USING BIODIVERSITY PLANS TO GUIDE MITIGATION AND OFFSETS FOR A ZINC MINE IN NORTHERN CAPE, SOUTH AFRICA

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Introduction

Black Mountain Mining (BMM), a subsidiary of Vedanta, proposed a Zinc mine (the 'Gamsberg Project') in a semi-desert area in the Northern Cape, South Africa. The area covers 6300km^2 and is home to unique succulent flora and a national priority for protected area expansion (DEA, 2010). Several inselbergs have been identified as "Critical Biodiversity Areas" (CBAs) in the Namakwa Bioregional Plan (Desmet *et al* 2011), based on fine-scale vegetation mapping (Desmet *et al* 2005). ERM was commissioned to conduct an Environmental and Social Impact Assessment (ESIA) for the project in parallel with a separate Biodiversity Offset Study (Botha *et al* 2013). The desirability for concurrent studies was based on prior knowledge of the area's biodiversity importance and recommendations by the Northern Cape's Department of Environment and Nature Conservation (DENC). This approach accords with Vedanta's sustainability framework which is aligned with IFC Performance Standards (2012). The process followed by the ESIA and Offset Study recognised that offsets are a 'last resort' and every effort must be made to avoid and minimize impacts. The need to avoid irreplaceable[(7)] habitat was considered in the early planning phases of the project.

This paper describes the approach followed to optimise application of the mitigation hierarchy throughout the ESIA and biodiversity offset planning process. It highlights the advantages of available fine-scale vegetation mapping and spatial plans of Regional Critical Biodiversity Areas (CBAs) with conservation targets.

Site Setting and Biodiversity Importance

The Bushmanland landscape comprises mostly flat to gently undulating grassy, sand-covered plains with scattered rocky inselbergs that slope gently northwards towards the Orange River - the border of South Africa and Namibia (Figure 1).

The mine is located in the Succulent Karoo Global Biodiversity Hotspot and the Gamsberg Centre of Endemism (Desmet 2000), a region rich in succulent flora. Five vegetation types and 18 habitat units occur, with a total of 397 plant species being recorded from Gamsberg (excluding annuals and monocots); 16 are of conservation concern (i.e. endemic or rare), four of which are restricted (Desmet 2000). The Gamsberg inselberg is the most botanically diverse and important, with priority plant habitats being gravel quartzite patches. A permanent water 'kloof' on the northern side of the mine deposit is one of three permanent water sources in the Bushmanland region.

The Mine Project and Alternatives

The deposit comprises a steep-sided inselberg in a crater-like structure measuring 7 km x 5km with a life of mine of ~19 years. Open-pit mining would have a larger impact on biodiversity, but

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(7) "Irreplaceable habitat" is equivalent to the IFC PS6 definition of those biodiversity values that trigger "critical habitat" determination, while "constrained and flexible habitat" are equivalent to the "natural habitat" definition.

underground mining was not considered viable due to technical constraints, sterilisation of >40% of available ore reserve, and low financial returns. Emphasis was shifted to identifying mitigation measures (including offsets) that would be required in open-pit mining, and evaluating mining viability.

