

**FLORAL, FAUNAL AND WETLAND ASSESSMENT AS
PART OF THE EIA AND EMP AMENDMENT PROCESS FOR
THE AFPLATS LEEUWKOP PLATINUM MINE, NORTH
WEST PROVINCE**

Prepared for

SLR Consulting (Africa) (Pty) Ltd.

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**SECTION A – Introduction & Background
Information**

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Declaration

This report has been prepared according to the requirements of Section 32 (2) of the Environmental Impact Assessments EIA Regulations, 2010 (GNR 543). We (the undersigned) declare the findings of this report free from influence or prejudice.

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Field of expertise:

Wetland, aquatic and terrestrial ecology.



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Date: 18/12/2012



EXECUTIVE SUMMARY

Scientific Aquatic Services (SAS) was appointed to conduct a floral, faunal and wetland ecological assessment as part of the environmental assessment and authorisation process and amendment of the Environmental Management Program (EMP). The current Environmental Impact Assessment (EIA) process caters for the proposed changes to the approved Leeuwkop Platinum Mine infrastructure layout and incorporating the farms Wolwekraal 408JQ and Kareepoort 407JQ into the mining right area. Afplats is proposing to amend the approved Leeuwkop Platinum Mine EMP to include the following:

- A change to the preferred mining method requiring a deeper shaft. The current mining method is changing from a fully mechanised room and pillar method to a more conventional stoping method and as such the depth of the shaft will be deepened from 1300m to 1600m;
- Development of a new waste rock dump. Due to the change in the mining method, additional waste rock will need to be stored on surface and as such Afplats is proposing to develop a new waste rock dump. This proposed waste rock dump will be approximately 24ha in size and will be located adjacent to the current mining activities;
- Expansion of the approved waste rock dump. As part of the 2006 EIA and EMP process a waste rock dump will be constructed between the approved shaft and the Segwaelane community. The purpose of this waste rock dump is to act as a noise barrier;
- The use of tailings backfill material for support underground. Grout packs will be used as additional shaft support underground. These grout packs will be comprised of tailings material, fly ash and other binding agents;
- Expansion of the sewage treatment plant. Due to the increase in the workforce the capacity of the sewage treatment plant will need to be increased in order to cater for the increased raw sewage generated at the mine;
- The expansion of water management facilities. The volumes of polluted water that will be generated on the mine will increase due to the change in mining method and as such an extension of the planned pollution control dams if required;
- The development of a new water holding facility. An additional water holding facility will be required to store make-up water for up to two weeks during the routing maintenance of the Madibeng water pipeline that currently supplies water to the mine;
- A change in the planned routing of the access road specifically around the shaft area as well as the increase to the future parking area; and
- The inclusion of the farms Wolwekraal 408JQ and Kareepoort 407JQ into the mining rights area. Afplats currently holds a prospecting permit on these farms. At this stage no surface infrastructure is planned to be established on these additional farms.

The approved mining rights area is approximately 6 400ha in extent and is located directly to the north of the Segwaelane township and approximately 14km to the west of Brits, within the North West Province. Some infrastructure, including the mine plant, has already been constructed within this area. The R556 roadway runs through the subject property and the N4 highway is located 9km to the south. The subject property is surrounded by undeveloped land and properties in which agricultural and mining activities dominate, leaving large areas transformed.

In order to address the changes to the planned mining infrastructure further studies were required within the proposed expansion footprint. The area of interest for this study was confined to an area of approximately 32ha in extent, situated directly to the north and south of the existing plant infrastructure. The study includes the footprint areas of the proposed re-aligned access road to the south of the existing infrastructure, the expansion of the sewage plant, the pollution control and emergency storage dams and the proposed new waste rock dump. In addition, a desktop assessment was undertaken for the farms Wolwekraal 408JQ and Kareepoort 407 JQ, covering a total area of approximately 900ha, for their potential inclusion into the mining rights area. It is important to note that no surface infrastructure is planned for the farms Wolwekraal 408JQ and Kareepoort 407 JQ and that these properties are expected to be mined underground only.

The ecological assessment was confined to the study areas as outlined above and indicated in Figures 1-4 and did not include an ecological assessment of surrounding properties. The surrounding area was however considered as part of the desktop assessment and literature review.



This report, after consideration and description of the ecological integrity of the property, must guide the property owner, authorities and proponent, by means of recommendations, as to the viability of the proposed mine expansions. The results of the study are presented in the sections below.

FLORAL ASSESSMENT

- The subject property falls within the *Savanna Biome, Central Bushveld Bioregion* and the *Norite Koppies Bushveld* and *Marikana Thornveld* vegetation types (Mucina & Rutherford, 2006). Marikana Thornveld is considered to be an Endangered vegetation type while the Norite Koppies vegetation type is of Least Concern. The conservation target for Marikana Thornveld is 19% with less than 1% currently statutorily conserved.
- Three habitat units were identified during the assessment, namely the Rocky Grassland Habitat Unit, the Open Veld Habitat Unit and the Wetland Habitat Unit.
- The Rocky Ridge Habitat Unit borders the study area towards the west, north and east, with smaller rocky outcrops occurring in the south of the study area, to the south of the existing plant and in the vicinity of the proposed re-aligned access road. The Open Veld Habitat Unit is located centrally with respect to the proposed new mine expansion areas, while the Wetland Habitat Unit, associated with a non-perennial drainage line, traverses the study area in an east-west direction.
- From the desktop assessment of the farms Wolwekraal 408JQ and Kareepoort 407JQ, these areas are expected to contain similar habitat units with similar species composition and vegetation characteristics to that of the study area assessed during the field survey. These properties are also expected to contain large areas of transformed habitat to the north as a result of agricultural activities. The rocky ridge and wetland areas identified during the desktop assessment of these properties may potentially host RDL floral species, such as *Stenostelma umbelluliferum*, *Ilex mitis*, *Prunus africana* and it is expected that the protected plant species, *Sclerocarya birrea* subsp. *africana* also occur within these areas.
- The Rocky Ridge Habitat Unit within the study area is considered to be of high ecological importance due to its high ecological functionality, intact habitat integrity, low levels of transformation and high floral biodiversity. These areas, as well as a 100m buffer zone (or a minimum of 50m, if a 100m buffer zone is not possible) around all rocky ridge and rocky outcrop areas in the vicinity of the study area should be excluded from development. The rocky outcrops to the south have already been exposed to development in their immediate vicinity and no buffer zones are recommended for these outcrops, provided that the proposed access road re-alignment avoids all rocky outcrops and that edge effects are managed.
- The Open Veld Habitat Unit is considered to be of moderate ecological functionality and moderately intact habitat integrity with some disturbance in the form of historic informal road construction, grazing activities and resulting bush encroachment. This area may be developed as part of the proposed mine expansion activities, provided that the mitigation measures as set out in this report are implemented and adhered to.
- The Wetland Habitat Unit is considered to be of moderately low ecological sensitivity and plays a role in channeling stormwater and in providing potential migratory connectivity for faunal species. The western portion of the wetland identified during the field assessment should be conserved if possible, while the wetlands and riverine areas potentially present on the farms Wolwekraal 408JQ and Kareepoort 407JQ warrants conservation should surface mining and mining infrastructure be constructed in this area.
- The vegetation Index Score (VIS) for each Habitat Unit has been calculated as follows:

Location	Score	Class	Motivation
Rocky Ridge Habitat Unit	22	B – Largely natural with few modifications	Little to no disturbance present. High floral diversity and no alien plant species present.
Open Veld Habitat Unit	14	C – Moderately modified	Moderate levels of disturbance and alien plant species invasion
Wetland Habitat Unit	14	C – Moderately modified	Some disturbance in the form of bush encroachment present.

- No RDL plant species as listed for the QDS 2527DA were identified within the field assessed study area. Should RDL species be present, such species are most likely to occur within the Rocky Ridge Habitat Unit.



- The protected plant species *Sclerocarya birrea* subsp. *africana* (Marula trees) was noted in large numbers, mostly within the Rocky Ridge Habitat Unit. Due to the large number of marula trees present, the specimens were not individually mapped, but the extent of the population within the study area was delineated. This map is included in Section B of this report. Should any *Sclerocarya birrea* subsp. *africana* trees fall within the development footprint, special authorisation is to be obtained from relevant authorities for such trees to be cut, disturbed, damaged or destroyed. All marula trees within the development footprint are to be clearly marked prior to commencement of construction activities.
- The number of alien plant species present is low and no significant alien vegetation communities were noted. Alien plant species are confined to the Open Veld Habitat Unit in the vicinity of areas having experienced historic disturbance.
- Significant bush encroachment by indigenous species such as *Asparagus laricinus* is present within the Open Veld and Wetland Habitat Units.
- A number of medicinal plant species were noted within the study area, with the largest number of medicinal species situated within the Rocky Ridge Habitat Unit.

Impact assessment:

The table below serves to summarise the significance of perceived impacts on the floral biodiversity of the subject property before mitigation measures are implemented. Also indicated is the impact significance of each perceived impact after the required mitigatory measures needed to minimise each impact are implemented.

Summary of impact significance

Impact	Unmanaged	Managed
1A: Impact on overall floral biodiversity due to development activities	Medium-High	Low
1B: Impact on overall floral biodiversity and protected, RDL and medicinal plant species due to destruction of sensitive habitats	High	Low
1C: Impacts on floral biodiversity due to alien and invasive floral species	Medium-High	Low
1D: Impact on overall floral biodiversity due to uncontrolled fires	Medium-Low	Low
1E: Impact on overall floral biodiversity due to dust generation	Medium-Low	Low

From the results of the impact assessment it was observed that 5 major impacts were applicable to the floral communities of the study area, with all impacts being of a high, medium-high or medium-low significance prior to mitigation.

Potential impacts related to floral biodiversity are considered to be of high or medium-high significance due to sections of the study area being of a sensitive ecological nature and hosting protected floral species, namely *Sclerocarya birrea* subsp. *africana*. Impacts on overall floral diversity, potential RDL and protected plant species and impacts due to alien plant species proliferation are considered to be of a high or medium-high significance prior to mitigation, while impacts as a result of dust and uncontrolled fires are considered to be of a medium-low significance prior to management and mitigation measures being put in place. Post-mitigation, all impacts may be reduced to a low significance level.

The majority of the negative impacts associated with the proposed mining expansion will be experienced during the construction and operational phases of the project.

WETLAND ASSESSMENT

- The study area falls within the Western Bankenveld Aquatic Ecoregion and is located within the A21J and A21K quaternary catchments. The wetland system identified within the study area falls only within quaternary catchment A21J.
- Two linked wetland systems have been identified within the study area, which may be divided into two wetland types according to the National Wetland Classification System Methodology



(SANBI 2009) in order to classify and determine the ecological function and sensitivity of each wetland feature.

- The eastern portion of the wetland was characterised as a hillslope seep wetland, while the western portion may be defined as a seasonally inundated valley bottom wetland, alternating between being channelled and unchannelled.
- The eastern wetland feature lacks a permanent and seasonal wetland zone and can best be defined as a highly ephemeral temporary wetland feature with very limited wetland development. The western wetland feature lacks only a permanent zone, but the temporary and seasonal wetland zones are present, which increases the functionality, PES and overall sensitivity thereof.
- According to the National Freshwater Ecosystem Priority Areas (NFEPA) (2011) databases consulted, the subject property falls within the Crocodile (west) and Marico Water Management Area (WMA) and within the Upper Crocodile sub-WMA. According to this database:
 - No NFEPA wetlands or flagship rivers were identified within or immediately adjacent to the study area.
 - No wetland clusters of conservational importance were indicated within or near the study area.
 - The applicable FEPA WMA data do not indicate any riverine resources within the Leeuwkop study area which is of significance in terms of fish conservation.
 - Wetlands located within the subject property are not shown to have sighting or breeding areas for cranes.
 - No RAMSAR wetlands are located within or close to the subject property.
 - No wetlands are indicated to fall within 500m of an IUCN threatened frog point locality.
- The eastern wetland feature was determined to have a low level of ecological function and service provision, while the western wetland feature has a moderately low level of ecological function and service provision.
- The Present Ecological State (PES) of the eastern wetland feature was found to fall within the border between Class C – Moderately modified and Class B – Largely natural with few modifications, while the PES of the western wetland feature was found to fall within Class B – Largely natural with few modifications.
- Based on the above, it is recommended that the western wetland feature be conserved if possible. Mitigation measures as outlined in this report should be adhered to where mine expansion activities encroach on the eastern wetland feature, which is of lowered ecological importance.
- A number of potential wetland features similar in nature to that of the eastern wetland feature is present to the north, east and west of the field assessed study area, which further lowers the ecological importance of the eastern wetland feature.

Impact assessment

The table below serves to summarise the significance of perceived impacts on the wetlands of the study area before mitigation measures are implemented. Also indicated is the impact significance of each perceived impact after the required mitigatory measures needed to minimise each impact are implemented.

Impact	Unmanaged	Managed
1A: Impact on the wetland and drainage areas due to development related activities	Low	Very Low
1B: Seepage of dirty water into wetland areas	Medium Low	Low
1C: Vehicles entering wetland areas	Medium Low	Low
1D: Impacts due to sedimentation, canalisation and erosion	Medium Low	Low
1E: Ineffective rehabilitation may impact on the western wetland areas	Low	Very low

From the impact assessment, five (5) potential impacts on the wetland ecology within the study area have been identified, which, with the application of appropriate management measures, could all be reduced to low and very low significance.



FAUNAL ASSESSMENT

Faunal habitat

- The majority of the study area has been transformed by livestock grazing and is considered to be of lowered ecological sensitivity. The habitat integrity of the sensitive rocky ridge areas in the vicinity of and bordering the study area is high and therefore the rocky ridges and associated buffer zones are considered to be highly sensitive.

