04

Figure 3-7

3.5.2 Roads

The R50 provincial road and D1059 district road are situated in close proximity to the Northern and Eastern boundaries of the mining area respectively. Access to the mine's North Shaft is gained from the R50 by a side road, which becomes a private road where it enters the Delmas Coal property.

There is also an access road from the tarred D1059 district road to the North Shaft, which is mainly used by the coal haul trucks. The D1059 links the R50 to Devon located to the south of Delmas Coal. The access roads are gravel roads and are used by private vehicles and trucks hauling coal. Internal haul roads and roadways within the mining complex are also gravel roads. Roads are regularly wetted to minimise dust suppression.

Access to the South Shaft complex is from the D1059 only.

3.5.3 Conveyors

Conveyors are used to transport coal at two main areas, namely:

- From the working sections (in the vicinity of South Shaft) coal is conveyed underground to North Shaft.
- At North Shaft, coal is transported from the underground works overland to the processing plant.

3.5.4 Railway

A railway siding is operational at Delmas Coal and is situated to the west of the processing plant. This enables Delmas Coal to distribute its coal via the national rail network to consumers. The siding belongs to Delmas Coal.

3.5.5 Power lines

A total of five Eskom power lines are present around Delmas Coal North Shaft and the adjacent Ikhwezi Colliery:

- Four 275kV lines, including:
  - o No.1 Matla/Nevis line;
  - o No.2 Matla/Nevis line;
  - o No. 1 Matla/Esselen line; and
  - o No. 1 Matla/Benburg line.
- 88 kV Brakfontein Delmas Colliery line connects to the Delmas Coal substation (429672) which is located just north of the existing primary PC dam.

3.5.6 Pipelines

There is an existing pipeline that runs along the haul road between the Delmas Coal plant and the neighbouring Ikhwezi Colliery Pit G. Water from the pit is used as a part of the process water.

Note that there are a range of pipelines used on site to transfer water from various storage dams and tanks to the processing plant and other infrastructure, as well as slurry from the coal washing plant to the slurry dam area.

3.6 Major Activities of the Overall Project

There are five main phases within the proposed project, namely:

- Planning / Definition Phase;
- Construction Phase;
- Operational and Maintenance Phase; and
- Decommissioning / Closure Phase.

Each of these phases is outlined below.

3.6.1 Planning / Definition Phase

The definition phase for the proposed project entails the following pre-construction activities/processes/applications:

- EIA;
- Waste Management Facility License for new residue disposal facility; and
- EMPR Amendment.

3.6.2 Construction Phase

The construction phase for the proposed project will take 12 months to complete and will entail the following process post authorisation:

- Detailed Design and Tender Phase will commence in preparation for the construction in order to inform and secure the contractors who will construct the proposed project;
- Vegetation clearance and topsoil stockpiling for the footprint for the new PC dam, should this option be selected. A laydown area will also be identified and cleared.
- Access and service roads: All existing access roads to mine will be used for the construction period and one new access road will be constructed for the duration of the PC dam construction in the vicinity of the PC Dams.
- Transportation of equipment and materials: All the equipment and materials required for construction will be transported to the laydown area.
- Pipelines: The existing Ikhwezi Colliery pipeline will be used to transport water back to the pit for storage during the PC dam reconstruction.
- Mine Residue Facility: The reshaping/reclaiming/upgrading of the Mine Residue Facility will be done in accordance with the designs approved and included in the WML.
- Areas that have been disturbed during the construction phase will be rehabilitated in line with the requirements stipulated in the EMPr (**Appendix E**).

In terms of the underground mining operation, existing shafts will be utilised and no new construction is envisaged.

3.6.3 Operational and Maintenance Phase

Once construction of the new facilities/ upgraded facilities has been completed the mine will continue with operations as follows:

- Water will be abstracted from the South shaft Borehole and Ikhwezi Pit G;

- Piping of untreated water will take place from the PC dam to the plant for use in processing;
- Mining of coal in underground sections (No. 2 seam and No. 4 seam);
- Coal transported by means of underground conveyor to the processing plant or stockpiles;
- Coal processing; and
- Disposal of waste water in the PC dam and disposal of coal waste on the Mine Residuel facility. Additional operational philosophies to be applied to the new/upgraded infrastructure is outlined below.

3.6.3.1. PC dam silt trap (i.e. the existing Primary PC Dam)

The silt trap has been designed to provide sufficient settling time for particles larger than 0.2 mm up to flood events equal to the 1:10 year storm event The following operational philosophy applies:

- Under normal operation both of the silt trap's compartments shall remain open, allowing water to flow through all compartments of the facility.
- During high flow conditions, a portion of the flow will pass through the silt trap, whilst the bulk of the flow will bypass the silt trap, passing through the central portion of the silt trap greater than the 1:10 year flood event. This will prevent the wash-out of silt from the silt trap.
- When the silt level in a compartment of the silt trap reaches approximately 50% the silt trap's capacity, it will be necessary to remove the silt so as to ensure that the silt trap's operation remains optimal.
- Subsoil drains are proposed in the floor of the compartments to promote quicker drying times of the silt to allow access into the silt trap. The thicker the saturated silt, the longer the drying time. If necessary, the excess water may need to be drawn off using a mobile pump or siphon.
- The silt can then be removed with a front end loader (typically a TLB), and placed onto the drying slab adjacent to the silt trap. Once the silt has dried out sufficiently, it can be loaded onto a truck and disposed of on the Mine Residue Facility.

To prevent damage to the concrete floor of the silt trap compartments, steel rail sections are proposed to be cast into the floor, but recessed above the floor to assist protection

3.6.3.2. Lined Pollution control dam

The operation of the pollution control dam forms part of the overall operational water management. The following operational philosophy will apply:

- The two compartments of the Lined PC Dam must normally be operated at 20% (or less) of Full Supply Level (FSL) to ensure that sufficient storage capacity is maintained at all times in order to accommodate a possible flood event.
- Water from the Lined PC dam will be used in the plant, as required, in order to maximise the reuse of water on site and maintain as low a level in this facility as possible.
- Excess water from the PC dam will be pumped to the existing North Shaft Plant Dams, from where it will be used in the processing plant – see **Figure 3-6**.

- The Lined PC dam has been designed with two separately manageable compartments. During the wet season the two compartments must be operated to function as a single dam (i.e. with a pipe linking the dams to remain open in order to utilise the full storage capacity). During dry months either of the compartments could be isolated to allow maintenance and cleaning of the one compartment, while the other compartment remains operational.
- By managing the inflow of water, the Lined PC dam can be operated with a primary and secondary compartment, thereby allowing the silt build-up to take place in the primary compartment only. This can be switched from time to time to tie in with the maintenance schedule.
- Should excessive leakage be noted from the Lined PC dam's continuous leakage detection system appropriate maintenance measures will be carried out to repair the leak(s).

3.6.3.3. Pumps

The following operational rules will apply:

- Once the PC Dam reaches Minimum Operating Level (MOL), pumps will be switched off by means of a level control switch in order to prevent the pumps from pulling air into the system.
- Once the PC Dam is at FSL, the pumping system will be switched on and the water level will be lowered in order to prevent a spill in the case of a storm occurring. Water will be pumped to the plant dams.

The sizing of the PC dam and pumping infrastructure has been based on a spill risk of no more than once in 50 years, if operated correctly.

- To prevent damage to the concrete floor of the silt trap compartments, steel rail sections are proposed to be cast into the floor, but recessed above the floor to assist protection.

3.6.4 Decommissioning / Closure Phase

The main closure/ decommissioning objectives for Delmas Coal are to reduce long term water liability emanating from the mining activities.

Therefore, areas that have been disturbed during the construction and operational phases will be rehabilitated in line with the requirements stipulated in the current EMPr and legislation relevant at the time of closure.

At the point of closure of the mine the following objectives will be applicable:

- To return the area (as far as possible), to a topography as agreed upon by consultation with stakeholders (grazing land as indicated in the original EMPR);
- To grass soils and return them to grazing land once adequate grass cover has been established. A rehabilitation plan is currently being developed for the mine as part of the WUL conditions;
- The disposal of materials from the decommissioned plant, pipelines and other infrastructure at an approved waste disposal facility, preferably reused. Alternatively, recycling opportunities could be investigated and implemented;
- All areas are to be free draining after rehabilitation as far as is practical; and

- The addressing of employee needs in preparation for and during periods of downscaling and closure to be able to meet these needs where practicably possible.

All of the aforementioned would be subject to a separate EIA, and environmental authorisation at the appropriate time.

3.7 Overall Project Schedule

The proposed project schedule for the upgrading of the PC dams, Mine Residue Facility, associated water infrastructure and extension of mining is outlined in **Table 3-3**.

Table 3-3: Proposed target dates for the upgraded water related infrastructure at Delmas Coal North Shaft

Action	Proposed target date
Geohydrological investigation for the siting of scavenger boreholes	June 2015
Submission of the DEIR and EMPR amendment	September 2016
Final EIR and EMPR reports to be made available to the public	November 2016
Construction of northern boundary dirty water drain	June/July 2017
Construction of the southern boundary dirty water drain and seepage barrier	June/July 2017
Construction of the PC Dam silt trap	June/July 2017
Construction of compartment 1 of the Lined PC Dam	June/July 2017
Construction of compartment 2 of the Lined PC Dam	June/July 2018
Silo for coal going to Eskom	December 2018
Construct the formalised coal handling and preparation plant (CHPP) to replace ROM and product stockpile areas	September 2019
Upgrading/waste recovery from the Mine Residue Facility	September 2019

Construction will only commence if all authorisations applying to that activity have been obtained. This includes the approval of the EMPR, the EA and waste licence. A WUL has already been approved for the purposes of the project.

3.8 Life of Project

The mining extension and upgrading of facilities to meet the new mining extension's requirements are envisaged to last for an additional 30 years, until 2046. Thereafter the mine is proposed to be closed and facilities rehabilitated in line with applicable legislation. The relevant closure plan and rehabilitation plan is discussed in **Section 8.3** below.

4. ALTERNATIVES CONSIDERED - REGULATION 50 (B)

4.1 Introduction

In terms of the EIA regulations consideration must be given to alternatives. Alternatives are different approaches and ways of meeting the need, purpose and objectives of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, processes or technology alternatives, temporal alternatives, etc. The no-go alternative or option is also considered, as it provides the baseline against which the impacts of other alternatives can be compared. The objective of presenting, evaluating and motivating the feasible alternatives during the Impact Assessment Phase, is to identify the preferred option.

For this project, several alternatives have been considered. These are outlined below.

4.2 Mine Plan Alternatives

Two mine plans/life of mine (LOM) alternatives have been developed for the proposed mining extension part of the project, based on inputs from stakeholders and design engineers. Mining by high extraction was considered as an alternative mining method, however it was found not to be feasible. The mining plan proposed is based on continuing mining, using the same infrastructure and method. High extraction methods could not be carried out using the existing infrastructure. Open cast mining was also not feasible as the depth of the mineable coal seams is very deep. The following mine plan alternative is therefore assessed along with the no-go alternative:

4.2.1 Mine Plan Alternative (1): Bord and Pillar

As outlined in the scoping report the only feasible mining method being considered for the proposed expansion of the mining of the No. 2 and 4 seam at Delmas Coal is the continuation of the current underground mining by means of bord and pillar extraction.

This will entail the expansion of the underground workings within the mining rights area. A layout of the proposed expansion of the No. 2 and No. 4 Seams are **Figure 4-1.**

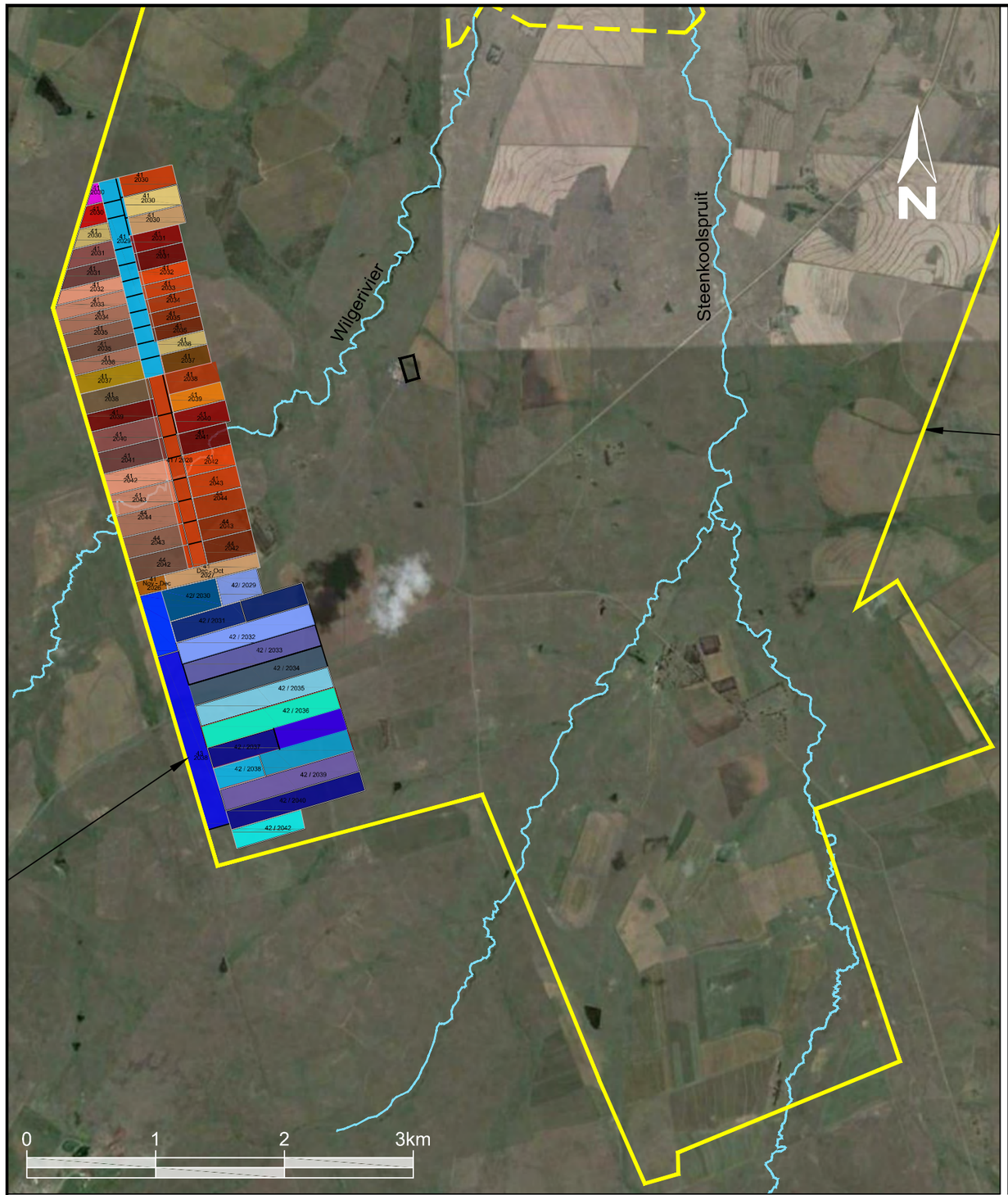
Current mining practices will be followed and all current infrastructure will be utilised in the expansion of the mining area. The coal will still be conveyed via underground conveyor to North Shaft and either processed in the process plant or sold as run of mine (ROM) product. The only additional surface infrastructure required for the expanded underground workings is the refuge bay boreholes which are required for safety purposes.

The proposed mining will start on No.4 seam in Jan 2017– see **Figure 4-1** Mining of the No.2 seam will commence in 2026 in Section 41. All activities related to the mining extension are proposed to be completed by the year 2035 for No.4 seam and 2045 for No.2 seam, based on the life of mine (LOM) plan

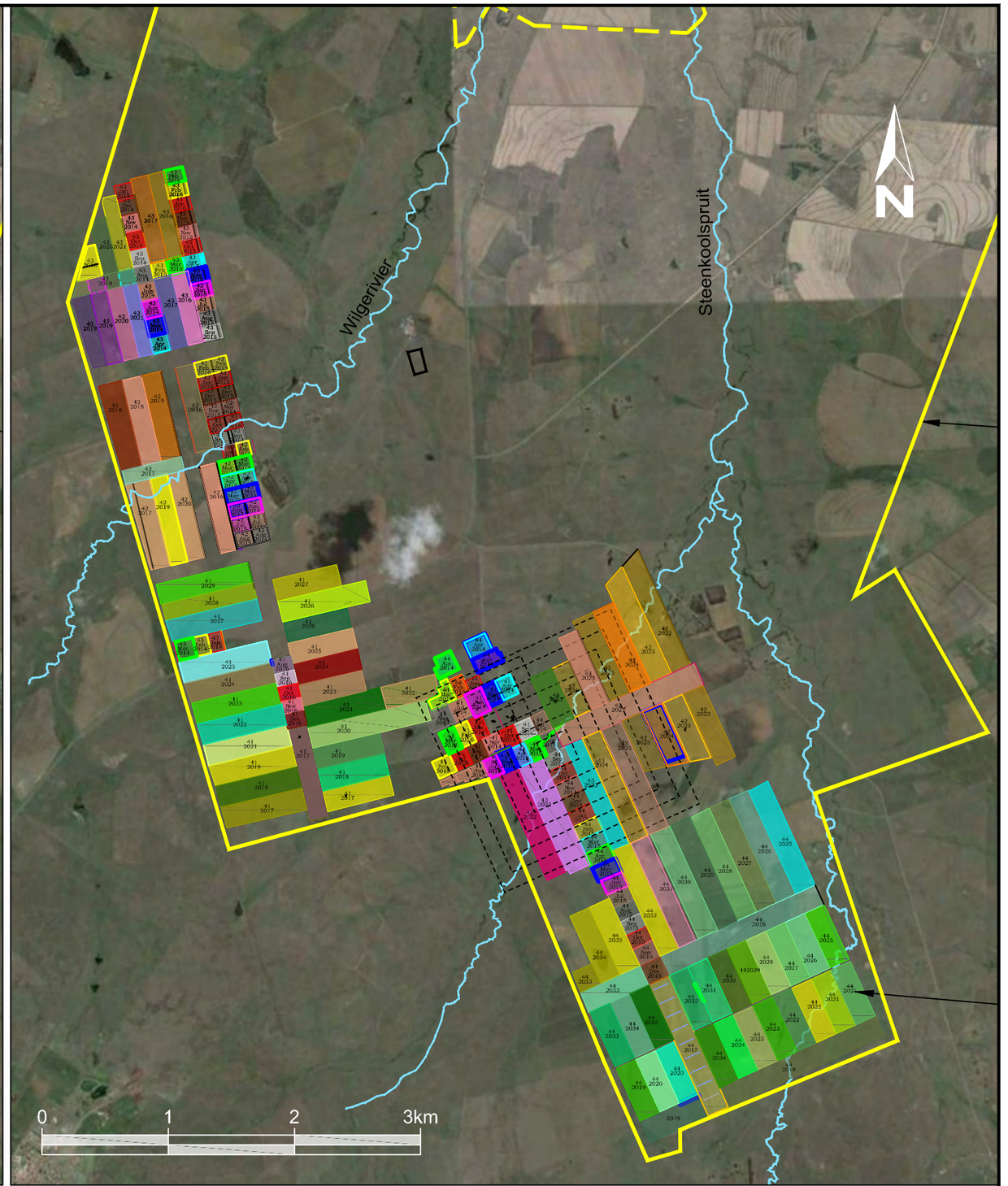
4.2.2 Mine Plan Alternative (2): No-go Alternative:

The no-go alternative will occur if the underground mining expansion is not approved. The current land use of the area will remain the same as the proposed mining expansion will not impact the land use, however the geological impact of altering the geology will not be realised should the mining expansion not be approved. If the status quo is maintained, there will be a change to the socio-economic composition of the area with the termination of mining activities due to the mine reaching the end of its current LOM

and the resultant loss of employment. Due to the end of the mining activities no importation, development or transfer of skills will occur, to employees and other beneficiaries, as outlined in the Social and Labour Plan (SLP) included in **Appendix F**. It is anticipated that the current public infrastructure and services for the area will remain as except for the provision of health services to the Delmas Coal employees.



SEAM 2 UNDERGROUND



SEAM 4 UNDERGROUND

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PROPOSED LIFE OF MINE BLOCK PLAN FOR 2 SEAM AND 4 SEAM

Job No: D910-04

Figure 4-1

4.3 PC Dam Alternatives

There are two PC dam alternatives which were considered to curb and control the release of contaminated water into the natural water resources from the PC dams (excluding the no-go alternative). These alternatives were assessed and evaluated by J&W as outlined in the design report, included in **Appendix B** of this Draft EIR/EMPR amendment. The design report describes in detail the design principles, criteria, constraints and operational philosophy that were followed in the preliminary designs of the surface water management infrastructure. The three alternatives which were considered are the following:

4.3.1 PC Dam Alternative (1): Upgrade both PC Dams *in situ*

The first alternative for the upgrade of the PC dams entails keeping the two existing PC dams in their current location but converting the top PC dam to a silt trap, and enlarging and lining the bottom PC dam with a synthetic liner. The proposed PC dam silt trap will be able to provide sufficient settling time for particles larger than 0.2 mm up to flood events equal to the 1:10 year storm event.

This proposed silt trap PC dam consists of four compartments with all four being utilised during normal operations. Provision has been made for the removal of silt from the Lined PC dam's compartments from time to time during operation and maintenance. The silt can then be removed with a front end loader (typically a TLB), and placed onto the drying slab adjacent to the silt trap. Once the silt has dried out sufficiently, it can be loaded onto a truck and disposed of on the Mine Residue Facility. During maintenance (or cleaning of the silt trap), inflows can be diverted into one half (e.g. two compartments) of the silt trap, enabling access to the other half. The concrete floor of the silt trap will be protected by casting steel rail sections into the floor.

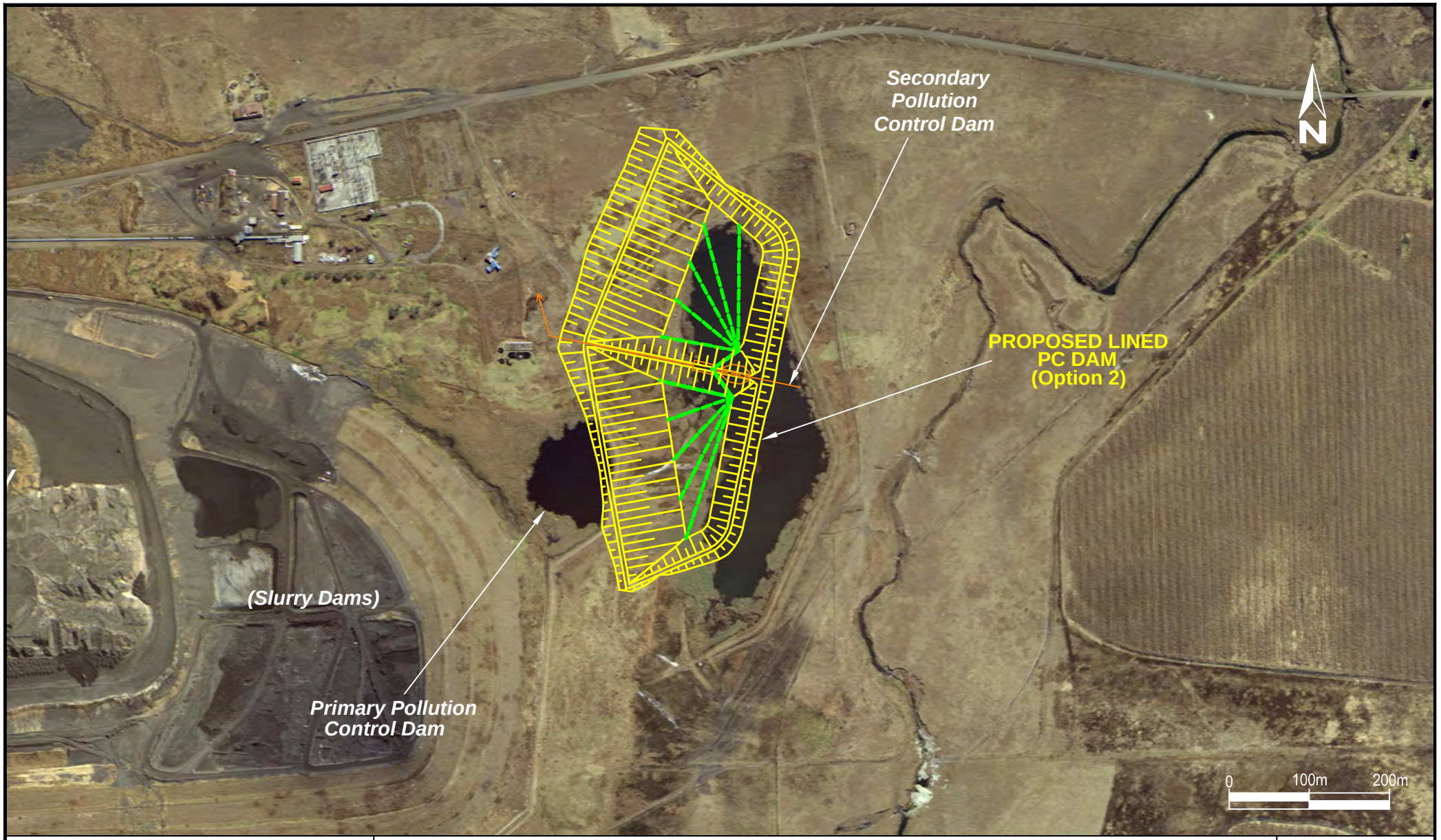
The water emanating from the silt trap will report to the newly proposed synthetically lined PC dam. The PC dam comprises of two lined earth embankment compartments. The proposed liner consists of a single composite liner with surface lining on top of the single composite liner. The surface lining consists of concrete and soil-crete filled geo-synthetic cells, which allows for the removal of silt by means of power washing and sludge pumps. The single composite liner is underlain by a leakage detection system. The flow to the two compartments can be regulated to allow for maintenance and to ensure sufficient storage capacity is maintained to accommodate a possible flood event. Excess water from the PC dam will be pumped for reuse in the processing plant. Factors considered in the design of the PC dam included dam sizing, the liner system, flood calculations and freeboard.

4.3.2 PC Dam Alternative (2): Upgrade both PC Dams and realign the secondary PC Dam

The second alternative for the upgrade of the PC dams also entails the conversion of the top PC dam to a silt trap as described in the alternative above, however proposes relocating the bottom Lined PC dam to a position North West of its current location, away from the Wilge River and towards the Mine Residue Facility – see **Figure 4-2**. This will entail the excavation of a new facility at the new proposed location. The design, operation and maintenance applicable to the first alternative will also apply to this alternative with the only differentiating factor between the two alternatives being the location of the PC dam.

4.3.3 PC Dam Alternative (3): No-go Alternative

The no-go alternative will involve not upgrading either of the PC Dams in situ or in a new location. From a bio-physical perspective, should the upgrading of the PC dams not be conducted, the surface water and groundwater resources may continually be affected negatively as a result of the possible release of contaminated water into the surrounding natural resources and watercourses.



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Delmas Coal (Pty) Ltd

EIR / EMPR

PROPOSED PC DAM ALIGNMENT OPTION 2

Job No: D910-04

Figure 4-2

4.4 Mine Residue Disposal Facility Alternatives

Four alternatives were investigated for the proposed upgrading and rehabilitation of the Mine Residue Facility and upgrading of its associated infrastructure. The intention is to remediate and upgrade the Mine Residue Facility and related infrastructure (surface water drains and PC dams as described above) in order to reduce and control the release of contaminated water into the natural water resources.

The alternatives which were considered as a part of this S&EIR process are described below.

4.4.1 Mine Residue Facility Alternative (1): Upgrading the facility *in situ* for deposition of discard and slurry

The first alternative entails keeping the Mine Residue Facility in its current location and upgrading and/or replacing where necessary its surrounding sub-surface drains and surface water infrastructure to improve its efficacy in capturing surface flow and sub-surface seep originating from the facility. In conjunction with this, remediation of the Mine Residue Facility will be undertaken with the aim to shape its slopes to an angle of at least 1:5 and provide a capping layer, and to establish the necessary surface water measures. The intention of this alternative is to continue operating the upgraded and remediated Mine Residue Facility, coal discard section for the deposition of coal discard and the slurry pond section of the facility for deposition of slurry. This alternative aims to maximise the available airspace of the existing facility but would require the development of a new facility in the event of the current facility reaching its maximum capacity. The capacity of the current Mine Residue Facility is however constrained by the stability of the underground workings underlying it. A stability assessment undertaken for the Mine Residue Facility, included in **Appendix C**, shows that the facility is nearing its full capacity and should not be laden with the discard from the all the proposed future mining expansions.

4.4.2 Mine Residue Facility Alternative (2): Upgrading the facility *in situ* for deposition of discard only

The second alternative is entails the upgrading of the Mine Residue Facility within the existing footprint as indicated in Alternative 1 above, however using the air space above the slurry dams for the deposition of coal discard. This will therefore maximise the life of the facility within its existing footprint, but will mean that in the future a new slurry handling facility will need to be developed on another footprint. This option has two limitations in that if Delmas Coal intends to continue washing coal and producing slurry it would require new slurry ponds and secondly the underground stability below the facility restricts the amount of coal discard that can be placed on the facility without risk of failure/subsidence.

4.4.3 Mine Residue Facility Alternative (3): Recovery of waste from the Mine Residue Facility and replacing reject material on the mined out footprint.

This alternative entails the recovery of discard from the Mine Residue Facility for the purpose of fuel for the KiPower IPP Plant. Discard that is not suitable for use in the power station will be placed back on the existing Mine Residue Facility footprint – see **Figure** 3-5**.** This option will also open up footprint to be used for disposal of coal slurry in the case that Delmas Coal may wash coal in the future. The intention is to progressively cap

the Mine Residue Facility with the aim to shape its slopes to an angle of at least 1:5 and establish the necessary surface water measures. Reshaping and capping is intended to prevent any deterioration (erosion, spontaneous combustion, dust generation, etc.) of the existing facility. This facility was analysed and it was determined that the material has a sufficient calorific value to be utilised as a source of fuel for the proposed KiPower IPP Plant to be constructed on the adjacent Ikhwezi Colliery. Therefore, the Mine Residue Facility is proposed to be reworked from the western side. Areas where discard is removed will be upgraded to house future discard being produced, i.e., those fractions that cannot be re-used in the proposed KiPower IPP Plant. As a result, the load of the facility on the underground workings is proposed to be reduced and the underground stability improved. This option is outlined in detail in the J&W specialist report on the remediation and reworking of the Mine Residue Facility – see **Appendix C** and the WMLAR for the new facility is included in **Appendix G**. This is the preferred option. Some design considerations for the new Waste Management Facility as follows:

- The current footprint will be reduced to approximately 25% of its current service area if the Mine Residue Facility is reworked.
- Approximately 10% of the material on the current Mine Residue Facility will remain. Which represents a substantial decrease in waste load, and hence pollution load, from the current approximately 12.7 million m³. The 10% rejects will be placed on a new disposal facility, which will have a formal barrier and composite capping system.
- No newly generated discard will be disposed of on the new rejects dump to be constructed on the footprint of the existing discard disposal facility.
- The new discard rejects facility will be rehabilitated on a continuous basis, thus ensuring that the volume of rainwater that comes into contact with the actual rejects is minimised as far as possible. The side slopes of the dump are planned at a 1:5 slope to ease placement of the capping layer and to lessen the effect of erosion on the slopes.
- The base of the new discard facility will be ripped, bentonite will be added to the loose soil and then re-compacted. A herringbone drainage system will be designed and will drain towards the upgraded dirty water canal on the southern side of the existing dump. (see **Figure 4-3**).
- The final discard facility will be capped with a geocomposite drainage layer followed by 300 mm of low permeability soil followed by 200 mm of topsoil – see **Figure 4-4**. The geocomposite drain consists of a single cuspated sheet with non-woven geotextile on both side. This system intercepts lateral seepage and drains it to the sides of the Mine Residue Facility and discharges into the polluted water drainage system.
- These measures will significantly reduce the progression of polluted surface and/or groundwater from the new discard facility into the receiving environment, i.e. the Wilge River.

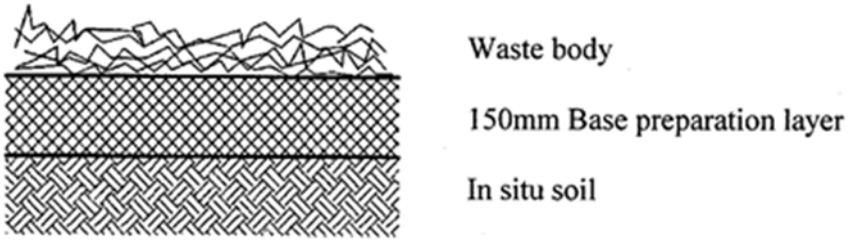


Figure 4-3: Class D Barrier System

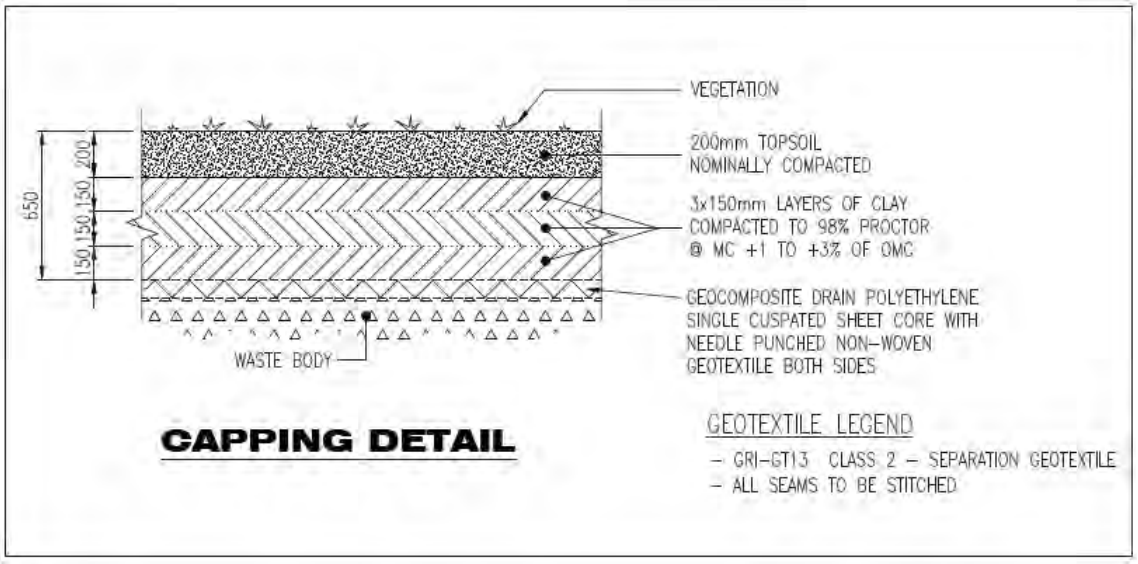


Figure 4-4: Capping detail of new facility

4.4.4 Mine Residue Facility Alternative (4): No-go alternative

Should none of the alternatives above be found to be viable or be approved, the impact the facility is having on groundwater and surface water resources will remain until the Mine Residue Facility is closed. If the facility is closed prior to reaching capacity or prior to the closure of the mine, a new facility (on a new footprint) may be required for the continuation of mining.

4.5 Conclusions and Recommendations

In terms of the alternatives the following options exist for approval, should the Mine Plan alternative (1), the mining expansion by means of bord and pillar mining not be approved, the mine will likely close, therefore negating the need for the upgraded facilities (the PC dams and Mine Residue Facility) before closure. Should the PC dam or Mine Residue Facility alternatives not be approved, the mine will continue contributing to pollution of water resources. The preferred PC dam alternatives and Mine Residue alternatives therefore aims to reduce the contamination of water resources. The approval of one of the no-go alternatives, will reduce the efficacy of preventing pollution.

5. RECEIVING ENVIRONMENT - REGULATION 50 (A)

This section provides a general description of the environment in which the proposed projects are located. The purpose of this section is to provide a perspective of the local environment within which the proposed infrastructure will exist and operate, with a view to identify sensitive issues/areas, such as wetlands or other ecological aspects, which need to be considered when conducting the impact assessment and designing the various components of the project.

During the Scoping Phase, existing baseline information had been used to describe the pre-activity environment. This information has been obtained from previous studies conducted for Delmas Coal and for other projects in the surrounding areas. These studies are listed below:

- Environmental Management Programme for Delmas Colliery Limited in Terms of the Minerals Act, 50 of 1991 and regulations. Jasper Muller and Associates. January 1997.
- Integrated Water Use Licence Application, Delmas Coal (Pty) Ltd. Natural Scientific Services CC (NSS). (Reference No. 1443) July 2011. (Additional information submitted in November 2014).
- Integrated Water and Waste Management Plan for Delmas Coal (Pty) Ltd. J&W Report No. JW198/14/D910, November 2014.
- Environmental Impact Assessment for the Construction of a 600 MW Independent Power Plant and Associated Infrastructure for KiPower (Pty) Ltd near Delmas in Mpumalanga. J&W Report No. JW189/13/C182. May 2014.

Several associated specialist studies for the above listed projects were used in compiling the receiving environment.

Additional standalone studies conducted for Delmas Coal, used in this baseline assessment are listed below:

- Delmas Coal EMPR Amendment: Biodiversity and Wetland Delineation. NSS (Reference No. 1283) June 2009.
- Delmas Coal Discard Dump Cut-Off Drain and Seepage Geotechnical Investigation Seepage & Stability J&W Report No.: Jw178/12/D223, October 2012.
- GN704 Compliance Audit Report: Findings and proposed mitigation measures. J&W Report No. JW121/12/D223. January 2013.
- Rock Engineering Stability Assessment of underground workings at Delmas Coal. Saxum Mining. March 2013.
- Delmas Coal Discard Dump Conceptual Design Report. J&W Report No. JW227/12/D223. October 2013.
- Rock Engineering Risk Assessment of Delmas Coal's Western and Southern Extension. Saxum Mining. July 2014.
- Rock Engineering Assessment of the Underground workings beneath the Discard Dump. Saxum Mining. August 2014.

All specialist reports undertaken for this proposed upgrading and expansion project can be found appended to the EIR / EMPR amendment, in **Appendix C**.

5.1 Biophysical Environment

5.1.1 Climate

5.1.1.1. Data Collection and Methodology

Baseline climatic information was attained from previous studies performed in the area. Relevant studies are listed above, in **Section 5**. The wind data was attained from the specialist Air Quality Impact Assessment which was undertaken specifically for this project. This study can be found appended to the EIR / EMPR amendment, in **Appendix C**.

5.1.1.2. Regional Description

Delmas Coal is located in the Highveld climatic region. This is a summer rainfall region with most rainfall usually occurring from October to March. The regional climate for the Delmas area can be described as a temperate climate with warm summers and cold winters with sharp frost.

5.1.1.3. Rainfall

Delmas Coal is situated in Mpumalanga Province for which the mean annual rainfall is 736 mm. The mine is located in the quaternary catchment B20E. The closest rainfall station with a long and reliable record is the station 0477309, named 'Delmas – Pol'. The rainfall record for this station extends from 1 January 1908 to 31 December 1999 (92 calendar years).

The mean annual precipitation (MAP) at Delmas Coal is: 680.7 mm. The mean monthly rainfall depths are contained in **Table 5-1** in millimetres.

Table 5-1: Mean monthly rainfall depths for weather station 'Delmas – Pol'

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
120.2	92.7	84.6	41.0	19.0	6.5	6.4	8.7	22.8	68.4	102.2	108.2

5.1.1.4. Evaporation

The closest evaporation station to Delmas Coal is the B2E001 station (Bronkhorstspruit dam). The mean annual evaporation (MAE) is 1 532 mm (S-Pan). The monthly division of this MAE is given below in **Table 5-2**.

Table 5-2: Monthly evaporation at evaporation station B2E001

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
168.5	140.5	138.6	106.6	89.8	72.9	79.8	105.7	137.0	165.1	155.8	171.6

5.1.1.5. Wind

Dispersion comprises vertical and horizontal components of motion. The wind field largely determines the horizontal dispersion of pollution in the atmospheric boundary

layer. The wind speed determines both the distance of downwind transport and the rate of dilution as a result of plume 'stretching'. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness. The wind direction, and the variability in wind direction, determines the general path pollutants will follow, and the extent of crosswind spreading (Airshed 2014).

The recorded wind speed and wind direction data are presented in the form of wind roses. Wind roses comprise 18 spokes which represent the directions from which winds blew during the period. The colours and width of the spokes reflect the different categories of wind speeds. The green area in **Figure 5-1**, for instance, represents winds of 2 m/s to 3 m/s. The dotted circles provide information regarding the frequency of occurrence of wind speed and direction categories. For and each dotted circle represents a 4% frequency of occurrence. The number given in the centre of the circle describes the frequency with which calms occurred, i.e. periods during which the wind speed was below 1 m/s.