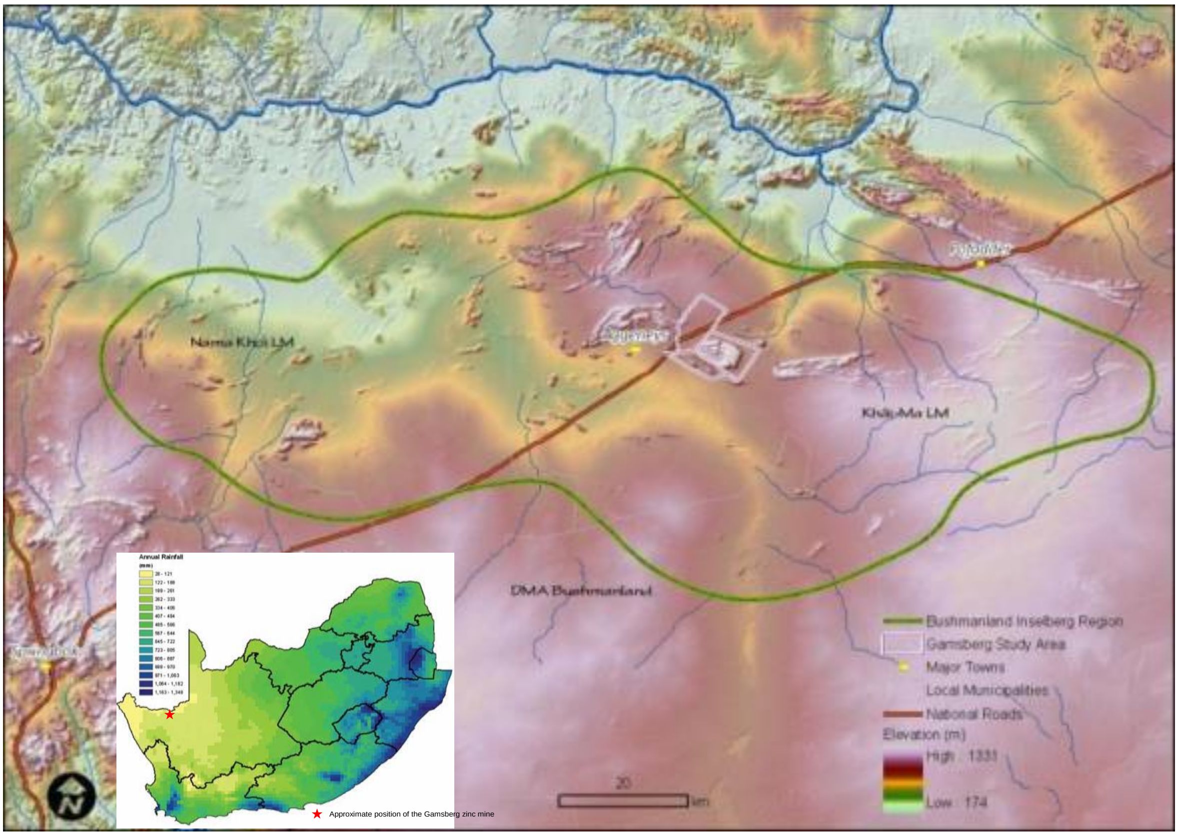

Figure 1. Gamsberg StudyArea Within Bushmanland Inselberg Region, Showing Orange River (Desmet et al 2005)

Outline of the Study Process

The study entailed applying the Mitigation Hierarchy as follows:

1. Identifying potentially irreplaceable biodiversity and sensitive habitats, and striving to avoid them through exploring mine design and layout alternatives;
2. Determining ways to minimise negative impacts on these biodiversity components through area- or management-based measures;
3. Investigating restoration or rehabilitation of disturbed areas; and
4. Planning biodiversity offsets for negative impacts that remained after the above steps had been completed.

These steps are described in more detail below.

Application of the Mitigation Hierarchy

Avoidance

Underground versus open cast mining was investigated but found not to be financially/ economically viable. The assessment then focused on alternative pit designs and locations for mine infrastructure and waste dumps relative to habitats, groundwater, visual and archaeological sensitivities. Sensitivity maps were compiled and integrated into an overall sensitivity map. Habitat sensitivity was a primary driver for influencing mine layout. This map defined areas of sensitive habitat (based on species rarity, endemicity and threat) and identified three categories reflecting degree of flexibility for locating infrastructure, as follows.

- Flexible areas impacting <5% of the regional extent of a habitat feature and where a complete like for like offset is possible;
- Constrained areas impacting 5-20% of regional extent of a habitat feature, where an offset is likely to be possible; and
- Irreplaceable areas impacting >20% of the regional extent of a habitat where features of conservation concern are only known from 5 or less locations, and where no offset is considered possible.

The sensitivity maps were overlain onto the original mine layout plan and used by the engineering team to shift infrastructure to avoid irreplaceable and sensitive vegetation as much as possible.

Avoidance measures were achieved through:

i) Siting tailings, waste-rock dump and processing facilities to avoid impacts on irreplaceable habitats; and
ii) Moving the access road, crusher and workshop to the north to avoid the southern slopes with irreplaceable succulent habitat.