Faunal assessment

- No Red Data List (RDL) mammal species were observed during the site survey. In terms of mammal conservation, the likelihood that any threatened mammal species that are listed by the North West Province will be encountered within the study area is deemed low due to narrow distribution range of many of these species, the high levels of habitat transformation within the majority of the study area, and the existing mining infrastructure within the subject property. The Rocky Ridge Habitat Unit bordering the study area may provide suitable habitat for such species.
- From the desktop assessment of the farms Wolwekraal 408JQ and Kareepoort 407JQ, it is expected that the faunal assemblages occurring within these properties are similar to those encountered within the study area and the remainder of the subject property, with the rocky ridge areas most likely to host RDL faunal species. The open veld areas associated with the farms Wolwekraal 408JQ and Kareepoort 407JQ is currently predominantly utilised for livestock and agricultural purposes and the faunal integrity is expected to be low throughout, except in the vicinity of rocky ridge and wetland areas. From the desktop study, the RDSIS and POC of RDL listed faunal species are expected to correlate with the findings for the field assessed study area as outlined in Section B of this report.
- No threatened or RDL bird species were identified during this survey. No evidence of threatened bird species occurring or roosting within the study area was encountered and the proposed mining expansion project is deemed unlikely to pose a conservation threat to RDL or protected bird species within the study area.
- Three reptile species were identified within the Rocky Ridge Habitat Unit bordering the study area. The importance of the study area in terms of reptile conservation is deemed low since the majority of the study area itself offers limited suitable habitat for reptile species. However, the sensitive rocky ridge areas have the potential to host RDL reptile species and as such must be conserved along with their associated buffer zones.
- No amphibian species were encountered during the assessment. Apart from the western wetland feature, the field assessed study area contains no suitable natural rivers, water bodies, wetland or riparian habitat expected to accommodate significant amphibian populations, which rely on the presence of surface water at periods in their life cycle. Amphibian species will therefore be more likely to occur in the vicinity of the western wetland feature than in the rest of the site.
- No RDL or protected invertebrate species were observed within the study area during the site survey, and the study area surveyed during the filed assessment is not expected to host any such species.
- No evidence was encountered of the Mygalomorph arachnids (Trapdoor and Baboon spiders) or scorpions within the study area. However, the sensitive rocky ridge areas have the potential to harbour RDL arachnid and scorpion species and as such must be preserved along with their associated buffer zones.

RDL and RDSIS assessment

- Seven RDL faunal species with a RDSIS POC greater than 60% were identified and include the African Grass Owl (*Tyto capensis*), the Peregrine Falcon (*Falco peregrinus*), Martial Eagle (*Polemaetus bellicosus*), Secretarybird (*Sagittarius serpentarius*), Red Winged Pratincole (*Glareola pratincola*), Short Tailed Pipit (*Anthus brachyurus*) and the South African Python (*Python natalensis*).
- The greater than 60% POC likelihood of these RDL faunal species is largely due to them utilising the study area for foraging purposes or using it as a migratory corridor.



- The RDSIS assessment of the study area provided a low score of 35%, indicating low importance to RDL faunal species conservation within the study area.

Faunal habitat conservation

- The proposed mine expansion activities are unlikely to pose a threat to RDL and threatened faunal species conservation provided that the sensitivity map indicating the western wetland area and rocky outcrop areas considered to be of higher ecological importance and buffer zones are adhered to.

Impact assessment

The table below serves to summarise the significance of perceived impacts on the faunal biodiversity of the study area before mitigation measures are implemented. Also indicated is the impact significance of each perceived impact after the required mitigatory measures needed to minimise each impact are implemented.

Impact	Unmanaged	Managed
1A: Impact on overall faunal biodiversity due to habitat loss	Medium High	Low
1B: Impact on overall faunal biodiversity due to fire and poaching within the study area	Medium Low	Low
1C: Impact on overall faunal biodiversity due to mining vehicle encroachment into sensitive habitat areas	Medium Low	Low
2A: Impact on IUCN RDL and NW SOER RDL faunal species with regards to the study area	Medium Low	Low

Four impacts which may affect the faunal communities of the study area were identified. The four identified impacts are of medium high to medium low significance and may affect overall faunal biodiversity due to habitat loss, fire and poaching within the study area, mining vehicle encroachment into sensitive habitat areas and impacts on RDL faunal species as a result of the proposed mining expansion. If mitigation and management measures are implemented as outlined in this document, the likelihood of impacts occurring and all four of the potential impacts may be significantly reduced to low significance impacts.

Sensitivity

The presence of faunal taxa is intrinsically related to habitat availability and as such, sensitivity mapping must consider faunal species habitat and not necessarily only the positions where more sensitive taxa were identified. The majority of the faunal species with a POC of 60% or more are likely to inhabit the Rocky Ridge Habitat Unit, which is considered to be of high ecological sensitivity. These areas are considered to be most important in terms of both faunal and floral habitat, with specific emphasis on the potential occurrence of RDL and the known occurrence of protected species, namely *Sclerocarya birrea* subsp. *africana*. The Wetland Habitat Unit may be divided into an eastern and western wetland feature. The eastern wetland feature is considered to be of low sensitivity due to the disturbances such as bush encroachment and terrestrial encroachment impacting on the wetland and due to the limited level of ecoservices this wetland area provides. The western wetland feature is of moderately low ecological sensitivity, as a result of less disturbance in this area, an increased level of wetland functioning and a higher PES. A 32m buffer zone as per the National Environmental Management Act (NEMA), 1998 and a 100m buffer zone as per Regulation GN704 of the National Water Act, 1998 around the wetland feature (please refer to Section 7 of this report) needs to be considered and the relevant authorisations in terms of NEMA and Regulation GN704 of the National Water Act need to be obtained in order to develop within such areas.

An overall sensitivity map was created with the use of the results from the floral, faunal and wetland assessment of the study area.



After conclusion of this biodiversity assessment, it is the opinion of the ecologists that the proposed mine expansion development is permitted, provided that the conditions and recommendations below are adhered to:

Development and operational footprint

- A sensitivity map has been developed for the study area, indicating the western wetland feature and rocky ridge areas which are considered to be of ecological importance. It is recommended that this sensitivity map (Section A) be considered during the planning/ pre-construction and construction phases of the proposed development activities to aid in the conservation of ecology within the proposed development area.
- It is recommended that this sensitivity map be considered during the planning/ pre-construction and construction phases of the proposed mine expansion activities to aid in the conservation of floral ecology, with specific reference to protected *Sclerocarya birrea* subsp *africana*, within the proposed development area. The footprint of the proposed mining activities should be confined to areas which are considered to be of lower ecological importance. If any *Sclerocarya birrea* subsp *africana* will be disturbed, the necessary permits must be applied for under the National Forest Act (1998).
- All development footprint areas should remain as small as possible. It must be ensured that all activities take the western wetland boundaries into account.
- Edge effects of activities should be strictly managed in the western wetland feature area as well as its associated buffer zones
- Prior construction it is advised to ‘flush out’ and help warn remaining faunal species to move and relocate naturally. ‘Flushing out’ of faunal species involves a number of people walking side by side at about 10m apart through the development site prior to construction. More mobile faunal species, such as hares, will move away from the site, while any less mobile species noted, such as chameleons, should be manually relocated to an area adjacent to the development site of similar habitat.
- It must be ensured that all sensitive open space areas of increased sensitivity are off-limits to construction vehicles and personnel.
- It must be ensured that construction related waste, waste rock material, building material, spillage and effluent do not affect the more sensitive western wetland features or rocky ridge areas and associated buffer zones.
- Should surface mining and mining infrastructure be developed on the farms Wolwekraal 408JQ and Kareepoort 407JQ, all wetland and rocky ridge areas should be delineated and assessed by a suitably qualified specialist. It should however be noted that these properties are earmarked for underground mining, with no surface infrastructure expected.

RDL and protected plant species

- All specimens of the protected tree species, *Sclerocarya birrea* subsp. *africana*, potentially impacted by development activities, are to be fenced for the duration of the construction phase. If these trees fall within the development footprint, special authorisation is to be obtained from relevant authorities for such trees to be cut, disturbed, damaged or destroyed. Applications for such activities should be made to the responsible official within the North-West Province.
- If possible, protected trees should be relocated, upon gaining authorisation to do so, to suitable open space areas. Should transplanting of such trees be unsuccessful, planting of additional *Sclerocarya birrea* subsp. *africana* trees must take place in disturbed areas/ areas earmarked for rehabilitation. For each protected tree species damaged or destroyed, two specimens of the same species, of reasonable size, should be planted in a designated open space area with similar habitat characteristics.
- Should the rocky ridge habitat or sections thereof be impacted by the mine, a detailed rescue and relocation plan must be compiled and all sensitive species occurring in these areas must be individually identified and marked prior to relocation. Biodiversity offset areas within nearby conservation areas must be identified should destruction of rocky ridge habitats occur. The offset should be undertaken as a minimum at a ratio of 5 (units): per unit of high ecological sensitivity unit disturbed. Additional marula trees may also be planted around any disturbed areas/ areas earmarked for rehabilitation.
- Sensitive flora species to be handled with care and any relocation of sensitive plant species is to be overseen by a botanist.
- Should any RDL or other protected plant species be encountered within the study area in the future, the following should be ensured:



- If any threatened species will be disturbed, ensure effective relocation of individuals to suitable offset areas.
- All rescue and relocation plans should be overseen by a suitably qualified specialist.

RDL and other faunal species

- Educate construction and mining personnel about the importance of faunal species that may be found in the area and biodiversity of the natural surroundings.
- No trapping or hunting of fauna is to take place. Access control into the mine expansion areas must be implemented to ensure that no illegal trapping or poaching takes place.
- Ensure that migratory connectivity is maintained by establishing a stream flow connection (such as a clean stormwater channel) between the rocky ridges to the east of the waste rock dump and the western wetland feature

Wetlands

- Where mining infrastructure is to be placed within or in the vicinity of the western wetland system, the associated buffers should be taken into account. Management measures to minimise impact of the western wetland feature as a result of mine expansion activities in the vicinity of the eastern wetland feature as outlined in this report should be adhered to where mine expansion activities encroach on the eastern wetland feature.
- The western wetland areas and the associated buffers should be clearly marked in the field prior to construction to ensure that all personnel are aware of the more sensitive habitats in vicinity of the project area.
- The boundaries of footprint areas are to be clearly defined and it should be ensured that all activities remain within defined footprint areas (i.e. edge effects must be limited where possible).
- As far as possible, the footprint areas of the proposed development should be minimised to minimise the impact on the western wetland feature and associated habitats in the area.
- It must be ensured that non-hazardous construction related waste and hazardous/ non-hazardous effluent do not affect the western wetland resources and associated buffer zones. Development impacts on the eastern wetland feature should be managed to minimise impacts on the western wetland feature.
- Edge effects of activities including erosion and alien/ weed control need to be strictly managed in these areas.
- It must be ensured that planning of mining infrastructure includes consideration of the more ecologically sensitive western wetland areas to ensure that these areas are avoided as far as possible.
- Access into these areas, particularly by vehicles, is to be strictly controlled.
- All vehicles should remain on designated roads with no indiscriminate driving through western wetland areas.
- Wetland and other rehabilitation measures are to be implemented where disturbance of the western wetland areas has occurred. The waste rock dump in the vicinity of the eastern wetland feature must be suitably grassed/ re-vegetated, if required, upon decommissioning.
- Ensure that all activities impacting on geohydrological resources of the property are managed according to the relevant DWA Licensing regulations and groundwater monitoring and management requirements.
- Clear separation of clean and dirty water systems must take place and good management of the dirty water system must take place to prevent unnecessary seepage and discharge.
- No dirty water runoff must be permitted to reach the western wetland resources and should be captured in a dirty water containment structure.
- No dumping should take place in or near western wetland resources and associated buffer zones in the vicinity of the Leeuwkop mine. The proposed waste rock dump is to be designed in such a manner as to minimise seepage in order to limit impacts on downstream aquatic resources, including the western wetland area.
- It must be ensured that all hazardous storage containers and storage areas comply with the relevant SABS standards to prevent leakage. All vehicles must be regularly inspected for leaks. Re-fuelling must take place on a sealed surface area to prevent ingress of hydrocarbons into topsoil.
- All spills should be immediately cleaned up and treated accordingly.
- Appropriate sanitary facilities must be provided for the life of the mine and all waste removed to an appropriate waste facility.



- Close monitoring of seepage and groundwater must take place by making use of physico-chemical assessment methods as well as toxicity testing protocols.

Vehicle access

- No activities are to infringe upon sensitive boundaries or the associated western wetland buffer zones and these areas should remain off limits to all unauthorized mining vehicle and personnel.
- All vehicles should remain on designated roads with no indiscriminate driving through western wetland areas or through open veld areas not earmarked for development and access into these areas, particularly by vehicles, is to be strictly controlled. If disturbance is unavoidable, it must be ensured that these areas are suitably rehabilitated.

Alien plant species

- Proliferation of alien and invasive species is expected within disturbed areas. These species should be eradicated and controlled to prevent their spread beyond the proposed development boundary. Alien plant seed dispersal within the top layers of the soil within footprint areas, that will have an impact on rehabilitation in the future, has to be controlled.
- An alien vegetation control plan has to be developed in order to manage alien plant species in the proposed future state of the study area.
- Removal of the alien and weed species encountered on the property must take place in order to comply with existing legislation (amendments to the regulations under the Conservation of Agricultural Resources Act, 1983 and Section 28 of the National Environmental Management Act, 1998). Removal of species should take place throughout the construction, operational, decommissioning and rehabilitation/ maintenance phases.
- Species specific and area specific eradication recommendations:
 - Care should be taken with the choice of herbicide to ensure that no additional impact and loss of indigenous plant species occurs due to the herbicide used.
 - No vehicles should be allowed to drive through designated sensitive areas during the eradication of alien and weed species.

Soils

- To prevent the erosion of top soils, management measures may include berms, soil traps, hessian curtains and stormwater diversion away from areas susceptible to erosion. It must be ensured that topsoil stockpiles are located outside of any drainage lines and areas susceptible to erosion. Such stockpiles should be placed away from areas known to contain hazardous substances such as fuel and if any soils are contaminated, it should be stripped and disposed of at a registered hazardous waste dumping site.
- During the construction and operational phases of the proposed mine expansion erosion berms should be installed to prevent gully formation and siltation of the wetland resources. The following points should serve to guide the placement of erosion berms:
 - Where the track has slope of less than 2%, berms every 50m should be installed.
 - Where the track slopes between 2% and 10%, berms every 25m should be installed.
 - Where the track slopes between 10%-15%, berms every 20m should be installed.
 - Where the track has slope greater than 15%, berms every 10m should be installed.

Fire

- All informal fires within the vicinity of the proposed mine expansion areas and surrounding veld should be prohibited, specifically during the construction and operational phases of the proposed development.
- Any local communities, if present, residing within close proximity to the study area where surface infrastructure is planned, should be informed about fire control and prevention measures to reduce the frequency of uncontrolled veld fires in areas surrounding and within the subject property.
- Fire management measures should be put in place for the portion of the study area where surface infrastructure is planned.



Dust

- It must be ensured that all roads and construction areas are regularly sprayed with water in order to curb dust generation. This is particularly necessary during the dry season when increased levels of dust generation can be expected. These areas should not be over-sprayed causing water run-off and subsequent sediment loss into waterways and drainage lines in the vicinity of the study area.

