APPENDIX G SPECIALIST REPORTS

APPENDIX G 1 BIODIVERSITY UPDATE AND VERIFICATION REPORT

SCIENTIFIC TERRESTRIAL SERVICES

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BIODIVERSITY VERIFICATION AND REPORT UPDATE AS PART OF THE ENVIRONMENTAL AUTHORISATION PROCESS FOR THE PROPOSED DEVELOPMENT OF THE FARM 751 REGISTRATION DIVISION I.Q., PROVINCE OF GAUTENG

Prepared for

ERM *The business of sustainability*

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EXECUTIVE SUMMARY

In 2016, Scientific Terrestrial Services (STS) conducted a Terrestrial Sensitivity Scan as part of the Environmental Impact Assessment (EIA) and authorisation process for the proposed development on The Farm 75 Registration Division I.Q., Province of Gauteng. The current report serves to update, where and if necessary, the results of the 2016 assessment. STS was also appointed to assist the Environmental Assessment Practitioner (EAP) to determine whether listed activities relating to the clearance of indigenous vegetation will be triggered under NEMA (Act 107 of 1998) and the associated Regulations.

This report updated the below information:

- Confirmed the absence of indigenous vegetation in the study area;
- The inclusion of the online National Web-based Environmental Screening Tool;
- All updated GIS databases were used as part of the background information study, which included the updated 2018 Final Vegetation Map of South Africa, Lesotho and Swaziland, the updated National Biodiversity Assessment (2018) database as well as the latest versions of the South Africa Protected and Conservation Areas Databases (SACAD and SAPAD, 2019_Q4);
- Refined the habitat units within the study area; and
- Updated the impact assessment for both faunal and floral species.

At the time of the assessment, the final layout of the proposed development had not been finalised, and as such the impact assessment assumed that the entire study area is targeted for development. Once a final layout is provided, the impact assessment should be updated accordingly by the biodiversity specialist.

During the field assessment, two habitat units were identified within the study area, namely:

1) Degraded Habitat: This habitat unit includes natural areas where the vegetation has been degraded and no longer represents the reference vegetation type (i.e. the Soweto Highveld Grassland). Within the study area, this habitat unit includes **degraded grassland** and large patches of **wattle stands**; and
2) Transformed Habitat: This habitat unit includes areas where vegetation has been completely transformed due to anthropogenic activities. Within the study area this refers to a **dumping** in the south and a **tar road** that intersects the study area in the north.

Species diversity and habitat integrity:

The vegetation structure and composition are severely altered and comprised mainly of alien and invasive species such as *Eucalyptus grandis* and *Acacia decurrens*. The study area is thus no longer representative of the Soweto Highveld Grassland vegetation type, nor does it have any characteristics indicative of the Kliprivier Highveld Grassland critically endangered ecosystem. Given this, the study area is not considered to have any remaining indigenous vegetation., as defined by NEMA.

The high levels of historic and ongoing anthropogenic activities associated with the study area and the surrounding areas, have led to the transformation of natural faunal habitat. Faunal movement within the study area is also negatively affected due to the extent of AIP proliferation, as preferred natural habitat for faunal species is lost. However, a number of seed bearing floral species are present within the study area, resulting in food resources for various invertebrate, avifaunal and small mammal species, therefore it is expected that common faunal species will be encountered within the study area. Only commonly occurring faunal species such as *Corvus albus* (Pied Crow), and *Acridotheres tristis* (Common Myna), adapted to urban environments, were observed within the study area.

Conservation significance of the study area:

According to Mucina and Rutherford (2006), the reference vegetation type, namely the Soweto Highveld Grassland, is **endangered** but is now listed as **vulnerable** in the updated Mucina and Rutherford 2018 dataset. Similarly, the National Biodiversity Assessment (2018 database), indicated that the study area

is located within the **vulnerable** Soweto Highveld Grassland vegetation type, which is an ecosystem that is currently **not protected**.

According to the Gauteng Conservation (C-Plan, 2011)) the study area is not located within a Critical Biodiversity Area (CBA) or Ecological Support Area (ESA), but the south eastern portion of the study area falls within an ecosystem considered to be **critically endangered**, known as Kliprivier Highveld Grassland (National Threatened Ecosystems, 2011).

Species of Conservation Concern (SCC):

During the field assessment, no floral SCC were encountered. It is highly unlikely that any floral SCC will occur within the study area, due to overall lack of suitable habitat and high levels of disturbance and transformation within the study area and surrounding areas.

No faunal SCC was observed during the field assessment. In terms of conservation, the likelihood that any such species will be encountered in or near the study area is considered low, due to the high levels of historic and ongoing anthropogenic activity and habitat transformation that has taken place within the study area and the immediate vicinity.

The proposed development is thus deemed unlikely to pose a conservation threat to faunal and floral SCC in the region.

Concluding Remarks:

From an ecological perspective, the study area is considered to be of low ecological sensitivity, mainly as a result of the increased level of disturbance and habitat transformation within and surrounding the study area, leading to increased loss of ecological connectivity to larger open space areas in the region and the very low probability of floral or faunal SCC occurring within the study area. The remaining vegetation is no longer representative of the reference vegetation and no indigenous vegetation was found in the study area.

The impacts on the floral and faunal habitat, diversity and SCC are considered to range from mainly low significance impacts with some very low significance impacts prior to the implementation of mitigation measures. With mitigation fully implemented all impacts can be reduced to very low significance impacts.

No significant impacts on the biodiversity associated with the study area are thus anticipated for the proposed development.

DOCUMENT GUIDE

The table below provides the specialist report requirements for the assessment and reporting of impacts on terrestrial biodiversity in terms of Government Notice 648 as promulgated in Government Gazette 45421 of 2019 in line with the Department of Environmental Affairs screening tool requirements, as it relates to the National Environmental Management Act, 1998 (Act No. 107 of 1998).

No.	Requirements	Section in report/Notes
2.1	Assessment must be undertaken by a suitably qualified SACNASP registered specialist	Appendix I
2.2	Description of the preferred development site, including the following aspects-	
2.2.1	*A description of the ecological drivers/processes of the system and how the proposed development will impact these;*	Section 4
2.2.2	*Ecological functioning and ecological processes (e.g. fire, migration, pollination, etc.) that operate within the proposed development site;*	Section 4
2.2.3	*The ecological corridors that the development would impede including migration and movement of flora and fauna;*	Section 3 and 4
2.2.4	*The description of any significant landscape features (including rare or important flora/faunal associations, presence of Strategic Water Source Areas (SWSAs) or Freshwater Ecosystem Priority Areas (FEPA) sub catchments;*	Section 4
2.2.5	*A description of terrestrial biodiversity and ecosystems on the proposed development site, including –* *a) Main vegetation types;* *b) Threatened ecosystems, including Listed Ecosystems as well as locally important habitat types identified;* *c) Ecological connectivity, habitat fragmentation, ecological processes and fine scale habitats; and* *d) Species, distribution, important habitats (e.g. feeding grounds, nesting sites, etc.) and movement patterns identified.*	Section 3 and 4
2.3	Identify any alternative development footprints within the preferred development site **which would be of a "low" sensitivity as identified by the national web** based environmental screening tool and verified through the Initial Site Sensitivity Verification.	Not Applicable
2.4	The Terrestrial Biodiversity Impact Assessment must be based on the results of a site inspection undertaken on the preferred development site and must identify:	
2.5	Terrestrial Critical Biodiversity Areas (CBAs), including: *2.5.1 The reasons why an area has been identified as a CBA;* *2.5.2 An indication of whether or not the development is consistent with maintaining the CBA in a natural or near natural state or in achieving the goal of rehabilitation;* *2.5.3 The impact on species composition and structure of vegetation with an indication of the extent of clearing activities;* *2.5.4 The impact on ecosystem threat status;* *2.5.5 The impact on explicit subtypes in the vegetation;* *2.5.6 The impact on overall species and ecosystem diversity of the site; and* 2.5.7 *The impact on populations of species of special concern in the CBA.*	Not applicable (Refer to Section 3 and 4)
2.6	Terrestrial Ecological Support Areas, including; *2.6.1 The impact on the ecological processes that operate within or across the site;* *2.6.2 The extent the development will impact on the functionality of the ESA; and* 2.6.3 *Loss of ecological connectivity (on site, and in relation to the broader landscape) due to the degradation and severing of ecological corridor or introducing barriers that impede migration and movement of flora and fauna.*	
2.7	Protected Areas as defined by the National Environmental Management: Protected Areas Act, 2004 (Act No. 57 of 2004) including an opinion on whether the proposed development aligns with the objectives/purpose of the Protected Area and the zoning as per the Protected Area Management Plan.	Not applicable (Refer to Section 3 and 4)
2.8	Priority Areas for Protected Area Expansion, including: The way in which in which the development will compromise or contribute to the expansion of the protected area network.	Section 3 and 4
2.9	Strategic Water Source Areas (SWSA) including: *2.9.1 The impact(s) on the terrestrial habitat of a Strategic Water Source Area; and* 2.9.2 *The impacts of the development on the SWSA water quality and quantity (e.g. describing potential increased runoff leading to increased sediment load in water courses)*	Not Applicable
2.10	Freshwater Ecosystem Priority Area (FEPA) sub catchments, including the impacts of the development on habitat condition and/or species in the FEPA sub catchment.	Not Applicable
2.11	Indigenous Forests, including:	Not Applicable

	2.11.1 Impact on the ecological integrity of the forest; *2.11.2 Extent of natural or near natural indigenous forest area lost.*	
3.	The report must contain as a minimum the following information:	
3.1	Contact detail of the specialist, their SACNASP registration number, their field of expertise and a curriculum vitae.	Appendix I
3.2	A signed statement of independence by the specialist.	Appendix I
3.3	A statement on the duration, date and season of the site inspection and the relevance of the season to the outcome of the assessment.	Section 1.3
3.4	The methodology used to undertake the site inspection and the specialist assessment, including equipment and modelling used, where relevant.	Section 2 Appendix B - D
3.5	A description of the assumptions made, any uncertainties or gaps in knowledge or data.	Section 1.3
3.6	The location of areas not suitable for development, which are to be avoided during construction and operation, where relevant.	Section 5
3.7	Additional environmental impacts expected from the proposed development based on those already evident on the site and a discussion on the cumulative impacts.	Section 6
3.8	Proposed impact management actions and impact management outcomes for inclusion in the Environmental Management Programme (EMPr).	Section 6
3.9	A motivation must be provided if there were development footprints identified as per paragraph 2.3 in this table were not considered stating reasons why.	Not applicable
3.10	A reasoned opinion, based on the findings of the specialist assessment, regarding the acceptability or not of the development and if the development should receive approval or not, and any conditions to which the statement is subjected.	Section 7

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GLOSSARY OF TERMS

Most definitions are based on terms and concepts elaborated by Richardson *et al*. (2011), Hui and Richardson (2017) and Wilson *et al*. (2017), with consideration to their applicability in the South African context, especially South African legislation [notably the National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004), and the associated Alien and Invasive Species (A&IS) Regulations, 2014].

Alien species (syn. exotic species; non-native species)	A species that is present in a region outside its natural range due to human actions (intentional or accidental) that have enabled it to overcome biogeographic barriers.
Biological diversity or Biodiversity (as per the definition in NEMBA)	The variability among living organisms from all sources including, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part and also includes diversity within species, between species, and of ecosystems.
Biome - as per Mucina and Rutherford (2006); after Low and Rebelo (1998).	A broad ecological spatial unit representing major life zones of large natural areas – defined mainly by vegetation structure, climate and major large-scale disturbance factors (such as fires).
Bioregion (as per the definition in NEMBA)	A geographic region which has in terms of section 40(1) been determined as a bioregion for the purposes of this Act;
CBA (Critical Biodiversity Area)	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges.
Corridor	A dispersal route or a physical connection of suitable habitats linking previously unconnected regions.
Disturbance	A temporal change, either regular or irregular (uncertain), in the environmental conditions that can trigger population fluctuations and secondary succession. Disturbance is an important driver of biological invasions.
Ecoregion	An ecoregion is a "recurring pattern of ecosystems associated with characteristic combinations of soil and landform that characterise that region".
Endangered	Organisms in danger of extinction if causal factors continue to operate.
Endemic species	Species that are only found within a pre-defined area. There can therefore be sub-continental (e.g. southern Africa), national (South Africa), provincial, regional or even within a particular mountain range.
ESA (Ecological Support Area)	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.
Habitat (as per the definition in NEMBA)	A place where a species or ecological community naturally occurs.
IBA (Important Bird and Biodiversity Area)	The IBA Programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that: are globally threatened, have a restricted range, are restricted to specific biomes/vegetation types or sites that have significant populations.
Indigenous vegetation (as per the definition in NEMA)	Vegetation occurring naturally within a defined area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.
Integrity (ecological)	The integrity of an ecosystem refers to its functional completeness, including its components (species) its patterns (distribution) and its processes.
Invasive species	Alien species that sustain self-replacing populations over several life cycles, produce reproductive offspring, often in very large numbers at considerable distances from the parent and/or site of introduction, and have the potential to spread over long distances.

Listed alien species	All alien species that are regulated in South Africa under the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004), Alien and Invasive Species (A&IS) Regulations, 2016.
Least Threatened	Least threatened ecosystems are still largely intact.
Native species (syn. indigenous species)	Species that are found within their natural range where they have evolved without human intervention (intentional or accidental). Also includes species that have expanded their range as a result of human modification of the environment that does not directly impact dispersal (e.g. species are still native if they increase their range as a result of watered gardens, but are alien if they increase their range as a result of spread along human-created corridors linking previously separate biogeographic regions).
RDL (Red Data listed) species	According to the Red List of South African plants (http://redlist.sanbi.org/) and the International Union for Conservation of Nature (IUCN), organisms that fall into the Extinct in the Wild (EW), critically endangered (CR), Endangered (EN), Vulnerable (VU) categories of ecological status.
SCC (Species of Conservation Concern)	The term SCC in the context of this report refers to all RDL (Red Data) and IUCN (International Union for the Conservation of Nature) listed threatened species as well as protected species of relevance to the project.

LIST OF ACRONYMS AND ABBREVIATIONS

AIP	Alien and Invasive Plant
CARA	Conservation of Agricultural Resource Act, 1983 [Act 43 of 1983]
CBA	Critical Biodiversity Area
CR	Critically Endangered
ESA	Ecological Support Area
ESAs	Ecological Support Areas
EN	Endangered
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
Ext	Extension
GDARD	Gauteng Department of Agriculture and Rural Development
GIS	Geographic Information System
GPS	Global Positioning System
IBA	Important Bird and Biodiversity Areas
IUCN	International Union for Conservation of Nature
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act, 1998 [Act No. 107 of 1998]
NEMBA	National Environmental Management: Biodiversity Act, 2004 [Act No. 10 of 2004]
NPAES	National Protected Area Expansion Strategy
POC	Potential of Occurrence
PES	Present Ecological State
QDS	Quarter Degree Squares
STS	Scientific Terrestrial Services
SAPAD	South Africa Protected Areas Database
SABAP2	South African Bird Atlas Project 2
SACAD	South African Conservation Areas Databases
SANBI	South African National Biodiversity Institute
SAPAD	South African Protected Areas Databases
SCC	Species of Conservation Concern
SWSAs	Surface water Strategic Water Source Areas
TSP	Threatened Species Programme
VU	Vulnerable
WSAs	Water Source Areas

1. INTRODUCTION

1.1 Background

In 2016, Scientific Terrestrial Services (STS) conducted a Terrestrial Sensitivity Scan[1] as part of the Environmental Impact Assessment (EIA) and authorisation process for the proposed development The Farm 75 Registration Division I.Q., Province of Gauteng hereafter referred to as the "study area". The current report serves to update, where and if necessary, the results of the 2016 assessment. STS was also appointed to assist the Environmental Assessment Practitioner (EAP) to determine whether listed activities relating to the clearance of indigenous vegetation[2] will be triggered under NEMA (Act 107 of 1998) and the associated Regulations.