Figure 5-1 depicts the period, day-time and night-time wind rose for the period May 2008 to August 2012 at the Kendal site as one of the nearby weather stations. Although the wind field is spatially variable, it is clearly evident in the figure that the dominant winds are from the west-north-westerly sector (~12% frequency of occurrence for the period) and the easterly sector (~10% frequency of occurrence for the period). The diurnal variability in the wind field is clearly shown in **Figure 5-1**. Whereas winds from the west-north-westerly sector are predominant during the day, night-times are characterised by an increase in the frequency of calms as is typical of the night-time flow regime in most regions on the Highveld, and by the predominance of winds from the easterly sector.

The significance in the diurnal shifts in the wind field will become clearer when investigating the predicted ground level concentrations. Night-time conditions are normally associated with stable atmospheres, whereas daytime conditions are more unstable. Limited vertical dispersion occurs under stable conditions, and hence near ground level releases can result in relatively high concentrations during the night. Elevated releases will travel relatively far downwind before this "stable" plume reaches ground level and may therefore be sufficiently diluted not to cause high ground level concentrations. This may not be the case for low-level releases. Unstable conditions, particularly convective conditions normally occur during low wind speeds and can result in high ground level concentrations from elevated releases.

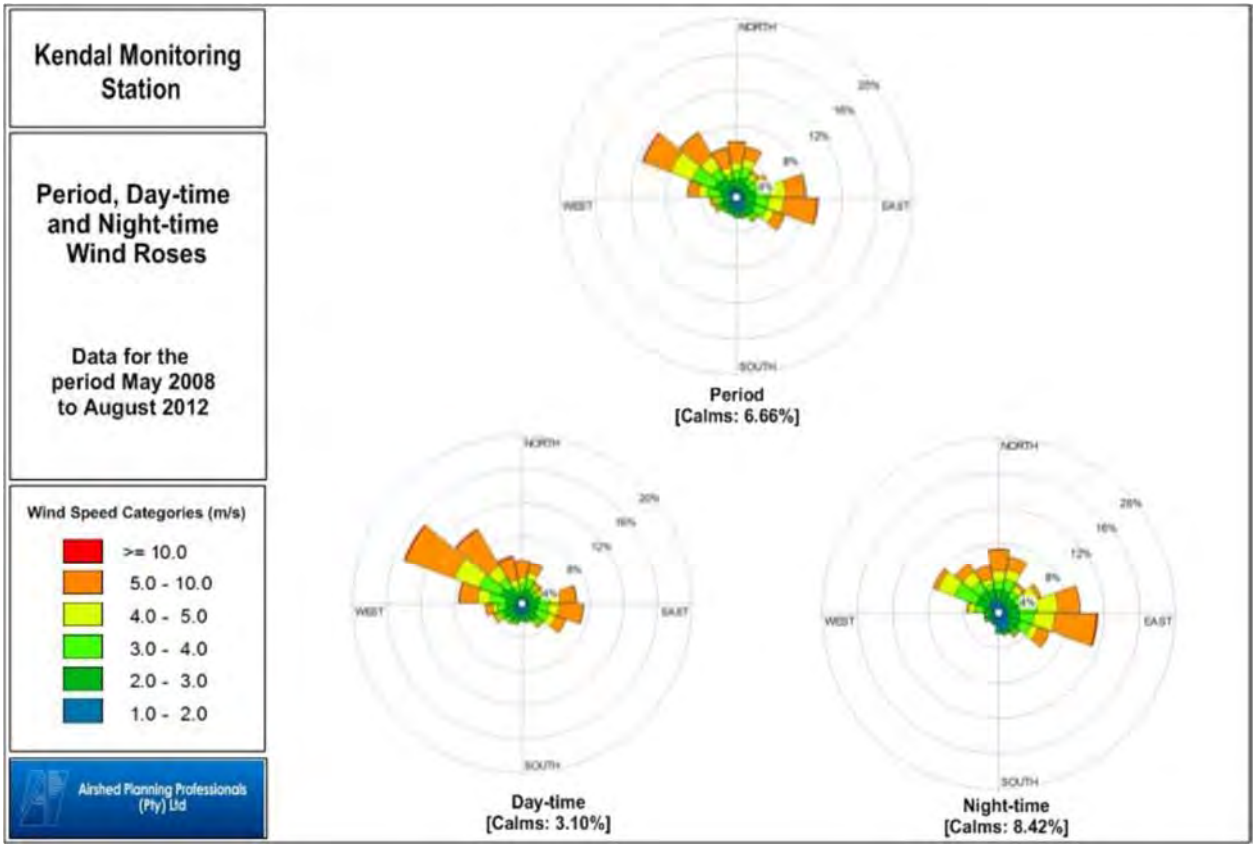


Figure 5-1: Period, day-time and night-time wind roses for the Kendal meteorological station (May 2008- August 2012)

5.1.1.6. Temperature

Air temperature is important, both for determining the effect of plume buoyancy (the larger the temperature difference between the plume and the ambient air, the higher the plume is able to rise), and determining the development of the mixing and inversion layers. The monthly diurnal average temperature profile for the period January 2009 to August 2012 is given in **Figure 5-2**.

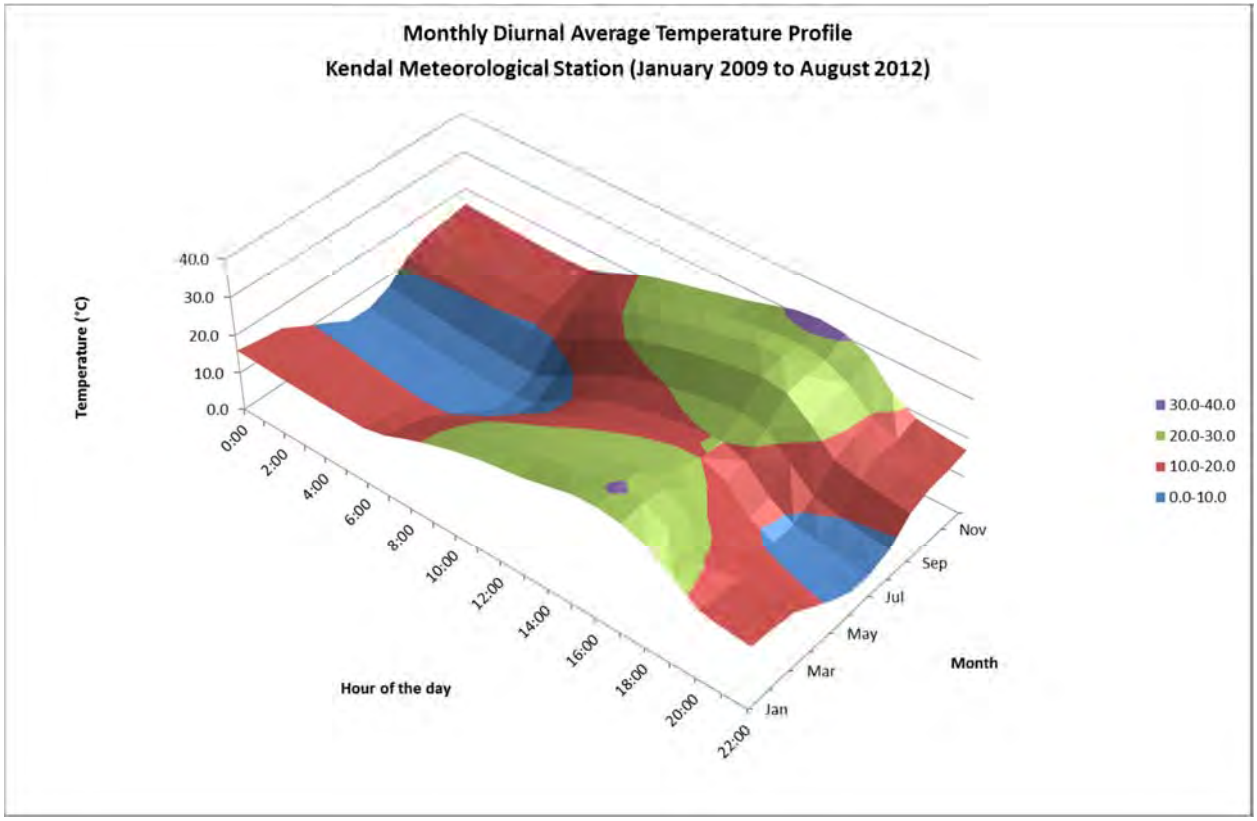


Figure 5-2: Monthly Diurnal Average Temperature Profile for Kendal Meteorological Station (January 2009 to August 2012)

Annual average maximum, minimum and mean temperatures for Kendal are given as 26.5°C, 9.6°C and 16.2°C, respectively, based on the January 2009 to August 2012 record. Average daily maximum temperatures range from 31.5°C in December to 19.9°C in June, with daily minima ranging from 14.9°C in January to 2.1°C in July.

5.1.1.7. Ambient Air Quality

Airborne particulates are considered to be the most significant air pollutant to emanate from the coal processing plant operations at the North Shaft (Airshed 2014). The availability of baseline monitoring data for PM2.5 and PM10 in the Delmas area are limited. It is therefore not possible to specify the current particulate air concentrations and fallout experienced at the site or immediate surrounds.

Use was made of the deposition results from the Delmas dustfall sampling network. A new sampling campaign was implemented at Delmas coal mine in January 2014. The dustfall network comprises of single dust buckets at six sites around the coal mine boundary. The locations of the sampling buckets are indicated in **Table 5-3**.

Delmas coal is situated in one of the Highveld "hot spots" (at Delmas) because of the contribution of domestic fires in the residential areas to air pollution (Airshed 2014). However, Delmas Coal is located some distance from Delmas town and also at some distance from Kendal/Witbank/Phola and peak concentrations are estimated to be slightly lower at Delmas Coal than at the latter locations (Airshed 2014).

Table 5-3: Location of the dust fallout network at Delmas

Location	Latitude	Longitude	Location Description	Site Classification
1	26˚15'33.7"S	28˚49'42.8"E	Offices	Non-residential
2	26˚15'42.6"S	28˚49'46.9"E	Stockpile Area	Non-residential
3	26˚15'47.9" S	28˚49'33.7" E	Farmer's field	Residential
4	26˚15'57.1" S	28˚49'37.0 E	Siding	Non-residential

For dustfall rates sampled between January and March 2014 the following is noted:

- Deposition rates for the period do not exceed the 600 mg/m^2 per day residential limit at any of the sampling locations (Airshed 2014).
- The highest deposition rate of 577 mg/m^2/day (January – February 2014) and 488 mg/m^2-day (February - March 2014) was recorded at Location 3 (Farmer's field).

However, long term trends could not be ascertained due to limited monitoring data availability (Airshed 2014).

5.1.1.8. Sensitivities

The sensitive receptors identified for the project were identified as farm houses and settlements in the vicinity of operations (Airshed 2014).

On average, prevailing winds are from the west-north-westerly and easterly sector. Winds from the west-north-westerly sector are predominant during the day with easterly winds particularly dominant in the area during the night (Airshed 2014). During winter months (June to August) there is an increased frequency of south-westerly and north westerly winds. The frequency of easterly and east-south-easterly winds increase during summer months (December to February). Autumn months are associated with a greater frequency of calm wind conditions, with the smallest number of calms occurring during spring months (Airshed 2014).

Neighbouring land use in the region comprises of mining activities, Power stations, industries, farming, residential areas and the N12 highway (Airshed 2014).

Impacts due to $PM_{2.5}$ emissions were within the National Ambient Air Quality Standard(s) (NAAQS) limit for both modelled Mine Residue Facility alternatives 1 and 2 (Airshed 2014). Frequency of exceedance of the NAAQS daily limit (40 µg/m³) was not exceeded at any of the sensitive receptors or at the boundary of Delmas coal mine. Annual average predictions significantly fall below the NAAQS ambient limit (20 µg/m³) for **unmitigated** and **mitigated** operations (Airshed 2014).

5.1.2 Geology

5.1.2.1. Data Collection and Methodology

Geological information was attained from previous studies conducted in the area, as listed in **Section 5**. All specialist reports conducted for this project can be found, in **Appendix C**. The local geology was assessed based on information obtained from recently drilled boreholes and the Geohydrological assessment conducted for this study.

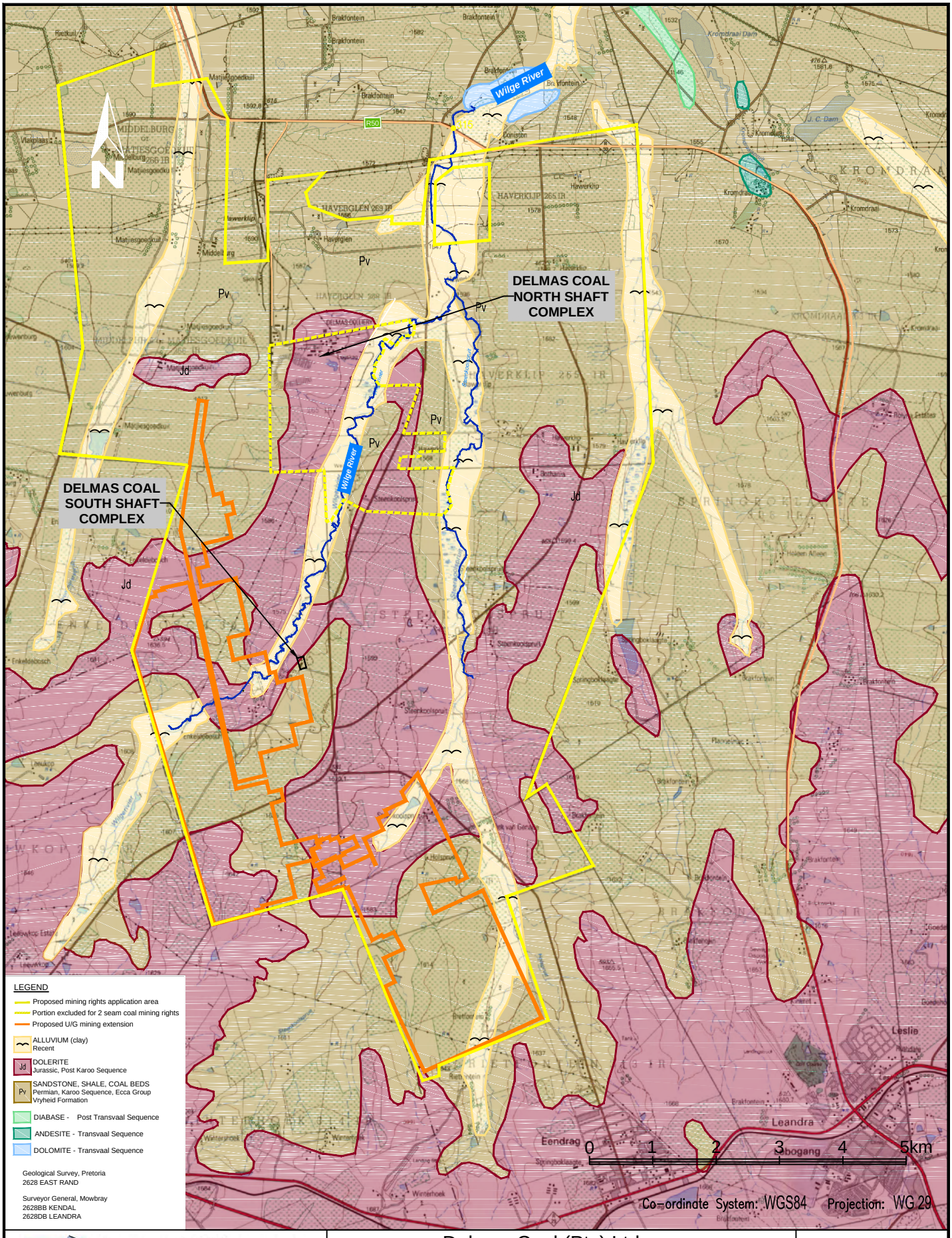
5.1.2.2. Regional Description

The regional surface geology is dominated by the Karoo Supergroup that overlies the Transvaal Sequence (J&W Groundwater 2014a). The Karoo rocks are represented by the Dwyka Formation and the Vryheid Formation of the Ecca Group. The Transvaal rocks are represented by the dolomites of the Malmani Formation, Chuniespoort Group. Post-Karoo dolerite intrusions are present within the region.

The Karoo rocks were deposited onto an uneven erosional topography characterised by paleo-valleys and paleo-highs. Consequently, marked variations in thickness will occur.

The Dwyka Formation consists mainly of tillite and diamictite that were deposited during late Carboniferous to early Permian times by glacial processes. The diamictite consists of angular to rounded clasts of basement rock embedded in a clay and silt matrix. Subordinate rock types are conglomerate, sandstone, rhythmite and mudrock. These rocks are generally massive with little jointing, but it may be stratified in places.

The Vryheid Formation (Ecca Group) comprises mudrock, rhythmite, siltstone and fine- to coarse-grained sandstone (pebbly in places) and coal. The Vryheid rocks are characterised by an upward-coarsening sequence of sediments (deltaic origin) and fining upward sediments (fluvial in origin).



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REGIONAL GEOLOGY

Job No: D910-04

Figure 5-3

5.1.2.3. Site Description

Lithology

In terms of the lithology of the Delmas Coal area, alluvium sands overlie the Karoo Supergroup in the lower elevated areas next to the Wilge River. The Karoo rocks are represented by sandstones, siltstones and shales of the Vryheid Formation (Ecca Group). Post-Karoo dolerite intrusions are also present within the Vryheid formation. The dolomitic strata of the Malmani Subgroup underlie the glacial deposits of the Dwyka Formation (J&W Groundwater 2014a). Dolomite is generally only encountered to the north of the mine and at depths deeper than 80 m.

Coal Seams

The exploitable seams (past, present & future) in the area include the No. 5, No. 4 - Upper, No. 4 - Lower and No. 2 seams. Only the No. 4 Lower seam and No. 2 seam will be mined in the planned mining extension.

The No. 4 coal seam is occasionally separated into a lower and upper seam by a sandstone layer and typically occurs at depths between 40 – 70 m in the north and between 75 – 150 m in the mining extension area towards the south west. The No. 4 seam is considered to be sloping towards the south east (J&W Groundwater 2014a). It generally consists of medium grade quality coal.

The No. 2 seam is overall well developed and may contain coal of medium to high quality. The B4 dolerite sill is, however, responsible for devolatilization of the No. 2 seam over large tracts. The No. 2 seam occurs at depths typically between 60 – 85 m in the north and between 95 – 175 m in the south west.

This depth to the coal seams is related to the surface topography of the area and the elevation of the coal seam. Due mostly to the undulatory nature of the surface but also as a result of localised dip variations along the coal seam, the depth to the seam varies from place to place. To the south much of the No. 4 - Lower seam mining area is underlain by previous underground workings along the No. 2 seam. The inter-seam parting is mostly composed of sandstone and is between 15 & 25 m in thickness (J&W Groundwater 2014).

Weathering Depth

The weathering depth, as determined from borehole logs done in the geohydrological assessment, across the study area varies from 9 to 26 metres below surface (mbs). The average weathering depth over the study area is estimated at 15.4 mbs. The weathering profile for this area can be summarised as follows:

- Highly weathered (0 – 5 mbs);
- Weathered (5 – 13 mbs); and
- Slightly weathered (13 – 25 mbs).

5.1.2.4. Sensitivities

The proposed expansion of Delmas Coals mining operation will result in the destruction of the underlying geological layers.

5.1.3 Topography and Drainage

5.1.3.1. Data Collection and Methodology

In addition to a desktop evaluation, baseline topographic information was attained from information provided by groundwater specialists.

5.1.3.2. Regional and Site Description

The terrain in the project area is mostly flat and slightly undulating closer to the major drainage lines. The local topographical highpoint for the North Shaft complex is towards the west and for the South Shaft complex it is towards the south. The Wilge River is the major drainage feature in this area and drains the study area in a northerly direction where it joins the Olifants River.

The local catchment is characterised by generally easterly flowing drainages leading to the topographically low Wilge River.

The Mine Residue Facility at North Shaft is located on a convex crestal terrain unit that slopes, both eastwards towards the Wilge River and South towards a small tributary which flows into the Wilge River. The coal discard facility borders this tributary.

5.1.3.3. Sensitivities

The primary sensitive aspect associated to the topography and drainage is the occurrence of some erosion within the study area. Another sensitivity is the close proximity of the Delmas Coal infrastructure to the Wilge River. Any potential spillages of the plant or PC dams would be within the drainage lines towards the Wilge River and any seepage from the Mine Residue Facility may run into the adjacent tributary of the Wilge River on the southern side. Construction from the upgrading of the PC dams and the upgrading of the Mine Residue Facility may contribute to particulates being freed which could wash into drainage lines if not managed properly.

5.1.4 Soils

5.1.4.1. Data Collection and Methodology

Desktop data of the soils of the study area was collected in conjunction with information from fieldwork conducted during previous studies in the Delmas Coal study area. Fieldwork was also conducted at the refuge bay borehole sites to determine the soil characteristics for the aquatic and wetland specialist assessment of this S&EIR.

A geotechnical investigation was also conducted on 46 test pits around the Mine Residue Facility and the PC dams in support of the concept design of the rehabilitation and upgrade of these facilities. The soil profiles for each of these pits were also logged. The fieldwork comprised test pitting followed by the laboratory testing of selected soil samples.

5.1.4.2. Regional and Site Description

The desktop study indicated that the soil characterisation in the study area has a largely red to yellow sandy texture and the soils vary from mesotrophic to eutrophic. The eutrophic soils have a depth of 750 mm or deeper. The soils tend to be well drained with massive or weak structured soils and a low to medium base status. The soils are moderate to deep clayey loam with areas in the south of the study area moderate to deep clays (NSS.,2014).

The typical soil profile of the areas around the PC dams and Mine Residue Facility as determined in the geotechnical investigation comprises the following:

Table 5-4: Soil profile in the study area

Depth	Description
0,00 - 0,40 m	TOPSOIL, soft silty clay
0,40 - 0,80 m	CLAY FILL, firm silty clay
0,80 - 1,00 m	COAL DISCARD FILL, medium dense silty coarse medium and fine sand and boulders
1,00 - 1,50 m	HILLWASH, soft to firm slightly sandy silty clay
1,50 - 2,50 m	ALLUVIUM, firm clay
2,50 - 3,00 m	RESIDUAL SANDSTONE/SILTSTONE, either firm slightly clayey sand, or stiff micaceous silt
3,00 - 3,50 m	RESIDUAL DOLERITE, dense silty medium and fine sand
+3,50 m	SILTSTONE / SANDSTONE, very soft rock
+3,50 m	DOLERITE BEDROCK, soft rock

5.1.4.3. Sensitivities

The sensitivities identified with regard to soils in the study area are predominantly associated with the changes in land use. Extensive crop cultivation has resulted in an increase in erosion and sediment entering the watercourses i.e. rivers and wetlands. Seepage from the Mine Residue Facility and PC dams have resulted in visible salt precipitation resulting in soil contamination in the floodplain and Wilge River channels (NSS 2014). Soils surrounding the Mine Residue Facility will be disturbed during construction phase of the upgrades and the implementation of new V-drains, however, the capturing of pollutants will reduce the soil contamination in the area. The PC dam Alternative 2, re-aligning the secondary PC dam, will result in additional excavations that are likely to disturb soil profiles.

5.1.5 Surface Water and Wetlands

5.1.5.1. Data Collection and Methodology

A Surface Water Specialist Study (SWSS) including a mine water and salt balance was undertaken by J&W for this specific project (J&W 2014b). The water and salt balances have been compiled for the current state of the mine (status quo water balance) and the proposed state of the mine with the infrastructure upgrades and mining extension (Life of Mine (LOM)). The water reticulation system at Delmas Coal includes both the North Shaft and South Shaft Complexes. The SWSS further incorporates a surface water baseline assessment, where the quality and quantity of surface water from the site is presented.

Alternatives that were assessed and surface water mitigation measures in the SWSS, are discussed in **Section** 4 above.

A Wetland and Aquatics Assessment has also been undertaken for the proposed project (NSS, 2014 – **Appendix C**). The wetland assessment was undertaken in detail for the areas surrounding the Mine Residue Facility and the PC dams. A desktop delineation was undertaken for the proposed underground mining expansion. The wetland study

includes a Wetland Classification, Wetland Delineation, Present Ecological Status (PES), Environmental Importance and Sensitivity (EIS) and Wetland Functionality Assessment.

The SWSS and the Wetland and Aquatics Assessment report are appended in **Appendix C** of this EIR / EMPR Amendment.

5.1.5.2. Catchment

Delmas Coal is located in the Wilge River catchment. The Wilge River originates south of Delmas Coal and west of Leandra. One of the main tributaries that feeds the Wilge River is the Bronkhorstspruit River. Delmas Coal is located between to the west of the Wilge River and east of the Bronkhorstspruit River. The mine is situated in the headwaters of the Wilge River.

5.1.5.3. Water Management Area

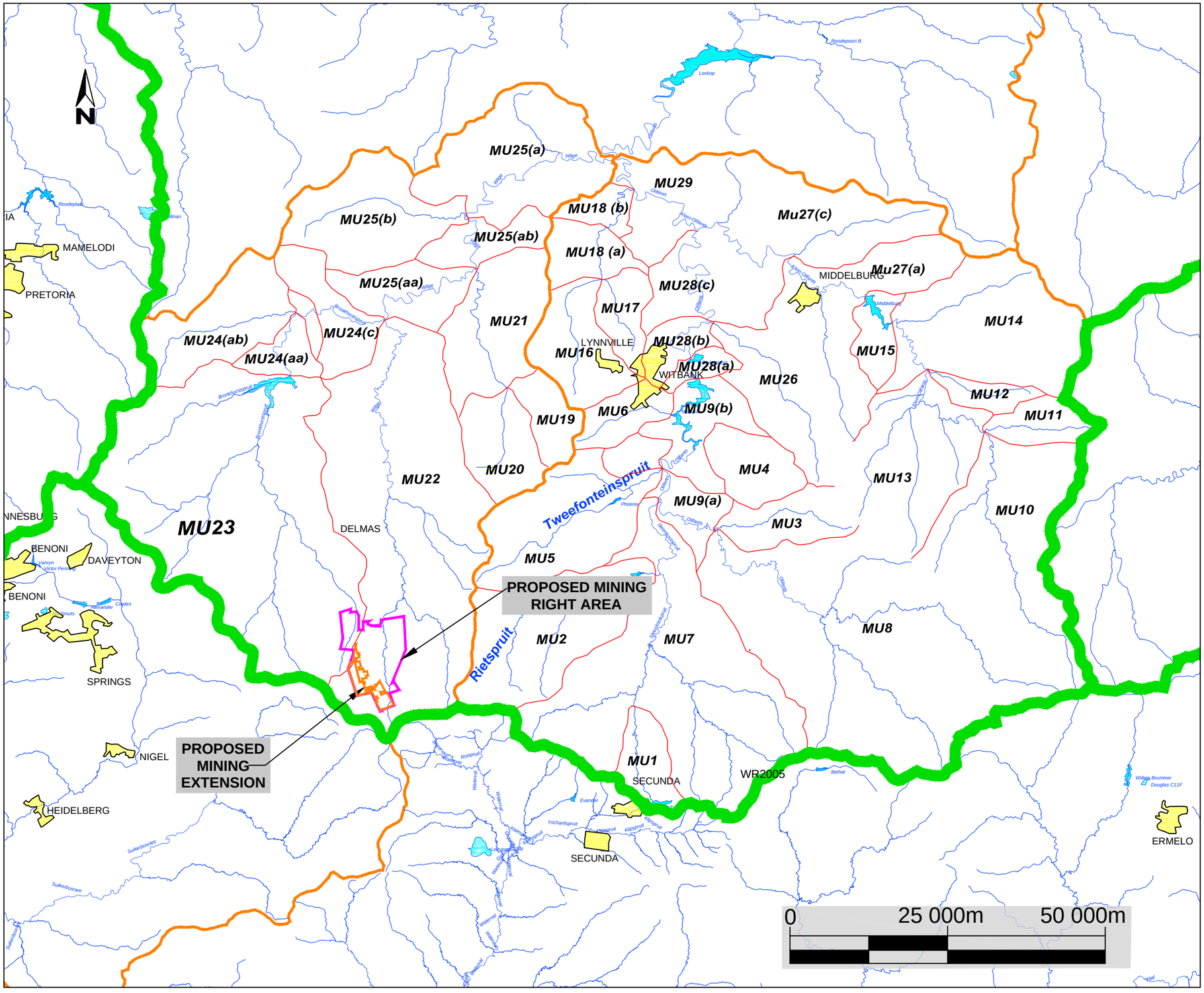
The region where Delmas Coal is situated falls within the Upper Olifants River catchment of the Olifants River Water Management Area (WMA) and in Catchment Management Units (CMU) 22 and 23. (**Figure 5-4**).

The main aquatic ecosystems associated with the study area are the Wilge River, Steenkoolspruit and Bronkhorstspruit. The study area is located in the Wilge River Catchment (Quaternary Catchment B20E), and a very small portion of the underground mining expansion on the watershed between the Wilge River and the Bronkhorstspruit (Quaternary Catchment B20A) (**Figure 5-5**).

The major downstream receiving water body is the Loskop Dam.

The Olifants River Catchment is of considerable economic importance as a significant number of mining, industrial and agricultural activities (including intensive irrigation schemes) are concentrated within the catchment. This catchment is a principal sub-catchment of the Limpopo River and covers an area of approximately 54 570 km^2 within the eastern parts of South Africa (DWAF, 2004).

According to the National Freshwater Ecosystem Priority Areas (NFEPA) classification, there is no Category 1 FEPA wetland on, or within 1 km of the study area, although wetland clusters are situated within 2 km of the study area.



General Notes

* Map From WRC: Surface Water Resources of SA 2005
* Book of Maps Version 1:

Legend

- Major towns and cities
- Rivers
- Impoundments
- Management Unit boundaries
- Water management areas
- Secondary catchments
- Tertiary catchments

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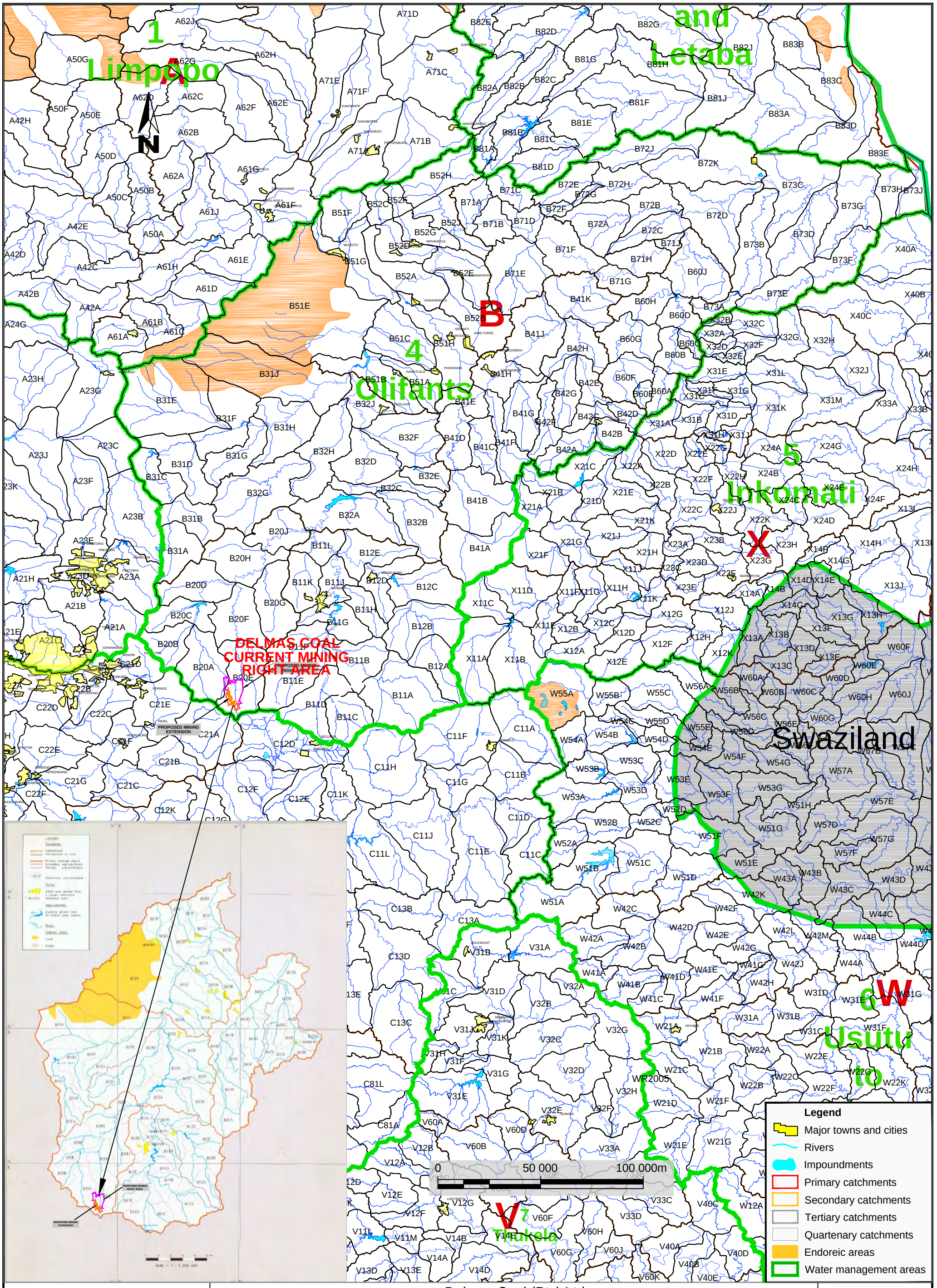
DELMAS COAL IN RELATION TO WATER MANAGEMENT UNITS

Job No D910-04

Figure 5-4



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LOCATION OF MINING AREA IN RELATION TO ITS CATCHMENT AND RECEIVING WATER BODY

Figure 4-5

5.1.5.4. Surface Water Quantity

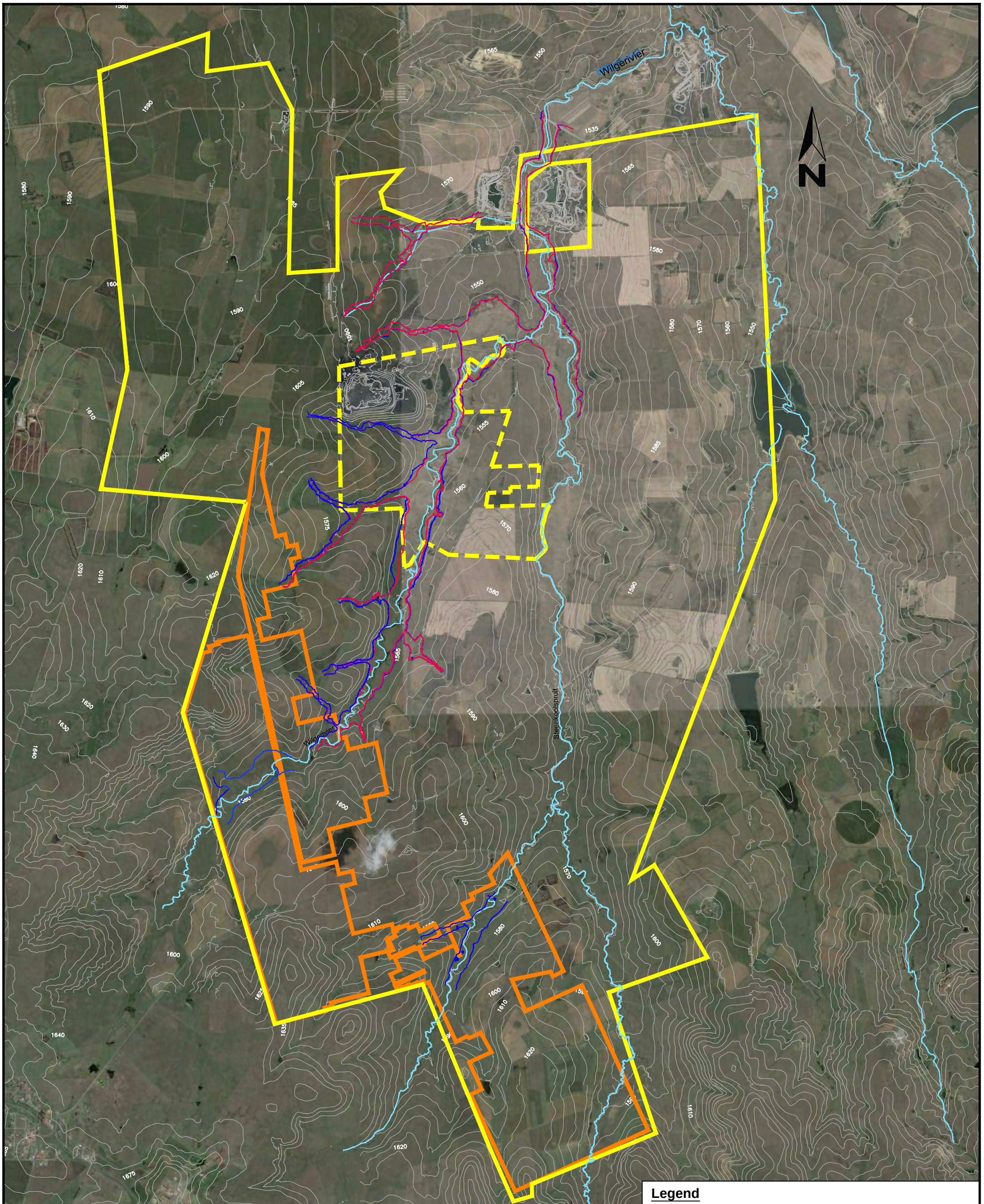
The Delmas Coal site is located entirely within the Wilge River catchment. This river drains ultimately to the Loskop Dam. Within the Wilge River catchment surface water is utilised primarily for agriculture and livestock watering. The MAR of the Loskop Dam is 21 million cubic metres. The loss in catchment yield due to the Delmas Coal's site capturing water in its PC dam is approximately 0.2%, as shown in **Table 5-5**.

Table 5-5: Percentage reduction in runoff from B20E due to Delmas Coal mine

B20E Catchment Area (ha)	Delmas Coal dirty catchment area (ha)	MAR for B20E before Delmas Coal development (10^6m^3)	MAR for B20E without Delmas Coal site (10^6m^3)	Percentage reduction in B20E runoff due to Delmas Coal (%)
62 000	133	21.0	20.995	0.2

5.1.5.5. Floodlines

The 1:100 year return period floodlines were determined for the entire site and can be seen in **Figure 5-6**.



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EIR / EMPR

1:100 YEAR FLOODLINES

Ï : D910-04

Figure 5-6

5.1.5.6. Resource Class, Resource Water Quality Objectives (RWQO) and Reserve Determination

Resource Water Quality Objectives

The Directorate National Water Resource Planning (DNWRP) of the (then) Department of Water Affairs and Forestry (DWAF) developed a water quality management strategy for the Upper and Middle Olifants River catchment, which was published in 2009 (DNWRP, 2009). One of the key elements of this strategy is Resource Water Quality Objectives (RWQO). Interim RWQO were determined based on the current set of objectives in the Witbank, Klipspruit and Middelburg Dam catchments, which was modified to account for the water quality component of the Ecological Reserve. Where previous objectives were not available, the South African Water Quality Guidelines, together with the present water quality status, were used to determine RWQO. The set of RWQO determined for the Upper Olifants catchment are interim objectives that will be reviewed once the water quality component of the Ecological Reserve has been updated (DNWRP, 2009).

Resource Class

The Minister of Water and Sanitation published, the proposed classes and resource quality objectives of water resources for the catchments of the Olifants River catchment in GN 466 on 22 April 2016.

Water resources are classified in terms of their permissible utilisation and protection. The classification of the Upper Olifants River catchment is Class III, requiring sustainable minimal protection and indicating high utilisation.

Reserve

The Ecological Reserve is not intended to protect the aquatic ecosystem per se, but to maintain aquatic ecosystems in such a way that they can continue to provide the goods and services to society. The Reserve (ecological and basic human needs) is the only right to water; all other water uses are subject to authorisations.

The objective of a Reserve Determination Study is to quantify the ecological water requirements of the water resource and to estimate the volume and the quality of water required to maintain the water resource system in the Recommended Ecological Category (REC).