Rehabilitation

- As much vegetation growth as possible should be promoted within the proposed development area in order to protect soils. In this regard special mention is made of the need to use indigenous vegetation species where hydroseeding, wetland and rehabilitation planting (where applicable) are to be implemented.
- All soils compacted as a result of construction activities falling outside the development footprint areas, such as temporary access roads, should be ripped and profiled. Special attention should be paid to alien and invasive control within these areas. Alien and invasive vegetation control should take place throughout all phases of the development.
- Upon completion of the project, reseedling of indigenous grasses should be implemented in all affected areas and strategic planting of bushveld tree species should take place to re-establish microclimates and niche habitats. Permanent infrastructure should be suitably re-vegetated, if possible.
- It must be ensured that flow connectivity within the western wetland feature be maintained.
- Reprofilling of the banks of disturbed areas in close proximity to the western wetland feature, should this occur, must take place concurrently.
- If required to ensure stable banks and drainage features, these may be reinforced with gabions, reno mattresses and geotextiles, if disturbance of the western wetland feature has taken place.
- Reseed, with indigenous vegetation, any areas where earthworks have impacted upon the western wetland feature to prevent erosion.
- It must be ensured that disturbed and exposed areas are rehabilitated and covered with indigenous vegetation to prevent dust generation.



TABLE OF CONTENTS

EXECUTIVE SUMMARY	iii
List of Figures	xiv
List of Tables.....	xiv
Glossary of Terms & Acronyms.....	xv
1 INTRODUCTION.....	1
1.1 Background.....	1
1.2 Scope.....	7
1.3 Assumptions and Limitations.....	7
1.4 Legislation.....	8
1.4.1 National Environmental Management Act, 1998.....	8
1.4.2 National Environmental Management: Biodiversity Act, 2004.....	8
1.4.3 National Water Act, 1998.....	9
1.4.4 GN 704 – Regulations on use of water for mining and related activities aimed at the protection of water resources, 1999.....	9
2 METHODOLOGY.....	10
2.1 General Methodology.....	10
2.2 Ecological Impact Assessment Methodology.....	10
2.3 Mitigation measure development.....	14
3 ECOLOGICAL DESCRIPTION OF THE PROPERTY.....	15
3.1 Biome and bioregion.....	15
3.2 Vegetation type and Landscape Characteristics.....	19
3.3 Norite Koppies Bushveld.....	21
3.3.1 Distribution.....	21
3.3.2 Climate.....	21
3.3.3 Geology and soils.....	21
3.3.4 Conservation.....	21
3.3.5 Taxa of the Norite Koppie Bushveld.....	22
3.4 Marikana Thornveld.....	23
3.4.1 Distribution.....	23
3.4.2 Climate.....	23
3.4.3 Geology and soils.....	23
3.4.4 Conservation.....	23
3.4.5 Taxa of the Marikana Thornveld.....	23
3.5 Importance of subject property.....	24
4 AQUATIC ECOLOGICAL CHARACTERISTICS OF THE STUDY AREA.....	28
4.1 Aquatic Ecoregions.....	28
4.2 Ecostatus.....	30
4.3 General importance of the study area with regards to watercourse conservation.....	33
4.3.1 Importance according to SANBI Wetlands.....	33
5 SURROUNDING PROPERTIES/LAND USES.....	33
6 SENSITIVITY MAPPING.....	34
7 STRUCTURE OF THE REPORT.....	37
8 REFERENCES.....	38



List of Figures

Figure 1: Digital satellite image depicting the location of the subject property in relation to its surrounds.	3
Figure 2: Digital satellite image depicting the location of the subject property in relation to its surrounds.	4
Figure 3: Digital satellite image depicting the location of the study area in relation to its surrounds.	4
Figure 4: Subject property depicted on a 1:50 000 map in relation to its surrounding area.	5
Figure 5: The study area depicted on a 1:50 000 topographical map in relation to its surrounding area.	6
Figure 6: Biomes of South Africa.	16
Figure 7: Biomes associated with the subject property (Mucina & Rutherford, 2006).	17
Figure 8: Bioregions associated with the study area (Mucina & Rutherford, 2006).	18
Figure 9: Vegetation type associated with the subject property (Mucina & Rutherford, 2006).	20
Figure 10: Terrestrial ecosystem status.	26
Figure 11: Terrestrial Critical Biodiversity Areas (CBA) for the NW Province.	27
Figure 12: Ecoregions and quaternary catchments associated with the study area (Mucina and Rutherford, 2006)	29
Figure 13: Ecological sensitivity map for the study area.	35
Figure 14: Conceptual ecological sensitivity map for the farms Wolwekraal 408JQ and Kareepoort 407 JQ indicating desktop delineated rocky ridge areas (left) and potential wetland areas (right).	36

List of Tables

Table 1: Criteria for assessing significance of impacts.	12
Table 2: Significance rating matrix	13
Table 3: Positive/Negative Mitigation Ratings	13
Table 4: Classification of river health assessment classes in line with the RHP	30
Table 5: Summary of the ecological status of quaternary catchments A21K based on Kleynhans 1999	30
Table 6: Summary of the ecological status of quaternary catchments A21J based on Kleynhans 1999.	31



Glossary of Terms & Acronyms

Alien vegetation – Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally.

Biome – A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.

Bush encroachment – A state where undesirable woody elements gain dominance within grassland, leading to depletion of the grass component. Typically due to disturbances and transformations as a consequence of veldt mismanagement (overgrazing, incorrect burning, etc.).

°C – Degrees Celsius.

Endangered – Organisms in danger of extinction if causal factors continue to operate.

GDARD – Gauteng Department of Agriculture and Rural Development

ha – Hectares.

Indigenous vegetation – Vegetation occurring naturally within a defined area.

m – Metres.

mm – Millimetres.

MAMSL – Metres above mean sea level.

MAP – Mean annual precipitation.

MAT – Mean annual temperature.

Orange Listed – Species that are not Red Data Listed, but are under threat and at risk of becoming RDL in the near future. Usually allocated to species with conservation status of *Near Threatened (NT)*, *Least Concern (LC)*, *Rare* and *Data Deficient (DD)*.

PES – Present Ecological State.

POC – Probability of occurrence.

PRECIS – Pretoria Computer Information Systems.

Pioneer species – A plant species that is stimulated to grow after a disturbance has taken place. This is the first step in natural veld succession after a disturbance has taken place.

QDS – Quarter degree square (1:50,000 topographical mapping references).

Rare – Organisms with small populations at present.

RDL (Red Data listed) species – Organisms that fall into the *Extinct in the Wild (EW)*, *critically endangered (CR)*, *Endangered (EN)*, *Vulnerable (VU)* categories of ecological status.

RDSIS – Red Data Sensitivity Index Score.

SANBI – South African National Biodiversity Institute.



1 INTRODUCTION

1.1 Background

Scientific Aquatic Services (SAS) was appointed to conduct a floral, faunal and wetland ecological assessment as part of the environmental assessment and authorisation process and amendment of the Environmental Management Program (EMP). The current Environmental Impact Assessment (EIA) process caters for the proposed changes to the approved Leeuwkop Platinum Mine infrastructure layout and incorporating the farms Wolwekraal 408JQ and Kareepoort 407JQ into the mining right area. Afplats is proposing to amend the approved Leeuwkop Platinum Mine EMP to include the following:

- A change to the preferred mining method requiring a deeper shaft. The current mining method is changing from a fully mechanised room and pillar method to a more conventional stoping method and as such the depth of the shaft will be deepened from 1300m to 1600m;
- Development of a new waste rock dump. Due to the change in the mining method, additional waste rock will need to be stored on surface and as such Afplats is proposing to develop a new waste rock dump. This proposed waste rock dump will be approximately 24ha and will be located adjacent to the current mining activities;
- Expansion of the approved waste rock dump. As part of the 2006 EIA and EMP process a waste rock dump will be constructed between the approved shaft and the Segwaelane community. The purpose of this waste rock dump is to act as a noise barrier.
- The use of tailings backfill material for support underground. Grout packs will be used as additional shaft support underground. These grout packs will be comprised of tailings material, fly ash and other binding agents;
- The change in the mining method will require an increased workforce. The operational workforce is expected to increase from 900 to 3500 employees;
- Expansion of the sewage treatment plant. Due to the increase in the workforce the capacity of the sewage treatment plant will need to be increased in order to cater for the increased raw sewage generated at the mine;
- The expansion of water management facilities. The volumes of polluted water that will be generated on the mine will increase due to the change in mining method and as such an extension of the planned pollution control dams if required;
- The development of a new water holding facility. An additional water holding facility will be required to store make-up water for up to two weeks during the routing



maintenance of the Madibeng water pipeline that currently supplies water to the mine;

- A change in the planned routing of the access road specifically around the shaft area as well as the increase to the future parking area; and
- The inclusion of the farms Wolwekraal 408JQ and Kareepoort 407JQ into the mining rights area. Afplats currently holds a prospecting permit on these farms. At this stage no surface infrastructure is planned to be established on these additional farms.

The approved mining rights area is approximately 6 400ha in extent and is located directly to the north of the Segwaelane township and approximately 14km to the west of Brits within the North West Province. Some infrastructure, including the mine plant, has already been constructed within this area. The R556 roadway runs through the subject property and the N4 highway is located 9km to the south. The subject property is surrounded by undeveloped land and properties in which agricultural and mining activities dominate, leaving large areas transformed.

In order to address the changes to the planned mining infrastructure further studies were required within the proposed expansion footprint. The area of interest for this study was confined to an area of approximately 32ha in extent, situated directly to the north and south of the existing plant infrastructure. The study includes the footprint areas of the proposed access road re-alignment to the south of the existing infrastructure, the expansion of the sewage plant, the pollution control and emergency storage dams and the proposed new waste rock dump. In addition, a desktop assessment was undertaken for the farms Wolwekraal 408JQ and Kareepoort 407 JQ, covering a total area of approximately 900ha, for their potential inclusion into the mining rights area.

The ecological assessment was confined to the study areas as outlined above and indicated in Figures 1 – 4 and did not include an ecological assessment of surrounding properties. The surrounding area was however considered as part of the desktop assessment and literature review.

This report, after consideration and description of the ecological integrity of the property, must guide the property owner, authorities and proponent, by means of recommendations, as to the viability of the proposed mine expansions. The results of the study are presented in the sections below.



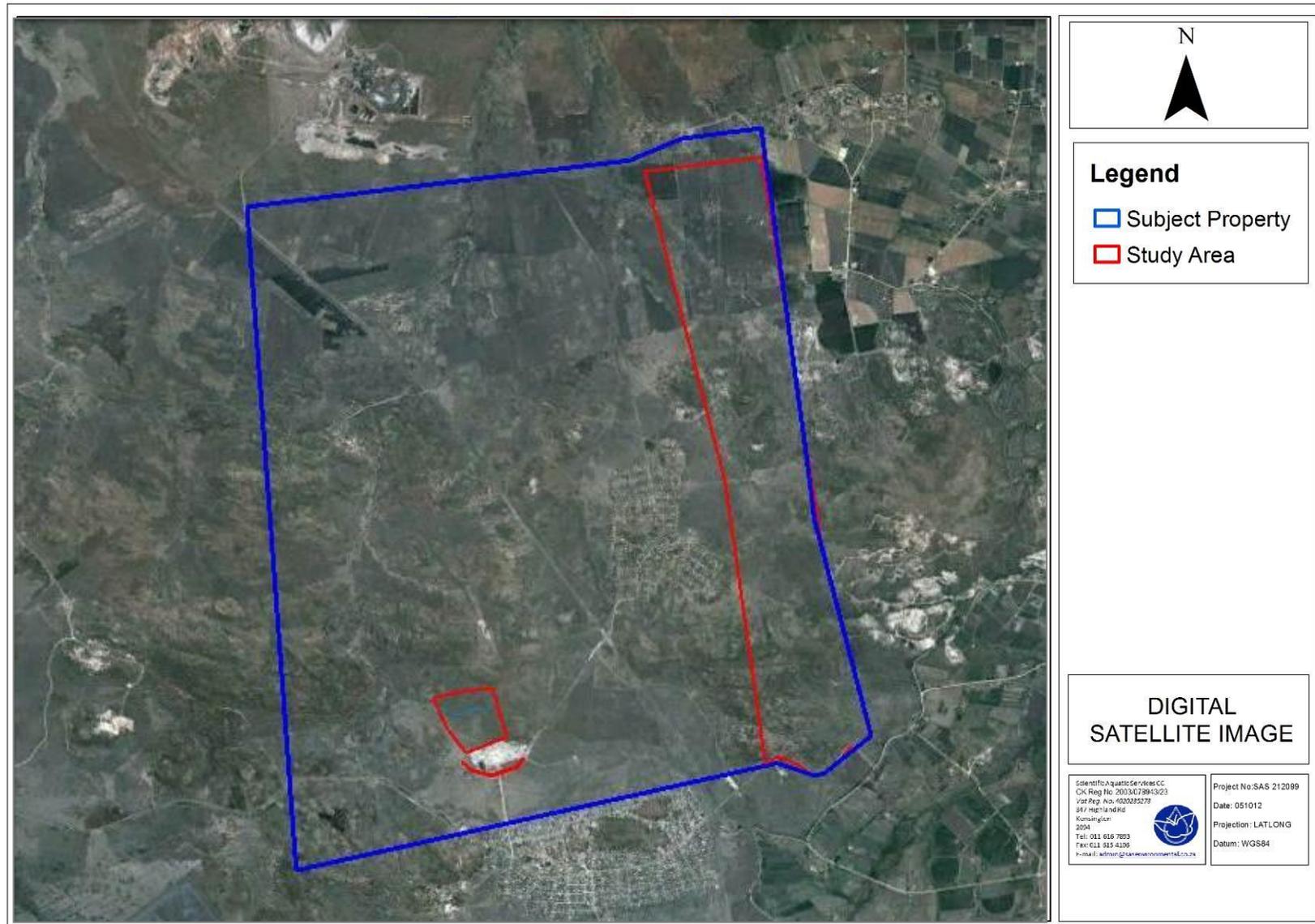


Figure 1: Digital satellite image depicting the location of the subject property in relation to its surrounds.





Figure 3: Digital satellite image depicting the location of the study area in relation to its surrounds.



