Report on the ecological and wetland assessment for the expansion of the De Aar Stone Crushers Mining Right (MR) area situated in De Aar, Northern Cape Province.

July 2025

Prepared by:

Darius van Rensburg
Pr.Sci.Nat. 400284/13
T 083 410 0770
darius@dprecologists.co.za
P.O. Box 12726 | 61 Topsy Smith Street
Brandhof | Langenhovenpark
9324 | 9300

Prepared for:
Greenmined Environmental
Baker Square
De Beers Avenue
Somerset West
7130

DECLARATION OF INDEPENDENCE

DPR Ecologists and Environmental Services is an independent company and has no financial, personal or other interest in the proposed project, apart from fair remuneration for work performed in the delivery of ecological services. There are no circumstances that compromise the objectivity of the study.

Report Version	**Final 1.0**		
Title	**Report on the ecological and wetland assessment for the expansion of the De Aar Stone Crushers Mining Right (MR) area situated in De Aar, Northern Cape Province.**		
Author	**DP van Rensburg (Pr.Sci.Nat)**		**Jul'25**

Executive Summary

The expansion of the existing mining right area is situated immediately to the south of the small town of De Aar (Appendix A: Map 1). The existing mining operations have a footprint of approximately 50 hectares, which will now be increased to approximately 100 hectares, essentially doubling the current footprint. The footprint of the current mining area is therefore already transformed, while the proposed expansion area will consist of surrounding natural areas which contain varying degrees of disturbance associated with the proximity of the mining area and associated activities. The site forms part of an arid region and consequently watercourses are limited to ephemeral systems. The surroundings do not contain any prominent watercourses, though smaller drainage lines are situated on and around the site and form part of the catchment of the Brak- and Elands River systems, forming the main drainage systems in this region. The proposed expansion of the mining area will also have to take into account its effect on this drainage system and implement comprehensive mitigation in order to minimise its impact on both the drainage lines and the downstream system (Appendix A: Map 3).

From the description of the vegetation on the site and proposed expansion areas, the existing mining area is completely transformed, while surrounding areas consist of natural vegetation which is still in a fairly good condition (Appendix A: Map 1). Signs of disturbance are present but are indicative of only low levels of disturbance. The species diversity is moderate, although the area does also contain a significant number of protected plant species which will contribute towards its conservation value (Appendix B). The areas of expansion therefore still contain elements of significant conservation value, which include protected plant species and drainage lines adjacent to and on the site (Appendix A: Map 3). Significant mitigation will therefore have to be implemented to ensure the impact on these elements of significant conservation value is decreased. Mitigation should include the following (Appendix A: Map 1 - 3):

- Numerous protected plant species have been identified in the proposed expansion areas (Appendix B). Where clearing of vegetation is required and the development will affect any of these species, the necessary permits will have to be obtained. Most of these species are fairly common, widespread and abundant and, with the necessary permits, can simply be removed. However, several are uncommon, localised species and at least a fair portion of affected plants should be transplanted to adjacent areas where they will remain unaffected.
- A drainage line is situated immediately to the south west of the site, while another small drainage line also originates in the northern portion of the site, draining northwards (Appendix A: Map 3). These drainage lines will both still have a high conservation value. Therefore, though they are very small drainage lines, the proposed expansion should ensure that the impact on the downstream system is prevented and both drainage lines excluded from future mining operations. This should be easily attainable.

The surface water of the surrounding area contains two small drainage lines, being tributaries of the Elands Spruit and large Brak River systems. These river systems are not situated near the site, though do form part of the catchment of this system, while the two small drainage lines form tributaries of the Elands Spruit and Brak River and a residual impact in terms of the system is therefore still likely, should mining operations affect these small drainage lines on the site.

One of these drainage lines is situated immediately to the south west of the site and borders on proposed mining activities (Appendix A: Map 3). The entire length of the drainage line is approximately 3.5 km, originating along the large hill to the west and flowing into the Elands Spruit approximately 6 km downstream of the site. The drainage line is however already affected by several impacts, and is being crossed by the existing railway line, which results in obstruction to its flow and concentrated flow patterns where culverts are situated within the drainage line. The drainage line also flows past the south western corner of the proposed mining expansion, which is therefore not anticipated to greatly increase the impact on it, as it is not situated on the site itself and will therefore only be affected by indirect impacts associated with mining activities. The drainage line itself is quite small with a poorly defined channel, characterised by diffuse surface flow, though significant riparian vegetation is present.

The second drainage line originates and is situated in the northern portion of the proposed mining expansion area (Appendix A: Map 3). The drainage line originates along the low ridges on the site, draining northwards, where it dissipates into the lower lying plains. It does however still form a part of the catchment and drainage pattern of the Brak River and will therefore still play a role in terms of the surface drainage of the area. The drainage line is still largely intact and without significant modification, though being situated on the site itself, may likely be affected by the proposed expansion of mining operations. The drainage line can however easily be excluded from mining activities, limiting any impacts on it. The drainage line is quite small, but with a narrow, prominent channel which drains to the north.

A Risk Assessment for the proposed mining area expansion which will affect the two drainage lines respectively, has been undertaken according to the Department of Water & Sanitation's requirements for risk assessment and the provisional Risk Assessment Matrix for Section 21(c) & (i) water use (Appendix E). Activities likely to be associated with the mining operations and which will likely affect the two drainage lines are largely associated with mining in close proximity to these systems. The proposed mining operations should completely exclude both these drainage lines and treat these systems as no-go areas (Appendix A: Map 3). Despite being excluded from mining operations, the following residual risks are still anticipated to occur:

- Should these drainage lines be excluded from mining activities, impacts on them should remain limited.
- Residual impacts are however still possible, but can be kept to a minimum, provided that adequate storm water management is implemented.
- The drainage lines are likely to be affected by residual impacts caused by the mining operations, largely as a result of increased sediment load. This can be managed through adequate mitigation, including storm water management measures and provided that adequate rehabilitation is undertaken, these operations should not have a long-term impact on them.
- Should these drainage lines be excluded from mining operations and adequate storm water management implemented, the anticipated risk should remain Low.

The impact significance has been determined and should expansion take place without mitigation, several impacts may be high, such as the impact of the loss of protected species and the impact on the drainage lines on the site (Appendix A: Map 1 - 3). The majority of impacts will also be moderate. However, should adequate mitigation be implemented as described, these can all be reduced to moderate impacts. This is however subject to the mining area excluding both drainage lines, implementing mitigation to ensure that protected plant species are transplanted and implementing an adequate storm water management system.

Table of contents

Ecological and wetland assessment

1. INTRODUCTION

1.1 Background

Natural vegetation is an important component of ecosystems. Some of the vegetation units in a region can be more sensitive than others, usually as a result of a variety of environmental factors and species composition. These units are often associated with water bodies, water transferring bodies or moisture sinks. These systems are always connected to each other through a complex pattern. Degradation of a link in this larger system, e.g. tributary, pan, wetland, usually leads to the degradation of the larger system. Therefore, degradation of such a water related system should be prevented.

Though vegetation may seem to be uniform and low in diversity, it may still contain species that are rare and endangered. The occurrence of such a species may render the development unviable. Should such a species be encountered, the development should be moved to another location or cease altogether.

South Africa has a large number of endemic species and in terms of plant diversity ranks third in the world. This has the result that many of the species are rare, highly localised and consequently endangered. It is our duty to protect our diverse natural resources.

South Africa's water resources have become a major concern in recent times. As a water scarce country, we need to manage our water resources sustainably in order to maintain a viable resource for the community, as well as to preserve the biodiversity of the system. Thus, it should be clear that we need to protect our water resources, so that we may be able to utilise this renewable resource sustainably. Areas that are regarded as crucial to maintain healthy water resources include wetlands, streams, as well as the overall catchment of a river system.

In order to better manage our water resources, several guidelines and research sources have been developed. Amongst these are the National Freshwater Ecosystem Priority Areas for South Africa 2011 (NFEPA).

It is well known that quarry mining operations have several detrimental impacts on the environment. These impacts are numerous, but the most pronounced impacts are associated with the excavation of large amounts of earth materials, the storage and disposal thereof and the sedimentation associated with it, especially where mining takes place near watercourses. This usually causes degradation of waterways due to sedimentation, as well as the transformation of the vegetation and ecosystem on the site.

The expansion of the existing mining right area is situated immediately to the south of the small town of De Aar (Appendix A: Map 1). The existing mining operations have a footprint of approximately 50 hectares, which will now be increased to approximately 100 hectares, essentially doubling the current footprint. The footprint of the current mining area is therefore already transformed, while the proposed expansion area will consist of surrounding natural areas which contain varying degrees of disturbance associated with the proximity of the mining area and associated activities. The site forms part of an arid region and consequently watercourses are limited to ephemeral systems. The surroundings do not contain any prominent watercourses, though smaller drainage lines are situated on and around the site and

form part of the catchment of the Brak- and Elands River systems, forming the main drainage systems in this region. The proposed expansion of the mining area will also have to take into account its effect on this drainage system and implement comprehensive mitigation in order to minimise its impact on both the drainage and the downstream system (Appendix A: Map 3).

A site visit was conducted on 18 June 2025. The entire footprint of the Mining Right (MR) expansion and immediate surroundings were surveyed. A detailed survey of the terrestrial vegetation on and around the site and watercourses which will be affected by the MR expansion was undertaken. The survey was conducted during mid-winter after recent rainfall and the plant identification on the site was considered sufficient, though given the arid climate of the region, it is likely that several plant species were overlooked.

For the above reasons it is necessary to conduct an ecological and wetland assessment of the area proposed for the MR expansion.

The report together with its recommendations and mitigation measures should be used to minimise the impact of the proposed development.

1.2 The value of biodiversity

The diversity of life forms and their interaction with each other and the environment has made Earth a uniquely habitable place for humans. Biodiversity sustains human livelihoods and life itself. Although our dependence on biodiversity has become less tangible and apparent, it remains critically important.

The balancing of atmospheric gases through photosynthesis and carbon sequestration is reliant on biodiversity, while an estimated 40% of the global economy is based on biological products and processes.

Biodiversity is the basis of innumerable environmental services that keep us and the natural environment alive. These services range from the provision of clean water and watershed services to the recycling of nutrients and pollution. These ecosystem services include:

- Soil formation and maintenance of soil fertility.
- Primary production through photosynthesis as the supportive foundation for all life.
- Provision of food, fuel and fibre.
- Provision of shelter and building materials.
- Regulation of water flows and the maintenance of water quality.
- Regulation and purification of atmospheric gases.
- Moderation of climate and weather.
- Detoxification and decomposition of wastes.
- Pollination of plants, including many crops.
- Control of pests and diseases.
- Maintenance of genetic resources.

1.3 Value of wetlands and watercourses

Freshwater ecosystems provide valuable natural resources, which contribute toward economic, aesthetic, spiritual, cultural and many recreational values. Yet, the integrity of freshwater ecosystems in South Africa has been rapidly declining in recent times. This crisis is largely a

consequence of a variety of challenges that are practical (managing vast areas of land to maintain connectivity among freshwater ecosystems), socio-economic (the need to utilise these resources among different stakeholders, i.e. individuals, communities, corporate and industrial) and institutional (implementing appropriate governance and management). Water affects every activity and aspiration of human society and sustains all ecosystems.

Freshwater ecosystems provide many of our fundamental needs, enable important regulating ecosystem services, support functional faunal and floral communities:

- Water for drinking and irrigation.
- Food, such as fish and water plants.
- Building material, such as clay and reeds.
- Preventing floods and easing the impacts of droughts.
- Removing excess nutrients and toxic substances from water.
- Rivers, wetlands and groundwater systems maintain water supplies and buffer the effects of storms, reducing the loss of life and property to floods.
- Riverbanks help to trap sediments, stabilise riverbanks and break down pollutants draining from the surrounding land.

1.4 Details and expertise of specialist

DPR Ecologists and Environmental Services (Pty.) Ltd.
Darius van Rensburg *Pr. Sci. Nat.*
61 Topsy Smith Street
Langenhoven Park
Bloemfontein
9300
Tel: 083 410 0770
darius@dprecologists.co.za

Professional registration:
South African Council for Natural Scientific Professions No. (400284/13) (Ecological Science).

Membership with relevant societies and associations:

- South African Society of Aquatic Scientists (SASAQS0091)
- South African Association of Botanists
- South African Wetlands Society (3SLY4IG4)

Expertise:

- Qualifications: B.Sc. (Hons) Botany (2008), M.Sc. in Vegetation Ecology (2012) with focus on ephemeral watercourses.
- Vegetation ecologist with over 10 years of experience in conducting ecological assessments. Founded DPR Ecologists & Environmental Services (Pty.) Ltd. in 2016.
- Has conducted over 200 ecological and wetland assessments for various developments.
- Regularly attends conferences and courses in order to stay up to date with current methods and trends:

2017: Kimberley Biodiversity Symposium.
2018: South African Association of Botanists annual conference.
2018: National Wetland Indaba Conference.
2019: SASS5 Aquatic Biomonitoring Training.
2019: Society for Ecological Restoration World Congress 2019.
2019: Wetland rehabilitation: SER 2019 training course.
2020: Tools For Wetlands (TFW) training course.
2022: National Wetland Indaba Conference.

2. SCOPE AND LIMITATIONS

- To evaluate the present state of the vegetation and ecological functioning of the area proposed for the MR expansion.
- To identify possible negative impacts that could be caused by the proposed clearing of vegetation and construction of the MR expansion.
    - Severity relates to the nature of the event, aspect or impact to the environment and describes how severely the aspects may impact on the ecosystem.
    - Duration refers to the amount of time that the environment will be affected by the event, risk or impact, if no intervention e.g. remedial action takes place.
    - Extent refers to the spatial influence of an impact.
    - Frequency refers to how often the specific activity, related to the event, aspect or impact, is undertaken.
    - Probability refers to how often the activity/event or aspect may have an impact on the environment.
- To provide a description of watercourses, wetlands and riparian vegetation included within the study area.
- To identify watercourses, including rivers, streams, pans and wetlands and determine the presence of wetland conditions within these systems.
- Where wetland conditions have been identified, the classification of the wetland system will be given.
- To evaluate the present state of the wetlands and riparian vegetation in close proximity to the site. The importance of the ecological function and condition will also be assessed.
- To determine the Present Ecological State (PES) and Ecological Importance & Sensitivity (EIS) for the watercourses in close proximity to construction.
- To conduct a risk assessment and determine the likelihood that watercourses and wetlands will be adversely affected by the development.

2.1 Vegetation

Aspects of the vegetation that will be assessed include:

- The vegetation types of the region with their relevance to the proposed site.
- The overall status of the vegetation on site.
- Species composition with the emphasis on dominant-, rare- and endangered species.

The amount of disturbance present on the site assessed according to:

- The number of grazing impacts.
- Disturbance caused by human impacts.
- Other disturbances.

2.2 Fauna

Aspects of the fauna that will be assessed include:

- A basic survey of the fauna occurring in the region using visual observations of species, as well as evidence of their occurrence in the region (burrows, excavations, animal tracks, etc.).

- The overall condition of the habitat.

2.3 Wetlands and watercourses

Aspects of the wetlands that will be assessed include:

- Identification and delineation of watercourses, including rivers, streams, pans and wetlands.
- Determining the presence of wetland conditions and riparian vegetation using obligate wetland and riparian species.
- Describing watercourses and wetlands and their importance relative to the larger system.
- Conducting habitat integrity assessment of perennial systems to inform the condition and status of watercourses.

2.4 Limitations

- Some geophytic or succulent species may have been overlooked due to a specific flowering time or cryptic nature.
- Given the aridity of the region, dormancy in many plant species limits identification and it is possible that species of conservation importance were overlooked or absent at the time of the survey.
- Although a comprehensive survey of the site was done, it is still likely that several species were overlooked.
- Due to time constraints, only limited soil sampling could be done.
- Smaller drainage lines may have been overlooked where a distinct channel or riparian vegetation is absent.
- Some animal species may not have been observed as a result of their nocturnal and/or shy habits.

3. METHODOLOGY

3.1 Several literature works were used for additional information.

General ecology:

- Red Data List (Raymondo *et al.* 2009).
- Vegetation types (Mucina & Rutherford 2006).
- NBA 2018: South African Inventory of Inland Aquatic Ecosystems (SAIIAE).
- NBA 2018 Technical Report: Inland Aquatic (Freshwater) Realm.
- NBA 2018 Technical Report Volume 1: Terrestrial Realm.
- National Freshwater Ecosystem Priority Areas 2011 (NFEPA).
- Strategic Water Source Areas 2018 (SWSA).
- SANBI (2011): List of threatened ecosystems.
- NEM:BA: List of threatened ecosystems and Threatened Or Protected Species (TOPS).
- Northern Cape Nature Conservation Act No. 9 of 2009.
- Northern Cape Critical Biodiversity Areas Plan (2016).