5.1.5.7. Surface Water Quality

Baseline water quality sampling was undertaken at four locations, three within the Wilge River downstream of the Delmas Coal site and one in the Wilge River of South Shaft. A monthly sampling programme was implemented for the period May 2012 to January 2014. For the purposes of the assessment, results of Electrical Conductivity (EC), fluoride (F), Sulphate (SO_4), Calcuim (Ca), Magnesuim (Mg), and Chlorine (Cl) values are compared with the interim RWQOs for CMU 22 of the Wilge River catchment.

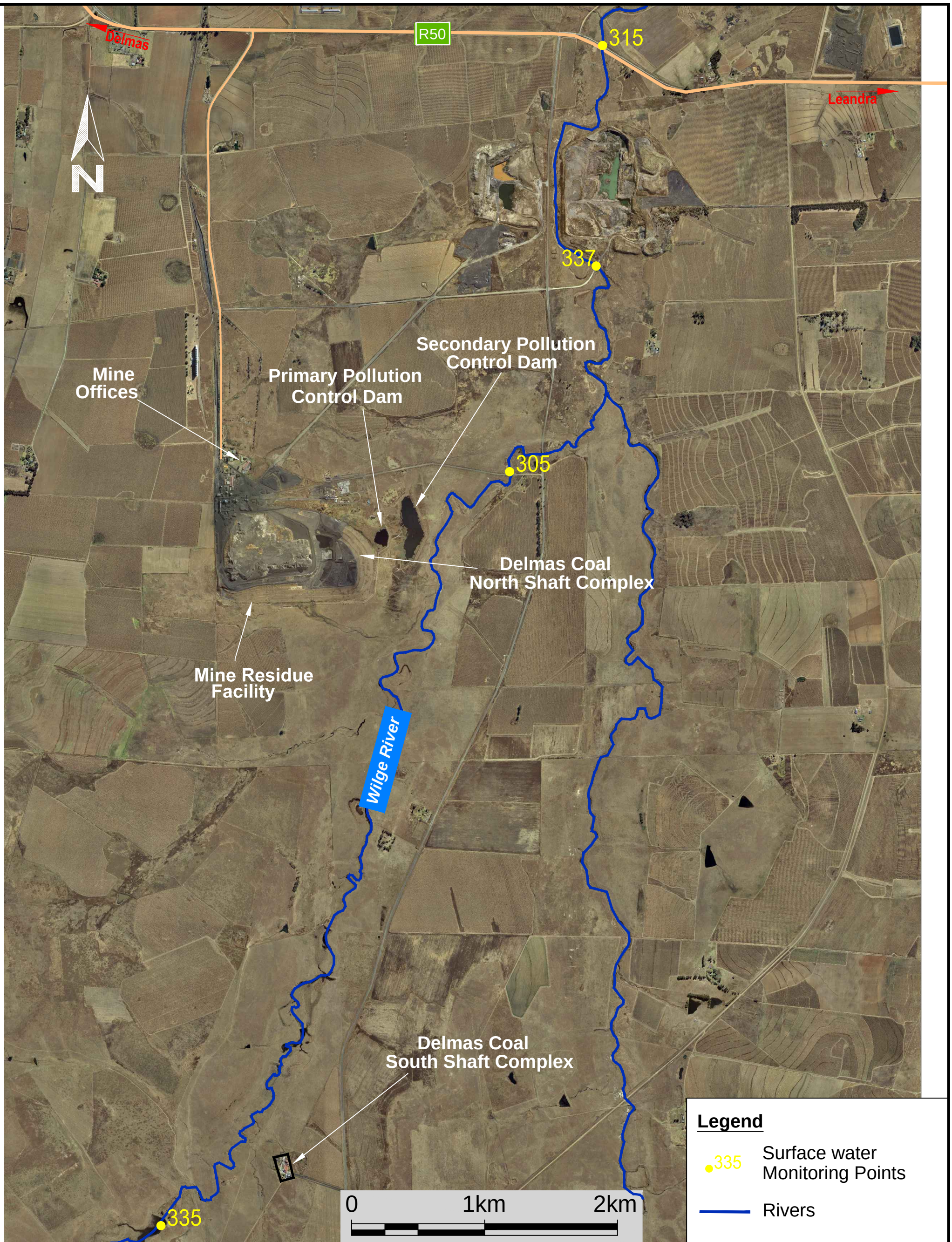
The surface water quality monitoring protocol for the Delmas Coal project can be found appended to the Surface Water Report, attached to this EIR / EMPR Amendment in **Appendix C**.

Surface water quality monitoring locations

The position of the surface water monitoring locations for the Delmas Coal project are illustrated in **Figure 5-7** and the coordinates of these points are given in **Table 5-6**.

Table 5-6: Surface water monitoring points.

Sampling location name	Sampling location description	Co-ordinates
305	Wilge River: Immediately downstream of the pollution control dams and mine residue	S 26°15.674' E 28°50.943'
315	Wilge River furthest downstream at bridge	S 26°13.938' E 28°51.365'
335	Wilge River: Upstream point at Enkeldebosch farm house and upstream of the South Shaft	Not available
337	Wilge River before river diversion at Ikhwezi Colliery	S 26°14.837' E 28°51.334'



Co-ordinate System: WGS84 Projection: WG 29

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SURFACE WATER MONITORING POINTS USED IN BASELINE DESCRIPTION

Job No: D910-04

Figure 5-7

Surface water quality objectives

There are various standards and objectives in terms of surface water quality, depending on what the end use is to be. Some of these include the DWS Domestic Use Guidelines and the South African National Standards (SANS) 241 Drinking Water specifications. In some cases, however, there are more specific standards in terms of the catchment itself, as determined by the Catchment Management Agency (CMA).

As mentioned above one of the key elements of water quality management strategy of the DNWRP is the establishment of Interim RWQOs. The catchment was delineated into CMUs and interim RWQO were developed for each CMU. The interim RWQOs for CMU 22 of the Wilge River catchment are indicated in **Table 5-7**.

Table 5-7: Interim RWQO for Management Unit 22 of the Wilge River Catchment (DNWRP, 2009)

Constituent	Unit	CMU 22
Physical		
Electrical conductivity (EC)	mS/m	40
Dissolved oxygen (DO)	% Sat	70
pH	-	6.5-8.4
Suspended solids	mg/ℓ	-
Turbidity	NTU	-
Chemical, Inorganic		
Alkalinity	mg $CaCO_3$/ℓ	120
Boron (B)	mg/ℓ	0.5
Calcium (Ca)	mg/ℓ	25
Chloride (Cl)	mg/ℓ	20
Fluoride (F)	mg/ℓ	0.5
Magnesium (Mg)	mg/ℓ	20
Potassium (K)	mg/ℓ	10
Sodium (Na)	mg/ℓ	50
Sodium Absorption Ration (SAR)	$Meql^{0.5}$	1.0
Sulfate (SO_4)	mg/ℓ	60
Total Dissolved Solids (TDS)	mg/ℓ	280
Chemical, Inorganic		
Dissolved Organic Carbon (DOC)	mg/ℓ	10
Metals, Dissolved		
Iron (Fe)	mg/ℓ	1.0
Manganese (Mn)	mg/ℓ	0.18
Aluminium (Al)	mg/ℓ	0.02
Chromium VI (Cr VI)	mg/ℓ	0.05

Constituent	Unit	CMU 22
Plant Nutrients		
Ammonia (NH_3)*	mg/ℓ as N	0.007
Nitrate (NO_3)	mg/ℓ as N	6
Phosphate (PO_4)	mg/ℓ as P	0.05
Total phosphorus	mg/ℓ as P	0.25
Total Inorganic Nitrogen	mg/ℓ as N	2.5
Microbiological		
E. coli	# per 100 mℓ	130
Chlorophyll a	mg/ℓ	0.02

***** Free unionised NH_3

Baseline water quality analysis

Constituents included in the analyses are pH, electrical conductivity (EC), chlorides (Cl), sulfates (SO_4), total dissolved solids (TDS), suspended solids (SS), iron (Fe), manganese (Mn), calcium (Ca), magnesium (Mg), sodium (Na), potassium (K), nitrates (NO_3), total alkalinity, fluoride (F) and zinc (Zn) (J&W, 2014b).

Water quality at sampling point 305, which is downstream of the Mine Residue Facility and pollution control dams, is negatively impacted by seepage water from the Delmas Coal site. The water samples collected at this point during October and November 2013 indicate that TDS, SO_4, Mg, Ca and Na levels are all significantly elevated above that of the upstream monitoring point (J&W, 2014b).

An assessment of the water quality status for the period May 2012 to January 2014 is provided in the time-series graphs and discussion in the specialist Surface Water Assessment included in **Appendix C**. For the purposes of the assessment, results of EC, F, SO_4, Ca, Mg, and Cl values were compared with the Interim RWQOs for CMU 22 of the Wilge River catchment.

A Piper diagram was compiled for the water collected from the abovementioned monitoring sites as indicated in **Figure 5-8**. Two aspects are noted from this figure:

- Water quality at the upstream point in the Wilge River (335) has a different chemical character than the downstream point (305); and
- The chemical character of water quality at the downstream point (305) is similar to the seepage collected in the two geotechnical test pit samples (TP2A/4 and TP6A/2). This indicated that seepage from the Mine Residue Facility is impacting on the Wilge River.

Water quality in the Wilge River therefore deteriorated from upstream to downstream, as water flows past the Delmas Coal activities. The mine therefore does indeed have a negative impact on the water quality in the Wilge River (J&W SWSS, 2014b).

5.1.5.8. Sensitivities

The clean water contribution of the Wilge River towards the water quality of the Loskop Dam is regarded as a high priority by the authorities. The DWS classified the Wilge River with a proposed Management Class of II, requiring moderate protection and moderate utilisation (J&W SWSS, 2014b).

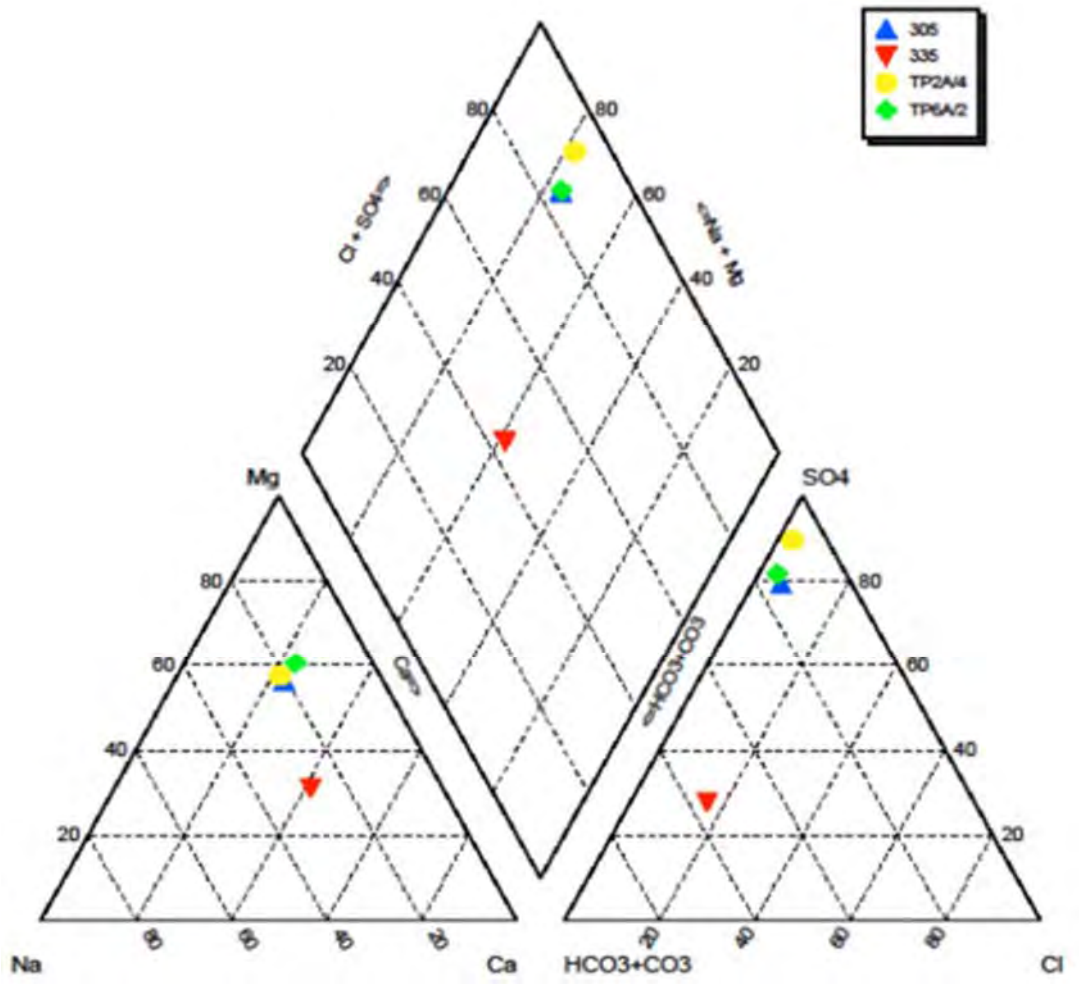

Figure 5-8: Piper diagram of the flows upstream, downstream and from Delmas Coal indicating Delmas Coal's impact on the Wilge River.(J&W 2014a)

5.1.5.9. Water Use

Most of the water uses at the Delmas Coal operation, as defined in terms of Section 21 of the NWA, commenced prior to the promulgation of the NWA. Although these water uses have not been formally declared as existing lawful water uses in terms of Section 33 of the NWA, the water uses were exercised two years prior to the commencement of the NWA. An application for an IWULA was submitted to DWS in 2011. An update to this IWULA was submitted in November 2014 to include additional existing water uses and to address comments received from DWS on the original application. A WUL was issued in 2015 with Licence Number: 04/B20E/ABCGIJ/3659. Water uses at the Delmas Coal operation includes domestic use, underground mining use, process water use, dust suppression, vehicle washing, etc.

5.1.6 Mine Water Balance

A comprehensive water balance model was developed in support of the Delmas Coal IWULA in 2014 and for the purposes of the EA and EMPR amendment. The objective of the water balance is to quantify the water make throughout the mine, to assist in the sizing and planning of the water management systems, and to facilitate the planning and costing of these. Please refer to the Surface Water Report, attached to this EIR / EMPR

amendment in **Appendix C**, for a list of important assumptions, limitations and information used in the development of this mine water balance.

In summary a schematic diagram of the status quo water balance is included **Figure 5-9** This water balance diagram sets out the modelled average flows within the Delmas Coal mine, based on the 92 years of historical daily rainfall data.

The following can be noted from the schematic water balance diagram:

- There are four sources of water for the Delmas Coal mine, namely: rainfall, Ikhwezi Colliery Pit G, the South Shaft borehole, and minimal groundwater into the underground workings;
- For average rainfall conditions, according to the water balance model, the PC dam at Delmas Coal will not spill to the environment;
- The model yields an average water use in the underground Sections 41, 42, 43, and 44 of 150.9 m^3/day;
- The groundwater that is generated underground is a relatively small volume when compared to the water requirements for the underground Sections, or the North Shaft plant;
- The largest flow into the proposed lined PC dam is from the co disposal facility, product stockpile area, ROM stockpile area and the shaft/substation area, via the proposed silt trap. This flow, for average rainfall conditions relates to 150.5 m^3/day; and
- The target water use within the North Shaft plant is 275 m^3/day.

5.1.6.1. Salt Balance

In conjunction with the water balance, a salt balance and salt load balance (in Total Dissolved Solids (TDS)) were also developed based on the status quo scenario as well as based on the proposed upgraded facilities (with the proposed reconstruction of the two PC dams) which are outlined in the schematic salt balance diagram in **Figure 5-10** and **Figure 5-11**. The diagrams present the average TDS concentration values and Salt loads within the Delmas Coal mine. Please refer to the Surface Water Report, attached to this EIR / EMPR amendment in **Appendix C**, for a detailed discussion of the salt balance related to the project.

The salt balance highlights the following aspects:

- The primary source of water for the mine is currently Ikhwezi Colliery Pit G which has a high salt concentration.;
- The TDS levels in the two existing unlined PC dams are even higher than the concentrations in Ikhwezi Pit G due to runoff from the discard facility, ROM stockpiles, product stockpiles and the dry weather flow from the plant;
- The TDS from the borehole at South Shaft is relatively high; and
- The TDS concentration of the water that exits the sewerage works at South Shaft, passing to the Underground Dam is also elevated, as water from the South Shaft borehole is used at South Shaft for household purposes.

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Client: Delmas Coal
Job: Mine Water Balance - Proposed New Lined PCD

FIG. 7(a): FLOWS - LOM WITH PROPOSED LINED PC DAM

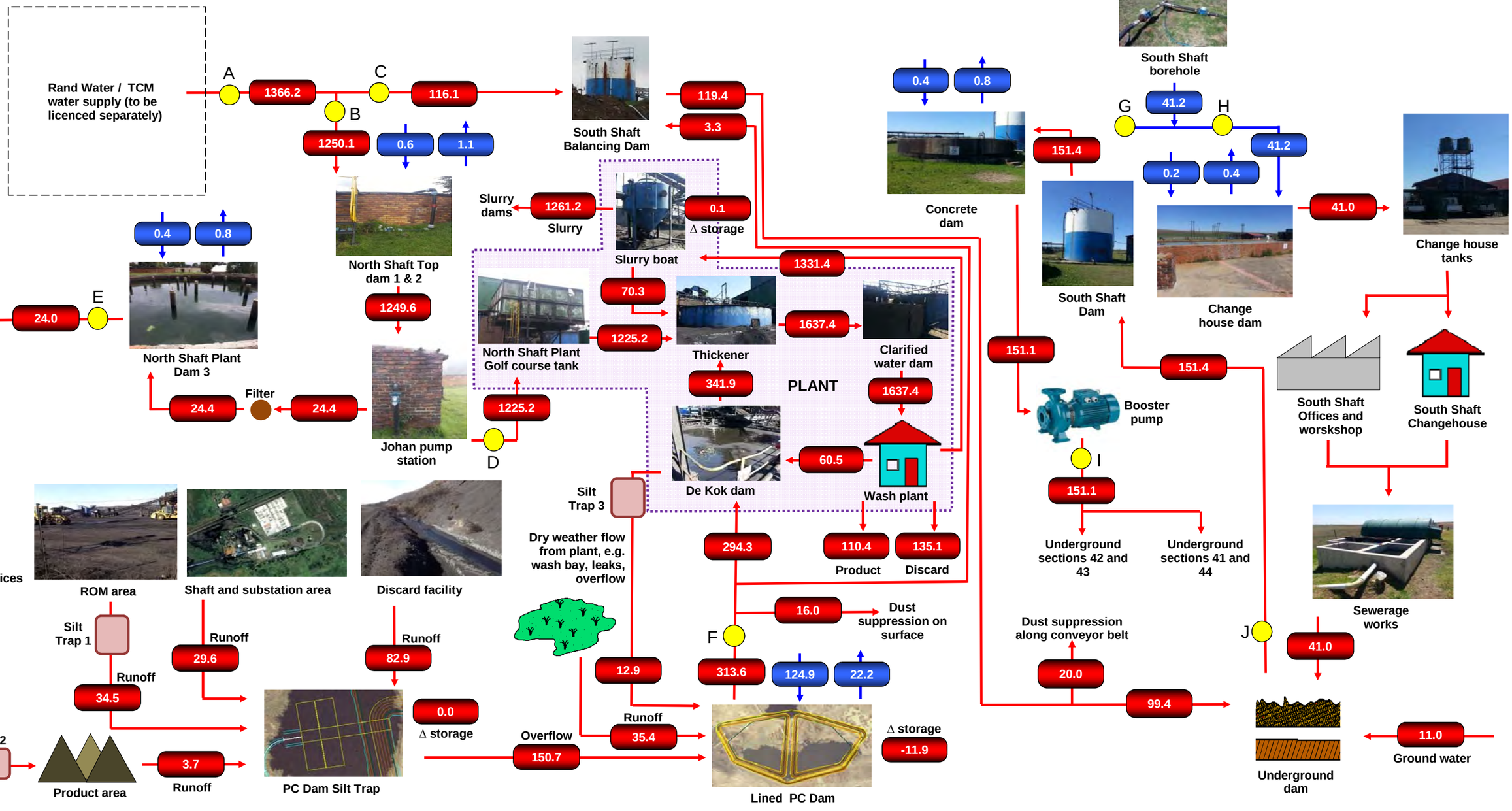
Our Ref: D223-01
Set no.: 1
Made by: GS
Date: 04 November 2014
Run time: 04-11-2014 12:55

Rainfall Used: Average
Analysis: LOM (with proposed PC dam and silt trap)

All flows in m^3/day

LEGEND
Flow (dirty water)
Flow (clean water)
Flow meter

1. WATER BALANCE



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Job: Mine Water Balance - Proposed New Lined PCD

FIG. 7(b): TDS CONCENTRATIONS - LOM WITH PROPOSED LINED PC DAM

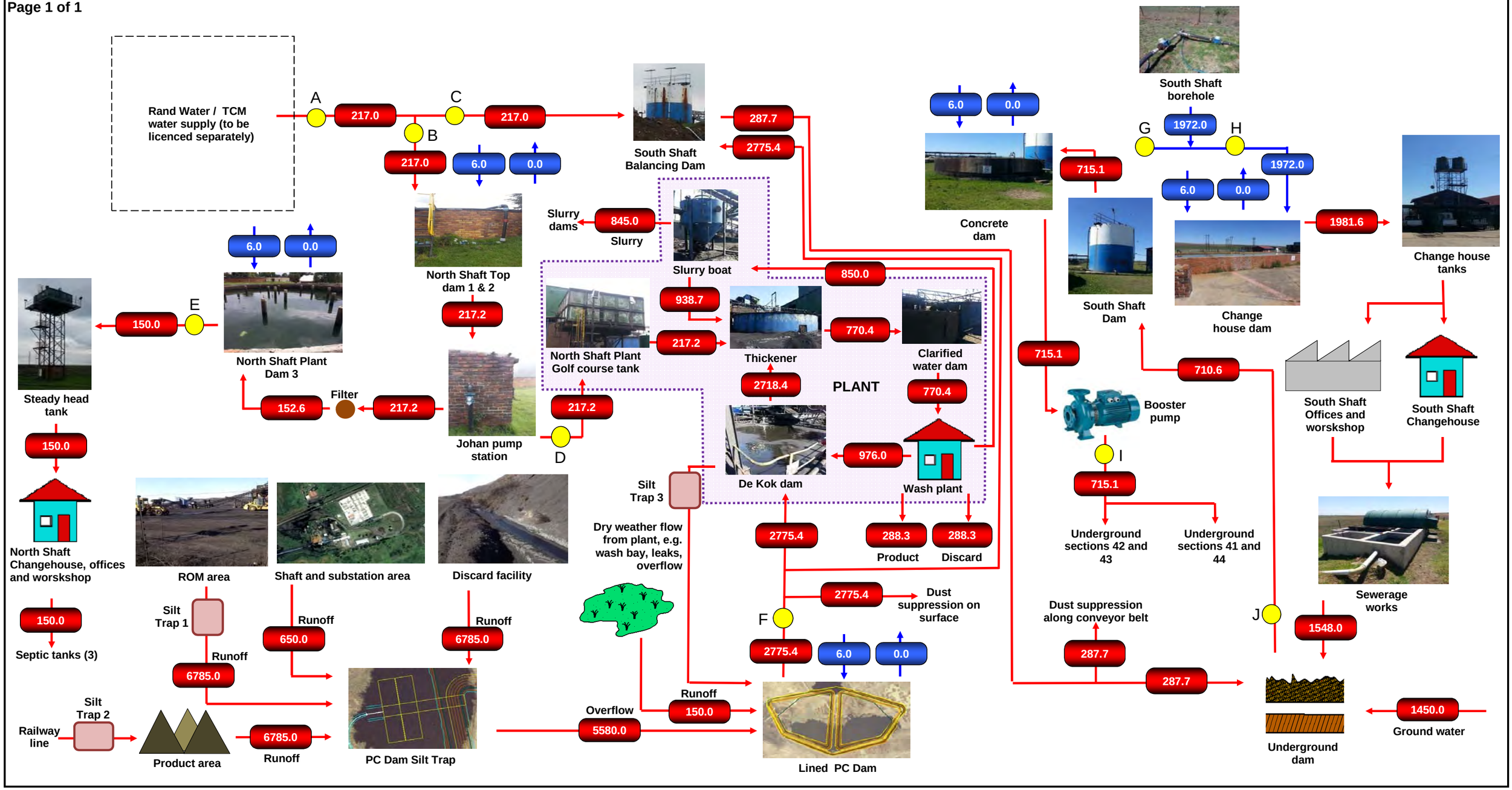
Our Ref: D223-01
Set no.: 1
Made by: GS
Date: 04 November 2014
Run time: 04-11-2014 12:55

Rainfall Used: Average
Analysis: LOM (with proposed PC dam and silt trap)

All TDS concentrations in mg/l

LEGEND
- Flow (dirty water)
- Flow (clean water)
- Flow meter

1. WATER BALANCE



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Client: Delmas Coal
Job: Mine Water Balance - Proposed New Lined PCD

FIG. 7(c): SALT LOADS - LOM WITH PROPOSED LINED PC DAM

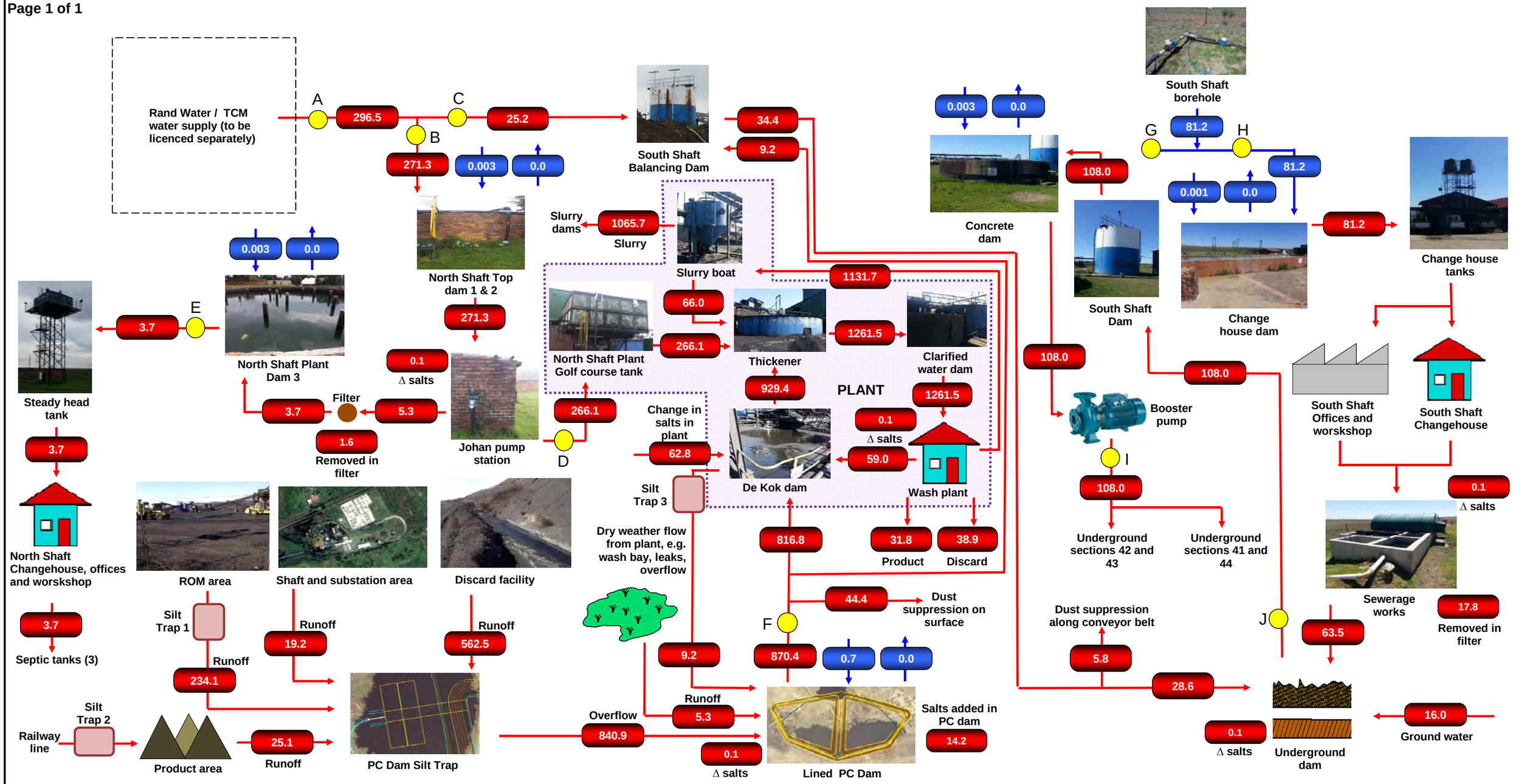
Our Ref: D223-01
Set no.: 1
Made by: GS
Date: 04 November 2014
Run time: 04-11-2014 12:55

Rainfall Used: Average
Analysis: LOM (with proposed PC dam and silt trap)

All salt loads in kg/day

LEGEND
- Flow (dirty water)
- Flow (clean water)
- Flow meter

1. WATER BALANCE



5.1.6.2. Wetlands

Delineated wetlands

In 2010, three major wetland systems were identified in a biodiversity assessment by NSS for the proposed KiPower IPP to the north of Delmas Coal.

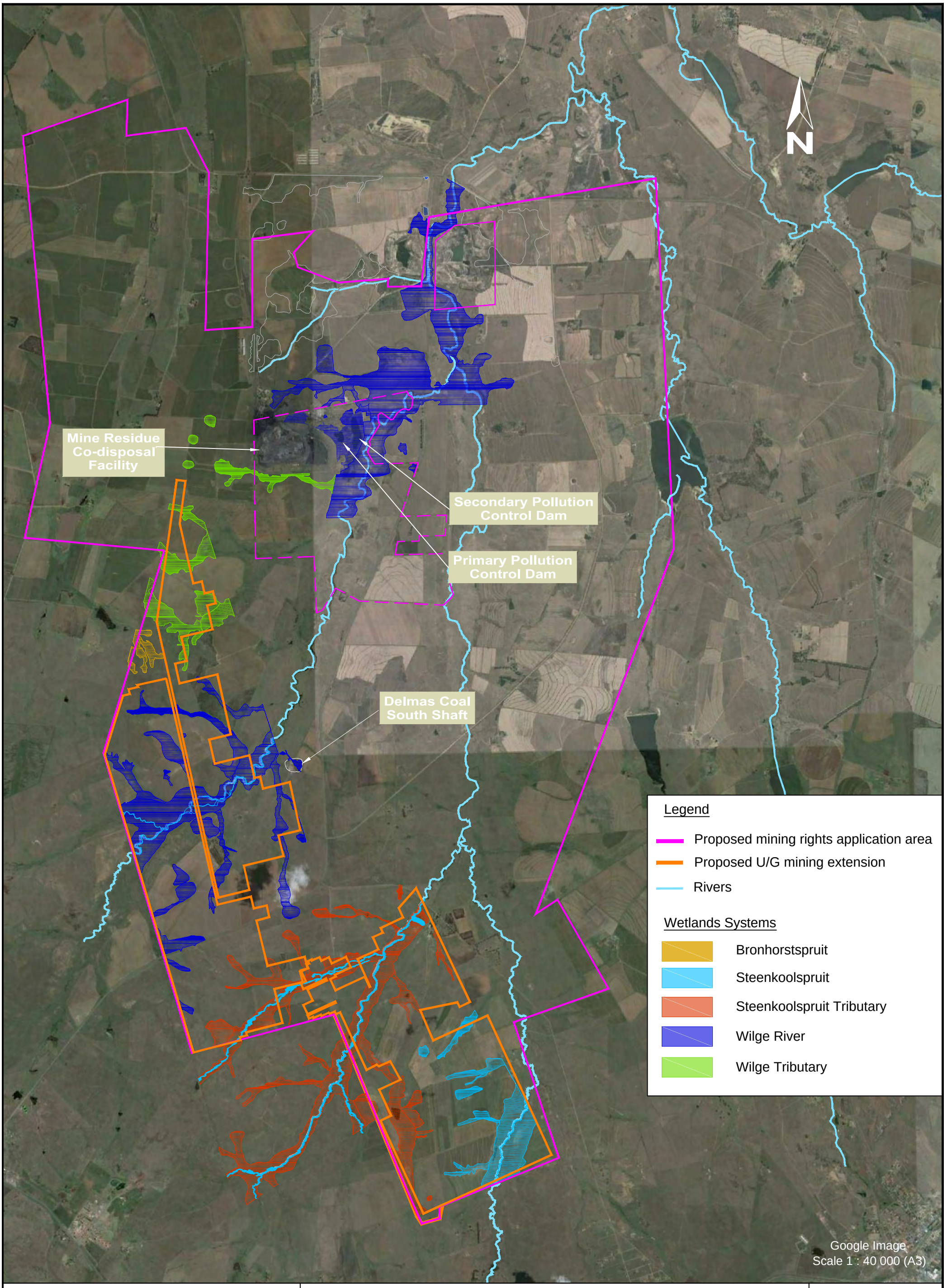
In 2014, the wetland assessment was extended by NSS to include the areas associated with the proposed underground mining expansion and residue disposal facility. The wetland systems identified during these studies are indicated on **Figure** 5-12 and the wetland types on **Figure 5-13**. A summary of the major wetland systems within these area, is provided in **Table 5-8**.

Table 5-8: Summary of delineated wetlands (adapted from NSS, 2014)

HGM[3] Unit name	Wetland type	Extent of wetland (ha)	
		Proposed underground mining extension	Mine Residue Facility
1 Steenkoolspruit wetland system			
1a	Floodplain	55.83	
1b	Hillslope seepage wetland with channelled outflow	7.10	
1c	Hillslope seepage wetland without channelled outflow	21.75	
1d	Depression	1.81	
1e	River	1.00	
2 Steenkoolspruit Tributary wetland system			
2a	Floodplain	172.40	
2b	Hillslope seepage wetland without channelled outflow	58.56	
2c	Channelled valley bottom wetland	64.69	
2d	Unchannelled valley bottom wetland	14.47	
2e	River	15.41	
3 Wilge River wetland system			
3a	Floodplain	101.50	65.01
3b	Hillslope seepage wetland with channelled outflow	20.76	
3c	Hillslope seepage wetland without channelled outflow	39.57	6.71
3d	Channelled valley bottom wetland	61.43	
3e	Unchannelled valley bottom wetland	12.25	
3f	Depression	0.25	

[3] HGM: Hydro geomorphic

HGM[3] Unit name	Wetland type	Extent of wetland (ha)	
		Proposed underground mining extension	Mine Residue Facility
3g	River	5.19	3.87
4 Tributary of Wilge River (South) wetland system			
4a	Hillslope seepage wetland without channelled outflow	56.30	
4b	Unchannelled valley bottom wetland	10.76	
5 Bronkhorstspruit			
5	Hillslope seepage wetland with channelled outflow	12.30	
6 Tributary of Wilge River (North) wetland system			
6a	Channelled valley bottom wetland		12.37
6b	Hillslope seepage wetland with channelled outflow		4.48
6c	Hillslope seepage wetland without channelled outflow		3.16
6d	Depression		5.12
TOTAL		733.33	100.73



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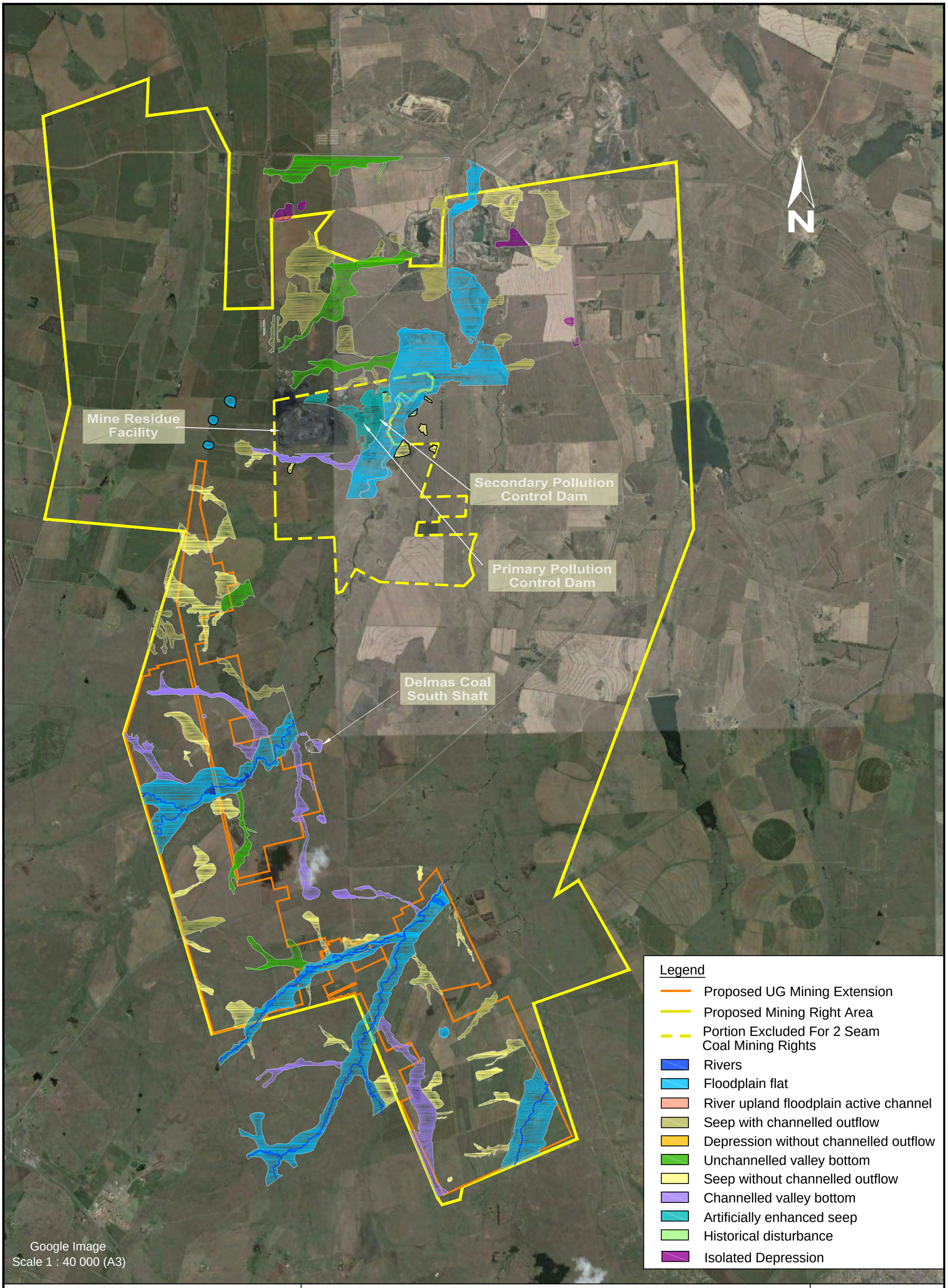
WETLANDS SYSTEM

Job No: D910-04

Figure 5-12



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DELINEATED WETLANDS

Job No: D910-04

Figure 5-13

Present Ecological State (PES)

Current impacts on the wetlands are mainly associated with mining and agriculture. A summary of the Present Ecological State (PES) of the wetland systems per wetland driver (hydrology, geomorphology and vegetation) is provided in **Table 5-9.**

Most of the systems were categorised as largely modified (category D) for hydrology, with the exception of the Wilge River system which, due to increased runoff and water inputs from point sources in its catchment, was categorised as seriously modified (category E). The seepage wetlands within the Bronkhorstspruit were categorised as moderately modified (category C) due to the lack of any major impacts reducing water input to, or distribution and retention within, the system.

From a geomorphology perspective, the Steenkoolspruit Tributary and Wilge River were found to be the most impacted and categorised as moderately modified (category C), mainly due to the numerous dams within the catchments of their floodplains. The Steenkoolspruit, Wilge Tributary and Bronkhorstspruit systems were less impacted. The section of the Wilge River associated with the Mine Residue Facility was categorised as seriously modified (category E), mainly due to the upstream dams as well as evidence of a historic shortening of the stream. The purpose this historic shortening is not known and it is not currently in use.

In terms of vegetation, the Wilge Tributary wetland system is the most impacted, and has been categorised as seriously modified (category E). The Steenkoolspruit Tributary and Bronkhorstspruit are the least impacted, and have been categorised as moderately modified (category C) (NSS, 2014).