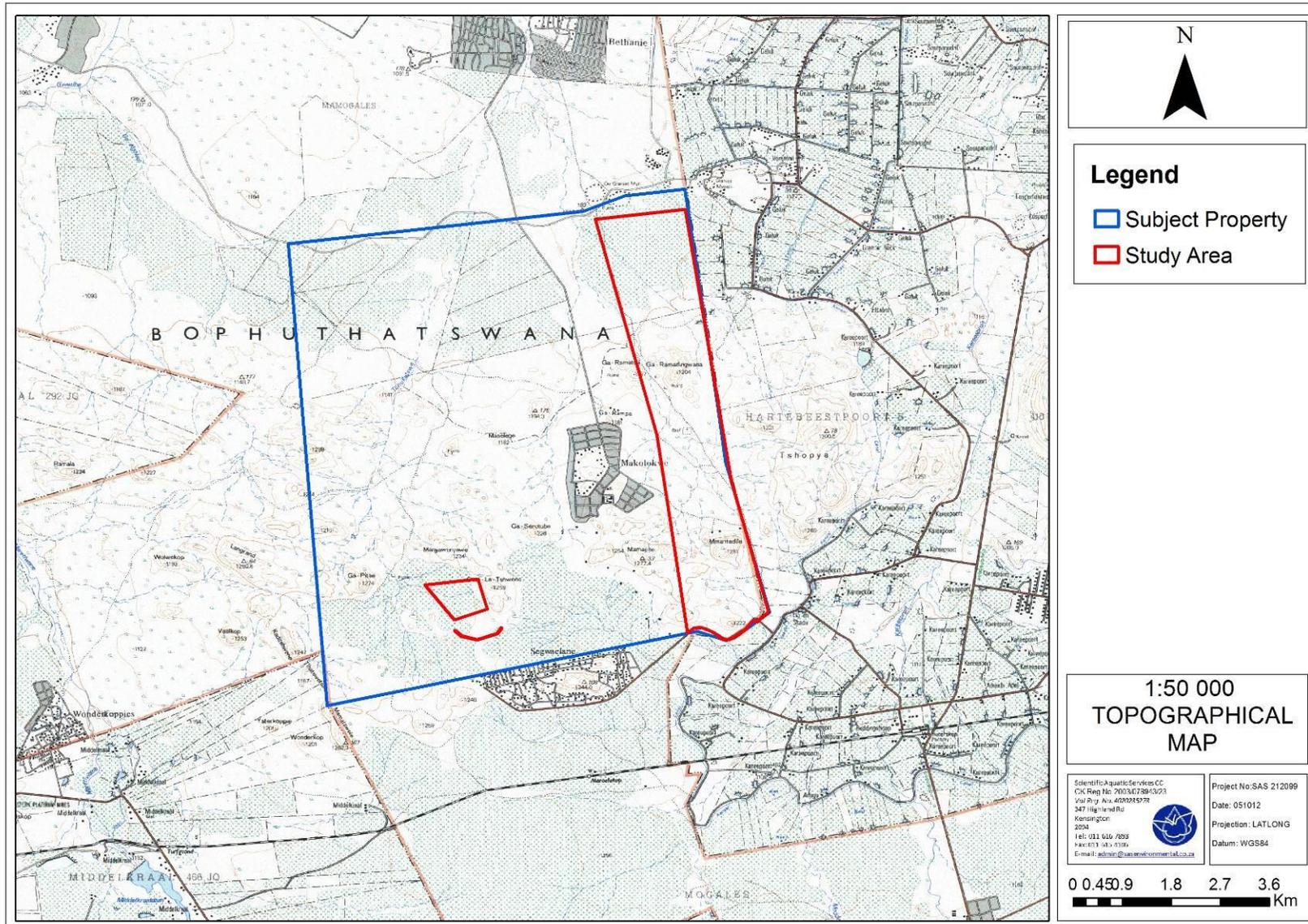


Figure 4: Subject property depicted on a 1:50 000 map in relation to its surrounding area.



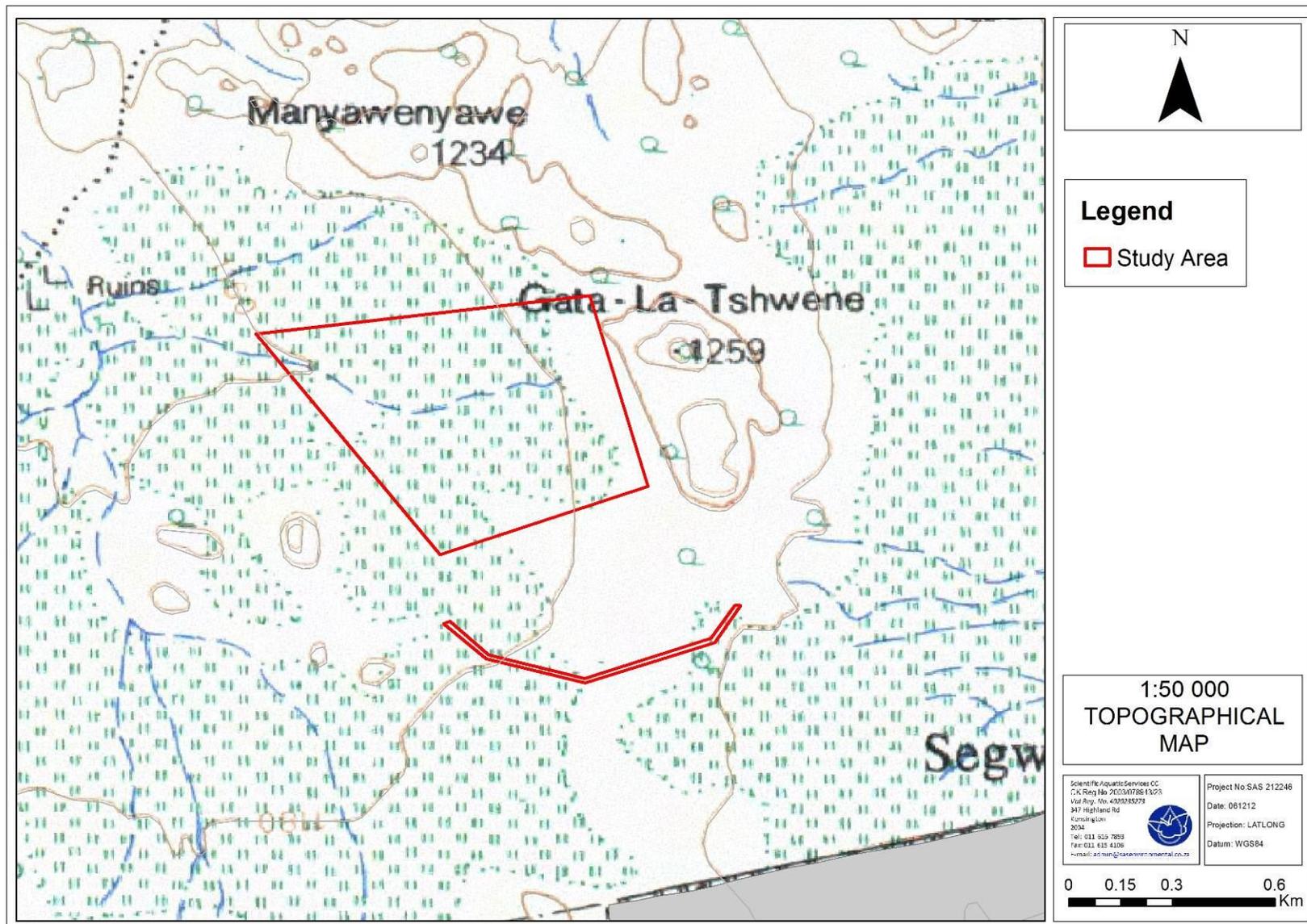


Figure 5: The study area depicted on a 1:50 000 topographical map in relation to its surrounding area.



1.2 Scope

Specific outcomes in terms of the floral and faunal assessment are as follow:

- To conduct a Red Data Listed (RDL) species assessment, including potential for species to occur on the subject property and the implementation of a Red Data Sensitivity Index Score (RDSIS) for the study area;
- To provide faunal and floral inventories of species as encountered on site;
- To determine and describe habitats, communities and ecological state of the study area and
- To describe the spatial significance of the subject property with regards to surrounding natural areas.

Specific outcomes in terms of the wetland assessment are as follow:

- To define the Present Ecological State (PES) of each wetland system within the study area;
- To determine the functioning of each system and the environmental and socio-cultural services that the system provide;
- To advocate a Recommended Ecological Category (REC) for each wetland feature;
- To delineate all wetlands or riparian zones occurring within the assessment site and
- To determine the environmental impacts of the proposed mining activity on the wetland areas within the proposed subject property.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The subject property is surrounded by undeveloped land and properties in which agricultural and mining activities dominate, leaving large areas transformed. Therefore the ecological assessment was confined to the study area and a desktop assessment of the farms Wolwekraal 408JQ and Kareepoort 407JQ and did not include an ecological assessment of surrounding properties. The surrounding area was however considered as part of the desktop assessment of the area.
- Due to the nature and habits of most faunal taxa it is unlikely that all species would have been observed during a site assessment of limited duration. Therefore, site observations are compared with literature studies where necessary.
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. A more accurate assessment would require that assessments take place in all seasons of the year however by undertaking



assessments in the spring/ summer period it is deemed likely that most faunal and floral communities would have been adequately assessed and/or considered.

- Sampling by its nature, means that not all individuals are assessed and identified. Some species and taxa on the subject property may therefore been missed during the assessment. The results of this study are however deemed to be an accurate representation of the overall ecology and conservation value of the subject property.
- The wetland delineation as presented in this report is regarded as a best estimate of the wetland boundary based on the site conditions present at the time of assessment.
- Wetlands and terrestrial areas form transitional areas where an ecotone is formed as vegetation species change from terrestrial species to facultative and obligate wetland species. Within this transition zone some variation of opinion on the wetland boundary may occur, however if the DWAF 2005 method is followed, all assessors should get largely similar results.

1.4 Legislation

1.4.1 National Environmental Management Act, 1998

- The National Environmental Management Act (Act 107 of 1998) and the associated Regulations (Listing No R. 544, No R. 545 and R. 546) as amended in June 2010, states that prior to any development taking place within a wetland or riparian area, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment process or the EIA process depending on the nature of the activity and scale of the impact.

1.4.2 National Environmental Management: Biodiversity Act, 2004

- The National Environmental Management: Biodiversity Act (Act 10 of 2004) provides for the management and conservation of biological diversity and the use of indigenous biological resources in a sustainable manner.
- The Biodiversity Act (Act 10 of 2004) provides for listing of threatened or protected ecosystems, in one of four categories: critically endangered (CR), endangered (EN), vulnerable (VU) or protected. The purpose of listing threatened ecosystems is primarily to reduce the rate of ecosystem and species extinction. This includes preventing further degradation and loss of structure, function and composition of threatened ecosystems. Under the National List of Ecosystems that are Threatened and in need of Protection (NEMBA, 2004) published on 9 December 2011, Marikana Thornveld is categorised as 'Vulnerable', referring to an ecosystem that have a high



risk of undergoing significant degradation of ecological structure, function or composition as a result of human intervention, although not considered critically endangered ecosystems or endangered ecosystems. Marikana Thornveld is classified as 'Vulnerable' because less than 60% of natural habitat is remaining of this vegetation type.

- The subject property fall within the southern reaches of a National Protected Areas Expansion Strategy Focus Area (NPAES, 2008). It is however not included in any formally or informally protected areas. Focus areas for land-based protected area expansion are large, intact and unfragmented areas of high importance for biodiversity representation and ecological persistence, suitable for the creation or expansion of large protected areas. The focus areas present the best opportunities for meeting the ecosystem-specific protected area targets set in the NPAES, and were designed with strong emphasis on climate change resilience and requirements for freshwater ecosystems. These areas should not be seen as future boundaries of protected areas, as in many cases only a portion of a particular focus area would be required to meet the protected area targets set in the NPAES. They are also not a replacement for fine-scale planning which may identify a range of different priority sites based on local requirements, constraints and opportunities.

1.4.3 National Water Act, 1998

- The National Water Act (Act 36 of 1998) recognises that the entire ecosystem and not just the water itself in any given water resource constitutes the resource and as such needs to be conserved.
- No activity may therefore take place within a watercourse unless it is authorised by Department of Water Affairs (DWA).

1.4.4 GN 704 – Regulations on use of water for mining and related activities aimed at the protection of water resources, 1999

- These Regulations, forming part of the National Water Act, were put in place in order to prevent the pollution of water resources and protect water resources in areas where mining activity is taking place from impacts generally associated with mining.



2 METHODOLOGY

2.1 General Methodology

In order to accurately determine the Present Ecological State (PES) of the study area and capture comprehensive data with respect to faunal and floral taxa the following methodology was used:

- Maps, aerial photographs and digital satellite images were consulted prior to the field assessment in order to determine broad habitats, vegetation types and potentially sensitive sites. An initial visual on-site assessment of the subject property was made in order to confirm the assumptions made during consultation of the maps.
- Literature review with respect to habitats, vegetation types and species distribution was conducted.
- Relevant data bases considered during the assessment of the study area included SANBI [Threatened species programme (TSP) and PRECIS] and the SANBI Biodiversity GIS database (BGIS).
- Specific methodologies for the assessment of faunal and floral ecological assemblages will be presented in the relevant sections along with the methodologies for assessing the integrity and function of wetland systems.
- A desktop assessment of potential site sensitivities was conducted for the farms Wolwekraal 408JQ and Kareepoort 407JQ. Areas with high potential sensitivity in terms of floral and faunal species occurrence and habitat availability were delineated with the use of aerial photography and topographical maps and are presented in this report. More sensitive landscape features include rocky ridge areas which may provide niche habitat for faunal and floral species (which is indicated as having high ecological sensitivity) as well as moderate ecological sensitive features including rocky areas of more gradual topography as well as potential rocky ridge buffer areas. Potential ecologically sensitive wetland and drainage line areas are also indicated.

2.2 Ecological Impact Assessment Methodology

In order for the EAP to allow for sufficient consideration of all environmental impacts, impacts were assessed using a common, defensible method of assessing significance that will enable comparisons to be made between risks/impacts and will enable authorities, stakeholders and the client to understand the process and rationale upon which risks/impacts have been assessed. The method to be used for assessing risks/impacts is outlined in the sections below.



The first stage of risk/impact assessment is the identification of environmental activities, aspects and impacts. This is supported by the identification of receptors and resources, which allows for an understanding of the impact pathway and an assessment of the sensitivity to change. The definitions used in the impact assessment are presented below.

- An **activity** is a distinct process or task undertaken by an organisation for which a responsibility can be assigned. Activities also include facilities or infrastructures that are possessed by an organisation.
- An **environmental aspect** is an ‘element of an organizations activities, products and services which can interact with the environment’¹. The interaction of an aspect with the environment may result in an impact.
- **Environmental risks/impacts** are the consequences of these aspects on environmental resources or receptors of particular value or sensitivity, for example, disturbance due to noise and health effects due to poorer air quality. In the case where the impact is on human health or well being, this should be stated. Similarly, where the receptor is not anthropogenic, then it should, where possible, be stipulated what the receptor is.
- **Receptors** can comprise, but are not limited to, people or human-made systems, such as local residents, communities and social infrastructure, as well as components of the biophysical environment such as wetlands, flora and riverine systems.
- **Resources** include components of the biophysical environment.
- **Frequency of activity** refers to how often the proposed activity will take place.
- **Frequency of impact** refers to the frequency with which a stressor (aspect) will impact on the receptor.
- **Severity** refers to the degree of change to the receptor status in terms of the reversibility of the impact; sensitivity of receptor to stressor; duration of impact (increasing or decreasing with time); controversy potential and precedent setting; threat to environmental and health standards.
- **Spatial extent** refers to the geographical scale of the impact.
- **Duration** refers to the length of time over which the stressor will cause a change in the resource or receptor.