Vegetation:

- Red Data List (Raymondo *et al.* 2009).
- Vegetation types (Mucina & Rutherford 2006).
- Field guides used for species identification (Adams 1976, Bromilow 1995, 2010, Bruyns 2005, Court 2010, Coates-Palgrave 2002, Fish *et al.* 2015, Gerber *et al.* 2004, Gibbs-Russell *et al.* 1990, Griffiths & Picker 2015, Hartmann 2017, Manning 2009, Moller & Becker 2019, Roberts & Fourie 1975, Shearing & Van Heerden 2008, Smith *et al.* 1998, Smith & Crouch 2009, Smith & Van Wyk 2003, Van Ginkel & Cilliers 2020, Van Ginkel *et al.* 2011, Van Oudtshoorn 2004, Van Rooyen & Van Rooyen 2019).

Terrestrial fauna:

- Field guides for species identification (Smithers 1983, Child *et al.* 2016, Cillié 2018).

Wetland methodology, delineation and identification:
Department of Water Affairs and Forestry 2004, 2005, 2008, Collins 2006, Duthie 1999, Kleynhans *et al.* 2008, Marnewecke & Kotze 1999, Macfarlane, Ollis & Kotze 2020, Ollis *et al.* 2013, Nel *et al.* 2011, SANBI 2009.

3.2 Site Sensitivity Verification

EIA Screening Tool: The EIA Screening Tool which provides a general indication of elements of sensitivity that may occur in a development area was utilised during the assessment for the following aspects:

- Animal species – A high and medium sensitivity for Ludwig's Bustard (*Neotis ludwigii*) is indicated for the site. However, as with the mammals of higher conservation value, this species is confined to habitats in good condition and avoids areas of high disturbance. Suitable habitat is still present in portions of the site, however, mining operations, railway lines and overhead powerlines will result in a decrease in likelihood

that the species will still occur on the site and the verified likelihood is therefore considered as Moderate (See Section 4.2).

- Aquatic biodiversity – A very high sensitivity is indicated for the northern portion of the site, as it forms part of the catchment of the Brak River, a NFEPA listed watercourse. The river is however located approximately 15 km north of the site. However, a small drainage line, forming a tributary of the river, originates in the northern portion of the site and the verified site sensitivity should still be regarded as at least High (See Section 4.3) (Appendix A: Map 3).

- Plant species – A low sensitivity is indicated for endangered plant species occurring on the site. The site survey has indicated the presence of several protected plant species, they are all fairly widespread though, none are listed as endangered, and it is considered unlikely that an endangered plant species would occur on the site. A verified low sensitivity is therefore confirmed for the site (See Section 4.1) (Appendix B).

- Terrestrial biodiversity – The development area is listed as Low and Very High Sensitivity. The area of Very High Sensitivity consists of the catchment of the Brak River, which is listed as an NFEPA watercourse. The site survey has indicated the presence of two small drainage lines forming tributaries of this river and the verified sensitivity, at least for these drainage systems, should be regarded as High (See Section 4.1 and 4.3) (Appendix A: Map 2).

3.3 Survey

The site was assessed by means of transects and sample plots. Observation w.r.t. the general ecology of the area includes:

- Noted species include rare and dominant species.
- The broad vegetation types present at the site were determined.
- The state of the environment was assessed in terms of condition, grazing impacts, disturbance by humans, erosion and presence of invader and exotic species.
- The state of the habitat was also assessed.

Ecological aspects surveyed and recorded include:

- The overall ecology of the area, including the diversity of species, uniformity or diversity of habitats and different vegetation communities.
- Identification and delineation of distinct vegetation communities and habitats and the ecological drivers responsible for these distinct communities, i.e. soil, geology, topography, aspect, etc.
- A comprehensive plant species survey, including the identification of protected, rare or threatened species.
- Any ecological process or function which is important to the ecosystem, including ecological drivers, such as fire, frost, grazing, browsing, etc. and any changes to these processes.

Animal species were also noted, as well as the probability of other species occurring on or near the site according to their distribution areas and habitat requirements.

The state of the habitat was also assessed.

In order to provide a visually representative overview of the results obtained from the survey, site sensitivity mapping will also be done. This should indicate the relative importance of different ecological elements on the site as obtained from the survey. In general, these levels of sensitivity will include:

- Low Sensitivity – normally confined to areas that are completely transformed from the natural condition or degraded to such an extent that they are no longer representative of the natural ecosystem. Such areas will also no longer contain any ecological processes of importance relative to the surrounding areas. However, in some instances, such as watercourses which are completely transformed but still provide important ecological functions, a low level of sensitivity will not apply.

- Moderate Sensitivity – normally applicable to areas that are still natural and therefore do still have some ecological importance but which do not contain elements of high conservation value and are not essential to the continued functioning of surrounding areas. Areas of Moderate Sensitivity usually require some mitigation but can be developed without resulting in high impacts.

- High Sensitivity – areas of high sensitivity contain one or more ecological elements which are considered of high conservation value. Such areas are normally preferred to be excluded from a development but where this is not possible, will require comprehensive mitigation and are also likely to result in high impacts.

- Very High Sensitivity – these areas are critical to the continued functioning of the ecosystem on and around the site. Development of such areas normally represent a fatal flaw and should be excluded from development. No manner of mitigation is able to decrease the anticipated impact in these areas.

All rivers, streams, pans and wetlands were identified and surveyed where they occurred in the study area. These systems were determined by use of topography (land form and drainage pattern) and riparian vegetation with limited soil sampling (Appendix B & C). The following outlines the process applied during the on-site survey in order to obtain all required data:

- Perform desktop overview of the study area utilising available resources (Section 3.1). From the desktop overview identify the different landscape forms, possible wetland areas, watercourses and their relative flow patterns. Using this information, identify transects and sample plots for possible on-site survey. This should be both representative of the wetland or watercourse as a whole but should also include any prominent or significantly unique features.
- Possible sites identified during the desktop overview should be surveyed on-site. Where access is not possible or where desktop features are considered poor representatives of the wetland or watercourse, the survey site or transect should be moved to another location, without compromising a comprehensive overview of the system.
- Where a lateral transect is taken of a watercourse, this is done from the water's edge, across the marginal, lower and upper zones and extended across the floodplain until the edge of the riparian zone is reached.

- Where a transect is taken of a wetland system, this should preferably be taken across the entire wetland at its widest part or where it is most relevant to the proposed development, from the terrestrial surroundings, across the temporary, seasonal and perennial zones across the wetland.
- Soil samples are taken at 10 metres intervals along the survey transect, or where a distinct transition into a different zone is observed.
- A survey of the plant species within each distinct riparian or wetland zone is undertaken and includes the identification of obligate wetland species, riparian species, terrestrial species, exotic species and the general species composition and vegetation structure, which allows for an accurate description of the watercourse or wetland.
- Visual survey of the general topography, which substantiates the presence of riparian zones and wetland forms.
- Other general observations include any impacts observed, the overall ecosystem function, presence of fauna, surrounding land uses and the overall condition of the watercourse or wetland.
- Data is recorded by means of photographs with GPS coordinates taken at all relevant soil sampling sites and borders of riparian and wetland zones.

Data obtained during the on-site survey is utilised to provide the following information on the system:

- Desktop overview and assimilation of information on the likely impacts and functioning of the wetland system.
    - Review all available spatial data and resources in order to provide an estimate of the likely impacts and condition of the wetland or watercourse system.
- Confirm the presence of the wetland or watercourse system and provide an estimate of its borders.
    - The border of wetland conditions or the edge of the riparian zone will be confirmed by using soil sampling, obligate wetland vegetation and topography. This will also include the delineation of any temporary, seasonal or perennial zones of wetness along wetlands and the marginal, lower, upper and riparian zones along watercourses.
- Provide a description of the wetland or watercourse.
    - Provide the hydrogeomorphic setting of the wetland, a longitudinal profile which will aid in determining the erodibility of the wetland and provide an overall description of the wetland and impacts affecting it.
    - Provide a general description of the lateral zonation of the watercourse banks, including the marginal, lower, upper and riparian zones and a description of the riparian vegetation along the banks of the watercourse. This will also include the description of any impacts or modification of the watercourse.
- Assess the current condition of the wetland or watercourse.
    - Utilising information obtained from the assessments listed above, determine the condition of this portion of the wetland by applying the WET-Health 2 tool.
    - Utilising information obtained from the assessments listed above, determine the condition of the relevant section of the watercourse by applying the Index of Habitat Integrity (IHI) tool.
- Utilising all of the information obtained from the assessment, provide recommendations to mitigate anticipated impacts that the development will have.

The following guidelines and frameworks were also used to determine the presence of the rivers, streams, pans and wetlands in the study area:

- Department of Water Affairs and Forestry. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas. Edition 1. Department of Water Affairs and Forestry, Pretoria.
- Marnewecke & Kotze 1999. Appendix W6: Guidelines for delineation of wetland boundary and wetland zones. In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

The following guidelines and frameworks were used to determine the sensitivity or importance of these identified watercourses or wetlands in the study area:

- Nel *et al.* 2011. Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

- Government of South Africa. 2008. National Protected Area Expansion Strategy for South Africa 2008: Priorities for expanding the protected area network for ecological sustainability and climate change adaptation. Government of South Africa, Pretoria.

- Duthie, A. 1999. Appendix W5: IER (floodplain and wetlands) determining the Ecological Importance and Sensitivity (EIS) and Ecological Management Class (EMC). In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

These guidelines provide the characteristics which can be utilised to determine if a wetland or watercourse is present and also aid in determining the boundary of these systems.

The following were utilised to inform the condition and status of watercourses:

- Kleynhans, C.J., Louw, M.D. & Graham, M. 2008. Module G: EcoClassification and EcoStatus determination in River EcoClassification: Index of Habitat Integrity. Joint Water Research Commission and Department of Water Affairs and Forestry report. WRC Report No. TT 377-08.

The following were utilised to inform the condition and status of wetlands:

- Macfarlane, D.M., Ollis, D.J. & Kotze, D.C. 2020. WET-Health (Version 2.0): a refined suite of tools for assessing the present ecological state of wetland ecosystems. WRC Report No. TT 820/20.

A Risk Assessment will be conducted for the proposed development in or near watercourses and wetlands in accordance with the Department of Water & Sanitation's requirements for risk assessment and the provisional Risk Assessment Matrix for Section 21(c) & (i) water use.

3.4 Criteria used to assess sites

The following criteria are also applied during the site survey to further inform the general sensitivity and conservation value of the site or specific elements on the site. These criteria are used to assess the site and determine the overall status of the environment.

3.4.1 Vegetation characteristics

Characteristics of the vegetation in its current state. The diversity of species, sensitivity of habitats and importance of the ecology as a whole.

Habitat diversity and species richness: normally a function of locality, habitat diversity and climatic conditions.
Scoring: Wide variety of species occupying a variety of niches – 1, Variety of species occupying a single niche – 2, Single species dominance over a large area containing a low diversity of species – 3.

Presence of rare and endangered species: The actual occurrence or potential occurrence of rare or endangered species.
Scoring: Occurrence actual or highly likely – 1, Occurrence possible – 2, Occurrence highly unlikely – 3.

Ecological function: All plant communities play a role in the ecosystem. The ecological importance of all areas can vary significantly though, e.g. wetlands, drainage lines, ecotones, etc.
Scoring: Ecological function critical for greater system – 1, Ecological function of medium importance – 2, No special ecological function (system will not fail if absent) – 3.

Degree of rarity/conservation value:
Scoring: Very rare and/or in pristine condition – 1, Fair to good condition and/or relatively rare – 2, Not rare, degraded and/or poorly conserved – 3.

3.4.2 Vegetation condition

The sites are compared to a benchmark site in a good to excellent condition. Vegetation management practices (e.g. grazing regime, fire, management, etc.) can have a marked impact on the condition of the vegetation.

Percentage ground cover: Ground cover is under normal and natural conditions a function of climate and biophysical characteristics. Under poor grazing management, ground cover is one of the first signs of vegetation degradation.
Scoring: Good to excellent – 1, Fair – 2, Poor – 3.

Vegetation structure: This is the ratio between trees, shrubs, sub-shrubs and grass layers. The ratio could be affected by grazing and browsing by animals.
Scoring: All layers still intact and showing specimens of all age classes – 1, Sub-shrubs and/or grass layers highly grazed, while tree layer still fairly intact (bush partly opened up) – 2, Mono-layered structure often dominated by a few unpalatable species (presence of barren patches notable) – 3.

Infestation with exotic weeds and invader plants or encroachers:
Scoring: No or very slight infestation levels by weeds and invaders – 1, Medium infestation by one or more species – 2, Several weed and invader species present and high occurrence of one or more species – 3.

Degree of grazing/browsing impact:
Scoring: No or very slight notable signs of browsing and/or grazing – 1, Some browse lines evident, shrubs show signs of browsing, grass layer grazed though still intact – 2, Clear browse line on trees, shrubs heavily pruned and grass layer almost absent – 3.

Signs of erosion: The formation of erosion scars can often give an indication of the severity and/or duration of vegetation degradation.
Scoring: No or very little sign of soil erosion – 1, Small erosion gullies present and/or evidence of slight sheet erosion – 2, Gully erosion well developed (medium to large dongas) and/or sheet erosion removed the topsoil over large areas – 3.

3.4.3 Faunal characteristics

Presence of rare and endangered species: The actual occurrence or potential occurrence of rare or endangered species on a proposed site plays a large role on the feasibility of a development. Depending on the status and provincial conservation policy, presence of a Red Data species or very unique and sensitive habitats can potentially be a fatal flaw.
Scoring: Occurrence actual or highly likely – 1, Occurrence possible – 2, Occurrence highly unlikely – 3.

3.5 Biodiversity sensitivity rating (BSR)

The total scores for the criteria discussed in section 3.3 were used to determine the biodiversity sensitivity ranking for the sites. On a scale of 0 – 30, five different classes are described to assess the biodiversity of the study area. The different classes are described in Table 1:

Table 1: Biodiversity sensitivity ranking

BSR	BSR general floral description	Floral score equating to BSR class
Totally Transformed (5)	Vegetation is totally transformed or in a highly degraded state, generally has a low level of species diversity, no species of concern and/or has a high level of invasive plants. The area has lost its inherent ecological function. The area has no conservation value and potential for successful rehabilitation is very low.	29 – 30
Advanced Degraded (4)	Vegetation is in an advanced state of degradation, has a low level of species diversity, no species of concern and/or has a high level of invasive plants. The area's ecological function is seriously hampered, has a very low conservation value and the potential for successful rehabilitation is low.	26 – 28
Degraded (3)	Vegetation is notably degraded, has a medium level of species diversity although no species of concern are present. Invasive plants are present but are still controllable. The area's ecological function is still intact but may be hampered by the current levels of degradation. Successful rehabilitation of the area is possible. The conservation value is regarded as low.	21 – 25
Good Condition (2)	The area is in a good condition although signs of disturbance are present. Species diversity is high and species of concern may be present. The ecological function is intact and very little rehabilitation is needed. The area is of medium conservation importance.	11 – 20
Sensitive/Pristine (1)	The vegetation is in a pristine or near pristine condition. Very few signs of disturbance other than those needed for successful management are present. The species diversity is very high with several species of concern known to be present. Ecological functioning is intact and the conservation importance is high.	0 - 10

4. ECOLOGICAL OVERVIEW OF THE SITE

For the purpose of this report the terrestrial ecology of the study area will first be discussed, followed by a discussion of the watercourses and wetland systems.

4.1 Overview of ecology and vegetation types

Refer to the list of species encountered on the site in Appendix B.

According to Mucina & Rutherford (2006) and utilising current mapping resources (National Biodiversity Assessment 2018) the site falls within Northern Upper Karoo (NKu 3) (Appendix A: Map 1). This vegetation type contains a varied topography with undulating plains, ridges, hills and uneven, rocky terrain, incised by a high number of small watercourses. This vegetation type is currently listed as being of Least Concern (LC) under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004) (Appendix A: Map 1). The vegetation type is not under sufficient development pressures to be considered a threatened ecosystem. This will also decrease the conservation value of remaining natural vegetation.

The Northern Cape Critical Biodiversity Areas Plan (2024) has recently been published and has identified areas which are essential to meeting conservation targets for specific vegetation types, i.e., Critical Biodiversity Areas. The site and surroundings are considered as transformed, mostly associated with existing mining areas, and Other Natural Areas (ONA) (Appendix A: Map 2). The site is therefore not considered as essential to meeting conservation targets for the area and therefore has a fairly low default conservation value. The area to the west of the site is however considered a Critical Biodiversity Area 2 (CBA 2), with the reason being given that it provides habitat to Endangered Ludwig's Bustard (*Neotis ludwigii*), a large, terrestrial bird species occurring in this arid region. The area designated as suitable habitat, is separated from the proposed site by a railway line and overhead powerlines, which are also likely to confine the birds to suitable areas to the west of the site, while the powerlines and mining activities will limit the occurrence of this species on the site itself.

