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EXXARO RESOURCES LIMITED

Identification of Potential Wetland Offsets for the proposed Exxaro NBC Belfast Coal Project, Mpumalanga

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REPORT

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Executive Summary

Golder Associates Africa (Pty) Ltd was contracted by Exxaro Resources Ltd. to conduct a specialist investigation into the identification of possible wetland offset sites for the wetland ecosystems affected by the proposed NBC Belfast Coal project. The study is divided into two phases, they are:

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

This document details the findings of the Phase 1 investigation.

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

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

Biodiversity offsetting in South Africa is a relatively new concept and there is no standard method to determine an appropriate biodiversity offset. According to the international Business and Biodiversity Offsets Programme (BBOP) biodiversity offsets are defined as:

"*Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people's use and cultural values associated with biodiversity*

Key to the definition cited above is the concept of *No net loss*. In fact it is preferable to achieve a net gain of biodiversity. Developers should first seek to avoid and minimize the impacts of their projects on biodiversity. In order to achieve this, developers should ensure that the biodiversity offset is focused on addressing only the remaining impacts after the appropriate mitigation hierarchy has been applied (avoidance, mitigation, and restoration). Biodiversity offsetting is considered when the loss of biodiversity due to the project activity cannot be regained through the usual steps associated with the mitigation hierarchy. A biodiversity offset

would generally involve the improvement of biodiversity of a selected site which had been chosen based on scientifically defensible criteria.

Onsite set-asides

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

Offsite offsets

For each pan and wetland type lost as a result of the proposed mining process, where the impacts could not be mitigated, offsite biodiversity offset pans and wetlands were identified in which compensation for the pans could be provided. Improved ecological catchment management and planning within the offsite offset areas, as well as protection statues for the pan and wetland offsets and no future mining activities can result in offset compensation for the wetlands and pans lost within the proposed Belfast coal reserves. These are shown in Figure B.

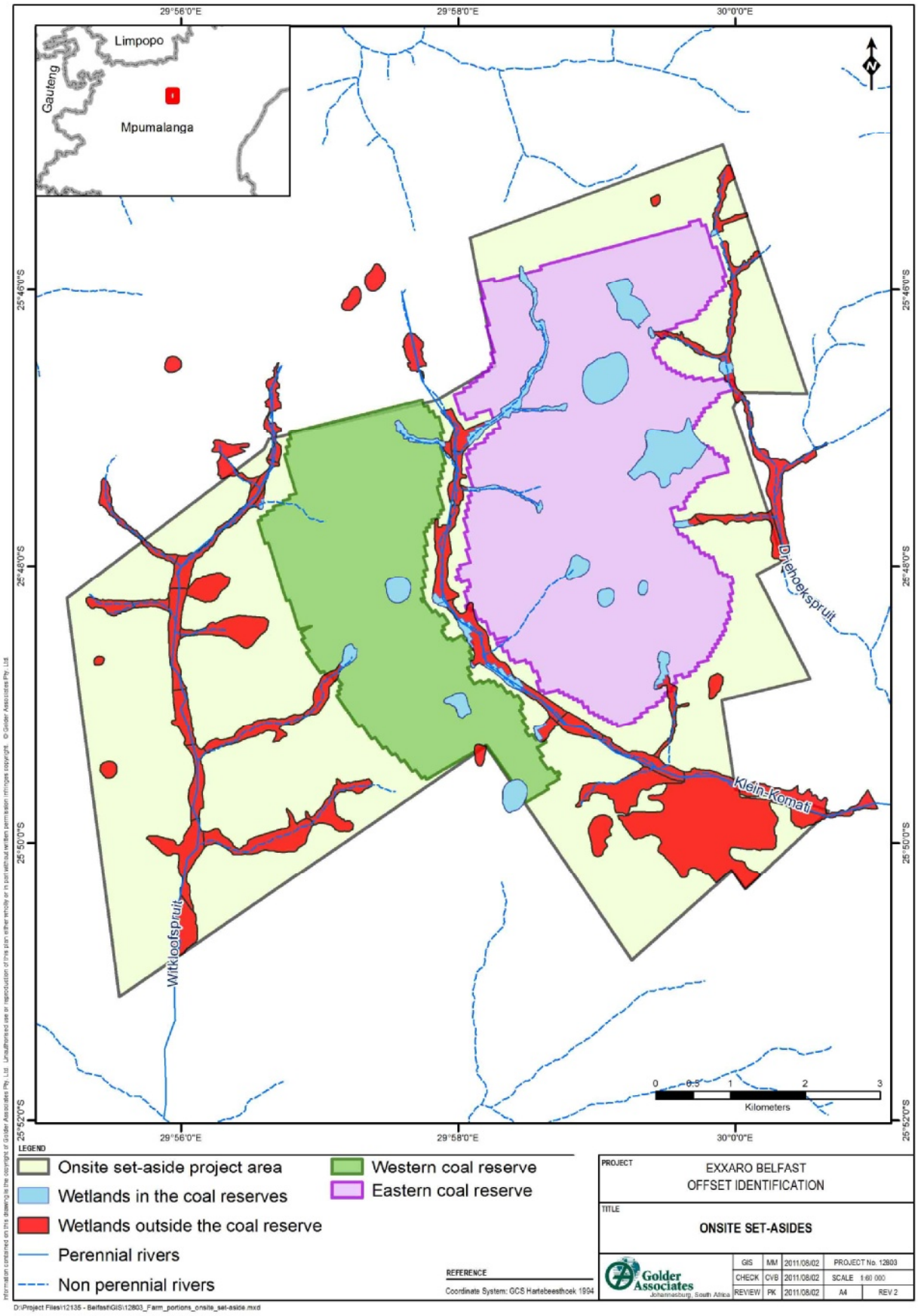

Figure A: Summary of identified onsite set-aside pans and wetlands associated with the proposed Belfast project area

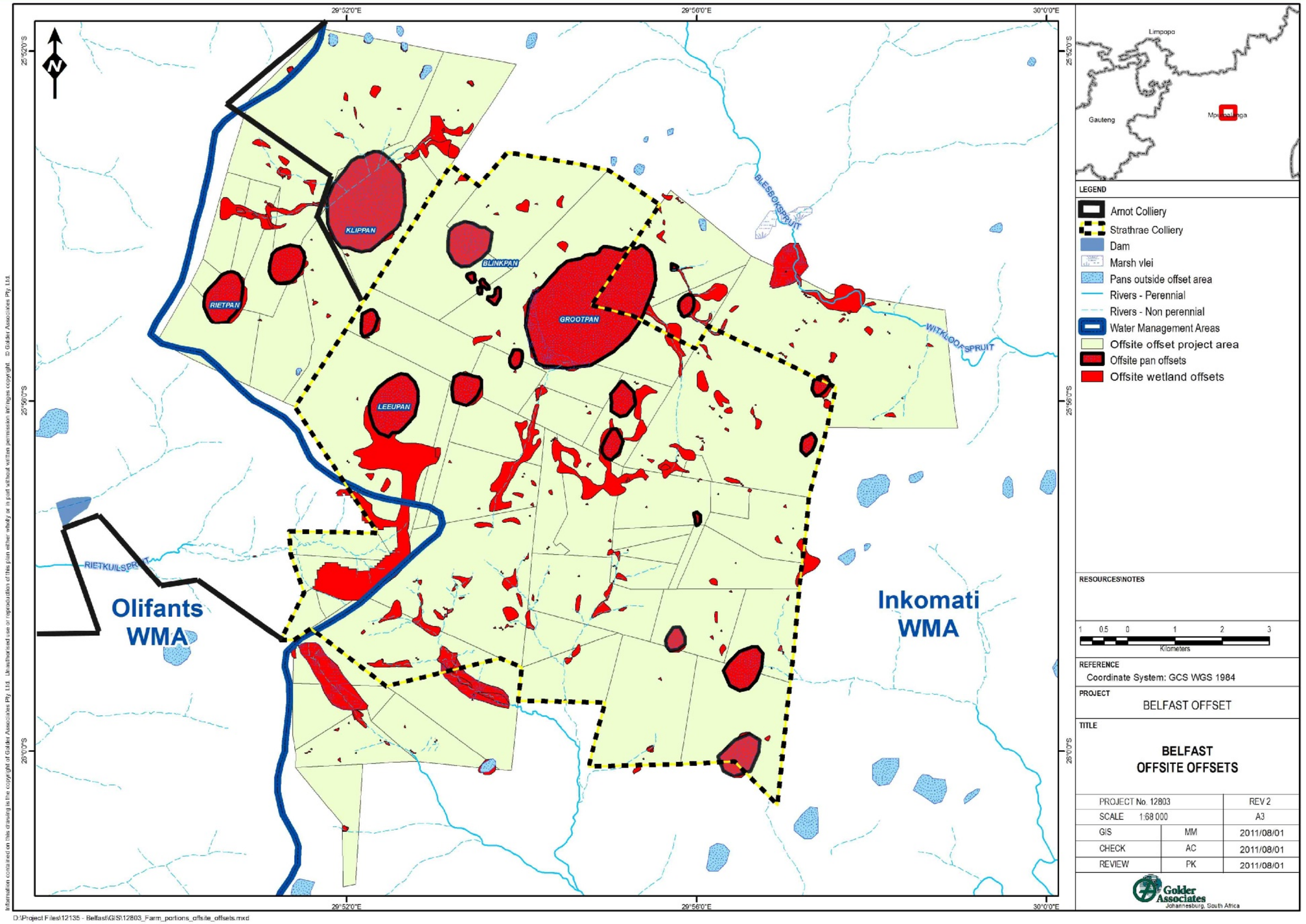

Figure B: Summary of identified offsite offset pans and wetlands associated with the Strathrae mine lease area

As a way forward it is proposed that the mined out and remaining coal reserves within the Strathrae mine lease area are determined. The offset project area should then be approved for potential offsetting by Exxaro. Once Exxaro have approved the offset area, engagement with the Department of Mineral Resources (DMR) is required in order to sterilize any remaining coal reserves within the Strathrae offset area from future mining activities and list the area as an offset protected area. Once the above has been achieved the Phase two can be initiated which would involve the development of a management plan for the identified off-set areas to ensure that the ecological integrity of the site is maintained or bettered to compensate for the loss in ecological habitat within the proposed Belfast coal reserves.