Table 5-9: Summary of PES of wetlands per wetland driver (adapted from NSS, 2014)

HGM Unit	Level of investigation	Hydrology	Geomorphology	Vegetation
1 Steenkoolspruit wetland system	Desktop	D	B	D
2 Steenkoolspruit Tributary	Desktop	D	C	C
3 Wilge River wetland system	Desktop	E	C	D
	Detailed	E	E	D
4 Wilge River Tributary (South)	Desktop	D	B	E
5 Bronkhorstspruit	Desktop	C	A	C
6 Wilge River Tributary (North)	Detailed	D	C	D
LEGEND:				
A	Unmodified, natural			
B	Largely natural with few modifications			
C	Moderately modified			
D	Largely modified			
E	Seriously modified			

Ecosystem services

The wetlands provide indirect ecosystem services that have regulating and supporting benefits. Of the various wetland units assessed, the Steenkoolspruit and Wilge River floodplains contribute the most towards flood attenuation. In terms of stream flow regulation, the floodplains, seepage wetlands and valley bottom systems contribute most. The seepage wetlands on site play an important role in sediment trapping. All wetland units contribute considerably towards the removal of phosphates, nitrate and other toxicants.

Although wetland units within the Wilge River system are heavily impacted by invasive vegetation encroachment and altered hydrological regimes, all the wetland units (except HGM Unit 3f) contribute considerably towards the maintenance of biodiversity, in that they still provide suitable habitat for several species of conservation importance (NSS, 2014).

Ecological Importance and Sensitivity (EIS)

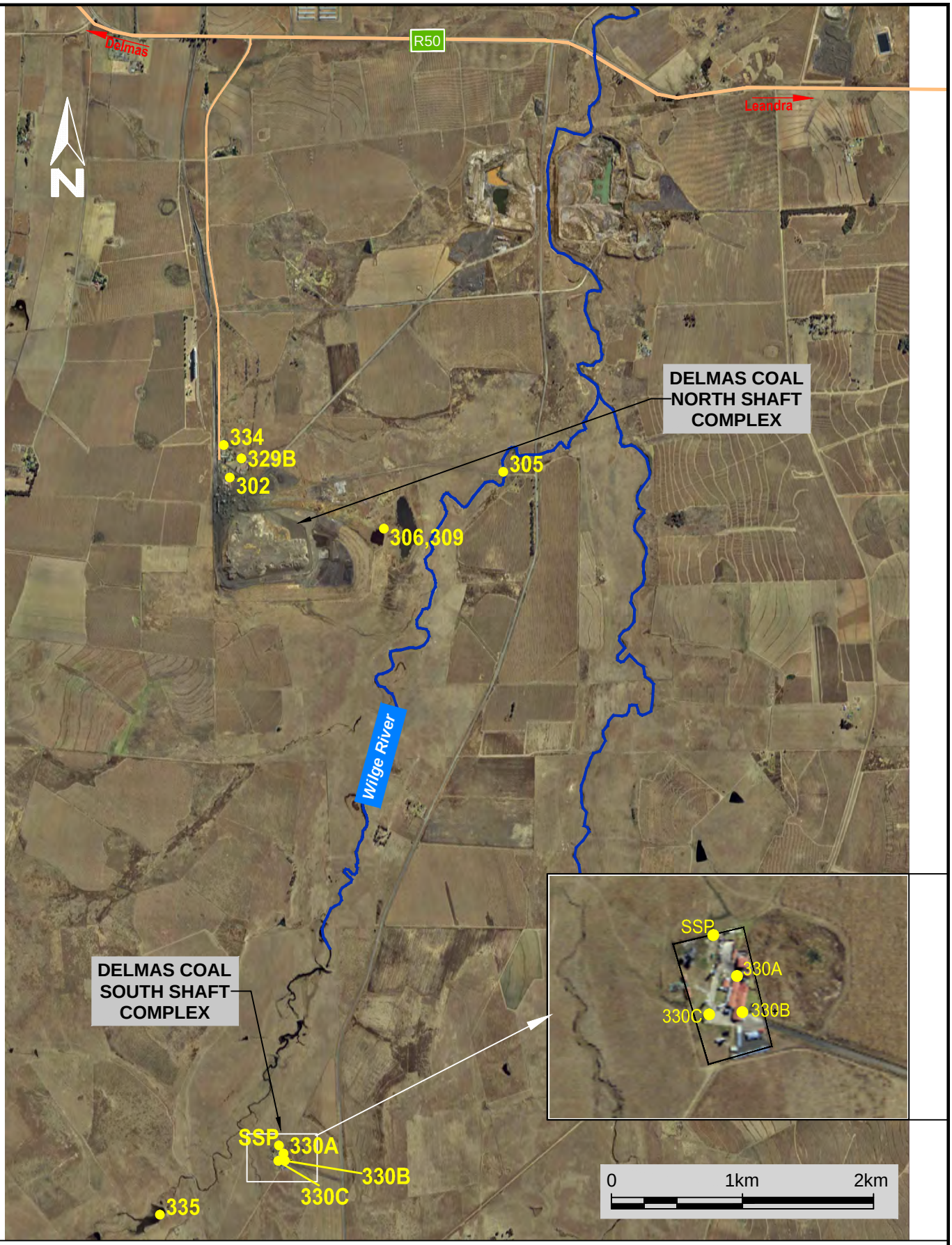
The large floodplains and associated wetland units of the Steenkoolspruit, Steenkoolspruit Tributary and Wilge River systems (HGM Units 1 and 2) were classified with a High Ecological Importance and Sensitivity (EIS) (or Category B). The smaller upland wetland units of the Wilge River Tributaries (HGM Units 4 and 6) and the Bronkhorstspruit (HGM Unit 5) systems were classified as a Moderate EIS, or Category C (NSS, 2014).

5.1.6.3. Aquatic ecosystem

An assessment was done by NSS in 2014 of the aquatic ecosystem at the points indicated in **Table 5-10**, and indicated on **Figure 5-14**. Details on the methodologies used are available in the specialist report attached in **Appendix C**.

Table 5-10: Aquatic sampling sites used in baseline assessment

Sampling site	Description	Co-ordinates	
ST1	On Steenkoolspruit, upstream of Mine Residue Facility	-26.26131	28.88857
335	On Wilge River, upstream of Mine Residue Facility	-26.30980	28.82533
337	On Wilge River, downstream of Mine Residue Facility	-26.24731	28.86031



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POSITION OF AQUATIC SAMPLING POINTS USED IN BASELINE ASSESSMENT

Job No: D910-04

Figure 5-14

Macro-invertebrates

Macro-invertebrate communities were sampled using the South African Scoring System, Version 5 (SASS5) method. An assessment was also done of the Macro-invertebrate Response Assessment Index (MIRAI) to determine the PES of the macro-invertebrate community assemblage. The index integrates the ecological requirements of the invertebrate taxa in a community or assemblage, and their response to modified habitat conditions, whilst comparing the present assemblage with a reference list.

The upstream sampling site, ST1 on the Steenkoolspruit, had the lowest SASS5 and MIRAI scores (45 and 40 respectively), indicating that the majority of the families present are mostly hardy and tolerant to ecological changes. The site has very slow flowing water, causing the species that prefer this habitat to be absent. The increased water levels also reduced habitat availability for macro-invertebrates.

In general, on the Wilge River system, the downstream sampling site 337 has slightly higher SASS5 scores than the upstream sampling site 335 (99 and 93 respectively). The same is observed for the MIRAI score (61 and 60 respectively). This was probably due to slightly better flow conditions and habitat availability for macro-invertebrates at sampling site 337. Based on the SASS5 scores, both sites are categorised as largely natural (category B). Both sites are however impacted upon by water quality and flow, and as a result should rather be considered to be moderately modified according to MIRAI.

Ichthyofauna (fish)

The fish community integrity was assessed using the Fish Response Assessment Index (FRAI). Data from this assessment suggests that the fish were negatively impacted upon by reduced habitat availability (especially at sampling site ST1), instream obstructions, such as weirs, impoundments and flow modifications that hinder fish migrations.

Six of the expected fish species were sampled during the 2014 assessment, including the indigenous species *Barbus anoplus, B. paludinosus, Pseudocrenilabrus philander*, *Tilapia sparrmanii, Clarias gariepinus* and *Labeo umbratus*. The FRAI scores ranged from moderately modified (at sampling sites ST1 and 335) to largely natural (sampling site 337).Therefore, the baseline study indicates that there are deteriorations in the fish assemblages in comparison to the expected reference list for the area.

The fish assemblages were mainly influenced by reduced habitat availability and flow conditions caused by numerous weirs, culverts, road crossings and dams. The water quality deterioration affected the population to a slightly lesser extent in this case, due to the species tolerance to modified water quality conditions.

No abnormalities were found on any of the fish sampled. However, black spot was observed on some of the *B. anoplus* specimens caught in the Wilge River. Black spot is a parasitic infection caused by the turbellarian flatworm species and can cause damage to the skin and fins of fish, haemorrhage and even death in juveniles. The presence of this parasite is indicative of the negative water quality impacts in the system (NSS, 2014).

Diatoms

The diatom species *Achnanthidium eutrophilum, Achnanthidium minutissima, Aulacoseira granulate* var. *angustissima, Cocconeis placentula* var. *placentula, Epithemia adnata, Epithemia sorex, Melosira varians, Nitzschia inconspicua, Nitzschia supralitorea, Rhopalodia gibba* var. *gibba* were dominant at the sampling sites. The diatom assemblage at the sampling sites consist of taxa typical of standing and slow flowing waters of moderate to high electrolyte content and therefore

suggests that the water quality is currently in a moderate to good condition (NSS, 2014). The outcome of the diatom assessment is summarised in **Table 5-11**.

Table 5-11: Outcome of diatom assessment (NSS, 2014)

	Sampling site		
	ST1	335	337
Total number of species	24	43	34
Ecological class based on diatom species composition	B	B/C	C
Class description	Good	Good/Moderate	Moderate

Index of Habitat Integrity

The instream habitats, at sampling sites 335 and 337 on the Wilge River and ST1 on the Steenkoolspruit, are all classified as being moderately modified (Category C). The Wilge River and Steenkoolspruit have slow flowing water that is affected by weirs, culverts, bridges and road crossings. At sampling site 335, large flow modifications and moderate inundations were observed due to upstream dams and numerous road crossings. The reduced flow caused an excessive increase in algal content that smothers the river bed.

In most cases, the riparian habitats were less impacted upon than the instream habitats. The riparian habitat of the upstream site on the Steenkoolspruit (ST1) was considered largely natural (category B) because it was only slightly affected by alien vegetation, bank erosion, water quality, as well as channel and flow modifications. The riparian habitats of both the sites on the Wilge River were classed as moderately modified (category C). The riparian habitat at sampling site 335 has limited impacts in terms of channel modification and inundation. The site has moderate water quality, flow modifications, loss of indigenous vegetation and increases in alien vegetation. In addition, extensive bank erosion has caused an increase in sedimentation, which has been worsened by cattle trampling. The downstream sampling site 337 was moderately affected by bank erosion, flow modifications, water quality, decreases in indigenous vegetation and increased alien vegetation.

5.1.6.4. National Freshwater Ecosystem Priority Areas (NFEPA)

The NFEPA project provides strategic spatial priorities for conserving freshwater ecosystems and supporting sustainable use of water resources in South Africa. The NFEPA spatial data indicate that there is no Category 1 FEPA wetland on, or within 1 km of the study area, although wetland clusters are situated within 2 km of the study area (NSS, 2014).

5.1.6.5. Surface water use

The last available surface water use survey in the area was conducted for the 2003 Ikhwezi Colliery EMPR Amendment. Ikhwezi Colliery is located directly to the north of Delmas Coal.

The main surface water use in the area is livestock watering (cattle and sheep) and irrigation of crops such as maize, soybean, sunflowers and sorghum (NSS, 2011).

5.1.6.6. Sensitivities

Wetlands are considered to be sensitivities when it comes to the proposed construction of upgraded infrastructure. The wetland delineation has shown that the

existing PC dams exist within wetlands or within 32 m of wetlands, including artificially enhanced seeps (NSS, 2014). For the underground mining extension, although several wetland systems are proposed to be undermined, the dolerites and deep mining depths result in reduced dewatering of the surface water bodies (NSS 2014).

5.1.7 Groundwater

A detailed geohydrological investigation was undertaken and a copy of the report is attached in **Appendix C**.

5.1.7.1. Aquifer type

Four aquifers are typically present:

- A shallow perched aquifer in the lower lying areas or depressions where a low permeable, clayey, ferricrete layer is overlain by alluvium and transported hillwash material. Wetlands commonly occur in these areas. The perched aquifer remains unimpacted by underground mining activities where aquitards (dolerite sills etc.) are present above the mined out coal seams;
- A double porosity weathered aquifer, which extends to depths of around 9 – 26 mbs, depending on the limit of weathering. In the project area, this aquifer is expected to be clay-rich, with comparatively low aquifer parameters. This aquifer is therefore not considered to be a major aquifer, although it plays a role in recharge to the deeper hard-rock aquifers;
- A deeper fractured rock aquifer, which is characterised by fractures, faults and contact zones with dolerite intrusions to the Karoo sediments. This aquifer is underlying the weathered aquifer and extends down to the bottom of the No. 2 coal seam; and
- A dolomitic aquifer, which is regarded as the most significant aquifer in the region. Dolomite aquifers are known for their high storage capabilities and water commonly accumulates in deeply weathered zones and solution cavities. The dolomitic aquifer was however not penetrated during drilling of new groundwater monitoring boreholes and the depth that it is encountered at, if at all present, could not be confirmed (J&W -Groundwater, 2014).

5.1.7.2. Aquifer parameters

Hydraulic testing was performed on newly drilled boreholes to determine the following aquifer parameters:

- *Hydraulic Conductivity (K):* This is the volume of water that will move through a porous medium in unit time under a unit hydraulic gradient through a unit area measured at right angles to the direction of flow. It is normally expressed in metres per day (m/day);
- *Transmissivity (T):* This is the rate of flow under a unit hydraulic gradient through a cross-section of unit width over the full, saturated thickness of the aquifer. Transmissivity is the product of the average hydraulic conductivity and the saturated thickness of the aquifer. Transmissivity is expressed in metres squared per day (m^2/day);
- *Storativity (S):* The storativity of a saturated confined aquifer is the volume of water released from storage per unit surface area of the aquifer per unit

decline in the component of hydraulic head normal to that surface. Storativity is a dimensionless quantity (J&W -Groundwater, 2014).

The calculated mean aquifer parameters for the tested boreholes are indicated in **Table 5-12**.

Table 5-12: Local average aquifer parameters (J&W, 2014e)

	Transmissivity (T)	Hydraulic Conductivity (K)	Storativity (S)
	(m^2/day)	(m/day)	-
Weathered Aquifer			
Geometric Mean	9.0×10^{-1}	9.0×10^{-2}	6.0×10^{-3}
Harmonic Mean	2.0×10^{-1}	3.0×10^{-2}	4.0×10^{-3}
Arithmetic Mean	2.3×10^{0}	2.4×10^{-1}	1.0×10^{-2}
Fractured Aquifer			
Geometric Mean	8.0×10^{-1}	3.0×10^{-2}	3.0×10^{-2}
Harmonic Mean	3.0×10^{-1}	9.0×10^{-2}	3.0×10^{-2}
Arithmetic Mean	1.6×10^{0}	6.0×10^{-2}	5.0×10^{-2}

5.1.7.3. Groundwater gradient and flow

The average depth to groundwater table for the study area was calculated to be 4.79 mbs.

It was determined that there is a good correlation (94%) between the groundwater table and surface topography. That is an indication that the groundwater table mimics the topography across the entire study area. A map indicating the groundwater elevations is provided in **Figure 5-15** overleaf.

Groundwater flows from the east and west towards the centrally located Wilge River, which flows towards the north (J&W -Groundwater, 2014).

5.1.7.4. Groundwater pathways and barriers

The groundwater pathways in the project area are fractures, faults, bedding planes and contact zones. The barriers are the intrusive bodies such as dolerite dykes and sills which commonly occur in this area.

The B4 dolerite sill is most probably the main geological feature of the Delmas Coal mining area. It reaches a maximum thickness of 30 m. The sill generally occurs above the No. 4 seam horizon and cuts through the coal horizons along the eastern and north-western portion of the Delmas Colliery underground workings. The sill is expected to act as an aquitard, and act as a barrier to groundwater flow and movement of contaminant plumes.

Dolerite dykes also intersect the Delmas Coal underground workings. The dykes vary in thickness and normally dip vertical to the north east with little associated displacement. One primary fault zone was also identified towards the south.

The Wilge River is the key receptor for the aquifer in the vicinity of the project area (J&W -Groundwater, 2014).

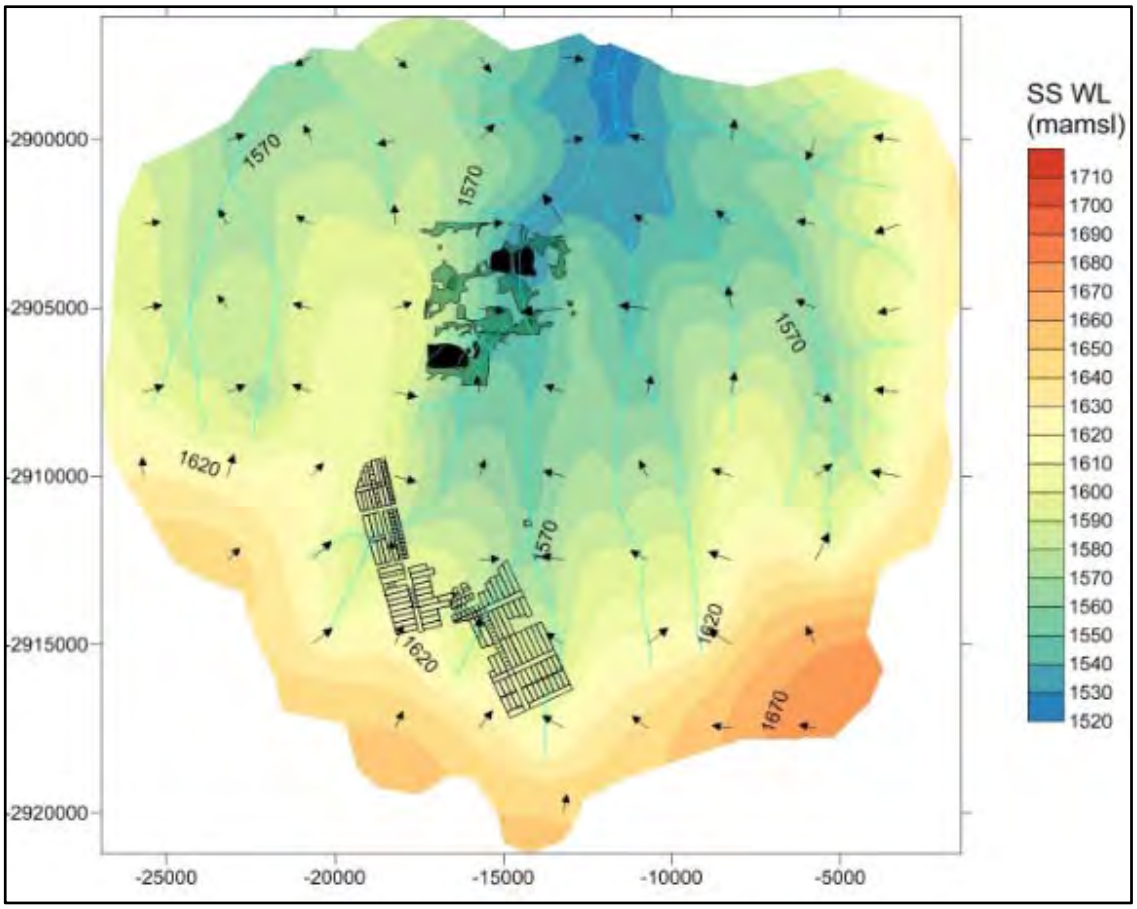


Figure 5-15: Groundwater elevation map (J&W -Groundwater, 2014)

5.1.7.5. Hydro census

A hydro census was conducted during September 2013 as part of the geohydrological study. Thirty-nine (39) boreholes were identified in the Delmas Coal mining area.

Details of the boreholes are available in the geohydrological specialist report attached as **Appendix C**.

5.1.7.6. Groundwater model

A numerical groundwater model was developed for Delmas Coal using the finite element 3D-modelling package *FEFLOW 6.2*. Details are available in the geohydrological specialist assessment in **Appendix C**.

5.1.7.7. Groundwater quality

An assessment of the groundwater quality was done as part of the geohydrological study which is attached as **Appendix C**.

The Mine Residue Facility, and primary and secondary PC dams, have an impact on groundwater quality as observed from the water quality measured in boreholes downstream of these facilities. This can be summarised as follows:

- Electrical conductivity levels in excess of 400 mS/m;
- Sulfate concentrations in excess of 2 000 mg/ℓ;
- Calcium concentrations which range between 241 mg/ℓ and 644 mg/ℓ;

- Magnesium concentrations which range between 164 mg/ℓ and 450 mg/ℓ; and
- Manganese concentrations between 1.78 mg/ℓ and 5.01 mg/ℓ (J&W - Groundwater, 2014).

In terms of groundwater signature, the groundwater qualities plot together in two main categories on a Piper diagram as indicated in **Figure 5-16**. The first group consisting of the boreholes DCBH, DCBH7, DCBH10 and DCBH11, as well as the upstream monitoring points DCS2, DC04S and DC04D. These plot towards the left of the central diamond field and represent unpolluted calcium / magnesium bicarbonate type waters. The location of the boreholes used in the assessment is indicated on **Figure 5-17**.

The second group plot towards the top and right of the central diamond field. These are the remaining samples taken from the downstream monitoring boreholes (DC01S, DC01D, DC02S, DC03S and DC03D), as well as the surface water features (DCS1, DCS2, DCPC and DD). This group represents mine impacted calcium (and magnesium) sulfate type water.

The groundwater in borehole DC02D also plot as mine impacted water, but with a definite sodium enrichment (J&W -Groundwater, 2014).

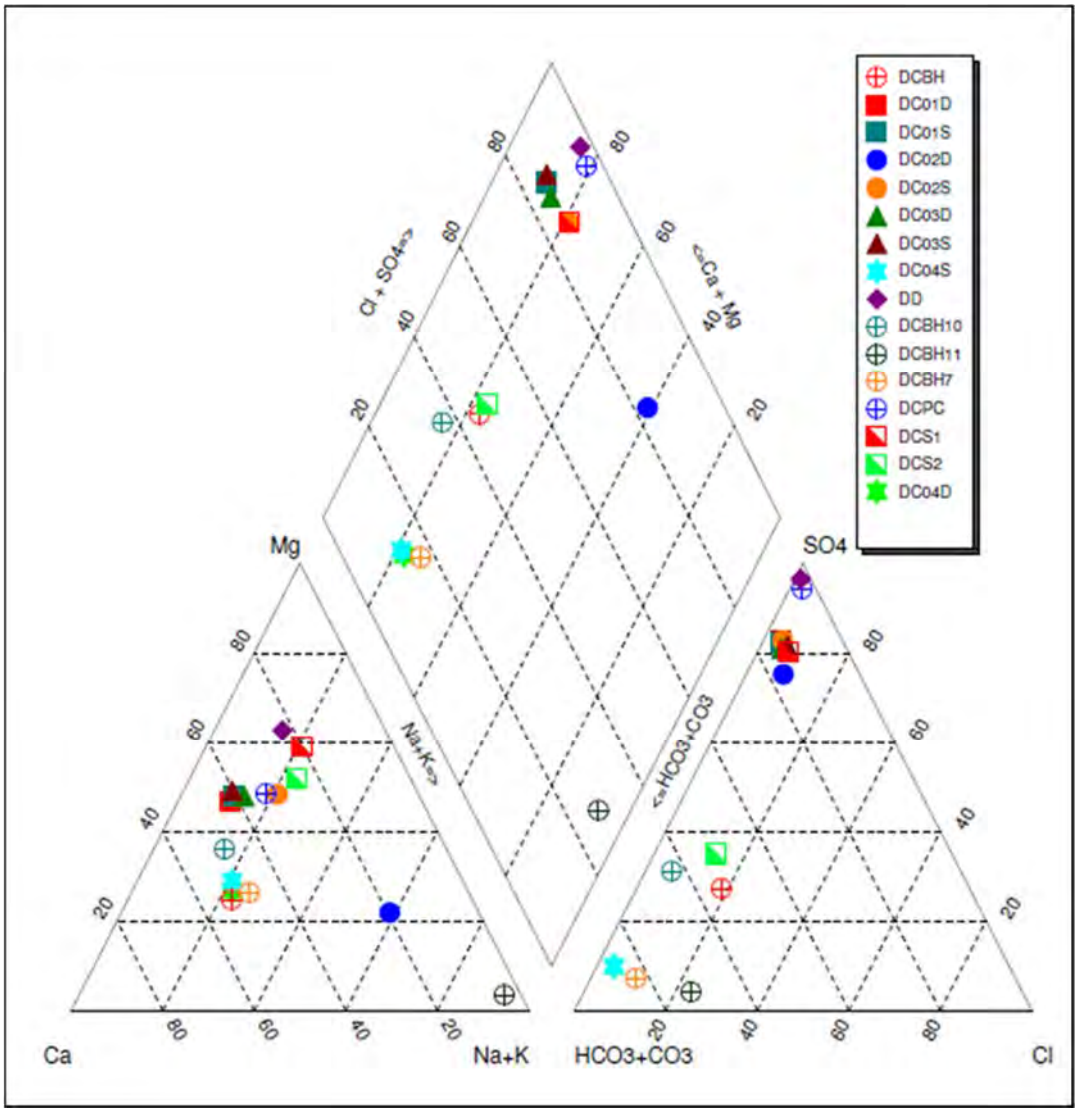
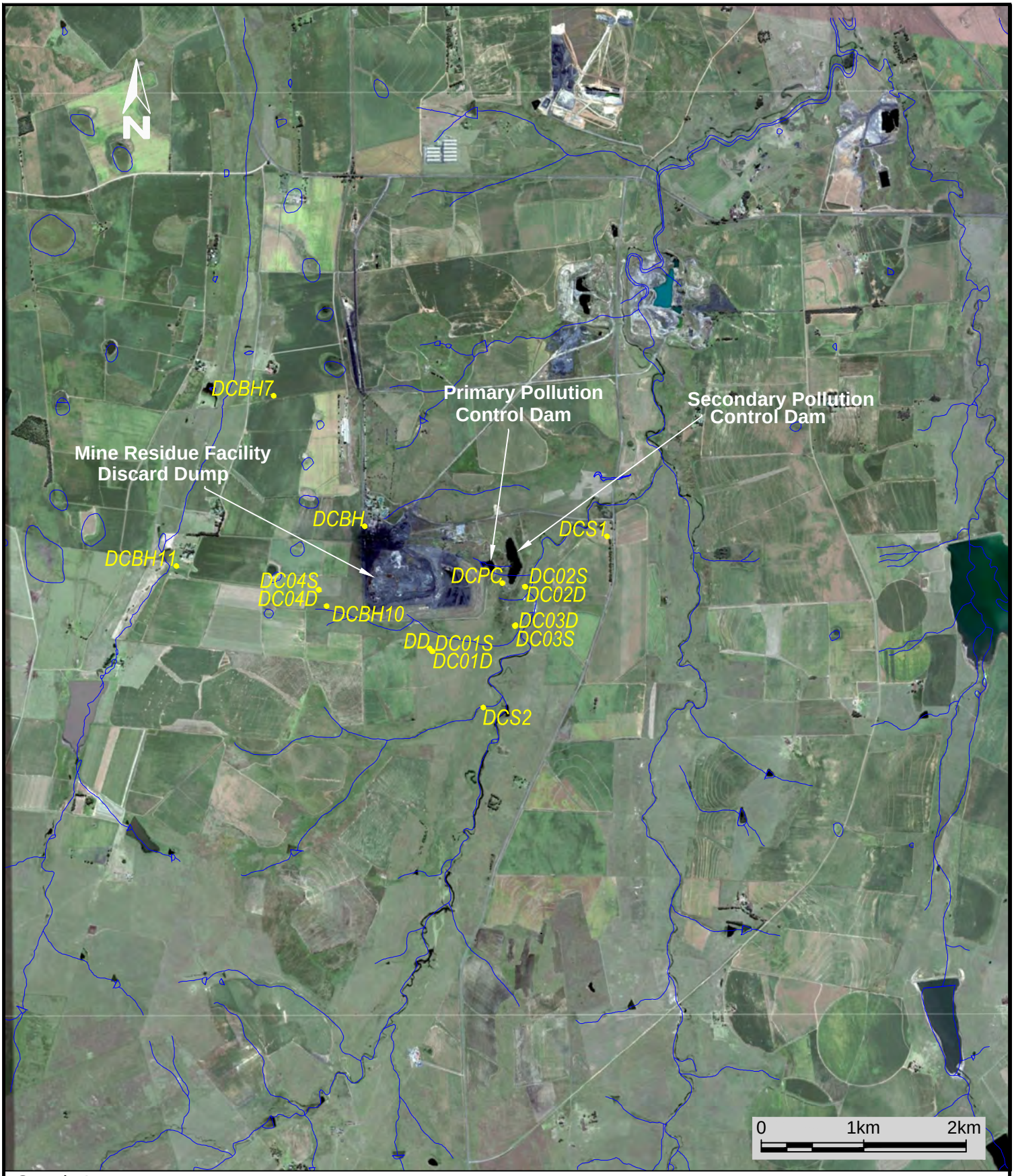


Figure 5-16: Piper diagram for groundwater quality (J&W -Groundwater, 2014)



Google Image

Legend

DCBH7 Boreholes

Rivers

Scale 1 : 50 000 (A4)
WG29

Jones & Wagener
Engineering & Environmental Consultants
59 Bovan Road PO Box 1434 Rivonia 2128 South Africa
tel 0027 11 319 0200 www.jaws.co.za email:post@jaws.co.za

Delmas Coal
EIR / EMPR
LOCATION OF BOREHOLES USED IN THE BASELINE ASSESSMENT

Job No: D910-04

Figure 5-17

The calibrated numerical groundwater model was used to simulate the expected contaminant migration (using sulfate concentrations) from Delmas Coal. The model was run for a period of 122 years, from 1964 to 2086. The inflow volume and the contaminant load into the river system are presented in **Figure 5-18**. From the modelling output it is noted that:

- Contaminant inflow volume and sulfate load into the Wilge River increased steadily since the mining operations started in 1964;
- The sulfate plume has already migrated approximately 877 m downstream towards the north east, and covers an area of 2 597 m^2;
- Over the next 72 years, the plume is expected to migrate a further 221 m in the same direction, and increased in area by an estimated 945 m^2;
- Over the same period, the extent of the worst affected area (i.e. sulfate concentration > 500 mg/ℓ) will increase from 1 400 m^2 to 11 876 m^2 (J&W - Groundwater, 2014).

This impact on the Wilge River has been observed in the surface water quality monitoring as discussed in **Section 5.1.5**.

5.1.7.8. Aquifer classification

The aquifers were classified according to the National Aquifer Classification System developed by Parsons in 1995.

The outcome of the classification and the level of protection required is provided in **Table** 5-13**.**

Table 5-13: Aquifer classification and level of protection required (J&W -Groundwater, 2014)

Description	Aquifer Class*	Vulnerability*	Protection required**
Water Quality Vulnerability			
Weathered aquifer at Mine Residue Facility	Minor (2)	Medium (3)	Medium (6)
Fractured aquifer at Mine Residue Facility	Minor (2)	Low (2)	Medium (4)
Water Quantity Vulnerability			
Mining Extension Perched Aquifer	Minor (2)	Low (1)	Low (3)
Mining Extension Weathered Aquifer	Minor (2)	Low (1)	Low (3)
Mining Extension Fractured Aquifer	Minor (2)	Medium (2)	Medium (4)

Notes:

* Scores indicated in brackets[4]

** Groundwater Quality Management (GQM) index indicated in brackets

[4] Class ratings: 6 = Sole Source Aquifer; 4 = Major Aquifer; 2 = Minor Aquifer; 0 = Non-Aquifer
Vulnerability classes: 3 = High; 2 = Medium; 1 = Low
GQM Index: <1 = Limited Protection; 1-3 = Low Level Protection; 3-6 = Medium Level Protection; 6-10 = High Level Protection; >10 = Strictly Non-degradation (J&W, 2014e)

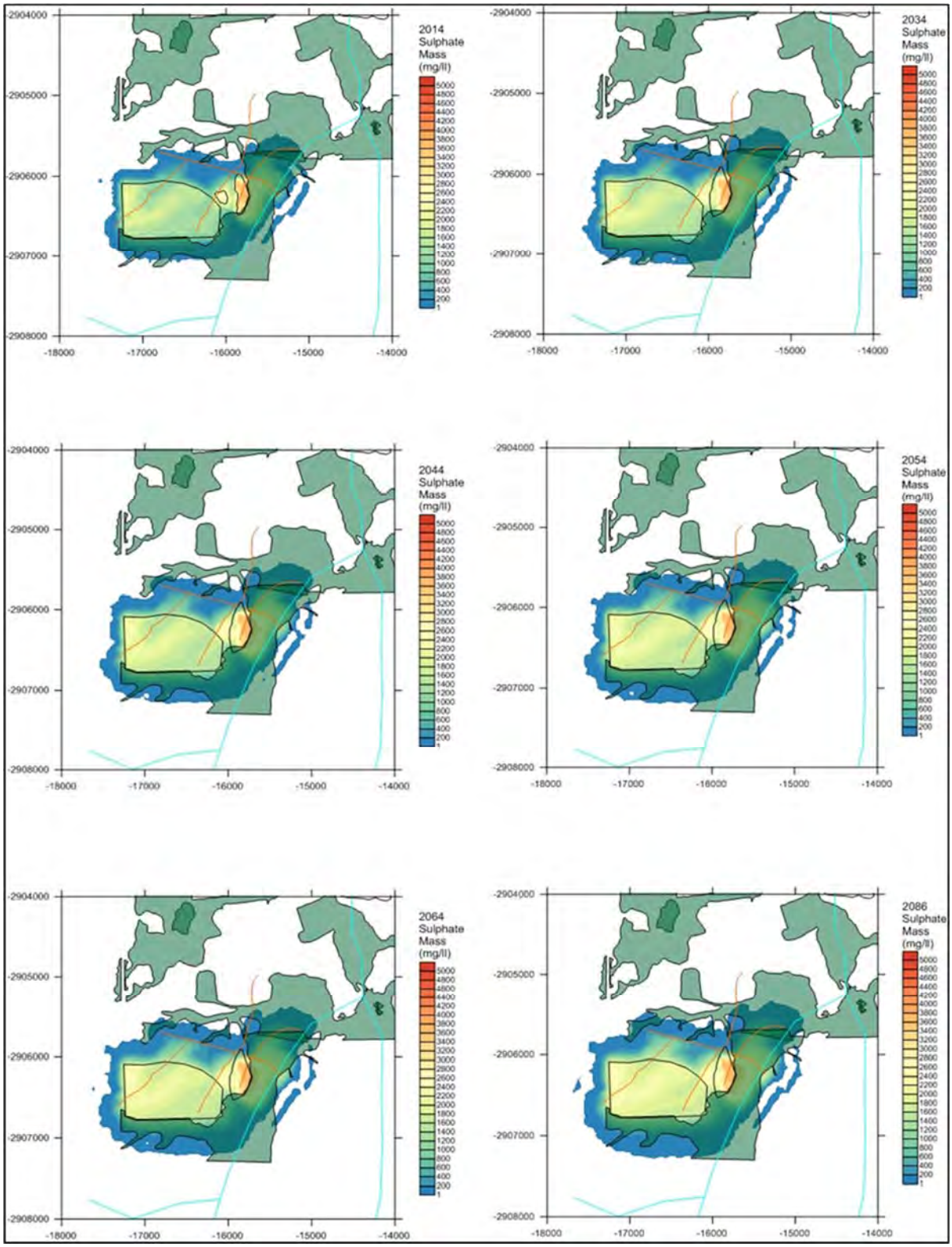


Figure 5-18: Modelled sulfate plume over time assuming that status quo remains (J&W -Groundwater, 2014)

5.1.8 Terrestrial Floral Biodiversity

A vegetation survey was conducted by Natural Scientific Services (NSS) and the report is included in **Appendix C**. The following is a description of the methodology followed and the outcome of the assessment.

5.1.8.1. Data Collection and Methodology

Desktop Research

A desktop investigation of 1: 50 000 topographical maps, Google Earth Images was undertaken to subjectively delineate specific areas of uniform vegetation structure. Due to the extent of the area, and the limited access, broad habitats were delineated for the new mining area south of the North Shaft complex.

Fieldwork

Floral fieldwork was undertaken during October 2008 and late January 2009 and involved the following:

- For the North Shaft complex field data collection was primarily plot-based and in the form of vegetation samples. The sampling plot size was standardised at 100 m^2. A sample entailed the compilation of a list of plant taxa, where each taxon was assigned an estimate (usually a cover-abundance estimate). For each sample, the species composition, as well as the mean percentage cover of each species per sampling plot was measured. Percentage cover was not measured precisely, but was placed in one of seven categories by a visual estimate as described by Braun-Blanquet (in Mueller-Dombois & Ellenberg, 1974). Agricultural pastures and cultivated land were not sampled by means of plots; and
- Random transect walks were conducted within the study site to ensure sampling of less abundant or localised species to assist with the compilation of a species inventory.

5.1.8.2. Regional Description

On a regional level, as discussed above, the study area falls within the Eastern Highveld and Soweto Highveld Grassland, and is dominated by sourveld grasses. The vegetation type, like many other grassland types is highly diverse and under major threat through anthropogenic influences.

5.1.8.3. Site Description

During site investigations different habitat types were identified for the study area. These habitats are listed below:

- Rocky Outcrops/ridges;
- Grasslands;
    - Natural Grasslands (often associated with rocky areas);
    - Hydromorphic Grasslands associated with Wetland Areas; and
    - Disturbed Grassland.
- Riverine & Aquatic;

  - River Systems;
  - Hydromorphic Grasslands associated with Wetland Areas; and
  - Dams.
- Transformed Areas;
  - Alien Bushclumps;
  - Agricultural – Crop/Pasture Areas; and
  - Built-up Areas.

The broad habitat types were delineated within the Delmas Coal surrounds for the purposes of the 2011 IWULA. The specialist study contains a full list of the species identified on site but in terms of the different habitats the following dominant species were identified:

- Rocky Outcrops:
  - *Diospyros lycioides* subsp *lycioides* - *Aristida bipartita* (2.75% cover)
- Low Lying Grasslands
  - *Eragrostis lehmanniana* - *Aristida bipartita* (8.34% cover)
  - *Eragrostis lehmanniana- Senecio erubescens- Berkheya maritima* (20.3% cover)
- Upper Grasslands
  - *Themeda triandra – Helichrysum rugulosum* (18.78% cover)
  - Monospecific stands of *Hyparrhenia hirta* (5.3% cover)
- Hydromorphic Grasslands (combined with wetlands – 12% coverage)
  - *Leersia hexandra- Typha capensis*
  - *Juncus* spp - *Cyperus esculentus*
  - *Cyperus denudatus* - *Setaria pallide-fusca*

Sensitivities

The specialist assessment found that from a floristic perspective, there are two (2) IUCN Red Data listed species that may occur on the site, according to the Gauteng Department of Agriculture and Rural Development (GDARD) Conservation Plan (C-Plan) (due to the site bordering on Gauteng) and the Mpumalanga Parks Board biodiversity database. These species are *Nerine gracilis* and *Gladiolus robertsoniae*. Neither of these species were found during field investigations although *Nerine gracilis* has been found south of the study area on the farm Palmietfontein 316IR.

Five (5) Orange Listed[5] species were identified within the boundaries of the study area during the field investigations. Furthermore, a Near Threatened species[6] was identified south of the proposed shaft development. It is also an endemic and Protected[7] Species under Schedule 11: Protected Plants, Section 69 (1)(a) of the Mpumalanga Nature Conservation Act, 1998 (Act No. 10 of 1998).

From an overall ecological sensitivity perspective, the wetlands and Rocky outcrops were determined as ecologically sensitive areas.

[5] Victor & Keith (2004) introduced the concept of an Orange List for plant taxa that warrant conservation measures but do not meet the IUCN criteria. These taxa include those species at risk of becoming threatened (all taxa currently considered “Near-threatened” or “Data Deficient”) or considered to comprise of rare or declining populations.

[6] A taxon is Near Threatened when available evidence indicates that it nearly meets any of the five IUCN criteria for Vulnerable, and is therefore likely to qualify for a threatened category in the near future.

[7] Protected Species: A plant species that is protected under Legislation (Not catagorised according to TSP listings). No person shall pick/remove a protected plant, unless he/she is a holder of a permit

5.1.9 Terrestrial Faunal Biodiversity

The terrestrial ecological assessment was conducted by NSS and the report is included in **Appendix C**. The following is a description of the methodology followed and the outcome of the assessment.