The expansion of the existing mining right area is situated immediately to the south of the small town of De Aar (Appendix A: Map 1). The existing mining operations have a footprint of approximately 50 hectares, which will now be increased to approximately 100 hectares, essentially doubling the current footprint. The footprint of the current mining area is therefore already transformed, while the proposed expansion area will consist of surrounding natural areas which contain varying degrees of disturbance associated with the proximity of the mining area and associated activities. The site forms part of an arid region and consequently watercourses are limited to ephemeral systems. The surroundings do not contain any prominent watercourses, though smaller drainage lines are situated on and around the site and form part of the catchment of the Brak- and Elands River systems, forming the main drainage systems in this region. The proposed expansion of the mining area will also have to take into account its effect on this drainage system and implement comprehensive mitigation in order to minimise its impact on both the drainage lines and the downstream system (Appendix A: Map 3).

Figure 1: View of the existing mining operations and proposed expansion (Google Earth 2023). The proposed expansion of the MR clearly contains extensive existing mining areas, but with some remaining natural vegetation present. Note also the railway to the west and gravel road to the east.

The footprint of the existing mining operations has been completely transformed from the natural conditions. This has also been confirmed by the current survey, as well as the National Biodiversity Assessment (2018) (Appendix A: Map 1). The existing mining operations are therefore largely irrelevant to this assessment. The areas identified for the proposed expansion of the MR to the west do however still consist of natural vegetation, though some disturbance was still noted in these areas. The area is dominated by undulating plains, with low ridges and containing several small drainage lines transecting it. This results in a moderate diversity of habitat, which includes low ridges, rocky and sandy habitats and drainage lines supporting a low but dense riparian vegetation layer. As a result of the moderate habitat diversity, the area also contains a moderate species diversity, which includes scant dwarf karroid shrubs, grasses, succulents and a denser riparian vegetation dominated by low shrubs and herbaceous species.


Figure 2: The landscape is dominated by a sparse grass layer and dwarf karroid vegetation which is still largely natural outside of the mining footprint.

As indicated, the footprint of the existing mining area is completely transformed from the natural condition, while the immediate surroundings, as well as the proposed expansion area, still consist of natural vegetation though with some disturbances also present. These modifications and disturbances also include:

- The mining operations area itself is completely transformed from the natural condition and any remaining vegetation consists of pioneer species and exotic weeds.
- Several internal dirt tracks contribute toward localised transformation.
- A railway line and overhead powerlines along the western border, as well as a large gravel road along the eastern and southern border, form artificial barriers, which will affect surface runoff patterns and faunal movement.
- Overgrazing and trampling by domestic livestock are evident, resulting in some disturbance of natural areas.

Figure 3: The existing mining operations are completely transformed and remaining vegetation is dominated by pioneer species and exotic weeds.

Figure 4: A railway line and numerous overhead powerlines along the western border result in localised transformation, which will also influence drainage patterns and movement of fauna.

Figure 5: Gravel roads along the eastern and southern borders of the site will also result in localised transformation. Note how this road also influences the natural runoff patterns as it forms an obstruction to flow.

As previously indicated, the topography of the site consists of undulating plains, with low ridges and a few small drainage lines draining from it. The slope is generally gentle, while the site is also situated on a catchment divide, with the northern portion draining northwards, while the southern portion drains to the south. The gentle slope of the site also generates a significant runoff, which leads to the formation of several drainage lines within the lower lying plains. One of these drainage lines is situated immediately to the south west of the site, while a very small drainage line also originates within the northern portion of the site, draining northwards (Appendix A: Map 3). These drainage lines incised into the landscape also contribute toward the diversity of topography and habitats. The topography of the existing mining area is heavily modified as a result of the current quarry, while the adjacent surroundings are still largely natural.

Figure 6: Topography of the area which consists of an undulating plain, with gentle slope (red arrow).

The region is characterised by an arid climate and receives on average between 200 and 300 mm annual rainfall with mean annual rainfall for De Aar being 248 mm. The average annual, daily temperature given for De Aar is 16°C. The highest average daily temperature occurs during January with an average of 24°C and the lowest average occurs during July with an average of 8°C.

The site lies within the Karoo Basin where geology is dominated by mudstone and sandstone rocks derived from marine sediments. These relatively soft sediments weather to form stony plains and flat or rounded hills. The site itself is situated within the lower lying plains dominated

by alluvial, sandy soils and is devoid of elevated hills and ridges. The surrounding landscape also includes dolerite capped ridges and mesas. The landscape thus comprises abrupt ridges and conical hills scattered across extensive sandy and silty plains. Vegetation in this landscape can be divided into montane shrubland on the dolerite capped hills and ridges, while the vast plains consist of dwarf shrubland, grassy dwarf shrubland and patches of succulent dwarf shrubland.

Figure 7: The landscape is dominated by vast plains with prominent mesas. The area can be regarded as a typical inselberg landscape.

In order to provide an overall description of the proposed MR expansion area, a detailed description of the vegetation will be provided. This will also aim to provide the condition of the terrestrial ecology at the site, while also indicating the presence of elements of conservation value where this will be relevant to the proposed expansion (Appendix A: Map 1 - 3).

The proposed expansion will occur to the west of the existing mining operations. The surroundings are still largely natural with few disturbances. Here vegetation is dominated by a range of growth forms, including sparse grasses, dwarf karroid shrubs and low, riparian shrubs along drainage lines. The sparse grass layer consists of *Stipgrostis uniplumis, Aristida congesta, Enneapogon cenchroides, Eragrostis lehmanniana, Eragrostis obtusa, Heteropogon contortus, Enneapogon desvauxii* and *Fingerhuthia africana*, which are natural to this vegetation type and indicate a largely intact vegetation layer. As indicated, dwarf karroid shrubs are also prominent and include species such as *Aptosimum spinescens, Pentzia incana, Pegolettia retrofracta, Helichrysum zeyheri, Eriocephalus ericoides, Asparagus suaveolens, Amphiglossa triflora, Melolobium candicans, Barleria rigida, Gnidia polycephala, Wahlenbergia nodosa, Rosenia oppostifiolia* and *Roepera lichtensteiniana*. Species diversity on the site is significant due to a variety of micro-habitats, though is still considered as moderate. As a result, a variety of different growth forms is present, including herbaceous species such as *Limeum aethiopicum, Lotononis listii, Chascanum pinatifidum, Aptosimum indivisum* and *Sesamum triphyllum,* while geophytic species (plants with underground storage organs) are also abundant and include *Colchicum orienticapense, Moraea pallida, Freesia andersoniae, Babiana hypogaea* and *Brunsvigia radulosa*. Several of these geophytic species are also listed as protected and have a significant conservation value. Given the arid climate, sandy soils and surface stone, succulent species are also abundant and include *Ruschia intricata, Euphorbia catveriflora, Hereroa concava* and *Mestoklema tuberosum*. These are all listed as protected within the Northern Cape, while some are also considered to be uncommon, and these

therefore also hold a high conservation value which will require significant mitigation. Where localised disturbance is higher, exotic weeds and pioneer species are also indicative of this disturbance. Such species include the exotic weed, *Bidens bipinnata* and pioneer herbs such as *Arctotis venusta* and *Chrysocoma ciliata,* while annual pioneer grasses also include *Aristida congesta*. The vegetation along the drainage line to the south west of the site and originating in the northern portion of the site, contains a denser vegetation layer, also containing several low riparian shrubs. These low shrubs include *Lycium cinerium, Galenia africana* and *Salsola aphylla.* A more detailed description of this riparian vegetation composition will however be provided in the wetland assessment section of the report (See Section 4.3).

As indicated, several of the succulent and geophytic species occurring on the site are also regarded as protected within the Northern Cape Province (Appendix B). These include *Colchicum orienticapense, Freesia andersoniae, Babiana hypogaea, Brunsvigia radulosa, Ruschia intricata, Euphorbia catveriflora, Hereroa concava* and *Mestoklema tuberosum.* Where the development will affect any of these, the necessary permits will have to be obtained. Most of these species are fairly common, widespread and abundant and, with the necessary permits, can simply be removed. However, several are uncommon, localised species and at least a fair portion of affected plants should be transplanted to adjacent areas where they will remain unaffected. These species include *Colchicum orienticapense, Freesia andersoniae, Babiana hypogaea, Brunsvigia radulosa, Euphorbia caterviflora* and *Hereroa concava.* These geophytic and succulent species are easily transplanted with a high success rate.

From the description of the vegetation composition, the existing mining operations can be considered as completely transformed and no longer contain any elements of conservation importance, while the surrounding areas which will be affected by the proposed expansion seem to be largely intact and in a fairly good condition (Appendix A: Map 1). Disturbances are present but considered indicative of only low levels of disturbance. The species diversity is moderate, although the area does also contain a significant number of protected plant species which will contribute towards its conservation value (Appendix B). Areas affected by the existing mining operations would therefore be considered to be of Low Sensitivity, while the remaining natural expansion areas to the west and centre of the site would be considered to be of Moderate Sensitivity (Appendix A: Map 3).

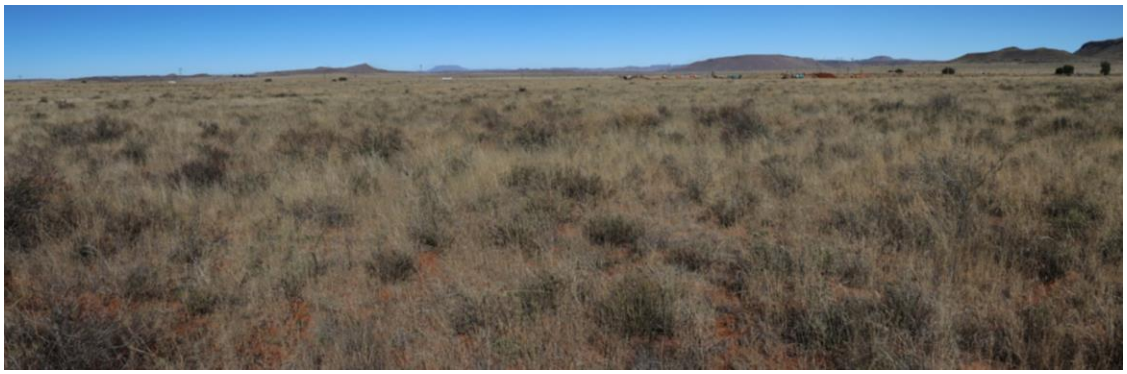


Figure 8: The vegetation composition on the site is dominated by a sparse grass layer and prominent dwarf karroid shrub component, which is natural for this vegetation type in this arid region.

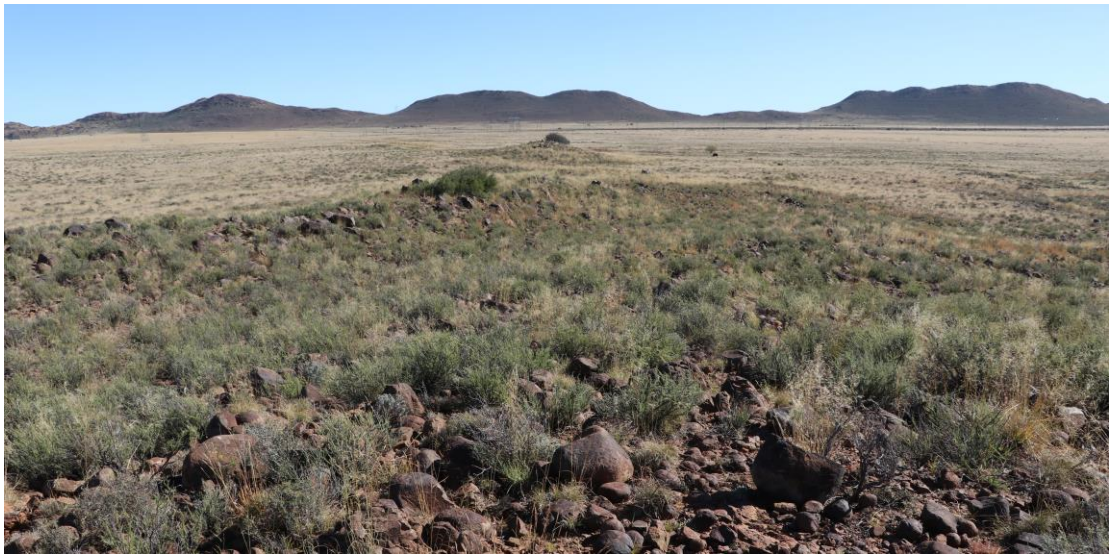


Figure 9: Where low ridges occur on the site, exposed rocky habitats are more abundant, further increasing the habitat diversity on the site.

Figure 10: Protected species occurring on the site which are considered to have a higher conservation value include, clockwise from top left: *Brunsvigia radulosa, Hereroa concava, Colchicum orienticapense, Freesia andersoniae, Euphorbia caterviflora, Hypogaea hypogaea.*

Conclusions

From the description of the vegetation on the site and proposed expansion areas, the existing mining area is completely transformed, while surrounding areas consist of natural vegetation

which is still in a fairly good condition (Appendix A: Map 1). Signs of disturbance are present but are indicative of only low levels of disturbance. The species diversity is moderate, although the area does also contain a significant number of protected plant species which will contribute towards its conservation value (Appendix B). The areas of expansion therefore still contain elements of significant conservation value, which include protected plant species and drainage lines adjacent to and on the site (Appendix A: Map 3). Significant mitigation will therefore have to be implemented to ensure the impact on these elements of significant conservation value is decreased.

Mitigation as indicated in the previous paragraph should include the following (Appendix A: Map 1 - 3):

- Numerous protected plant species have been identified in the proposed expansion areas (Appendix B). Where clearing of vegetation is required and the development will affect any of these species, the necessary permits will have to be obtained. Most of these species are fairly common, widespread and abundant and, with the necessary permits, can simply be removed. However, several are uncommon, localised species and at least a fair portion of affected plants should be transplanted to adjacent areas where they will remain unaffected. These species include *Colchicum sp., Colchicum orienticapense, Freesia andersoniae, Babiana hypogaea, Brunsvigia radulosa, Euphorbia caterviflora* and *Hereroa concava*

- A drainage line is situated immediately to the south west of the site, while another small drainage line also originates in the northern portion of the site, draining northwards (Appendix A: Map 3). These are very small drainage systems, but still form defined watercourses, also forming part of the Elands Spruit and Brak River systems. These drainage lines will therefore both still have a high conservation value. Therefore, though they are very small drainage lines, the proposed expansion should ensure that the impact on the downstream system is prevented and both drainage lines excluded from future mining operations. This should be easily attainable, given the location of these drainage lines and the proposed future mining operations. These drainage lines will be discussed in detail within the wetland assessment section.

4.2 Overview of terrestrial fauna (actual & possible)

Tracks and signs of mammals are still abundant on and around the site. It is however considered highly likely that the mammal population has been affected by the ongoing mining operations on the site. As a result, it is considered unlikely that species of conservational importance will occur on and around the site. The mammal population is therefore anticipated to be dominated by generalist species which are better adapted to these disturbed areas, associated with mining activities. In addition, mammal species which are rare and endangered are often habitat specific and sensitive to habitat change. It is therefore considered unlikely that such species would occur on the site. Extensive natural areas to the east, south and west of the site should provide adequate habitat and the mammal population will still be largely natural there. It is also considered likely that the area will also contain several other mammal species, but these were not observed on the site.

The mammal survey of the site was conducted by means of active searching and recording any tracks or signs of mammals and actual observations of mammals. It is also considered likely

that the area will also contain several other mammal species, but these were not observed on the site. From the survey the following actual observations of mammals were recorded:

- Spoor of a small antelope, most likely Steenbok (*Raphicerus campestris*) was observed on the site. This is a small antelope, that is common in natural areas and not dependent on pristine habitat.
- Porcupine (*Hystrix africaeaustralis*) are common on the site and visible through scat, spoor, quills and excavations. It is a very common species anticipated to occur in this region.
- Common Molerat (*Cryptomys hottentottus*) are abundant on the site. This is a common species, well adapted to disturbed environments.

These species identified on the site indicate a significant mammal population still remains, although dominated by widespread and generalist species. Given the disturbance and proximity of mining areas and human activities, it is also considered unlikely that species of high conservation value would still remain.

Mammal species likely to occur on the site have been determined by means of FitzPatrick Institute of African Ornithology (2021).

Table 2: Red Listed mammals previously recorded in the surrounding region (Child *et al* 2016).