At the time of the assessment, the final layout of the proposed development has not been finalised, and as such the impact assessment assumed that the entire study area is targeted for development. Once a final layout is provided that differ from the assumptions made in this report, the impact assessment will be updated accordingly by the biodiversity specialist.

The study area is bordered by the N12 national roadway to the north, Aerodrome Road to the west and Chris Hani Road to the southwest. Furthermore, Southgate Road traverses the northern portion of the study area and is situated directly adjacent to Baragwanath South Africa Brewery Depot. The study area is situated approximately 3 km east of the Chris Hani Baragwanath Hospital and approximately 800 west of Southgate Mall. The study area is located within moderately high density mixed development area (residential and industrial), however the immediate surrounding areas to the south and west are vacant land and immediate surroundings to the north and east of the study area comprise industrial development. Refer to Figures 1 and 2.

This report, after consideration of the description of the ecological integrity of the study area, must guide the Environmental Assessment Practitioner (EAP), the regulatory authorities and the developing proponent, by means of the presentation of results and recommendations as to the viability of the proposed development activities from a biodiversity resource management perspective.

[1] STS 160033. 2016. Terrestrial sensitivity scan as part of the Environmental Authorisation process for the proposed development of Baragwanath Extension 5, Gauteng Province. Prepared for Seaton Thomson & Associates. September 2016.

[2] Indigenous vegetation is described according to the NEMA definition as "vegetation of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years."

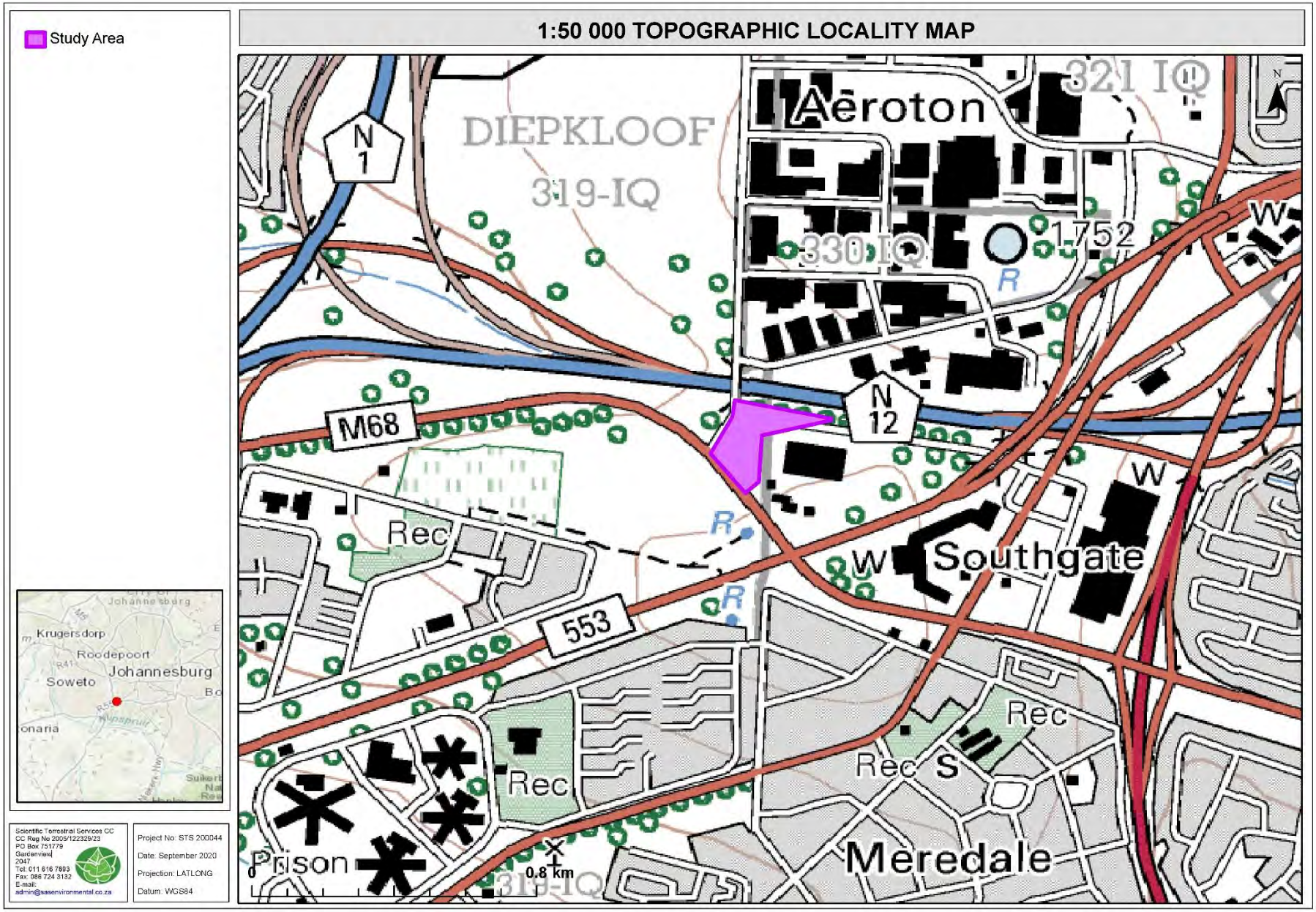


Figure 1: The study area depicted on a 1:50 000 topographical map in relation to the surrounding area.

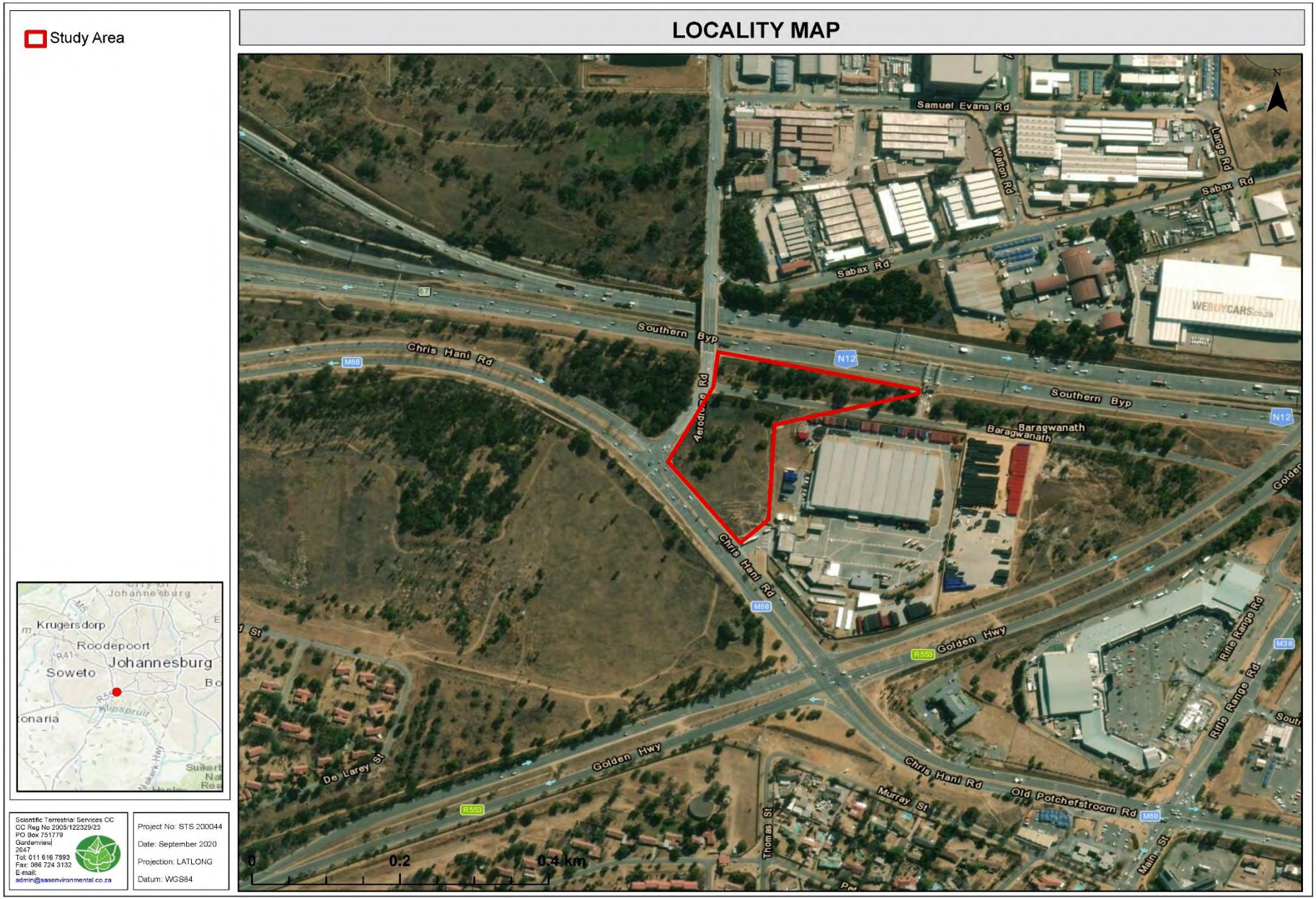


Figure 2: Digital satellite image depicting the location of the study area in relation to surrounding areas.

1.2 Project Scope

Specific outcomes in terms of this report are outlined below:

- To establish whether the previously defined Present Ecological State (PES) of the biodiversity of the study area has changed;
- To update, where necessary, the descriptions of habitats, communities and the ecological state of the study area;
- To confirm or update the results of the 2016 faunal and floral Species of Conservation Concern (SCC) assessment, including refining the descriptions and delineations of potential suitable habitat for such species within the study area;
- To provide updated information of potentially occurring sensitive landscapes including indigenous forests, rocky ridges, wetlands and/ or any other special features such as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs);
- To update the environmental impacts that the construction of the proposed development might have on the biodiversity associated with the study area; and
- To update mitigation and management measures for all phases of the development.

1.3 Assumptions and Limitations

The following assumptions and limitations apply to this report:

- The biodiversity update assessment was confined to the study area and did not include the neighbouring and adjacent properties. These were considered as part of the desktop assessment. This report builds on the 2016 assessment and thus historic date was available for the study area;
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most floral and faunal communities were accurately assessed and considered, with all relevant online sources and background information utilised to improve on the overall understanding of the study area's ecology;
- Due to the nature and habits of most faunal taxa, it is unlikely that all species would have been observed during a field assessment of limited duration. Due to the locality of the study area (urban area), continuous anthropogenic activities, the cyclical nature of many species' life stages, as well as the season of the assessment, very few faunal species were observed. As such, background data (desktop) and literature studies (previous studies undertaken for the area) were used to further infer faunal species communities and sensitivities in relation to the available habitat;

- Sampling, by its nature, means that not all individuals are assessed and identified. Some species and taxa associated with the study area may have been missed during the assessment; and
- The data presented in this report are based on two site visits. The initial site assessment took place in August 2016, with the site assessment for this assessment update undertaken on the 18th of August 2020. A more accurate assessment would require that assessments take place in all seasons of the year. Given the extent of habitat degradation within the assessment areas, as well as anthropogenic activities within and surrounding the assessment areas, it is expected that dominant floral and faunal communities associated with the study area were identified and considered, with all relevant online sources, specialist experience in the area, and background information utilised to improve on the overall understanding of the study area's ecology.

1.4 Legislative Requirements

The following legislative requirements were considered during the assessment:

- The Constitution of the Republic of South Africa, 1996[3];
- The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA);
- The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA);
- Government Notice R598 Alien and Invasive Species Regulations as published in the Government Gazette 37885 dated 1 August 2014 as it relates to the National Environmental Management Biodiversity Act, 1998 (Act 107 of 1998); and
- The Conservation of Agricultural Resource Act, 1983 (Act 43 of 1983) (CARA).

The following documentation was also considered:

- The Gauteng Department of Agriculture and Rural Development (GDARD) Requirements for Biodiversity Assessments Version 3 (GDARD, 2014).

The details of each of the above, as they pertain to this study, are provided in Appendix A of this report.

[3] Since 1996, the Constitution has been amended by seventeen amendments acts. The Constitution is formally entitled the 'Constitution of the Republic of South Africa, 1996". It was previously also numbered as if it were an Act of Parliament – Act No. 108 of 1996 – but since the passage of the Citation of Constitutional Laws Act, neither it not the acts amending it are allocated act numbers

2. ASSESSMENT APPROACH

An on-site visual investigation of the assessment areas was conducted (August 2016 and August 2020) to confirm the assumptions made during the consultation of the background maps and to determine whether the sensitivity of the terrestrial biodiversity associated with the assessment areas confirms the results of the online National Web-based Environmental Screening Tool.

2.1 General Approach

A thorough 'walk through' on foot was undertaken in order to identify the occurrence of the dominant floral and faunal species and habitat diversities. To accurately determine the PES of the biodiversity significance of the study area and capture comprehensive data with respect to the biodiversity, the following methodology was used:

- Background data and digital satellite images were consulted prior to the field assessment in order to distinguish broad habitats, vegetation types and potentially sensitive sites. The results of these analyses were then used to focus the fieldwork on specific areas of concern and to identify areas where target specific investigations were required;
- Relevant databases considered during the assessment of the study area included the South African National Biodiversity Institute (SANBI) Threatened Species Programme (TSP), the Gauteng Conservation Plan Version 3.3 (2011), Mucina and Rutherford (2018), National Biodiversity Assessment (NBA, 2018), Important Bird and Biodiversity Areas (IBA, 2015) in conjunction with the South African Bird Atlas Project (SABAP2), South African Protected and Conservation Areas Databases (SAPAD & SACAD, Quarter 4, 2019), National Protected Areas Expansion Strategy (NPAES, 2011), and International Union for Conservation of Nature (IUCN);
- Specific methodologies for the assessment, in terms of the field assessment and data analysis of faunal and floral ecological assemblages, will be presented in **Appendices B and C**; and
- For the methodologies relating to the impact assessment and development of the mitigation measures, please refer to **Appendix D** of this report.

2.2 Sensitivity Mapping

All the ecological features associated with 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 satellite imagery.

3. RESULTS OF THE DESKTOP ANALYSIS

3.1 Conservation Characteristics associated with the Study Area

The following table contains data accessed as part of the desktop assessment. It is important to note that although all data sources used provide useful and often verifiable, high-quality data, the various databases do not always provide an entirely accurate indication of the study area's actual biodiversity characteristics.

Table 1: Summary of the biodiversity characteristics associated with the study area [Quarter Degree Squares (QDS) 2627BD].

DETAILS OF THE STUDY AREA IN TERMS OF MUCINA & RUTHERFORD (2012 AND 2018)	
Biome	The study area is situated within the Grassland Biome
Bioregion	The study area is situated within the Mesic Highveld Grassland Bioregion
Vegetation Type	The study area is situated within the Soweto Highveld Grassland vegetation type.
CONSERVATION DETAILS PERTAINING TO THE STUDY AREA (VARIOUS DATABASES)	
National Threatened Ecosystems [4] (2011)	The south-eastern portion of the study area falls within an ecosystem considered to be critically endangered (CR), known as the Kliprivier Highveld Grassland (Figure 3). The NEMBA provides for listing 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. The purpose of listing protected ecosystems is primarily to preserve witness sites of exceptionally high conservation value.
National Biodiversity Assessment (2018) (Figure 4)	The study area falls within the vulnerable Soweto Highveld Grassland, an ecosystem that is currently not protected. Ecosystem types are categorised as "not protected", "poorly protected", "moderately protected" and "well protected" based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act, 2003 (Act No. 57 of 2003), and compared with the biodiversity target for that ecosystem type.