5.1.9.1. Data Collection and Methodology

Desktop Research

The desktop research was conducted to generate an expected checklist of flora, mammals, birds, reptiles, amphibians, and invertebrates likely to occur in the region and to identify species that are of concern to conservation.

Fieldwork

Faunal investigations were undertaken in two phases. A short 2-day ecological scan (Phase 1) was conducted in October 2008 (pre-wet summer season), and a detailed faunal investigation (Phase 2) conducted in January 2009 (mid-wet summer season).

The 2-day ecological scan included traversing the study area to identify, where possible, faunal species through observations and through gathering evidence of their presence in the form of faeces, pellets, spoor, nests, burrows, feathers etc. The scan was also used to identify potential faunal trapping sites for the detailed faunal investigation.

The detailed faunal investigation, during the 'mid-wet summer season', was undertaken over 5 days and focused on identifying potential wildlife habitats and the species utilizing those habitats for breeding, foraging or as migration corridors. Sampling methods included setting up four trapping sites, visual observations and communication with land owners in the area.

The faunal species investigated in the specialist assessment are mammals, avifauna, herpetofauna and invertebrates.

Visual observations & grab-sampling

Numerous visual observations were performed by traversing the site on foot and by vehicle and noting habitat types and the visual presence of animals or evidence of their presence in the form of faeces, pellets, spoor, nests, burrows, feathers, road kills etc. Night observations were done along the roads with the aid of a spotlight to identify nocturnal creatures.

Live-trapping

Four trapping sites were established; these sites were laid in representative areas of important habitats within the study area. Examples of trap sites are shown in the NSS specialist report in **Appendix C**. **Figure 5-20** indicates the faunal trapping sites within the project area. Array traps and live mammal traps (Sherman traps) were employed for the faunal trapping. A schematic layout an array trap including pitfall traps, wooden drift boards and wire funnel traps for capture of small herpetological specimens and invertebrates is shown in **Figure 5-19**.

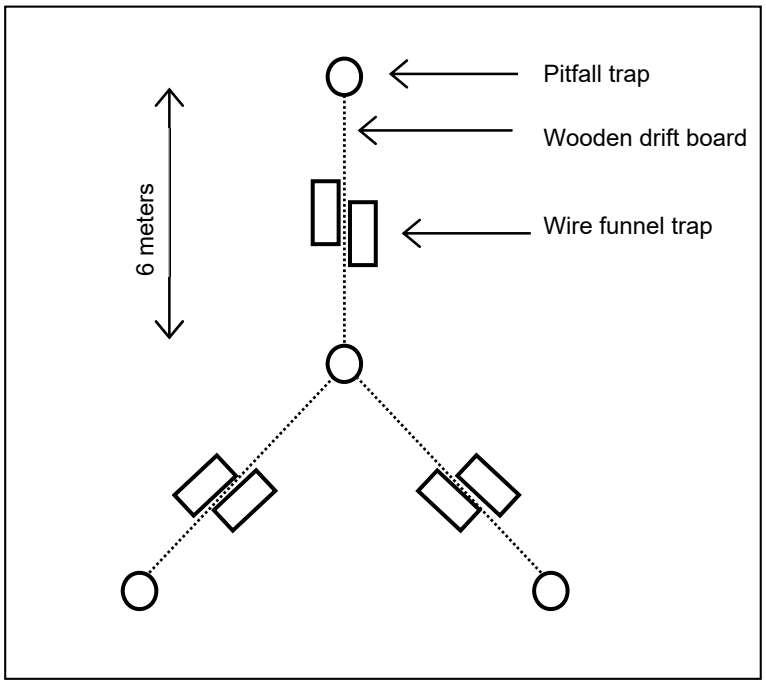


Figure 5-19: Schematic lacyout of an array trap

Communication

The presence of faunal species in the study area was discussed with farmers and people familiar with the study area during the specialist assessment. The faunal species were noted as present when observations by such persons were considered reliable.

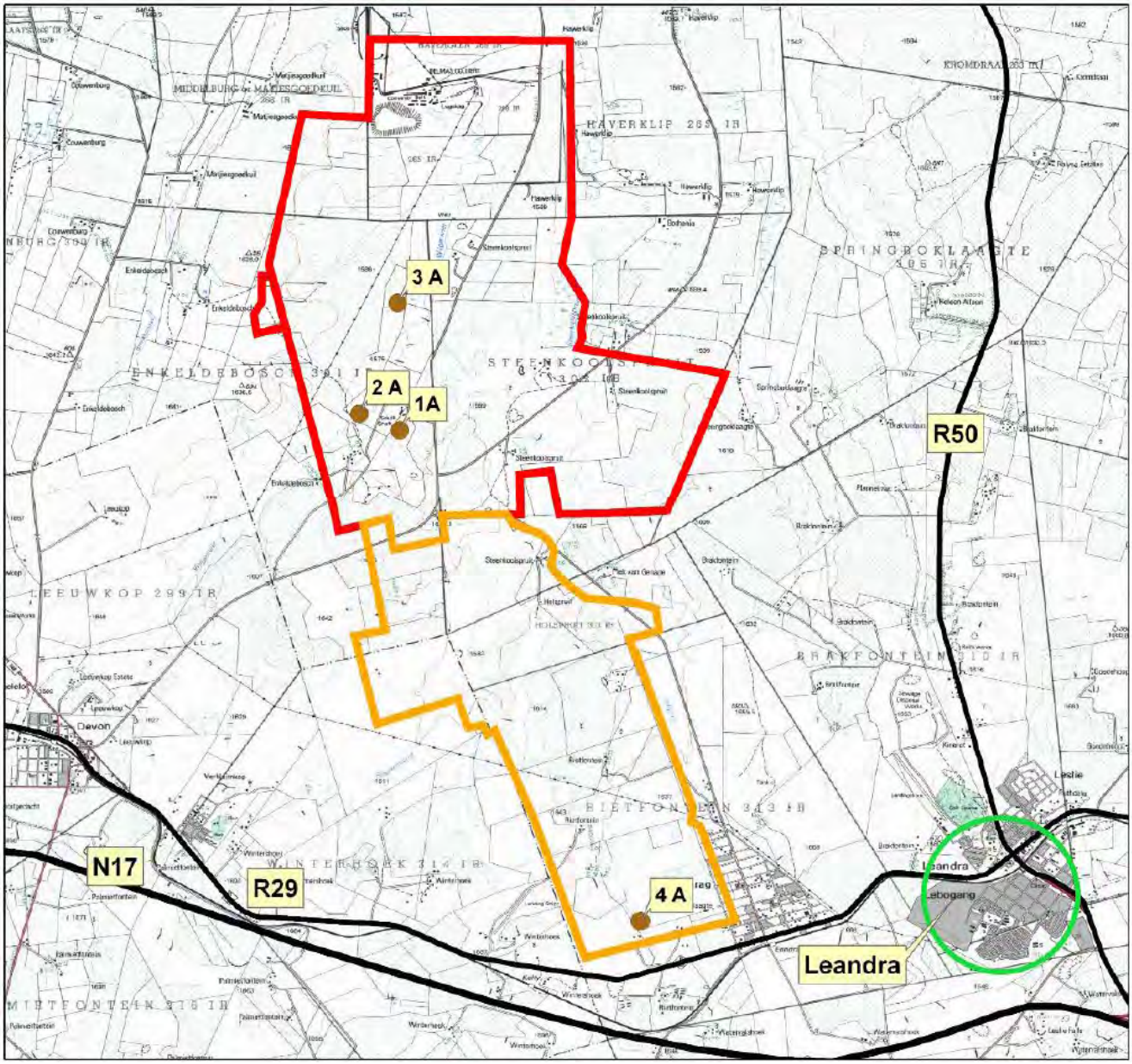


Figure 5-20: Faunal Trapping Sites in the study area (NSS 2009)

5.1.9.2. Regional Description

From the biodiversity specialist assessment, it was concluded that the Mpumalanga Province supports a high faunal diversity, including 163 mammal species, of which 98 species fall into the small mammal category and that the grassland and forest areas within the province provide suitable habitat for many endemic and threatened species of which the grassland biome itself supports close to 89 of the 163 mammal species, many of which are insectivores. A desktop study identified 105 mammal species potentially occurring in the Delmas region.

In terms of avifauna Mpumalanga supports a highly diverse bird life, with over 567 birds recorded within the province. Of these, about 71 are Red Data species. According to the South African Bird Atlas Project (SABAP), there are 196 bird species recorded within the Quarter Degree Grid (QDG) 2628BD.

From a herpetofaunal perspective 154 reptile species were identified as occurring in the Mpumalanga Province. Within the QDS 2628BD 24 snake species, 13 geckos, skinks and lizards, one terrapin species and 15 frog species were recorded.

5.1.9.3. Site Description

Faunal species were identified throughout the study area through actual observation, capture, evidence of presence and communication with resident farmers. Comprehensive lists of these species and locations where they were observed are included in the specialist assessment in **Appendix C**.

Mammals

During the specialist assessment 21 mammal species were identified with the majority of the species occurring in the Rodentia Order (33%) with over 40% of the species listed as carnivores. The comprehensive list of mammals identified on site is contained below in **Table 5-14**.

Table 5-14: List of Mammals identified on site (NSS, 2009)

Scientific name	Common name	Observed abundance	Habitat	Status
Aonyx capensis	African Clawless Otter	Uncommon	RA	LC
Atelerix frontalis	South African Hedgehog	Uncommon	RO; NG	NT
Atilax paludinosus	Marsh (Water) Mongoose	Uncommon	RA; HG	LC
Canis mesomelas	Black-backed Jackal	Uncommon	All	LC
Cryptomys hottentotus	African Molerat	Uncommon	NG; DG	LC
Cynictus penicillata	Yellow mongoose	Single specimen observed	NG; DG; RO	LC
Galerella sanguinea	Slender Mongoose	Uncommon	NG; DG; RO	LC
Hystrix africaeaustralis	Cape Porcupine	Common	NG; DG; A	LC
Ictonyx striatus	Striped Polecat	Reported to be present	NG; DGA	LC
Leptailurus serval	Serval	Reported to be present	RA; NG	NT
Lepus saxatilis	Scrub Hare	Common	All	LC
Mastomys	Multimammate Mouse	Common	NG; DG; HG	LC
Mus minutoides	Pygmy mouse	Common	NG; DG	LC
Raphicerus campestris	Steenbok	Common	NG; HG; RO	LC
Rattus rattus	Norwegian house rat	Uncommon	B	LC
Redunca arundinum	Southern Reedbuck	Three known individuals observed	HG; NG	LC
Rhabdomys pumilio	Four-striped Mouse	Common	NG; DG; HG	LC
Suricata suricatta	Suricate (Meerkat)	Reported to be present	NG	LC
Sylvicapra grimmia	Common Duiker	Common	RO; NG; DG; A	LC
Tatera brantsii	Highveld Gerbil	Single specimen observed	NG; DG	LC
Vulpes chama	Cape Fox	Reported to be present	RO; NG	LC

Avifauna

During the specialist assessment site investigations 77 bird species were identified through visual observations and through signs such as faeces, spoor or. Seven bird

species recorded during the site visits (9% of observations) are not listed in the SABAP data for the QDG 2628BD. In terms of distribution, 25% of the species identified during the site visits were water birds, including waterfowl and 8% were grassland specialists. The comprehensive list of avifauna identified on site is contained below in **Table 5-15** with the species on the **Red Data species list highlighted**.

Table 5-15: List of bird species recorded in the study site (NSS, 2009)

Common name	Scientific name	Classification group	Abundance	Status
Common Ostrich	*Struthio camelus*	Terrestrial fowl	D	LC
Reed (Long-tailed) Cormorant	*Phalacrocorax africanus*	Water birds	C	LC
Grey Heron	*Ardea cinerea*	Water birds	C	LC
Black-headed Heron	*Ardea melanocephala*	Water birds	B	LC
Little Egret	*Egretta garzetta*	Water birds	B	LC
Cattle Egret	*Bubulcus ibis*	Terrestrial fowl	A	LC
White Stork	*Ciconia ciconia*	Water birds	B	LC
Southern Bald (Bald) Ibis	*Geronticus calvus*	Terrestrial fowl	D	VU
Glossy Ibis	*Plegadis falcinellus*	Water birds	C	LC
Hadeda Ibis	*Bostrychia hagedash*	Terrestrial fowl	B	LC
African Spoonbill	*Platalea alba*	Water birds	C	LC
White-faced (Whistling-) Duck	*Dendrocygna viduata*	Water birds	B	LC
Egyptian Goose	*Alopochen aegyptiacus*	Water birds	B	LC
Yellow-billed Duck	*Anas undulata*	Water birds	B	LC
Hottentot Teal	*Anas hottentota*	Water birds	C	LC
Red-billed Teal (Duck)	*Anas erythrorhyncha*	Water birds	C	LC
Spur-winged Goose	*Plectropterus gambensis*	Water birds	D	LC
Secretarybird	*Sagittarius serpentarius*	Raptors	D	NT
Black-shouldered (Winged) Kite	*Elanus caeruleus*	Raptors	C	LC
Steppe (Common) Buzzard	*Buteo vulpinus*	Raptors	C	LC
Pallid Harrier °	*Circus macrourus*	Raptors	D	NT
Amur (Eastern Red-footed) Falcon (Kestrel)	*Falco amurensis*	Raptors	A	LC
Grey-winged Francolin * °	*Scleroptila africanus*	Terrestrial fowl	D	LC
Swainson's Spurfowl (Francolin)	*Pternistis swainsonii*	Terrestrial fowl	B	LC
Helmeted Guineafowl *	*Numida meleagris*	Terrestrial fowl	B	LC
Black Crake	*Amaurornis flavirostris*	Water birds	C	LC
Red-knobbed Coot	*Fulica cristata*	Water birds	B	LC
Blue Korhaan	*Eupodotis caerulescens*	Grassland specialists	D	NT
Northern Black (White-quilled) Korhaan (split) °	*Afrotis afraoides*	Terrestrial fowl	D	LC
Three-banded Plover	*Charadrius tricollaris*	Water birds	B	LC
Crowned Lapwing (Plover)	*Vanellus coronatus*	Terrestrial fowl	A	LC
Blacksmith Lapwing (Plover)	*Vanellus armatus*	Terrestrial fowl	A	LC
African Wattled Lapwing (Plover)	*Vanellus senegallus*	Terrestrial fowl	C	LC
African (Ethiopian) Snipe	*Gallinago nigripennis*	Water birds	B	LC
Spotted Thick-knee (Dikkop)	*Burhinus capensis*	Terrestrial fowl	C	LC
Whiskered Tern	*Chlidonias hybrida*	Water birds	B	LC
Speckled (Rock) Pigeon	*Columba guinea*	Other birds	A	LC

Common name	Scientific name	Classification group	Abundance	Status
Red-eyed Dove	*Streptopelia semitorquata*	Other birds	C	LC
Cape Turtle (Ring-necked) Dove	*Streptopelia capicola*	Other birds	A	LC
Laughing (Palm) Dove	*Streptopelia senegalensis*	Other birds	A	LC
Dideric (Diederik) Cuckoo	*Chrysococcyx caprius*	Other birds	B	LC
Burchell's Coucal (split) °	*Centropus burchelli*	Other birds	C	LC
Barn Owl	*Tyto alba*	Nocturnal birds	C	LC
Marsh Owl	*Asio capensis*	Nocturnal birds	D	LC
Spotted Eagle-Owl	*Bubo africanus*	Nocturnal birds	D	LC
African Black (Black) Swift °	*Apus barbatus*	Migrants	D	LC
Pied Kingfisher	*Ceryle rudis*	Water birds	D	LC
Green (Red-billed) Wood-hoopoe*	*Phoeniculus purpureus*	Other birds	C	LC
Crested Barbet	*Trachyphonus vaillantii*	Other birds	C	LC
Barn (European) Swallow	*Hirundo rustica*	Migrants	A	LC
Greater Striped-Swallow	*Hirundo cucullata*	Migrants	B	LC
Common House-Martin	*Delichon urbicum*	Migrants	B	LC
Anteating (Southern Anteating) Chat	*Myrmecocichla formicivora*	Other birds	B	LC
African (Common) Stonechat	*Saxicola torquatus*	Other birds	A	LC
Zitting (Fan-tailed) Cisticola	*Cisticola juncidis*	Grassland specialists	A	LC
Cloud (Tink-tink) Cisticola	*Cisticola textrix*	Grassland specialists	A	LC
Le Vaillant's (Tinkling) Cisticola	*Cisticola tinniens*	Grassland specialists	B	LC
Spotted Flycatcher	*Muscicapa striata*	Other birds	C	LC
Cape Wagtail	*Motacilla capensis*	Water birds	B	LC
African (Grassveld/Grassland) Pipit	*Anthus cinnamomeus*	Grassland specialists	B	LC
Cape (Orange-throated) Longclaw	*Macronyx capensis*	Grassland specialists	B	LC
Common (Fiscal) Fiscal (Shrike)	*Lanius collaris*	Other birds	C	LC
Common Myna	*Acridotheres tristis*	Other birds	C	LC
Pied (African Pied) Starling	*Spreo bicolor*	Other birds	C	LC
Cape Sparrow	*Passer melanurus*	Seed-eaters	B	LC
Southern Grey-headed Sparrow (split) *	*Passer diffusus*	Seed-eaters	C	LC
Southern Masked-Weaver *	*Ploceus velatus*	Seed-eaters	A	LC
Southern Red (Red) Bishop *	*Euplectes orix*	Seed-eaters	A	LC
Yellow-crowned (Golden) Bishop *	*Euplectes afer*	Seed-eaters	C	LC
Fan-tailed (Red-shouldered) Widowbird	*Euplectes axillaris*	Seed-eaters	C	LC
White-winged Widowbird	*Euplectes albonotatus*	Seed-eaters	B	LC
Long-tailed Widowbird	*Euplectes progne*	Seed-eaters	B	LC

Common name	Scientific name	Classification group	Abundance	Status
Blue Waxbill °	*Uraeginthus angolensis*	Seed-eaters	B	LC
Red-headed Finch	*Amadina erythrocephala*	Seed-eaters	C	LC
Pin-tailed Whydah	*Vidua macroura*	Seed-eaters	B	LC
Black-throated Canary	*Crithagra atrogularis*	Seed-eaters	B	LC
Streaky-headed Seedeater (Canary)	*Crithagra gularis*	Seed-eaters	C	LC

* = Evidence of breeding activity on site during survey;

° = Normal for the region, but not recorded in the area during the First South African Bird Atlas Project

[1] = NEMA: Biodiversity Act 2004: Publication of lists of critically endangered, endangered, vulnerable and protected species. Feb 2007

Key to Abundance: A = Abundant; B = Frequently observed; C = Infrequently observed; D = Single observation Source: Sinclair *et al.* (2002)

Nomenclature according to the South African Bird Atlas Project

Herpetofauna

During the specialist assessment relatively few reptiles were observed within the study area, in comparison to the potential reptile diversity within the area. Six reptiles were recorded in the study area during the two site visits (**Table 5-16**). These species represent 16% of the potential reptile fauna of the study area. Nine amphibian species were positively identified within the study area, representing 60% of the amphibian species that could potentially occur there. The species highlighted in the table represent the Conservation Important species that were identified on site.

Table 5-16: Herpetofauna species recorded in the study area

Scientific name	Common name	Conservation Status	Abundance
Reptiles			
Pachydactylus capensis	Cape Gecko	LC	D
Trachylepis varia	Variable Skink	DD	B
Nucras lalandii	Delalande's Sandveld Lizard	Rare	D
Leptotyphlops scutifrons conjunctus	Eastern Cape Worm Snake	DD	D
Lycodonomorphus rufulus	Brown Water Snake	DD	D
Psammophylax rhombeatus	Spotted Skaapsteker	DD	C
Amphibians			
Bufo gutturalis	Guttural Toad	LC	C
Bufo rangeri	Raucous toad	LC	B
Kassina senegalensis	Bubbling Kassina	LC	C
Semnodactylus wealii	Rattling Frog	LC	A
Cacosternum boettgeri	Common Caco	LC	A
Xenopus laevis	Common Platanna	LC	B
Amieta angolensis	Common River Frog	LC	A

Scientific name	Common name	Conservation Status	Abundance
Tomopterna cryptotis	Tremolo Sand Frog	LC	B
Tomopterna natalensis	Natal Sand Frog	LC	C
Observed abundance codes: A = Abundant; B = Frequently observed; C = Infrequently observed; D = Single observation Sources: Carruthers (2001); Marais (2004)			

Invertebrates

At least 34 invertebrate families were recorded during the site investigations conducted by the specialists. These include species trapped using pitfall trapping. The expansive list of Macro-Invertebrates is contained in the specialist assessment in **Appendix C**.

5.1.9.4. Sensitivities

From the list of mammals identified on site only two are listed as Near Threatened (NT) in the Red Data species list. These species are *Atelerix frontalis* (South African Hedgehog) which is considered uncommon on the site and *Leptailurus serval* (Serval) which was reported to be present on site. All the other species identified are listed as Least Concern (LC). In the specialist report a number of mammal species of conservation importance was identified as possible but unlikely to occur on site due to land use practices and habitat destruction.

The Mpumalanga Tourism and Parks Agency lists the four bird species of conservation importance, highlighted in **Table 5-15**, as having been recorded on farms covered by the Delmas Coal Project. Farmers resident in the area reported that *Anthropoides paradiseus* (Blue Crane), a Vulnerable species, is frequently present in the area. Blue Cranes prefer open grasslands and wetlands as well as agricultural fields, and therefore may well occur widely in the study area.

Four herpetofauna species of conservation importance were found along the banks of the Wilge River on the farm Enkeldebosch. These four species indicate the importance of the habitat along the Wilge River for herpetofauna. These include:

- A single *Nucras lalandei* (Delalande's Sandveld Lizard) was found under rocks of an old graveyard close to the Wilge River on the farm Enkeldebosch.
- Two specimens of *Pachydactylus capensis* (Cape gecko) were found beneath rocks in the vicinity of termitaria on the hill slopes above Trapping Site 2.
- A *Lycodonomorphus rufulus* (Brown water snake) was found nearby in the water of the Wilge River. This species is listed by the Mpumalanga Parks Board as being of conservation importance in the area.
- A *Psammophylax rhombeatus rhombeatus* (Spotted Skaapsteker) was also found along the banks of the Wilge River. This species is similarly listed by the Tourism and Parks Agency as being of conservation importance in the area.

A fifth species listed by the Tourism and Parks Agency as being of conservation importance was found in the area. A small *Leptotyphlops conjunctus conjunctus* (Eastern Thread Snake) was found within the southern section in the new mining study area.

In terms of macro-invertebrates no species of conservation importance is listed by the Tourism and Parks Agency as having been recorded in the vicinity of the site. The Marsh sylph butterfly (*Metisella meninx*) (listed as a Vulnerable species) was not identified during the site visit although there is evidence of the host plant (*Leersia hexandra*) being

present and therefore a high possibility exists that this species could occur on the study site.

5.1.10 Stability

5.1.10.1. Data collection

Saxum Mining conducted a rock engineering assessment of the underground workings that directly underlie the Mine Residue Facility at Delmas Coal's North shaft complex. Another assessment was undertaken to determine the stability of Delmas Coal's No. 2 and No. 4 Seam underground workings directly beneath the river/streams and possible effects on the water table in the mining area. These assessments can be found in **Appendix C.**

5.1.10.2. Regional description

The stratigraphy of the area is made up of four domains, the No. 5 Seam overburden, underlain by the No. 5 Seam sequence, the No. 4 Seam sequences and the basal No. 2 Seam sequence (Saxum, 2014a). The No. 5 Seam overburden is from the surface to the No. 5 Seam roof and is made up of weathered rock and soils zone. This is underlain by a dolerite intrusion, then laminated sandstone beds.

The No. 5 Seam sequence includes the No. 5 Seam and its floor up to the No. 4 Seam roof and is made of a succession of sandstone and siltstones (Saxum, 2014a). The No. 4 Seam sequence extends from the No. 4 Seam roof to the No. 2 Seam roof. The No. 4 Seam thickness in this area varies from 1.8 m to 3.2 m with an average of 2.8 m (Saxum, 2014a). The sequence is made up of a series of sandstones, siltstones, shales and mudstones which include the ±16 m thick parting between the two seams (Saxum, 2014a).

5.1.10.3. Site description

The available Delmas mining plans and information show that both the No. 2 and No. 4 Seams were mined beneath the Mine Residue Facility. The mining of the No. 2 Seam at Delmas Coal predates the extraction of the No. 4 Seam by approximately 25 years. Conventional drill and blast methods were employed in the extraction of both the No. 2 and No. 4 Seam coal in the area underneath the Mine Residue Facility (Saxum, 2014a).

The No. 2 Seam was mined in the late 1970's on assumed average bord width of ±6.5 m (assumed at 7.0 m to include pillar scaling) and a mining height of approximately 3.3 m on average (Saxum, 2014a). The average mining depth on the No. 2 Seam has been estimated to be 81 m based on the available survey peg information, the information available regarding the No. 2 Seam shaft area, as well as the surface contours.

It is commonly known that both selective bottom and top coal mining of the No. 2 Seam occurred, however it cannot be ascertained based on available survey plan information as to the precise spatial locations of both practices (Saxum, 2014a).

The No. 4 Seam was mined after the No. 2 Seam on pillar centres ranging from 15 m on the eastern side to 20 m on the western side (Saxum, 2014a). The average mining heights used in the stability investigation were estimated based on the mining heights indicated on the mining plans provided and the pillar centres were estimated based on measurements taken from the available survey plans.

Two methods were used to assess the stability of the underground workings before and after the extension of the Mine Residue Facility. One method used, was an analytical method (where the pillar safety factors and width to height ratio were used as indicators of pillar stability) and the other, a numerical simulation and analysis using modelling software LAMODEL to calculate the stress distribution on the pillars (Saxum, 2014a).

Results showed that provided the Mine Residue Facility height does not exceed ±40 m, the stability of the underground workings is likely to be maintained. If any coal pillar failure is to occur, however, it is expected that the No. 2 Seam workings may fail first and the effects of this failure could be transferred to the No. 4 Seam workings (Saxum, 2014a). While the area under the Mine Residue Facility is currently stable, the specialist report indicates that any further dumping of discard material on the existing Mine Residue Facility will serve to further increase the likelihood of pillar instability (Saxum, 2014a). The Delmas Coal Mine Residue Facility is therefore considered to be at full capacity (height) for the centre portions of the dump, and adding discard material to these portions could possibly result in overloading of the pillars in both the No. 2 and No. 4 seams (Saxum, 2014a).

For the proposed mining extension, a rock engineering related risk assessment was successfully conducted for the underground workings beneath the Wilge River and Steenkoolspruit River at Delmas Coal.

The areas undermining the rivers/streams were subdivided into four (4) areas namely: Area A, Area B, Area C and Area D (see **Figure 5-21**) and stability analysis carried out where pillar Factor of Safety (FOS), probability of survival and width to height (w:h) ratios were used as indicators of pillar stability (Saxum 2014b). The Coaltech (coal seam specific power formula) was used to estimate the stability of the mined pillars. The No. 2 Seam pillars were mined by conventional methods within the Southern Extension area (Area D), but have not been developed in the other areas.

The general pillar design philosophy for Delmas Coal's No. 4 Seam workings is to maintain safety factors of 2.0, 1.8 and 1.6 for primary, secondary and tertiary development areas respectively and to design pillar centres based on these safety factors (Saxum 2014b). The designed width to height (w:h) ratios range between 2.2 and 2.6.

The overall No. 4 Seam pillar centres range from 14 m to 20 m pillar centres at 1.8-safety factor (Coaltech) (Saxum 2014b). The increase in safety factor is directly proportional to the increase in cover depth (Saxum 2014b).

It is recommended that pillar centres in the areas directly underlying the rivers/streams must be increased from 14 m pillar centres at 1.8 pillar safety factor to the recommended minimum pillars centre distance of 15 m resulting in a square pillar of 8.2, w:h of 3.0, FOS of 2.1 and a pillars survival probability of 0.9999 (Saxum 2014b).

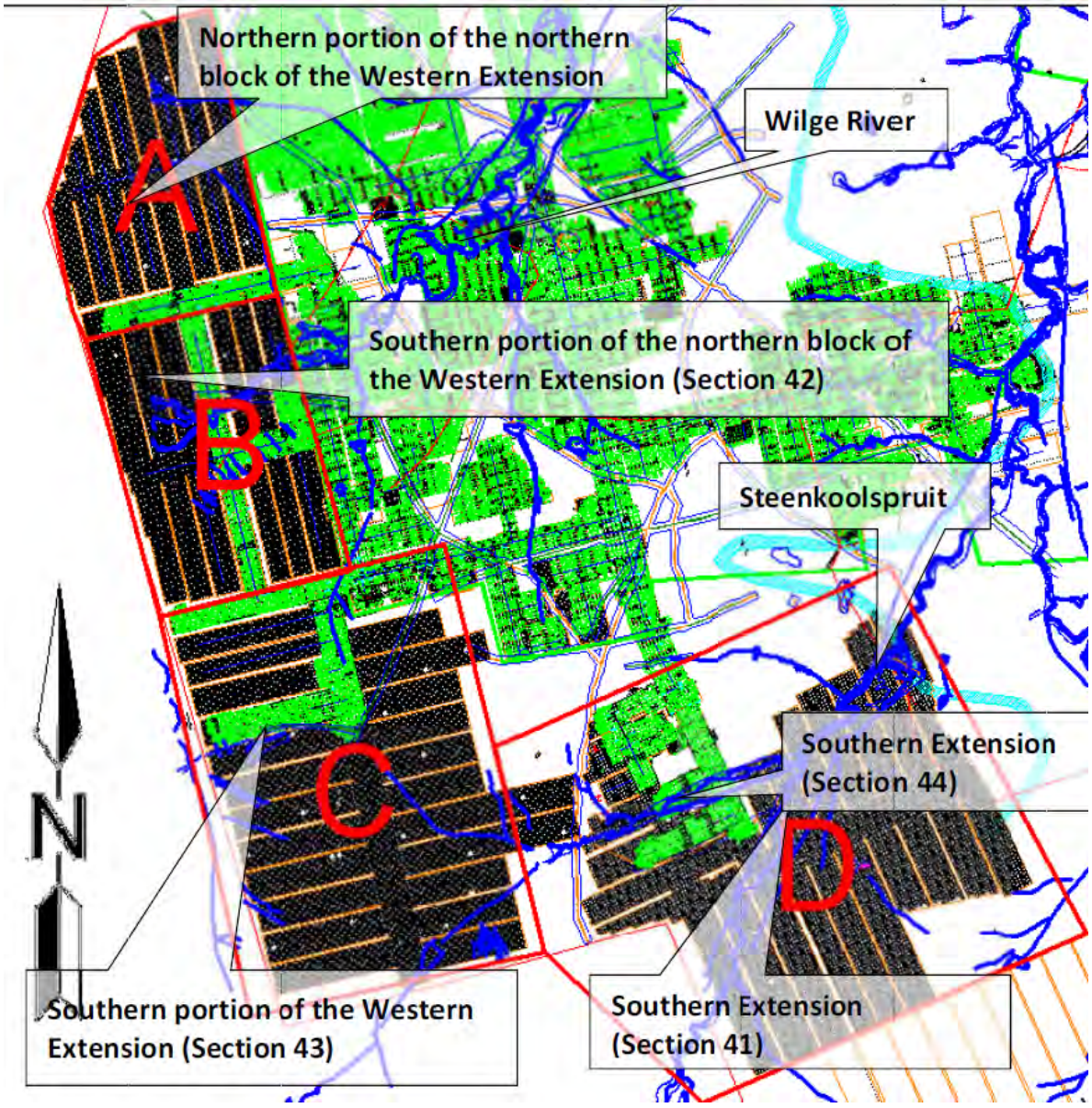


Figure 5-21: Undermining stability assessment areas of the proposed mining extension (Saxum 2014b)

5.1.10.4. Sensitivities

Sensitivities exist in that the Mine Residue Facility will reach a maximum safe capacity in terms of stability if discard or slurry is continually deposited on the facility. The risk of failure of the facility would endanger lives and would pose a threat to the surrounding environment.

5.2 Socio-Economic Environment

5.2.1 Data Collection and Methodology

A socio economic impact assessment, traffic impact assessment and noise impact assessment was undertaken for the KiPower plant adjacent to the Delmas Coal project.

Due to the close proximity of the two study areas it is anticipated that the social, traffic and noise baselines will remain applicable to both the projects.

5.2.2 Social Setting

5.2.2.1. Regional Population Description

The proposed project site is located within the Victor Khanye Local Municipality (LM), which forms part of the Nkangala District of the Mpumalanga Province. Mpumalanga has a land surface area of approximate 79 511.5 km^2, which represents approximately 6.5 % of South Africa's total land surface. The province is home to approximately 3 643 435 people, with a population growth of approximately 7.6 % over the 6 year period between 2001 and 2007. The population in Mpumalanga accounts for 7.5 % of South Africa's total population as of 2007. The province appears to be largely rural in nature, which is evident in the fairly low population density of 45.8 persons per km^2.

Agriculture is one of Mpumalanga's largest economic sectors, producing some 15% of South Africa's total agricultural output. Products produced in the province include sugar cane, sunflowers, sorghum, potatoes, onions, cotton and maize. The province has extensive coal deposits and coal mining contributes approximately one fifth of Mpumalanga's Gross Geographic Product (GGP). The coal resources are mostly situated in the western and south-western parts of the province and are used to sustain the coal-fired power stations between Witbank, Standerton, Piet Retief and Carolina. Coal is further used to sustain the petrochemical plants in the province.

The mining sector in Mpumalanga is fairly capital intensive but in general associated with large outflow of profits from the area as well as relatively low wages that could imply a relatively low impact on local income levels despite high numbers employed in the sector.

5.2.2.2. Site Population Description

In terms of the population size, it was estimated that Delmas in 2007 had a population of approximately 50 452 people with a population density of approximately 32 people per km^2. Delmas area has a high unemployment rate. The skills levels are generally low which may be attributed partially to Delmas having a fairly young population with 42.0% of the population below the age of 15 in 2007.

Victor Khanye LM is a resourced based economy where the agriculture as well as mining industries play a significant role in employment creation. The agricultural sector makes a large contribution towards employment but makes a fairly small contribution towards value output signifying this low-wage sector. The higher output value from the mining sector relative to employment levels suggest mining as a fairly capital intensive sector but as for the province mining within the local municipality has a low impact on local income levels despite high numbers employed in the sector.

In terms of access to basic services, an estimated 26% of households in the area lived in informal housing mainly as a result of farm evictions as well as migrants coming into the area in search of work. The lack of other basic services such as electricity and sanitation is related to the informal housing problem

5.2.2.3. Sensitivities

The social aspects that are pertinent and considered sensitive in the context of this proposed project include the need for sustainable employment opportunities within the

local economy, the lack of skills development, inadequate basic services and housing provision and increasing poverty levels.

5.2.3 Infrastructure

5.2.3.1. Regional and Site Description

The Delmas Coal site is serviced with road and rail infrastructure and the mine receives power from Eskom via overhead power lines. Potable water is sourced from the Leandra municipality and is trucked to the reservoirs on site for domestic use.

Major roads in the area include the following:

- The N12 highway linking Delmas with other towns in the province (Ogies, Witbank, and Nelspruit), and major cities and towns in neighbouring Gauteng;
- The N17 highway in close proximity to Leandra and Devon to the south of the site linking Secunda and major cities and towns in neighbouring Gauteng;
- The R548 between Delmas and Devon;
- The R50 between Pretoria, Delmas and Leandra;
- The D1059 from Delmas to Devon via the R50; and
- The R42 between Nigel, Delmas and Bronkhorstspruit.

A dedicated coal siding services Delmas Coal to the west of the coal processing plant and links up with the national rail network.

5.2.3.2. Sensitivities

No sensitivities in terms of the continued provision of services or infrastructure is identified.

5.2.4 Visual Aesthetics

5.2.4.1. Regional Description

The site and surrounding area is characterised as grassland and agricultural land with patches of mining in the study area. The area is typified by commercial crop production, mostly maize, and grazing of cattle. These activities are interspersed with coal mining, both opencast and underground. The terrain is relatively flat with the rolling topography of the Highveld.

5.2.4.2. Site Description

The current visual baseline is impacted by the existing mining operations within the study area, particularly the Mine Residue Facility and the visual exposure thereof from the surrounding areas and roadways which is quite high as the terrain is relatively flat and the vegetation cover is mostly grasses and grains.

5.2.4.3. Sensitivities

Due to the existing visual impact from the operations and activities at Delmas Coal the only sensitivities related to the proposed project is the potential increase in the visual

exposure that the mine may generate by increasing the airspace of the Mine Residue Facility and dust generated on site from construction and operational activities.

5.2.5 Traffic

5.2.5.1. Regional and Site Description

The major road in the vicinity of the study area is R50, which is the shortest route from Leandra to Delmas carrying 3 654 vehicles with 26% heavy vehicles over a period of 12 hours. Roads D1059 and D1134 are secondary side roads and carry 379, and 25 vehicles over 12 hours respectively. The D1059 and D1134 carry 38% and 36% heavy vehicles respectively. The heavy vehicles mainly comprise coal trucks and other large trucks. The roads in the vicinity of the proposed project are in a poor condition.

5.2.5.2. Sensitivities

Due to the existing poor condition of the roads surrounding Delmas Coal it is anticipated that an increase in heavy vehicular traffic may cause further deterioration of the condition thereof. An increase in traffic is however not expected beyond the construction phase as coal is transported by rail. During construction workers, and construction materials will need to be transported to and from the mine. For the PC dam alternatives, the relocation of the secondary PC dam will result in more excavation activities, excavation of the new footprint and filling, where necessary, of the existing PC dam void. For the in-situ PC dam alternative, only some additional excavation may be required. The resultant traffic impact is however deemed to be similar for all alternatives.

5.2.6 Noise

5.2.6.1. Regional and Site Description

As indicated the noise baseline measurements from the KiPower noise impact assessment was used to inform the proposed Delmas Coal project. The closest sensitive receptor to the Delmas Coal process plant and siding is the house of the grain silo manager approximately 700 m north-northwest from the plant and siding. A baseline measurement was taken in the garden of the silo manager's residence.

The results of the baseline measurements indicate that the values are typical of a rural area and that the L_{eq}[8] is dominated by the silo ventilation fans and to a less significant extent the daily activity there and at the adjacent Delmas Coal Mine. The background noise level, the L_{90}[9], is also dominated by noise from the silo fans, when operating, and in their absence dominated by remote mining operations from Delmas Coal and the natural sounds, such as birds and insects. The L_{90} noise levels measured at this sensitive receptor during daytime are stable around 32-34 dB(A) when the silo fans are not in operation which is below the SABS recommended noise levels for rural areas i.e. 45 dB(A) in daytime and 35 dB(A) in night-time.

[8] L_{eq} is the A-weighted equivalent sound level using the 'I' (Impulse) dynamic response characteristic as recommended in SANS 10103:2008

[9] The noise level exceeded for 90% of the time (L_{90}) is taken as an expression of the background noise in the absence of intrusive noisy events, primarily road traffic and random noise events such as pedestrians, animals, birds, and local road or air traffic.

5.2.6.2. Sensitivities

Increased activity of earthmoving vehicles from the proposed rehabilitation and reworking of the Mine Residue Facility may cause an increase in the noise levels experienced by the sensitive receptors in close proximity to the site.

5.2.7 Air Quality

5.2.7.1. Data Collection and Methodology

The air quality baseline for the Delmas Coal project was obtained from the air quality impact assessment that was conducted for the KiPower power plant project. The baseline modelling for KiPower included the Delmas Coal operations. The KiPower air Quality impact assessment is contained in **Appendix C**. A number of literature sources were consulted as no measurements on the site have been carried out. The meteorological data for the air quality baseline was obtained from the nearby Kendal site for the period 2006-2010.

5.2.7.2. Regional Description

The Highveld Airshed Priority Area (HPA) was declared the second national air quality priority area. The proposed project falls within the HPA. Therefore, the particulate emissions from the facility are likely to contribute to the air quality of the HPA. The proposed project is located just outside of the Delmas SO_2 Hot Spot.

5.2.7.3. Site Description

Representative baseline concentrations of particulate matter at Delmas Coal was done for dustfall, PM_{10} and $PM_{2.5}$. The air dispersion model that was used is Aermod (which is discussed in more detail in the air quality assessment included in **Appendix C**). An emissions inventory of all possible sources of a certain pollutant was compiled. It was decided to compile emissions for the Delmas Coal process plant and mine residue areas separately and run the model with the respective emissions spread over the areas. The total suspended particulates (TSP) for the plant area was measured at 5.17 g/s and at the mine residue area as 0.06 g/s. PM_{10} was measured in the plant area as 2.24 g/s whilst in the mine residue area as 0.007 g/s. From the baseline measurements it was determined that the residential and industrial dust fallout limits are exceeded albeit only over a small area on the Delmas Coal site. In terms of PM_{10} and $PM_{2.5}$ both the annual average and daily and daily frequency of exceedance of the NAAQS are being exceeded.