Scientific name	Common name	Status
Pelea capreolus	Vaal Rhebok	**Near Threatened**
Equus quagga	Plains Zebra	**Near Threatened**
Hyaena brunnea	Brown Hyena	**Near Threatened**
Parotomys littledalei	Littledale's Whistling Rat	**Near Threatened**
Felis nigripes	Black-footed Cat	**Vulnerable**

The survey and available literature (Table 3) have indicated that the mammal population in the area will consist largely of widespread, generalist species. There is however still some likelihood that species of conservation value may occur in the surroundings. Especially smaller mammals (Black-footed Cat) and far roaming mammals (Brown Hyena) are still likely to be present. However, these species are shy, reclusive and avoid urban areas. They are also dependent on habitat in good condition and are therefore highly unlikely to occur on and around the site.

A further note should be made of Ludwig's Bustard (*Leonotis ludwigii*), which is a large terrestrial bird of high conservation value. Remaining natural vegetation on the site does seem to be suitable for this species, which is also confirmed to occur in areas to the west of the site. However, given the ongoing mining operations on the site and the proximity of surrounding powerlines, the likelihood of the species occurring on the site is decreased. Therefore, habitat remains suitable, though only a moderate likelihood is anticipated for the species actually occurring on the site.

The impact that the proposed development will have, is mainly concerned with the loss of habitat and fragmentation of available habitat due to the development. Transformation of the natural vegetation on the site will result in a decrease in the population size as available habitat decreases. However, extensive natural areas still occur in the surrounding area and any mammals on the site are likely to vacate the site into these adjacent areas, should development take place. The extent of the proposed development is also small and the

associated impact that it would have on mammals would accordingly also be relatively low. Furthermore, the likelihood that any species of high conservation value would be affected is low and consequently, the overall impact on the mammal population is anticipated to remain low.

In order to ensure no direct impact on the mammals on the site occurs, the hunting, capturing or trapping of mammals on the site should be strictly prohibited during operation of the mining development.

Table 3: Likely mammal species in the region (Mammalmap 2023).

Order	Scientific name	Common name	Status
Bovidae	*Antidorcas marsupialis*	Springbok	Least Concern
	Damaliscus pygargus phillipsi	Blesbok	Least Concern
	Oryx gazella	Gemsbok	Least Concern
	Pelea capreolus	Vaal Rhebok	Near Threatened
	Raphicerus campestris	Steenbok	Least Concern
Canidae	*Canis mesomelas*	Black-backed Jackal	Least Concern
	Otocyon megalotis	Bat-eared Fox	Least Concern
Cercopithecidae	*Papio ursinus*	Chacma Baboon	Least Concern
Equidae	*Equus quagga*	Plains Zebra	Near Threatened
Felidae	*Caracal caracal*	Caracal	Least Concern
	Felis nigripes	Black-footed Cat	Vulnerable
	Felis silvestris	Wildcat	Least Concern
Herpestidae	*Cynictis penicillata*	Yellow Mongoose	Least Concern
	Herpestes pulverulentus	Cape Gray Mongoose	Least Concern
	Suricata suricatta	Meerkat	Least Concern
Hyaenidae	*Hyaena brunnea*	Brown Hyena	Near Threatened
	Proteles cristata	Aardwolf	Least Concern
Leporidae	*Lepus saxatilis*	Scrub Hare	Least Concern
	Pronolagus rupestris	Smith's Red Rock Hare	Least Concern
Macroscelididae	*Elephantulus edwardii*	Cape Elephant Shrew	Least Concern
	Elephantulus rupestris	Western Rock Elephant Shrew	Least Concern
	Macroscelides proboscideus	Short-eared Elephant Shrew	Least Concern
Muridae	*Aethomys granti*	Grant's Rock Mouse	Least Concern
	Aethomys namaquensis	Namaqua Rock Mouse	Least Concern
	Otomys unisulcatus	Karoo Bush Rat	Least Concern
	Parotomys littledalei	Littledale's Whistling Rat	Near Threatened
	Rhabdomys pumilio	Xeric Four-striped Grass Rat	Least Concern
Mustelidae	*Ictonyx striatus*	Striped Polecat	Least Concern

Orycteropodidae	*Orycteropus afer*	Aardvark	Least Concern
Procaviidae	*Procavia capensis capensis*	Cape Rock Hyrax	Least Concern
Sciuridae	*Sciurus carolinensis*	Eastern Grey Squirrel	Least Concern
	Xerus inauris	South African Ground Squirrel	Least Concern
Soricidae	*Crocidura sp.*	Shrews	
Viverridae	*Genetta genetta*	Common Genet	Least Concern

Figure 11: Tracks and signs of mammals identified on and around the site include, clockwise from top left; scat and quill of Porcupine (*Hystrix africaeaustralis*), soil mounds of Common Molerat (*Cryptomys hottentottus*) and spoor of Steenbok (*Raphicerus campestris*).

4.3 Wetland Assessment

4.3.1 Introduction

The surface water of the surrounding area contains two small drainage lines, being tributaries of the Elands Spruit and large Brak River systems. These river systems are not situated near the site, though do form part of the catchment of this system, while the two small drainage lines form tributaries of the Elands Spruit and Brak River and a residual impact in terms of the system is therefore still likely, should mining operations affect these small drainage lines on the site. The main focus of the assessment will therefore be on the two small drainage lines, likely to be affected by the mining operations.

One of these drainage lines is situated immediately to the south west of the site and borders on proposed mining activities (Appendix A: Map 3). The entire length of the drainage line is approximately 3.5 km, originating along the large hill to the west and flowing into the Elands Spruit approximately 6 km downstream of the site. The drainage line is however already affected by several impacts, and is being crossed by the existing railway line, which results in obstruction to its flow and concentrated flow patterns where culverts are situated within the drainage line. The drainage line also flows past the south western corner of the proposed mining expansion, which is therefore not anticipated to greatly increase the impact on it as it is not situated on the site itself and will therefore only be affected by indirect impacts associated with mining activities. The drainage line itself is quite small with a poorly defined channel, characterised by diffuse surface flow, though significant riparian vegetation is present. The drainage line is clearly ephemeral in terms of flow and will drain by means of flash floods only after heavy rainfall events.

The second drainage line originates and is situated in the northern portion of the proposed mining expansion area (Appendix A: Map 3). The drainage line originates along the low ridges on the site, draining northwards, where it dissipates into the lower lying plains. It does however still form a part of the catchment and drainage pattern of the Brak River and will therefore still play a role in terms of the surface drainage of the area. The drainage line is still largely intact and without significant modification, though being situated on the site itself, may likely be affected by the proposed expansion of mining operations. The drainage line can however easily be excluded from mining activities, limiting any impacts on it. The drainage line is quite small, but with a narrow, prominent channel which drains to the north. The drainage line is clearly ephemeral in terms of flow and will drain by means of flash floods only after heavy rainfall events.

The term watercourse refers to a river, stream, wetland or pan. The National Water Act (NWA, 1998) includes rivers, streams, pans and wetlands in the definition of the term watercourse. This definition is as follows:

Watercourse means:

- A river or spring.
- A natural channel in which water flows regularly or intermittently.
- A wetland, lake or dam into which water flows.
- Any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse, and a reference to a watercourse includes, where relevant, its bed and banks.

Riparian habitat is an accepted indicator of watercourses used to delineate the extent of wetlands, rivers, streams and pans (Department of Water Affairs and Forestry 2005).

The classification of stream orders from 1 to 3 can be illustrated by means of the Strahler 1952 classification (Figure 12). Both of the two small drainage lines likely to be affected by the mining operations are situated near their origin and are therefore first order drainage lines.

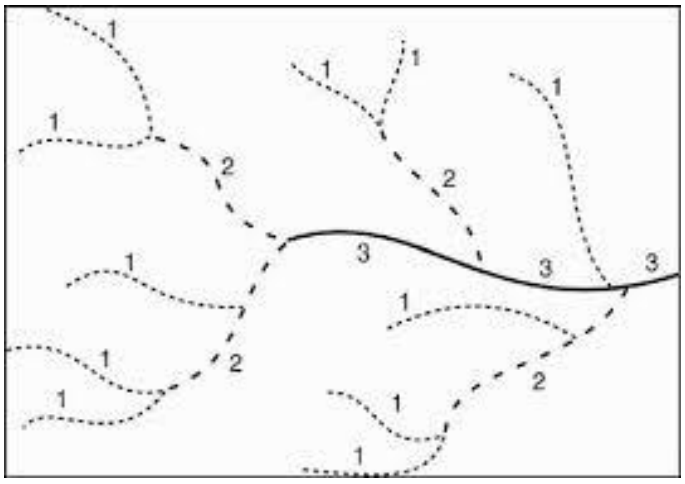


Figure 12: The classification of stream orders from 1 to 3 (Strahler 1952)

4.3.2 Wetland indicators

Riparian habitat is an accepted indicator of watercourses used to delineate the extent of wetlands, rivers, streams and pans (Department of Water Affairs and Forestry 2005).

Delineation of both of the small drainage lines likely to be affected by the mining expansion was done by a combination of topography (land form and drainage pattern) and riparian vegetation with limited soil sampling (Appendix C). Due to time constraints soil samples were only taken within sample points along the channel of the drainage lines in order to confirm the presence of wetland or riparian conditions. The following guidelines and frameworks were used to determine and delineate the drainage line system in the study area:

- Department of Water Affairs and Forestry. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas. Edition 1. Department of Water Affairs and Forestry, Pretoria.
- Marnewecke & Kotze 1999. Appendix W6: Guidelines for delineation of wetland boundary and wetland zones. In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

Obligate wetland vegetation was utilised to determine the presence and border of wetlands, while riparian vegetation was used to confirm the presence of a watercourse or floodplain. Soil samples were used to determine the border and also to confirm the presence of wetland soils along the small drainage lines affected by the mining expansion (Appendix C). Soil samples were investigated for the presence of anaerobic evidence which characterises wetland soils.

Both of these drainage lines are clearly natural drainage systems (Appendix A: Map 3). They are however completely devoid of any wetland conditions, both in terms of soils and vegetation.

Though the drainage lines do not contain any natural wetland conditions, they contain clear riparian conditions, containing a defined though very small channel and an abundance of riparian vegetation, which confirms that they must be regarded as natural watercourses. The proposed mining expansion will therefore have to ensure that both drainage lines are not affected by any storm water inflow from the site and are excluded from any mining activities.

Figure 13: Historical aerial images (Google Earth 2023) provide a good indication of the position of these two drainage lines and also confirm that they are part of the natural drainage pattern of the area.

The absence of wetland soil indicators was also confirmed by the absence of any obligate wetland vegetation, while an abundance of obligate riparian species confirms the presence of a watercourse. Unlike the delineation of wetland areas, where soil wetness indicators are the primary indicator, the identification of riparian areas relies heavily on vegetative indicators. Obligate riparian species occur almost exclusively in the riparian zone (> 90% probability). They are seldom found in non-riparian areas, but where they are outside of riparian areas, they still indicate wetness (DWAF 2008).

4.3.3 Classification of wetland systems

Both of the affected drainage lines are devoid of wetland conditions and can therefore not be placed within any of the defined wetland hydrogeomorphic units but can to some extent be regarded as a channel system:

Though devoid of wetland conditions, the drainage lines can, to some extent, be characterised as a channel system (SANBI 2009):

"An open conduit with clearly defined margins that (i) continuously or periodically contains flowing water, or (ii) forms a connecting link between two water bodies. Dominant water sources include concentrated surface flow from upstream channels and tributaries, diffuse surface flow or interflow, and/or groundwater flow. Water moves through the system as concentrated flow and usually exits as such but can exit as diffuse surface flow because of a sudden change in gradient. Unidirectional channel-contained horizontal flow characterises the

hydrodynamic nature of these units. Note that, for purposes of the classification system, channels generally refer to rivers or streams (including those that have been canalised) that are subject to concentrated flow on a continuous basis or periodically during flooding, as opposed to being characterised by diffuse flow (see unchannelled valley-bottom wetland). As a result of the erosive forces associated with concentrated flow, channels characteristically have relatively obvious active channel banks. An active channel is a channel that is inundated at sufficiently regular intervals to maintain channel form and keep the channel free of established terrestrial vegetation. These channels are typically filled to capacity during bank full discharge (i.e. during the annual flood, except for intermittent rivers that do not flood annually)."

Both drainage lines fit well within this description and contain a small channel, which may not be prominent, though concentrated, unidirectional flow clearly occurs along these drainage lines. These drainage lines can therefore be confirmed as natural watercourses (Appendix A: Map 3).

Figure 15: The two affected drainage lines are clearly very small, though a defined channel (red) is present, while riparian vegetation is also abundant along them.

4.2.4 Description of watercourses and wetlands

The proposed mining area expansion contains a small drainage line immediately to the south west of the site, with another small drainage line originating in the northern portion of the site itself and which may still be affected by the development (Appendix A: Map 3). A short description of these two drainage lines will be provided below.

Obligate wetland vegetation was used to determine the presence of wetland conditions. Obligate wetland species are confined to wetlands and are only able to occur in wetlands. They are therefore reliable indicators of wetland conditions. Field observations over time, as well as the following sources, were used to determine FW and OW species:

- Marnewecke, G. & Kotze, D. 1999. Appendix W6: Guidelines for delineation of wetland boundary and wetland zones. In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

- DWAF. 2008. Updated manual for the identification and delineation of wetlands and riparian areas, prepared by M.Rountree, A.L. Batchelor, J. MacKenzie and D. Hoare. Stream Flow Reduction Activities, Department of Water Affairs and Forestry, Pretoria, South Africa.

- Van Ginkel, C.E. & Cilliers, C.J. 2020. Aquatic and wetland plants of Southern Africa. Briza Publications, Pretoria.

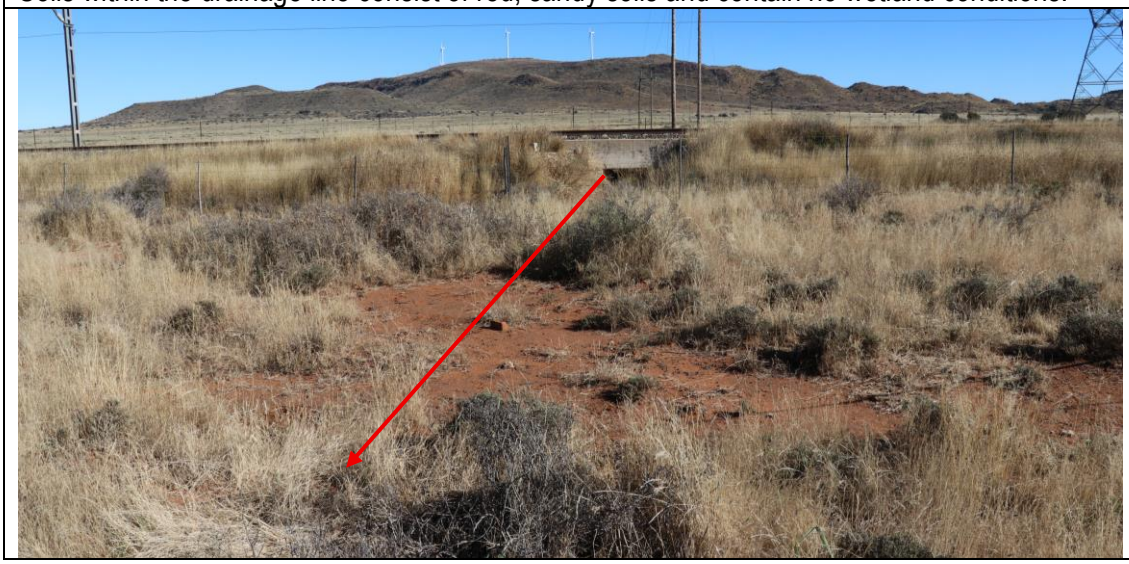
Table 4: Description of the individual watercourses and wetlands which form part of the study area (Appendix A: Map 3) (FW – Facultative wetland species, OW – Obligate wetland species, * - Exotic species).