DESCRIPTION OF THE SOWETO HIGHVELD GRASSLAND (GM8) VEGETATION TYPE RELEVANT TO THE STUDY AREA (MUCINA & RUTHERFORD 2006)						
Distribution	Mpumalanga, Gauteng (and to a very small extent also in neighbouring Free State and North-West).					
Climate	Summer rainfall region					
	MAP (mm)	MAT (°C)	MFD (days)	MAPE (mm)	MASMS (%)	
	662	19.4	19	2505	79	
Altitude (m)	1420 – 1760					
Conservation	Endangered as per Mucina and Rutherford (2006) but now listed as Vulnerable in the updated Mucina and Rutherford 2018 dataset. Target 24%. Only a handful of patches statutorily conserved (Waldrift, Krugersdorp, Leeuwkuil, Suikerbosrand, Rolfe's Pan Nature Reserves) or privately conserved (Johanna Jacobs, Tweefontein, Gert Jacobs, Nikolaas and Avalon Nature Reserves, Heidelberg Natural Heritage Site). Almost half of the area already transformed by cultivation, urban sprawl, mining and building of road infrastructure.					
Geology & Soils	Shale, sandstone or mudstone of the Madzaringwe Formation (Karoo Supergroup) or the intrusive Karoo Suite dolerites which feature prominently in the area. In the south, the Volksrust Formation (Karoo Supergroup) is found and in the west, the rocks of the older Transvaal, Ventersdorp and Witwatersrand Supergroups are most significant. Soils are deep, reddish on flat plains and are typically Ea, Ba and Bb land types.					

[4] For Environmental Impact Assessments (EIAs), the 2011 National list of Threatened Ecosystems remains the trigger for a Basic Assessment in terms of Listing Notice 3 of the EIA Regulations 2014, as amended published under the National Environmental Management Act, 1998 (Act No. 107 of 1998). However, the updated 2018 ecosystem threat status have also been considered in the assessment of impact significance in EIAs.

<table>
<tr><td></td><td>The ecosystem protection level status is assigned using the following criteria:
i. If an ecosystem type has more than 100% of its biodiversity target protected in a formal protected area either A or B, it is classified as Well Protected;
ii. When less than 100% of the biodiversity target is met in formal A or B protected areas it is classified it as Moderately Protected;
iii. If less than 50% of the biodiversity target is met, it is classified it as Poorly Protected; and
iv. If less than 5% it is Hardly Protected.</td><td>Vegetation & landscape features (Dominant Floral Taxa in Appendix B)</td><td>Gently to moderately undulating landscape on the Highveld plateau supporting short to medium-high, dense, tufted grassland dominated almost entirely by Themeda triandra and accompanied by a variety of other grasses such as Elionurus muticus, Eragrostis racemosa, Heteropogon contortus and Tristachya leucothrix.

In places not disturbed, only scattered small wetlands, narrow stream alluvia, pans and occasional ridges or rocky outcrops interrupt the continuous grassland cover.</td></tr>
<tr><td rowspan="3">SAPAD (2019, Q4); SACAD (2019, Q4); NPAES (2009)

(Figure 5)</td><td rowspan="3">The South Africa Conservation Areas Database (SACAD, 2019_Q4) database does not indicate any important conservation areas[5] within a 10 km radius of the study area.

The South Africa Protected Areas Database (SAPAD, 2019_Q4) and National Protected Area Expansion Strategy (NPAES, 2009) databases[6] indicate that the Klipriviersberg Municipal Nature Reserve is situated within 5 km south-east of the study area. The SAPAD (2019) dataset further indicates the Olifantsvlei Nature Reserve (also within 5 km) to the south of the study area – not indicated within the NPAES dataset.

No other NPAES focus areas for expansion is located within 10 km of the study area.</td><td colspan="2">NATIONAL WEB-BASED ENVIRONMENTAL SCREENING TOOL (2020)</td></tr>
<tr><td colspan="2">The Screening Tool is intended to allow for pre-screening of sensitivities in the landscape to be assessed within the EA process. This assists with implementing the mitigation hierarchy by allowing developers to adjust their proposed development footprint to avoid sensitive areas.</td></tr>
<tr><td>Terrestrial Sensitivity</td><td>The Terrestrial Sensitivity for the entire study area is considered to have a Very High sensitivity.

The triggered sensitivity features include a critically endangered ecosystem, i.e. the Kliprivier Highveld Grassland – as per the National Threatened Ecosystems (2011) database.</td></tr>
<tr><td>IBA (2015)</td><td>The study area is not located in an Important Bird and Biodiversity Area (IBA), nor is it located within 10 km of one.</td><td>Plant Species</td><td>For the Plant Species theme, the entire study area is within a Medium sensitivity area.

Species identified by the EIA Screening tool for the study area include Delosperma purpureum (Endanngered), Cineraria longipes (Vulnerable), and Khadia beswickii (Vulnerable).</td></tr>
</table>

[5] The types of conservation areas that are currently included in the database are the following: 1. Biosphere reserves, 2. Ramsar sites, 3. Stewardship agreements (other than nature reserves and protected environments), 4. Botanical gardens, 5. Transfrontier conservation areas, 6. Transfrontier parks, 7. Military conservation areas and 8. Conservancies.

[6] The definition of protected areas follows the definition of a protected area as defined in the National Environmental Management: Protected Areas Act, (Act 57 of 2003). Chapter 2 of the National Environmental Management: Protected Areas Act, 2003 sets out the "System of Protected Areas", which consists of the following kinds of protected areas - 1. Special nature reserves; 2. National parks; 3. Nature reserves; 4. Protected environments (1-4 declared in terms of the National Environmental Management: Protected Areas Act, 2003); 5. World heritage sites declared in terms of the World Heritage Convention Act; 6. Marine protected areas declared in terms of the Marine Living Resources Act; 7. Specially protected forest areas, forest nature reserves, and forest wilderness areas declared in terms of the National Forests Act, 1998 (Act No. 84 of 1998); and 8. Mountain catchment areas declared in terms of the Mountain Catchment Areas Act, 1970 (Act No. 63 of 1970).

DETAIL OF THE STUDY AREA IN TERMS OF THE GAUTENG CONSERVATION PLAN (C-PLAN V3.3, 2011)			
Critical Biodiversity Area (CBA) (Figure 6)	The study area is not located within a CBA, with the nearest CBA being situated ± 42 m southwest of the study area. CBAs include natural and near-natural terrestrial and aquatic features that are required to meet targets for biodiversity patterns and ecological processes. Furthermore, CBAs are areas considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges.	Animal Species	For the Animal Species theme, the entire study area is considered to have a Medium sensitivity. Species identified by the EIA Screening tool: Insecta: *Lepidochrysops praeterita* (Highveld blue, Endangered[7]) and *Aloeides dentatis dentatis* (Roodepoort Coppenr, Endangered[8]).
		STRATEGIC WATER SOURCE AREAS FOR SURFACE WATER (2017)	
Ecological Support Area (ESA) (Figure 6)	The study area is not located within an ESA, with the nearest ESA located ± 92 m north. ESAs are natural, near natural, degraded or heavily modified areas required to be maintained in an ecologically functional state to support CBAs and/or Protected Areas.	Surface water Strategic Water Source Areas (SWSAs) are defined as areas of land that supply a disproportionate (i.e. relatively large) quantity of mean annual surface water runoff in relation to their size. They include transboundary areas that extend into Lesotho and Swaziland. The sub-national Water Source Areas (WSAs) are not nationally strategic as defined in the report but were included to provide a complete coverage.	
Wetland and River Buffers and Ridges (Figure 6)	According to the Gauteng C-Plan, the study area is not in a wetland or river buffer, nor are any ridges associated with the study area.	Name and Criteria	The study area is not within 10 km of a Strategic Water Source Area.

NBA = National Biodiversity Assessment; SAPAD = South African Protected Areas Database; SACAD = South African Conservation Areas Database; NPAES = National Protected Areas Expansion Strategy; IBA = Important Bird Area; MAP = Mean annual precipitation; MAT = Mean annual temperature; MAPE = Mean annual potential evaporation; MFD = Mean Frost Days; MASMS = Mean annual soil moisture stress (% of days when evaporative demand was more than double the soil moisture supply); CBA = Critical Biodiversity Areas; ESA = Ecological Support Areas.

[7] http://speciesstatus.sanbi.org/assessment/last-assessment/1272/

[8] http://speciesstatus.sanbi.org/assessment/last-assessment/1078/

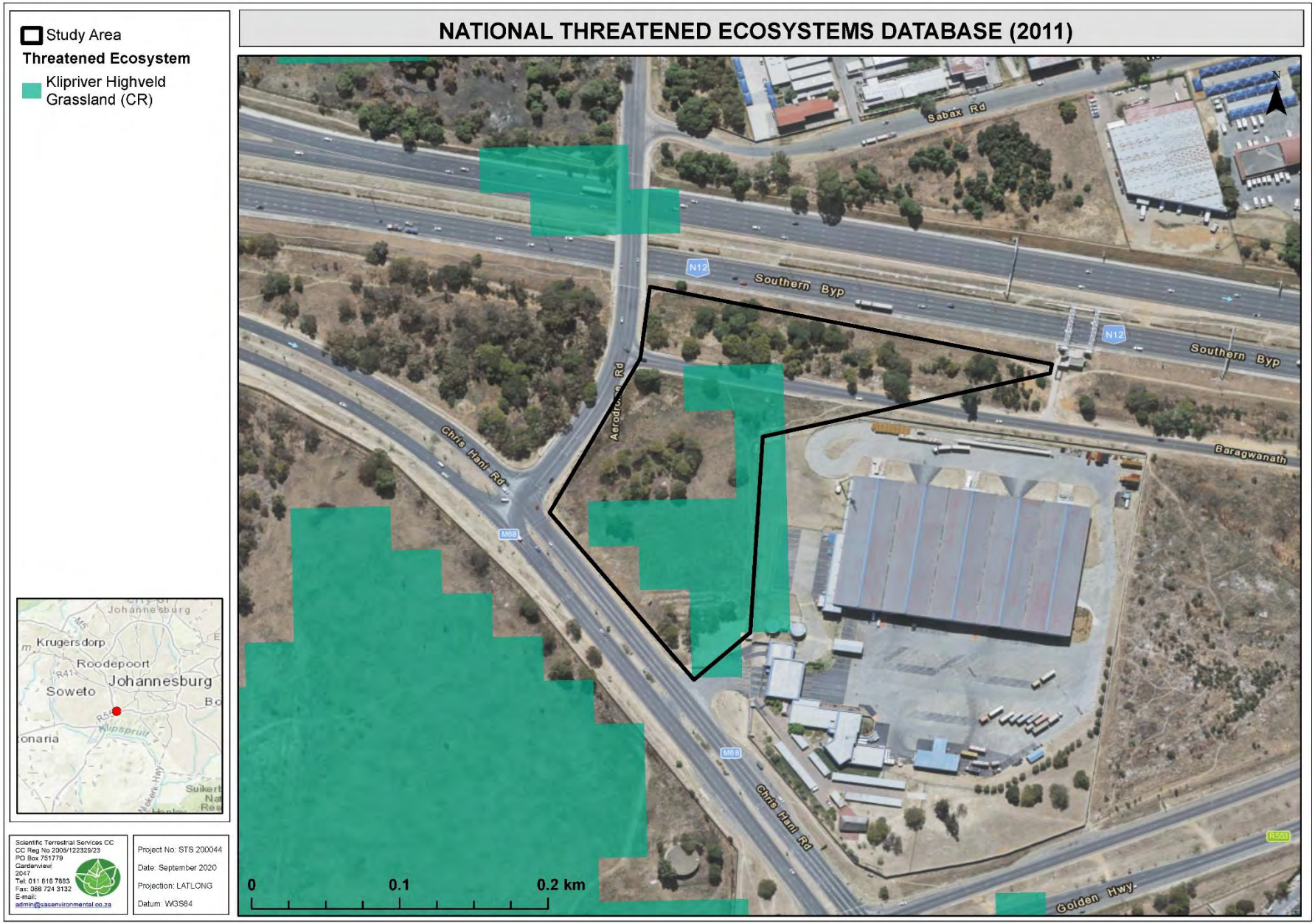


Figure 3: Threatened Ecosystems associated with the study area (National Threatened Ecosystems, 2011).

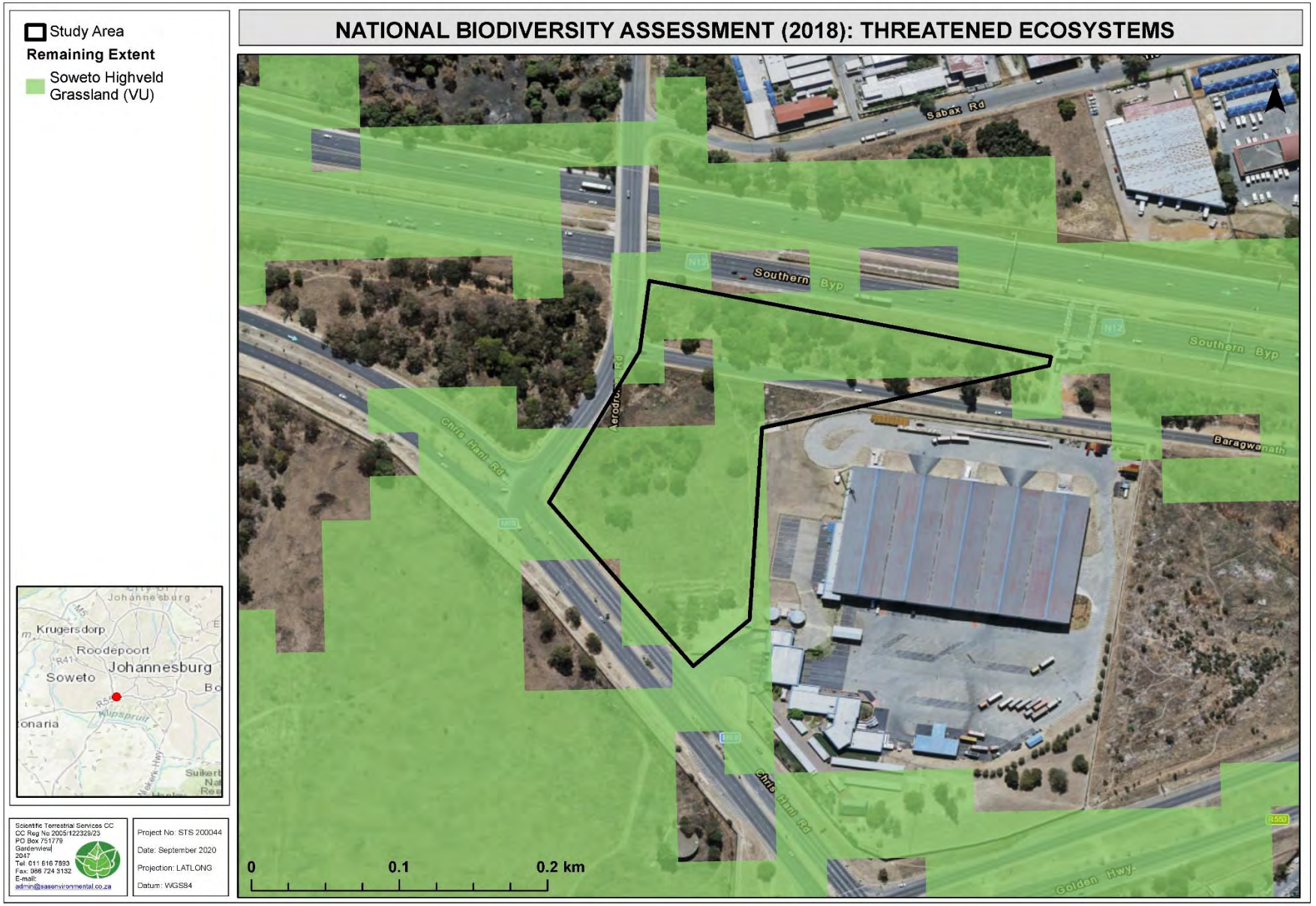


Figure 4: Remaining extent of the Soweto Highveld Grassland (vulnerable vegetation type) as indicated by the National Biodiversity Assessment (2018) dataset.