5.2.7.4. Sensitivities

The main pollutant of concern associated with the proposed operations is particulate matter. Particulates are divided into different particle size categories with TSP associated with nuisance impacts (dustfall) and the finer fractions of PM_{10} and $PM_{2.5}$ linked with potential health impacts. PM_{10} is primarily associated with mechanically generated dust whereas $PM_{2.5}$ is associated with combustion sources. Gaseous pollutants (such as SO_2, NO_X, CO, etc.) derive from vehicle exhausts and other combustions sources. Spontaneous combustion was noticed on the Mine Residue Facility during a site visit for the air quality impact assessment. This may cause local high concentrations of SO_2 due to the high sulphur content of discard.

5.3 Cultural Environment

5.3.1 Historical Setting and Significance

Due to all construction activities proposed on the existing footprints of the facilities it was not anticipated that any cultural or heritage resources would be affected by the proposed project. A phase 1 heritage impact assessment was not conducted, but during auditing by J&W staff and from information obtained from operational staff at Delmas Coal, as well as the biodiversity and wetland specialists, the existence of a grave site in proximity to the Mine Residue Facility was confirmed. This site is considered as sensitive and will be demarcated to prevent it from being disturbed during construction and rehabilitation of the Mine Residue Facility and PC dams.

6. PROCESS FOLLOWED TO DATE - REGULATION 50 (F)

6.1 Scoping Process

6.1.1 Technical Process

For the Scoping Phase of this EIA, the following technical process has been followed:

6.1.1.1. Consultation with client

On notification and receipt of the appointment letter from Delmas Coal, a project inception meeting was held between Delmas Coal and the J&W Project Team. During this project kick-off meeting the following was discussed:

- Project Scope and Requirements;
- Project Schedule; and
- Identification of key stakeholders and role players.

6.1.1.2. Screening

Following the appointment of J&W by Delmas Coal on 20 September 2013 various feasible and reasonable alternatives were identified to take into this EIA based on biophysical, technical, social, economic and cultural constraints. The alternatives were screened based on the aforementioned criteria by the EAP before inclusion in this report.

6.1.1.3. Scoping Report and Plan of Study for EIA

The Draft Scoping Report (DSR) was prepared with information and issues identified during the Scoping Phase. The DSR and Plan of Study (PoS) for EIA were updated based on comments from key commenting authorities, public review and comments obtained from I&APs. The Final Scoping Report (FSR) and the PoS for EIA was submitted to the MDARDLEA on 27 February 2015. This was accepted and approved on 01 April 2015 (**Appendix A**). The terms of reference (ToR) of the specialist studies were included in the approved PoS for EIA.

6.1.2 Scoping Public Participation Process – Regulation 50 (F)

Public participation is an essential and legislative requirement for the environmental authorisation process for which Delmas Coal has applied. The principles that demand communication with society at large are best embodied in the principles of the National Environmental Management Act (Act 107 of 1998, Chapter 1), South Africa's overarching environmental law. In addition, Section 24 (5), Regulation 54-57 of GNR 543 under the National Environmental Management Act, guides the public participation process that is required for an Environmental Impact Assessment (EIA) process. The public participation process followed for the EIA process integrates the requirements for public participation for the following applications for the proposed rehabilitation of the Mine Residue Facility and the reconstruction of the PC dams:

- Environmental authorisation in accordance with the NEMA EIA regulations of 2010;

- Amendment of the existing EMPR in terms of the MPRDA, as amended; and
- Application for a Waste Management Licence in terms of the NEM:WA.

The public participation process for the proposed project has been designed to satisfy the requirements laid down in the above legislation and guidelines. **Figure 6-1** provides an overview of the integrated NEMA and MPRDA for the EIR and EMPR amendment technical and public participation processes, and illustrates how issues and concerns raised by the public are used to inform the technical investigations of the EIA at various milestones during the process. This section of the report highlights the key elements of the public participation process during scoping.

6.1.2.1. Consultation with authorities, application forms and landowner notification

The EIA application form (**Appendix A**) for the proposed project was submitted to the MDARDLEA on 16 September 2013. A letter with reference number 17/2/3N-300 was received from MDARDLEA on 25 September 2013. A letter for extension of the MDARDLEA registered project was submitted to MDARDLEA on 25 March 2014.

As a point of departure existing I&AP databases developed through previous projects in the area were used for initial project notification and ground-truthed by the J&W team to identify additional I&APs. The list of potentially affected landowners is attached as **Appendix B** of this report.

6.1.2.2. Objectives of public participation in the EIR / EMPR amendment

The objectives of public participation in an EIA are to provide sufficient and accessible information to I&APs in an objective manner so as to:

- During Scoping:
  - Assist I&APs with the identification of issues of concern, and provide suggestions for enhanced benefits and alternatives;
  - Contribute their local knowledge and experience; and
  - Verify that their issues have been considered and to help define the scope of the technical studies to be undertaken during the Impact Assessment.
- During Impact Assessment:
  - Verify that their issues have been considered either by the EIA Specialist Studies, or elsewhere; and
  - Comment on the findings of the EIA, including the measures that have been proposed to enhance positive impacts and reduce or avoid negative ones.

The key objective of public participation is to ensure transparency throughout the process and promote informed decision making.

6.1.2.3. Identification of interested and affected parties

The identification of stakeholders is on-going and is refined throughout the process. As the on-the-ground understanding of affected stakeholders improves through interaction with various stakeholders in the area the database is updated. The identification of key stakeholders and community representatives (landowners and occupiers) for this project is important as their contributions are valuable in informing the EIA process. The identification of key stakeholders was done in collaboration with Delmas Coal, the local municipalities and other organisations in the study area.

The stakeholders' details are captured in an electronic database and provide an on-going record of communications - an important requirement by the authorities for public participation. In addition, comments and contributions received from stakeholders are recorded, linking each comment to the name of the person who made it.

According to the NEMA EIA Regulations under Section 24(5) of NEMA, a register of I&APs must be kept by the public participation practitioner. A list of potential I&APs was compiled. This list included landowners and relevant governmental organisations. Further, networking was done to identify, amongst others, potentially affected landowners and adjacent landowners and businesses in the area. This database is updated on an ongoing basis as additional I&APs register (See **Appendix B**).

6.1.2.4. Announcement of opportunity to become involved

The opportunity to participate in the EIA was announced in November 2013 as follows:

- Distribution of a letter of invitation to become involved, addressed to individuals and organisations, accompanied by a Background Information Document (BID) containing details of the environmental authorisation process, the proposed project and a registration sheet (See **Appendix B** for a copy of the documents). The BID was also published on the J&W website. The BIDs were hand delivered to people residing near Delmas Coal Mine – including residents of the Sub-highway community.
- A media advertisement, (**Appendix B**) describing the proposed project and the listed activities which will be triggered by the proposed project, was placed in the *Streeknuus* local newspaper on 15 November 2013.
- Notice Boards (**Appendix B**) were placed in conspicuous places within the vicinity of Delmas Coal Mine (North Shaft). Placement of notice boards was conducted on 7 November 2013 to invite stakeholder participation, refer to **Appendix B** for proof of placement of notice boards.

6.1.2.5. Public Meeting

A Public Meeting was held on 1 October 2014, the details of which can be found **Table** 6-1 below. Attendees were required to sign an attendance register. The purpose of the Public Meeting was to:

- Provide attendees with background information on the proposed project;
- Identify further issues, comments and concerns; and
- Discuss the way forward.

The Public Meetings was advertised by newspaper in the Streeknuus on 12 September 2014, as well as by letters of invitation to all individuals and organisations on the stakeholder database (post and email) sent out on Friday 5 September 2014.

Table 6-1: Scoping Phase Public Meeting.

Date	Time	Area	Venue and Address
1 October 2014	14:00	Delmas	Delmas Coal – Conference Centre

The minutes of the public meeting were attached to the Final Scoping Report in the form of a Comments and Response Report (CRR) and are again attached to this DEIR / EMPR amendment (***Appendix B***)

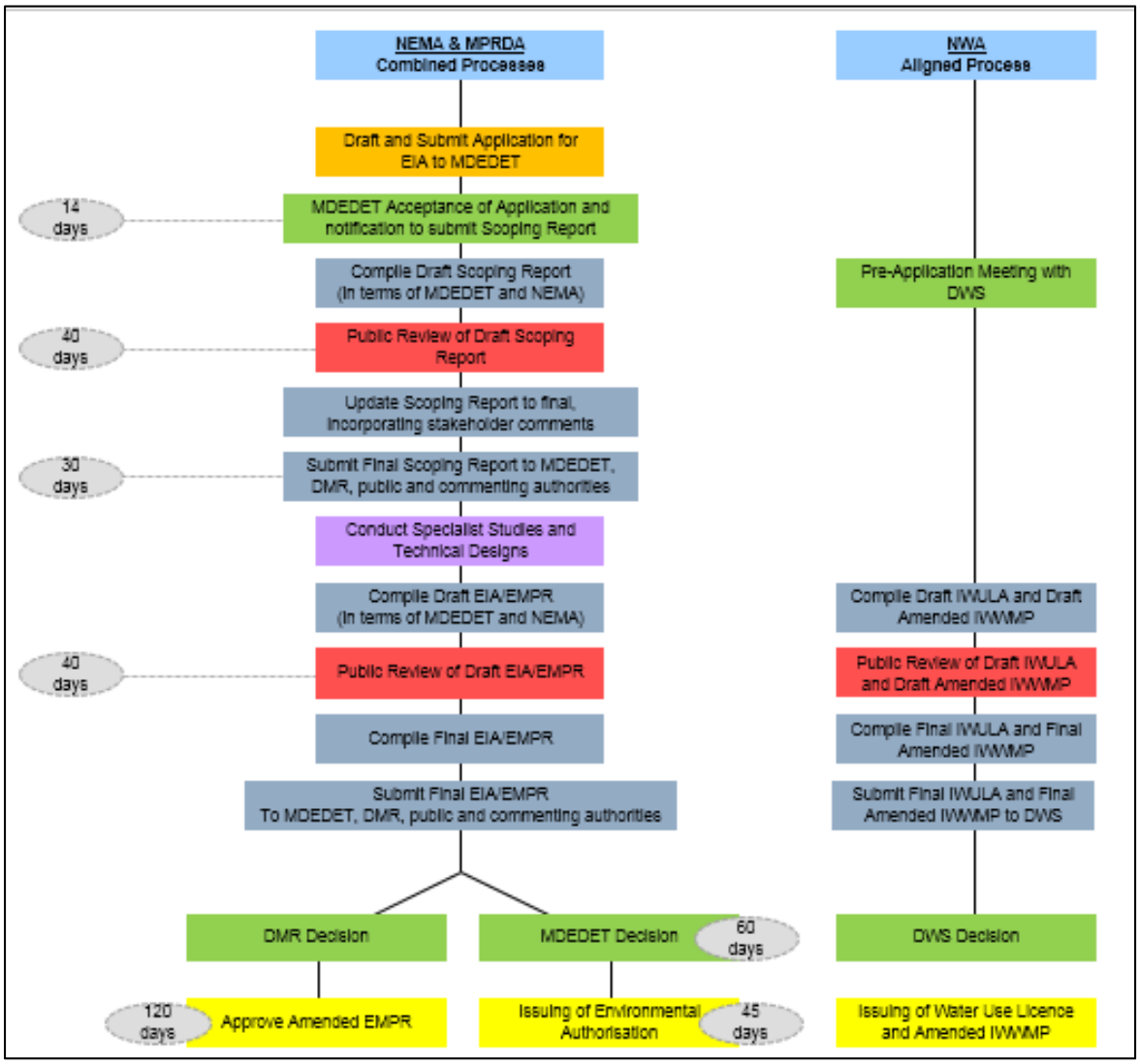


Figure 6-1: Integrated technical and public participation process and activities that comprise the EIA and EMPR amendment for the proposed project.

6.1.2.6. Obtaining comment and contributions

The following opportunities were made available during the Scoping phase for contribution from the I&APs:

- Completing and returning the registration/comment sheets on which space was provided for comment (registration/comment sheets included in BID and on request). Comment sheets were distributed with the BID, Draft and Final Scoping Reports for completion by stakeholders.
- Providing comment telephonically (accepted only from I&APs who do not have access to fax or e-mail facilities or need assistance in writing up their comment) or by email to the public participation office.
- Attending a public meeting that was widely advertised (see table below) and raise comments there.

Issues relevant to the current project configuration were considered and have been carried forward into this Impact Assessment phase.

6.1.2.7. Comments and Response Report and acknowledgements

The issues raised in the Scoping phase of the project, were captured in the CRR (***Appendix B***). The report was then updated to include additional I&AP contributions that were received as the Scoping phase process proceeded. The issues and comments raised during the public review period of the DSR were added to the Final SR and have been carried through to this EIR / EMPR Amendment. The contributions made by I&APs were acknowledged in writing.

6.1.3 Draft Scoping Report

The purpose of the public participation process during Scoping is to enable I&APs to verify that their contributions have been captured, understood and correctly interpreted, and to raise further issues. At the end of Scoping, the issues identified by the I&APs and by the environmental technical specialists, were used to define the Terms of Reference (ToR) for the Specialist Studies that have been conducted during this Impact Assessment phase. The availability of the DSR for public review and comment was advertised in a letter (post and email) sent out in August 2014, and addressed to all individuals and organisations on the stakeholder database. The availability of the DSR for public review was also advertised by newspaper in the 5 September 2014 issue of the Streeknuus.

The DSR, including the CRR Version 1, was distributed for comment from 11 August 2014 to 19 September 2014 as follows:

- Made available in electronic format on the J&W website;
- Made available at public venues within the vicinity of the project area (listed in **Table 6-2**); and
- Copies were made available at the Public Meeting.

I&APs could comment on the report in various ways, such as completing the comment sheet accompanying the report, and submitting individual comments in writing by email or fax.

Table 6-2: List of public places where all reports for the project have been and will be made available.

Contact	Location	Contact Tel
Ms N Potgieter	Leandra Public Library	017 683 1148
Ms Lydia Mehlape	Delmas Public Library	013 665 1831
Ms Nelia Nienaber	Devon Public Library	017 688 0028
Reception	Delmas Coal	013 665 7000
Electronic copies		
Anelle Lötter/ Sibongile Bambisa	www.jaws.co.za / phone and request a cd copy	012 667 4860

6.1.4 Final Scoping Report

The FSR was updated with additional issues and comments raised by I&APs. The FSR was distributed to the competent authorities (MDARDLEA and the DMR), to key I&APs,

and to those individuals who specifically requested a copy. I&APs were notified of the submission of the FSR to the decision-making authorities and the availability of the FSR on the J&W website and at the public venues indicated in **Table 6-2**.

The FSR was made available for a period of 21 days from 27 February 2015 – 20 March 2015. Acceptance of the FSR and permission to continue with the EIA phase was received from MDARDLEA on 1 April 2015 (a copy of this notification is contained in **Appendix A)**.

6.1.5 Impact Assessment Public Participation Process – Regulation 50 (F)

6.1.5.1. Public review of the Draft EIR / EMPR amendment and IWULA

The DEIR / EMPR amendment is available for period of 40 days for public review. The review period commenced on 16 September 2016 until 26 October 2016.

The opportunity for public review of the DEIR / EMPR amendment was announced in advertisements published in the following newspaper (see **Appendix B** and **Table 6-3**) and in a letter distributed and addressed to all individuals and organisations on the stakeholder database.

Table 6-3: Advertisements placed to announce the public review of the Draft EIR / EMPR amendment.

Newspaper	Date
Streeknuus	16 September 2016

The Draft EIR and EMPR amendment, including the comments and response report, is being distributed for comment as follows:

- Left in public venues within the vicinity of the project area. (these are listed in **Table** 6-2 above – the same venues were used as during the Scoping phase);
- Mailed to key stakeholders;
- CDs mailed to I&APs who requested the report;
- Available on the J&W website (www.jaws.co.za); and
- Electronic copies will be made available at the Public Meeting.

I&APs can comment on the report in various ways, such as completing the comment sheet that accompanies the report, and submitting individual comments in writing or by email.

6.1.5.2. Comments and Response Report (CRR)

The issues raised in the impact assessment phase of the project will be captured in the updated CRR and is appended to this DEIR / EMPR amendment (**Appendix B**). The report will be updated to include additional I&AP contributions that are received. The contributions made by I&APs have been and will continue to be acknowledged in writing.

6.1.5.3. Final EIR / EMPR amendment

The FEIR / EMPR amendment will be submitted to the authorities (MDARDLEA and the DMR), key I&APs, and to those individuals who specifically requested a copy. I&APs will be notified of the availability of the final reports in a letter that will be distributed to all stakeholders.

6.2 Decision-Making / Authorisation Process

6.2.1 Announcement of Environmental Authorisation

Once the MDARDLEA has provided Environmental Authorisation for the proposed project and the DMR has approved the EMPR amendment, stakeholders will be notified according to the requirements set by the authorisations, including the notification of the appeal period. A letter will be distributed to the list of stakeholders and those without e-mail or fax facilities will be contacted telephonically. Advertisements will be published in the same newspapers as listed above.

6.2.2 Post Authorisation EMPr

The EMPr will be updated based on the conditions stipulated in the Environmental Authorisation and licences, if applicable, and re-submitted to the relevant authority prior to commencement of construction.

Consultation with landowners does not cease once authorisation and approval is received. Delmas Coal will continue to consult with neighbouring landowners and keep them informed of the developments ahead in order to address concerns they may have in the future.

7. IMPACT ASSESSMENT METHODOLOGY

In order to ensure uniformity, a standard impact assessment methodology has been utilised so that a wide range of impacts can be compared. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Significance;
- Spatial scale;
- Temporal scale; and
- Probability.

A combined quantitative and qualitative methodology was used to describe impacts for each of the aforementioned assessment criteria. A summary of each of the qualitative descriptors along with the equivalent quantitative rating scale for each of the aforementioned criteria is given in **Table 7-1**.

Table 7-1: Quantitative rating and equivalent descriptors for the impact assessment criteria.

Rating	Significance	extent scale	Temporal scale
1	VERY LOW	*Isolated corridor / proposed corridor*	Incidental
2	LOW	*Study area*	Short-term
3	MODERATE	*Local*	Medium-term
4	HIGH	*Regional / Provincial*	Long-term
5	VERY HIGH	*Global / National*	Permanent

A more detailed description of each of the assessment criteria is given in the following sections.

7.1 Significance Assessment

Significance rating (importance) of the associated impacts embraces the notion of extent and magnitude, but does not always clearly define these since their importance in the rating scale is very relative. For example, the magnitude (i.e. the size) of area affected by atmospheric pollution may be extremely large (1000 km^2) but the significance of this effect is dependent on the concentration or level of pollution. If the concentration is great, the significance of the impact would be HIGH or VERY HIGH, but if it is diluted it would be VERY LOW or LOW. Similarly, if 60 ha of a grassland type are destroyed the impact would be VERY HIGH if only 100 ha of that grassland type were known. The impact would be VERY LOW if the grassland type was common. A more detailed description of the impact significance rating scale is given in **Table 7-2** below.

Table 7-2: Description of the significance rating scale.

Rating		Description
5	VERY HIGH	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4	HIGH	Impact is of substantial order within the bounds of impacts, which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of

Rating		Description
		achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these.
3	MODERATE	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc.
2	LOW	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these.
1	VERY LOW	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity is needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.
0	NO IMPACT	There is no impact at all - not even a very low impact on a party or system.

7.2 Spatial Scale

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale. The spatial assessment scale is described in more detail in **Table 7-3**.

Table 7-3: Description of the significance rating scale.

Rating		Description
5	Global/National	The maximum extent of any impact.
4	Regional/Provincial	The spatial scale is moderate within the bounds of impacts possible, and will be felt at a regional scale (District Municipality to Provincial Level). The impact will affect an area up to 50 km from the proposed site / corridor.
3	Local	The impact will affect an area up to 5 km from the proposed route corridor / site.
2	Study Area	The impact will affect a route corridor not exceeding the boundary of the corridor / site.
1	Isolated Sites / proposed site	The impact will affect an area no bigger than the corridor / site.

7.3 Duration Scale

In order to accurately describe the impact it is necessary to understand the duration and persistence of an impact in the environment. The temporal scale is rated according to criteria set out in **Table 7-4**.

Table 7-4: Description of the temporal rating scale.

Rating		Description
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.
2	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
3	Medium term	The environmental impact identified will operate for the duration of life of the project.
4	Long term	The environmental impact identified will operate beyond the life of operation.

Rating		Description
5	Permanent	The environmental impact will be permanent.

7.4 Degree of Probability

The probability or likelihood of an impact occurring will be described as shown in **Table 7-5** below.

Table 7-5: Description of the degree of probability of an impact accruing.

Rating	Description
1	Practically impossible
2	Unlikely
3	Could happen
4	Very Likely
5	It's going to happen / has occurred

7.5 Quantitative Description of Impacts

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus the total value of the impact is described as the function of significance, spatial and temporal scale as described below:

$$\textit{Impact Risk} = \frac{(\text{SIGNIFICANCE} + \textit{Spatial} + \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

An example of how this rating scale is applied is shown below:

Table 7-6: Example of Rating Scale.

Impact	Significance	Spatial scale	Temporal scale	Probability	Rating
	LOW	*Local*	Medium Term	*Could Happen*	
Impact to air	2	*3*	3	3	1.6

Note: The significance, spatial and temporal scales are added to give a total of 8, that is divided by 3 to give a criteria rating of 2,67. The probability (3) is divided by 5 to give a probability rating of 0,6. The criteria rating of 2,67 is then multiplied by the probability rating (0,6) to give the final rating of 1,6.

The impact risk is classified according to 5 classes as described in the table below.

Table 7-7: Impact Risk Classes.

Rating	Impact class	Description
0.1 – 1.0	1	Very Low
1.1 – 2.0	2	Low
2.1 – 3.0	3	Moderate
3.1 – 4.0	4	High
4.1 – 5.0	5	Very High

Therefore with reference to the example used for air quality above, an impact rating of 1.6 will fall in the Impact Class 2, which will be considered to be a low impact.

8. IMPACT ASSESSMENT - REGULATION 50 (C),(E),(G)&(I)

The Impact Assessment will highlight and describe the impact to the environment following the above mentioned methodology and will assess the following components.

- Air Quality;
- Stability;
- Wetlands and Aquatics;
- Geohydrology; and
- Surface Water.

The impact assessment was undertaken for the construction, operational and decommissioning phases. Should decommisioning however be conducted and closure of the operations sought, a separate Environmental Authorisation would be required prior to the commencement of decommisioning and closure.

This section provides a list of impacts (including cumulative impacts) together with associated mitigation measures. The impacts of the PC dam upgrades, Mine Residue Facility upgrade and mining alternatives during all phases of the project are indicated in **Table 8-1** to

Table 8-8

8.1 Construction Phase

Due to Delmas Coal being an operational mine there are no major construction activities required for the mining extension. For the proposed infrastructure upgrades, the construction activities are listed below.

8.1.1 Expansion of mine workings

- Drilling of refuge bay boreholes for the underground sections (where required).

8.1.2 PC dams upgrade

- Draining of water from the PC dams to Ikhwezi Pit G;
- Excavation for the enlarged dam (alternative 1) or excavation of the new facility (alternative 2) and removal of silt to the Mine Residue Facility;
- Earthworks, importation and compaction of bedding material and clay, and shaping of the dam walls;
- Establishment of the synthetic liner and a soil-crete layer;
- Concrete and steelwork for the slipway and ramps; and
- Installation of equipment, pumps and pipes.

8.1.3 Surface water infrastructure upgrade

- Cleaning and removal of silt from the existing drains to the Mine Residue Facility;
- Demolishing of defective drains to be replaced and removal of waste to Mine Residue Facility;
- Earthworks for construction of new drains;
- Importation of clay material for liner;
- Installation of synthetic liner; and
- Concrete and steelwork for the new drains.

8.1.4 Mine Residue Facility rehabilitation, reworking and upgrade

- Earthworks for reshaping the current facility to within 1:5 slopes;
- Construction of contoured channels on the reshaped facility;
- Construction of chutes from the channels to the surface water drains;
- Earthworks for the establishment of the Mine Residue Facility rejects dumps; and
- Importing of clay, soils, drain materials for the barrier system to be used.

8.2 Operational Phase

8.2.1 Expansion of mine workings

The expansion of the underground mining will be a continuation of the current mining operations mining coal reserves from the newly proposed areas and it will be a continuous process, moving into the new areas as it opens up due to depletion of the existing coal resource. Therefore, the operational phase has no defined commencement date. Mining operations have moved into new areas being applied for in this EIA/EMPR update in some of the Sections on the No. 4 seam. The operational activities include:

- Extraction of coal by bord and pillar mining method;
- Conveying of coal via underground conveyor to North Shaft;
- Stockpiling of ROM coal;
- Processing ROM coal in the coal processing plant and/or distribution of ROM to consumers;
- Stockpiling and distribution of processed coal to consumers; and
- Disposal of discard material and slurry from the process plant to the Mine Residue Facility.

8.2.2 PC dams

The operation of the upgraded PC dams will entail the management of the water levels within the compartments of both the PC dam silt trap and the PC dam in order to ensure that sufficient capacity exists to deal with a flood event. Regular maintenance of the infrastructure will be undertaken including the removal of silt from the compartments and disposing thereof on the Mine Residue Facility. Return water from the PC dam will be pumped for use in the processing plant.

8.2.3 Surface water infrastructure

The operation of the surface water infrastructure goes hand in hand with the operation of the Mine Residue Facility and the PC dam silt trap and PC dam. The drains will capture and transport dirty surface and sub-surface flow originating from the Mine Residue Facility and plant areas to the PC dam silt trap or divert clean water to the Wilge River. Maintenance of the drains will entail periodic manual cleaning of accumulated silt and disposal thereof on the newly lined Mine Residue Facility.

8.2.4 Mine Residue Facility

The operational phase activities associated with the Mine Residue Facility are twofold in that the discard from the existing facility will be reclaimed for use in the KiPower plant and a new facility will be operational in the area laid bare by the removal of the discard. The activities include:

- Reclamation (loading and hauling) of discard for use in the KiPower plant;
- Shaping of the slopes at the reclamation face to within a 1:5 angle;
- Disposal of discard on the newly lined facility;
- Continual expansion of the lined facility as the current dump size decreases; and
- Shaping of the slopes of the new facility to within a 1:5 angle.

8.3 Decommissioning and Closure Phase

The decommissioning and closure of the mine will occur in accordance with the MPRDA's requirements and any other approved closure plans pertaining to mine infrastructure and facilities. The closure plan for Delmas Coal is contained in **Appendix F**.

The aim of the closure plan is to give effect to the obligations and commitments to rehabilitation of areas disturbed by the current and the proposed project and associated infrastructure so as to comply to internal company standards for environmental management and ultimately to the requirements of the controlling legislation.

The closure of the mine would be subject to an appropriate EIA, and Environmental Authorisation application process at the time and is therefore only conceptually assessed further in this document.

The decommissioning and closure of the Delmas Coal operations can be differentiated into the mining areas, the plant and office areas and permanent fixtures.

8.3.1 Mining areas

The broad closure and decommissioning of the mining related components entail the following:

- Abandonment of all underground workings through the reclamation and removal of underground equipment and infrastructure and sealing off of all access points to the underground workings (shafts);
- Demolition and removal of surface infrastructure, structures and buildings;
- Removal and replacement of all contaminated soil, landscaping, top-soiling and re-vegetating the entire shaft areas; and.

- Ensuring equipment for measuring water levels are installed.

8.3.2 Plant and offices

- Demolishing of all buildings, structures and infrastructure within the plant and office areas;
- Removal and replacement of all contaminated soil, landscaping, top-soiling and re-vegetating the entire plant and office areas.

8.3.3 Permanent facilities

The Mine Residue Facility, surface water drains and PC dam and PC dam silt trap will remain permanent structures into perpetuity and a possible source of contamination which needs to be managed and monitored. The end state and functioning of the Mine Residue Facility would entail:

- Shaping of the slopes of the facility to within 1:5;
- Capping and vegetating and providing the facility with contoured channels which connect to the surface water drains surrounding it; and
- Monitoring and maintenance of the vegetation cover, erosion of the capping layer and the contoured channels and leak detection of the liner system.

The surface drains would be maintained to ensure that it functions satisfactorily in terms of transporting all surface and sub-surface flows originating from the Mine Residue Facility to the PC dams and/or diverting clean water away from the PC dams towards the Wilge River during and post decommissioning and closure. The activities associated to this would entail:

- Periodic clearing and disposal of silt from the drains and clearance of reeds and grasses establishing in and around the drains; and
- Repairs to damaged drains or chutes.

The PC dam silt trap and PC dam will remain functional to contain runoff from the Mine Residue Facility. The activities foreseen for the operation thereof during and post decommissioning and closure entails:

- Periodic clearing and disposal of silt from the compartments of the dams;
- Repairs to damaged equipment or structures;
- Leak detection and ground and surface water monitoring.

The different activities associated with the different alternatives of the proposed project are ranked individually in **Table 8-1** to

Table 8-8 below.

Mitigation measures are provided per impact. Where separate activities have similar impacts, these activities have been grouped in order to avoid repetition.

Table 8-1: Mine Plan Alternative (1): Bord and Pillar Mining Expansion - Impact rating

Activity	Aspect	Impact/s	Proposed Mitigation Measures		Post-Activity Impact		Cumulative Impact		Post-Mitigatory Impact	
				Ranking Criteria	Scores	Impact Rating	Scores	Impact Rating	Scores	Impact Rating
Construction Phase										
Drilling of any additional refuge bay boreholes	Ecology	• Vegetation removal and potential for alien invasive species establishment. • Surface water and soil contamination due to spills and leaks. • Erosion due to exposed soils.	• Minimise the disturbance footprint and minimise the duration of construction • Vehicles to utilise existing roads wherever possible or utilise the same access paths to and from the refuge bay boreholes; • All access paths are to be rehabilitated after the construction of the Refuge Bay boreholes and any erosion stabilised; • Regularly check vehicles, machinery and equipment for leaks or damage; • Use of chemical toilets outside of the 1:100 year flood line; • All discard (including drill cuttings and contaminated soils) should be removed from site; • Mechanical or chemical control of alien vegetation.	Significance	3	2.1 MODERATE	3	2.1 MODERATE	2	0.9 VERY LOW
				Spatial	2		2		2	
				Temporal	3		3		3	
				Probability	4		4		2	
Operational Phase										
Underground Mining	Wetlands	Decline in water inflows and loss of wetland s	•Annual monitoring of the PES of the major wetland systems potentially affected by the de-watering cone; • Seal off water-bearing geological structures like faults and dykes as they are intersected in the underground workings to minimise groundwater seepage.	Significance	4	1.6 LOW	4	1.6 LOW	4	1.6 LOW
				Spatial	4		4		4	
				Temporal	4		4		4	
				Probability	2		2		2	

Activity	Aspect	Impact/s	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
Abstraction of water for use in underground mining (as the mine is a dry mine)	Surface water	Decline in water inputs and loss of rivers	• No surface water is to be abstracted for mining expansion activities other than what is authorised in terms of the WUL • Monitor flow levels in the Wilge River and Steenkoolspruit systems.	Significance	4	2.2	MODERATE	4	2.4	MODERATE	3	2.0	LOW
				Spatial	4			4			4		
				Temporal	3			4			3		
				Probability	3			3			3		
Underground mining	Ground-water	Change in groundwater yield of the perched aquifer as a result of seepage into mine workings	No mitigation possible, however the geohydrological assessment shows that the impact of mining on the perched aquifer will be insignificant	Significance	4	0.6	VERY LOW	4	0.6	VERY LOW	4	0.6	VERY LOW
				Spatial	1			1			1		
				Temporal	4			4			4		
				Probability	1			1			1		
Mining extension	Ground-water	Groundwater yield of the weathered aquifer	No mitigation possible	Significance	4	2.0	LOW	4	2.0	LOW	4	2.0	LOW
				Spatial	2			2			2		
				Temporal	4			4			4		
				Probability	3			3			3		
Mining extension	Ground-water	Groundwater yield of the confined aquifer	No mitigation possible	Significance	4	2.9	MODERATE	4	2.9	MODERATE	4	2.9	MODERATE
				Spatial	3			3			3		
				Temporal	4			4			4		
				Probability	4			4			4		
Decommissioning & Closure Phase													
Decant of mine water	Wetlands	Deterioration in wetlands PES and functionality	• No untreated water should enter the receiving environment; • The water quality, during closure, is to be monitored; • Decant points must be sealed using sound engineering principles and no decant is to be released into	Significance	4	1.4	LOW	4	1.6	LOW	4	1.6	LOW
				Spatial	4			4			4		
				Temporal	3			4			4		
				Probability	2			2			2		
	Surface Water	Deterioration in river PES and functionality		Significance	4	3.2	HIGH	4	3.2	HIGH	4	1.6	LOW

Activity	Aspect	Impact/s	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
			the receiving environment; • Bio-monitoring to be conducted during closure;	Spatial	4			4			4		
				Temporal	4			4			4		
				Probability	4			4			2		
Decommissioning activities such	Ecology	• Vegetation removal and alien invasive species establishment. •Surface water and soil contamination due to spills and leaks. •Erosion due to exposed soils.	• Minimising the disturbance footprint and timing of closure construction activities; • Vehicles to utilise same access paths to and from decommissioning sites; • All access roads are to be rehabilitated after the decommissioning activities and any erosion stabilised; • Regularly check vehicles, machinery and equipment for oil leaks or damage; • Use of chemical toilets outside of the 1:100 year flood line; • Chemical toilets should be regularly serviced and their contents safely disposed of. Safe disposal certificates need to be issued for each load • All waste removed should be assessed and then disposed of on the correct class of landfill. Safe disposal certificates to be issued for the disposal of hazardous waste and demolition material should be removed from site; • Mechanical or chemical control of alien vegetation. • Denuded areas, where infrastructure has been	Significance	3	2.1	MODERATE	3	2.1	MODERATE	2	0.9	VERY LOW
				Spatial	2			2			2		
				Temporal	3			3			3		
				Probability	4			4			2		

Activity	Aspect	Impact/s	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
			removed, must be grassed with grass species endemic to the area. • Stability assessment must be conducted on mined out area to identify high risk areas. • Mine water balance must be updated to indicate decant points and decant volumes over time as well as mitigatory measures, such as a water treatment plant.										
Post-Closure Phase: After Closure Certificate has been grantedr													
Acid Mine drainage and decant of mine impact water into water resources	Wetlands	Deterioration in wetlands PES and functionality	• Decant points must be monitored and no decant is to be released into the receiving environment. Inspection of decant points to be carried out twice per annum; • The surface water quality in surrounding wetlands and rivers, post-closure, is to be monitored once per annum; • Biomonitoring to be conducted post-closure if change in surface water quality is identified	Significance	4	1.6	LOW	4	1.6	LOW	4	1.6	LOW
				Spatial	4			4			4		
				Temporal	4			4			4		
				Probability	2			2			2		
	Surface Water	Deterioration in river PES and functionality		Significance	4	3.2	HIGH	4	3.2	HIGH	4	1.6	LOW
				Spatial	4			4			4		
				Temporal	4			4			4		
				Probability	4			4			2		
Mine water filling underground voids before decanting	Ecology	Decline in water inputs and loss of wetlands	• Annual monitoring of the PES of the major wetland systems potentially affected by the de-watering cone over total mined area.	Significance	4	1.6	LOW	4	1.6	LOW	4	1.6	LOW
				Spatial	4			4			4		
				Temporal	4			4			4		
				Probability	2			2			2		
	Ecology			Significance	4	2.4	MO	4	2.4	MO	4	2.4	MO

Activity	Aspect	Impact/s	Proposed Mitigation Measures		Post-Activity Impact		Cumulative Impact		Post-Mitigatory Impact	
				Ranking Criteria	Scores	Impact Rating	Scores	Impact Rating	Scores	Impact Rating
Mine water filling underground voids before decanting		Decline in water inputs and loss of rivers	• Monitor flow levels in the Wilge and Steenkoolspruit systems post closure.	Spatial	4		4		4	
				Temporal	4		4		4	

Table 8-2: Mine Plan Alternative (2): No-go Alternative impact rating

Activity	Aspect	Impact/s	Proposed Mitigation Measures		Post-Activity Impact		Cumulative Impact		Post-Mitigatory Impact	
				Ranking Criteria	Scores	Impact Rating	Scores	Impact Rating	Scores	Impact Rating
Construction Phase										
Mine Closure	Social	Should the mining reserves not be obtained and the underground mining does not commence, the impact may be that the mine will close and the workers will lose their jobs	No Mitigation possible.	Significance	3	2.1 MODERATE	4	3.2 HIGH	4	3.2 HIGH
				Spatial	2		3		3	
				Temporal	3		5		5	
				Probability	4		4		4	

Table 8-3: PC Dam Alternative (1): Upgrade of both PC Dams *in situ*- Impact rating

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
Construction Phase													
Vegetation clearing	Ecology	Habitat destruction	•Minimise construction footprint and laydown area footprints as far as possible; Additional excavations for the secondary PC dam should be limited to only what is needed; • Demarcate construction areas and confine vehicle and personnel movement to within these areas; • Sensitive species to be identified and relocated from construction areas.	Significance	3	2.1	MODERATE	3	2.1	MODERATE	3	1.9	LOW
				Spatial	1			1			1		
				Temporal	4			4			3		
				Probability	4			4			4		
Noise pollution, ground vibrations and the physical disturbance of habitats by earth moving equipment	Ecology	Disturbance, loss and/or dispersal of fauna	• Minimise development footprint as far as possible and ensure no double handling of materials; • Demarcate construction areas and confine vehicle and personnel movement to within construction areas • Outside lighting should be designed to minimize impacts on fauna; • Sensitive species to be identified and relocated from construction areas.	Significance	2	1.6	LOW	2	1.6	LOW	2	1.0	VERY LOW
				Spatial	2			2			1		
				Temporal	2			2			2		
				Probability	4			4			3		
Spills from dams before construction is complete	Wetlands	Decline in water quality and deterioration of wetlands PES and functionality	• Appoint a contractor who is experienced with lined PC dam construction; • Appoint an experienced consultant for the site supervision or EPCM role;	Significance	3	3.0	MODERATE	3	3.0	MODERATE	3	1.2	LOW
				Spatial	3			3			3		
				Temporal	3			3			3		
				Probability	5			5			2		

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
Clearance of construction laydown area	Surface water	Increased erosion and sedimentation	• Although this option both PC dams will be upgraded in situ, the construction lay down and smaller excavations should be kept to what is strictly needed thereby minimising the disturbance footprint; • Control of fugitive dust; • Construct during dryer (autumn/winter) months as far as possible.	Significance	1	0.8	VERY LOW	1	0.8	VERY LOW	1	0.3	VERY LOW
				Spatial	1			1			1		
				Temporal	2			2			2		
				Probability	3			3			1		
PC dam civil works	Surface water	Increased erosion and sedimentation	• Conduct civil works in phases, with appropriate water management measures during the two phases; • Control of fugitive dust; • Implement erosion control measures such as the use of silt traps to prevent sedimentation of watercourses • Construct during dryer (autumn/winter) months as far as possible.	Significance	2	1.6	LOW	2	1.6	LOW	2	0.8	VERY LOW
				Spatial	2			2			2		
				Temporal	2			2			2		
				Probability	4			4			2		
PC dam overtopping during construction	Surface water	Pollution due to inadequate storm runoff storage capacity	• Pump PC dam water to Ikhwezi Pit G; • Construction of the lined PC dam in phases; • Maintain the Secondary PC Dam at the lowest level to provide the maximum storage for stormflow runoff.	Significance	5	2.7	MODERATE	5	2.7	MODERATE	5	1.3	LOW
				Spatial	3			3			3		
				Temporal	2			2			2		
				Probability	4			4			2		
Spills resulting from the dewatering of	Surface water	The PC dam will need to be emptied during upgrading of the new facility therefore pollution	• Pipeline construction to be in accordance with SABS codes to ensure quality control; •Weekly inspections of the pipeline	Significance	3	1.2	LOW	3	1.2	LOW	3	0.4	VERY LOW
				Spatial	1			1			1		
				Temporal	2			2			2		