Watercourse name:	**Coordinates of sampling:**	**Flow regime:**
#1 Drainage line – South west of the proposed site**.**	S 30.713016°, E 23.985917° S 30.714504°, E 23.985828°	Temporary/ Ephemeral
Description of watercourse: The drainage line is situated immediately to the south west of the area and may therefore still be affected by indirect impacts associated with mining operations. It contains a broad channel, following a largely diffuse flow pattern. Upstream of the railway line the drainage line is largely natural, though the downstream section is modified to some degree. The adjacent railway line crosses this drainage line and contains two large culverts to allow for continued flow. These culverts will however affect the natural flow regime of the drainage line where the railway line itself acts as a barrier to flow, while the culverts result in concentrated flow. Upstream of the railway line the drainage line is largely natural, though the downstream section is modified to some degree. The drainage line follows a diffuse flow pattern and a main channel is generally not well defined. The presence of culverts does magnify the presence of the drainage line, and coupled with riparian vegetation, confirms the presence of the drainage line. Soils within the channel are however completely devoid of wetland conditions and this drainage line only functions as an ephemeral watercourse which will flow for very short periods after heavy rainfall events. Riparian vegetation along the drainage line is dominated by a low but dense vegetation. Several of the low shrubs comprising the majority of this vegetation layer are well known to be obligate riparian species within this arid region and can reliably be used to confirm the presence of watercourses.		
Dominant plant species: Drainage line and riparian zone: *Enneapogon cenchroides, Eragrostis lehmanniana, Aristida congesta, Figerhuthia africana, Pentzia incana, Digitaria eriantha, Sporobolus fimbriatus, Eragrostis echnichloidea, Lycium cinerium, Eriocephalus ericoides, Galenia africana, Oxalis depressa, Mesembryanthemum coriarium, Eriocephalus spinescens, Salvia verbenaca, Hertia pallens, Salsola aphylla, *Argemone ochroleuca, Eragrostis truncata.*		
Protected plant species: *Oxalis depressa, Mesembryanthemum coriarium.*		

View of the delineated south western drainage line (red) situated adjacent to the site (yellow). Note that it follows a diffuse flow pattern, also being crossed by the existing railway line. A small upstream impoundment is also visible.

Soil samples:

Soils within the drainage line consist of red, sandy soils and contain no wetland conditions.



The drainage line follows a diffuse flow pattern, although the channel becomes magnified where it is crossed by the railway culverts.

Another view of the drainage line to the south west of the site. Note dense riparian vegetation associated with the drainage line.

Watercourse name:	**Coordinates of sampling:**	**Flow regime:**
#2 Drainage line – Northern portion of the proposed site**.**	S 30.713016°, E 23.985917° S 30.714504°, E 23.985828°	Temporary/ Ephemeral

Description of watercourse:

The drainage line originates in the northern portion of the proposed mining expansion area and can therefore potentially be directly affected by it. It is a very small drainage line, but with prominent and clearly defined channel. It originates on the low ridges situated on the site, flows northwards and dissipates into the surrounding plains to the north. It is largely natural, affected by very few, low magnitude impacts. It should be possible to easily exclude the drainage line from the proposed mining operations without affecting mining operations to a significant degree, nor having a large impact on the drainage line itself.

The drainage line has a concentrated flow on the site, having a clearly defined channel, while transitioning to a diffuse flow pattern upon reaching the plains to the north of the site. Riparian vegetation is present though not dominant, also indicating the small size of the drainage line. However, it still meets the definition of a watercourse: a natural channel in which water flows regularly or intermittently. Soils within the channel are however completely devoid of wetland conditions and this drainage line only functions as an ephemeral watercourse which will flow for very short periods after heavy rainfall events.

Riparian vegetation along the drainage line is present but does not dominate, while terrestrial vegetation is also present, indicating the small size of the drainage line. However, several of the low shrubs occurring along the drainage line are well known to be obligate riparian species within this arid region and can reliably be used to confirm the presence of watercourses.

Dominant plant species:

Drainage line and riparian zone: *Eragrostis lehmanniana, Aristida congesta, Fingerhuthia africana, Pentzia incana, Sporobolus fimbriatus, Eragrostis echnichloidea, Lycium cinerium, Eriocephalus ericoides, Salsola aphylla, *Bidens bipinnata, Arctotis venusta, Berkheya spinosissima.*

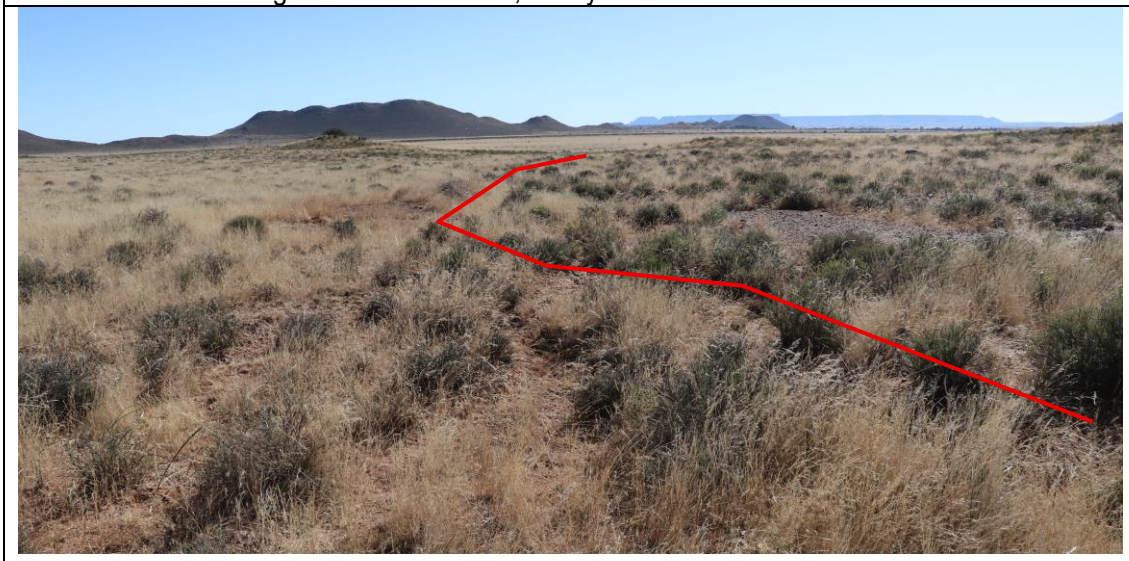
Protected plant species:

None observed.

View of the delineated northern drainage line (red) situated along the northern border of the site (yellow). It contains a clear channel but is very small and should be easily excluded from mining operations.

Soil samples:

Soils within the drainage line consist of red, sandy soils and contain no wetland conditions.



The northern drainage line is very small but contains a clear channel.

4.4 Risk Assessment

A Risk Assessment for the proposed mining area expansion which will affect two drainage lines respectively, has been undertaken according to the Department of Water & Sanitation's requirements for risk assessment and the provisional Risk Assessment Matrix for Section 21(c) & (i) water use (Appendix D). Activities likely to be associated with the mining operations and which will likely affect the two drainage lines are largely associated with mining in close proximity to these systems.

The anticipated activities as indicated above have also been confirmed to a large extent by previous studies. According to research concerning small scale mining, several impacts of similar mining operations occur and are likely to take place during these operations (Heath *et al.* 2004):

- Accelerated erosion of areas adjacent to workings that have been de-vegetated leads to increased suspended sediment loads in nearby streams and rivers.
- Excavation of flood terraces and riverbanks increases the instability of these riverbanks and enhances the likelihood of increased flood scouring.
- Excavation of river sediments exposes these sediments to oxidising conditions and enhances the solubility and release of any metal ions that may previously have been trapped as insoluble sulphides.
- Wind-blown dusts from unprotected tailings and waste rock dumps enter aquatic environment.

The proposed mining operations should completely exclude both these drainage lines and treat these systems as no-go areas (Appendix A: Map 3). Despite being excluded from mining operations, the following residual risks are still anticipated to occur:

- Should these drainage lines be excluded from mining activities, impacts on them should remain limited.
- Residual impacts are however still possible, but can be kept to a minimum, provided that adequate storm water management is implemented.
- The drainage lines are likely to be affected by residual impacts caused by the mining operations, largely as a result of increased sediment load. This can be managed through adequate mitigation, including storm water management measures and provided that adequate rehabilitation is undertaken, these operations should not have a long-term impact on them.
- Should these drainage lines be excluded from mining operations and adequate storm water management implemented, the anticipated risk should remain Low.

Low Risks: Acceptable as is or consider requirement for mitigation. Impact to watercourses and resource quality small and easily mitigated.

Mitigation as recommended should be implemented as far as possible.

For the complete risk assessment please refer to Appendix D.

Phases	Activity	Impact	Risk Rating	Confidence level	Control measures
Construction/ Operation/ Decommissioning	South western drainage line: mining and excavation of dolerite in close proximity to the drainage line	Mining will require removal of the vegetation layer in the catchment of the adjacent drainage line. This activity will not entail modification of the geomorphology but will nonetheless also entail erosion and increased sedimentation of the drainage line. Establishment of exotic weeds is likely due to disturbance caused by mining. The functioning of the drainage line is anticipated to remain largely intact.	**L**	**High**	This impact will be mainly during the operational phase but will only cease once rehabilitation has been completed and an indigenous vegetation layer has become established. This activity is anticipated to have a low risk of impact as long as adequate mitigation and comprehensive rehabilitation is adhered to. Measures must be implemented to minimise the amount of sediment entering the drainage line. A comprehensive storm water management system should be implemented. Comprehensive rehabilitation should be applied and should aim to re-instate the natural topography as far as possible and establish an indigenous vegetation layer.
Construction/ Operation/ Decommissioning	Northern drainage line: mining and excavation of dolerite in close proximity to the drainage line	Mining will require removal of the vegetation layer in the catchment of the adjacent drainage line. This activity will not entail modification of the geomorphology but will nonetheless also entail erosion and increased sedimentation of the drainage line. Establishment of exotic weeds is likely due to disturbance caused by mining. The functioning of the drainage line is anticipated to remain largely intact, but is subject to the mining operations completely excluding the drainage line from mining activities.	**L**	**High**	This impact will be mainly during the operational phase but will only cease once rehabilitation has been completed and an indigenous vegetation layer has become established. This activity is anticipated to have a low risk of impact as long as the drainage is completely excluded from mining activities and comprehensive rehabilitation is adhered to. Measures must be implemented to minimise the amount of sediment entering the drainage line. A comprehensive storm water management system should be implemented. Comprehensive rehabilitation should be applied and should aim to re-instate the natural topography as far as possible and establish an indigenous vegetation layer.

5. ANTICIPATED IMPACTS

Anticipated impacts that the development will have, are primarily concerned with the loss of habitat and species diversity but will also include impacts on the two drainage lines on and adjacent to the site (Appendix A: Map 1 - 3). The development consists of the existing mining operations and proposed expansion, and it is therefore anticipated that impacts will be similar during both the construction and operational phases.

The following impacts on the ecosystem, ecology and biodiversity will be assessed:

- Loss of vegetation and consequently habitat and species diversity as a result.
- Loss of protected, rare or threatened plant species.
- Impacts on watercourses, wetlands or the general catchment.
- The impact that the development will have on exotic weeds and invasive species, both current and anticipated conditions.
- Impacts resulting on the mammal population on and around the site.
- Any significant cumulative impacts that the development will contribute towards.

As indicated in previous sections, the existing mining operations have already transformed the area and in these areas impacts on the ecology are therefore irrelevant. However, the surrounding areas for the proposed expansion still consist of a natural vegetation layer (Appendix A: Map 1). Though disturbances are present, the habitat is therefore largely intact. The proposed expansion will therefore result in the loss of the habitat and vegetation. In terms of species diversity, species composition and uniqueness of the habitat, the site is considered to have a moderate conservation value. The overall loss of these aspects is therefore expected to have moderate values.

Loss of vegetation, habitat and species diversity

From the description of the vegetation in the surrounding areas which will be affected by the proposed expansion, it is clear that they seem to be largely intact and in a fairly good condition (Appendix A: Map 1). Disturbances are present but considered indicative of only low levels of disturbance. The species diversity is moderate, although the area does contain a significant number of protected plant species which will contribute towards its conservation value (Appendix B). The areas of expansion therefore still contain elements of significant conservation value which include protected plant species and two small drainage lines (Appendix A: Map 3). Significant mitigation will therefore have to be implemented to ensure the impact on these elements of significant conservation value is decreased. The impact of the loss of vegetation and species diversity is therefore considered to be moderate.

Loss of protected plant species

As indicated, several of the succulent and geophytic species occurring on the site are regarded as protected within the Northern Cape Province (Appendix B). These include *Colchicum orienticapense, Freesia andersoniae, Babiana hypogaea, Brunsvigia radulosa, Ruschia intricata, Euphorbia catveriflora, Hereroa concava* and *Mestoklema tuberosum.* Where clearing of vegetation is required and the development will affect any of these species, the necessary permits will have to be obtained. Most of these species are fairly common, widespread and abundant and, with the necessary permits, can simply be removed. However, several are

uncommon, localised species and at least a fair portion of affected plants should be transplanted to adjacent areas where they will remain unaffected. These species include *Colchicum sp., Colchicum orienticapense, Freesia andersoniae, Babiana hypogaea, Brunsvigia radulosa, Euphorbia caterviflora* and *Hereroa concava.* These geophytic and succulent species are easily transplanted with a high success rate. Should the mitigation as indicated above be implemented successfully, the anticipated impact will remain moderate.

Impacts on drainage systems and watercourses

The proposed expansion of the mining area will include two small drainage lines, one immediately to the south west and another within the northern portion of the site (Appendix A: Map 3). These drainage lines are very small, but form defined watercourses and any direct impacts on them will therefore be significant. It should however be possible to easily exclude both these drainage lines from the mining operations, in which case impacts will be limited to indirect impacts which can be further decreased, provided adequate mitigation is implemented. The required authorisations must also be lodged with the Department of Water and Sanitation (DWS) for the proposed expansion of the mining area and its impact on the associated drainage lines. Refer to the risk assessment (Section 4.4) for a more detailed discussion on the likely risks and impacts that the development will have on these drainage lines.

Impact of increased weed and invasive species establishment

Due to the removal of vegetation and disturbance of the soil surface, the proposed mining expansion will further increase the susceptibility for the establishment of weeds and invasive species. The development may also act as a distribution node for invasive species into the surrounding environment. It is therefore recommended that weed control be judiciously and continually practised. Monitoring of weed establishment should form a prominent part of management of the mining operations. Where category 1 and 2 weeds occur, they require removal by the property owner according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004. Unmitigated this is anticipated to be at least a moderate impact, though should be easily decreased through adequate weed control.

Impact on mammal population

The impact that the proposed development will have on the mammal population is mainly concerned with the loss of habitat and fragmentation of available habitat due to the development. Transformation of the natural vegetation on the site will result in a decrease in the population size as available habitat decreases. However, extensive natural areas still occur in the surrounding area and any mammals on the site are likely to vacate the site into these adjacent areas, should development take place. The extent of the proposed development is also small and the associated impact that it would have on mammals would accordingly also be relatively low. Furthermore, the likelihood that any species of high conservation value would be affected is low and consequently the overall impact on the mammal population is anticipated to remain low. In order to ensure no direct impact on the mammals on the site occurs, the hunting, capturing or trapping of mammals on the site should be strictly prohibited during operation of the mining development. Voids and excavations may also act as pitfall traps to fauna, and these should continuously be monitored, and any trapped fauna removed and released in adjacent natural areas.

Cumulative Impact

As previously indicated, the proposed expansion will form part of the existing mining area, while surrounding areas remain largely natural and the current cumulative impact associated with existing mining operations are therefore already present (Appendix A: Map 1). Therefore, the expansion of the mining area into the surrounding natural area will contribute toward the overall cumulative transformation of the area. Overall cumulative impact is therefore anticipated to be moderate.

Conclusion

The impact significance has been determined and should expansion take place without mitigation, several impacts may be high, such as the impact of the loss of protected species and the impact on the drainage lines on the site (Appendix A: Map 1 - 3). The majority of impacts will also be moderate. However, should adequate mitigation be implemented as described, these can all be reduced to moderate impacts. This is however subject to the mining area excluding both drainage lines, implementing mitigation to ensure that protected plant species are transplanted and implementing an adequate storm water management system.

Please refer to Appendix E for the impact methodology.

Significance of the impact:

Impact	Severity	Duration	Extent	Consequence	Probability	Frequency	Likelihood	Significance
Before Mitigation								
Loss of vegetation type and clearing of vegetation	3	5	2	3.3	5	3	4	13.2
Loss of protected species	3	5	2	3.3	5	3	4	13.2
Impact on watercourses	4	5	3	4	5	4	4.5	18
Infestation with weeds and invaders	3	4	3	3.3	4	3	3.5	11.5
Impact on Terrestrial fauna	2	4	2	2.6	4	3	3.5	9.1
Cumulative impact	3	5	2	3.3	4	2	3	10
After Mitigation								
Loss of vegetation type and clearing of vegetation	3	5	2	3.3	5	3	4	13.2
Loss of protected species	1	5	1	2.3	5	3	4	9.2
Impact on watercourses	2	5	2	3	3	2	2.5	7.5
Infestation with weeds and invaders	2	3	1	2	3	2	2.5	5

Impact on Terrestrial fauna	2	4	2	2.6	4	3	3.5	9.1
Cumulative impact	3	5	2	3.3	4	2	3	10

6. BIODIVERSITY SENSITIVITY RATING (BSR)

Habitat diversity and species richness:
Habitat diversity at and around the site can be considered as moderate. The area is dominated by undulating plains, with low ridges containing several small drainage lines transecting it. This results in a moderate diversity of habitat, which includes low ridges, rocky and sandy habitats and drainage lines supporting a low but dense riparian vegetation layer. As a result of the moderate habitat diversity, the area also contains a moderate species diversity, which includes scant dwarf karroid shrubs, grasses, succulents and a denser riparian vegetation dominated by low shrubs and herbaceous species. Likewise, the species diversity is also considered moderate and not significant when seen in the context of the surrounding area.