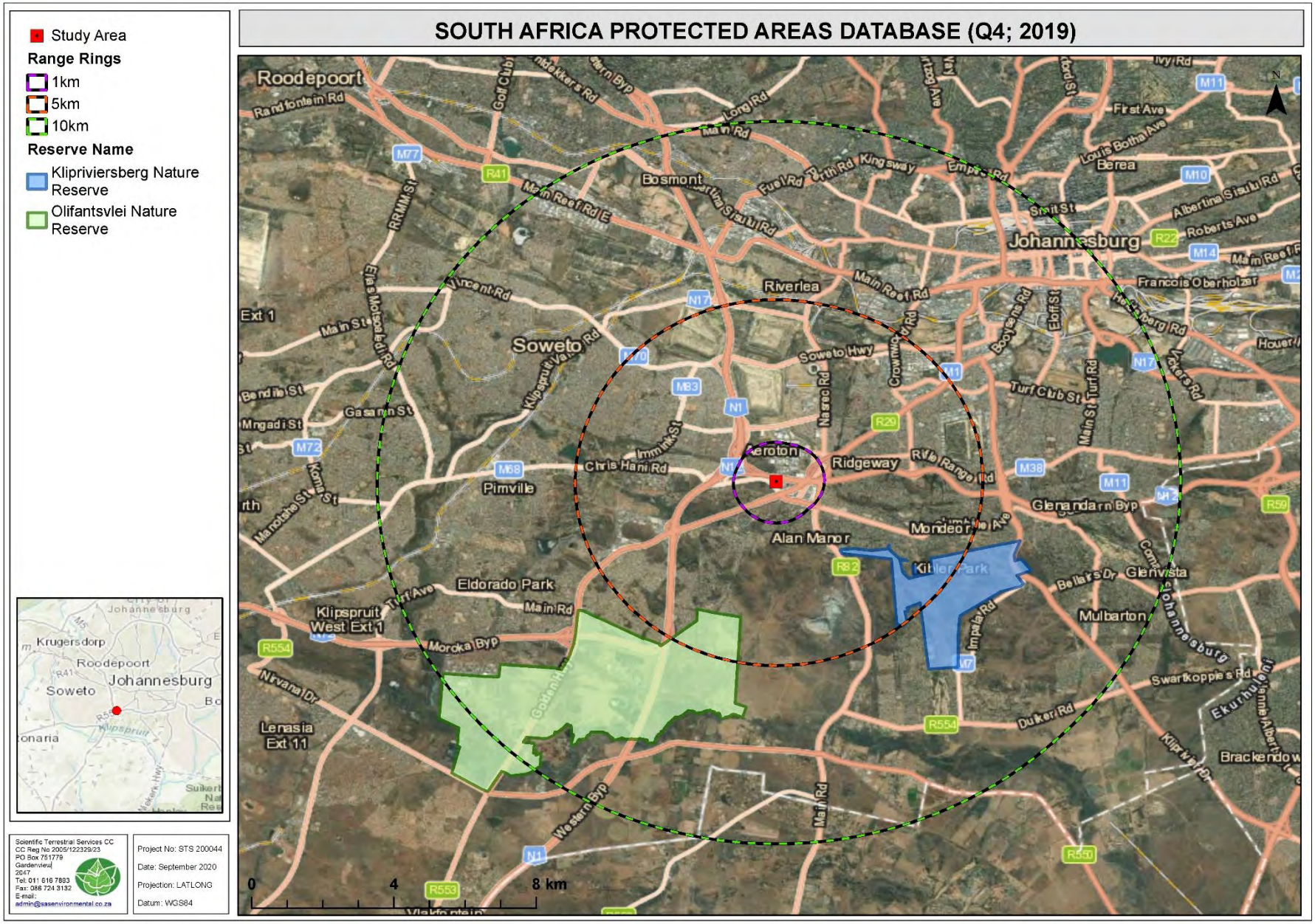


Figure 5: Protected areas within 5 km of the study area (SAPAD, 2019).

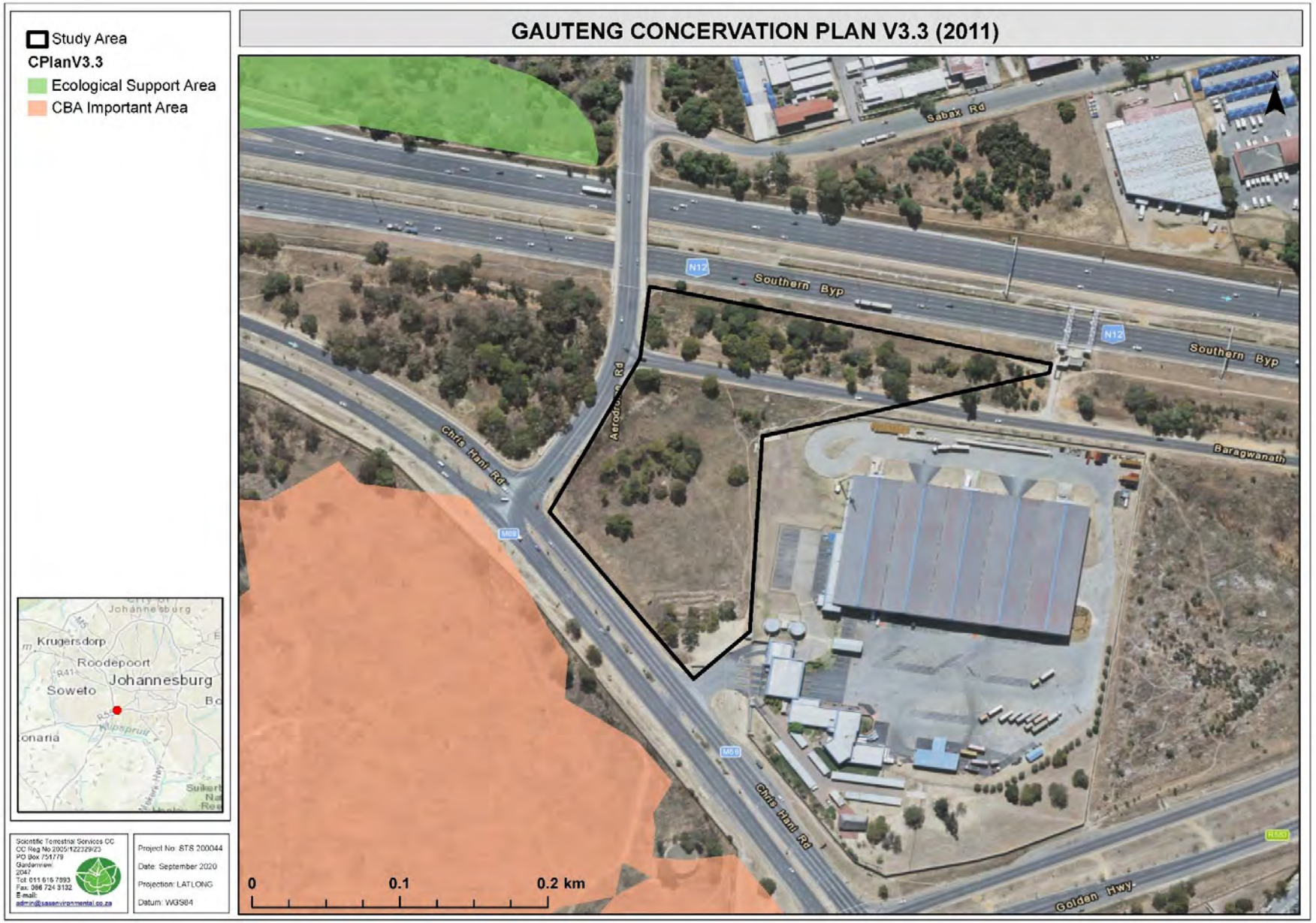


Figure 6: Gauteng C Plan v3.3 indicating a CBA and an ESA in proximity to the study area (2011).

4. RESULTS OF THE BIODIVERSITY UPDATE

The findings of this study align with the findings of the 2016 terrestrial scan (STS 160033). Following the 2020 site assessment, the habitat units were refined; however, the overall habitat condition remain degraded – as stated in the 2016 terrestrial scan.

Two broad habitat units could be distinguished (Figure 7):

- Degraded Habitat: This habitat unit includes natural areas where the vegetation has been degraded and no longer represents the reference vegetation type (i.e. the Soweto Highveld Grassland). Within the study area, this habitat unit includes **degraded grassland** and large patches of **wattle stands**; and
- Transformed Habitat: This habitat unit includes areas where vegetation has been completely transformed due to anthropogenic activities. Within the study area this refers to a **dumping** in the south and a tar **road** that intersects the study area in the north.

The entire study area is in a significantly modified ecological condition, with limited natural habitat remaining for faunal species. The degraded condition of the study area is driven by direct and indirect anthropogenic disturbances, which includes dumping of building material within the southern section (direct anthropogenic disturbance) and the proliferation of alien and invasive plant (AIP) species throughout the study area (indirect anthropogenic disturbance).

As a result of historic and ongoing anthropogenic activities occurring both on site but also in the surrounding neighbourhoods, only common faunal species adapted to an urban setting are expected to reside within the study area. The study area is not fenced, and humans can freely move through the site, further placing additional pressures on the faunal and floral communities. Although there are no fences around the study area, the site is isolated (or fragmented) from other natural areas as it is surrounded by either tar roads or built-up areas - no intact ecological corridors thus remain.

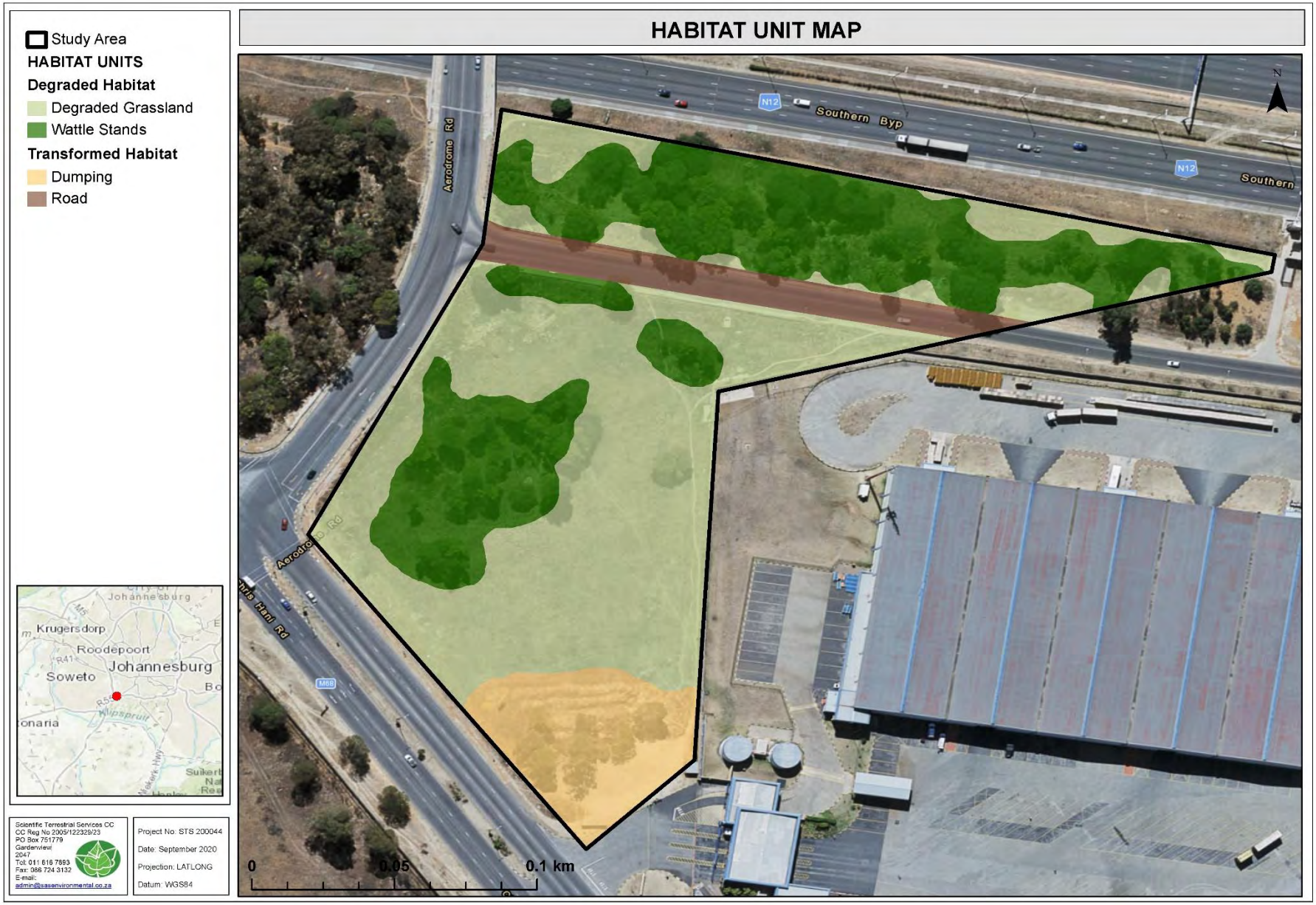
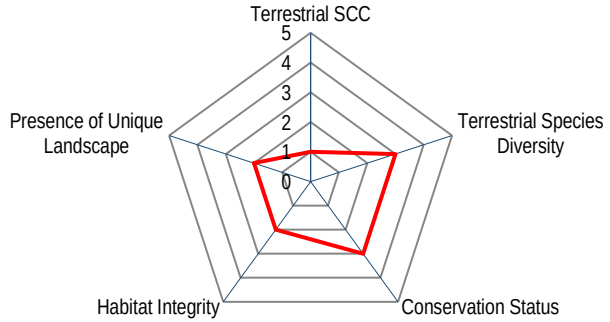
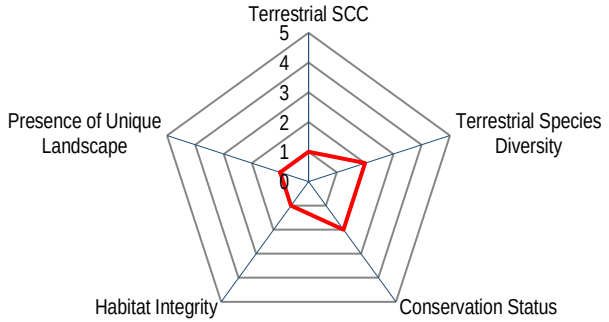


Figure 7: Habitat units encountered within the study area.

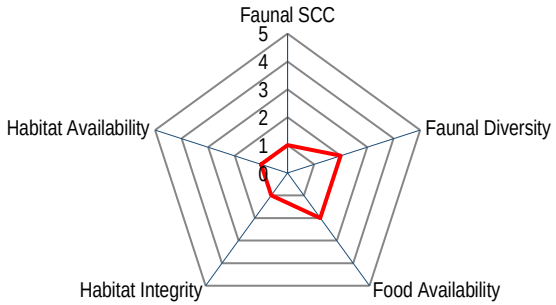
Table 2: Summary of results of the floral assessment.