The significance of the impact is then assessed by rating each variable numerically according to the defined criteria. Refer to the table below. The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The severity, spatial scope and duration of the impact together comprise the consequence of

¹ The definition has been aligned with that used in the ISO 14001 Standard.



the impact and when summed can obtain a maximum value of 15. The frequency of the activity and the frequency of the impact together comprise the likelihood of the impact occurring and can obtain a maximum value of 10. The values for likelihood and consequence of the impact are then read off a significance rating matrix and are used to determine whether mitigation is necessary².

The assessment of significance is undertaken twice. Initial, significance is based on only natural and existing mitigation measures (including built-in engineering designs). The subsequent assessment takes into account the recommended management measures required to mitigate the impacts. Measures such as demolishing infrastructure, and reinstatement and rehabilitation of land, are considered post-mitigation.

The model outcome of the impacts was then assessed in terms of impact certainty and consideration of available information. The Precautionary Principle is applied in line with South Africa's National Environmental Management Act (No. 108 of 1997) in instances of uncertainty or lack of information, by increasing assigned ratings or adjusting final model outcomes. In certain instances where a variable or outcome requires rational adjustment due to model limitations, the model outcomes have been adjusted.

Table 1: Criteria for assessing significance of impacts

LIKELIHOOD DESCRIPTORS

Probability of impact	RATING
Highly unlikely	1
Possible	2
Likely	3
Highly likely	4
Definite	5
Sensitivity of receiving environment	RATING
Ecology not sensitive/important	1
Ecology with limited sensitivity/importance	2
Ecology moderately sensitive/ /important	3
Ecology highly sensitive /important	4
Ecology critically sensitive /important	5

CONSEQUENCE DESCRIPTORS

Severity of impact	RATING
Insignificant / ecosystem structure and function unchanged	1
Small / ecosystem structure and function largely unchanged	2
Significant / ecosystem structure and function moderately altered	3

² Some risks/impacts that have low significance will however still require mitigation



Great / harmful/ ecosystem structure and function Largely altered	4
Disastrous / ecosystem structure and function seriously to critically altered	5
Spatial scope of impact	RATING
Activity specific/ < 5 ha impacted / Linear features affected < 100m	1
Development specific/ within the site boundary / < 100ha impacted / Linear features affected	2
Local area/ within 1 km of the site boundary / < 2000ha impacted / Linear features affected <	3
Regional within 5 km of the site boundary / < 5000ha impacted / Linear features affected < 10	4
Entire habitat unit / Entire system/ > 5000ha impacted / Linear features affected > 10 000m	5
Duration of impact	RATING
One day to one month	1
One month to one year	2
One year to five years	3
Life of operation or less than 20 years	4
Permanent	5

Table 2: Significance rating matrix

		CONSEQUENCE (Severity + Spatial Scope + Duration)														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
LIKELIHOOD (Frequency of activity + Frequency of impact)	1	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30
	2	4	6	9	12	15	18	21	24	27	30	33	36	39	42	45
	3	6	9	12	16	20	24	28	32	36	40	44	48	52	56	60
	4	8	12	16	20	25	30	35	40	45	50	55	60	65	70	75
	5	10	15	20	25	30	36	42	48	54	60	66	72	78	84	90
	6	12	18	24	30	36	42	49	56	63	70	77	84	91	98	105
	7	14	21	28	35	42	48	56	64	72	80	88	96	104	112	120
	8	16	24	32	40	48	54	63	72	81	90	99	108	117	126	135
	9	18	27	36	45	54	60	70	80	90	99	108	117	126	135	144
	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160

Table 3: Positive/Negative Mitigation Ratings

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150	Improve current management	Maintain current management
High	101-125	Improve current management	Maintain current management
Medium-high	76-100	Improve current management	Maintain current management
Medium-low	51-75	Maintain current management	Improve current management
Low	26-50	Maintain current management	Improve current management
Very low	1-25	Maintain current management	Improve current management



The following points were considered when undertaking the assessment:

- Risks and impacts were analysed in the context of the *project's area of influence* encompassing:
 - Primary project site and related facilities that the client and its contractors develops or controls;
 - Areas potentially impacted by cumulative impacts for further planned development of the project, any existing project or condition and other project-related developments; and
 - Areas potentially affected by impacts from unplanned but predictable developments caused by the project that may occur later or at a different location.
- Risks/Impacts were assessed for all stages of the project cycle including:
 - Construction;
 - Operation; and
 - Rehabilitation and Closure.
- If applicable, transboundary or global effects were assessed;
- Individuals or groups who may be differentially or disproportionately affected by the project because of their *disadvantaged* or *vulnerable* status were assessed.
- Particular attention was paid to describing any residual impacts that will occur after rehabilitation.

2.3 Mitigation measure development

The following points present the key concepts considered in the development of mitigation measures for the proposed development.

- *Mitigation and performance improvement measures* and actions that address the risks and impacts³ are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimization, mitigation or compensation.

Desired outcomes are defined, and have been developed in such a way as to be *measurable events with performance indicators, targets and acceptable criteria* that can be tracked over *defined periods*, with estimates of the *resources* (including human resource and training requirements) *and responsibilities for implementation*.

³ Mitigation measures should address both positive and negative impacts



3 ECOLOGICAL DESCRIPTION OF THE PROPERTY

3.1 *Biome and bioregion*

Biomes are broad ecological units that represent major life zones extending over large natural areas (Rutherford 1997). This assessment site falls within the Savanna Biome (Figure 5 & 6) (Rutherford & Westfall, 1994). Biomes are further divided into bioregions, which are spatial terrestrial units possessing similar biotic and physical features, and processes at a regional scale. This assessment site is situated within the Central Bushveld Bioregion (Figure 7) (Mucina & Rutherford, 2006).



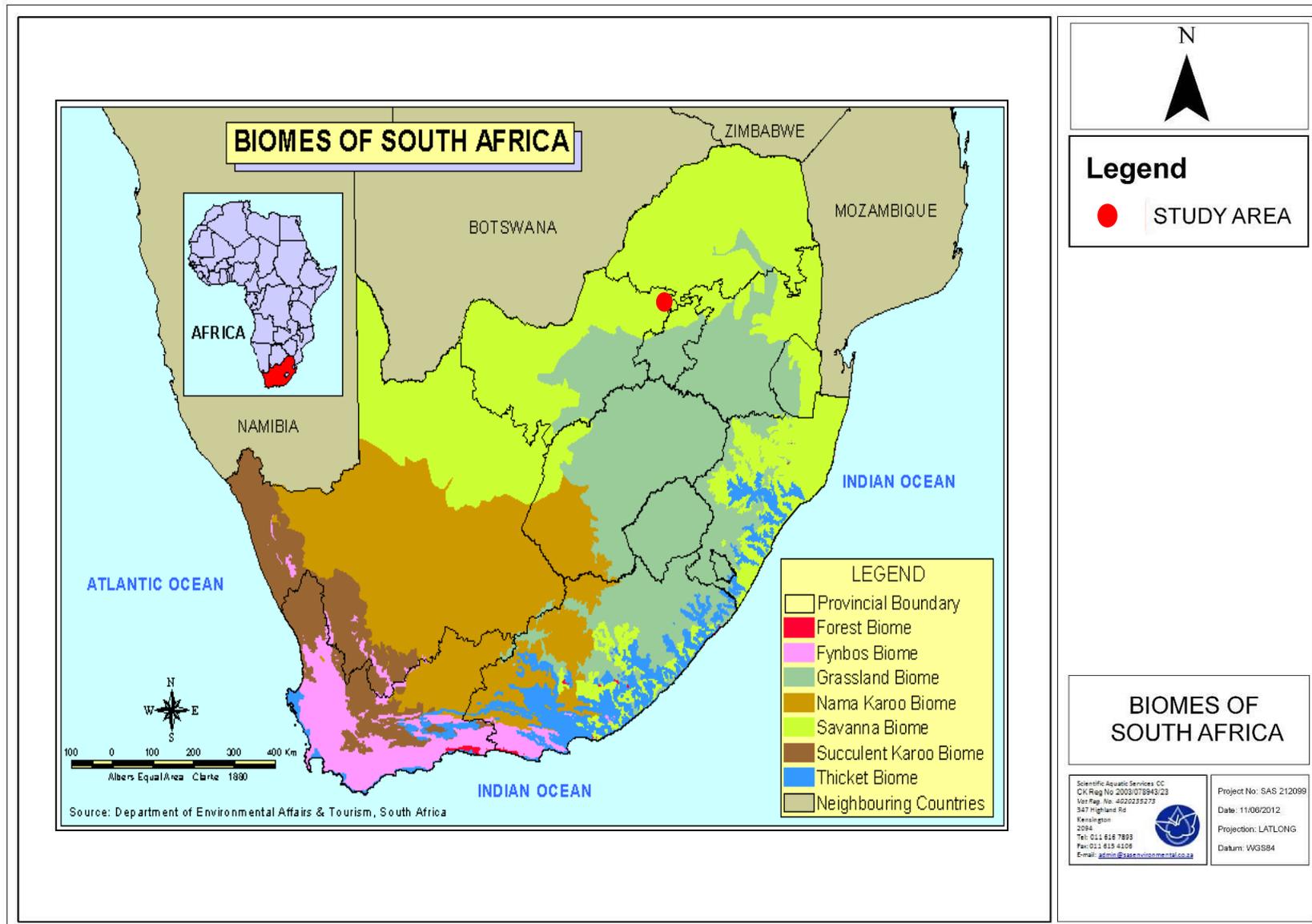


Figure 6: Biomes of South Africa.



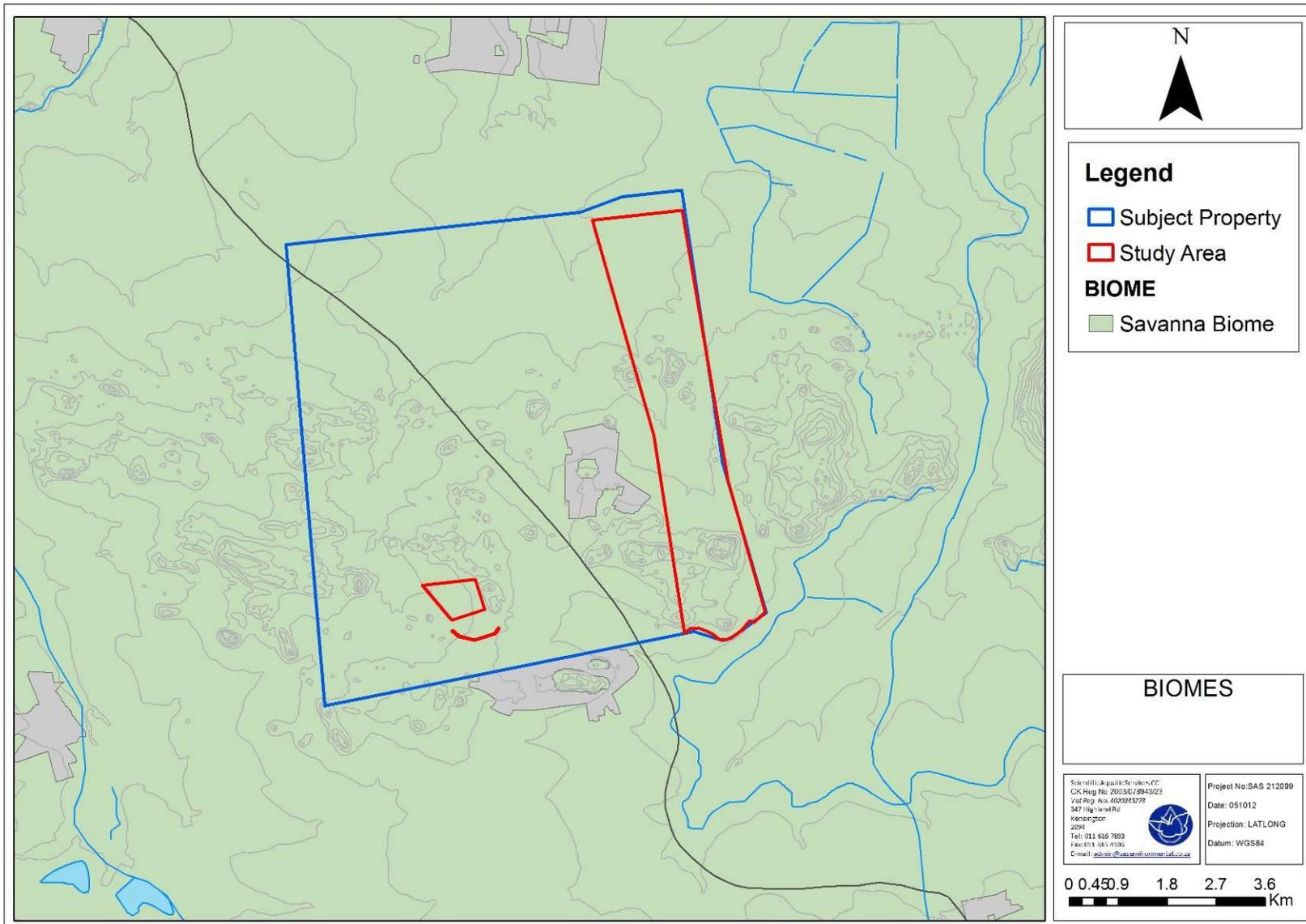


Figure 7: Biomes associated with the subject property (Mucina & Rutherford, 2006).