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

In order for this project to succeed, it is important to remember that the mitigations outlined in the Belfast EMPR need to be met in terms of the management hierarchy, before biodiversity offsets (compensation mitigation) can be considered. In the light of this project, rehabilitation of the lost pans and wetlands within the two proposed coal reserves at Belfast would not be feasible and therefore offsetting these specific pans and wetlands was considered as an option that would still allow the development to continue. Therefore engagement is required with the various regulatory bodies (DWA, DMR and MTPA) in order to consider this option and offset sites that have been identified.

Study Limitations

This study had the following limitations:

- The data was based on baseline work conducted for the proposed Belfast NBC opencast EIA (Golder report 12135-9383-2, 2011);
- Due to time constraints and the scope of work for this project only selected pans of the 416 candidate pans were sampled as representative pans within identified clusters of pans. A total of 73 pans were sampled within the project timeframe (Figure 12);
- The pans were sampled during one site visit during the December 2010 wet season only and therefore constitute a single season effort;
- *In situ* EC/TDS concentrations were based on single surveys using an EuTech ECTestr 11+ hand-held meter that was calibrated before the field survey; and
- All wetland fauna and flora of the candidate pans were based on opportunistic recordings during the field site visit and no mammal, reptile or bird trapping was conducted.

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1.0 INTRODUCTION

Exxaro Coal Mpumalanga (Pty) Ltd (referred to as Exxaro) is a subsidiary of Exxaro Coal (Pty) Ltd and is owned by Exxaro Resources Limited. Exxaro operates a coal mining complex in the province of Mpumalanga which is situated between the towns of Carolina and Belfast. This complex is referred to as the North Block Complex (NBC) and consists of the Glisa and Strathae coal mines as well as the Eerstelingsfontein and Belfast coal projects. The complex uses both underground and opencast mining methods and employs 250 people to produce 3 million tons per annum (Mtpa) of thermal coal for both the domestic and export markets. The complex has a reserve base of 43.8 million tons (Mt) and a resource of 52.6 Mt (excluding the Belfast project). As part of the NBC, Exxaro is in the process of permitting the Belfast Project, situated some 10 km southwest of Belfast in Mpumalanga. The Belfast Project entails the development of an opencast mine to produce 2.0 Mtpa of coal for Eskom and 1.5 Mtpa of A-grade thermal coal for export markets. Exxaro submitted a mining right application for the mining of coal near Belfast in Mpumalanga to the Department of Minerals and Energy (DME), Mpumalanga Province, which was accepted on 10 July 2009 [MP 30/5/1/2/2/431 MR]. As per Regulations 49, 50 and 51 of the Mineral Petroleum Resources Development Act, 2002 [MPRDA] (Act No. 28 of 2002), Exxaro has also submitted a Scoping Report, and is in the process of submitting an Environmental Impact Assessment (EIA) and Environmental Management Programme (EMP).

In the light of this project, rehabilitation of the lost pans and wetlands within the two proposed coal reserves at Belfast would not be feasible and therefore offsetting these specific pans and wetlands was considered as an option that would still allow the development to continue.

Golder Associates Africa (Pty) Ltd was contracted by Exxaro Resources Limited to conduct a specialist investigation into the identification of possible wetland offset sites for the wetland ecosystems affected by the proposed NBC Belfast Coal project. The study is divided into two phases, they are:

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

This document details the findings of the Phase 1 investigation. The document limitations are presented in APPENDIX A.

2.0 BACKGROUND

2.1 Project Locality

The study site covers an area in extent of approximately 5819.18 hectares (ha) on various portions of the farms Zoekop 426JS, Leeuwbank 427 JS and Blyvooruitzicht 383 in the Magisterial district of Belfast in Mpumalanga (Table 1 and Figure 1). Continuous rehabilitation will take place and the active mining area will in all likelihood not exceed 200 ha at any time.

Table 1: Description of the farms associated with the mining area

Farm Name	Portion	Deed Number	Owner
Zoekop 426 JS	Remaining Extent (RE)	T 108970 / 1997	HJW Pretorius
	Portion 1	T 38438 / 1990	WP Pretorius
	RE Portion 2	T 108970 / 1997	HJW Pretorius
	RE Portion 3	T 17060 / 1997	Soekop Trust
	RE Portion 4	T 3358 / 1990	A Viljoen
	Portion 5	T 10909 / 1985	EC Botha
	Portion 6	T 53815 / 1986	GL Roos

Farm Name	Portion	Deed Number	Owner
	RE Portion 7	T 79636 / 189	WP Pretorius
	Portion 8	T 16689 / 1982	JH Gerrits
	Portion 9	T 53815 / 1986	GL Roos
	RE Portion 11	T 14481 / 2008	Zoekop Farmers Trust
	Portion 12	T 38438 / 1990	WP Pretorius
	RE Portion 13	T 77921 / 2003	Eyesizwe Coal (Pty) Ltd
	RE Portion 14	T 17438 / 1995	Victory Fellowship World & Outreach Centre Church
	Portion 15	T 10909 / 1985	CJ Botha
	Portion 16	T 142225 / 2004	Soekop Trust
	Portion 21	T 16398 / 1992	Transnet Ltd
Leeuwbank 427 JS	Portion of the RE	T 44235 / 1980	LG Roos
	Portion of RE of Portion 2	T 23347 / 2003	PV van Wyk
	Portion 3	T 13090 / 1968	BCE Viljoen
	Portion of RE of Portion 4	T 5 188 / 1988	LG Roos
	Portion of Portion 5	T 40298 / 1975	LG Roos
	Portion of Portion 6	T 40298 / 1975	LG Roos
	Portion 7	T 31222 / 1991	CJ Burger
	Portion 8	T 31222 / 1991	CJ Burger
	RE Portion	9 T 46510 / 2001	Hooggenoeg Boerdery cc
	Portion 10	T 84645 / 1989	CJ Burger
	Portion 11	T 10909 / 1985	JC Botha
	Portion 15	T 46510 / 2001	Hooggenoeg Boerdery cc
	Portion 16	T 113513 / 2000	Beestepan Boerdery (Pty) Ltd
Blyvooruitzicht 383 JT	RE Portion 2	T 101146 / 1993	WP & JP Pretorius Trust
	RE Portion 6	T 15402 / 1987	CJ Burger
	RE Portion 7	T 101146 / 1993	WP & JP Pretorius Trust
	RE Portion 8	T 101146 / 1993	WP & JP Pretorius Trust
	Portion 9	T 8150 / 1996	WP Pretorius
	RE Portion 10	T 62917 / 1987	WP Pretorius

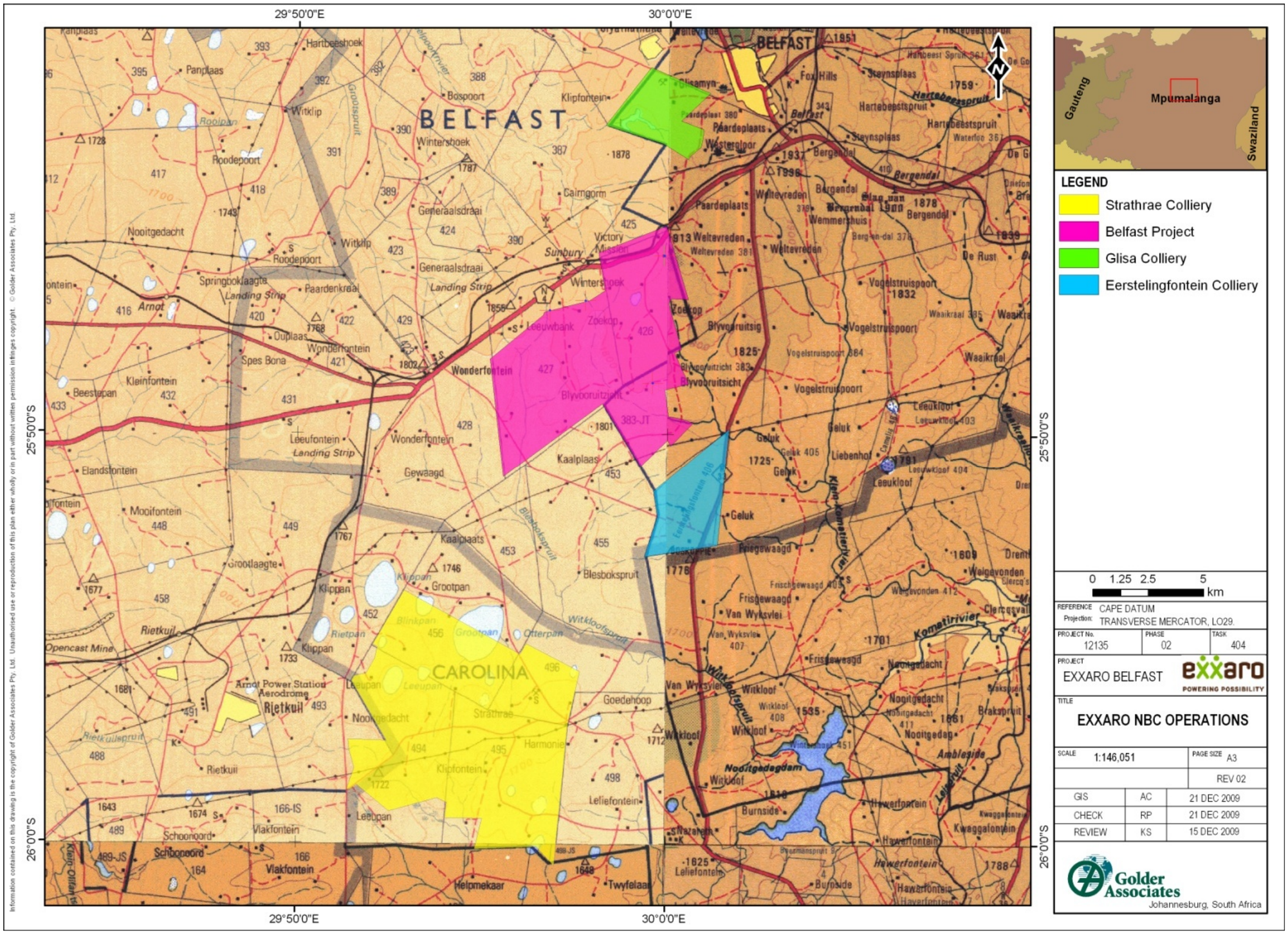

Figure 1: Regional map of the study area showing the proposed Exxaro Belfast NBC project in relation to the other Exxaro Collieries

2.2 The Belfast Coal Project

The planned life-of-mine consists of two years for the construction of Phase 1, followed by a 30-year operational (production) phase, and four years for decommissioning, closure, rehabilitation, monitoring and maintenance. The details of these have been extracted from the Belfast EIA that was undertaken by Golder Associates Africa in 2010 (Golder report 12135-9383-2, 2011).