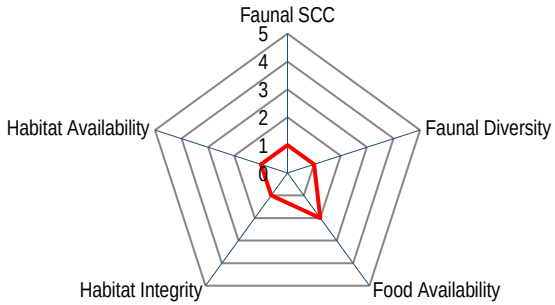
REPRESENTATIVE PHOTOGRAPHS AND SENSITIVITIES OF THE HABITAT WITHIN THE STUDY AREA			
Degraded Grassland Habitat Sensitivity	Moderately Low	Transformed Habitat	Low
			

SCC Discussion
Based on the results obtained, it is highly unlikely that any floral SCC would be present within the study area, due to the level of habitat transformation already associated with the study area. However, should any floral SCC be encountered during any phase of the proposed development, such species must be removed and relocated under the supervision of a qualified specialist to suitable, similar habitat in close proximity to its original location, but outside of the development footprint.
Ecological Discussion
The entire study area has been exposed to several historic and current disturbances that have resulted in poor habitat conditions throughout and a diminished habitat integrity. This is especially true when the vegetation is compared to the reference vegetation type which is expected to support a high diversity of floral species. The study area is thus no longer representative of the Soweto Highveld Grassland (EN) vegetation type, nor does it have any characteristics indicative of the Kliprivier Highveld Grassland (CR) endangered ecosystem. Floral diversity was low throughout the study area. The study area is well-represented by an abundance of alien vegetation dominating the forb (*Bidens pilosa*, *Tagetes minuta* and *Verbena bonariensis*) and woody layers (*Eucalyptus grandis* and *Acacia decurrens*). Graminoids included few aliens; however, the grass species that were dominant are species typically associated with areas of increased disturbance, such as *Hyparrhenia hirta*. For a comprehensive species list refer to Appendix F
Statement on Indigenous Vegetation
The extent of the study area and, more relevant, the extent of the degraded grassland, is larger than 1 ha, but smaller than 20 ha, and thus can potentially trigger Activity 27 of Listing Notice 1. Moreover, since the degraded grassland is approximately 1.4 ha, it can potentially trigger Activity 12 of Listing Notice 3. The study area is largely characterised by alien species. The woody component almost exclusively comprises alien trees (*Eucalyptus grandis* and *Acacia decurrens*). The forb layer has been degraded to the extent that weedy alien species dominate and have displaced most of the native species. Not only does dumping occur on site, but there is evidence of uncontrolled fires and a large section is used by vehicles for parking which leaves little opportunity for native vegetation to recover. As mentioned previously, the vegetation is no longer representative of the reference vegetation type, nor does it have any characteristics indicative of the Kliprivier Highveld Grassland (CR) endangered ecosystem. Given this, the study area is not considered to have any remaining indigenous vegetation. Activity 27 of Listing Notice 1 (R.983) and Activity 12 of Listing Notice 3 (R.985) will therefore not be triggered as no indigenous vegetation, as defined by NEMA, was present in the study area.
Business Case, Conclusion and Mitigation Requirements:
This habitat unit is of moderately low (the small stretches of degraded grassland) and low (transformed areas) ecological importance and sensitivity. Anthropogenic disturbances and proliferation of alien plant species have resulted in the degradation of the available habitat and the proposed development is not deemed likely to have a significant negative impact on floral communities. Although habitat modifications have already occurred, it is nonetheless imperative that the development footprint be restricted to the property boundary, and edge effects strictly managed, to limit the impact on natural areas outside of the footprint area. Important considerations: Several AIPs occur within the study area of which four (4) species are listed as NEMBA category 1b, with three (3) listed as NEMBA category 2, and one (1) species listed as NEMBA category 3. The NEMBA regulations do not require that Category 2 and 3 species be removed but rather that further planting, propagation, or trade of these species is prohibited. It is still recommended that these species be monitored to ensure they do not spread to adjacent areas where they do not yet occur. Category 1b species require compulsory control.

Table 3: Summary of results of the faunal assessment.

Degraded Grassland Habitat Sensitivity	Low	Transformed Habitat Sensitivity	Low





FAUNAL SPECIES OBSERVED DURING THE FIELD ASSESSMENT

Trinervitermes (Snouted Harvester Termite) mount

Phymateus viridipes (Green Milkweed Locust)

Signs of *Cryptomys hottentotus* (African Mole Rat)

Ploceus cucullatus (Village Weaver)

Ploceus cucullatus (Village Weaver) nest

Pontia helice helice (Meadow White)

SCC Discussion
During field assessments it is not always feasible to identify or observe all species within a study area, largely due to the secretive nature of many faunal species, possible low population numbers or varying habits of species. As such, and to specifically assess an area for faunal SCC, a Probability of Occurrence (POC) matrix is used, utilising a number of factors to determine the probability of faunal SCC occurrence within the study area. Species listed in Appendix H whose known distribution ranges and habitat preferences include the study area were taken into consideration. No faunal SCC were observed during the field assessment. In addition, no faunal SCC are considered to have a POC of 60% or higher to occur within the study area, due to the severe levels of habitat transformation that has taken place within the study area thereby decreasing the ecological integrity of the study area. Due to the fact that no faunal SCC or signs thereof were identified, and the lack of suitable habitat or known occurrences of faunal SCC within the study area, it can be concluded that the proposed development is unlikely to affect faunal SCC conservation in the region. Should any faunal SCC listed in Appendix H of this report, however be encountered during the development of the proposed development, all operations must be stopped immediately and a biodiversity specialist must be consulted and a rescue and relocation plan implemented.
Ecological Discussion
The habitat within the study area is highly transformed and no longer representative of the natural conditions associated with the vegetation type. The high levels of ongoing anthropogenic activity within the study area, such as illegal dumping and veld fires further reduces habitat integrity of the study area. The remaining patch of Degraded Habitat within the study area is fragmented and isolated from surrounding natural habitat via man-made barriers such as roads and built-up areas. These barriers influence the presence of expected grassland fauna – although this applies mostly to larger mammal species. Faunal movement within the study area is also negatively affected due to the extent of AIP proliferation, as preferred natural habitat for faunal species is lost. However, a number of seed bearing floral species are present within the study area, resulting in food resources for various invertebrate, avifaunal and small mammal species, therefore it is expected that common faunal species will be encountered within the study area. The faunal diversity within the study area was low and comprised mainly of common avifaunal species. It is further expected that only common invertebrate, reptile, and small mammal species adapted to urban areas will utilise the study area. Species observed on site were limited to common and widely occurring faunal species known to survive in areas of decreased sensitivity and that have integrated well into urban settings, including species such as *Acridotheres tristis* (Common Myna), *Ploceus cucullatus* (Village Weaver), *Streptopelia semitorquata* (Red-eyed Dove), *Passer domesticus* (House sparrow), *Passer melanurus* (Cape Sparrow), *Streptopelia senegalensis* (Laughing Dove) and *Lanius collaris* (Common Fiscal).
Business Case, Conclusion and Mitigation Requirements:
Habitat availability is considered low within the study area because of historic and ongoing anthropogenic activities and its location within a low-density industrial setting. Although habitat depredation and transformation have occurred, and AIPs were dominant throughout, the study area is still capable of providing habitat to a number of avifaunal and small mammal species (Muridae family), albeit common widespread species that have adapted to live in close proximity to developed areas. However, it is unlikely that the study area will be able to support any faunal SCC. The faunal habitat associated with the study area is of a low ecological sensitivity. Development related activities would therefore have a low impact on the faunal habitat, as the habitat integrity is already considered to be highly disturbed. To prevent further habitat loss for fauna in adjacent natural veld to the south-west of the study area, it is recommended that an AIP control plan be implemented for the study area during construction activities. It is important that cleared alien plants not be dumped within adjacent natural habitat.

5. SENSITIVITY MAPPING

The Online EIA Screening Tool identified the study area to be in a **medium sensitivity** area for the Plant Species Theme and the Animal Species Theme but in a **very high sensitivity** area for the Terrestrial Biodiversity Theme (triggering feature is the critically endangered ecosystem, i.e. the Kliprivier Highveld Grassland). Based on the ground-truthed results of the site visit, Table 4 below presents the sensitivity of each identified habitat unit along with an associated conservation objective and implications for development.

Figures 8 conceptually illustrates the areas considered to be of varying ecological sensitivity and how they will be impacted by the proposed development. The areas are depicted according to their sensitivity in terms of the presence or potential for floral SCC, habitat integrity and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity (compared to a reference type).

Table 4: A summary of the sensitivity of each habitat unit and implications for development.

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Degraded Grassland Habitat	Moderately Low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.	This habitat unit is of moderately low ecological importance and sensitivity due to the level of habitat disturbance and extent of AIP proliferation. The likelihood of an abundance and diversity of faunal species utilising these areas is low, with the potential for indigenous plants to flourish also low. No suitable habitat was found for faunal or floral SCC. Development within the degraded grassland will have a low impact on native faunal and floral biodiversity; however, were development to proceed, edge effects would need to be mitigated – most notably the spread of AIP species.
Transformed Habitat	Low	Optimise development potential.	The floral composition is highly transformed in these portions because of AIP proliferation, thus resulting in low ecological importance and sensitivity for the habitat unit. Continuity to other larger natural areas in the region is limited. Historic and ongoing anthropogenic activities have resulted in severe degradation and transformation of habitat associated with the study area, and it is therefore highly unlikely to support any faunal or floral SCC. Development related activities would therefore have a low impact on this habitat unit. As abovementioned, edge effects would need to be mitigated – most notably the spread of AIP species.

Figure 8: Sensitivity map of the study area.

6. IMPACT ASSESSMENT

The sections below provide the significance of perceived impacts on the floral and faunal ecology of the study area. An impact discussion and assessment of all potential pre-construction, construction, operational and maintenance phase impacts are provided in Section 6.1 (flora) and Section 6.2 (fauna). All mitigatory measures required to minimise the perceived impacts are presented in Section 6.3.

No planned layouts are available yet and as such the impact assessment will assume that the entire study area is targeted for development. Once a final layout is provided, the impact assessment will be updated accordingly by the biodiversity specialist.

The table below indicates the perceived risks to floral and faunal species associated with the activities pertaining to the proposed development.

Table 5: Activities and Aspects likely to impact on the faunal and floral resources of the study area.

ACTIVITIES AND ASPECTS REGISTER
Pre-Construction Phase
- Lack of planning to relocate potential floral SCC, if any, to suitable habitat outside the development footprint. - Impact: Permanent loss of floral SCC from the study area.
- Inconsiderate planning of infrastructure placement and design, leading to unnecessary edge effect impacts on areas outside of the proposed development footprint. - Impact: Degradation and modification of the receiving environment, loss of faunal and floral habitat.
- Potential failure to design and implement an Alien and Invasive Plant (AIP) Management/Control plan before the commencement of construction activities, resulting in the spread of AIPs from the development footprint to surrounding natural habitat. - Impact: Spreads of AIPs, leading to potential loss of floral species diversity from surrounding natural habitat.
Construction Phase
- Site clearing and the removal of vegetation. - Impact: Loss of faunal and floral habitat, diversity, and the SCC, if present. Potential loss of faunal SCC.
- Proliferation of AIP species that colonise in areas of increased disturbances and that outcompete native species, including the further transformation of nearby natural habitat. - Impact: Loss of favourable faunal and floral habitat outside of the direct development footprint, including a decrease in species diversity and a potential loss of faunal and floral SCC for the local area.
- Dumping of construction material within areas where no construction is planned, thereby leading to further habitat disturbance - allowing the establishment and spread of AIPs. - Impact: Loss of preferred faunal and floral habitat, diversity and SCC as AIPs outcome and replace these species.
- Potential overexploitation through the trapping and/or hunting of faunal species, including faunal SCC, beyond the direct footprint area. - Impact: Local loss of faunal abundance and diversity.
- Possible increased fire frequency during construction. - Impact: Loss or alteration of floral and faunal habitat and species diversity.
- Dust generated during construction and operational activities accumulating on the surrounding floral individuals, altering the photosynthetic ability of plants[9] and potentially further decreasing optimal growing/re-establishing conditions. - Impact: Declines in plant functioning leading to loss of floral species and habitat for optimal growth.

[9] Sett, R. (2017). Responses in plants exposed to dust pollution. Horticulture International Journal, 1(2), 00010.).

ACTIVITIES AND ASPECTS REGISTER
Operational and Maintenance Phases
- Increased introduction and proliferation of alien plant species due to a lack of maintenance activities, or poorly implemented and monitored AIP Management programme, leading to ongoing displacement of natural vegetation outside of the footprint area. - Impact: Ongoing or permanent loss of faunal and floral habitat, diversity, and potential SCC.

6.1 Floral Impact Assessment

6.1.1 Floral Impact Assessment Results

The below table indicates the perceived risks to the floral ecology associated with all phases of the proposed development. The table also provides the findings of the impact assessment undertaken with reference to the perceived impacts prior to the implementation of mitigation measures and following the implementation of mitigation measures. The mitigated results of the impact assessment have been calculated on the premise that all mitigation measures as stipulated in this report are adhered to and implemented. Should such actions not be adhered to, it is highly likely that post-mitigation impact scores will increase.

Table 6: Impact on the floral habitat, diversity and SCC from the proposed development activities.

Habitat Unit	UNMANAGED								MANAGED							
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance
PRE-CONSTRUCTION PHASE																
Impact of floral Habitat and Diversity																
Study area	3	2	2	2	5	5	9	45 Low	2	2	1	1	2	4	4	16 Very Low
Impact on Floral SCC																
Study area	3	2	2	2	5	5	9	45 Low	2	2	1	1	2	4	4	16 Very Low
CONSTRUCTION PHASE																
Impact of floral Habitat and Diversity																
Study area	5	2	2	2	2	7	6	42 Low	4	2	1	1	2	6	4	24 Very Low
Impact on Floral SCC																
Study area	3	2	2	2	2	5	6	30 Low	2	2	2	1	2	4	5	20 Very Low
OPERATIONAL AND MAINTENANCE PHASE																
Impact of floral Habitat and Diversity																
Study area	3	2	2	3	4	5	9	45 Low	2	2	1	1	4	4	6	24 Very Low
Impact on Floral SCC																
Study area	3	2	2	1	5	5	8	40 Low	2	2	1	1	4	4	6	24 Very Low

6.1.2 Impact Discussion

The direct impact of the proposed development on the floral ecology of the study area is not anticipated to be detrimental, with impact significance varying between **low** and **very low** levels prior to mitigation measures implemented. With mitigation measures implemented, the direct and indirect impacts on the floral ecology for the entire study area can be reduced to **very low** levels.

Due to the study area being surrounded by man-made barriers such as roads and other developments, the surrounding natural vegetation within the local region will likely not be impacted by the proposed development. As part of the rehabilitation actions, disturbed areas not within the development footprint must be rehabilitated appropriately and AIP establishment controlled within such areas.

6.1.2.1 Impact on Floral Habitat and Diversity

The historic and current disturbances within the study area, i.e. proliferation of AIPs, vegetation clearing, fragmentation from surrounding natural vegetation communities and dumping of rubble, has resulted in decreased habitat integrity and an increase in floral communities that are indicative of disturbance. The remaining grassland within the study area is no longer representative of the reference vegetation type, i.e. the Soweto Highveld Grassland, and is also not considered indigenous vegetation. AIP proliferation within the Grassland Habitat is moderately high, leading to an ongoing decline in preferred habitat for native floral species.

The proposed development will result in the loss of very few native grassland species, and the impact will be localised within the footprint area. No regional impacts on floral communities are anticipated.

6.1.2.2 Impacts on Floral SCC

During the field assessment no floral SCC were encountered and it is unlikely that any such species would be present within the study area due to the high levels of transformation that has taken place due to both current and historic anthropogenic activities. The impact associated with the loss of habitat for these species is of low significance during both the construction and operational phases of the project prior to the implementation of mitigation measures. With the implementation of mitigation measures, the impact significance of the loss of important species may be even further reduced to very low levels.

6.1.2.3 Probable Residual Impacts

Even with extensive mitigation, residual impacts on the receiving floral ecological environment are deemed likely. The following points highlight the key latent impacts that have been identified:

- Further loss of floral habitat outside of the footprint area;
- Loss and alteration of floral species diversity outside of the footprint area; and
- Continued alien and invasive plant proliferation to adjacent natural vegetation communities.

6.1.2.4 Cumulative Impacts

The greatest threat to the floral ecology within the study area is the continued proliferation of AIP species, resulting in the overall loss of native floral communities within the local area. The proposed development will also increase the movement of humans within the area and could lead to further degradation of floral habitat outside of the proposed development footprint.

6.2 Faunal Impact Assessment

6.2.1 Faunal Impact Assessment Results

The table below summarises the findings indicating the significance of the impact before and after mitigation. In the consideration of mitigation, it is assumed that a high level of mitigation takes place, but which does not lead to prohibitive costs. From the tables, it is evident that prior to mitigation, the impacts on faunal SCC are low level impacts. If effective mitigation takes place, all impacts may be reduced to low and very low-level impacts. Impacts will have reduced severity; duration and the scale of the footprint will be minimised.