Presence of rare and endangered species:
The site and surroundings contain a high number of protected species with several also being considered uncommon and of high conservation value. Several of the succulent and geophytic species occurring on the site are also regarded as protected within the Northern Cape Province (Appendix B). These include *Colchicum orienticapense, Freesia andersoniae, Babiana hypogaea, Brunsvigia radulosa, Ruschia intricata, Euphorbia catveriflora, Hereroa concava* and *Mestoklema tuberosum.*

Ecological function:
The site and proposed expansion area functions as habitat for a variety of fauna, supports a specific vegetation type and also functions as part of the two small drainage systems. As a result of the existing mining operations, these functions have been affected to a significant extent. The local ecological function at the site is therefore moderately modified, while the surrounding area still supports a natural ecosystem and therefore the ecological function is overall considered as moderately modified.

Degree of rarity/conservation value:
Although the existing mining area has already been transformed, the surrounding areas for the proposed expansion still consist of a natural vegetation layer. The proposed expansion will therefore result in the loss of habitat and vegetation. In terms of species diversity, species composition and uniqueness of the habitat, the site is considered to have a moderate conservation value.

From the description of the vegetation composition, the existing mining operations can be considered as completely transformed and no longer contain any elements of conservation importance, while the surrounding areas which will be affected by the proposed expansion seem to be largely intact and in a fairly good condition (Appendix A: Map 1). Disturbances are present but considered indicative of only low levels of disturbance. The species diversity is moderate, although the area does contain a significant number of protected plant species which will contribute towards its conservation value (Appendix B). Areas affected by the existing mining operations would therefore be considered to be of Low Sensitivity, while the remaining natural expansion areas to the west and centre of the site would be considered to be of Moderate Sensitivity (Appendix A: Map 3).

Percentage ground cover:
Percentage ground cover is low, which is natural though for this arid region. The portion of the existing mining operations is considered even lower than the surrounding natural areas and overall percentage vegetation cover is therefore considered as at least moderately modified.

Vegetation structure:
The footprint of the existing mining area has been completely transformed and any remaining vegetation here consists of pioneer species and exotic weeds. The proposed expansion still consists of natural vegetation, which includes scant dwarf karroid shrubs, grasses, succulents and a denser riparian vegetation dominated by low shrubs and herbaceous species. Overall, the vegetation structure is therefore considered as at least moderately modified.

Infestation with exotic weeds and invader plants:
Where existing mining operations result in disturbance of the natural areas, an abundance of weeds is present, though no significant infestation by invasive species was noted. Natural areas only contain a low abundance of exotic weeds. Overall, the area is therefore considered to still contain a moderate degree of exotic weeds and invasive species (Appendix B).

Degree of grazing/browsing impact:
The site is being utilised for grazing by domestic livestock, which is still regarded to only result in a moderate degree of overgrazing and trampling.

Signs of erosion:
Due to the slope and moderate overgrazing of the area some erosion is present but still considered to be moderate.

Terrestrial animals:
Tracks and signs of mammals are still abundant on and around the site. It is however considered highly likely that the mammal population has been affected by the ongoing mining operations on the site. As a result, it is considered unlikely that species of conservational importance will occur on and around the site. The mammal population is therefore anticipated to be dominated by generalist species which are better adapted to these disturbed areas, associated with mining activities. In addition, mammal species which are rare and endangered, are often habitat specific and sensitive to habitat change. It is therefore considered unlikely that such species would occur on the site. Extensive natural areas to the east, south and west of the site should provide adequate habitat and the mammal population will still be largely natural there. It is also considered likely that the area will contain several other mammal species, but these were not observed on the site.

Table 6: Biodiversity Sensitivity Rating for the proposed mining area expansion.

	Low (3)	Medium (2)	High (1)
Vegetation characteristics			
Habitat diversity & Species richness		2	
Presence of rare and endangered species		2	
Ecological function		2	
Uniqueness/conservation value		2	
Vegetation condition			
Percentage ground cover		2	
Vegetation structure		2	
Infestation with exotic weeds and invader plants or encroachers		2	
Degree of grazing/browsing impact		2	
Signs of erosion		2	
Terrestrial animal characteristics			
Presence of rare and endangered species		2	
Subtotal	0	20	0
Total		20	

7. BIODIVERSITY SENSITIVITY RATING (BSR) INTERPRETATION

Table 7: Interpretation of Biodiversity Sensitivity Rating.

Site	Score	Site Preference Rating	Value
De Aar Stone Crushers expansion	20	Good Condition	2

8. DISCUSSION AND CONCLUSION (Appendix A: Map 1 - 3)

The existing mining operations considerably decrease the conservation value of the area. However, the remaining natural areas are still considered to be in a relatively good condition, dominated by natural vegetation, with a moderate habitat and species diversity and containing several protected plant species. Other elements of significant conservation value include two small drainage lines on and adjacent to the site (Appendix A: Map 3).

The expansion of the existing mining right area is situated immediately to the south of the small town of De Aar (Appendix A: Map 1). The existing mining operations have a footprint of approximately 50 hectares, which will now be increased to approximately 100 hectares, essentially doubling the current footprint. The footprint of the current mining area is therefore already transformed, while the proposed expansion area will consist of surrounding natural areas, which contain varying degrees of disturbance associated with the proximity of the mining area and associated activities. The site forms part of an arid region and consequently watercourses are limited to ephemeral systems. The surroundings do not contain any prominent watercourses, though smaller drainage lines are situated on and around the site and form part of the catchment of the Brak- and Elands River systems, forming the main drainage systems in this region. The proposed expansion of the mining area will also have to take into account its effect on this drainage system and implement comprehensive mitigation in order to minimise its impact on both the drainage lines and the downstream system (Appendix A: Map 3).

According to Mucina & Rutherford (2006) and utilising current mapping resources (National Biodiversity Assessment 2018) the site falls within Northern Upper Karoo (NKu 3) (Appendix A: Map 1). This vegetation type contains a varied topography with undulating plains, ridges, hills and uneven, rocky terrain, incised by a high number of small watercourses. This vegetation type is currently listed as being of Least Concern (LC) under the National List of Threatened Ecosystems (Notice 1477 of 2009) (National Environmental Management Biodiversity Act, 2004) (Appendix A: Map 1). The vegetation type is not under sufficient development pressures to be considered a threatened ecosystem. This will also decrease the conservation value of remaining natural vegetation.

The Northern Cape Critical Biodiversity Areas Plan (2024) has recently been published and has identified areas which are essential to meeting conservation targets for specific vegetation types, i.e., Critical Biodiversity Areas. The site and surroundings are considered as transformed, mostly associated with existing mining areas, and Other Natural Areas (ONA) (Appendix A: Map 2). The site is therefore not considered as essential to meeting conservation targets for the area and therefore has a fairly low default conservation value. The area to the west of the site is however considered a Critical Biodiversity Area 2 (CBA 2), with the reason being given that it provides habitat to Endangered Ludwig's Bustard (*Neotis ludwigii*), a large, terrestrial bird species occurring in this arid region. The area designated as suitable habitat, is separated from the proposed site by a railway line and overhead powerlines, which are also likely to confine the birds to suitable areas to the west of the site, while the powerlines and mining activities will limit the occurrence of this species on the site itself.

The footprint of the existing mining operations has been completely transformed from the natural conditions. This has also been confirmed by the current survey, as well as the National Biodiversity Assessment (2018) (Appendix A: Map 1). The existing mining operations are therefore largely irrelevant to this assessment. The areas identified for the proposed expansion

of the MR to the west do however still consist of natural vegetation, though some disturbance was still noted in these areas. The area is dominated by undulating plains, with low ridges containing several small drainage lines transecting it. This results in a moderate diversity of habitat which includes low ridges, rocky and sandy habitats and drainage lines supporting a low but dense riparian vegetation layer. As a result of the moderate habitat diversity, the area also contains a moderate species diversity, which includes scant dwarf karroid shrubs, grasses, succulents and a denser riparian vegetation dominated by low shrubs and herbaceous species.

From the description of the vegetation on the site and proposed expansion areas, the existing mining area is completely transformed, while surrounding areas consist of natural vegetation which is still in a fairly good condition (Appendix A: Map 1). Signs of disturbance are present but are indicative of only low levels of disturbance. The species diversity is moderate, although the area does also contain a significant number of protected plant species which will contribute towards its conservation value (Appendix B). The areas of expansion therefore still contain elements of significant conservation value, which include protected plant species and drainage lines adjacent to and on the site (Appendix A: Map 3). Significant mitigation will therefore have to be implemented to ensure the impact on these elements of significant conservation value is decreased.

Mitigation as indicated in the previous paragraph should include the following (Appendix A: Map 1 - 3):

- Numerous protected plant species have been identified in the proposed expansion areas (Appendix B). Where clearing of vegetation is required and the development will affect any of these species, the necessary permits will have to be obtained. Most of these species are fairly common, widespread and abundant and, with the necessary permits, can simply be removed. However, several are uncommon, localised species and at least a fair portion of affected plants should be transplanted to adjacent areas where they will remain unaffected. These species include *Colchicum sp., Colchicum orienticapense, Freesia andersoniae, Babiana hypogaea, Brunsvigia radulosa, Euphorbia caterviflora* and *Hereroa concava*

- A drainage line is situated immediately to the south west of the site, while another small drainage line also originates in the northern portion of the site, draining northwards (Appendix A: Map 3). These are very small drainage systems, but still form defined watercourses, also forming part of the Elands Spruit and Brak River systems. These drainage lines will therefore both still have a high conservation value. Therefore, though they are very small drainage lines, the proposed expansion should ensure that the impact on the downstream system is prevented and both drainage lines excluded from future mining operations. This should be easily attainable, given the location of these drainage lines and the proposed future mining operations. These drainage lines will be discussed in detail within the wetland assessment section.

Tracks and signs of mammals are still abundant on and around the site. It is however considered highly likely that the mammal population has been affected by the ongoing mining operations on the site. As a result, it is considered unlikely that species of conservational importance will occur on and around the site. The mammal population is therefore anticipated to be dominated by generalist species which are better adapted to these disturbed areas, associated with mining activities. In addition, mammal species which are rare and endangered, are often habitat specific and sensitive to habitat change. It is therefore considered unlikely that

such species would occur on the site. The impact that the proposed development will have on the mammal population is mainly concerned with the loss of habitat and fragmentation of available habitat due to the development. Transformation of the natural vegetation on the site will result in a decrease in the population size as available habitat decreases. However, extensive natural areas still occur in the surrounding area and any mammals on the site are likely to vacate the site into these adjacent areas, should development take place. The extent of the proposed development is also small and the associated impact that it would have on mammals would accordingly also be relatively low.

The surface water of the surrounding area contains two small drainage lines, being tributaries of the Elands Spruit and large Brak River systems. These river systems are not situated near the site, though do form part of the catchment of this system and the two small drainage lines form tributaries of the Elands Spruit and Brak River and a residual impact in terms of the system is therefore still likely, should mining operations affect these small drainage lines on the site. The main focus of the assessment will therefore be on the two small drainage lines, likely to be affected by the mining operations.

One of these drainage lines is situated immediately to the south west of the site and borders on proposed mining activities (Appendix A: Map 3). The entire length of the drainage line is approximately 3.5 km, originating along the large hill to the west and flowing into the Elands Spruit approximately 6 km downstream of the site. The drainage line is however already affected by several impacts, and is being crossed by the existing railway line, which results in obstruction to its flow and concentrated flow patterns where culverts are situated within the drainage line. The drainage line also flows past the south western corner of the proposed mining expansion, which is therefore not anticipated to greatly increase the impact on it, as it is not situated on the site itself and will therefore only be affected by indirect impacts associated with mining activities. The drainage line itself is quite small with a poorly defined channel, characterised by diffuse surface flow, though significant riparian vegetation is present. The drainage line is clearly ephemeral in terms of flow and will drain by means of flash floods only after heavy rainfall events.

The second drainage line originates and is situated in the northern portion of the proposed mining expansion area (Appendix A: Map 3). The drainage line originates along the low ridges on the site, draining northwards, where it dissipates into the lower lying plains. It does however still form a part of the catchment and drainage pattern of the Brak River and will therefore still play a role in terms of the surface drainage of the area. The drainage line is still largely intact and without significant modification, though being situated on the site itself, may likely be affected by the proposed expansion of mining operations. The drainage line can however easily be excluded from mining activities, limiting any impacts on it. The drainage line is quite small, but with a narrow, prominent channel which drains to the north. The drainage line is clearly ephemeral in terms of flow and will drain by means of flash floods only after heavy rainfall events.

Delineation of both of the small drainage lines likely to be affected by the mining expansion was done by a combination of topography (land form and drainage pattern) and riparian vegetation with limited soil sampling (Appendix C). Both of these drainage lines are clearly natural drainage systems (Appendix A: Map 3). They are however completely devoid of any wetland condition, both in terms of soils and vegetation. Though the drainage lines do not contain any natural wetland conditions, they contain clear riparian conditions, containing a defined though very small channel and an abundance of riparian vegetation, which confirms that they must be

regarded as natural watercourses. The proposed mining expansion will therefore have to ensure that both drainage lines are not affected by any storm water inflow from the site and are excluded from any mining activities.

A Risk Assessment for the proposed mining area expansion which will affect the two drainage lines respectively, has been undertaken according to the Department of Water & Sanitation's requirements for risk assessment and the provisional Risk Assessment Matrix for Section 21(c) & (i) water use (Appendix E). Activities likely to be associated with the mining operations and which will likely affect the two drainage lines are largely associated with mining in close proximity to these systems.

The proposed mining operations should completely exclude both these drainage lines and treat these systems as no-go areas (Appendix A: Map 3). Despite being excluded from mining operations, the following residual risks are still anticipated to occur:

- Should these drainage lines be excluded from mining activities, impacts on them should remain limited.
- Residual impacts are however still possible, but can be kept to a minimum, provided that adequate storm water management is implemented.
- The drainage lines are likely to be affected by residual impacts caused by the mining operations, largely as a result of increased sediment load. This can be managed through adequate mitigation, including storm water management measures and provided that adequate rehabilitation is undertaken, these operations should not have a long-term impact on them.
- Should these drainage lines be excluded from mining operations and adequate storm water management implemented, the anticipated risk should remain Low.

The impact significance has been determined and should expansion take place without mitigation, several impacts may be high, such as the impact of the loss of protected species and the impact on the drainage lines on the site (Appendix A: Map 1 - 3). The majority of impacts will also be moderate. However, should adequate mitigation be implemented as described, these can all be reduced to moderate impacts. This is however subject to the mining area excluding both drainage lines, implementing mitigation to ensure that protected plant species are transplanted and implementing an adequate storm water management system.

9. RECOMMENDATIONS

- Where mining operations occur, it is important that comprehensive rehabilitation and monitoring of the rehabilitation take place.

- Correct topsoil and seedbank management will be paramount to rehabilitation. Where disturbance or excavation will occur, the upper 30 cm, or topsoil, should be removed, together with the vegetation, and stored on the site. The topsoil, together with the seedbank and any vegetation material, should then be placed on top of the rehabilitated soil surface. Subsoil should be used as backfilling and not as top dressing. Only removed topsoil should be utilised to rehabilitate the disturbed surface. The rehabilitated borrow pit should be incorporated into the surrounding landscape as far as possible.

- The following mitigation should be implemented to prevent or decrease the anticipated impacts on the two small drainage lines likely to be affected by the mining operations (Appendix A: Map 3):

    - The drainage line to the south west of the site, as well as the drainage line originating in the northern portion of the site, should be completely excluded from mining operations, should be designated no-go areas and no mining activities, including construction or operational activities, vehicle movement, laydown areas, vegetation clearing or any other associated activities should occur in or near these watercourses. (Appendix A: Map 3). Given the nature of the mining operations this should be easily attainable.
    - Adequate storm water management measures should be implemented and should include diverting storm- and floodwater around operational and excavation areas and preventing sediment and silt from entering the two delineated drainage lines.

- Adequate monitoring of weed establishment and their continued eradication must be maintained (Appendix B). Where category 1 and 2 weeds occur, they require removal by the property owner according to the Conservation of Agricultural Resources Act, No. 43 of 1983 and National Environmental Management: Biodiversity Act, No. 10 of 2004.

- The area proposed for the mining expansion contains numerous protected species which have significant conservation value and will require mitigation (Appendix B):
    - Prior to any clearing of vegetation for mining activities a walkthrough of the affected area should be undertaken and should include identification and marking of all protected plants on the site.
    - Species occurring on the site that may be affected by the development include *Colchicum orienticapense, Freesia andersoniae, Babiana hypogaea, Brunsvigia radulosa, Ruschia intricata, Euphorbia catveriflora, Hereroa concava* and *Mestoklema tuberosum.* Where clearing of vegetation is required and the development will affect any of these species, the necessary permits will have to be obtained.
    - .Where the development will affect any of these, the necessary permits will have to be obtained.