2.2.1 Construction Phase

This phase will take place over 2 years. The construction phase will include, but may not be limited to the following activities:

2.2.1.1 Infrastructure Development

- Construction of surfaced access roads and internal roads, as well as un-surfaced haul roads and surfaced parking areas;
- Construction of crushing and screening plant;
- Construction of a materials handling plant;
- Construction of buildings including:
  - A guard house;
  - Office blocks;
  - Weighbridge and weighbridge office;
  - Change-houses;
  - Plant and mine workshops; and
  - Laboratory.
- Explosives magazine;
- Railway siding and load-out facility;
- Diesel storage area;
- Process water pipeline;
- Co-disposal facility;
- Boreholes;
- Fire water reticulation, process water reticulation and internal potable water reticulation and internal sewer reticulation, and electrical reticulation;
- Sewage purification plant;
- Storm water channels and pollution control dams;
- Silt traps;
- Washing bays;
- Water treatment and purification plants;
- Process water dam and return water dam;

- Fencing; and
- River diversions / crossings.

2.2.1.2 *Mine Development*

- Pre-stripping of topsoils, wetland soils and overburden for the first box-cut;
- Establishment of initial box-cut;
- Stockpiling of topsoils, wetland soils and overburden separately at the final void positions; and
- Establishment of coal handling stockpiles.

2.2.2 Mining Phase

The Belfast reserves consist of two mining areas separated by a small stream (Leeubankspruit). The western area has better quality raw coal than the eastern area. A-grade coal can be produced from the western area, and a P58 (5800 kCal/kg) or B-grade from the eastern area. The quality of the raw coal also deteriorates in a northerly direction to such an extent that it is only economically viable to produce a B grade coal from the northern areas.

The Phase 1 mining will commence in the south to produce coal for Eskom. Mining operations will then be expanded in Phase 2 to supply Eskom and the export markets. It is planned to mine the eastern and western areas at the same time to achieve the correct product mix. Mining and batch washing of different quality coal will take place to maximize product yields. The position of the plant and infrastructure will only be finalised after the completion of the site selection studies as part of the EIA. The general direction of mining will be from south to north. The proposed mining sequence is illustrated in Figure 2 below.

An initial boxcut will be established during the construction phase of the project. Topsoil and overburden from the initial boxcut area will be stockpiled at the final void positions. Opencast mining will take place using a conventional truck and shovel operation, assisted by roll-over dozing, to allow for continuous backfilling and rehabilitation of the mined-out area. The expected mining conditions are good, due to the geology and good storm water drainage.

The final void will be backfilled with the overburden from the initial boxcut. Rehabilitation and final closure will take place on a continuous basis and be completed two years after the completion of mining. Mining will take place on a 24-hour day, 7-day week basis, for which the required authorization will be applied for. The diagrams, shown in Figure 3, numbered from 1 to 12, constitute a schematic representation of the mining process after the first four cuts, at which stage a steady state will have been reached. As can be seen from the diagram the following generic actions involved, are sequenced as follows:

- Stripping of topsoil;
- Removing sub-soil;
- Drilling and blasting overburden;
- Loading and hauling the top off;
- Dozing the roll over;
- Cleaning the top of the coal;
- Digging trenches to prevent contamination;
- Drilling, blasting, loading, and hauling coal, and
- Starting with next cut.