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
PC dams to Pit G		could emanate from a burst pipe	to be conducted to detect leaks or pipe bursts.	Probability	3			3			1		
PC dam overtopping during construction	Surface water	Pollution due to dry weather flow from the plant	• Pumping PC dam water to Ikhwezi Pit G; • Construction of the lined PC dam in phases; • Maintain the Secondary PC Dam at the lowest level to provide the maximum storage for stormflow runoff.	Significance	2	0.8	VERY LOW	2	0.8	VERY LOW	2	0.4	VERY LOW
				Spatial	2			2			2		
				Temporal	2			2			2		
				Probability	2			2			1		
Refuelling of vehicles	Surface water and wetlands	Pollution from hydrocarbon spillages	• Bunding of refuelling areas • Refuelling areas to be located out of delineated wetlands wherever possible • Contain spills or leaks (ensuring spill kits are available; • Appropriate disposal of contained spills or leaks.	Significance	3	1.6	LOW	3	1.6	LOW	3	0.4	VERY LOW
				Spatial	1			1			1		
				Temporal	2			2			2		
				Probability	4			4			1		
Sewage disposal	Surface water	Contamination of water resources	• Chemical toilets to be provided and serviced regularly. • Sewage to be removed to a registered disposal facility – safe disposal certificates to be obtained.	Significance	2	0.7	VERY LOW	2	0.7	VERY LOW	2	0.3	VERY LOW
				Spatial	1			1			1		
				Temporal	2			2			2		
				Probability	2			2			1		
Waste management	Surface water	Pollution of water resources	• Collect and dispose all rubble, waste concrete, packaging waste and other general waste in a skip and dispose of it on a licensed general waste facility; • Dispose of hazardous materials in a hazardous waste skip which is to be disposed at a licenced hazardous waste facility. Obtain safe disposal certificates for each waste load.	Significance	4	2.3	MODERATE	4	2.3	MODERATE	4	0.9	VERY LOW
				Spatial	1			1			1		
				Temporal	2			2			2		
				Probability	5			5			2		

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
Improper installation of the PC Dam liner	Surface water	Water resource contamination	• Replace the current PC dams with a lined silt trap and PC dam; • Appoint a contractor who is experienced with lined PC dam construction; • Appoint a consultant to fulfil either the site supervision or EPCM role for the construction project. • The usage of discard for construction of site access and construction roads to be avoided; • Silt netting to be installed to prevent silt run-off during construction;	Significance	5	1.3	LOW	5	1.3	LOW	5	0.7	VERY LOW
				Spatial	3			3			3		
				Temporal	2			2			2		
				Probability	2			2			1		
PC dam liner construction	Surface water	Contaminated water seepage through a poorly constructed liner	• Appoint a contractor who is experienced with lined PC dam construction; • Appoint an experienced consultant for the site supervision or EPCM role; • Implement quality control and quality assurance procedures • Implement a seepage collection system during construction.	Significance	4	2.2	MODERATE	4	2.2	MODERATE	4	1.5	LOW
				Spatial	3			3			3		
				Temporal	4			4			4		
				Probability	3			3			2		
Borrow pit development	Surface water	• Reduced runoff; • Increased erosion; • Safety hazard.	• Remove and stockpile all topsoil and organic material in horizons; • Shape and protect stockpiles from erosion and alien invasive species; • Shape the borrow pit area to be free-draining after construction; • Replace topsoil and re-vegetate the borrow pit.	Significance	4	2.7	MODERATE	4	2.7	MODERATE	4	1.3	LOW
				Spatial	2			2			2		
				Temporal	4			4			4		
				Probability	4			4			2		
	Ecology			Significance	3	2.4	MO	3	2.4	MO	2	1.9	LO

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
Disturbance of soil or vegetation		Increase in weedy and alien invasive species	• Mechanical removal of plants; • Chemical control using herbicides.	Spatial	2			2			2		
				Temporal	4			4			3		
				Probability	4			4			4		
Operational Phase													
Seepage from Silt Trap and Lined PC dam	Wetlands	Decline in water quality and deterioration of wetlands PES and functionality due to leakages in liner systems	• Continued monitoring and maintenance of the facilities. • Appoint a contractor who is experienced with lined PC dam operation	Significance	3	1.2	LOW	3	1.2	LOW	3	0.6	VERY LOW
				Spatial	3			3			3		
				Temporal	3			3			3		
				Probability	2			2			1		
Operation of upgraded subsoil drains, silt trap and PC dam and capping of Mine Residue Facility	Groundwater	Seepage and contamination plume expansion	• Continuous monitoring and maintenance of the system.	Significance	4	3.2	HIGH POSITIVE	4	3.2	HIGH POSITIVE	4	3.2	HIGH POSITIVE
				Spatial	4			4			4		
				Temporal	4			4			4		
				Probability	4			4			4		
Surface water drains operation	Surface water	Siltation of dirty water drains reducing its capacities	• Drains to be kept free of silt; • Drains to be inspected monthly; • Silt removed from the drains to be disposed on the Mine Residue Facility; • Drains to be designed to be self-cleaning in storm events >1:2 year return periods.	Significance	4	2.7	MODERATE	4	2.7	MODERATE	4	2.0	LOW
				Spatial	2			2			2		
				Temporal	4			4			4		
				Probability	4			4			3		
PC dam operation	Surface water	Siltation and reduction of lined PC dam capacity	• PC dam designed with two compartments; • Cleaning of compartments to be conducted in dry seasons; • Silt in the silt trap to be removed with a TLB and the PC dam sump to be pumped with a sludge pump;	Significance	4	3.0	MODERATE	4	3.0	MODERATE	4	1.8	LOW
				Spatial	1			1			1		
				Temporal	4			4			4		
				Probability	5			5			3		

Activity	Aspect	Impact	Proposed Mitigation Measures	Ranking Criteria	Post-Activity Impact Scores	Post-Activity Impact Rating		Cumulative Impact Scores	Cumulative Impact Rating		Post-Mitigatory Impact Scores	Post-Mitigatory Impact Rating	
			• Removed silt to be disposed on the Mine Residue Facility.										
PC dam operation	Surface water	Clean water entering the PC dam	Maintenance of the berm, up-gradient of the PC dam.	Significance	3	3.0	MODERATE	3	3.0	MODERATE	3	0.6	VERY LOW
				Spatial	1			1			1		
				Temporal	5			5			5		
				Probability	5			5			1		
PC dam wall failure	Surface water	Water resource contamination	• Maintain and monitor lined silt trap and PC dam operations; • Appoint a contractor who is experienced with lined PC dam operation; • Appoint an experienced consultant for the site auditing and monitoring	Significance	5	1.3	LOW	5	1.3	LOW	5	0.7	VERY LOW
				Spatial	3			3			3		
				Temporal	2			2			2		
				Probability	2			2			1		
PC dam liner failure	Surface water	Surface and groundwater contamination	• Monitor seepage detection system; • Appoint a contractor who is experienced with lined PC dam operation; • Ensure regular monitoring and auditing of the dams liner systems and nearby water resources	Significance	4	3.2	HIGH	4	3.2	HIGH	4	1.6	LOW
				Spatial	3			3			3		
				Temporal	5			5			5		
				Probability	4			4			2		
Maintenance vehicles (for desilting the dam) refuelling	Surface water	Pollution from hydrocarbon spillages	• Bunding of refuelling areas; • Contain spills or leaks – ensure spill kits are available on site at all times; • Appropriate disposal of contained spills or leaks.	Significance	3	2.1	MODERATE	3	2.1	MODERATE	3	1.1	LOW
				Spatial	1			1			1		
				Temporal	4			4			4		
				Probability	4			4			2		
				Significance	5	2.2	MO	5	2.2	MO	5	1.5	LO

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
Spills from reduced dam capacities due to reeds and siltation	Surface water	Water resource contamination	Maintain silt trap and PC dam free of reeds and remove silt periodically.	Spatial	2			2			2		
				Temporal	4			4			4		
				Probability	3			3			2		
Seepage from unlined PC dams	Groundwater	Water resource contamination	• Remove the head behind the polluted groundwater plume by lining PC Dam itself; • Inhibit the spread of the contamination plume via scavenger boreholes if found to be necessary; • Continuous monitoring and maintenance of the system.	Significance	4	4.0	HIGH	4	4.0	HIGH	4	1.6	LOW
				Spatial	3			3			3		
				Temporal	5			5			5		
				Probability	5			5			2		
Spills due to pump failure at PC dam	Surface water	Water resource contamination	• PC Dam to have a pump station with two pumps and a diesel generator in case of an extended power failure.	Significance	3	1.6	LOW	3	1.6	LOW	3	0.5	VERY LOW
				Spatial	1			1			1		
				Temporal	4			4			4		
				Probability	3			3			1		
Increase in the dam size	Surface water	Reduction in the Wilge River's catchment yield	No mitigation possible	Significance	2	2.7	MODERATE	2	2.7	MODERATE	2	2.7	MODERATE
				Spatial	2			2			2		
				Temporal	4			4			4		
				Probability	5			5			5		
Decommissioning & Closure Phase													
Surface disturbance during rehabilitation activities	Surface water	Sedimentation and erosion prior to the establishment of vegetation on these areas	• Utilisation of products to provide support for the topsoil until vegetation is established; • Limit slope length to limit velocity and erosion.	Significance	3	1.9	LOW	3	1.9	LOW	3	0.9	VERY LOW
				Spatial	2			2			2		
				Temporal	2			2			2		
				Probability	4			4			2		
	Ecology	Increase in weedy and alien invasive species	• Bare exposed surfaces to be rehabilitated with an approved seed	Significance	3	2.4	MODERATE	3	2.4	MODERATE	2	1.9	LOW
				Spatial	2			2			2		

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
Disturbance of soil or vegetation			mix and monitored for any signs of alien invasion; • Mechanical removal of alien invasive plants; • Chemical control using herbicides.	Temporal	4			4			3		
				Probability	4			4			4		
Post- Closure Phase													
Leakage through the PC dam liner system	Surface Water	Water resource contamination	• Maintenance of a leakage collection under-drain system; • Investigate the removal of the PC dams after closure of the mine (and everything has been capped, demolished). Passive treatment systems for seepage water to be also be investigated.	Significance	4	3.2	HIGH	4	3.2	HIGH	4	1.6	LOW
				Spatial	3			3			3		
				Temporal	5			5			5		
				Probability	4			4			2		
Seepage from PC dams	Wetlands	Decline in water quality and deterioration of wetlands PES and functionality	Continued monitoring and maintenance of the facilities	Significance	4	1.6	LOW	4	1.6	LOW	3	0.7	VERY LOW
				Spatial	3			3			3		
				Temporal	5			5			5		
				Probability	2			2			1		
Dam wall failure	Surface Water	Water resource contamination	• Investigate the removal of the PC dams after closure of the mine (and everything has been capped or demolished). Passive treatment systems for seepage water to be also be investigated	Significance	5	1.7	LOW	5	1.7	LOW	5	0.9	VERY LOW
				Spatial	3			3			3		
				Temporal	5			5			5		
				Probability	2			2			1		

Table 8-4: PC Dam Alternative (2): Upgrade both PC Dams and realign the secondary PC Dam - Impact rating

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
Construction Phase													
Vegetation clearing	Ecology	Habitat destruction	•Minimise construction lay down areas/ footprint as far as possible; • Demarcate construction areas and confine vehicle and personnel movement to within these areas; • Sensitive species to be identified and relocated.	Significance	3	2.4	MODERATE	3	2.4	MODERATE	3	2.1	MODERATE
				Spatial	2			2			2		
				Temporal	4			4			3		
				Probability	4			4			4		
Noise pollution, ground vibrations and the physical disturbance of habitats by earth moving equipment	Ecology	Disturbance, loss and/or dispersal of fauna	• Minimise development footprint as far as possible; • Demarcate construction areas and confine vehicle and personnel movement to within these areas; • Outside lighting should be designed to minimize impacts on fauna; •Sensitive species to be identified and relocated.	Significance	2	1.6	LOW	2	1.6	LOW	2	1.0	VERY LOW
				Spatial	2			2			1		
				Temporal	2			2			2		
				Probability	4			4			3		
Seepage from PC dams	Wetlands	Decline in water quality and deterioration of wetlands PES and functionality	• Develop and implement a quality control system for the construction of the silt trap and Lined PC Dam • Ensure a specification on the quality of the construction material is developed and implemented, such as for the HDPE material • Appoint a contractor who is experienced with liner construction; • Appoint an experienced consultant for the site supervision or EPCM role.	Significance	3	3.0	MODERATE	3	3.0	MODERATE	3	1.2	LOW
				Spatial	3			3			3		
				Temporal	3			3			3		
				Probability	5			5			2		
PC dam site clearance	Surface water	Increased erosion and sedimentation	• Minimising the disturbance footprint; • Control of fugitive dust;	Significance	1	1.0	VERY	1	1.0	VERY	1	0.3	VERY
				Spatial	2			2			2		

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
			•Construct during dryer (autumn/winter) months as far as possible.	Temporal	2			2			2		
				Probability	3			3			1		
PC dam civil works	Surface water	Increased erosion and sedimentation	• Conduct civil works in phases, with appropriate water management measures during the two phases; • Control of fugitive dust; • Construct during dryer (autumn/winter) months as far as possible.	Significance	3	1.9	LOW	3	1.9	LOW	3	0.9	VERY LOW
				Spatial	2			2			2		
				Temporal	2			2			2		
				Probability	4			4			2		
PC dam overtopping during construction	Surface water	Pollution due to inadequate storm runoff storage capacity	• Pump PC dam water to Ikhwezi Pit G; • Construction of the lined PC dam in phases; • Maintain the Secondary PC Dam at the lowest level to provide the maximum storage for stormflow runoff.	Significance	5	2.7	MODERATE	5	2.7	MODERATE	5	1.3	LOW
				Spatial	3			3			3		
				Temporal	2			2			2		
				Probability	4			4			2		
Dewatering of PC dams to Pit G	Surface water	Pollution from burst pipe	• Pipeline construction to be in accordance with SABS codes to ensure quality control; •Weekly inspections of the pipeline to be conducted to detect leaks or pipe bursts.	Significance	3	1.2	LOW	3	1.2	LOW	3	0.4	VERY LOW
				Spatial	1			1			1		
				Temporal	2			2			2		
				Probability	3			3			1		
PC dam overtopping during construction	Surface water	Pollution due to dry weather flow from the plant	• Pump PC dam water to Ikhwezi Pit G; • Construction of the lined PC dam in phases; • Maintain the Secondary PC Dam at the lowest level to provide the maximum storage for stormflow runoff.	Significance	2	0.8	VERY LOW	2	0.8	VERY LOW	2	0.4	VERY LOW
				Spatial	2			2			2		
				Temporal	2			2			2		
				Probability	2			2			1		
				Significance	3	1.6	LO	3	1.6	LO	3	0.4	VE

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
Refuelling of vehicles	Surface water	Pollution from hydrocarbon spillages	• Bunding of refuelling areas; • Contain spills or leaks; • Appropriate disposal of contained spills or leaks.	Spatial	1			1			1		
				Temporal	2			2			2		
				Probability	4			4			1		
Sewage disposal	Surface water	Contamination of water resources	• Chemical toilets to be provided and serviced regularly. Safe disposal certificates to be issued for safe disposal of sewage loads by service provider	Significance	2	0.7	VERY LOW	2	0.7	VERY LOW	2	0.3	VERY LOW
				Spatial	1			1			1		
				Temporal	2			2			2		
				Probability	2			2			1		
Waste management	Surface water	Pollution of water resources	• Collect and dispose all rubble, waste concrete, packaging waste and other general waste in a skip and dispose of it on a licensed general waste facility; • Dispose of hazardous in a hazardous waste skip to be disposed at a licenced hazardous waste facility.	Significance	4	2.3	MODERATE	4	2.3	MODERATE	4	0.9	VERY LOW
				Spatial	1			1			1		
				Temporal	2			2			2		
				Probability	5			5			2		
PC dam wall failure	Surface water	Water resource contamination	• Replace the current PC dams with a formally lined silt trap and Lined PC dam; • Appoint a contractor who is experienced with lined PC dam construction; • Appoint a consultant to fulfil either the site supervision or EPCM role for the construction project.	Significance	5	1.3	LOW	5	1.3	LOW	5	0.7	VERY LOW
				Spatial	3			3			3		
				Temporal	2			2			2		
				Probability	2			2			1		
PC dam liner construction	Surface water	Contaminated water seepage through a poorly constructed liner	• Quality control system to be developed and implemented by contractor. • Materials qualification specifications to be developed and must be approved by design engineer.	Significance	4	2.2	MODERATE	4	2.2	MODERATE	4	1.5	LOW
				Spatial	3			3			3		
				Temporal	4			4			4		
				Probability	3			3			2		

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
			• Appoint a contractor who is experienced with lined PC dam construction; • Appoint an experienced consultant for the site supervision or EPCM role; • Implement a seepage collection system during construction.										
Borrow pit construction	Surface water	• Reduced runoff; • increased erosion; • safety hazard.	• Remove and stockpile all topsoil and organic material; • Shape and protect stockpiles from erosion and alien invasive species; • Shape the borrow pit area to be free-draining after construction; • Replace topsoil and re-vegetate the borrow pit with grass species endemic to the area.	Significance	4	2.9	MODERATE	4	2.9	MODERATE	4	1.5	LOW
				Spatial	3			3			3		
				Temporal	4			4			4		
				Probability	4			4			2		
Disturbance of soil or vegetation	Ecology	Increase in weedy and alien invasive species	• Mechanical removal of invasive plant species; • Chemical control using herbicides. Chemicals to be used must be safe for usage near water bodies	Significance	3	2.7	MODERATE	3	2.7	MODERATE	2	2.1	MODERATE
				Spatial	3			3			3		
				Temporal	4			4			3		
				Probability	4			4			4		
Operational Phase													
Seepage from PC dams	Wetlands	Decline in water quality and deterioration of wetlands PES and functionality	Each compartment must have its own seepage collection sump so that the seepage and leakage and quality from the specific compartment can be monitored. If deterioration in the water quality is observed, the compartment must be emptied of water and the problem area identified and rectified.	Significance	3	1.2	LOW	3	1.2	LOW	3	0.6	VERY LOW
				Spatial	3			3			3		
				Temporal	3			3			3		
				Probability	2			2			1		
	Groundwater			Significance	4	3.2	HIG	4	3.2	HIG	4	3.2	HIG

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
Operation of upgraded subsoil drains, silt trap and PC dam		Seepage and contamination plume expansion	• Continuous monitoring and maintenance of the system. • If deterioration in the water quality is observed, the compartment must be emptied of water and the problem area identified and rectified	Spatial	4			4			4		
				Temporal	4			4			4		
				Probability	4			4			4		
Surface water drains operation	Surface water	Siltation of dirty water drains reducing its capacities	• Drains to be kept free of silt; • Drains to be inspected weekly; • Silt removed from the drains to be disposed on the Mine Residue Facility; • Drains to be designed to be self-cleaning in storm events >1:2 year return periods.	Significance	4	2.7	MODERATE	4	2.7	MODERATE	4	2.0	LOW
				Spatial	2			2			2		
				Temporal	4			4			4		
				Probability	4			4			3		
PC dam operation	Surface water	Siltation and reduction of Lined PC dam capacity	• PC dam designed with two compartments; • Cleaning of compartments to be conducted in dry seasons; • Silt in the silt trap to be removed with a TLB and the PC dam sump to be pumped with a sludge pump; • Removed silt to be disposed on the Mine Residue Facility.	Significance	4	3.0	MODERATE	4	3.0	MODERATE	4	1.8	LOW
				Spatial	1			1			1		
				Temporal	4			4			4		
				Probability	5			5			3		
PC dam operation	Surface water	Clean water entering the PC dam	• Maintenance of the berm up-gradient of the PC dam.	Significance	3	3.0	MODERATE	3	3.0	MODERATE	3	0.6	VERY LOW
				Spatial	1			1			1		
				Temporal	5			5			5		
				Probability	5			5			1		
PC dam wall failure	Surface water	Water resource contamination	• Maintain and monitor lined silt trap and PC dam operations; • Appoint a contractor who is experienced with lined PC dam operation;	Significance	5	1.3	LOW	5	1.3	LOW	5	0.7	VERY LOW
				Spatial	3			3			3		
				Temporal	2			2			2		
				Probability	2			2			1		

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
			• Appoint an experienced consultant for the auditing and monitoring										
PC dam liner failure	Surface water	Surface and groundwater contamination	• Monitor seepage detection system; • Appoint a contractor who is experienced with lined PC dam operation; • Appoint an experienced consultant for the site auditing.	Significance	4	3.2	HIGH	4	3.2	HIGH	4	1.6	LOW
				Spatial	3			3			3		
				Temporal	5			5			5		
				Probability	4			4			2		
Waste management	Ecology	Pollution of water resources	• Collect and dispose all general waste (excluding recyclable material) in a skip and then dispose of this waste periodically on a licensed general waste facility; • Collect and separate all recyclable waste on site; • Dispose of hazardous in a hazardous waste skip to be disposed at a licenced hazardous waste facility.	Significance	4	3.3	HIGH	4	3.3	HIGH	4	1.3	LOW
				Spatial	2			2			2		
				Temporal	4			4			4		
				Probability	5			5			2		
Refuelling of vehicles	Surface water	Pollution from hydrocarbon spillages	• Bunding of refuelling areas; • Contain spills or leaks; • Appropriate disposal of contained spills or leaks.	Significance	3	2.1	MODERATE	3	2.1	MODERATE	3	1.1	LOW
				Spatial	1			1			1		
				Temporal	4			4			4		
				Probability	4			4			2		
Servicing and washing of vehicles	Surface water	Pollution from uncontained spillages	• Service area and wash bay to be bunded and located on an impermeable concrete surface; • The area will be sloped to divert all surface water flow to a sump, where after the water will pass through an oil-water separator,	Significance	4	3.0	MODERATE	4	3.0	MODERATE	4	1.2	LOW
				Spatial	1			1			1		
				Temporal	4			4			4		

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
			before it flows into the dirty water drain.	Probability	5			5			2		
Spills from reduced dam capacities due to reeds and siltation	Surface water	Water resource contamination	Maintain silt trap and PC dam free of reeds and remove silt periodically.	Significance	5	2.2	MODERATE	5	2.2	MODERATE	5	1.5	LOW
				Spatial	2			2			2		
				Temporal	4			4			4		
				Probability	3			3			2		
Seepage from unlined PC dams	Groundwater	Water resource contamination	• Remove the head behind the polluted groundwater plume by lining PC Dam itself; • Inhibit the spread of the contamination plume via scavenger boreholes; • Continuous monitoring and maintenance of the system.	Significance	4	4.0	HIGH	4	4.0	HIGH	4	1.6	LOW
				Spatial	3			3			3		
				Temporal	5			5			5		
				Probability	5			5			2		
Spills due to pump failure at unlined PC dam	Surface water	Water resource contamination	• Lined PC Dam to have a pump station with two pumps and a diesel generator in case of an extended power failure.	Significance	3	1.6	LOW	3	1.6	LOW	3	0.5	VERY LOW
				Spatial	1			1			1		
				Temporal	4			4			4		
				Probability	3			3			1		
Increase in the dam size	Surface water	Reduction in the Wilge River's catchment yield	No mitigation possible	Significance	2	2.7	MODERATE	2	2.7	MODERATE	2	2.7	MODERATE
				Spatial	2			2			2		
				Temporal	4			4			4		
				Probability	5			5			5		
Decommissioning & Closure Phase													
Surface disturbance during rehabilitation activities	Surface water	Sedimentation and erosion prior to the establishment of vegetation on these areas	• Utilisation of products to provide support for the topsoil until vegetation is established; • Limit slope length to limit velocity and erosion.	Significance	3	1.9	LOW	3	1.9	LOW	3	0.9	VERY LOW
				Spatial	2			2			2		
				Temporal	2			2			2		
				Probability	4			4			2		
	Ecology			Significance	3	2.4	MO	3	2.4	MO	2	1.9	LO

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
Disturbance of soil or vegetation		Increase in weedy and alien invasive species	• Bare exposed surfaces to be rehabilitated with an approved seed mix and monitored for any signs of alien invasion; • Mechanical removal of plants; • Chemical control using herbicides.	Spatial	2			2			2		
				Temporal	4			4			3		
				Probability	4			4			4		
Post- Closure Phase													
Leakage through the PC dam liner system	Surface Water	Water resource contamination	• Maintenance of a leakage collection under-drain system; • Investigate the removal of the PC dams after closure of the mine (and everything has been capped, demolished). Passive treatment systems for seepage water to be also be investigated.	Significance	4	3.2	HIGH	4	3.2	HIGH	4	1.6	LOW
				Spatial	3			3			3		
				Temporal	5			5			5		
				Probability	4			4			2		
Seepage from PC dams	Wetlands	Decline in water quality and deterioration of wetlands PES and functionality	Continued monitoring and maintenance of the facilities	Significance	4	1.6	LOW	4	1.6	LOW	3	0.7	VERY LOW
				Spatial	3			3			3		
				Temporal	5			5			5		
				Probability	2			2			1		
Dam wall failure	Surface Water	Water resource contamination	• Investigate the removal of the PC dams after closure of the mine (and everything has been capped or demolished). Passive treatment systems for seepage water to be also be investigated	Significance	5	1.7	LOW	5	1.7	LOW	5	0.9	VERY LOW
				Spatial	3			3			3		
				Temporal	5			5			5		
				Probability	2			2			1		

Table 8-5: PC Dam Alternative (3): No-go Alternative impact rating

Activity	Aspect	Impact/s	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
All Phases													
Continual operation of existing PC Dams and surface water drains	Surface Water and wetlands	Seepage of pollution through unlined PC dams Spills from silted up dams into surface water resources	• Continued monitoring and maintenance of the PC Dams; Regular de-sludging of Dams and removal of reeds	Significance	3	2.1	MODERATE	4	3.2	HIGH	4	3.2	HIGH
				Spatial	2			3			3		
				Temporal	3			5			5		
				Probability	4			4			4		
No vegetation clearing or civil works to be conducted	Ecology	No Habitat destruction or increased sedimentation of water resources	No Mitigation proposed	Significance	2	1.1	LOW POSITIVE	2	1.1	LOW POSITIVE	2	0.5	VERY LOW POSITIVE
				Spatial	1			1			1		
				Temporal	1			1			1		
				Probability	4			4			2		
Dam spills	Surface water and wetland	Close proximity to the Wilge River and therefore contamination of water resources if Dam spills during any flood events	• Ensure Dam is operated at Minimum Operating levels; •Continuous monitoring and Emergency response procedures in place	Significance	4	3.2	HIGH	4	3.2	HIGH	4	3.2	HIGH
				Spatial	3			3			3		
				Temporal	5			5			5		
				Probability	4			4			4		

Table 8-6: Mine Residue Facility Alternative (1): Upgrading the facility *in situ* for deposition of discard and slurry- Impact rating

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
Construction Phase													
Vegetation clearing for construction laydown area	Ecology	Habitat destruction	•Minimise development footprint as far as possible; • Demarcate construction areas and confine vehicle and personnel movement to within these areas; • Sensitive species to be identified and relocated.	Significance	2	1.1	LOW	2	1.1	LOW	2	0.5	VERY LOW
				Spatial	1			1			1		
				Temporal	1			1			1		
				Probability	4			4			2		
Noise pollution, ground vibrations and the physical disturbance of habitats by earth moving equipment	Ecology	Disturbance, loss and/or dispersal of fauna	• Minimise development footprint as far as possible; • Demarcate construction areas and confine vehicle and personnel movement to within these areas; • Outside lighting should be designed to minimize impacts on fauna; • Sensitive species to be identified and relocated.	Significance	2	1.6	LOW	2	1.6	LOW	2	1.0	VERY LOW
				Spatial	2			2			1		
				Temporal	2			2			2		
				Probability	4			4			3		
Erosion and sediment loading from side slope vegetation clearance	Surface water and Wetlands	Decline in water quality and deterioration of PES and functionality	• Conduct civil works in phases, with appropriate water management measures during the two phases; • Control of fugitive dust; • Construct during dryer (autumn/winter) months as far as possible.	Significance	3	3.0	MODERATE	3	3.0	MODERATE	3	1.2	LOW
				Spatial	3			3			3		
				Temporal	3			3			3		
				Probability	5			5			2		
Refuelling of vehicles	Surface water	Pollution from hydrocarbon spillages	• Bunding of refuelling areas; • Contain spills or leaks; • Appropriate disposal of contained spills or leaks.	Significance	3	1.6	LOW	3	1.6	LOW	3	0.4	VERY LOW
				Spatial	1			1			1		
				Temporal	2			2			2		
				Probability	4			4			1		

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
Sewage disposal	Surface water	Contamination of water resources	• Chemical toilets to be provided and serviced regularly.	Significance	2	0.7	VERY LOW	2	0.7	VERY LOW	2	0.3	VERY LOW
				Spatial	1			1			1		
				Temporal	2			2			2		
				Probability	2			2			1		
Waste management	Surface water	Pollution of water resources	• Collect and dispose all rubble, waste concrete, packaging waste and other general waste in a skip and dispose of it on a licensed general waste facility; • Dispose of hazardous in a hazardous waste skip to be disposed at a licenced hazardous waste facility.	Significance	4	2.3	MODERATE	4	2.3	MODERATE	4	0.9	VERY LOW
				Spatial	1			1			1		
				Temporal	2			2			2		
				Probability	5			5			2		
Disturbance of soil or vegetation	Ecology	Increase in weedy and alien invasive species	• Mechanical removal of plants; • Chemical control using herbicides.	Significance	3	2.4	MODERATE	3	2.4	MODERATE	2	1.9	LOW
				Spatial	2			2			2		
				Temporal	4			4			3		
				Probability	4			4			4		
Operational Phase													
Surface flow on the Mine Residue Facility	Surface water	Erosion of rehabilitation cover	• Slope gradient (1:5) and length will be limited; • Additional protection to be provided where slopes are steeper, e.g. providing a lined chute on the western side of the rehabilitated facility; • Contoured channels and Armorflex chutes to be operated and maintained.	Significance	4	2.7	MODERATE	4	2.7	MODERATE	4	1.6	LOW
				Spatial	1			1			1		
				Temporal	3			3			3		
				Probability	5			5			3		
Operation of upgraded subsoil drains, silt trap and	Groundwater	Seepage and contamination plume expansion	Continuous monitoring and maintenance of the system.	Significance	4	3.2	HIGH POSITIVE	4	3.2	HIGH POSITIVE	4	3.2	HIGH POSITIVE
				Spatial	4			4			4		
				Temporal	4			4			4		

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
PC dam and capping and recovery of new Mine Residue Facility				Probability	4			4			4		
Over loading the Mine Residue Facility with Discard and Slurry resulting in failure of the facility	Stability	Deposition of Slurry and Discard onto the facility above recommended capacity	Ensure the capacity of the facility is not exceeded and that the maximum height of 40 m is maintained.	Significance	5	5	HIGH	5	5	HIGH	4	2.7	MODERATE
				Spatial	5			5			2		
				Temporal	5			5			4		
				Probability	5			5			4		
Surface water drains operation	Surface water	Siltation of dirty water drains reducing its capacities	• Drains to be maintained and kept free of silt and reeds; • Drains to be inspected monthly; • Silt removed from the drains to be disposed on the Mine Residue Facility; • Drains to be designed to be self-cleaning in storm events >1:2 year return periods.	Significance	4	2.7	MODERATE	4	2.7	MODERATE	4	2.0	LOW
				Spatial	2			2			2		
				Temporal	4			4			4		
				Probability	4			4			3		
				Spatial	2			2			2		
				Temporal	4			4			4		
				Probability	5			5			2		
Refuelling of any maintenance vehicles	Surface water	Pollution from hydrocarbon spillages	• Bunding of refuelling areas; • Contain spills or leaks; • Appropriate disposal of contained spills or leaks.	Significance	3	2.1	MODERATE	3	2.1	MODERATE	3	1.1	LOW
				Spatial	1			1			1		
				Temporal	4			4			4		
				Probability	4			4			2		

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
				Spatial	1			1			1		
				Temporal	4			4			4		
				Probability	5			5			2		
Decommissioning & Closure Phase													
Surface disturbance during rehabilitation activities	Surface water	Sedimentation and erosion prior to the establishment of vegetation on these areas	• Utilisation of products to provide support for the topsoil until vegetation is established; • Limit slope length to limit velocity and erosion.	Significance	3	1.9	LOW	3	1.9	LOW	3	0.9	VERY LOW
				Spatial	2			2			2		
				Temporal	2			2			2		
				Probability	4			4			2		
Disturbance of soil or vegetation	Ecology	Increase in weedy and alien invasive species	• Bare exposed surfaces to be rehabilitated with an approved seed mix and monitored for any signs of alien invasion; • Mechanical removal of plants; • Chemical control using herbicides.	Significance	3	2.4	MODERATE	3	2.4	MODERATE	2	1.9	LOW
				Spatial	2			2			2		
				Temporal	4			4			3		
				Probability	4			4			4		
Post- Closure Phase													
Surface flow on the Mine Residue Facility	Surface water	Erosion of rehabilitation cover	• Slope gradient and length will be limited to acceptable values; • Additional protection to be provided where slopes are steeper, e.g. providing a lined chute on the western side of the rehabilitated facility; • Contoured channels and Armorflex chutes to be maintained.	Significance	4	3.3	HIGH	4	3.3	HIGH	4	2.0	LOW
				Spatial	1			1			1		
				Temporal	5			5			5		
				Probability	5			5			3		

Table 8-7: Mine Residue Facility Alternative (2): Upgrading the facility in situ for deposition of discard only - Impact rating

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
Construction Phase													
Vegetation clearing for construction laydown area	Ecology	Habitat destruction	•Minimise development footprint as far as possible; • Demarcate construction areas and confine vehicle and personnel movement to within these areas; • CI species to be identified and relocated.	Significance	2	1.1	LOW	2	1.1	LOW	2	0.5	VERY LOW
				Spatial	1			1			1		
				Temporal	1			1			1		
				Probability	4			4			2		
Noise pollution, ground vibrations and the physical disturbance of habitats by earth moving equipment	Ecology	Disturbance, loss and/or dispersal of fauna	• Minimise development footprint as far as possible; • Demarcate construction areas and confine vehicle and personnel movement to within these areas; • Outside lighting should be designed to minimize impacts on fauna; • CI species to be identified and relocated.	Significance	2	1.6	LOW	2	1.6	LOW	2	1.0	VERY LOW
				Spatial	2			2			1		
				Temporal	2			2			2		
				Probability	4			4			3		
Erosion and sediment loading from side slope vegetation clearance	Surface water and Wetlands	Decline in water quality and deterioration of PES and functionality	• Conduct civil works in phases, with appropriate water management measures during the two phases; • Control of fugitive dust; • Construct during dryer (autumn/winter) months as far as possible.	Significance	3	3.0	MODERATE	3	3.0	MODERATE	3	1.2	LOW
				Spatial	3			3			3		
				Temporal	3			3			3		
				Probability	5			5			2		
Refuelling of any construction vehicles	Surface water	Pollution from hydrocarbon spillages	• Bunding of refuelling areas; • Contain spills or leaks; • Appropriate disposal of contained spills or leaks.	Significance	3	1.6	LOW	3	1.6	LOW	3	0.4	VERY LOW
				Spatial	1			1			1		
				Temporal	2			2			2		
				Probability	4			4			1		
				Significance	2	0.7	VERY LOW	2	0.7	VERY LOW	2	0.3	VERY LOW

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
Sewage disposal	Surface water	Contamination of water resources	• Chemical toilets to be provided and serviced regularly.	Spatial	1			1			1		
				Temporal	2			2			2		
				Probability	2			2			1		
Waste management	Surface water	Pollution of water resources	• Collect and dispose all rubble, waste concrete, packaging waste and other general waste in a skip and dispose of it on a licensed general waste facility; • Dispose of hazardous in a hazardous waste skip to be disposed at a licenced hazardous waste facility.	Significance	4	2.3	MODERATE	4	2.3	MODERATE	4	0.9	VERY LOW
				Spatial	1			1			1		
				Temporal	2			2			2		
				Probability	5			5			2		
Disturbance of soil or vegetation	Ecology	Increase in weedy and alien invasive species	• Mechanical removal of plants; • Chemical control using herbicides.	Significance	3	2.4	MODERATE	3	2.4	MODERATE	2	1.9	LOW
				Spatial	2			2			2		
				Temporal	4			4			3		
				Probability	4			4			4		
Operational Phase													
Surface flow on the Mine Residue Facility	Surface water	Erosion of rehabilitation cover	• Slope gradient (1:5) and length will be limited; • Additional protection to be provided where slopes are steeper, e.g. providing a lined chute on the western side of the rehabilitated facility; • Contoured channels and Armorflex chutes to be operated.	Significance	4	2.7	MODERATE	4	2.7	MODERATE	4	1.6	LOW
				Spatial	1			1			1		
				Temporal	3			3			3		
				Probability	5			5			3		
Operation of upgraded subsoil drains, silt trap and PC dam and capping of	Groundwater	Seepage and contamination plume expansion	Continuous monitoring and maintenance of the system.	Significance	4	3.2	HIGH POSITIVE	4	3.2	HIGH POSITIVE	4	3.2	HIGH POSITIVE
				Spatial	4			4			4		
				Temporal	4			4			4		
				Probability	4			4			4		

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
new reduced Mine Residue Facility													
Over loading the Mine Residue Facility with Discard and Slurry resulting in failure of the facility	Stability	Deposition of Slurry and Discard onto the facility above recommended capacity	Ensure the capacity of the facility is not exceeded and that the maximum height of 40 m is maintained. A new facility will be required should the mine wash coal and produce slurry.	Significance	5	5	HIGH	5	5	HIGH	5	5	HIGH
				Spatial	5			5			5		
				Temporal	5			5			5		
				Probability	5			5			5		
Surface water drains operation	Surface water	Siltation of dirty water drains reducing its capacities	• Drains to be maintained and kept free of silt; • Drains to be inspected monthly; • Silt removed from the drains to be disposed on the Mine Residue Facility; • Drains to be designed to be self-cleaning in storm events >1:2 year return periods.	Significance	4	2.7	MODERATE	4	2.7	MODERATE	4	2.0	LOW
				Spatial	2			2			2		
				Temporal	4			4			4		
				Probability	4			4			3		
				Spatial	2			2			2		
				Temporal	4			4			4		
				Probability	5			5			2		
Refuelling of vehicles used for maintenance	Surface water	Pollution from hydrocarbon spillages	• Bunding of refuelling areas; • Contain spills or leaks; • Appropriate disposal of contained spills or leaks.	Significance	3	2.1	MODERATE	3	2.1	MODERATE	3	1.1	LOW
				Spatial	1			1			1		
				Temporal	4			4			4		
				Probability	4			4			2		
Servicing and washing of vehicles	Surface water	Pollution from uncontained spillages	• Service area and wash bay to be bunded and located on an impermeable concrete surface; • The area will be sloped to divert all surface water flow to a silt trap, where after the water will pass through an oil-water separator,	Significance	4	3.0	MODERATE	4	3.0	MODERATE	4	1.2	LOW
				Spatial	1			1			1		
				Temporal	4			4			4		
				Probability	5			5			2		

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
			before it flows into the dirty water drain.										
Decommissioning & Closure Phase													
Surface disturbance during rehabilitation activities	Surface water	Sedimentation and erosion prior to the establishment of vegetation on these areas	• Utilisation of products to provide support for the topsoil until vegetation is established; • Limit slope length to limit velocity and erosion.	Significance	3	1.9	LOW	3	1.9	LOW	3	0.9	VERY LOW
				Spatial	2			2			2		
				Temporal	2			2			2		
				Probability	4			4			2		
Disturbance of soil or vegetation	Ecology	Increase in weedy and alien invasive species	• Bare exposed surfaces to be rehabilitated with an approved seed mix and monitored for any signs of alien invasion; • Mechanical removal of plants; • Chemical control using herbicides.	Significance	3	2.4	MODERATE	3	2.4	MODERATE	2	1.9	LOW
				Spatial	2			2			2		
				Temporal	4			4			3		
				Probability	4			4			4		
Post- Closure Phase													
Surface flow on the Mine Residue Facility	Surface water	Erosion of rehabilitation cover	• Slope gradient and length will be limited to acceptable values; • Additional protection to be provided where slopes are steeper, e.g. providing a lined chute on the western side of the rehabilitated facility; • Contoured channels and Armorflex chutes to be maintained.	Significance	4	3.3	HIGH	4	3.3	HIGH	4	2.0	LOW
				Spatial	1			1			1		
				Temporal	5			5			5		
				Probability	5			5			3		

Table 8-8: Mine Residue Facility Alternative (3): Recovery of waste from the Mine Residue Facility and replacing reject material on the mined out footprint- Impact rating