Table 7: Impact on the faunal habitat, diversity and SCC arising from the proposed development activities.

Habitat Unit	UNMANAGED								MANAGED							
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial Scale	Duration of Impact	Likelihood	Consequence	Significance
PRE-CONSTRUCTION PHASE																
Impact of Faunal Habitat and Diversity																
Study area	3	2	2	2	5	5	9	45 Low	1	2	1	1	3	3	5	15 Very Low
Impact on Faunal SCC																
Study area	3	2	3	1	3	5	7	35 Low	2	2	2	1	3	4	6	24 Very Low
CONSTRUCTION PHASE																
Impact of Faunal Habitat and Diversity																
Study area	3	2	2	2	5	5	9	45 Low	1	2	1	1	5	3	7	21 Very Low
Impact on Faunal SCC																
Study area	3	2	2	1	5	5	8	40 Low	1	2	2	1	5	3	8	24 Very Low
OPERATIONAL AND MAINTENANCE PHASE																
Impact of Faunal Habitat and Diversity																
Study area	3	2	2	2	4	5	8	40 Low	1	2	1	1	4	3	6	18 Very Low
Impact on Faunal SCC																
Study area	3	2	2	1	4	5	7	35 Low	1	2	2	1	4	3	7	21 Very Low

6.2.2 Impact Discussion

The proposed development is anticipated to have a limited impact on faunal communities. The habitat integrity of the study area has been degraded and only a few, commonly occurring faunal species were observed utilising the habitat. With mitigation measures implemented, the direct and indirect impacts on the floral ecology can be reduced to low and very-low levels.

The study area is surrounded by man-made barriers such as roads and other developments, and it is thus also not anticipated that any migratory routes for faunal species will be significantly impacted by the proposed development. As part of the rehabilitation actions, disturbed areas not within the development footprint must be rehabilitated appropriately and AIP establishment controlled within such areas.

6.2.2.1 Loss of Faunal Habitat and Ecological Structure

The proposed development will result in a loss of faunal habitat from the area; however, the study area is associated with a moderately low diversity of fauna and no SCC were recorded. The proposed development is thus not likely to have a significant negative impact on faunal communities and their preferred habitat.

Despite the fragmented habitat and levels of habitat transformation and disturbance, the study area still provides habitat for common and widespread faunal species that have integrated well into the urban setting.

Mitigation efforts should be aimed at limiting edge effects from construction activities to the surrounding area and implementing an AIP management plan.

6.2.2.2 Impact on Important Faunal Species of Conservation Concern

No faunal SCC were identified within the study area and there is a low probability of such species occurring permanently within the study area due to loss of suitable habitat, historic and ongoing anthropogenic activity within the study area. The impact associated with the loss of habitat for these species is of low significance during both the construction and operational phases of the project prior to the implementation of mitigation measures. With the implementation of mitigation measures, the impact significance of the loss of important species may even further reduced to very low levels.

6.2.2.3 Probable Residual Impacts

Even with extensive mitigation, residual impacts on the receiving faunal ecological environment are deemed likely. The following points highlight the key residual impacts that have been identified:

- Continued loss of faunal habitat outside of the direct footprint; and
- Continued loss of and altered faunal species diversity outside of the footprint area.

6.2.2.4 Possible cumulative Impacts

Much of the study area has already been disturbed, fragmented from nearby natural habitat and is associated with high levels of anthropogenic activities. The proposed development will result in the clearance of vegetated areas and further isolation and displacement of faunal species within the local area – especially as poaching could increase with increased human movement in the area. Furthermore, ineffective control and monitoring of edge effects can result in the spread of AIP species to the surrounding natural areas, which will further alter faunal habitat and subsequently faunal diversity within this area.

Due to the limited development footprint and the urban landscape of the study area, it is highly unlikely that the proposed development will impact conservation targets for sensitive faunal species.

6.3 Integrated Impact Mitigation

The table below highlights the key, general integrated mitigation measures that are applicable to the proposed development in order to suitably manage and mitigate the ecological impacts that are associated with all phases of the proposed development.

Provided that all management and mitigation measures are implemented, as stipulated in this report, the overall risk to floral and faunal diversity, habitat and SCC can be mitigated and minimised.

Table 8: A summary of the mitigatory requirements for the biodiversity associated with the study area.

Project phase	Planning Phase
Impact Summary	Loss of floral and faunal habitat, species and SCC
Proposed mitigation and management measures:	
Floral and Faunal Habitat and Diversity	
• Minimise loss of natural vegetation where possible through planning and where necessary by incorporating the sensitivity of the biodiversity report as well as other specialist studies.	
Project phase	Construction Phase
Impact Summary	Loss of floral and faunal habitat, species and SCC
Proposed mitigation and management measures:	
Development footprint	
• The construction footprint must be kept as small as possible in order to minimise impact on the surrounding environment (edge effect management); • Removal of vegetation must be restricted to what is absolutely necessary and should remain within the approved development footprint. Where possible / feasible, any remaining natural areas should be utilised as part of the landscaping of the proposed development; • Clearing of vegetation should take place in a phased manner. This will allow for faunal species within the study area to flee and avoid harm; • Vehicles should be restricted to travelling only on designated roadways to limit the ecological footprint of the construction activities. Additional road construction should be limited to what is absolutely necessary, and the footprint thereof kept to a minimal; • No hunting or trapping of faunal species is to be allowed by construction personnel; • Informal fires by construction personnel should be prohibited, and no uncontrolled fires whatsoever should be allowed; • Care should be taken during the construction and operation of the proposed development to limit edge effects to surrounding natural habitat. This can be achieved by: - No construction rubble or cleared alien invasive species are to be disposed of outside of demarcated areas, and should be taken to a registered waste disposal facility; - All soils compacted as a result of construction activities should be ripped and profiled and reseeded; and - Manage the spread of AIP species, which may affect remaining natural habitat within surrounding areas. Specific mention in this regard is made to Category 1b species identified within the development footprint areas (refer to Appendix F of this report). • Appropriate sanitary facilities must be provided during the construction of the development and must be removed to an appropriate waste disposal site; • No dumping of litter, rubble or cleared vegetation on site should be allowed. Infrastructure and rubble removed because of the construction activities should be disposed of at an appropriate registered dump site away from the development footprint. No temporary dump sites should be allowed in areas with natural vegetation. It is advised that waste disposal containers and bins be provided during the construction phase for all construction rubble and general waste. Vegetation cuttings must be carefully collected and disposed of at a separate waste facility; • If any spills occur, they should be immediately cleaned up to avoid soil contamination that can hinder floral rehabilitation later down the line. Spill kits should be kept on-site within workshops. In the event of a breakdown, maintenance of vehicles must take place with care, and the recollection of spillage should be practised, preventing the ingress of hydrocarbons into the topsoil; and • Upon completion of construction activities, it must be ensured that no bare areas remain, and that indigenous species be used to revegetate the disturbed area.	
Alien Vegetation	
• Edge effects arising from the proposed development, such as erosion and alien plant species proliferation, which may affect adjacent natural areas, need to be strictly managed. Specific mention in this regard is made of Category 1b AIP species (as listed in the NEMBA Alien species lists, 2016), in line with the NEMBA Alien and Invasive Species Regulations (2014) (Appendix F of this report); • Ongoing alien and invasive plant monitoring and clearing/control should take place throughout the construction and operational phase of the development, and a 30 m buffer surrounding the study area should be regularly checked for AIP proliferation and to prevent spread into surrounding natural areas; and • Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility which complies with legal standards.	
Floral and Faunal SCC	

- No collection of floral SCC or medicinal floral species, if located on site, must be allowed by construction personnel;
- Edge effect control needs to be implemented to prevent further degradation and potential loss of floral SCC outside of the proposed development footprint area;
- No trapping or hunting of fauna whatsoever must be allowed; and
- Should the presence of any faunal SCC be noted, or their breeding sites be located, within the development footprint a suitably qualified specialist should be consulted on the best way to proceed.

Fire

- No illicit fires must be allowed during the construction of the proposed development.

Rehabilitation

- Any areas that have been left bare as a result of the construction activities should be rehabilitated using indigenous species.

Project phase	Operational Phase
Impact Summary	Loss of floral and faunal habitat, species and SCC

Proposed mitigation and management measures:

Development footprint

- Where formal landscaped gardens are envisioned, use should be made of indigenous species or ornamental alien species that are not listed within the NEMBA Alien Species List (2016);
- As part of any landscaping plans, the recreation of habitat for faunal species such as small lizards, arachnids, small mammals and birds should be considered. Creation of rock gardens, using dead logs and fallen trees in landscape areas should also be considered, as these will provide areas of niche habitat and refuge for small faunal species. Trees can be planted to provide nesting and roosting sites for avifauna; and
- No dumping of litter or garden refuse must be allowed on-site. As such it is advised that vegetation cuttings from landscaped areas be carefully collected and disposed of at a separate waste facility.

Alien Vegetation

- Ongoing alien and invasive plant monitoring and clearing/control should take place throughout the operational phase, and the project perimeters should be regularly checked for AIP establishment to prevent spread into surrounding natural areas; and
- Alien vegetation that is removed must not be allowed to lay on unprotected ground as seeds might disperse upon it. All cleared plant material to be disposed of at a licensed waste facility, which complies with legal standards.

Floral and Faunal SCC

- Should the presence of any faunal SCC be noted, or their breeding sites be located within the operational footprint, a suitably qualified specialist should be consulted on the best way to proceed.

7. CONCLUSION

The current report serves to update, where and if necessary, the results of the 2016 assessment (STS 160033, 2016) for the proposed development on The Farm 75 Registration Division I.Q., Province of Gauteng. STS was also appointed to assist the EAP to determine whether listed activities relating to the clearance of indigenous vegetation[10] will be triggered under NEMA (Act 107 of 1998) and the associated Regulations.

This report updated the below information:

- Confirmed the absence of indigenous vegetation in the study area;
- The inclusion of the online National Web-based Environmental Screening Tool;
- All updated GIS databases were used as part of the background information study, which included the updated 2018 Final Vegetation Map of South Africa, Lesotho and Swaziland, the updated National Biodiversity Assessment (2018) database as well as the latest versions of the South Africa Protected and Conservation Areas Databases (SACAD and SAPAD, 2019_Q4);
- Refined the habitat units within the study area; and
- Updated the impact assessment for both faunal and floral species.

During the field assessment, two habitat units were identified within the study area, namely the Degraded Habitat and Transformed Habitat. The study area is situated within an area that comprises urban development to the north and east, with open veld to the west. Within the study area the remaining natural habitat has been exposed to various historic and ongoing disturbances, resulting in largely degraded habitat with generally low floral and faunal diversity and abundance. Most of the study area is dominated by species associated with disturbance, including AIPs, and the fauna within this area was noted to be commonly occurring and widespread species that have adapted to urban settings.

Given the above, the biodiversity assessment confirmed that the remaining vegetation within the study area no longer represent the reference vegetation type. The study area also lacks indigenous vegetation.

Following the ecological assessment of the biodiversity within the study area, the impacts associated with the proposed development activities were determined. The impacts on the floral and faunal habitat, diversity and SCC are considered to range from mainly low

[10] Indigenous vegetation is described according to the NEMA definition as “vegetation of indigenous plant species occurring naturally in an area, regardless of the level of alien infestation and where the topsoil has not been lawfully disturbed during the preceding ten years.”

significance impacts with some very low significance impacts prior to the implementation of mitigation measures. With mitigation fully implemented all impacts can be reduced to very low significance impacts. No significant impacts on the biodiversity associated with the study area are thus anticipated for the proposed development.

The objective of this study was to provide sufficient information on the biodiversity significance of the area, together with other studies on the physical and socio-cultural environment for the EAP and the relevant authorities to apply the principles of Integrated Environmental Management (IEM) and the concept of sustainable development. The need for conservation as well as the risks to other spheres of the physical and socio-cultural environment need to be compared and considered along with the need to ensure sustainable economic development of the country.

It is the opinion of the ecologists that this study provides the relevant information required in order to implement Integrated Environmental Management (IEM) and to ensure that the best long-term use of the ecological resources in the study area will be made in support of the principle of sustainable development.

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APPENDIX A: Legislative Requirements

The Constitution of the Republic of South Africa, 1996

The environment and the health and well-being of people are safeguarded under the Constitution of the Republic of South Africa, 1996 by way of section 24. Section 24(a) guarantees a right to an environment that is not harmful to human health or well-being and to environmental protection for the benefit of present and future generations. Section 24(b) directs the state to take reasonable legislative and other measures to prevent pollution, promote conservation, and secure the ecologically sustainable development and use of natural resources (including water and mineral resources) while promoting justifiable economic and social development. Section 27 guarantees every person the right of access to sufficient water, and the state is obliged to take reasonable legislative and other measures within its available resources to achieve the progressive realisation of this right. Section 27 is defined as a socio-economic right and not an environmental right. However, read with section 24 it requires of the state to ensure that water is conserved and protected and that sufficient access to the resource is provided. Water regulation in South Africa places a great emphasis on protecting the resource and on providing access to water for everyone.

The National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)

The National Environmental Management Act, 1998 (Act 107 of 1998) (NEMA) and the associated Environmental Impact Assessment (EIA) Regulations (GN R326 as amended in 2017 and well as listing notices 1, 2 and 3 (GN R327, R325 and R324 of 2017), state that prior to any development taking place which triggers any activity as listed within the abovementioned regulations, an environmental authorisation process needs to be followed. This could follow either the Basic Assessment process or the Environmental Impact Assessment process depending on the nature of the activity and scale of the impact.

The National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA)

The objectives of this act are (within the framework of NEMA) to provide for:

- The management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity;
- The use of indigenous biological resources in a sustainable manner;
- The fair and equitable sharing among stakeholders of the benefits arising from bio prospecting involving indigenous biological resources;
- To give effect to ratify international agreements relating to biodiversity which are binding to the Republic;
- To provide for cooperative governance in biodiversity management and conservation; and
- To provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of the surrounding areas are not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of the benefits arising from indigenous biological resources.
Furthermore, a person may not carry out a restricted activity involving either:

a) A specimen of a listed threatened or protected species;
b) Specimens of an alien species; or
c) A specimen of a listed invasive species without a permit.

Government Notice 598 Alien and Invasive Species Regulations (2014), including the Government Notice 864 Alien Invasive Species List as published in the Government Gazette 40166 of 2016, as it relates to the National Environmental Management Biodiversity Act, 2004 (Act No 10 of 2004)

NEMBA is administered by the Department of Environmental Affairs and aims to provide for the management and conservation of South Africa's biodiversity within the framework of the NEMA. In terms of alien and invasive species. This act in terms of alien and invasive species aims to:

- Prevent the unauthorized introduction and spread of alien and invasive species to ecosystems and habitats where they do not naturally occur,
- Manage and control alien and invasive species, to prevent or minimize harm to the environment and biodiversity; and
- Eradicate alien species and invasive species from ecosystems and habitats where they may harm such ecosystems or habitats.

Alien species are defined, in terms of the National Environmental Management: Biodiversity Act, 2004 (Act no 10 of 2004) as:

(a) A species that is not an indigenous species; or
(b) An indigenous species translocated or intended to be translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.

Categories according to NEMBA (Alien and Invasive Species Regulations, 2017):

- **Category 1a**: Invasive species that require compulsory control;
- **Category 1b**: Invasive species that require control by means of an invasive species management programme;
- **Category 2**: Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread; and
- **Category 3**: Ornamentally used plants that may no longer be planted.

The Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) (CARA)

Removal of the alien and weed species encountered in the application area must take place in order to comply with existing legislation (amendments to the regulations under the CARA, 1983 and Section 28 of the NEMA, 1998). Removal of species should take place throughout the construction and operation, phases.

GDARD Requirements for Biodiversity Assessments Version 3 (GDARD, 2014b).