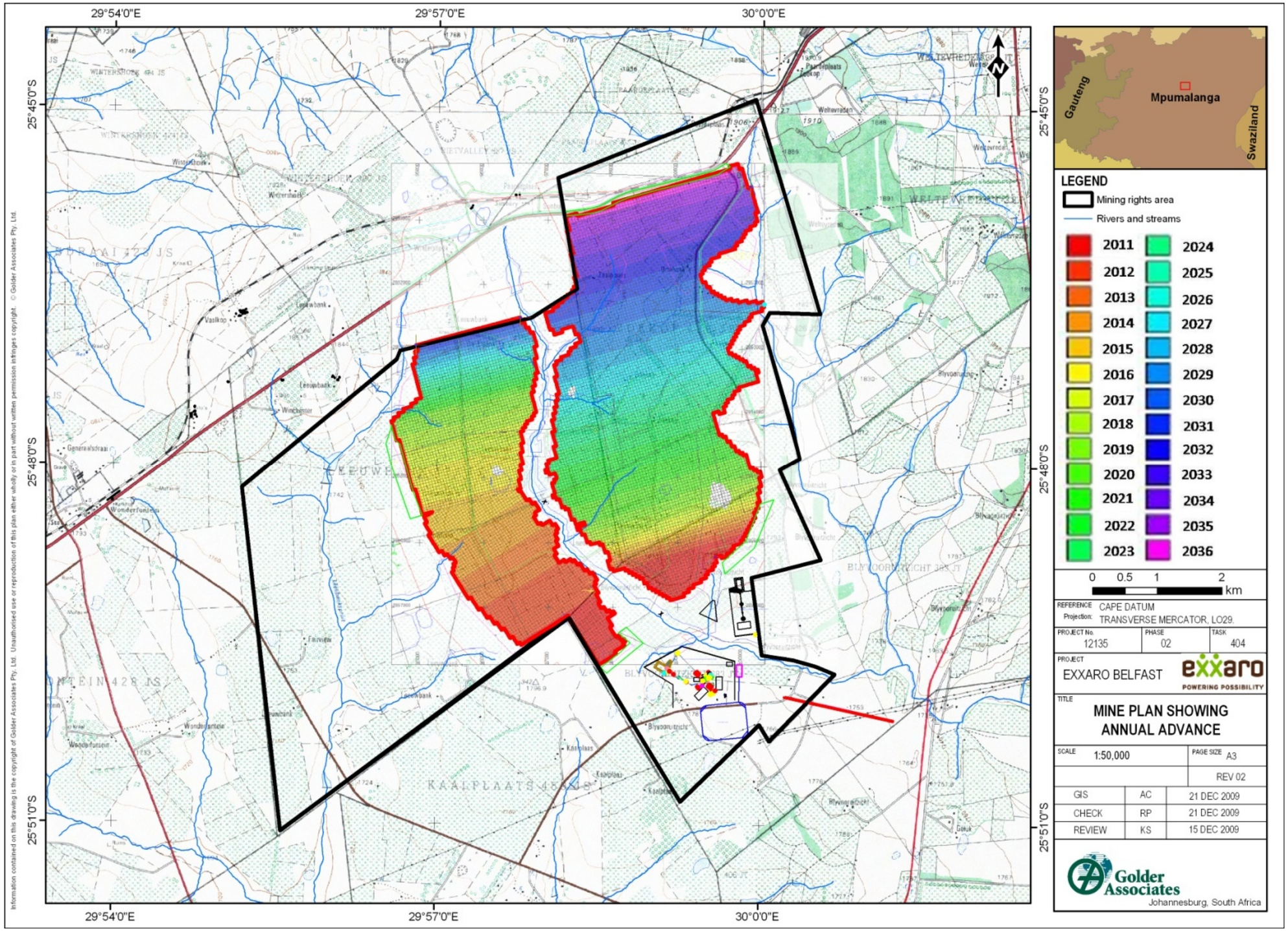

Figure 2: Mine plan showing annual advance

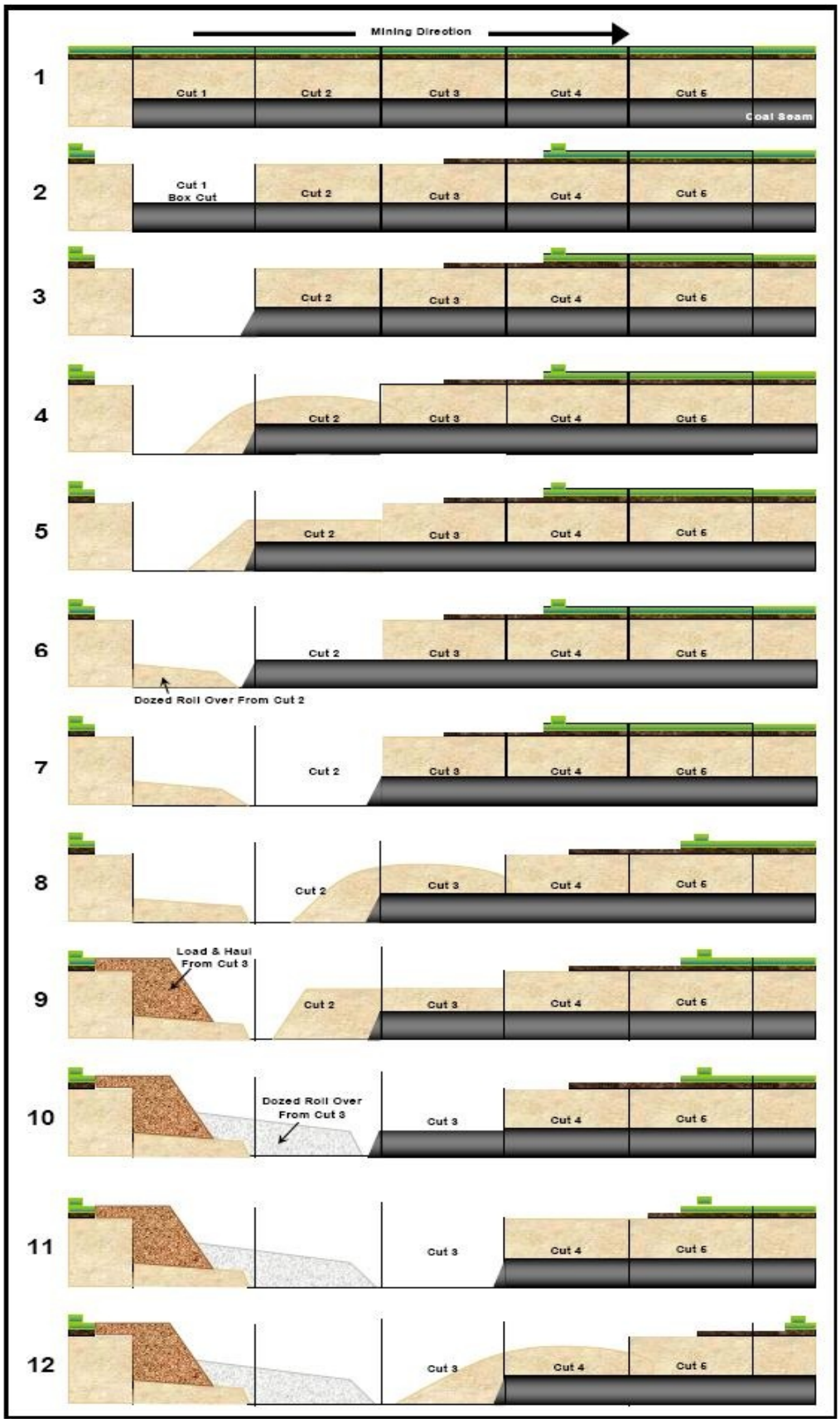

Figure 3: Steps 1-12 of mining method

2.2.3 Decommissioning Phase

The decommissioning phase will take place over approximately four (4) years, and will be undertaken in three (3) phases, namely decommissioning, maintenance, and monitoring. The decommissioning phase will include, but may not be limited to the following activities:

- Notifying the DME of the intention to close the operation;
- Scaling down of the operation;
- Implementing the Social and Labour Plan (SLP) and the retrenchment plan;
- Retrenching the non-essential workforce;
- The closure and rehabilitation phase will include, but may not be limited to the following activities:
  - Dismantling of processing plant and related structures;
  - Demolition of:
    - Steel buildings and structures;
    - Reinforced concrete buildings and structures; and
    - Administration facilities and housing.
- Rehabilitation of access roads;
- Opencast rehabilitation;
- Wetland rehabilitation;
- Fencing off pit areas;
- Rehabilitation of overburden, spoil and process plant waste;
- General surface rehabilitation;
- Waste removal; and
- Water management.

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

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

2.3 Biodiversity offsetting – an introduction

It is important to remember that the mitigations outlined in the Belfast EMPR need to be met in terms of the management hierarchy;

- Avoidance;
- Minimisation;
- Reduction;
- Rehabilitation; and
- Compensation (e.g. biodiversity offsets)

The management hierarchy must be done before biodiversity offsets (compensation mitigation) can be considered. In the light of this project, rehabilitation of the lost pans and wetlands within the two proposed coal reserves at Belfast would not be feasible and therefore offsetting these specific pans and wetlands was considered as an option that would still allow the development to continue.

Biodiversity offsetting in South Africa is a relatively new concept and there is no standard method to determine an appropriate biodiversity offset (DEADP, 2007). This section aims to give the reader an introduction to the concept of biodiversity offsetting and its associated principals. According to the international Business and Biodiversity Offsets Programme (BBOP) biodiversity offsets are defined as:

"*Biodiversity offsets are measurable conservation outcomes resulting from actions designed to compensate for significant residual adverse biodiversity impacts arising from project development after appropriate prevention and mitigation measures have been taken. The goal of biodiversity offsets is to achieve no net loss and preferably a net gain of biodiversity on the ground with respect to species composition, habitat structure, ecosystem function and people's use and cultural values associated with biodiversity."* (BBOP, 2009).

Key to the definition cited above is the concept of *No net loss*. In fact it is preferable to achieve a net gain of biodiversity. Developers should first seek to avoid and minimize the impacts of their projects on biodiversity. In order to achieve this, developers should ensure that the biodiversity offset is focused on addressing only the remaining impacts after the appropriate mitigation hierarchy has been applied (avoidance, mitigation, and restoration). Figure 4 illustrates the thinking behind utilizing the mitigation hierarchy and when a biodiversity offset should be applied.

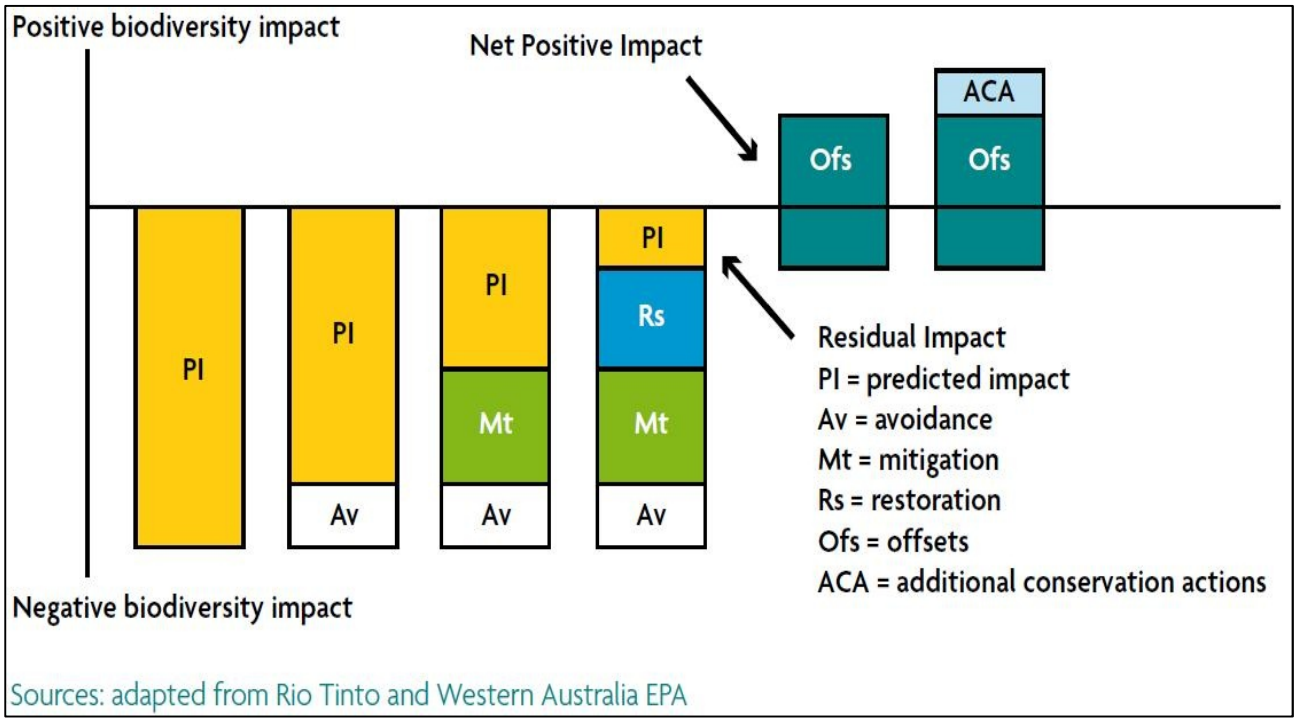

Figure 4: The Mitigation Hierarchy (BBOP, 2009)

As biodiversity offsetting is a relatively new field in South Africa, it is important to outline the overarching principals associated with it. The BBOP Principals on Biodiversity Offsets provide a solid base from which to work, they are as follows (BBOP, 2009):

1) **No net loss:** A biodiversity offset should be designed and implemented to achieve *in situ*, measurable conservation outcomes that can reasonably be expected to result in no net loss and preferably a net gain of biodiversity.

2) **Additional conservation outcomes:** A biodiversity offset should achieve conservation outcomes above and beyond results that would have occurred if the offset had not taken place. Offset design and implementation should avoid displacing activities harmful to biodiversity to other locations.

3) **Adherence to the mitigation hierarchy:** A biodiversity offset is a commitment to compensate for significant residual adverse impacts on biodiversity identified after appropriate avoidance, minimization and on site rehabilitation measures have been taken according to the mitigation hierarchy.

4) **Limits to what can be offset:** There are situations where residual impacts cannot be fully compensated for by a biodiversity offset because of the irreplaceability or vulnerability of the biodiversity affected.

5) **Landscape Context:** A biodiversity offset should be designed and implemented in a landscape context to achieve the expected measurable conservation outcomes taking into account available information on the full range of biological, social and cultural values of biodiversity and supporting an ecosystem approach.

6) **Stakeholder participation:** In areas affected by the project and by the biodiversity offset, the effective participation of stakeholders should be ensured in decision-making about biodiversity offsets, including their evaluation, selection, design, implementation, and monitoring.

7) **Equity:** A biodiversity offset should be designed and implemented in an equitable manner, which means the sharing among stakeholders of the rights and responsibilities, risks and rewards associated with a project and offset in a fair and balanced way, respecting legal and customary arrangements.

Special consideration should be given to respecting both internationally and nationally recognized rights of indigenous peoples and local communities.

8) **Long-term outcomes:** The design and implementation of a biodiversity offset should be based on an adaptive management approach, incorporating monitoring and evaluation, with the objective of securing outcomes that last at least as long as the project's impacts and preferably in perpetuity.

9) **Transparency:** The design and implementation of a biodiversity offset, and communication of its results to the public, should be undertaken in a transparent and timely manner.

10) **Science and traditional knowledge:** The design and implementation of a biodiversity offset should be a documented process informed by sound science, including an appropriate consideration of traditional knowledge.

Thus in summary, biodiversity offsetting is considered when the loss of biodiversity due to the project activity cannot be regained through the usual steps associated with the mitigation hierarchy. A biodiversity offset would generally involve the improvement of biodiversity of a selected site which had been chosen based on scientifically defensible criteria. It can additionally involve the protection of existing important biodiversity areas which are in a good present ecological state.