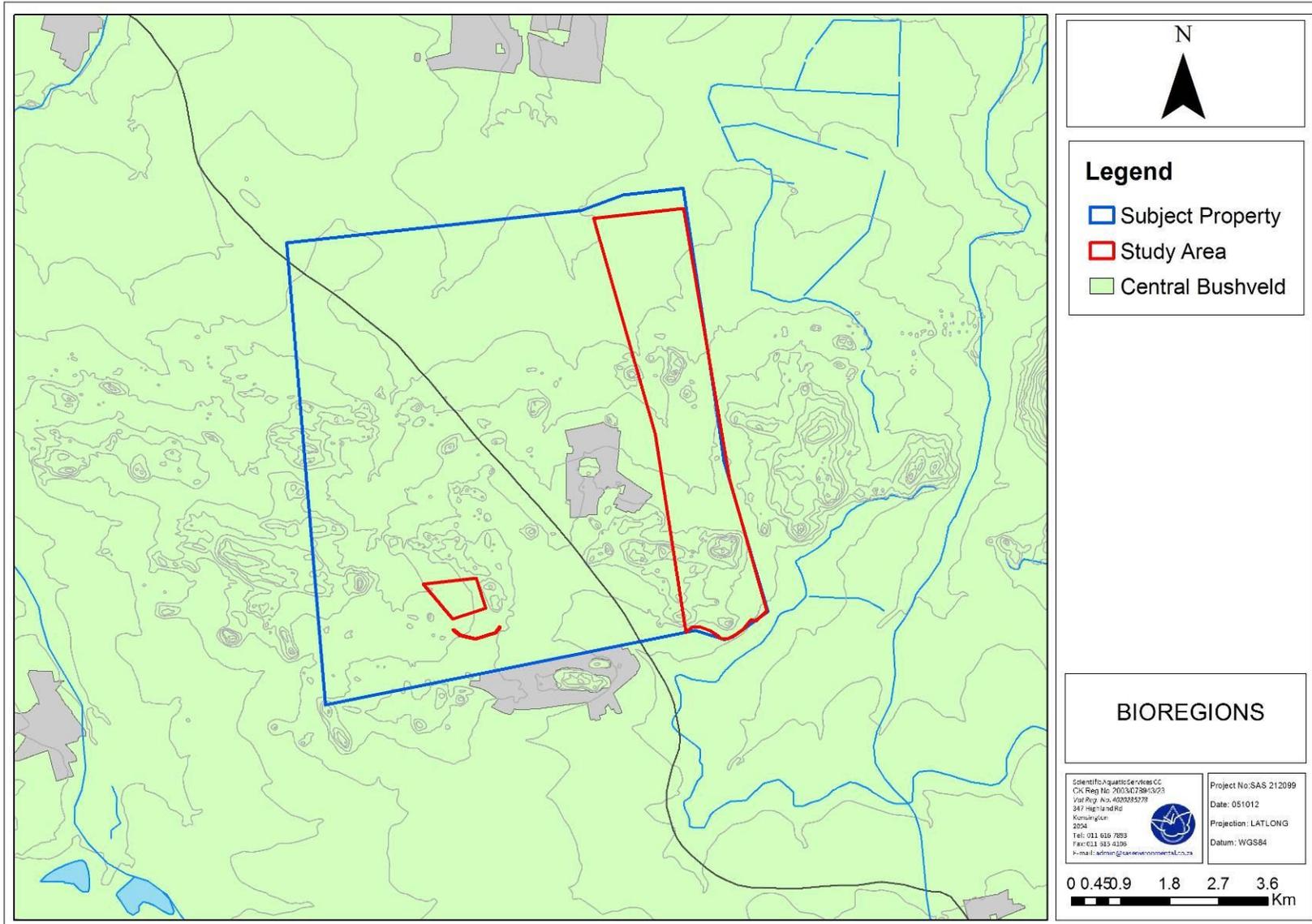


Figure 8: Bioregions associated with the study area (Mucina & Rutherford, 2006).



3.2 *Vegetation type and Landscape Characteristics*

While biomes and bioregions are valuable as they describe broad ecological patterns, they provide limited information on the actual species that are expected to be found in an area. Knowing which vegetation type an area belongs to provides an indication of the floral composition that would be found if the assessment site was in a pristine condition, which can then be compared to the observed floral list and so give an accurate and timely description of the ecological integrity of the assessment site. When the boundary of the assessment site is superimposed on the vegetation types of the surrounding area it can be seen that it falls within the Norite Koppies Bushveld and Marikana Thornveld Vegetation Type (Figure 8).



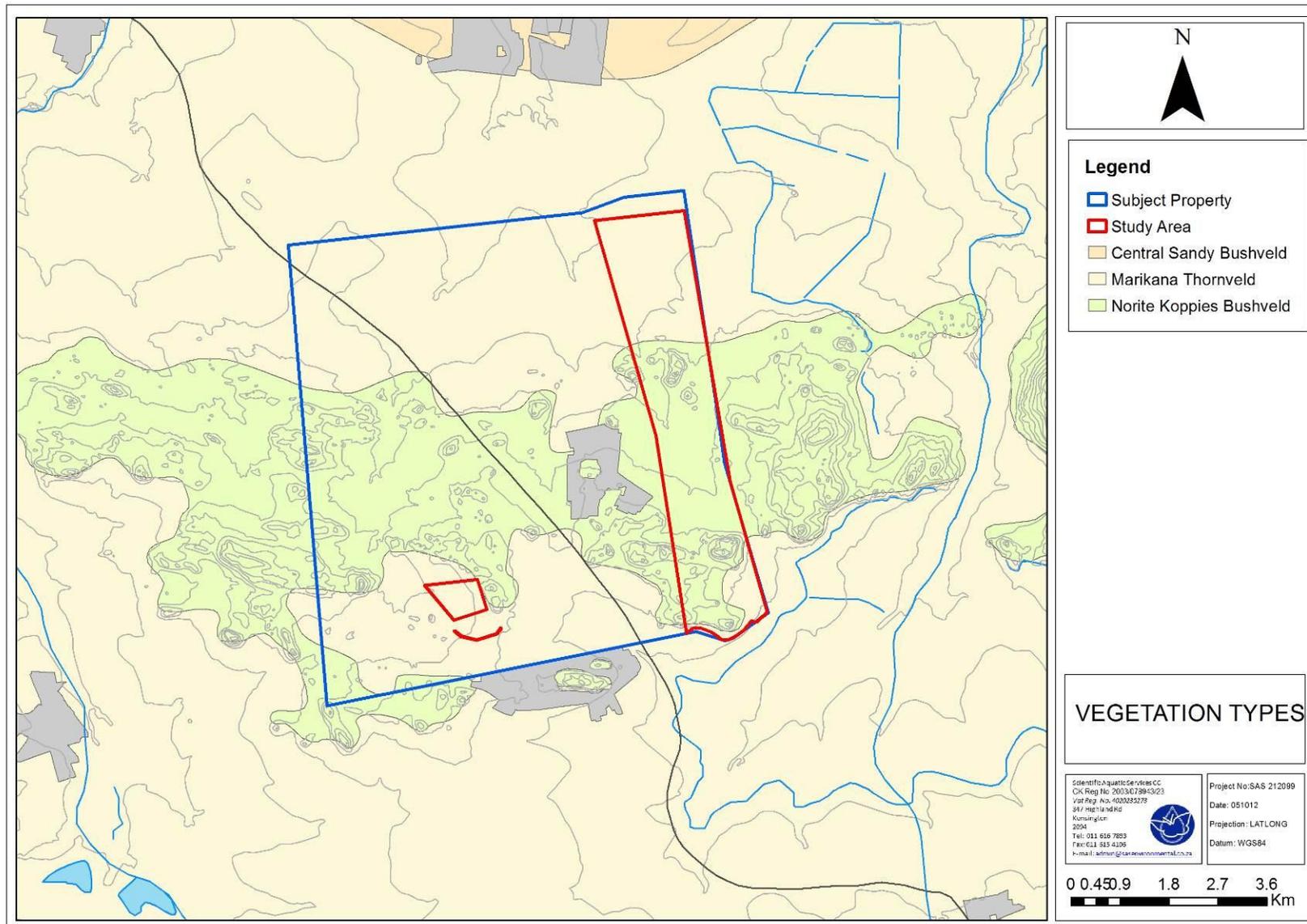


Figure 9: Vegetation type associated with the subject property (Mucina & Rutherford, 2006).



3.3 Norite Koppies Bushveld

3.3.1 Distribution

Norite Koppies Bushveld occurs in the North West and Gauteng Provinces. It is embedded in the Marikana Thornveld, north of the Magaliesberg, on rocky hills between Rustenburg and Pretoria with the highest hills near Brits. Altitude ranges from 1100 – 1350m (Mucina & Rutherford, 2006).

3.3.2 Climate

Norite Koppie Bushveld is characterised by summer rainfalls with dry winters. MAP has a relatively narrow range of 600 - 700 mm. Frost is fairly frequent around the base of hills in winter but less so on the hills (Mucina & Rutherford, 2006).

3.3.3 Geology and soils

The area is characterised by sediments of mostly gabbro and norite with interlayered anorthosite of the Pyramid Gabbro-Norite, Rustenburg Layered Suite, with a small area of the Rashoop Granophyre Suite (felsic igneous rocks), both of the Bushveld Complex. Large rock boulders and very shallow lithosols occur. Soils are well drained, Glenrosa and Mispah forms. In some areas vertic, melanic clays are found as well. Land types are mainly lb with some Ea also occurring (Mucina & Rutherford, 2006).

3.3.4 Conservation

Norite Koppies Bushveld is considered Least Threatened. The conservation target for the area is 24%. None of the vegetation type is conserved in statutory reserves but 4% is conserved in De Onderstepoort Nature Reserve. About 10% is transformed (but more recent assessments suggest about 20%), especially at the unit fringes, mainly by mining as well as urban and built up developments and cultivated areas. Mining is primarily in the form of granite quarries on koppies, but also affects surrounding lower-lying areas. Areas close to human settlement are often severely disturbed and many woody species may have been harvested from these areas for fuel or building materials. Weeds, including a number of declared aliens, are more common in these disturbed sites. Erosion is very low to moderate (Mucina & Rutherford, 2006).



3.3.5 Taxa of the Norite Koppie Bushveld

In terms of recent vegetation classifications, the assessed area occurs within the Norite Koppies Bushveld vegetation type (Mucina & Rutherford, 2006). This vegetation occurs as a low, semi-open to closed woodland up to 5m tall, consisting of dense deciduous shrubs and trees with very sparse undergrowth on shallow soils, with large areas not covered by vegetation. Tree and shrub layers are continuous. The stands of this unit are found on noritic outcrops and koppies, many appearing as inselbergs above the surrounding plains (Mucina and Rutherford, 2006).

Key indicator species of this vegetation type include:

- Tall trees: *Sclerocarya birrea subsp. caffra*,
- Small trees: *Combretum molle* (d), *Croton gratissimus* (d), *Ficus abutilifolia* (d), *Pappea capensis* (d), *Acacia caffra*, *Bridelia mollis*, *Combretum apiculatum*, *Cussonia paniculata*, *Dombeya rotundifolia*, *Faurea saligna*, *Ficus glumosa*, *Lanea discolor*, *Obetia tenax*, *Peltophorum africanum*, *Rhus leptodictya*, *Vangueria infausta*, *Ziziphus mucronata*,
- Succulent trees: *Euphorbia cooperi*
- Tall shrubs: *Triapsis glaucophylla* (d), *Canthiom gilfillanii*, *Clerodendrum glabrum*, *Diplorhynchus condylocarpon*, *Euclea natalensis*, *Grewia flavescens*, *G. monticola*, *Gymnosporia nemorosa*, *G. polyacantha*, *Pavetta eylesii*, *Pouzolzia mixta*, *Psydrax livida*, *Vitex zeyheri*,
- Low shrubs: *Jatropha latifolia var latifolia* (d), *Abutilon austro-africanum*, *Hermannia floribunda*, *Hibiscus subreniformis*, *Rhus zeyheri*,
- Succulent shrubs: *Tetradenia brevispicata*,
- Semiparasitic shrub: *Osyris lanceolata*,
- Woody climbers: *Helinus integrifolius*, *Rhoicissus tridentate*, *Turraea obtusifolia*,
- Woody Succulent climber: *Sarcostemma viminale*,
- Grass: *Chrysopogon serrulatus* (d), *Setaria lindenbergiana* (d), *Aristida congesta*, *Bulbostylis humilis*, *Eustachys paspaloides*, *Heteropogon contortus*, *Loudetia simplex*, *Melinis nerviglumis*, *Panicum maximum*, *Themeda triandra*,
- Herbs: *Hibiscus sidiformis*, *Pellaea calomelanos*, *P. viridis*, *Scadoxus puniceus*

*(d) = dominant species



3.4 Marikana Thornveld

3.4.1 Distribution

Marikana Thornveld occurs in the North West and Gauteng Provinces. It occurs on plains from the Rustenburg area in the west, through Marikana and Brits to the Pretoria area in the east. Altitude ranges from 1050 – 1450m (Mucina & Rutherford, 2006).

3.4.2 Climate

Marikana Thornveld is characterised by summer rainfalls with very dry winters. The mean annual temperature (MAP) ranges between 600 and 700mm and frost is fairly frequent in winter. Mean monthly maximum and minimum temperatures for the Brits region are 35.3°C and -3.3°C for January and June respectively. Corresponding values are 35.3°C and -1.4°C for Rustenburg (November and July) and 32.8°C and -1.0°C for Pretoria University Experimental Farm (Jan and July). (Mucina & Rutherford, 2006).

3.4.3 Geology and soils

Most of the area is underlain by the mafic intrusive rock of the Rustenburg layered suite of the Bushveld Igneous Complex. Rocks include gabbro, norite, pyroxenite and anorthosite. The shales and quartzites of the Pretoria group also contribute. The soils mainly consist of vertic melanic clay with some dystrophic or mesotrophic plinthic catenas and some freely drained, deep soils. Land types are mainly Ea, Ba and Ae (Mucina & Rutherford, 2006).

3.4.4 Conservation

Marikana Thornveld is considered Endangered. The conservation target for the area is 19% and less than 1% is statutorily conserved in for example, Magaliesberg Nature Area. More of the vegetation type is conserved in other reserves such as De Onderstepoort Nature Reserve. The vegetation type is considerably impacted. With 48% transformed, mainly by cultivation and urban or built up areas. Most agricultural development of this area is in the western regions towards Rustenburg, while in the east industrial development is a greater threat. Erosion is very low to moderate. Alien invasive plants occur localised in high densities, especially along drainage lines (Mucina & Rutherford, 2006).

3.4.5 Taxa of the Marikana Thornveld

In terms of recent vegetation classifications, the assessed area occurs within the Marikana Thornveld vegetation type (Mucina & Rutherford, 2006). This vegetation occurs as open



Acacia karroo woodland, in valleys and slightly undulating plains and some lowland hills. Shrubs are more dense along drainage lines, on termitaria and rocky outcrops or in other habitats protected from fire.