The biodiversity assessment must comply with the minimum requirements as stipulated by GDARD Version 3 of 2014 and must contain the following information:

- A location and description of the application site and proposed activities;
- Photographic record and description of the site characteristics and inventories of the faunal and floral species observed on site, with special mention to Red Listed species;
- Sensitivity map displaying all sensitive areas and associated buffers as listed in the Sensitivity Mapping Rules for Biodiversity Assessments section of GDARD V3 (2014); and
- A list of recommendations and mitigation measures to reduce the potential environmental impacts that the proposed development might have on the terrestrial ecology associated with the site.

Indemnity and Terms of use of this Report

The findings, results, observations, conclusions and recommendations given in this report are based on the author's best scientific and professional knowledge as well as available information. The report is based on survey and assessment techniques which are limited by seasonality, time and budgetary constraints relevant to the type and level of investigation undertaken as well as the project program and STS CC and its staff, at their sole discretion, reserve the right to modify aspects of the report including the recommendations if and when new information may become available from ongoing research or further work in this field or pertaining to this investigation.

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APPENDIX B: Floral Method of Assessment

Floral Species of Conservational Concern Assessment

Prior to the site visit, a record of floral SCC and their habitat requirements was developed for the study area, which includes consulting the National Web-based Environmental Screening Tool. Because not all SCC have been included in the Screening Tool layers (e.g. NT and DD taxa), it remains important for the specialist to be on the lookout for additional SCC. For this study, two primary sources were consulted and are described below.

The National Web-Based Environmental Screening Tool

The Screening Tool was accessed to obtain a list of potentially occurring species of conservation concern for the study area. Each of the themes in the Screening Tool consists of theme-specific spatial datasets which have been assigned a sensitivity level namely, "*low*", "*medium*", "*high*" and "*very high*" sensitivity. The four levels of sensitivity are derived and identified in different ways, e.g. for **confirmed** areas of occupied habitat for SCC a Very High and High Sensitivity is assigned and for areas of suitable habitat where SCC may occur based on spatial models only, a Medium Sensitivity is assigned. The different sensitivity ratings pertaining to the Plant [and Animal] Protocols are described below[11]:

- **Very High**: Habitat for species that are endemic to South Africa, where all the known occurrences of that species are within an area of 10 km^2 are considered Critical Habitat, as all remaining habitat is irreplaceable. Typically, these include species that qualify under Critically Endangered (CR), Endangered (EN), or Vulnerable (VU) D criteria of the IUCN or species listed as Critically/ Extremely Rare under South Africa's National Red List Criteria. For each species reliant on a Critical Habitat, all remaining suitable habitat has been manually mapped at a fine scale.
- **High**: Recent occurrence records for all threatened (CR, EN, VU) and/or rare endemic species are included in the high sensitivity level. Spatial polygons of suitable habitat have been produced for each species by intersecting recently collected occurrence records (those collected since the year 2000) that have a spatial confidence level of less than 250 m with segments of remaining natural habitat.
- **Medium**: Model-derived suitable habitat areas for threatened and/or rare species are included in the medium sensitivity level. Two types of spatial models have been included. The first is a simple rule-based habitat suitability model where habitat attributes such as vegetation type and altitude are selected for all areas where a species has been recorded to occur. The second is a species distribution model which uses species occurrence records combined with multiple environmental variables to quantify and predict areas of suitable habitat. The models provide a probability-based distribution indicating a continuous range of habitat suitability across areas that have not been previously surveyed. A probability threshold of 75% for suitable habitat has been used to convert the modelled probability surface and reduce it into a single spatial area which defines areas that fall within the medium sensitivity level.
- **Low**: Areas where no SCC are known or expected to occur.

[11] More details on the use of the Screening Tool for Species of Conservation Concern can be found in the below resources:

- South African National Biodiversity Institute (SANBI). 2020. Draft Species Environmental Assessment Guideline. Guidelines for the implementation of the Terrestrial Flora (3c) & Terrestrial Fauna (3d) Species Protocols for environmental impact assessments in South Africa. South African National Biodiversity Institute, Pretoria. Version 1.0.
- The National Web based Environmental Screening Tool website: https://screening.environment.gov.za/screeningtool/#/pages/welcome

BRAHMS Online Website

The Botanical Database of Southern Africa (BODATSA) is accessed to obtain plant names and floristic details (http://posa.sanbi.org/) for species of conservation concern within a selected boundary;

- This website provides access to South African plant names (taxa), specimens (herbarium sheets) and observations of plants made in the field (botanical records). Data is obtained from the Botanical Database of Southern Africa (BODATSA), which contains records from the National Herbarium in Pretoria (PRE), the Compton Herbarium in Cape Town (NBG & SAM) and the KwaZulu-Natal Herbarium in Durban (NH).
- Information on habitat requirements etc. is obtained from the SANBI Red List of South African Plants website (http://redlist.sanbi.org/).
- Typically, data is extracted for the Quarter Degree Square (QDS) in which the study area is situated but where it is deemed appropriate, a larger area can be included.

NEMBA TOPS Species

The Threatened or Protected Species (TOPS) Regulations (GN 255 of 2015) under Section 56(1) of the National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) (NEMBA), were taken into consideration.

Throughout the floral assessment, special attention was paid to the identification of any of these SCC as well as the identification of suitable habitat that could potentially support these species.

The Probability of Occurrence (POC) for each floral SCC is described:

- "**Confirmed'**: if observed during the survey;
- "**High**": if within the species' known distribution range and suitable habitat is available;
- "**Medium**": if either within the known distribution range of the species or if suitable habitat is present; or
- "**Low**": if the habitat is not suitable and falls outside the distribution range of the species.

The accuracy of the POC is based on the available knowledge about the species in question, with many of the species lacking in-depth habitat research.

Vegetation Surveys

When planning the timing of a floristic survey, it is important to remember that the primary objective is not an exhaustive species list but rather to ensure that sufficient data are collected to describe all the vegetation communities present in the area of interest, to optimise the detection of SCC and to assess habitat suitability for other potentially occurring SCC (SANBI, 2020).

The vegetation survey incorporates the subjective (or stratified) sampling method. Subjective sampling is a sampling technique in which the specialist relies on his or her own professional experience when choosing sample sites within the study area. This allows representative recordings of floral communities and optimal detection of SCC. Subjective sampling is used to consider different areas (or habitat units) which are identified within the main body of a habitat/study area.

One of the problems with random sampling, another popular sampling method, is that random samples may not cover all areas of a study area equally and thus increase the potential to miss floral SCC. Random sampling methods also tend to require more time in the field to locate the amount of SCC that can be detected using subjective sampling methods - In the context of an EIA where time constraints are often restrictive, priority needs to be given to collecting data in the shortest time possible without compromising the efficiency of locating SCC (SANBI, 2020).

Vegetation structure has been described following the guideline in Edwards (1983). Refer to Figure A1 below:

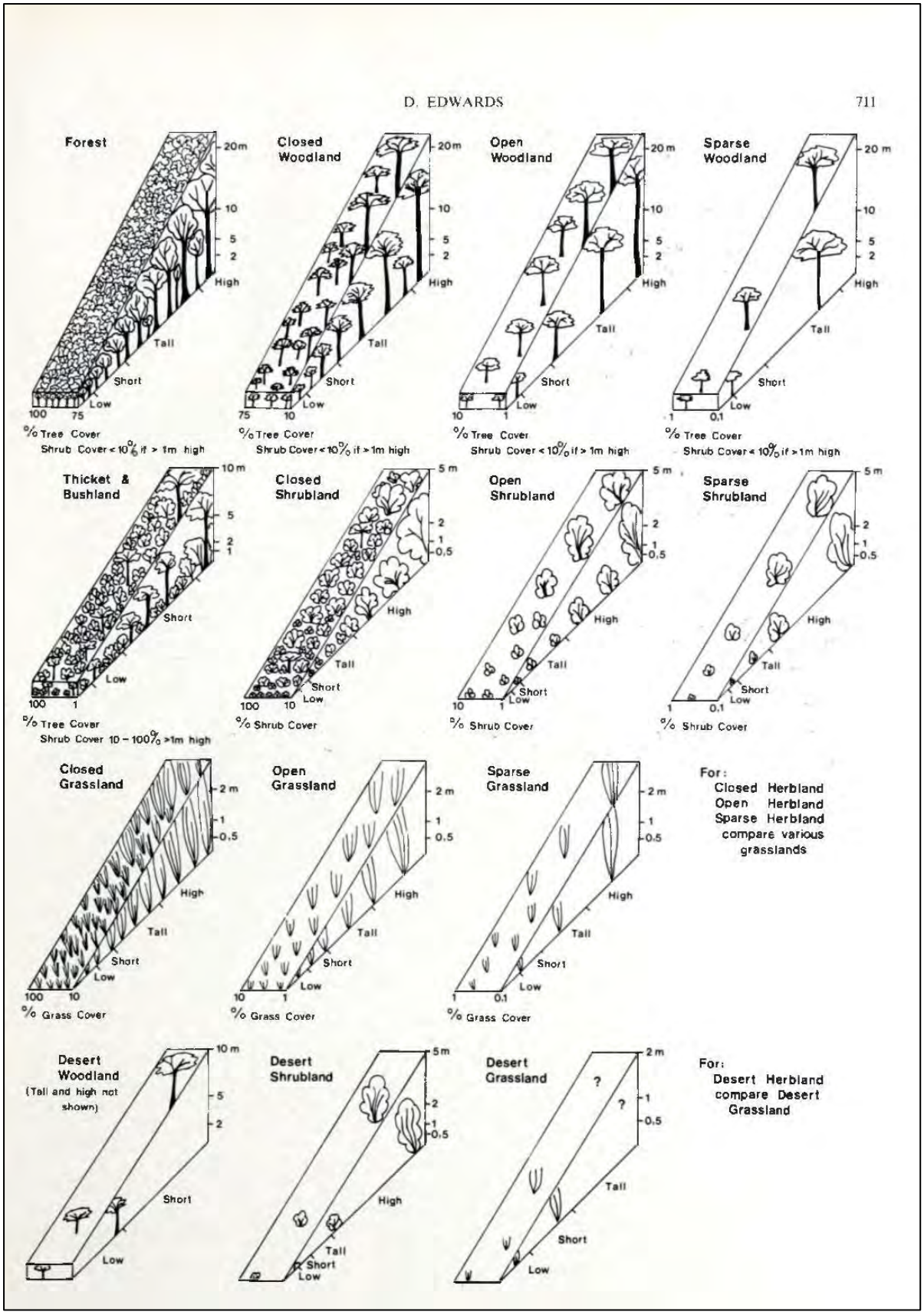

Figure B1: Diagrammatic representation of structural groups and formation classes. Only dominant growth forms are shown.

Floral Habitat Sensitivity

The floral habitat sensitivity of each habitat unit was determined by calculating the mean of five different parameters which influence floral communities and provide an indication of the overall floristic ecological integrity, importance and sensitivity of the habitat unit. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Floral SCC:** The confirmed presence or potential for floral SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Unique Landscapes:** The presence of unique landscapes or the presence of an ecologically intact habitat unit in a transformed region;
- **Conservation Status:** The conservation status of the ecosystem or vegetation type in which the habitat unit is situated based on local, regional and national databases. Whether the habitat is representative of a Critical Biodiversity Area or forms part of an Ecological Support Area is also taken into consideration;
- **Floral Diversity:** The recorded floral diversity compared to a suitable reference condition such as surrounding natural areas or available floristic databases; and
- **Habitat Integrity:** The degree to which the habitat unit is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contribute equally to the mean score, which determines the floral habitat sensitivity class in which each habitat unit falls. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilization of the habitat unit in question. In order to present the results use is made of spider diagrams to depict the significance of each aspect of floral ecology for each vegetation type. The different classes and land-use objectives are presented in the table below:

Table B1: Floral habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1 < 1.5	Low	Optimise development potential.
≥1.5 <2.5	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
≥2.5 <3.5	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimizing development potential.
≥3.5<4.5	Moderately high	Preserve and enhance the biodiversity of the habitat unit, limit development and disturbance.
≥4.5 ≤5.0	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX C: Faunal Method of Assessment

Faunal Species of Conservational Concern Assessment

The Probability of Occurrence (POC) for each faunal SCC was determined using the following four parameters:

- Species distribution;
- Habitat availability;
- Food availability; and
- Habitat disturbance.

The accuracy of the calculation is based on the available knowledge about the species in question. Therefore, it is important that the literature available is also considered during the calculation.
Each factor contributes an equal value to the calculation.

Scoring Guideline				
Habitat availability				
No Habitat	Very low	Low	Moderate	High
1	2	3	4	5
Food availability				
No food available	Very low	Low	Moderate	High
1	2	3	4	5
Habitat disturbance				
Very High	High	Moderate	Low	Very Low
1	2	3	4	5
Distribution/Range				
Not Recorded		Historically Recorded		Recently Recorded
1		3		5
[Habitat availability + Food availability + Habitat disturbance + Distribution/Range] / 20 x 100 = POC%				

Faunal Surveys

It is important to note that due to the nature and habits of fauna, varied stages of life cycles, seasonal and temporal fluctuations along with other external factors, it is unlikely that all faunal species will have been recorded during the site assessment. The presence of human habitation nearby the study area and the associated anthropogenic activities may have an impact on faunal behaviour and in turn the rate of observations.

Mammals

Mammal species were recorded during the field assessment with the use of visual identification, spoor, call and dung. Specific attention was paid to mammal SCC as listed by the IUCN, 2015.

Avifauna

The Southern African Bird Atlas Project 2 database (http://sabap2.adu.org.za/) was compared with the recent field survey of avifaunal species identified on the study area. Field surveys were undertaken utilising visual observation and bird call identification techniques in order to accurately identify avifaunal species. Specific attention was given to avifaunal SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Reptiles
During the field assessment, suitable applicable habitat areas (rocky outcrops and fallen dead trees) were inspected for the presence of reptiles, and any individuals encountered were identified. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which reptile species are likely to occur on the study area. Specific attention was given to reptile SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Amphibians
Identifying amphibian species is done by the use of direct visual identification along with call identification technique. Amphibian species flourish in and around wetland, riparian and moist grassland areas. It is unlikely that all amphibian species will have been recorded during the site assessment, due to their cryptic nature and habits, varied stages of life cycles and seasonal and temporal fluctuations within the environment. The data gathered during the assessment along with the habitat analysis provided an accurate indication of which amphibian species are likely to occur within the study area as well as the surrounding area. Specific attention was given to amphibian SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Invertebrates
Whilst conducting transects through the study area, all insect species visually observed were identified, and where possible photographs taken. Due to the terrain, and shallow/ rocky soil structure pitfall traps were not utilised during the site assessment.

It must be noted however that due to the cryptic nature and habits of insects, varied stages of life cycles and seasonal and temporal fluctuations within the environment, it is unlikely that all insect species will have been recorded during the site assessment period. Nevertheless, the data gathered during the assessment along with the habitat analysis provided an accurate indication of which species are likely to occur in the study area at the time of survey. Specific attention was given to insect SCC listed on a regional and national level, as well as those identified by the International Union for the Conservation of Nature (IUCN).

Arachnids
Suitable applicable habitat areas (rocky outcrops, sandy areas and fallen dead trees) where spiders and scorpions are likely to reside were searched. Rocks were overturned and inspected for signs of these species. Specific attention was paid to searching for Mygalomorphae arachnids (Trapdoor and Baboon spiders) as well as potential SCC scorpions within the study area.