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
Construction Phase													
Vegetation clearing for construction laydown area	Ecology	Habitat destruction	•Minimise development footprint as far as possible; • Demarcate construction areas and confine vehicle and personnel movement to within these areas; • CI species to be identified and relocated.	Significance	2	1.1	LOW	2	1.1	LOW	2	0.5	VERY LOW
				Spatial	1			1			1		
				Temporal	1			1			1		
				Probability	4			4			2		
Noise pollution, ground vibrations and the physical disturbance of habitats by earth moving equipment	Ecology	Disturbance, loss and/or dispersal of fauna	• Minimise development footprint as far as possible; • Demarcate construction areas and confine vehicle and personnel movement to within these areas; • Outside lighting should be designed to minimize impacts on fauna; • CI species to be identified and relocated.	Significance	2	1.6	LOW	2	1.6	LOW	2	1.0	VERY LOW
				Spatial	2			2			1		
				Temporal	2			2			2		
				Probability	4			4			3		
Erosion and sediment loading from vegetation clearance	Surface water and Wetlands	Decline in water quality and deterioration of PES and functionality	• Conduct civil works in phases, with appropriate water management measures during the two phases; • Control of fugitive dust; • Construct during dryer (autumn/winter) months as far as possible.	Significance	3	3.0	MODERATE	3	3.0	MODERATE	3	1.2	LOW
				Spatial	3			3			3		
				Temporal	3			3			3		
				Probability	5			5			2		
Refuelling of vehicles	Surface water	Pollution from hydrocarbon spillages	• Bunding of refuelling areas; • Contain spills or leaks; • Appropriate disposal of contained spills or leaks.	Significance	3	1.6	LOW	3	1.6	LOW	3	0.4	VERY LOW
				Spatial	1			1			1		
				Temporal	2			2			2		
				Probability	4			4			1		
				Significance	2	0.7	VERY LOW	2	0.7	VERY LOW	2	0.3	VERY LOW

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
Sewage disposal	Surface water	Contamination of water resources	• Chemical toilets to be provided and serviced regularly.	Spatial	1			1			1		
				Temporal	2			2			2		
				Probability	2			2			1		
Waste management	Surface water	Pollution of water resources	• Collect and dispose all rubble, waste concrete, packaging waste and other general waste in a skip and dispose of it on a licensed general waste facility; • Dispose of hazardous in a hazardous waste skip to be disposed at a licenced hazardous waste facility.	Significance	4	2.3	MODERATE	4	2.3	MODERATE	4	0.9	VERY LOW
				Spatial	1			1			1		
				Temporal	2			2			2		
				Probability	5			5			2		
Disturbance of soil or vegetation	Ecology	Increase in weedy and alien invasive species	• Mechanical removal of plants; • Chemical control using herbicides.	Significance	3	2.4	MODERATE	3	2.4	MODERATE	2	1.9	LOW
				Spatial	2			2			2		
				Temporal	4			4			3		
				Probability	4			4			4		
Operational Phase													
Surface flow on the Mine Residue Facility	Surface water	Erosion of rehabilitation cover	• Slope gradient (1:5) and length will be limited; • Additional protection to be provided where slopes are steeper, e.g. providing a lined chute on the western side of the rehabilitated facility; • Contoured channels and Armorflex chutes to be operated.	Significance	4	2.7	MODERATE	4	2.7	MODERATE	4	1.6	LOW
				Spatial	1			1			1		
				Temporal	3			3			3		
				Probability	5			5			3		
Operation of upgraded subsoil drains, silt trap and PC dam and capping of	Groundwater	Seepage and contamination plume expansion	Continuous monitoring and maintenance of the system.	Significance	4	4.0	HIGH POSITIVE	4	4.0	HIGH POSITIVE	4	4.0	HIGH POSITIVE
				Spatial	4			4			4		
				Temporal	4			4			4		
				Probability	5			5			5		

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
new Mine Residue Facility													
Surface water drains operation	Surface water	Siltation of dirty water drains reducing its capacities	• Drains to be maintained and kept free of silt; • Drains to be inspected monthly; • Silt removed from the drains to be disposed on the Mine Residue Facility; • Drains to be designed to be self-cleaning in storm events >1:2 year return periods.	Significance	4	2.7	MODERATE	4	2.7	MODERATE	4	2.0	LOW
				Spatial	2			2			2		
				Temporal	4			4			4		
				Probability	4			4			3		
Recovering water from the Mine Residue Facility	Stability	Reducing total loading of facility and reducing risk of failure	No mitigation propsoed	Significance	5	4.3	VERY HIGH POSITIVE	5	4.3	VERY HIGH	5	4.3	VERY HIGH POSITIVE
				Spatial	4			4			4		
				Temporal	4			4			4		
				Probability	5			5			5		
Recovering water from the Mine Residue Facility	Air quality	Dust creation and pollution of surrounding receptors	• Put dust suppression measures in place during all recovery hauling and excavating • Extend the air-quality monitoring network to include the recovery activities	Significance	4	3.3	HIGH	4	3.3	HIGH	4	2.7	MODERATE
				Spatial	2			2			2		
				Temporal	4			4			4		
				Probability	5			5			4		
Refuelling of vehicles	Surface water	Pollution from hydrocarbon spillages	• Bunding of refuelling areas; • Contain spills or leaks; • Appropriate disposal of contained spills or leaks.	Significance	3	2.1	MODERATE	3	2.1	MODERATE	3	1.1	LOW
				Spatial	1			1			1		
				Temporal	4			4			4		
				Probability	4			4			2		
Servicing and washing of vehicles	Surface water	Pollution from uncontained spillages	• Service area and wash bay to be bunded and located on an impermeable concrete surface; • The area will be sloped to divert	Significance	4	3.0	MODERATE	4	3.0	MODERATE	4	1.2	LOW
				Spatial	1			1			1		
				Temporal	4			4			4		

Activity	Aspect	Impact	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
			all surface water flow to a silt trap, where after the water will pass through an oil-water separator, before it flows into the dirty water drain.	Probability	5			5			2		
Decommissioning & Closure Phase													
Surface disturbance during rehabilitation activities	Surface water	Sedimentation and erosion prior to the establishment of vegetation on these areas	• Utilisation of products to provide support for the topsoil until vegetation is established; • Limit slope length to limit velocity and erosion.	Significance	3	1.9	LOW	3	1.9	LOW	3	0.9	VERY LOW
				Spatial	2			2			2		
				Temporal	2			2			2		
				Probability	4			4			2		
Disturbance of soil or vegetation	Ecology	Increase in weedy and alien invasive species	• Bare exposed surfaces to be rehabilitated with an approved seed mix and monitored for any signs of alien invasion; • Mechanical removal of plants; • Chemical control using herbicides.	Significance	3	2.4	MODERATE	3	2.4	MODERATE	2	1.9	LOW
				Spatial	2			2			2		
				Temporal	4			4			3		
				Probability	4			4			4		
Post- Closure Phase													
Surface flow on the Mine Residue Facility	Surface water	Erosion of rehabilitation cover	• Slope gradient and length will be limited to acceptable values; • Additional protection to be provided where slopes are steeper, e.g. providing a lined chute on the western side of the rehabilitated facility; • Contoured channels and Armorflex chutes to be maintained.	Significance	4	3.3	HIGH	4	3.3	HIGH	4	2.0	LOW
				Spatial	1			1			1		
				Temporal	5			5			5		
				Probability	5			5			3		

Table 8-9: Mine Residue Facility Alternative (4): No-go alternative - impact rating

Activity	Aspect	Impact/s	Proposed Mitigation Measures		Post-Activity Impact			Cumulative Impact			Post-Mitigatory Impact		
				Ranking Criteria	Scores	Impact Rating		Scores	Impact Rating		Scores	Impact Rating	
All Phases													
Continued operation of existing Mine Residue Facility without upgrading surrounding water infrastructure	Surface Water and wetlands	Seepage of pollution through cracked canals; Seepage of water into surrounding wetlands at the Facility	• Continued monitoring and maintenance of the canals and the Mine Residue Facility; Regular maintenance of the drains and canals	Significance	3	2.1	MODERATE	4	3.2	HIGH	4	3.2	HIGH
				Spatial	2			3			3		
				Temporal	3			5			5		
				Probability	4			4			4		
	Air-quality	Spontaneous combustion and release of particles at the plant	• Apply dust suppression measures where discard is deposited onto the facility	Significance	3	2.1	MODERATE	3	2.6	MODERATE	3	2.1	MODERATE
				Spatial	2			3			2		
				Temporal	3			3			3		
				Probability	4			4			4		
	Groundwater	Seepage of water into the groundwater. Sustained head of the pollution plume at from the Mine Residue Facility	• Continued monitoring and maintenance of the canals and the Mine Residue Facility; Regular maintenance of the drains and canals	Significance	4	3.2	HIGH	4	3.2	HIGH	4	3.2	HIGH
				Spatial	3			3			3		
				Temporal	5			5			5		
				Probability	4			4			4		

9. ALTERNATIVE SENSITIVITY ANALYSIS - REGULATION 50 (D)

The various alternatives identified for the proposed project are outlined and discussed in **Section 9**. This section provides a comparison of the various alternatives being assessed as part of the EIA. The different alternatives are compared in terms of environmental sensitivities and technical constraints. The sensitivity analysis was conducted on the PC dam alternatives and the Mine Residue Facility alternatives.

Each alternative was evaluated in terms of the environmental sensitivities and was ranked relative to the other corridors from best to worst (1 to 2 for the mine plan, 1 to 3 for the PC Dam alternatives and 1 to 4 for the Mine Residue Facility Alternatives). Each Environmental sensitivity is discussed below.

9.1 Air Quality

9.1.1 Mine Plan alternatives

The mining expansion will create an air quality impact in the sense that the current impact created by the coal processing plant will be extended by another 30 years with the newly proposed LOM. The sensitivity of the LOM alternative in terms of air quality is directly related to the extent and production rates of the mine and plant. If the status quo in terms of ambient air quality will be applicable over the extended period of the LOM. The mining expansion is likely to result in the continuation of the status quo of non-compliance with NAAQS within close proximity to the process plant.

The No-go alternative will result in the plant operations being closed and therefore emissions will cease.

9.1.2 PC Dam Alternatives

In terms of the PC dam alternatives it is anticipated that the alternative of relocating the PC dam will have a greater sensitivity in terms of air quality due to the additional earthworks and vegetation clearance associated to its construction in comparison with the alternative of upgrading the PC dam in its current location and the No-go alternative.

9.1.3 Mine Residue Facility Alternatives

The contribution that the activities associated with Alternative 3 (the recovery of waste from the of the Mine Residue Facility) will have on the ambient air quality will be the highest of the four Mine Residue Facility alternatives. The liberation of ambient dust will increase as a result of this option due to the additional loading and hauling of large volumes of discard material in conjunction with the shaping of the current facility and earthworks related to the newly proposed facility. The No-go alternative where the facility is likely to be closed the soonest will contribute air-pollution for the least amount of time and is therefore rated as the preferred option in terms of air quality.

9.2 Terrestrial Biodiversity

9.2.1 Mine Plan alternatives

Both alternatives were rated as equally preferred in terms of terrestrial biodiversity as mining will only be conducted under ground or in the case of the no-go option, mining will not be conducted.

9.2.2 PC Dam Alternatives

PC dam Alternative 1 is the most preferable alternative from a biodiversity impact perspective and will pose the least risk to the environment as a result of the following:

- The smallest footprint will be disturbed during the construction phase;
- The smallest total area of wetland and natural habitat would be destroyed; and

The least vegetation clearing is required for Alternative 1.

The No-go option is least preferred as the current impacts the dams have on the environment will persist.

9.2.3 Mine Residue Facility Alternatives

In terms of the sensitivity of the Mine Residue Facility alternatives on terrestrial biodiversity the alternatives assessed had very similar impacts but ultimately alternative 3 is most preferable due to the reduction of future seepage of contaminated water into natural habitats as a result of the reduction in size of the proposed new facility.

9.3 Geohydrology

9.3.1 Mine Plan alternatives

As the mine is a dry mine, the effect of the mining extension on the geohydrology is rated as minimal and thus has been equally rated with the No-go option.

9.3.2 PC Dam Alternatives

In terms of geohydrology, both the PC dam alternatives have similar sensitivities due to the improvement anticipated as a result of the proposed upgrading and lining of the PC dam and silt trap. The position of the PC dam is the only differentiator between the options but irrespective of the position of the dam, both options will ensure an improvement to the current seepage and contamination of groundwater. The No-go option is least preferred as the current impacts the dams have on the environment will persist.

9.3.3 Mine Residue Facility Alternatives

Mine Residue Facility Alternative 3 is the preferred option from a geohydrological sensitivity perspective as a result of the reduction of the footprint of the current unlined Mine Residue Facility due to the recovery and reuse of the discard. This will minimise the impact of the existing facility on the groundwater resource due to the reduction of possible future seepage into the groundwater. Progressive capping of the facility will also

be undertaken for Alternative 3. These are the differentiating factors because three of the Mine Residue Facility alternatives (where upgrading will be undertaken) share the positive effect of the proposed remediation of the facility and the sub-surface cut off drains to limit seepage to the groundwater but only Alternative 3 adds further benefit to the improvement of the groundwater quality and the reduction of the contamination plume. The No-go alternative is least preferred as it allows the current impact on the environment to persist.

9.4 Aquatic and Wetland Biodiversity

9.4.1 Mine Plan alternatives

Both alternatives were rated as equally preferred in terms of Aquatic and Wetland Biodiversity as mining will only be conducted underground and has been shown to be sufficiently below the surface water resources. In the case of the no-go option, mining will not be conducted and therefore no impacts will be realised.

9.4.2 PC Dam Alternatives

The potential impacts of the proposed project on the aquatic and wetland habitats was assessed and the sensitivity analysis for the PC dam and Mine Residue Facility alternatives are based on the impact assessment.

In terms of aquatic and wetland biodiversity PC dam, Alternative 1 is the preferred alternative due to the smaller surface area to be disturbed and vegetation to be cleared during construction thereof. The smaller footprint of Alternative 1 minimises the impact on water quality within the wetland and aquatic habitats caused by erosion and siltation. Furthermore, a smaller area of wetland habitat will be lost than with the relocation of the PC dam associated with Alternative 2. The No-go option is least preferred as the current impacts the dams have on the environment will persist.

9.4.3 Mine Residue Facility Alternatives

From a mine residue alternative perspective all three the alternatives make similar positive contributions towards the improvement of water quality that contributes to the wetland and aquatic habitats due to the remediation of the facility and the upgrades to the surface water management infrastructure. It is considered though that Mine Residue Facility Alternative 3 will show a more rapid improvement of the water quality, especially of the aquatic ecosystem due to the reduction of the footprint of the existing facility i.e. the source of contamination and the prevention and management of future groundwater seepage from the new facility.

9.5 Surface Water

9.5.1 Mine Plan alternatives

Both alternatives were rated as equally preferred in terms of Surface Water as mining will only be conducted underground and has been shown to be sufficiently below the surface water resources. In the case of the no-go option, mining will not be conducted and therefore no impacts will be realised.

9.5.2 PC Dam Alternatives

The PC dam alternatives were compared against each other in terms of their surface water impacts and resulted in the preferred alternative being PC dam Alternative 1. This alternative will have the lowest impact on the surface water resources due to it having the smallest footprint to be cleared of vegetation, which will create the least erosion and sedimentation and limit the impact on surface water quality. The No-go option is least preferred as the current impacts the dams have on the environment will persist.

9.5.3 Mine Residue Facility Alternatives

The four Mine Residue Facility alternatives were compared and the results indicated that all three the alternatives make similar positive contributions towards the improvement of surface water quality due to the remediation of the facility and the upgrades to the surface water management infrastructure. It is anticipated though that Mine Residue Facility Alternative 3 will show a more rapid improvement of the surface water quality of the Wilge River due to the reduction of the footprint of the existing facility i.e. the source of contamination and the prevention and management of future groundwater seepage from the facility to the Wilge River. The No-go alternative is least preferred as it allows the current impact on the environment to persist

9.6 Visual and Social Impacts

Visual impacts were included in this assessment for the Mine Residue Facility Alternatives only as the visual impact for the PC Dam Alternatives and Mine plan alternatives were all found to be negligible.

The smaller the Mine Residue Facility, the smaller the visual impact. Therefore, Alternative 3 was preferred, with Alternative 2 being least preferred (the airspace above the slurry ponds will be used). Alternatives 1 and the No-go alternative were equally rated.

In terms of social impacts, only the mine plan alternatives were considered. Should the No-go alternative be selected, the mine will be forced to close and a loss of jobs will occur for the workers at the mine, as well as a reduced contribution to the local and regional economy. Should the mine plan Alternative 1 be selected, jobs and work will be secured for the longer term.

9.7 Results of the alternative sensitivity analysis

The ranking of the alternatives in terms of their preference were summed and the alternative in each case with the lowest score was indicated to be the preferred alternative. Where environmental aspects were not applicable to the set of alternatives, the ranking were indicated as Not Applicable (N/A). **Table 9-1** below shows that that the Mine Plan alternative 1, PC Dam Alternative 1 and Mine Residue Facility 3 are the preferred alternatives.

Table 9-1: Alternative sensitivity analysis

ASPECT	Mine Plan Alternative (1): Bord and Pillar	Mine Plan Alternative (2): No-go Alternative	PC Dam Alternative (1): Upgrade both PC Dams in situ	PC Dam Alternative (2): Upgrade both PC Dams and realign the secondary PC Dam	PC Dam Alternative (2): No-go Alternative	Mine Residue Facility Alternative (1): Upgrading the facility in situ for deposition of discard and slurry	Mine Residue Facility Alternative (2): Upgrading the facility in situ for deposition of discard only	Mine Residue Facility Alternative (3): Recovery of waste from the Mine Residue Facility and replacing reject material on the mined out footprint	Mine Residue Facility Alternative (4): No-go alternative
Air Quality	N/A		1	3	1	2	2	4	1
Terrestrial biodiversity	1	1	1	2	3	2	2	1	4
Geohydrology	1	1	1	1	3	2	2	1	4
Aquatic & Wetland	1	1	1	2	3	2	2	1	4
Surface water	1	1	2	1	3	2	2	1	4
Social	1	2	N/A			N/A			
Visual	N/A		N/A			2	4	1	2
Total	5	6	6	9	13	12	14	9	19

10. ENVIRONMENTAL MANAGEMENT MEASURES - REGULATION 51 (A) & (B), 50 (H) & (I)

The management measures outlined below have been compiled and are contained in the EMPr in **Appendix E** of this report. The management measures have been compiled using the Impact Assessment and mitigation measures documented in this report.

The management measures have been divided into those applicable during the planning, construction, operational and decommissioning phases.

10.1 Objectives of the Specific Environmental Measures

The table below details the objectives of the specific management objectives and proposed measures to achieve the objectives for the various project stages associated with the proposed Delmas Coal project.

Table 10-1: Objectives of the Environmental Measures.

Project Stage	Objectives	Management measures
Construction Initiation	Project Area • The project is conducted within the laws of the country; and • Stakeholders are informed of the project.	Project Area • Ensure that all necessary legal obligations and contractual conditions have been met prior to the construction commencement; and • Ensure that all role players and stakeholders are aware of the pending construction activities and have received timeous notice.
Site Establishment and Demarcation	Project Area • Construction is limited to the approved areas; and • The project area is rehabilitated to defined and approved levels.	Project Area • Ensure proper demarcation of the project area prior to construction; and • Ensure that all baseline conditions of the area are met and rehabilitation plans/ strategies are formulated.
Construction and Operation and Decommissioning	Wetlands and Watercourses • Ensure that the PES watercourses are maintained, or improved to ensure that the REC is achieved; and • Prevent deterioration of water quality.	Wetlands and Watercourses • All wetland areas shall be marked as no-go areas (unless applied for and a WUL has been received); • No construction activities outside of the designated authorised wetlands and Wilge River areas; and • No material which could cause pollution, or seepage from upgraded facilities is to come in contact with wetland areas and watercourses.
	Soils • Mixing of soil horizons is prevented; • Ensure erosion of stockpiles and denuded areas is prevented; and • Ensure soils are not contaminated by spills	Soils • Strip and stockpile up to the first 1 m of topsoil from all areas where topsoil is stripped; • Place erosion protection measures in steep areas or excavated areas; • Ensure construction vehicles are serviced on designated areas and that spill kits are available; and • Ensure monitoring of dirty water infrastructure for spills is conducted.
	Hazardous Substance Spills and Waste Management	Hazardous Substance Spills and Waste Management

Project Stage	Objectives	Management measures
	• Prevent any spills or pollution resulting from the construction on the environment; • Keep the construction site and servitudes neat and clean; • Minimise litigation; and • Minimise stakeholder complaints	• Ensure designated waste disposal areas are provided and are suitable to prevent spills to the environment; and • Disposal of rubble and refuse in an appropriate manner.
	Groundwater • Prevent pollution or degradation of nearby groundwater resources.	Groundwater • Operate and maintain liners and water infrastructure to prevent spills; and • Continually monitor resources to detect pollution
	Dust • Ensure dust is controlled and does not contribute discomfort of workers and nearby landowners.	Dust • Ensure dust is suppressed by regular wetting of exposed areas and haul roads; and • Address complaints from stakeholders to avoid litigation.
	Fire • Prevent fires; • Ensure the safety of workers and the surrounding land-users; • No claims from landowners for damages due to veld fires and • No litigation	Fire • No veld fires started by the Contractor's work force; • Ensure fire is addressed in the Emergency Response Procedures.
	Heritage • Cultural and customary requirements to be adhered to.	Heritage • Ensure exhumation of remains and relocation of graveyards are conducted in accordance with legislative requirements.
	Noise • Prevent complaints during construction; and • Address all grievances and complaints.	Noise • Ensure noise levels are kept to within the required limits; • Limit construction hours; and • Maintain a complaints register.
	Social • Prevent claims for damages and litigation.	Social • Maintain stakeholder relations; and • Address complaints and grievances.
	Health • Promote awareness of health concerns and ways to prevent harm to human health.	Health • Ensure the continuation of the current HIV/AIDS awareness strategy.
	Biodiversity • Minimise damage to terrestrial, wetland and aquatic habitats and conservation important species; and • Prevent pollution or degradation of sensitive habitats	Biodiversity • Ensure disturbed areas are limited to the construction areas; • Limit the construction footprint; • Operate and maintain liners and water infrastructure to prevent spills; and • Eradicate any alien invader species.

The detailed management measures to ensure that the objectives listed above are implemented are provided in detail in the EMPr (**Appendix E**).

10.1.1 Reporting Structure

The reporting structure for the implementation, monitoring, reporting and continuous improvement of the management measures of the EMPr for the proposed project is contained and detailed in the EMPr (**Appendix E**).

10.2 Environmental Monitoring Programme

The monitoring programme to be implemented for the proposed project is contained in the EMPr in **Appendix E**. Monitoring of the following aspects are detailed in the EMPr:

- Surface water quality;
- Groundwater and seepage water quality;
- Biomonitoring and wetland assessments; and
- Air quality monitoring.

As part of the WUL requirements, soils monitoring and wetland monitoring plans are being developed. These plans will be made available in the EMPr once they have been approved by the relevant authorities.

10.3 Emergency Preparedness & Response Plan

Delmas Coal's current Code of Practice (COP) on emergency preparedness and response (Revision No. 06 dated August 2014) is contained in the EMPr in **Appendix F**. The purpose of the COP is to establish, implement and maintain procedures to identify the potential for emergency situations and respond to such situations and in so doing prevent or mitigate associated adverse safety health and environmental (SHE) consequences.

This COP will remain relevant during construction, operation and decommissioning and should any activity, not covered by it, be conducted by the contractor it will be the contractor's responsibility as part of his method statement to include an emergency response for that particular activity.

10.4 Financial Provision

In terms of Section 41(3) of the MPRDA Delmas Coal appointed J&W to carry out a closure cost estimate for their operations based on the DMR's Quantum for Closure. This detailed mine closure assessment was conducted in March 2016 and is contained in **Appendix F**. The closure cost estimate is required to be updated annually and as such Delmas Coal has updated the 2013 detailed estimate by adjusting the cost estimate by the Consumer Price Index (CPI) of 6%. The Financial Provision is assessed for current day closure of the mine. Each year the update will make provision for new mining areas and infrastructure.

On 20 November 2015, however, Regulations appertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations (GN 1147), in terms of NEMA (1998) were promulgated (termed the Financial Provisioning Regulations, 2015). These new Regulations require the development of three separate reports (see regulation 6) namely:

- Annual rehabilitation plan,
- Final rehabilitation, decommissioning and mine closure plan, and

- Environmental risk assessment report.

The closure cost estimate that was previously determined by means of the *DMR's Quantum for Closure Guidelines* in 2013, is now required to be determined "through a detailed itemisation of all activities and costs, calculated based on the actual costs of implementation of the measures required" (see clause 6 of the Financial Provisioning Regulations, 2015). This quantitative portion of the work must be captured in the Final rehabilitation, decommissioning and mine closure plan. The work in line with the 2015 regulations will be undertaken to meet the 2017 deadline stipulated by the legislation.

10.5 Performance Assessment

In compliance with the legislative requirements Delmas Coal must conduct monitoring on a continuous basis and conduct EMPR performance audits for the purpose of determining compliance to the commitments made in the EIR. Performance assessment reports must be submitted to the DMR to demonstrate that performance assessments of the EMPr are being conducted. These should include a GN 704 audit.

Delmas Coal currently conducts EMPR performance audits on a biennial basis. The audits are conducted as per the requirements of the MPRDA. Delmas Coal will follow the same structure and procedure when performing audits for the proposed activities. The findings of these audits must be submitted to the relevant authorities. A summary of the structure of the Performance Assessment Reports is outlined below:

10.5.1 Scope of Assessment

The main objective of a performance assessment is to determine whether or not Delmas Coal has complied with its environmental policies and objectives. Therefore, the scope of the performance assessment for the proposed project will include:

- An assessment of the conformance to the environmental policy;
- An assessment of the extent of compliance with the EMPR and legislation;
- A review of the results; and
- The identification of areas of potential improvement for the EMPR.

10.5.2 Relevant legislation is outlined

- The Constitution of the Republic of South Africa (Act 108 of 1996)
- Mineral and Petroleum Resources Development Act (Act 28 of 2002)
- National Water Act, 1998 (Act No. 36 of 1998)
- National Environmental Management Act (Act 107 of 1998))
- Mine Health and Safety Act (Act 29 of 1996).

10.5.3 Interpreted Information

Where raw data and information is not meaningful for auditing purposes, the data will be interpreted by a suitably qualified specialist, e.g. surface water and groundwater quality, bio-monitoring, noise and dust monitoring. Once the information has been interpreted and a problem has been identified, measures will be recommended to remediate the existing problem, or to prevent the identified potential problem from reoccurring.

10.5.4 Evaluation Criteria Used

The criteria used for performance assessments will be conducted taking the following aspects into consideration:

- The legislative requirements;
- Applicable policies and procedures (guidelines) of relevant regulatory authorities applicable to the various environmental components; and
- The aspects identified (and management measures stipulated) in the EMPR.

10.5.5 Results of Assessment

The EMPR performance assessment will result in the provision of documentation concerning EMPR performance assessment findings. Recommendations for the initiation of corrective action will be outlined for submission to the mine and authorities.

10.5.6 Reporting and Submission of EMPR Performance Assessments

The performance assessment will be submitted to the DMR on a biennial basis unless otherwise indicated by the authorities

10.6 Environmental Awareness Plan

An Environmental Awareness Plan has been developed by Delmas Coal.

10.6.1 Introduction

An Environmental Awareness Plan has been developed for Delmas Coal in accordance with Regulation 51(b)(vi) of the Mineral and Petroleum Resources Development Regulations (MPRDR) of 2004 and the Environmental Impact Assessment (EIA) Regulations under Government Notice 543, Regulation 33 (j) in terms of the Section 20 of the National Environmental Management Act (NEMA, Act 107 of 1998) as amended. According to the EIA regulations and Section 39(3)(c) of the MPRDA (2002) any applicant that prepares an Environmental Management Program (EMPR/r), must include with it, an Environmental Awareness Plan. This awareness plan must:

Outline the manner in which the applicant intends to educate and inform one's employees of any potential harm that can be done on the environment or environmental risk by the workings at the proposed operation; and

Include the way in which pollution and degradation is to be avoided or indicate how the risk must be dealt with in order to avoid the pollution or degradation

10.6.2 Legal Requirements

The following legislation forms the basis for an Environmental Awareness Plan:

- The Constitution of the Republic of South Africa (Act 108 of 1996);
- National Water Act (Act 36 of 1998);
- Employment Equity Act, 1998 (Act 55 of 1998);
- National Environmental Management Act (Act 107 of 1998);

- Mineral and Petroleum Resources Development Act (Act 28 of 2002);
- National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004);
- National Environmental Management: Air Quality Act (Act 39 of 2004); and
- National Environmental Management Waste Act (Act 59 of 2008).

10.6.3 Objectives of the Environmental Awareness Plan

The objectives of this Environmental Awareness Plan are to inform employees contractors of any environmental risks that may result from their work and indicate how they should deal with such risks should they materialise.

The overall purpose of implementing an Environmental Awareness Plan is to optimise the awareness of those partaking in the activities which have the potential to negatively impact on the environment and in doing so, promote the global goal of sustainable development.

10.6.4 Implementation of the Environmental Awareness Plan and other Training Programmes

Delmas Coal are to ensure a basic induction process is followed by all employees working on site including visitors. This induction process must form part of the Environmental Awareness Plan. This induction process should include a brief video on "Environmental and Community awareness at the Delmas Coal Mine". The video must be made available on entry to the mine (during both construction and operation), upon request and will form the awareness part of the induction procedure for all staff and guests to the Mine. The subject of the Environmental awareness is also to be addressed at weekly orientation sessions held on site.

Environmental principles must be communicated effectively to newly appointed employees, employees returning from annual leave, as well as to contractors and visitors upon entering the Mine. This must be done in conjunction with any other induction or safety awareness education.

The Environmental Awareness Plan/induction process/video presented must include the following concepts:

- Why we need an awareness plan?
- What is the environment?
- Why the environment needs protecting?
- How do we protect and manage our environment?
- Working area management
- Water management
- Floral and faunal management
- Fire management
- Air quality management
- Waste systems
- Incident reporting

A brief outline of what each of the above should entail is provided below.

Why we need an awareness plan?

An EMPr contains various measures to protect the environment. Legally, Delmas Coal must make employees and contractors aware of the commitments made in the EMPr in order for all parties to work towards fulfilling these obligations and thus protecting the environment.

What is the environment?

The environment can be separated into the natural and built environment. The natural environment includes the air, water, soil, plants, animals and people. The built environment in this instance includes the processing plant, the buildings including offices, workshops, stores, roads, shafts and machinery. Controlling the environment we are in and in which we interact, forms the basis of environmental management.

Why does the environment need protecting?

We need to be mindful of, and protect the environment for four reasons:

- it provides us with food, water and air to breathe;
- it is our right to a healthy environment;
- the next generation has a right a healthy environment; and
- the law demands that we protect the environment.

If we fail to protect the environment,

- Delmas Coal may be subject to a fine; and/or
- Individuals may be removed from site; and/or
- Construction may be stopped.

How can we protect and manage our environment?

To protect our environment; we must:

- report all incidents to a superior,
- work together; and
- follow rules and management measures discussed below.

Working area management

All personal must stay within demarcated working areas on site. Areas marked as ‘no go’ must be obeyed. The reason for this is that the sites may be chosen based on having the smallest impact or based on not destroying sensitive landscapes. If these rules are not obeyed, unnecessary damage may be done to the environment and disciplinary action may be taken.

Water management

Water must be saved on site by ensuring taps are closed, ensuring pipes are checked for leaks. Prevention of water pollution needs to be undertaken by preventing spillage of oils, diesel. This is crucial as water is a scarce resource and a non-renewable resource.

Floral and faunal management

Any animals on site must not harmed or killed but rather should be removed safely when found. Similarly, no trees, shrubs or grasses may be removed or killed without

permission. Animals and plants play a role in the environment even they are deemed pests to humans. It is part of the promise to protect the environment that protects plants and animals too.

Fire management

Matches and cigarette butts must be disposed of in demarcated areas and bins provided. No fire including matches are allowed near fuels such as diesel. General waste must not burned and personnel must be aware of the location of the nearest fire safety equipment. Fires can be difficult to control and may cause explosions that can burn people, damage equipment and reduce the safety of the surrounding areas.

Air quality management

Dust creation should be prevented or minimised as far as possible. Dust can be suppressed by watering of roads. Dust causes irritation to lungs and eyes. It also reduces visibility on site which can be dangerous to drivers and pedestrians. This may cause result in damage to the surrounding people and environment.

Waste systems

Any wastes generated must be stored properly and disposed of in the correct manner. This includes hazardous wastes such as by products or non-hazardous wastes such as food packaging, litter. Waste that is not disposed of correctly can cause pollution or harm to people and the natural environment.

All incidents must be reported.

Any problem such as water leaks, oil spilled, waste leaked must be reported to a manager or the responsible officer. Always report incidents with date, time, location and brief descriptions.

The awareness training of employees, contractors and visitors will help to ensure that co-operation in terms of environmental management will occur. In addition, it will ensure the success of the Mine regarding compliance with legislation, and avoid possible future disciplinary and legal action from a lack of awareness on the site.

10.7 Social and Labour Plan

A Social and Labour Plan has been developed by Delmas Coal. The Social and Labour Plan addresses Delmas Coal's plans and objectives regarding Human Resource Development as well as Local Economic Development. The objectives of the Social and Labour Plan are to:

- Promote employment and advance the social and economic welfare of all South Africans;
- Contribute to transformation of the mining industry; and
- Ensure that the holders of mining rights contribute towards the socio-economic development of the areas in which they are operating.

The Social and Labour Plan is included as **Appendix F**.

11. KNOWLEDGE GAPS – REGULATION 50 (G)

In accordance with Section 30(m) of R543 of the NEMA EIA Regulations, the knowledge gaps, adequacy of predictive methods, underlying assumptions and uncertainties encountered in compiling the required information have been identified and discussed in this section of the Draft EIR / EMPR amendment.

At present, several gaps in the information available regarding the project have been identified. The following information will be gathered to supplement out-dated or insufficient information through monitoring data:

- Detailed mine water balance has been developed which quantified volumes of mine water however these volumes will be updated during the operation of the extension of the mine workings;
- The impacts of water seepage from the upgraded and remediated Mine Residue Facility and PC dams on the receiving environment have been predicted however this will be confirmed during operational phase of the mine;
- The objectives of this document will only be met if the mitigation measures are successfully and duly implemented; and
- Competent and qualified specialists were appointed to undertake the specialist studies. The mitigation measures proposed by the specialists and their predicated impacts are based on their company predictive methodologies, as such these impacts and mitigation measures can only be confirmed during the operational phase.

12. ENVIRONMENTAL IMPACT STATEMENT

12.1 Impact Assessment Summary

The environmental impact statement summarises the key findings of the environmental impact assessment and compares the positive and negative implications of the proposed Delmas Coal mining extension and upgrade and remediation of PC dams and Mine Residue Facility project.

It is evident from this document that currently the provision of coal is a vital requirement for the generation of electricity in South Africa and the proposed extension of current underground mining will therefore sustain coal supply for electricity generation, as well as extend the LOM, thereby extending the duration of job availability for current employees and potentially creating a limited number of new job opportunities during the construction phase of the PC dam and Mine Residue Facility upgrade and remediation. It was determined that the proposed project will impact on the biophysical and social environment and the best possible means of managing these impacts are required to ensure the feasibility of the project from an environmental perspective.

This assessment illustrates that there are various potential negative and positive impacts that may result from the proposed project and its associated infrastructure namely: wetlands and surface water bodies, groundwater, terrestrial ecology and sensitive social receptors.

An effort has been made to ensure that the alternatives identified for the proposed project provide a balance between the optimal extraction and processing of coal with the least environmental impact.

With the clearance of vegetation for the footprint of the PC dam and Mine Residue Facility, including the surface water drains and infrastructure, the potential impact on terrestrial and wetland habitats is moderate during the construction and operational phases of the project. Further associated to the construction and operational phases are the potential impacts on surface and groundwater quality, wetland and terrestrial ecology and the social aspects related to dust, which vary between moderate and high. However, it must be emphasised that appropriate infrastructure and management measures are proposed to limit the impact of the extension of the mine and the upgrade and remediation of the Mine Residue Facility and PC dams on the environment. It is concluded that the proposed extension of the Delmas Coal underground mining operations is highly desirable for its contribution to the local, regional and national economy in terms of ensuring prolonged employment provision and electricity generation. The rehabilitation and upgrade of the PC dams and Mine Residue Facility and associated surface water management infrastructure will contribute positively to the reduction of the contamination of surface and groundwater resources being experienced from these facilities

Should this project go ahead it will ensure prolonged employment to Delmas Coal employees along with the much needed provision of coal for the generation of electricity. Several mitigation measures have been proposed to minimise the anticipated environmental impacts together with an environmental monitoring programme to monitor the effectiveness of these mitigation measures.

As is noted from the above section, the Delmas Coal project will impact on a range of environmental components. The positive impacts of the project as well as the benefits of the project must be weighed up against the losses and negative impacts.

12.2 Preferred Alternative

On the basis of the findings in this report, it is suggested that the proposed Mine Plan Alternative 1 be approved for the extension of the underground operations. Furthermore, that PC dam Alternative 1 and Mine Residue Facility Alternative 3 be approved for the upgrade and remediation of the PC dams and Mine Residue Facility.

A detailed alternative sensitivity analysis was conducted as can be seen in **Section 9**.

From the PC dam alternative impact rating for both alternatives, the greater majority of all the environmental aspects having been assessed had similar impact ratings with PC dam Alternative 1 ultimately posing the least risk to the environment due to it disturbing the smallest footprint, requiring the least vegetation clearing and habitat destruction and is therefore considered the preferred alternative.

In terms of the Mine Residue Facility alternative impact rating very similar impact ratings were experienced on all three upgrading alternatives for the greater majority of the environmental aspects assessed, with Mine Residue Facility Alternative 3 ultimately having similar environmental risks as the other two alternatives but posing the greatest advantage to the environment due to the reduction of the footprint of the current unlined facility. It is therefore considered the preferred alternative.

12.3 Recommendations

It is recommended that the preferred alternatives for the proposed extension of underground operations and upgrade and remediation of the Mine Residue Facility (including the recovery of the discard), PC dams and surface water management infrastructure being applied for be approved by the MDARDLEA with the condition that all mitigation measures included in this report and contained in the EMPr be implemented and adhered to. It is suggested that where relevant the MDARDLEA stipulate any additional mitigation measures that they deem necessary as a condition in the Environmental Authorisation.

It is recommended that the DMR approve the EMPR amendment in order the mining rights to be approved and in order Delmas Coal to have an approved EMPR in terms of the MPRDA.

Furthermore, it is recommended that Environmental Authorisation is granted by MDARDLEA but construction may not commence until Environmental Authorisation is received.

13. CONCLUSION AND WAY FORWARD

It is concluded that the proposed extension of the Delmas Coal underground mining operations is highly desirable for its contribution to the local, regional and national economy in terms of ensuring prolonged employment provision and electricity generation. The rehabilitation and upgrade of the PC dams and Mine Residue Facility and associated surface water management infrastructure will contribute positively to the reduction of the contamination of surface and groundwater resources being experienced from these facilities.

The preferred and least sensitive alternatives will ensure that the smallest infrastructure footprint be disturbed with the least impact on sensitive habitats and species as well as sensitive social receptors. The implementation of the proposed mitigation measures will ensure that the predicted impacts will be appropriately mitigated to within acceptable limits.

Post closure, the primary anticipated impacts are related to the permanent nature of the Mine Residue Facility, surface water drains, silt trap and PC dam.

The way forward recommended by this study is as follows:

- Make this Draft Environmental Impact Report / EMPR amendment available for public comment for a period of 40 days;
- Update the Draft Environmental Impact Report / EMPR amendment with comments received from I&APs to a Final EIR/ EMPR;
- Make the Final Environmental Impact Report / EMPR amendment available for public comment for a period of 21 days;
- Submit the Final Environmental Impact Report / EMPR amendment to the competent authority for a decision on whether or not to grant Environmental Authorisation.
- Within 12 days of receipt of the Environmental Authorisation, the decision will be communicated to all stakeholders and the appeal process will be outlined;
- Should no appeals be lodged, the client will commence construction within the conditions of the Environmental Authorisation and approved EMPr.

14. UNDERTAKING BY APPLICANT

14.1 Undertaking by the applicant

I_____ the undersigned and duly authorised hereto by _____ have studied and understand the contents of the Environmental Impact Report and Environmental Management Programme Amendment and duly undertake to adhere to the conditions as set out therein, unless specifically or otherwise agreed to.

Signed at _____on this _____ day of _____2016

Signature of designated authority

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9 September 2016

Document source: C:\Alljobs\D910_DelmasCoalEIA\REP\EIR - EMPR\D910_000_REP_DelCoal_DEIR_DEMPR_rA_ob_jcp-20150630_2.docx
Document template: EIR Template3.dotx

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