Minimisation

Minimisation measures were achieved through:

i) increasing the set-back distance between the open pit and the permanent waterbody (kloof), and reshaping the pit slopes to minimise risks of contamination;
ii) designing sprinkler systems for dust suppression within the open pit; and
iii) appropriate water management to reduce habitat and kloof contamination risks.

Restoration of disturbed areas was considered, but rehabilitation, at most, could be achieved given the nature of succulent habitats in the semi-desert environment.

Biodiversity Offsetting

Biodiversity offsetting for the Gamsberg Project was underpinned by the international principles in the Business and Biodiversity Offset Policy (BBOP 2009) and the Draft South African National Policy Framework for Biodiversity Offsets (SANBI/DEA 2012). In South Africa, biodiversity offsets aim for ‘no net loss in relation to conservation targets’ whereby scientifically-determined conservation targets are the basis for calculating offset requirements, rather than an absolute ‘no net loss’ goal.

Residual adverse impacts of the Gamsberg Project on biodiversity were quantified to determine offset needs, by:

i) calculating the area of vegetation/ habitat types lost in the mine footprint and in modelled dust and groundwater drawdown zones. Potential impacts of mine-related black dust on succulent species, which typically occur in white quartzite gravel patches, are uncertain. Therefore, a precautionary approach was taken by including the modelled areas likely to be impacted by dust and water drawdown. This increased the residual impact from 1 480ha in the mine footprint to 6857ha including dust and drawdown risks.
ii) calculating the percentage habitat loss at a regional level. Habitats with the greatest regional loss were kloof, headwater seeps and wetlands, all scarce and localised in the landscape and predicted to be impacted by groundwater lowering from pit dewatering.
iii) calculating offset ratios for each impacted vegetation types derived from conservation targets in the National Biodiversity Strategy and Action Plan (NBSAP) (Driver *et al* 2004), taking into account the proportion of the remaining extent of each habitat type lost to mining.

iv) adjusting the offset ratio by applying three types of multipliers to cater for risks and uncertainties, habitat condition, and biodiversity priority.
v) multiplying the adjusted offset ratio by the size of the impacted area (calculated in (i)) to determine the offset requirement for each habitat type in hectares. The highest ratio of 16X was applied to calcrete gravel plains - an Endangered habitat type.

Suitable offset sites were identified using existing fine-scale vegetation mapping of land within the core Bushmanland Inselberg Region. Land units were selected in an incremental process based on the following criteria: ability to best meet the conservation targets for impacted vegetation types, location in adjoining areas for optimal management; least potential land-use conflicts, and were smallest in extent to reduce purchase and management costs. Priority was given to selecting plateaux tops and south-facing slopes as climate refugia; corridors linking the inselberg units and available kloof and seep habitats. Set-asides of mine property were also included in offset areas.

Outcome of Biodiversity Offset Selection and Approval Process
Most habitat targets could be met through securing the optimal selection of land units as a protected area in perpetuity, except:

i) Kloofs, seeps and springs which would be harmed by groundwater extraction and aquifer drawdown; and
ii) Quartz and Calcrete Gravel habitat types which, depending on the severity of dust impacts on flora, could be reduced in extent to below conservation targets.

Offsets for these habitats would not be feasible given their irreplaceability within the Bushmanland Inselberg Region; compensation was required, however. Protection of kloofs and wetlands in the neighbouring region, and securing regional representations of other unique succulent communities were recommended to compensate for loss of Quartz and Calcrete Gravel habitats. Net gain could be achieved for two habitat types.

An Environmental License was awarded for the proposed mine subject to implementation of a biodiversity offset. In fulfilment of license requirements, a Biodiversity Offset Agreement was signed in late 2014 between the mine and the provincial conservation authority, under which the mining company is required to secure, fence, and manage the biodiversity offset. It specifies that IUCN is to audit the offset implementation for five years, subject to renewal and that the offset must be transferred to the provincial conservation authority, with prescribed financial provision for its management paid to a Trust.

Lessons Learned

1. Availability of regional spatial data and knowledgeable experts allowed for well-informed evaluation of biodiversity impacts in a regional context, and confirmed the potential to achieve biodiversity offsets as the basis for environmental licensing.

2. Overlap between the ESIA and offset process optimised mine re-design to minimise residual impacts prior to calculating offset requirements.