2.4 The Belfast project and biodiversity offsetting

This section aims to provide an understanding of how Exxaro could consider investigating wetland offsets for the Belfast project.

The proposed Belfast open cast mining activities (Figure 5) will destroy a number of habitats, as identified in the baseline and impact assessment (Golder report 12135-9383-2, 2011). The habitats that would be affected are disturbed grasslands, non-natural wooded areas (specifically Declared Category 1, 2, & 3 alien invader species (*Eucalyptus sp.* (Blue gums) / *Acacia sp.* (Wattle)), as well as a number of wetlands (Figure 5).

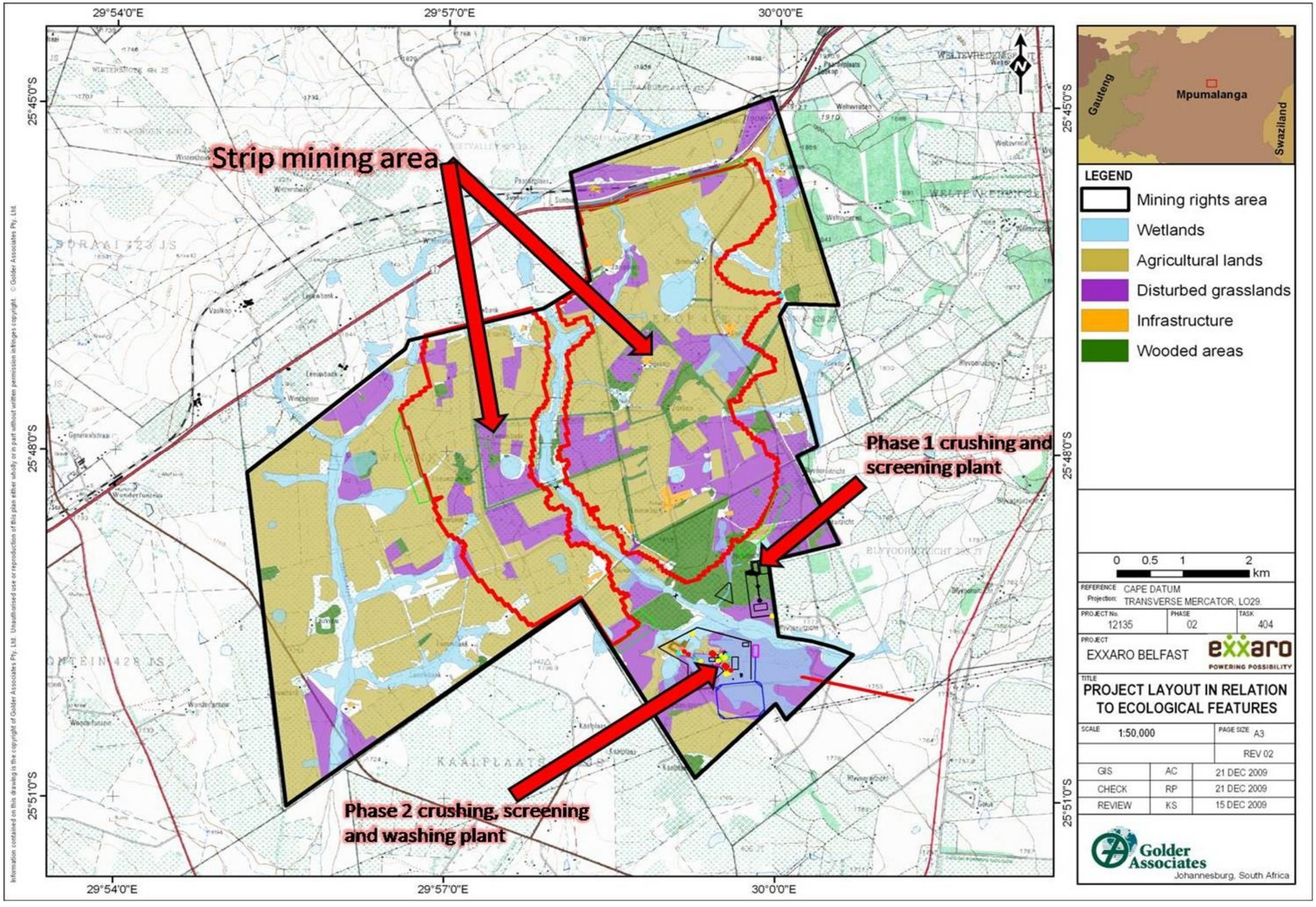

Figure 5: Proposed Exxaro Belfast mining area in relation to ecological biodiversity features, including the non-natural wooded areas (Eucalyptus sp. (Blue gums) / Acacia sp. (Wattle))

Of these habitats the disturbed grasslands are the least sensitive to impacts. It was noted in the baseline report that "Natural grassland areas throughout the study area must be regarded as disturbed and does not represent good quality natural grassland expected to be found in the Highveld" (Golder report 12135-9383-2, 2011). The wooded areas are dominated by alien invasive species and whilst they do provide habitat for fauna such as birds and small mammals, strictly speaking they should be removed or controlled under the Conservation of Agricultural Resources Act (Act No. 43 of 1983). The loss of biodiversity in disturbed grasslands and wooded areas in relation to their regional abundance and the proposed rehabilitation goals would not necessitate a biodiversity offset.

With regards to the wetland habitats there are three main types of wetlands that will be affected, namely:

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

These wetland habitats were found to mostly have a Present Ecological Status (PES) of **Moderate** to **Very High** and Ecological Importance and Sensitivity (EIS) of **Moderate** to **High**. These habitats supply a range of ecosystem services which are of significant importance to people and the natural environment (Golder report 12135-9383-2, 2011).

2.5 Wetlands in the Mpumalanga Coal Fields - a regional context

Situated in the north east of South Africa, Mpumalanga covers approximately 77 918 km^2. With its gently undulating topography in the west and more hilly and terrain in the east, the province is known for its channelled and unchanneled valley bottom wetlands, and particularly its pans (depressions). A map indicating the distribution of wetlands within the province is shown in Figure 6.

The province is home to a number of well know wetlands such as the Mpumalanga Lake District, Chrissiesmear wetlands, Hazyview Wetlands, as well as the Verloren Vallei Nature Reserve. The wetlands within Mpumalanga under pressure from a variety of land uses, including dry land agriculture, forestry, and mining (Lotter, 2011).

In a recent article in the Mpumalanga Wetland Forum (MWF) Newsletter, Mervyn Lotter gave a brief insight into an ongoing geographical assessment of mining related applications between 2005 and 2010 on biodiversity in Mpumalanga (Lotter, 2011). With reference to Figure 7, below are some of the key statistics from this article:

- Of all the EIA applications received in the province over the five year period, mining related applications accounted for 86% with residential development at 9% and infrastructure at 5%;
- In terms of the mining applications, coal accounted for 78% of all mining and prospecting related applications;
- 13.7% of the province's spatial area has mining applications and 40.3 % have prospecting applications;