- Most of these species are fairly common, widespread and abundant and, with the necessary permits, can simply be removed.
- However, several are uncommon, localised species and at least a fair portion of affected plants should be transplanted to adjacent areas where they will remain unaffected. These species include *Colchicum sp., Colchicum orienticapense, Freesia andersoniae, Babiana hypogaea, Brunsvigia radulosa, Euphorbia caterviflora* and *Hereroa concava*. These geophytic and succulent species are easily transplanted with a high success rate.
- Protected plants occurring on the site are listed as such under the Northern Cape Nature Conservation Act No. 9 of 2009.

- Mining activities may affect the mammal population and care should therefore be taken to ensure none of the faunal species on site are harmed. The hunting, capturing or harming in any way of mammals on the site should not be allowed.

- Open excavations may act as pitfall traps to mammals, reptiles and amphibians and trenches should be monitored daily for trapped animals which should be removed promptly.

- In the event of poisonous snakes or other dangerous animals encountered on the site, an experienced and certified snake handler or zoologist must remove these animals from the site and re-locate them to a suitable area.

- No littering must be allowed and all litter must be removed from the site.

- Monitoring of mining and compliance with recommended mitigation measures must take place.

- The necessary authorisations must be acquired from the Department of Water and Sanitation (DWS) for mining activities within 100 metres of any of the delineated watercourses around the site (Appendix A: Map 3).

10. REFERENCES

Adams, J. 1976. Wild flowers of the Northern Cape. The Department of Nature and Environmental Conservation of the Provincial Administration of the Cape of Good Hope, Cape Town.

Bromilow, C. 1995. Problem Plants of South Africa. Briza Publications CC, Cape Town.

Bromilow, C. 2010. Problem plants and alien weeds of South Africa. Briza Publications CC, Cape Town.

Bruyns, P.V. 2005. Stapeliads of Southern Africa and Madagascar. Umdaus Press, Hatfield, South Africa.

Child, M.F., Roxburgh, L., Do Linh San, E., Raimondo, D., Davies-Mostert, H.T., editors. The 2016 Red List of Mammals of South Africa, Swaziland and Lesotho. South African National Biodiversity Institute and Endangered Wildlife Trust, South Africa.

Cillié, B. 2018. Mammal guide of Southern Africa. Briza Publications CC, Pretoria.

Coates-Palgrave, M. 2002. Keith Coates-Palgrave Trees of Southern Africa, ed. 3, imp. 4 Random House Struik (Pty.) Ltd. Cape Town.

Collins, N.B. 2005. Wetlands: The basics and some more. Free State Department of Tourism, Environmental and Economic Affairs.

Conservation of Agricultural Resources Act, 1983 (ACT No. 43 OF 1983) Department of Agriculture.

Court, D. 2010. Succulent flora of Southern Africa. Struik Publishers, Cape Town.

Department of Water Affairs and Forestry. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas. Edition 1. Department of Water Affairs and Forestry, Pretoria.

Duthie, A. 1999. Appendix W5: IER (floodplain and wetlands) determining the Ecological Importance and Sensitivity (EIS) and Ecological Management Class (EMC). In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

Department of Water Affairs and Forestry. 2005. A practical field procedure for identification and delineation of wetlands and riparian areas, Edition 1. Department of Water Affairs and Forestry, Pretoria.

Duthie, A. 1999. Appendix W5: IER (floodplain and wetlands) determining the Ecological Importance and Sensitivity (EIS) and Ecological Management Class (EMC). In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

DWAF. 2008. Updated manual for the identification and delineation of wetlands and riparian areas, prepared by M. Rountree, A.L. Batchelor, J. MacKenzie and D. Hoare. Stream Flow Reduction Activities, Department of Water Affairs and Forestry, Pretoria, South Africa.

Fish, L., Mashau, A.C., Moeaha, M.J. & Nembudani, M.T. 2015. Identification guide to the Southern African grasses. An identification manual with keys, descriptions and distributions. *Strelitzia* 36. South African National Biodiversity Institute, Pretoria.

FitzPatrick Institute of African Ornithology (2024). mammalmap Virtual Museum. Accessed at https://vmus.adu.org.za/?vm=mammalmap on 2024-07-01.

Gerber, A., Cilliers, C.J., Van Ginkel, C. & Glen, R. 2004. Easy identification of aquatic plants. Department of Water Affairs, Pretoria.

Government of South Africa. 2008. National Protected Area Expansion Strategy for South Africa 2008: Priorities for expanding the protected area network for ecological sustainability and climate change adaptation. Government of South Africa, Pretoria.

Germishuizen, G. & Meyer, N.L. (eds) 2003. Plants of Southern Africa: an annotated checklist. *Strelitzia* 14. National Botanical Institute, Pretoria.

Gibbs Russell, G.E., Watson, L., Koekemoer, M., Smook, L., Barker, N.P., Anderson, H.M. & Dallwitz, M.J. 1990. Grasses of Southern Africa. Memoirs of the Botanical Survey of South Africa No. 58. Botanical Research Institute, South Africa.

Google Earth V 7.3.6.10201. 2023. De Aar, Northern Cape, South Africa. S 30.711142°, E 23.995641°. Eye alt. 5.29 km. Airbus 2025. http://www.earth.google.com (July 2025).

Government of South Africa. 2008. National Protected Area Expansion Strategy for South Africa 2008: Priorities for expanding the protected area network for ecological sustainability and climate change adaptation. Government of South Africa, Pretoria.

Griffiths, C., Day, J. & Picker, M. 2015. Freshwater Life: A field guide to the plants and animals of Southern Africa. Penguin Random House South Africa (Pty.) Ltd., Cape Town.

Hartmann, H.E.K. 2017. Illustrated handbook of succulent plants: Aizoaceae (Second Edition). Springer-Verlag, Berlin.

Kleynhans, C.J. 2000. Desktop estimates of the ecological importance and sensitivity categories (EISC), default ecological management classes (DEMC), present ecological status categories (PESC), present attainable ecological management classes (present AEMC), and best attainable ecological management class (best AEMC) for quaternary catchments in South Africa. DWAF report, Institute for Water Quality Studies, Pretoria, South Africa.

Kleynhans, C.J. & Louw, M.D. 2007. Module A: EcoClassification and EcoStatus determination in River EcoClassification: Manual for EcoStatus Determination (version 2). Joint water Research Commission and Department of Water Affairs and Forestry report. WRC Report No. TT 329/08.

Kleynhans, C.J., Louw, M.D. & Graham, M. 2008. Module G: EcoClassification and EcoStatus determination in River EcoClassification: Index of Habitat Integrity (Section 1, Technical Manual). Joint Water Research Commission and Department of Water Affairs and Forestry Report. WRC Report No. TT 377-08.

Le Maitre, D.C., Seyler, H., Holland, M., Smith-Adao, L., Nel, J.L., Maherry, A. and Witthüser, K. (2018) Identification, Delineation and Importance of the Strategic Water Source Areas of South Africa, Lesotho and Swaziland for Surface Water and Groundwater. Report No. TT 743/1/18, Water Research Commission, Pretoria.

Manning, J. 2009. Field Guide to Wild Flowers. Struik Nature, Cape Town.

Marnewecke, G. & Kotze, D. 1999. Appendix W6: Guidelines for delineation of wetland boundary and wetland zones. In: MacKay (Ed.), H. Resource directed measures for protection of water resources: wetland ecosystems. Department of Water Affairs and Forestry, Pretoria.

Mucina, L. & Rutherford, M.C. (eds.) 2006. The Vegetation of South Africa, Lesotho and Swaziland. *Strelitzia* 19. South African National Biodiversity Institute, Pretoria.

National Environmental Management: Biodiversity Act (10/2004): National list of ecosystems that are threatened and in need of protection. Government Notice 1002 of 2011, Department of Environmental Affairs.

National Environmental Management: Biodiversity Act (10/2004): Publication of lists of critically endangered, endangered, vulnerable and protected species. Government Notice 151 of 2007, Department of Environmental Affairs.

National Water Act (Act No. 36 of 1998). Republic of South Africa.

Nel, J.L., Murray, K.M., Maherry, A.M., Petersen, C.P., Roux, D.J., Driver, A., Hill, L., Van Deventer, H., Funke, N., Swartz, E.R., Smith-Adao, L.B., Mbona, N., Downsborough, L. and Nienaber, S. (2011). Technical Report for the National Freshwater Ecosystem Priority Areas project. WRC Report No. K5/1801.

Ollis, D.J., Snaddon, C.D., Job, N.M. & Mbona, N. 2013. Classification System for Wetlands and other Aquatic Ecosystems in South Africa. User Manual: Inland Systems. *SANBI Biodiversity Series 22*. South African National Biodiversity Institute, Pretoria.

Raymondo, D., Van Staden, L., Foden, W., Victor, J.E., Helme, N.A., Turner, R.C., Kamundi, D.A., Manyama, P.A. (eds.) 2009. Red List of South African Plants. *Strelitzia* 25. South African National Biodiversity Institute, Pretoria.

Roberts, B.R. & Fourie, J.H. 1975. Common grasses of the Northern Cape. Northern Cape Livestock Co-Operative Limited, Vryburg.

SANBI. 2009. Further Development of a Proposed National Wetland Classification System for South Africa. Primary Project Report. Prepared by the Freshwater Consulting Group (FCG) for the South African National Biodiversity Institute (SANBI).

Shearing, D. & Van Heerden, K. 2008. Karoo: South African wild flower guide 6. Botanical Society of South Africa, Cape Town.

Smith, G.F., Chesselet, P., Van Jaarsveld, E., Hartmann, H., Van Wyk, B.E., Burgoyne, P., Klak, C. & Kurzweil, H. 1998. Mesembs of the World. Briza Publications, Pretoria.

Smith, G.F. & Crouch, N.R. 2009. Guide to succulents of Southern Africa. Random House Struik (Pty.) Ltd., Cape Town.

Smith, G.F. & Van Wyk, B.E. 2003. Guide to the Aloes of South Africa. Briza Publications, Pretoria.

Smithers, R.H.N. 1983. The mammals of the Southern African Subregion. University of Pretoria, Pretoria.

Strahler, A.N. 1952. Hyposometric (area-altitude) analysis of erosional topology. *Geological Society of American Bulletin* 63 (11): 1117-1142.

Van Deventer, H., Smith-Adao, L., Mbona, N., Petersen, C., Skowno, A., Collins, N.B., Grenfell, M., Job, N., Lötter, M., Ollis, D., Scherman, P., Sieben, E., Snaddon, K. 2018. South African Inventory of Inland Aquatic Ecosystems. South African National Biodiversity Institute, Pretoria. Report Number: CSIR report number CSIR/NRE/ECOS/IR/2018/0001/A; SANBI report number http://hdl.handle.net/20.500.12143/5847.

Van Ginkel, C.E. & Cilliers, C.J. 2020. Aquatic and wetland plants of Southern Africa. Briza Publications, Pretoria.

Van Ginkel, C.E., Glen, R.P., Gordon-Grey, K.D., Cilliers, C.J., Musaya, M. & Van Deventer, P.P. 2011. Easy Identification of some South African Wetland Plants. WRC Report No. TT 479/10.

Van Oudtshoorn, F. 2004. Gids tot Grasse van Suider-Afrika. Briza Publications, Pretoria.

Van Rooyen, N. & Van Rooyen, G. 2019. Flowering plants of the Southern Kalahari. Published by the authors, Somerset West.

.

Appendix A: Maps

Locality and general ecology map for the proposed the expansion of the De Aar Stone Crushers Mining Right (MR) area situated in De Aar, Northern Cape Province.

Preparred for:
Greenmined Environmental
De Beers Avenue
Somerset West
7130

Legend:

- Study area
- Watercourses
- Wetlands and impoundments
- Northern Upper Karoo

Map Information

Spheroid: WGS 84

Quantum GIS

Scale: 1:20 000

DPR Ecologists
Contact Darius van Rensburg at:
darius@dprecologists.co.za
P.O. Box 12726, Brandhof, 9324
Tel: 083 410 0770

Map 1: Locality and general ecology map of the proposed the expansion of the De Aar Stone Crushers Mining Right (MR). Remaining natural vegetation in the area is indicated, which confirms the existing mining operations having transformed a significant portion, while remaining areas still consisting of natural vegetation in fairly good condition dominate the surroundings and large portion of the proposed expansion.

Northern Cape Critical Biodiversity Areas map for the proposed the expansion of the De Aar Stone Crushers Mining Right (MR) area situated in De Aar, Northern Cape Province.

Prepared for:
Greenmined Environmental
De Beers Avenue
Somerset West
7130

Legend:

- Study area
- Watercourses
- Wetlands and impoundments
- Critical Biodiversity Area 1
- Critical Biodiversity Area 2
- Ecological Support Area
- Other Natural Area

Map Information

Spheroid: WGS 84

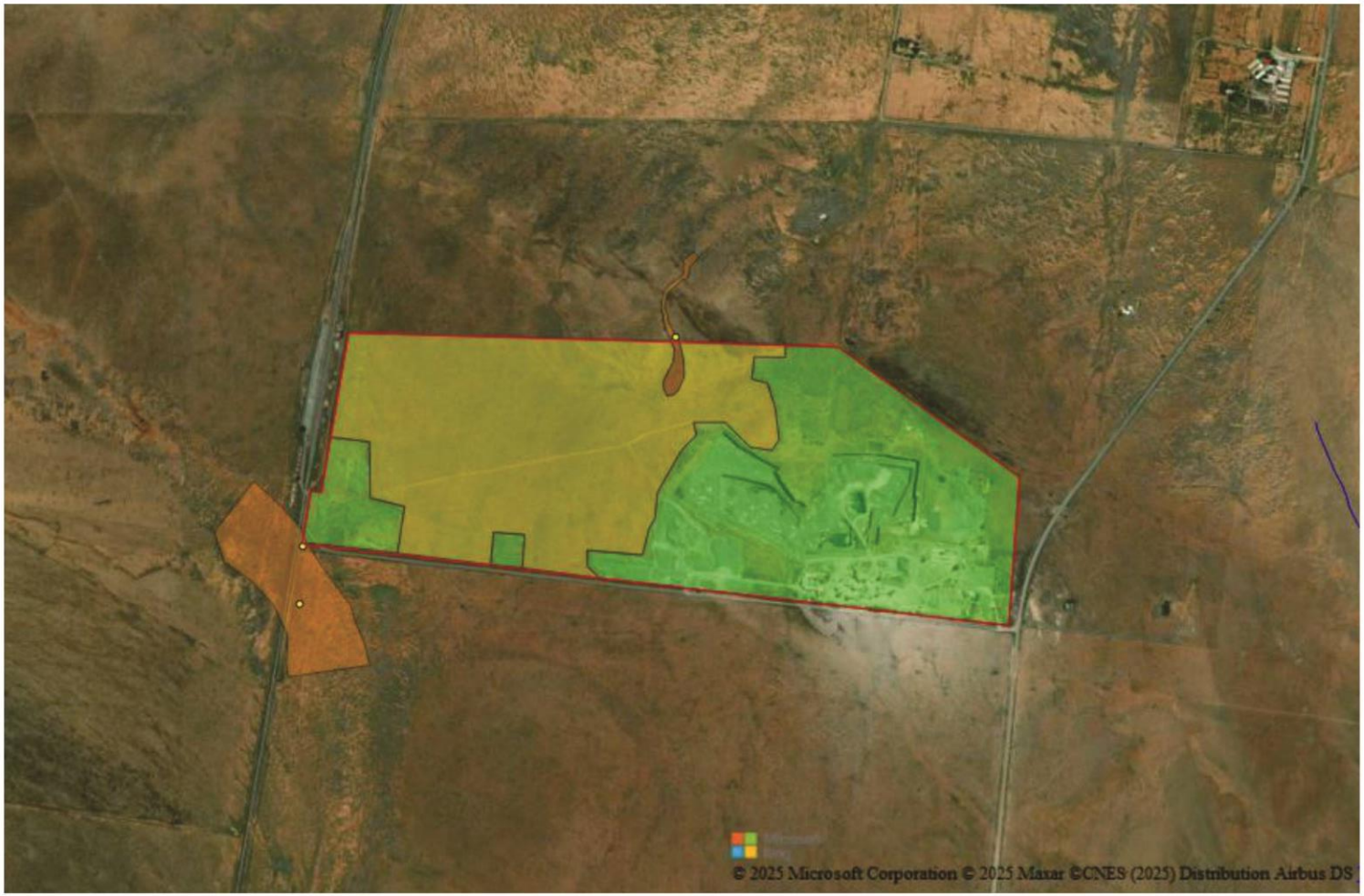
Quantum GIS

Scale: 1:20 000

DPR Ecologists
Contact Darius van Rensburg at:
darius@dprecologists.co.za
P.O. Box 12726, Brandhof, 9324
Tel: 083 410 0770

Map 2: Northern Cape Critical Biodiversity Areas map of the proposed the expansion of the De Aar Stone Crushers Mining Right (MR). This also indicates that mining areas, roads, railways and infrastructure are all considered as transformed and not considered as essential to meeting conservation targets. The remainder of the site is considered as an Other Natural Area (ONA), which indicates that it is not a Critical Biodiversity Area (CBA) or performing any important ecological support function. The areas to the west are however considered as CBA 2 areas as they provide intact habitat to the endangered Ludwig's Bustard, a large terrestrial bird species. The site itself also still contains suitable natural habitat, though due to railways, overhead powerlines and ongoing mining operations the species is unlikely to occur here.