3. Uncertainty of the potential impacts of groundwater lowering and black dust on succulent vegetation led to the precautionary inclusion of additional land for offsetting. Monitoring is required to confirm these predictions.

4. Alignment of offset planning and ESIA processes and engagement with key conservation stakeholders improved stakeholder support for the outcome. This led to the agreement between the mining company and the provincial conservation regulatory authority to implement and manage the biodiversity offset.

6. Despite the best efforts to secure the offset as a protected area, mining rights could in future take precedence over surface land rights, potentially compromising the long-term security of the offset in perpetuity.

7. The scale of analysis of biodiversity has a significant influence on whether or not offsets are feasible. While offsets at ‘vegetation type’ level may be achievable; offsets for finer-scale habitat types are not.

The Gamsberg Project is an example where an achievable offset has been identified, confirmed and approved based on an expert-driven process, and subject to a tight legal agreement between the mining company and regulatory authority, offering a high potential for successful implementation and securing a protected area for conservation of this unique inselberg region in perpetuity. However, the project would result in some irreplaceable loss of habitat types.

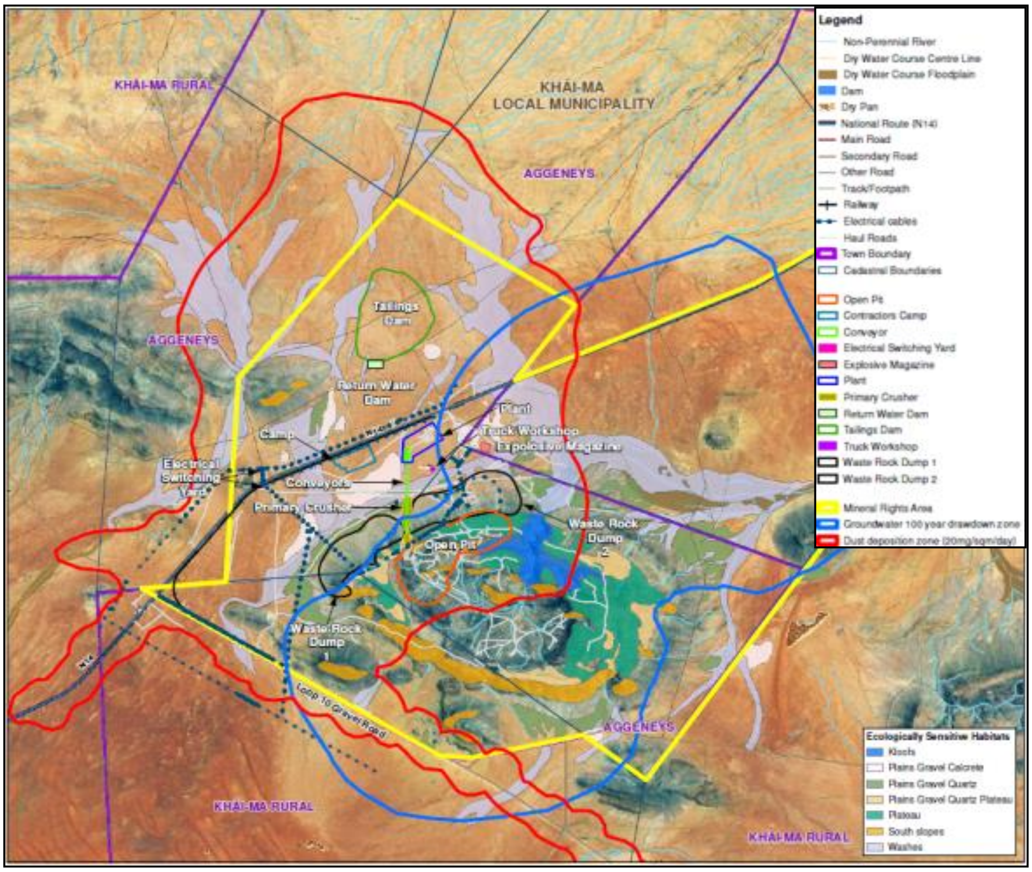

Figure 2. Gamsberg Sensitivity Map Showing Mine Layout

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