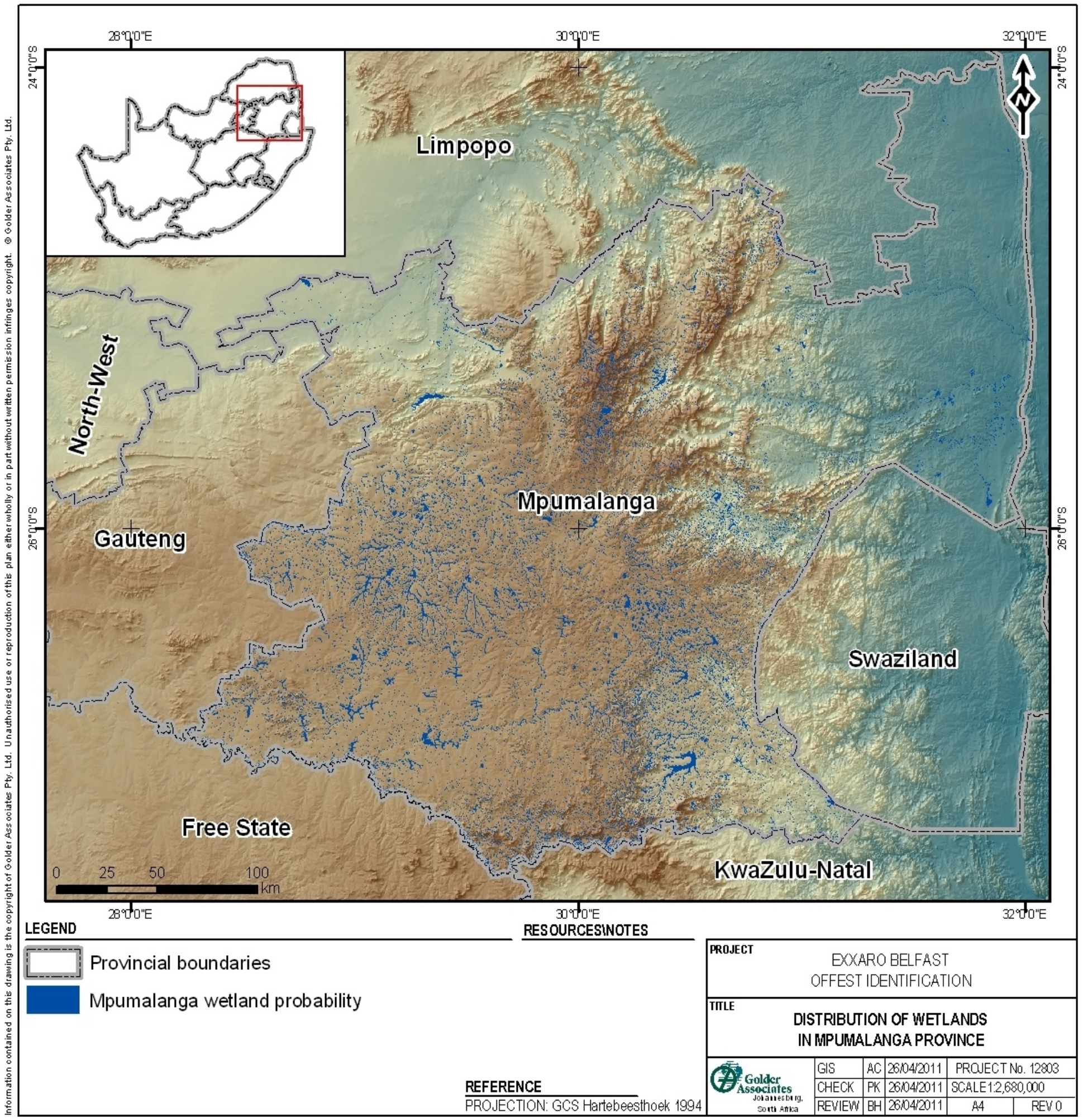

Figure 6: Wetland probability map of the Mpumalanga Province

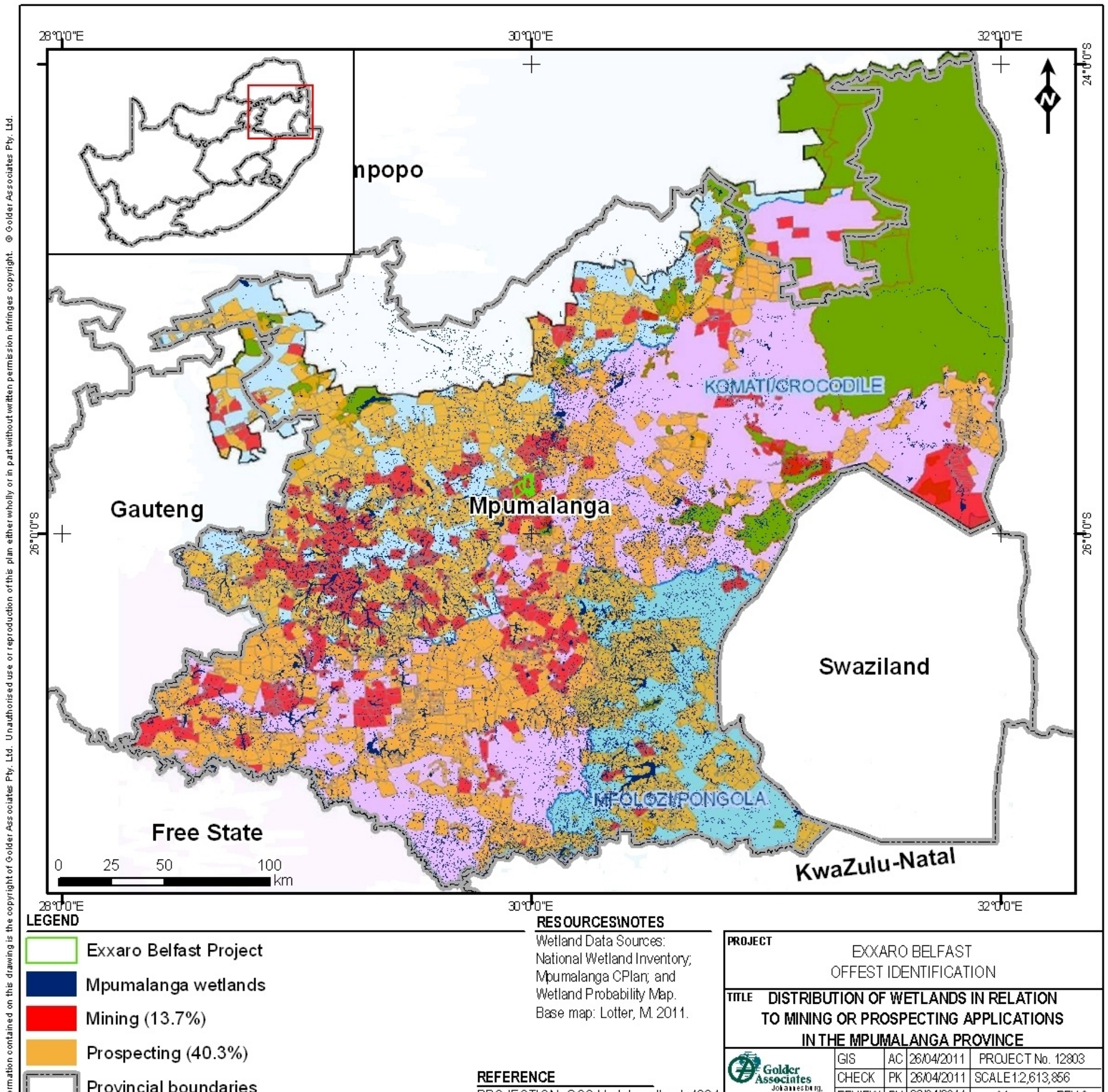

Figure 7: Distribution of wetlands in relation to mining or prospecting applications in Mpumalanga (2005 - 2010) (Lotter, 2011)

- Bearing in mind that several prospecting applications would be later converted to mining applications; mining related rights have been applied for in 46% of the province's surface area over existing land use rights.

With specific reference to biodiversity and water resources, mining or prospecting applications within Mpumalanga have been received for:

- 53% of the provinces protected areas;
- 50% of the provinces Irreplaceable areas (in terms of the Mpumalanga Biodiversity Conservation Plan (Ferrar, 2007));
- 56% of the provincial Protected Area Expansion priority areas;
- 65% of the areas in the province listed nationally as Threatened Ecosystems;
- 39% of the provinces high water yield areas (that produce 50% of the provinces run-off); and
- 38% of the provinces National Freshwater Ecosystem Priority Area.

It is important to note that not only have many of the wetlands in the province been affected by mining and other activities like agriculture, but they may be further affected in the future. This increases the difficulty of identifying and implementing a successful offset initiative.

2.6 Description of pans and wetlands within the proposed coal reserves

The description of the pans and wetlands for which offsets will be identified was done using the baseline work done for the impact assessment (Golder report 12135-9383-2, 2011). The wetlands on the Belfast site are generally divided into:

- Hillslope seeps;
- Valley bottoms (channelled and non-channelled), and
- Pans:
  - Open water pans;
  - Open water sedge pans; and
  - Grass pans.

Four (seasonal) surveys were conducted on the pans and wetlands of the proposed Belfast mine lease area and the following assessments/procedures were conducted:

- **Wetland delineation** - The field procedure for the pan and wetland delineation was conducted according to the Guidelines for delineating the boundaries of a wetland set out by the Department of Water Affairs and Forestry (DWAF, 2005).
- **Wetland classification** – Pans and wetlands were described in terms of their position in the landscape, and the classification was done according to its hydro-geomorphic setting as described by Kotze *et al* (2005). With regards to the pans, classification was done first on a hydrogeomorphic level. They were then separated into open water, open water grass/sedge, and grass/sedge pans.
- **Wetland Site Description** - The area surveyed was described in terms of current impacts on the pans and wetlands, dominant vegetation and overall impression of the pans and wetland sites. Photos were taken of each site.

- **Wetland flora and fauna** - The area was traversed on foot and all species of plants or animals seen or deduced as being present from the opportunistic recordings were recorded. No mammal trapping or detailed amphibian and reptile surveys were conducted.
- **Shannon Index of Diversity** - The Shannon Mean Diversity Index was used by means of running survey data in EstimateS software to determine plant species diversity or species richness (Khan, 2001). The Shannon diversity index is commonly used to characterize species diversity in a community. Shannon's index accounts for both abundance and evenness of the species present.
- **Present Ecological Status (PES)** - The Present Ecological Status (PES) method (DWAF, 1999a) was used to establish the integrity of the pans and wetlands. This method is based on the modified Habitat Integrity approach developed by Kleynhans (DWAF, 1999a).
- **Wetland ecological importance and sensitivity (EIS)** - The ecological importance and sensitivity assessment was conducted according to the guidelines as discussed by DWAF (1999c).
- **Wetland Index for Habitat Integrity (Wetland-IHI)** - The Wetland Habitat Integrity (Wetland-IHI) (DWAF, 2007) was used to determine the habitat integrity of the pans and wetlands found on site. From this rating the Present Ecological Status (PES) of the pans and wetlands can be derived in the form of Ecological Category (EC).
- **Ecosystem services supplied by wetlands (Wet-EcoServe)** - The assessment of the ecosystem services supplied by the identified wetland units were conducted according to the guidelines as described by Kotze, *et al.* (2005). A Level 2 assessment was undertaken which examines and rates Natural and Human services.
- ***In situ* water quality analysis -** *In situ* water quality measurements were determined for each of the pans on site, using light-weight field instruments. These measurements included:
  - pH (EuTech pH meter);
  - Dissolved Oxygen (DO) (Cyberscan DO110 meter);
  - Electrical Conductivity (EC)/Total Dissolved Salts (TDS) (Eutech EC *tester 11*+); and
  - Temperature (Cyberscan DO110 meter).
- **Pan aquatic macroinvertebrates** – the pan aquatic macroinvertebrates were assessed using the United States Environmental Protection Agency (USEPA) methodology for single habitat sampling in aquatic ecosystems (USEPA, 2002; USEPA, 2006). The invertebrates are sampled using a prescribed number of kick samples for varying micro-habitats with the aquatic system (vegetation, substrate and water column). The invertebrates are preserved along with a biological stain (Rose Bengal) and quantitatively assessed in the lab using microscopy. Taxa are identified to family level (Gerber, et al., 2002; WRC, 2000; WRC, 2002; WRC, 2003; WRC, 2001).

Selected information from these studies was used for this study. For the full detailed descriptions of the wetland systems refer to Golder report number 12135-9383-2 (2011).

Following discussions with Working for Wetlands (WfWet) (Dini, 2010), the Hillslope seeps and valley bottoms wetlands were grouped together and a separate approach devised to that of the pans. This was due to the unique ecosystem characteristics of pans.