Sensitivity and wetland delineation map for the proposed the expansion of the De Aar Stone Crushers Mining Right (MR) area situated in De Aar, Northern Cape Province.



Prepared for:
Greenmined Environmental
De Beers Avenue
Somerset West
7130

Legend:

- Study area
- Watercourses
- Wetlands and impoundments
- Very High Sensitivity
- High Sensitivity
- Moderate Sensitivity
- Low Sensitivity
- Wetland Sampling Sites

Map Information

Spheroid: WGS 84

Quantum GIS

Scale: 1:20 000

DPR Ecologists
Contact Darius van Rensburg at:
darius@dprecologists.co.za
P.O. Box 12726, Brandhof, 9324
Tel: 083 410 0770

Map 3: Sensitivity and wetland delineation map of the proposed the expansion of the De Aar Stone Crushers Mining Right (MR). Those areas having been affected by previous and ongoing mining operations are considered transformed and therefore of Low Sensitivity. The remaining natural areas are still intact, in fairly good condition with a moderate habitat and species diversity, but do however not contain elements of high conservation value and area therefore only of Moderate Sensitivity. Protected plant species are still present here, though they are fairly widespread, not considered endangered and therefore not of very high conservation value. The two drainage lines are indicated to the south west and in the northern portion of the site. There are very small, but still of high conservation value, and perfomring importanty ecological functions and they are therefore considered to be of High Sensitivity and should be completely excluded from any mining activities in order to prevent any significant impacts on them.

Appendix B: Species list

Species indicated with an * are exotic.

Protected species are coloured orange and Red Listed species red.

Species	Growth form
**Agremone ochorleuca*	Herb
**Bidens bipinnata*	Herb
Amphiglossa triflora	Dwarf shrub
Aptosimum indivisum	Herb
Aptosimum spinescens	Dwarf shrub
Arctotis venusta	Herb
Aristida congesta	Grass
Aristida diffusa	Grass
Asparagus suaveolens	Dwarf shrub
Babiana hypogaea	Geophyte
Barleria rigida	Dwarf shrub
Berkheya spinosissima	Herb
Brunsvigia radulosa	Geophyte
Chascanum pinatifidum	Herb
Chrysocoma ciliata	Dwarf shrub
Colchicum orienticapense	Geophyte
Digitaria eriantha	Grass
Enneapogon cenchroides	Grass
Enneapogon desvauxii	Grass
Enneapogon scaber	Grass
Eragrostis echinchloidea	Grass
Eragrostis lehmanniana	Grass
Eragrostis obtusa	Grass
Eragrostis truncata	Grass
Eriocephalus africanus	Dwarf shrub
Eriocephalus ericoides	Dwarf shrub
Eriocephalus spinescens	Dwarf shrub
Euphorbia caterviflora	Succulent
Fingerhuthia africana	Grass
Freesia andersoniae	Geophyte
Galenia africana	Dwarf shrub
Gnidia polycephala	Dwarf shrub
Helichrysum zeyheri	Dwarf shrub
Hereroa concava	Succulent
Hermannia cuneata	Dwarf shrub
Hertia pallens	Dwarf shrub
Heteropogon contortus	Grass
Limeum aethiopicum	Herb
Lotononis listii	Herb
Lycium cinerium	Dwarf shrub

Melolobium candicans	Dwarf shrub
Mesembryanthemum coriarium	Succulent
Mestoklema tuberosum	Succulent
Moraea pallida	Geophyte
Oxalis depressa	Geophyte
Pegolettia retrofracta	Dwarf shrub
Pentzia incana	Dwarf sghrub
Rhigozum obovatum	Shrub
Rosenia oppositifolia	Dwarf shrub
Ruschia intricata	Succulent
Salsola aphylla	Dwarf shrub
Salvia verbenaca	Herb
Searsia ciliata	Dwarf shrub
Sebaea sp.	Herb
Sesamum triphyllum	Herb
Sporobolus fimbriatus	Grass
Stipagrostis uniplumis	Grass
Wahlenbergia nodosa	Dwarf shrub

Appendix C: Soil Samples

Obligate wetland vegetation was utilised to determine the presence and border of wetlands. Soil samples were used to confirm the wetland conditions in the study area. Soil samples were taken at approximately 10 metres intervals. Soil samples were investigated for the presence of anaerobic evidence which characterises wetland soils.

Within wetlands the hydrological regime differs due to the topography and landscape. For instance; a valley bottom wetland would have a main channel that is below the water table and consequently permanently saturated, i.e. permanent zone of wetness. Moving away from the main channel, the wetland would become dependent on flooding in order to be saturated. As a result, along this hydrological regime areas of permanent saturation, seasonal and temporary saturation would occur. At some point along this gradient, the saturation of the soil would be insufficient to develop reduced soil conditions and therefore will not be considered as wetland.

Within wetland soils, the pores between soil particles are filled with water instead of atmosphere. As a result, available oxygen is consumed by microbes and plant roots, and due to the slow rate of oxygen diffusion, oxygen is depleted, and biological activity continues in anaerobic conditions, and this causes the soil to become reduced.

Reduction of wetland soils is a result of bacteria decomposing organic material. As bacteria in saturated soils deplete the dissolved oxygen, they start to produce organic chemicals that reduce metals. In oxidised soils the metals in the soil give it a red, brown, yellow or orange colour. When these soils are saturated and metals reduced, the soil attains a grey matrix characteristic of wetland soils.

Within this reduction taking place in the wetland soils there may be reduced matrix, redox depletions and redox concentrations. The reduced matrix is characterised by a low chroma and therefore a grey soil matrix. Redox depletions result in the grey bodies within the soil where metals have been stripped out. Redox concentrations result in mottles within the grey matrix with variable shape and are recognised as blotches or spots, red and yellow in colour.

Soil wetness indicator is used as the primary indicator of wetlands. The colour of various soil components is often the most diagnostic indicator of hydromorphic soils. Colours of these components are strongly influenced by the frequency and duration of soil saturation. Generally, the higher the duration and frequency of saturation in a soil profile, the more prominent grey colours in the soil matrix would become.

Coloured mottles, another feature of hydromorphic soils, are usually absent in permanently saturated soils and are at their most prominent in seasonally saturated soils, becoming less abundant in temporarily saturated soils until they disappear altogether in dry soils (Collins 2005).

The following soil wetness indicators can be used to determine the permanent, seasonal and temporary wetness zones. The boundary of the wetland is defined as the outer edge of the temporary zone of wetness and is characterised by a minimal grey matrix (<10%), few high chroma mottles and short periods of saturation (less than three months per year). The seasonal zone of wetness is characterised by a grey matrix (>10%), many low chroma mottles and significant periods of wetness (at least three months per year). The permanent zone of wetness

is characterised by a prominent grey matrix, few to high chroma mottles, wetness all year round and sulphuric odour (rotten egg smell).

According to convention hydromorphic soil must display signs of wetness within 50 cm of the soil surface (DWAF 2005).

Appendix D: Risk Assessment Matrix

PROJECT:	**Proposed expansion of the De Aar Stone Crushers Mining Right (MR) area situated in De Aar, Northern Cape Province.**

RISK ASSESSMENT MATRIX for Section 21 (c) and (i) Water Use activities - Version 2.1

Name of Assessor:	Darius van Rensburg	**Signature:**	
SACNASP Registration Number:	400284/13		
Date of assessment:	18/06/2025		

Risk to be scored for all relevant phases of the project (**factoring in specified control measures**). MUST BE COMPLETED BY SACNASP PROFESSIONAL MEMBER REGISTERED IN AN APPROPRIATE FIELD OF EXPERTISE.

Phase	Activity	Impact	Potentially affected watercourses			Intensity of Impact on Resource Quality					Overall Intensity (max = 10)	Spatial scale (max = 5)	Duration (max = 5)	Severity (max = 20)	Importance rating (max = 5)	Consequence (max = 100)	Likelihood (Probability) of impact	Significance (max = 100)	Risk Rating	Confidence level
			Name/s	PES	Overall Watercourse Importance	Abiotic Habitat (Drivers)			Biota (Responses)											
						Hydrology	Water Quality	Geomorph	Vegetation	Fauna										
CONSTRUCTION	Mining and excavation of dolerite in close proximity to the drainage line.	Mining will require removal of the vegetation layer in the catchment of the adjacent drainage line. This activity will not entail	#1 Drainage line – South west of the proposed site.	B	High	1	2	0	1	0	4	1	1	6	4	24	60%	14.4	L	High
		geomorphology but will nonetheless also entail erosion and increased sedimentation of the drainage line. Establishment of	#2 Drainage line – Northern portion of the proposed site.	B	High	1	2	0	1	0	4	1	1	6	4	24	60%	14.4	L	High
		due to disturbance caused by mining. The functioning of the drainage line is anticipated to remain largely intact, but is subject to the mining operations completely excluding the drainage line																		
OPERATIONAL	Mining and excavation of dolerite in close proximity to the drainage line.	Mining will require removal of the vegetation layer in the catchment of the adjacent drainage line. This activity will not entail	#1 Drainage line – South west of the proposed site.	B	High	1	2	0	1	0	4	1	1	6	4	24	60%	14.4	L	High
		geomorphology but will nonetheless also entail erosion and increased sedimentation of the drainage line. Establishment of	#2 Drainage line – Northern portion of the proposed site.	B	High	1	2	0	1	0	4	1	1	6	4	24	60%	14.4	L	High
		due to disturbance caused by mining. The functioning of the drainage line is anticipated to remain largely intact, but is subject to the mining operations completely excluding the drainage line																		
DECOMMISSIONING	Mining and excavation of dolerite in close proximity to the drainage line.	Mining will require removal of the vegetation layer in the catchment of the adjacent drainage line. This activity will not entail	#1 Drainage line – South west of the proposed site.	B	High	1	2	0	1	0	4	1	1	6	4	24	60%	14.4	L	High
		geomorphology but will nonetheless also entail erosion and increased sedimentation of the drainage line. Establishment of	#2 Drainage line – Northern portion of the proposed site.	B	High	1	2	0	1	0	4	1	1	6	4	24	60%	14.4	L	High
		due to disturbance caused by mining. The functioning of the drainage line is anticipated to remain largely intact, but is subject to the mining operations completely excluding the drainage line																		

Appendix E: Impact methodology

The environmental significance assessment methodology is based on the following determination:
Environmental Significance = Overall Consequence x Overall Likelihood

Determination of Consequence

Consequence analysis is a mixture of quantitative and qualitative information and the outcome can be positive or negative. Several factors can be used to determine consequence. For the purpose of determining the environmental significance in terms of consequence, the following factors were chosen: **Severity/Intensity, Duration and Extent/Spatial Scale.** Each factor is assigned a rating of 1 to 5, as described below and in tables 6, 7, 9 and 10.

Determination of Severity

Severity relates to the nature of the event, aspect or impact to the environment and describes how severe the aspects impact on the biophysical and socio-economic environment.
Table 7 will be used to obtain an overall rating for severity, taking into consideration the various criteria.

Table 7: Rating of severity

Type of criteria	**Rating**				
	1	**2**	**3**	**4**	**5**
Quantitative	0-20%	21-40%	41-60%	61-80%	81-100%
Qualitative	Insignificant / Non-harmful	Small / Potentially harmful	Significant / Harmful	Great / Very harmful	Disastrous Extremely harmful
Social/ Community response	Acceptable / I&AP satisfied	Slightly tolerable / Possible objections	Intolerable/ Sporadic complaints	Unacceptable / Widespread complaints	Totally unacceptable / Possible legal action
Irreversibility	Very low cost to mitigate/ High potential to mitigate impacts to level of insignificance / Easily reversible	Low cost to mitigate	Substantial cost to mitigate / Potential to mitigate impacts / Potential to reverse impact	High cost to mitigate	Prohibitive cost to mitigate / Little or no mechanism to mitigate impact Irreversible
Biophysical (Air quality, water quantity and quality, waste production, fauna and flora)	Insignificant change / deterioration or disturbance	Moderate change / deterioration or disturbance	Significant change / deterioration or disturbance	Very significant change / deterioration or disturbance	Disastrous change / deterioration or disturbance

Determination of Duration
Duration refers to the amount of time that the environment will be affected by the event, risk or impact, if no intervention e.g. remedial action takes place.

Table 8: Rating of Duration

Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

Determination of Extent/Spatial Scale
Extent refers to the spatial influence of an impact be local (extending only as far as the activity, or will be limited to the site and its immediate surroundings), regional (will have an impact on the region), national (will have an impact on a national scale) or international (impact across international borders).

Table 9: Rating of Extent / Spatial Scale

Rating	Description
1: Low	Immediate, fully contained area
2: Low-Medium	Surrounding area
3: Medium	Within Business Unit area of responsibility
4: Medium-High	Within Mining Boundary area
5: High	Regional, National, International

Determination of Overall Consequence
Overall consequence is determined by adding the factors determined above and summarised below, and then dividing the sum by 4.

Table 10: Example of calculating Overall Consequence

Consequence	Rating
Severity	Example 4
Duration	Example 2
Extent	Example 4
SUBTOTAL	10
TOTAL CONSEQUENCE:(Subtotal divided by 4)	3.3

Likelihood
The determination of likelihood is a combination of Frequency and Probability. Each factor is assigned a rating of 1 to 5, as described below and in Table 11 and Table 12.

Determination of Frequency
Frequency refers to how often the specific activity, related to the event, aspect or impact, is undertaken.

Table 11: Rating of frequency

Rating	Description
1: Low	Once a year or once/more during operation/LOM
2: Low-Medium	Once/more in 6 Months
3: Medium	Once/more a Month
4: Medium-High	Once/more a Week
5: High	Daily

Determination of Probability
Probability refers to how often the activity/event or aspect has an impact on the environment.

Table 12: Rating of probability

Rating	Description
1: Low	Almost never / almost impossible
2: Low-Medium	Very seldom / highly unlikely
3: Medium	Infrequent / unlikely / seldom
4: Medium-High	Often / regularly / likely / possible
5: High	Daily / highly likely / definitely

Overall Likelihood
Overall likelihood is calculated by adding the factors determined above and summarised below, and then dividing the sum by 2.

Table 13: Example of calculating the overall likelihood

Consequence	Rating
Frequency	Example 4
Probability	Example 2
SUBTOTAL	6
TOTAL LIKELIHOOD (Subtotal divided by 2)	3

Determination of Overall Environmental Significance
The multiplication of overall consequence with overall likelihood will provide the environmental significance, which is a number that will then fall into a range of LOW, LOW-MEDIUM, MEDIUM, MEDIUM-HIGH or HIGH, as shown in the table below.

Table 14: Determination of overall environmental significance

Significance or Risk	Low	Low-Moderate	Moderate	Moderate-High	High
Overall Consequence X Overall Likelihood	1 - 4.9	5 - 9.9	10 - 14.9	15 – 19.9	20 - 25

Qualitative description or magnitude of Environmental Significance
This description is qualitative and is an indication of the nature or magnitude of the Environmental Significance. It also guides the prioritisations and decision making process associated with this event, aspect or impact.

Table 15: Description of the environmental significance and the related action required.

Significance	Low	Low-Moderate	Moderate	Moderate-High	High
Impact Magnitude	Impact is of very low order and therefore likely to have very little real effect. Acceptable.	Impact is of low order and therefore likely to have little real effect. Acceptable.	Impact is real, and potentially substantial in relation to other impacts. Can pose a risk to the company.	Impact is real and substantial in relation to other impacts. Pose a risk to the company. Unacceptable.	Impact is of the highest order possible. Unacceptable. Fatal flaw.
Action Required	Maintain current management measures. Where possible, improve.	Maintain current management measures. Implement monitoring and evaluate to determine potential increase in risk. Where possible, improve.	Implement monitoring. Investigate mitigation measures and improve management measures to reduce risk, where possible.	Improve management measures to reduce risk.	Implement significant mitigation measures or implement alternatives.