Key indicator species of this vegetation type include:

- Tall tree: *Acacia burkei*;
- Small trees: *Acacia caffra* (d), *A. gerrardii*, *A. karoo* (d), *A. nilotica*, *A. tortilis* subsp. *heteracantha*, *Combretum molle* (d), *Rhus lancea* (d), *Ziziphus mucronata* (d), *Pappea capensis*, *Dombeya rotundifolia*, *Peltophorum africanum*, *Celtis africana*, *Terminalia sericea*;
- Tall shrubs: *Euclea crispa* subsp. *crispa* (d), *Olea europaea* subsp. *africana* (d), *Rhus pyroides* var. *pyroides* (d), *Diospyros lycoides* subsp. *guerkei*, *Ehretia rigida* subsp. *rigida*, *Euclea undulata*, *Grewia flava*, *Pavetta gardeniifolia*;
- Low shrubs: *Asparagus cooperi* (d), *Rhynchosia nitens* (d), *Indigofera zeyheri*, *Justicia flava*;
- Woody climbers: *Clematis brachiata* (d), *Helinus integrifolius*;
- Herbaceous climber: *Cyphostemma cirrhosum*, *Pentarrhium insipidum* (d);
- Graminoids: *Elionurus muticus* (d), *Eragrostis lehmanniana* (d), *Setaria sphacelata* (d), *Themeda triandra* (d), *Aristida scabrivalvis* subsp. *scabrivalvis*, *Fingerhuthia africana*, *Heteropogon contortus*, *Hyperthelia dissoluta*, *Melinis nerviglumis*, *Pogonarthria squarrosa*;
- Herb: *Hermannia depressa* (d), *Ipomoea obscura* (d), *Vernonia oligocephala*; and
- Geophytic herbs: *Ledebouria revoluta*, *Ornithogalum tenuifolium*, *Sansevieria aethiopica*

*(d) = dominant species

3.5 Importance of subject property

According to the North West Province Biodiversity Conservation Assessment (2009)⁴, the subject property may fall within a Vulnerable Ecosystem and within a T2 Critical Biodiversity Area (CBA) (See figures below). According to the North West Province Biodiversity Conservation Assessment (2009)⁵, T2 CBA's can be described as follows:

- Remaining patches larger than 5ha of provincially endangered and vulnerable ecosystems (vegetation types), i.e. the amount remaining intact of this vegetation type

⁴ North West Province Biodiversity Conservation Assessment Technical Report Version One (2009)

⁵ North West Province Biodiversity Conservation Assessment Technical Report Version One (2009)



is less than 60%. Any further transformation of these vegetation types should be limited to existing transformed or heavily degraded areas.

Thus, in terms of the North West Province Biodiversity Conservation Assessment (2009), the proposed mining expansion project must be situated in transformed or heavily degraded areas. From this assessment, it is clear that the majority of the areas within the Leeuwkop study area earmarked for mine expansion has already experienced significant habitat transformation.



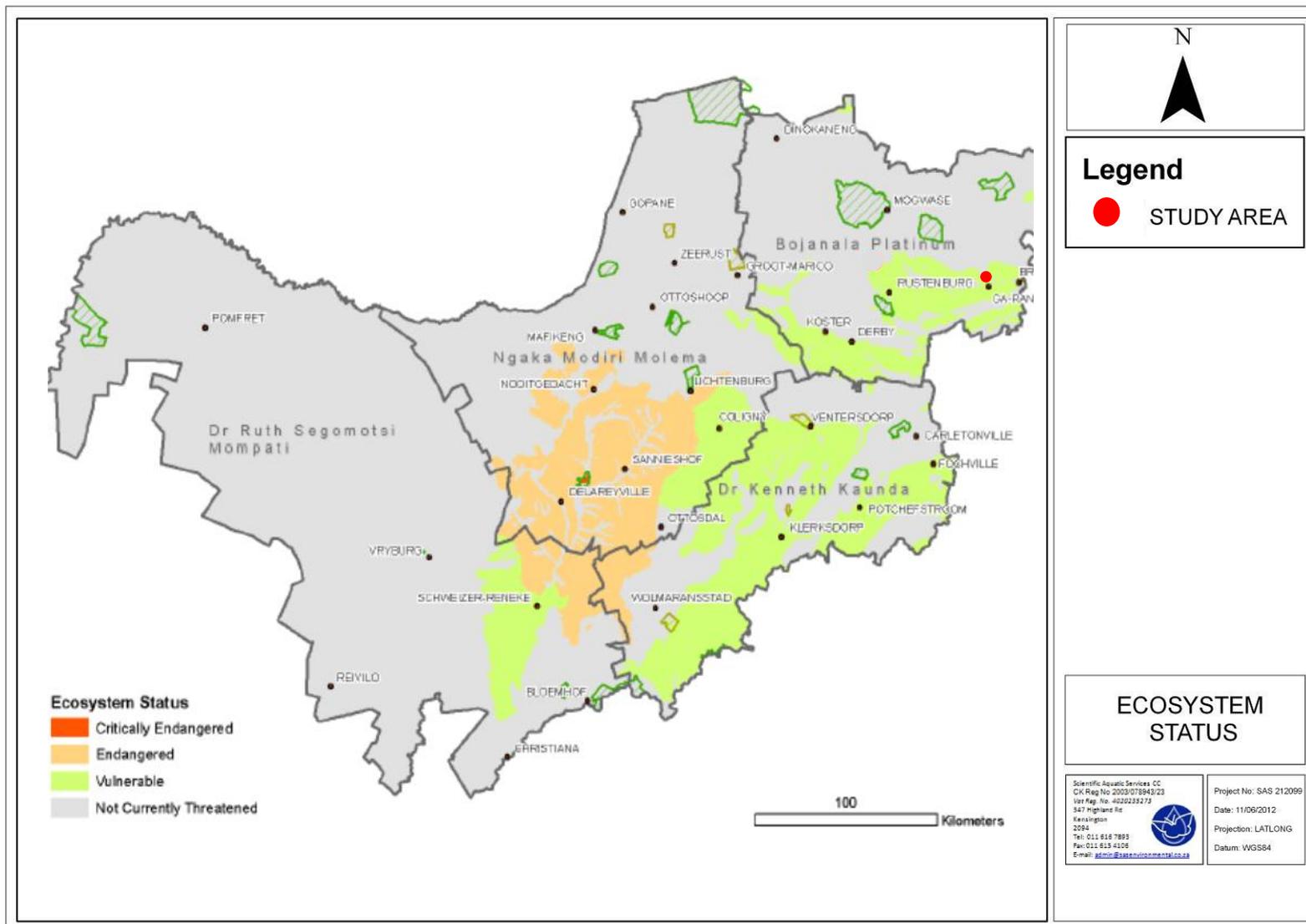


Figure 10: Terrestrial ecosystem status.



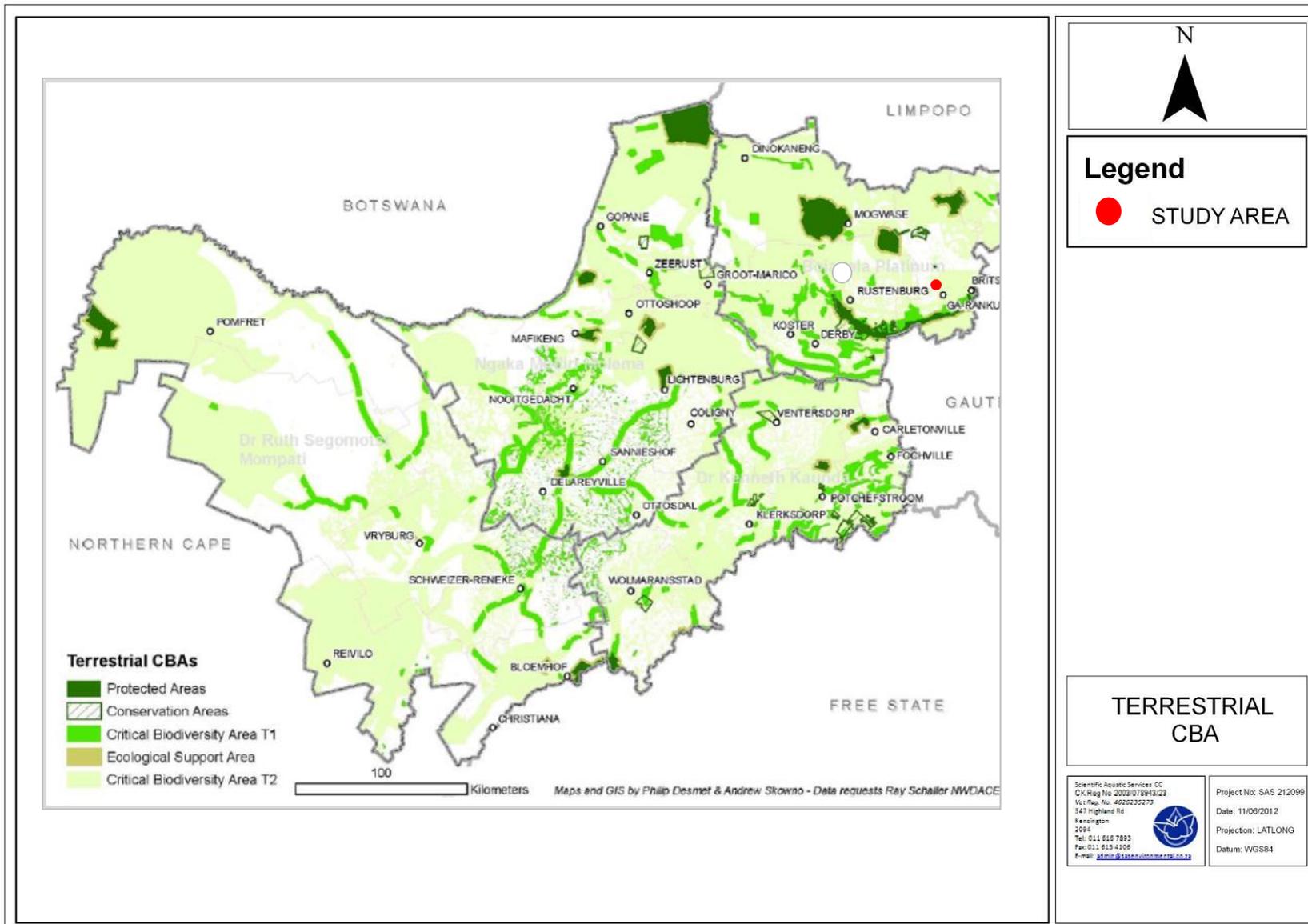


Figure 11: Terrestrial Critical Biodiversity Areas (CBA) for the NW Province.



4 AQUATIC ECOLOGICAL CHARACTERISTICS OF THE STUDY AREA

4.1 Aquatic Ecoregions

When assessing the ecology of any area (aquatic or terrestrial), it is important to know which ecoregion the study area is located within. This knowledge allows for improved interpretation of data to be made, since reference information and representative species lists are often available on this level of assessment, which aids in guiding the assessment.

The study area falls within the Bushveld Basin Aquatic Ecoregions and is located within on the catchment divide between the A21J and A21K quaternary catchments. Figure 11 below indicates the aquatic ecoregions and quaternary catchment of the study area. From the figure it is evident that the majority of the study area falls in the extreme headwaters of the A21K quaternary catchment. With this position in the landscape any drainage features in the area can be expected to be small ephemeral streams fed by hillslope seepage wetlands.



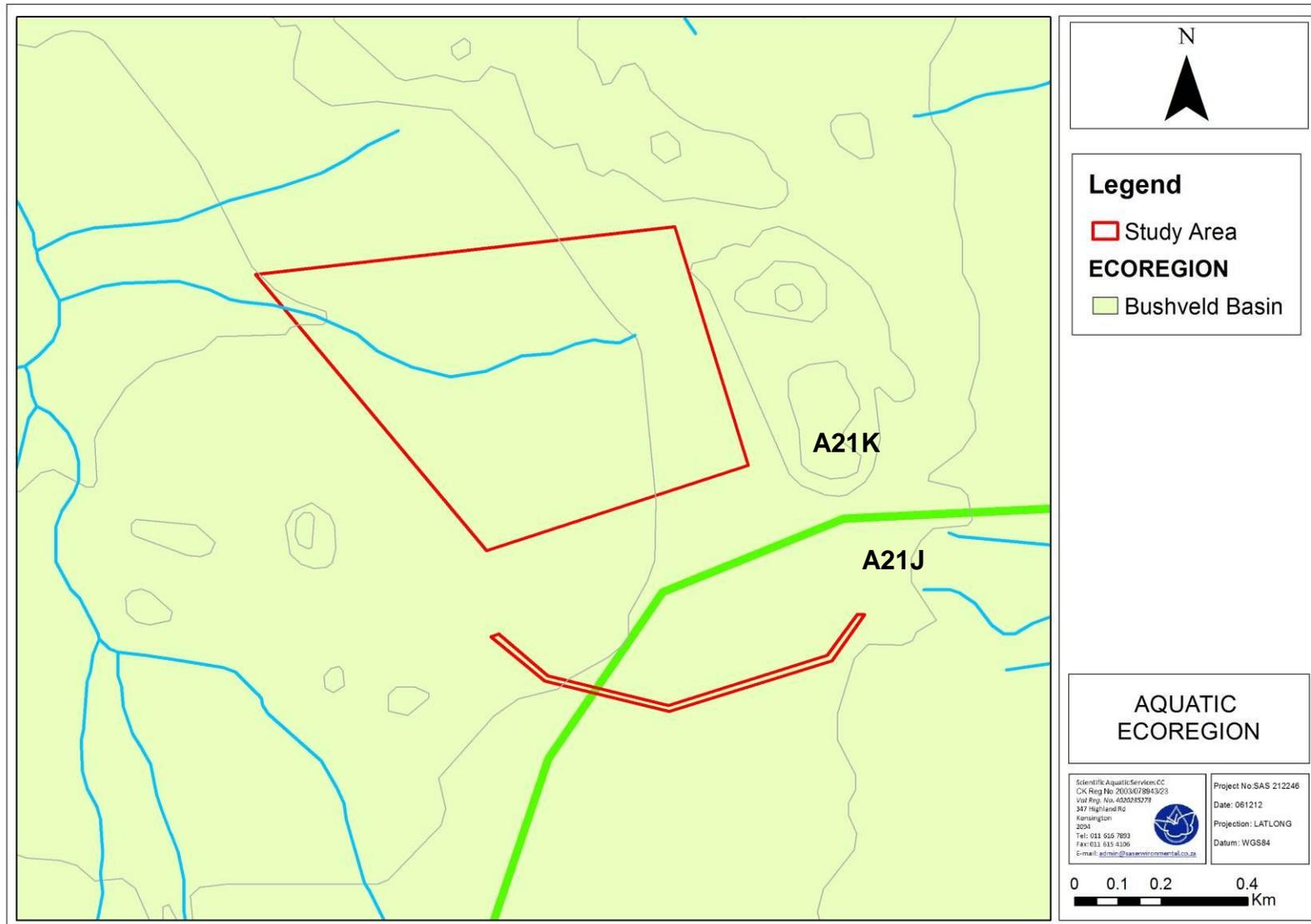


Figure 12: Ecoregions and quaternary catchments associated with the study area (Mucina and Rutherford, 2006)



4.2 Ecstatus

Water resources are generally classified according to the degree of modification or level of impairment. The classes, used by the South African River Health Program (RHP), are presented in the table below and will be used as the basis of classification of the systems in this desktop study, as well as future field studies.