3.0 METHODOLOGY

3.1 Hillslope seeps and valley bottom wetlands

Discussions held with WfWet revealed that with regards to the valley bottom and hillslope seeps wetlands site identification and rehabilitation would be best conducted in collaboration them. The identified wetlands, along with their current status (type, characteristics, flora & fauna, PES and EIS), within the proposed Exxaro Belfast NBC mining area, were assessed during the baseline and impact assessment project (Golder report 12135-9383-2, 2011). The function of the wetlands, in terms of similar catchment area source zones, as well as the feasibility of offset potential within Exxaro-owned farm portions were used as priority criteria for the identification of wetland offset areas. This information will be used by WfWet to select wetlands of similar type and function for rehabilitation/restoration.

The discussions with WfWet did give some indication of the area equivalents that are often used, the following was noted:

"Experience around the world has shown that using hectare-for-hectare alone is a poor currency for determining how many hectares need to be rehabilitated to offset the impact, since it does not take into account the value, rarity etc of the wetland to be destroyed and that to be rehabilitated." (Dini, 2010)

"Since we have the tools available, we are leaning towards an approach that uses the concept of "hectare equivalents", which takes wetland functioning into account. Our starting point is that the same number of hectare equivalents must be reinstated as those destroyed." (Dini, 2010)

Dini notes that the number of hectare equivalents can be measured by the improvement in health as a result of rehabilitation, multiplied by the number of hectares rehabilitated. He goes on to note that in addition to this they advocate mitigation to impact ratio of at least 2:1, to accommodate risk and uncertainty.

"So the bottom line is that double the number of hectare equivalents lost should be rehabilitated through offsite mitigation. This ratio could even be increased if the wetland to be lost is of particularly high value etc." (Dini, 2010)

Kotze (2007) notes that the concept of 'hectare equivalents' can be effectively applied in the context of offsite mitigation. He provides the following example:

"*… a development that is to unavoidably destroy 15 ha of wetland, for which there are no onsite mitigation options, and for which a compensation ratio of 2 to 1 has been specified. This would mean that 30 ha equivalents of intact wetland would be required to compensate for the loss. This could be supplied by the example given above of a 60 ha area with a 50% improvement in health, assuming that it met the other requirements (e.g. was in the same catchment as the impacted wetland, etc.). If, in the 60 ha example given above, the improvement in health was only 20% (i.e., a reinstatement of 12 ha equivalents of intact wetland) then this would be inadequate for the mitigation despite the large size of the area in which the rehabilitation took place*."

As expressed by Dini (Dini, 2010) in mind and employing the logic used by Kotze (2007) in his work on assessing rehabilitation outcomes, the following equation was used for the determination the total offset area required for valley bottom wetlands and hillslope seeps:

$$\textbf{Total offset area required} = [(\textbf{Area of affected wetlands}) \times (\textbf{PES\% of affected wetlands})] \times \mathbf{2}$$

The PES scores from the baseline Wetland IHI assessments will be used for this operation (Golder report 12135-9383-2, 2011).

Onsite set-asides

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

Offsite offsets

For each wetland type lost as a result of the mining process, where the impacts could not be mitigated, offsite biodiversity offset wetlands were identified in which compensation for the wetlands could be provided. Improved ecological catchment management and planning within the offsite offset areas, as well as protection statues for the wetland offsets and no future mining activities can result in offset compensation for the wetlands and pans lost within the proposed Belfast coal reserves.

This offset identification phase follows a four-step approach to identifying hillslope and valley bottom offsets:

- Onsite set-asides: Not all hillsope seeps and valley bottom wetlands would be disturbed or lost within the proposed Belfast mine lease area, and these would be used as onsite set-asides;
- Rehabilitation and improvement of baseline conditions (to natural/pristine condition) of hillsope seeps and valley bottom wetlands within the onsite set-asides; and
- Offsite offsets: Hillsope seeps and valley bottom wetlands that may have been impacted already in areas of coal mines other than the proposed Belfast mine area. These should be protected from future mining activities; and
- Rehabilitation and improvement of baseline conditions (to natural/pristine condition) of hillsope seeps and valley bottom wetlands within the offsite offset areas.

3.2 Pans

For the pans the same hectare equivalent equation will be applied as with the valley bottoms and hillslope seeps. The PES assessment protocol used in the baseline studies of the pans the DWAF (1999a) method. The pans were surveyed seasonally (four times) and thus an average score for the assessments was generated. With reference to Table 2, the pans are rated 0-5 on a number of criteria and then a site average obtained. For the purposes of this exercise the average scores will be converted to a percentage in order for the equation in Section 3.1, above to be applied.

Table 2: Ratings in the DWAF (1999a) PES method used to assess the Belfast pans

Scoring Guidelines per Attribute:	Score
Natural/Unmodified	5
Largely Natural	4
Moderately Modified	3
Largely Modified	2
Seriously Modified	1
Critically Modified	0

With respect to the pans, a like-for-like approach was employed for the initial identification phase, whereby the pans within the proposed Exxaro Belfast NBC mine lease area were characterised, and then pans of similar characteristics were identified. The identified pans, along with their current status (type, characteristics, flora & fauna, PES and EIS), within the proposed Exxaro Belfast NBC mining area, were assessed during the baseline and impact assessment project (Golder report 12135-9383-2, 2011).

The pan component follows the same four-step approach to identifying pan offsets as for the wetlands:

- Onsite set-asides: Not all pans would be disturbed or lost within the proposed Belfast mine lease area, and these would be used as onsite set-asides;
- Rehabilitation and improvement of baseline conditions (to natural/pristine condition) of pans within the onsite set-asides; and

- Offsite offsets: Pans that may have been impacted already in areas of coal mines other than the proposed Belfast mine area. These should be protected from future mining activities; and
- Rehabilitation and improvement of baseline conditions (to natural/pristine condition) of pans within the offsite offset areas.

406 pans within a defined study area around the proposed Belfast mine lease area were identified and went through a series of eliminations, based on various ecological criteria, in order to eliminate pans that were unsuitable for offsetting. The function of the pans, in terms of similar catchment area source zones, as well as the feasibility of offset potential within Exxaro-owned farm portions were used as priority criteria for the identification of pan offsets.

The methodology is divided into the following parts:

- The methodology for the onsite set asides and rehabilitation criteria of the pans and hillslope seeps and valley bottom wetlands ; and
- The methodology for the offsite offset identification, rehabilitation and protection criteria for the pans and hillslope seeps and valley bottom wetlands.

3.3 Onsite set asides and rehabilitation criteria

The two coal reserves of the proposed Belfast NBC project were reduced in size in order not to destroy/impact the majority of the pans, and hillslope seeps and valley bottom wetlands associated with the Leeubankspruit, Klein-Komati River and the Driehoekspruit. These areas were used as onsite set-asides within the proposed mine lease area.

The onsite set-aside pans and wetlands would need to be managed in order to improve baseline conditions and mitigate any impacts associated with the proposed project. The rehabilitation criteria for these on site-set asides would include:

- Implementation of an Exxaro, land-owner, DWA and MTPA Wetland Management Forum (WMF) for the onsite set aside pans and wetlands;
- Limitation of agricultural impacts due to cattle overgrazing and trampling, and crop encroachment into the pan and wetland areas;
- Implementation of pan and wetland mitigation identified in the impact assessment phase for pans and wetlands that may be impacted from the proposed project, especially those directly outside of the two proposed coal reserve areas;
- Implementation of a fire-management programme;
- Implementation of an alien and exotic vegetation (declared Category 1, 2 and 3 listed alien and invader species) management programme;
- Revegetation of disturbed areas and areas of pan catchment and wetland loss; and
- Implementation of a pan and wetland biomonitoring programme.

These criteria for the onsite set-aside pans and wetlands will form the basis for the implementation and management plan for the offset programme.

3.4 Offsite offset identification, rehabilitation and protection criteria

For the pans and hillslope seeps and valley bottom wetlands that will be lost within the two proposed coal reserves, offsite offsets would have to be identified.

The identification criteria for the offsite area investigation included the following:

- Ecoregions: The offsite area(s) would have to fall within the same or similar Level I Ecoregion;
- Geomorphic provinces: The offsite area(s) would have to fall within the same or similar geomorphic provinces;
- Vegetation zones: The offsite area(s) would have to fall within the same or similar vegetation zones;
- Water Management Areas: The offsite area(s) would have to fall within the Inkomati Water Management Area (WMA: 05);
- MBCP: The offsite area(s) would have to fall within the same biodiversity conservation management areas;
- NFEPA: The offsite area(s) would have to fall within the same Freshwater Ecosystem Protected Areas (FEPAs); and
- Exxaro-owned land: The offsite area(s) would have to fall within or near an existing mining area, owned by Exxaro for easy of management and implementation of the offset project.

The offsite off-set pans and wetlands would need to be managed in order to improve baseline conditions and mitigate any impacts associated with the proposed project. The rehabilitation criteria for these offsite set-asides would include:

- Implementation of an Exxaro, land-owner and MTPA wetland management forum for the offsite set-aside pans and wetlands;
- Limitation of agricultural impacts due to cattle overgrazing and trampling, and crop encroachment into the pan and wetland areas;
- Implementation of wetland mitigation and rehabilitation for pans and wetlands that may be impacted by existing mining impacts;
- Implementation of a fire-management programme;
- Implementation of an alien and exotic vegetation management programme; and
- Implementation of a pan and wetland biomonitoring programme.

These criteria for the offsite offset pans and wetlands will form the basis for the implementation and management plan for the offset programme.

Pan field surveys

Field surveys for the pans were required due to the uniqueness of pan ecosystems as single ecosystem units. This was done in order to determine the following:

- Pan type (Open water, Open water sedge, and grass pans);
- Turbidity;
- Total Dissolved Solids (TDS) as an indication of pan salinity; and
- Aquatic macroinvertebrates.

A 50 km buffer zone was established around the Belfast Mineral rights boundary. This is due to the fact that it was felt that further than 50 km away from the Belfast Project area would not only diminish the likelihood of similarity and functionality for the wetland and river systems. The remaining pans were then investigated in the field. Due to the large number of candidate pans that were to be investigated, the pans were spatially grouped and representative sites of the groups were sampled.

The field surveys consisted of the following activities:

- **Wetland delineation** - The field procedure for the wetland (pan) delineation was conducted according to the guidelines for delineating the boundaries of a wetland (pan) set out by the Department of Water Affairs and Forestry (DWAF, 2005).
- **Wetland classification** – The pans were described in terms of their position in the landscape, and the classification was done according to its hydro-geomorphic setting as described by Kotze *et al* (2005).
- **Wetland Site Description** - The area surveyed was described in terms of current impacts on the pans, dominant vegetation and overall impression of the pans. Photos were taken of each site.
- **Wetland flora and fauna** - The area was traversed on foot and all species of plants and animals seen or deduced as being present were recorded.
- **Present Ecological Status (PES)** - The Present Ecological Status (PES) method (DWAF, 1999a) was used to establish the integrity of the pans. This method is based on the modified Habitat Integrity approach developed by Kleynhans (DWAF, 1999a).
- **Wetland ecological importance and sensitivity (EIS)** - The ecological importance and sensitivity assessment was conducted according to the guidelines as discussed by DWAF (1999c).
- ***In situ* water quality analysis -** *In situ* water quality measurements of each of the pans were determined on site, using light-weight field instruments. These measurements included:
  - pH (EuTech pH meter);
  - Dissolved Oxygen (DO) (Cyberscan DO110 meter);
  - Electrical Conductivity (EC)/Total Dissolved Salts (TDS) (Eutech EC *tester 11*+); and
  - Temperature (Cyberscan DO110 meter).
- **Pan aquatic macroinvertebrates** - were assessed using the United States Environmental Protection Agency (USEPA) methodology for single habitat sampling in aquatic ecosystems (USEPA, 2002; USEPA, 2006). The invertebrates are sampled using a prescribed number of kick samples for varying micro-habitats with the aquatic system (vegetation, substrate and water column). The invertebrates are preserved along with a biological stain (Rose Bengal) and quantitatively assessed in the lab using microscopy. Taxa are identified to family level (Gerber, et al., 2002; WRC, 2000; WRC, 2002; WRC, 2003; WRC, 2001).

Pan offset candidate identification

The identification of potential offset pans was conducted using the following process:

- Elimination of pans which fall outside of the defined study area;
- Prioritisation pans that were within the 50 km buffer zone;
- Elimination of pans within other Ecoregions, geomorphic provinces, vegetation zones, and WMAs;
- Statistical spatial correlation of pan assessment data using the PRIMER statistical software (Ludwig, et al., 1988) in order to determine pans of similar attributes to the pans of within the proposed Belfast coal reserve areas. The following data were used in this assessment:
  - *In situ* Total Dissolved Solids (TDS) as an indication of pan water salinity;
  - Turbidity: based on observed depth of clarity in centimetres (cm);
  - Pan specific macroinvertebrates including:

- Cladocera (Water fleas);
- Ostracoda (Ostracods);
- Copepoda (Copepods);
- Conchostraca (Clam shrimps);
- Triops sp. (Tadpole shrimps)

- There is to our knowledge no formal definition of what constitutes a fresh water or brackish pan. Thus in order to differentiate between the different salinity types of pans the following sources were considered:
  - The Department of Water Affairs states that fresh water river ecosystems are those that have a TDS of between 200 – 1100 mg/l (DWAF, 1996);
  - Discussions with wetland expert Alan Bachelor of Wetland Consulting Services revealed that he would recommend the division to be at 2000 mg/l (Batchelor, 2011);
  - Thus for the purposes of this study the limit for freshwater pans will be 2000 mg/l.

The quantitative field data results are analyzed using PRIMER software (Clarke, et al., 1994) statistics in order to identify site groupings, similar habitats or sensitive indicators.

Quantitative aquatic macroinvertebrate data was analysed by means of multivariate procedures. This is due to the community based nature of the data which makes classical univariate assumptions invalid. Non-parametric multivariate analysis of community data, based on among sample similarity matrices, draws inferences only from its ranks. These methods lack model assumptions and have a general validity of application. In contrast to univariate analyses, analysis of variance (ANOVA, regression) multivariate procedures consider each taxon to be a variable and the presence/ absence of each taxon to be an attribute of a site or time. Subtle changes in community composition across sites, which are generally masked when the characteristics of a site are combined into a single index value, are more likely to be detected by multivariate procedures. Spatial trends in community composition can therefore be displayed by means of multivariate methods of data analyses.

The quantitative aquatic macroinvertebrate data was single root (√) transformed prior to analyses. According to (Clarke, et al., 1994) the choice of a transformation is in many cases more a biological than a statistical question and that statistical considerations enter mostly in relation to the reliability of sampling. The Bray-Curtis coefficient, which is regarded as the most reliable similarity coefficient in ecological work, was applied to the data (Clarke, et al., 1994). The major advantage of this similarity coefficient above other similarity coefficients is that joint absences have no effect on it (Cyrus, et al., 2000).

Displaying community patterns through Cluster Analysis and Non-metric Multi-dimensional Scaling (MDS)

Hierarchical clustering and non-metric multi-dimensional scaling (MDS) was conducted on the community data in order to investigate spatial patterns in community structure. Both procedures start from a triangular similarity matrix computed between sets of samples. These multivariate techniques attempt to reduce the complexity of the community data by representing relationships between samples in a lower dimension (Cyrus, et al., 2000).

Cluster analysis represents community data as a dendrogram, with the x-axis representing the full set of samples and the y-axis defining the level at which two samples or groups of samples are related. According to (Clarke, et al., 1994) hierarchical clustering with group average linking has proved a useful technique in a number of studies. (Clarke, et al., 1994) advocate Non-metric Multi-dimensional Scaling (MDS) as one of the best ordination techniques available for community data chiefly because of its superior ability to preserve complex amongst sample relationships accurately in a low dimensional picture. MDS ordination makes few assumptions about the nature or quality of the data and relies on the ranks of similarities between samples. This renders it the most widely applicable and effective method available. The purpose of the MDS is simple,

to construct a configuration of the samples, usually in two dimensions, in which the rank order of the distances between samples attempts to match the rank order of the corresponding similarities taken from the triangular similarity matrix. There is no guarantee that these rank similarities can be accurately preserved in a lower dimension configuration, due to the fact that convergence to the global minimum of stress is not guaranteed.

When interpreting the results of a MDS ordination it is important to assess how well it succeeds in providing a reliable representation of among-sample relationships and modify interpretation accordingly. The simplest indicator of this success is the stress which can be defined as a measure of the difficulty involved in compressing the sample relationships into 2-dimensions (2D). The stress value reflects the extent to which the similarity rankings and the corresponding distance rankings in the MDS ordination correspond (Table 3).

Table 3: Range of stress values used to determine accuracy of 2-dimensional MDS algorithm (Clarke, et al., 1994)

Stress	Type of representation
< 0.05	Provides an excellent representation with no misinterpretation
< 0.10	Good ordination with no real prospect of misleading interpretation
< 0.20	Potentially useful 2D picture (reliance should not be placed on values at the upper end of this range)
> 0.30	Points are arbitrarily placed in the 2D ordination.

Spatial differences in species associations

The appropriate method to determine inter-group and intra-group relationships is to calculate similarity percentages in respect to contributions to average similarity/ dissimilarity within groups and between groups (Clarke, et al., 1994).

4.0 RESULTS

4.1 Description of pans and wetlands within the proposed coal reserves

Based on the results of the baseline surveys (Golder report 12135-9383-2, 2011) the wetlands will be briefly described (Figure 8). With reference to Figure 8 and Table 4, 34.2 ha of wetland and pan habitat will be lost due to the mining activities in the Western Coal Reserve.

Table 4: Wetlands lost within the western coal reserve

Wetland Type	Area (ha)	PES	EIS	Salinity
Channelled Valley Bottom	16.5	Very low to Moderate	Low/Marginal to Moderate	N/A
Hillslope seep	3.8	High	Moderate	N/A
Pan - Grass	5.7	Moderate	Moderate	N/A
Pan - Open water sedge	8.2	High	High	Fresh water

With reference to Figure 8, Table 5 and Table 6, 131.3 ha of wetland and pan habitat will be lost due to the mining activities in the Eastern Coal Reserve.

Table 5: Wetlands lost within the eastern coal reserve

Wetland Type	Area (ha)	PES	EIS	Salinity
Channelled Valley Bottom	28.0	Very low to Moderate	Low/Marginal to Moderate	N/A
Hillslope seep	41.7	Very low	Moderate	N/A
Pan - Grass	7.7	Very high	Moderate	N/A
Pan - Open water	27.8	Very high	Moderate	Fresh water
Pan - Open water sedge	19.9	Very high	High	Fresh water
Un-channelled Valley Bottom	6.2	High	Moderate	N/A

Table 6: Calculation of specific pan areas

Belfast pans	Pan types	Area (ha)	PES
Pan 12	Grass/ sedge pans	1.6	4.52
Pan 14		5.7	3
Pan 16		6.10	2
Pan 11	Open water pans	27.8	3.86
Pan 05	Open water sedge pans	8.2	3.55
Pan13		3.8	3.86

Whilst much of the mining will not impact directly on the all of the downstream wetlands and associated pans of the Leeubankspruit, Klein-Komati River, and Driehoekspruit (i.e. those not within the two proposed coal reserves), mining will have an indirect impact on these systems. This will mainly be in the form of draw down on the water table during mining, thus starving the wetlands of water, and possible acidic mine water decant into the wetlands during the post mining phase. Thus each of these systems will need to be considered for biodiversity offsetting, in terms of onsite set-asides.

4.1.1 Onsite set asides and rehabilitation criteria

The two coal reserves of the proposed Belfast NBC project were reduced in size in order not to destroy/impact the majority of the pans and hillslope seeps and valley bottom wetlands associated with the Leeubankspruit, Klein-Komati River and the Driehoekspruit. This fulfils the avoidance criteria of the BBOP mitigation hierarchy (Figure 4). These pan and wetland areas were used as onsite set-asides within the proposed mine lease area. A figure indicating the potential onsite set-asides is shown in Figure 9.

These areas should be viewed as sensitive areas or no-go areas. The onsite set-aside pans and wetlands would need to be managed in order to improve baseline conditions and mitigate any impacts associated with the proposed project. The mitigations recommended in the impact assessment phased should be implemented in order to fulfil the mitigation criteria within the BBOP mitigation hierarchy (Figure 4).