Table 4: Classification of river health assessment classes in line with the RHP

Class	Description
A	Unmodified, natural.
B	Largely natural, with few modifications.
C	Moderately modified.
D	Largely modified.
E	Extensively modified.
F	Critically modified.

Studies undertaken by the Institute for Water Quality Studies assessed all quaternary catchments as part of the Resource Directed Measures for Protection of Water Resources. In these assessments, the Ecological Importance and Sensitivity (EIS), Present Ecological Management Class (PEMC) and Desired Ecological Management Class (DEMC) were defined and serve as a useful guideline in determining the importance and sensitivity of aquatic ecosystems, prior to assessment or as part of a desktop assessment.

This database was searched for the two catchments of concern in order to define the EIS, PEMC and DEMC. The results of the assessment are summarised in the table below.

Table 5: Summary of the ecological status of quaternary catchments A21K based on Kleynhans 1999

Catchment	Resource	EIS	PESC	DEMC
A21K	Sterkstroom	MODERATE	CLASS C	C: Moderately sensitive systems

A21K

According to the ecological importance classification for the quaternary catchment, the system can be classified as a *Moderately Sensitive* system which, in its present state, can be considered a Class C (moderately modified) stream.

The points below summarise the impacts on the aquatic resources in the quaternary catchment A21K (Kleynhans 1999):



- The aquatic resources within this quaternary catchment have been moderately affected by bed modification.
- Low levels of flow modification occur within the quaternary catchment due to the Buffelspoort Dam.
- Low levels of impact have occurred as a result of introduced aquatic biota, namely *Cyprinus carpio* and *Micropterus salmoides*.
- Impact due to inundation as a result of the presence of dams in the catchment is moderate.
- Riparian zones and stream bank conditions are considered to be moderately impacted by exotics and cultivation.
- Water quality modification is of a moderate degree.

In terms of ecological functions, importance and sensitivity, the following points summarise the conditions in this catchment:

- The riverine systems in this catchment have a high diversity of habitat types.
- The quaternary catchment has a moderate importance in terms of conservation.
- The quaternary catchment has a moderate flow and flow related water quality.
- The quaternary catchment is regarded as having no importance for rare and endangered species conservation.
- The quaternary catchment is considered of low importance in terms of provision of migration routes in the instream and riparian environments.
- The quaternary catchment has a moderate importance in terms of providing refugia for aquatic community members.
- The quaternary catchment can be considered to have a moderate sensitivity to changes in water quality and a high sensitivity to changes in water flow.
- The quaternary catchment is of moderate importance in terms of species richness.
- The quaternary catchment is of high importance in terms of endemic and isolated species, namely *Amphilius uranoscopus* and *Barbus motebensis*.

Table 6: Summary of the ecological status of quaternary catchments A21J based on Kleynhans 1999.

Catchment	Resource	EIS	PESC	DEMC
A21J	Crocodile	MODERATE	CLASS B	C: Moderately sensitive systems



A21J

According to the ecological importance classification for the quaternary catchment, the system can be classified as a *Moderately Sensitive* system which, in its present state, can be considered a Class B (largely natural) stream.

The points below summarise the impacts on the aquatic resources in this quaternary catchment (Kleynhans 1999):

- The aquatic resources within this quaternary catchment have been greatly affected by bed modification with the main causes being sediment and scouring algal growth.
- Very high levels of flow modifications have taken place in areas assessed downstream from the Hartebeespoort dam due to water regulation.
- A high impact from the introduced fish species, including *Cyprinus carpio*, and introduced plant species, including *Eichhornia crassipes* (Common water hyacinth), exists, which is likely to affect populations of smaller fish species and possibly the invertebrate community.
- A very high impact from inundation as a result of weir construction is likely.
- Riparian zones and stream bank conditions are considered to be impacted due to alien vegetation encroachment and the presence of cultivated lands.
- A high impact due to water quality modification is deemed likely, due to agricultural and return water, as well as eutrophication within the system.

In terms of ecological functions, importance and sensitivity, the following points summarise the conditions in this catchment:

- The riverine systems in this catchment have a moderate diversity of habitat types.
- The system has a low importance in terms of conservation.
- The system has a high intolerance to flow requirements and flow related water quality changes.
- In terms of instream and riparian function as a migration route/ corridor, the system is moderately important, specifically in terms of fish and birds migratory corridors.
- In terms of rare and endangered species importance, the system is not important.
- The riverine resources are moderately sensitive to changes in water quality and moderately sensitive to changes in flow.
- The area has a high importance in terms of species and toxon richness.
- The system hosts a moderate number of unique species, with specific reference to *Aplocheilichthys johnstoni* and *Chiloglanis pretoriae*.
- The area has a moderate importance as a source of refugia for aquatic species.



4.3 General importance of the study area with regards to watercourse conservation

4.3.1 Importance according to SANBI Wetlands

The SANBI Wetland Inventory (2006) and National Freshwater Ecosystem Priority Areas (NFEPA) (2011), databases was consulted to define the aquatic ecology of the wetland or river systems close to or within the subject property that may be of ecological importance.

Aspects applicable to the subject property and surroundings are discussed below:

- The subject property falls within the Crocodile (west) and Marico Water Management Area (WMA). Each Water Management Area is divided into several sub-Water Management Areas (subWMA), where the catchment or watershed is defined as a topographically defined area which is drained by a stream or river network. The Sub-Water management unit indicated for the subject property is the Upper crocodile sub-WMA.
- No NFEPA wetlands or flagship rivers were identified within or immediately adjacent to the study area.
- No wetland clusters of conservational importance were indicated within or near the study area.
- The applicable FEPA WMA data do not indicate any riverine resources within the Leeuwkop study area which is of significance in terms of fish conservation.
- Wetlands located within the subject property are not shown to provide breeding habitat for cranes.
- No RAMSAR wetlands are located within or close to the subject property.
- No wetlands are indicated to fall within 500m of an IUCN threatened frog point locality.

5 SURROUNDING PROPERTIES/LAND USES

The R556 highway runs through the subject property which is located directly north Segwaelane and approximately 14km to the west of Brits within the North West Province. The subject property is surrounded by areas of open veld and properties in which agricultural and mining activities dominate, leaving the surrounding areas largely transformed.



6 SENSITIVITY MAPPING

All the ecological features of the study area were considered and sensitive areas were delineated with the use of a Global Positioning System (GPS). A Geographic Information System (GIS) was used to project these features onto aerial photographs and topographic maps. The sensitivity map should guide the design and layout of the proposed development (See figures below).



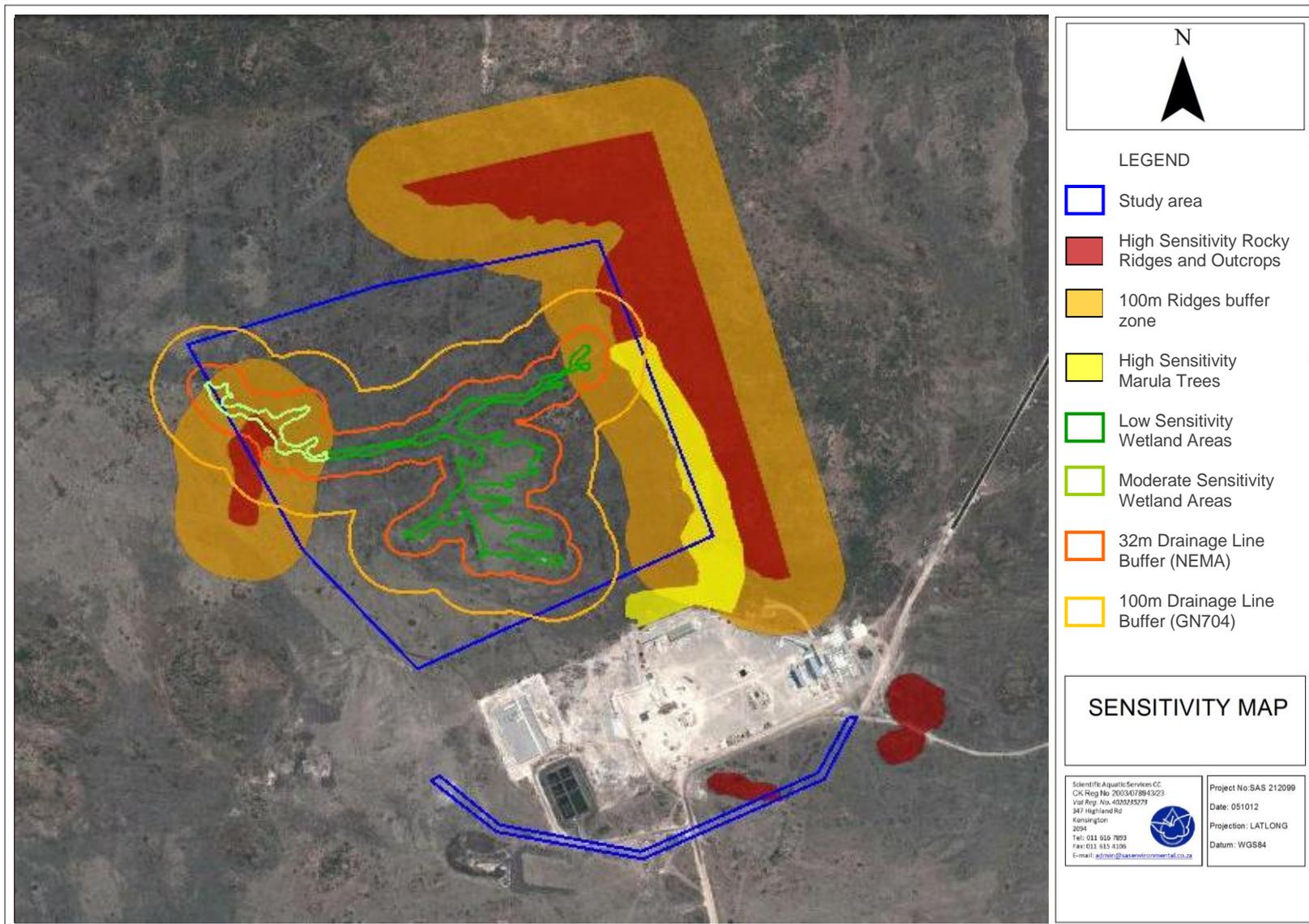


Figure 13: Ecological sensitivity map for the study area.



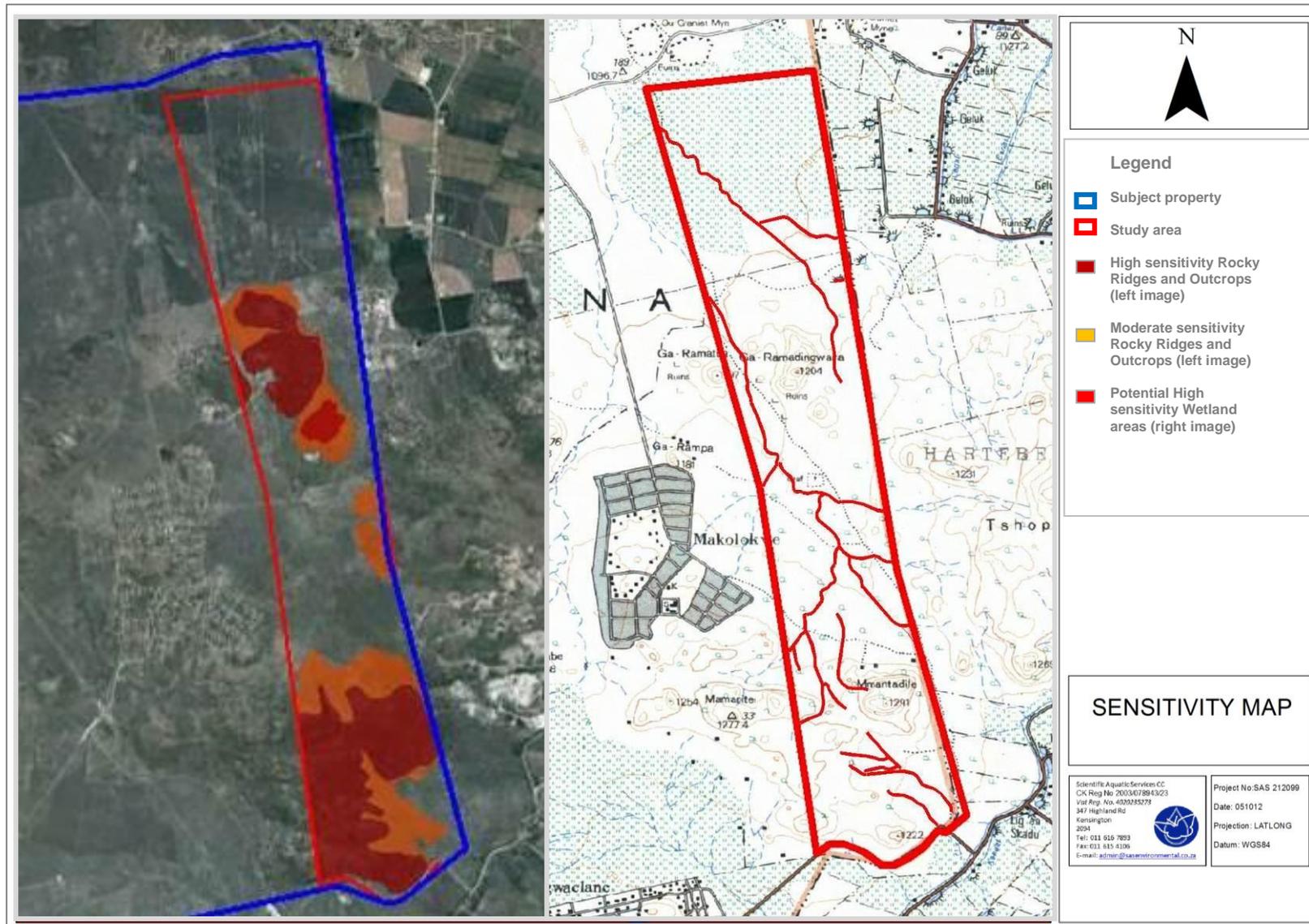


Figure 14: Conceptual ecological sensitivity map for the farms Wolwekraal 408JQ and Kareepoort 407 JQ indicating desktop delineated rocky ridge areas (left) and potential wetland areas (right).



7 STRUCTURE OF THE REPORT

Section A of this report served to provide an introduction to the subject property, the general approach to the study as well as the method of impact assessment. Section A also presents the results of general desktop information reviewed as part of the study including the information generated by the relevant authorities as well as the context of the site in relation to the surrounding anthropogenic activities and ecological character. The section also indicates that the requirements for mitigation, monitoring and rehabilitation are addressed in each section.

Section B addresses all the issues pertaining to the assessment of the floral and wetland ecology of the subject property.

Section C addresses all the issues pertaining to the assessment of the faunal ecology of the subject property.



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