Faunal Habitat Sensitivity
The sensitivity of the study area for each faunal class (i.e. mammals, birds, reptiles, amphibians and invertebrates) was determined by calculating the mean of five different parameters which influence each faunal class and provide an indication of the overall faunal ecological integrity, importance and sensitivity of the study area for each class. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Faunal SCC:** The confirmed presence or potential for faunal SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Habitat Availability:** The presence of suitable habitat for each class;
- **Food Availability:** The availability of food within the study area for each faunal class;
- **Faunal Diversity:** The recorded faunal diversity compared to a suitable reference condition such as surrounding natural areas or available faunal databases; and
- **Habitat Integrity:** The degree to which the habitat is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contributes equally to the mean score, which determines the suitability and sensitivity of the study area for each faunal class. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilisation of the study area in relation to each faunal class. The different classes and land-use objectives are presented in the table below:

Table C1: Faunal habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1.0 < 1.5	Low	Optimise development potential.
≥1.5 <2.5	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
≥2.5 <3.5	Intermediate	Preserve and enhance biodiversity of the habitat unit surrounds while optimising development potential.
≥3.5<4.5	Moderately high	Preserve and enhance the biodiversity of the habitat limit development and disturbance.
≥4.5 ≤ 5.0	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX D: Impact Assessment Methodology

In order for the Environmental Assessment Practitioner (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 infrastructure that is possessed by an organisation.
- An **environmental aspect** is an 'element of an organizations activities, products and services which can interact with the environment'[12]. 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 wellbeing, 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 3. 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 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 necessary[13].

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

[12] The definition has been aligned with that used in the ISO 14001 Standard.
[13] Some risks/impacts that have low significance will however still require mitigation.

Environmental Management Act 1998 (Act No. 107 of 1998) 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 D1: 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
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 developments affected < 100m	1
Development specific/ within the site boundary / < 100ha impacted / Linear developments affected < 100m	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear developments affected < 1000m	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear developments affected < 2000m	4
Entire habitat unit / Entire system/ > 2000ha impacted / Linear developments affected > 3000m	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 D2: Significance Rating Matrix.

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

Table D3: Positive/Negative Mitigation Ratings.

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150	Critically consider the viability of proposed projects Improve current management of existing projects significantly and immediately	Maintain current management
High	101-125	Comprehensively consider the viability of proposed projects Improve current management of existing projects significantly	Maintain current management
Medium-high	76-100	Consider the viability of proposed projects Improve current management of existing projects	Maintain current management
Medium-low	51-75	Actively seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Low	26-50	Where deemed necessary seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Very low	1-25	Maintain current management and/or proposed project criteria and strive for continuous improvement	Maintain current management and/or proposed project criteria and strive for continuous improvement

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 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:
  - Pre-construction;
  - Construction; and
  - Operation.
- 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.

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 impacts[14] are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, 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.*

Recommendations

Recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through to construction and operation.

[14] Mitigation measures should address both positive and negative impacts

APPENDIX E: Vegetation Type

Gm 8 Soweto Highveld Grassland

Mucina and Rutherford (2006) page 397. Gm 8 Soweto Highveld Grassland: Typical mesic highveld grassland with *Themeda triandra* and several *Eragrostis* species still found in some parts of southern Gauteng in natural condition.

Table E1: Floristic species of *Carletonville Dolomite Grassland* (Mucina & Rutherford, 2012).

Plant Community	Species
Dominant and typical floristic species	
Woody Layer	
Low Shrubs	*Anthospermum rigidum* subsp. *pumilum*, *Indigofera comosa*, *Pygmaeothamnus zeyheri* var. *rogersii*, *Searsia magalismontana*, *Tylosema esculentum*, *Ziziphus zeyheriana*.
Geoxylic Suffrutices	*Elephantorrhiza elephantina*, *Parinari capensis* subsp. *capensis*.
Forb layer	
Herbs	*Acalypha angustata*, *Barleria macrostegia*, *Chamaecrista mimosoides*, *Chamaesyce inaequilatera*, *Crabbea angustifolia*, *Dianthus mooiensis*, *Dicoma anomala*, *Helichrysum caespititium*, *Helichrysum miconiifolium*, *Helichrysum nudifolium* var. *nudifolium*, *Ipomoea ommaneyi*, *Justicia anagalloides*, *Kohautia amatymbica*, *Kyphocarpa angustifolia*, *Ophrestia oblongifolia*, *Pollichia campestris*, *Senecio coronatus*, *Hilliardiella elaeagnoides*.
Geophytic Herbs	*Boophone disticha*, *Habenaria mossii*.
Gramminoid layer	
Graminoids	*Aristida congesta (d), Brachiaria serrata (d), Cynodon dactylon (d), Digitaria tricholaenoides (d), Diheteropogon amplectens (d), Eragrostis chloromelas (d), E. racemosa (d), Heteropogon contortus (d), Loudetia simplex (d), Schizachyrium sanguineum (d), Setaria sphacelata (d), Themeda triandra (d), Alloteropsis semialata subsp. eckloniana, Andropogon schirensis, Aristida canescens, Aristida diffusa, Bewsia biflora, Bulbostylis burchellii, Cymbopogon caesius, Cymbopogon pospischilii, Elionurus muticus, Eragrostis curvula, Eragrostis gummiflua, Eragrostis plana, Eustachys paspaloides, Hyparrhenia hirta, Melinis nerviglumis, Melinis repens subsp. repens, Monocymbium ceresiiforme, Panicum coloratum, Pogonarthria squarrosa, Trichoneura grandiglumis, Triraphis andropogonoides, Tristachya leucothrix, Tristachya rehmannii.*
Endemic Taxa associated with the Carletonville Dolomite Grassland vegetation type	
Woody layer	
Succulent Shrub	*Delosperma davyi*.

**(d) – Dominant species for the vegetation type*

APPENDIX F: Species List

Floral Species List

Table F1: Dominant floral species encountered in the study area. Alien species and garden ornamentals are indicated with an asterisk (*). Also indicated are species falling within an alien invasive category as per the National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, 2014.

Grasses and sedges	Forbs and groundcovers	Trees and shrubs
**Cortaderia selloana* 1b	**Alternanthera pungens*	**Acacia decurrens* 2
Aristida adscensionis	**Amaranthus hybridus*	**Acacia mearnsii* 2
Cynodon dactylon	**Bidens pilosa*	**Eucalyptus grandis*
Digitaria eriantha	**Datura stramonium* 1b	**Melia azedarach* 3
Eragrostis curvula	**Portulaca oleracea*	**Solanum mauritianum* 1b
Eragrostis plana	**Tagetes minuta*	*Celtis africana*
Hyparrhenia hirta	**Verbena bonariensis* 1b	*Pentarrhinum insipidum*
Melinis repens	*Asclepias fruticosa*	*Vachellia karoo*
Pogonarthria squarrosa	*Felicia filifolia*	
Sporobolus africanus	*Helichrysum caespititium*	
	Helichrysum nudifolium var. nudifolium	
	Nidorella hottentotica	
	Senecio oxyriifolius	

1a: Category 1a – Invasive species that require compulsory control.
1b: Category 1b – Invasive species that require control by means of an invasive species management programme.
2: Category 2 – Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.
3: Category 3 – Ornamentally used plants that may no longer be planted; existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread (Bromilow, 2001).

Faunal Species List

Table F2: Mammal species observed

Scientific name	Common Name	IUCN Red List Status
Cryptomys hottentotus	African Mole Rat	LC

LC = Least concerned. NT = Near Threatened, NYBA = Not yet been assessed by the IUCN.

Table F3: Avifaunal species observed

Scientific name	Common Name	Regional Status (2015)	IUCN Red List Status (2016)
Pycnonotus tricolor	Dark-capped Bulbul		NYBA
Phalacrocorax africanus	Reed Cormorant		LC
Corvus albus	Pied crow		LC
Streptopelia senegalensis	Laughing Dove		LC
Streptopelia semitorquata	Red-eyed Dove		LC
Columba livia	Rock Dove		LC
Lanius collaris	Common Fiscal		LC
Threskiornis aethiopicus	African Sacred Ibis		LC
Bostrychia hagedash	Hadeda Ibis		LC
Vanellus coronatus	Crowned Lapwing		LC
Ploceus velatus	Southern Masked Weaver		LC
Colius striatus	Speckled Mousebird		LC
Acridotheres tristis	Common Myna		LC
Cisticola fulvicapilla	Neddicky		LC
Passer melanurus	Cape Sparrow		LC
Passer domesticus	House Sparrow		LC
Streptopelia capicola	Cape Turtle Dove		LC

LC = Least concerned. NT = Near Threatened, NYBA = Not yet been assessed by the IUCN.

Table F4: Insect species observed

Scientific Name	Common Name	IUCN 2015 Status
Belenois aurota	Brown-veined White	NYBA
Junonia hierta	Yellow Pansy	LC
Danaus chrysippus	African Monarch	NYBA
Acanthacris ruficornis	Garden Locust	NYBA
Phymateus viridipes	Green Milkweed Locust	NYBA
Oedaleus sp	N/A	NYBA
Gastrimargus sp	N/A	NYBA
Orthoctha dasycnemis	N/A	NYBA
Anoplolepis custodiens	Pugnacious Ant	NYBA
Trinervitermes sp	Snouted Harvester Termite	NYBA
Musca domestica	House fly	NYBA

NYBA = Not Yet Been Assessed, LC = Least Concern

APPENDIX G: Floral SCC

South Africa uses the internationally endorsed IUCN Red List Categories and Criteria in the Red List of South African plants. This scientific system is designed to measure species' risk of extinction. The purpose of this system is to highlight those species that are most urgently in need of conservation action. Due to its strong focus on determining risk of extinction, the IUCN system does not highlight species that are at low risk of extinction but may nonetheless be of high conservation importance. Because the Red List of South African plants is used widely in South African conservation practices such as systematic conservation planning or protected area expansion, we use an amended system of categories designed to highlight those species that are at low risk of extinction but of conservation concern.

Definitions of the national Red List categories

Categories marked with ^{N} are non-IUCN, national Red List categories for species not in danger of extinction but considered of conservation concern. The IUCN equivalent of these categories is Least Concern (LC).

- **Extinct (EX)** A species is Extinct when there is no reasonable doubt that the last individual has died. Species should be classified as Extinct only once exhaustive surveys throughout the species' known range have failed to record an individual.
- **Extinct in the Wild (EW)** A species is Extinct in the Wild when it is known to survive only in cultivation or as a naturalized population (or populations) well outside the past range.
- **Regionally Extinct (RE)** A species is Regionally Extinct when it is extinct within the region assessed (in this case South Africa), but wild populations can still be found in areas outside the region.
- **Critically Endangered, Possibly Extinct (CR PE)** Possibly Extinct is a special tag associated with the category Critically Endangered, indicating species that are highly likely to be extinct, but the exhaustive surveys required for classifying the species as Extinct has not yet been completed. A small chance remains that such species may still be rediscovered.
- **Critically Endangered (CR)** A species is Critically Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Critically Endangered, indicating that the species is facing an extremely high risk of extinction.
- **Endangered (EN)** A species is Endangered when the best available evidence indicates that it meets at least one of the five IUCN criteria for Endangered, indicating that the species is facing a very high risk of extinction.
- **Vulnerable (VU)** A species is Vulnerable when the best available evidence indicates that it meets at least one of the five IUCN criteria for Vulnerable, indicating that the species is facing a high risk of extinction.
- **Near Threatened (NT)** A species is Near Threatened when available evidence indicates that it nearly meets any of the IUCN criteria for Vulnerable and is therefore likely to become at risk of extinction in the near future.
- ^{N}**Critically Rare** A species is Critically Rare when it is known to occur at a single site but is not exposed to any direct or plausible potential threat and does not otherwise qualify for a category of threat according to one of the five IUCN criteria.
- ^{N}**Rare** A species is Rare when it meets at least one of four South African criteria for rarity but is not exposed to any direct or plausible potential threat and does not qualify for a category of threat according to one of the five IUCN criteria. The four criteria are as follows:
  - Restricted range: Extent of Occurrence (EOO) <500 km^2, OR
  - Habitat specialist: Species is restricted to a specialized microhabitat so that it has a very small Area of Occupancy (AOO), typically smaller than 20 km^2, OR
  - Low densities of individuals: Species always occurs as single individuals or very small subpopulations (typically fewer than 50 mature individuals) scattered over a wide area, OR
  - Small global population: Less than 10 000 mature individuals.
- **Least Concern** A species is Least Concern when it has been evaluated against the IUCN criteria and does not qualify for any of the above categories. Species classified as Least Concern are considered at low risk of extinction. Widespread and abundant species are typically classified in this category.

- **Data Deficient - Insufficient Information (DDD)** A species is DDD when there is inadequate information to make an assessment of its risk of extinction, but the species is well defined. Listing of species in this category indicates that more information is required, and that future research could show that a threatened classification is appropriate.
- **Data Deficient - Taxonomically Problematic (DDT)** A species is DDT when taxonomic problems hinder the distribution range and habitat from being well defined, so that an assessment of risk of extinction is not possible.
- **Not Evaluated (NE)** A species is Not Evaluated when it has not been evaluated against the criteria. The national Red List of South African plants is a comprehensive assessment of all South African indigenous plants, and therefore all species are assessed and given a national Red List status. However, some species included in Plants of southern Africa: an online checklist are species that do not qualify for national listing because they are naturalized exotics, hybrids (natural or cultivated), or synonyms. These species are given the status Not Evaluated and the reasons why they have not been assessed are included in the assessment justification.

Floral Species of Conservation Concern (SCC) that were assessed for the study area are listed within the table below:

Table G1: Floral SCC for the QDS 2627BD as obtained from GDARD (17-08-2020), with additional information on their threat status as defined in The Red List of South African Plants (http://redlist.sanbi.org/index.php). The Potential of Occurrence (POC) of these floral SCC within the study area is also provided.

Family	Scientific Name	National Threat status	Habitat and distribution details	POC
ASTERACEAE	*Cineraria longipes*	VU	Range: Klipriviersberg and Suikerbosrand. Major habitats: Gold Reef Mountain Bushveld, Andesite Mountain Bushveld, Soweto Highveld Grassland. Description: Grassland, amongst rocks and along seepage lines, exclusively on basalt koppies on south-facing slopes. Population trend: Stable. Flowering Season: March-May	Low
AIZOACEAE	*Delosperma purpureum*	EN	Range: Witwatersrand. Major habitats: Gold Reef Mountain Bushveld, Andesite Mountain Bushveld. Description: South-facing slopes, in shallow soils among crystalline or conglomerate quartzitic rocks, in sun or in partial shade, rarely in shade, in grassland with some trees. Population trend: Decreasing. Flowering Season: August-March	Low
DIOSCOREACEAE	*Dioscorea sylvatica*	VU	Range: Western Cape, Eastern Cape, KwaZulu-Natal, Free State, Gauteng, Mpumalanga, Limpopo Province, Swaziland, Zimbabwe and Zambia. Major habitats: Terrestrial. Description: Wooded and relatively mesic places, such as the moister bushveld areas, coastal bush and wooded mountain kloofs. Population trend: Decreasing. Flowering Season: October-January	Low
ORCHIDACEAE	*Habenaria mossii*	EN	Range: Johannesburg, Pretoria and Krugersdorp. Major habitats: Carletonville Dolomite Grassland, Andesite Mountain Bushveld. Description: Open grassland on dolomite or in black, sandy soil. Population trend: Decreasing. Flowering Season: March-April	Low

Family	Scientific Name	National Threat status	Habitat and distribution details	POC
AIZOACEAE	*Khadia beswickii*	VU	Range: Nigel. Major habitats: Tsakane Clay Grassland, Soweto Highveld Grassland, Carletonville Dolomite Grassland, Andesite Mountain Bushveld, Gauteng Shale Mountain Bushveld. Description: Open shallow soil over rocks in grassland. Population trend: Decreasing. Flowering Season: July-April	Low
BRASSICACEAE	*Lepidium mossii*	DDD	Range: Gauteng – Nancefield, and Free State. Major habitats: Grassland. Description: Unknown. Population trend: Decreasing. Flowering Season: Unknown.	Low
AIZOACEAE	*Lithops lesliei* subsp. *lesliei*	NT	Range: Douglas in the Northern Cape Province to central Limpopo Province and south-eastern Botswana. Major habitats: Grassland, Savanna. Description: Primarily in arid grasslands, usually in rocky places, growing under the protection of forbs and grasses. Population trend: Decreasing. Flowering Season: March-June	Low

DDD - Data Deficient - Insufficient Information; EN = Endangered; NT = Near Threatened; VU = Vulnerable; POC = Probability of Occurrence.

APPENDIX H: Faunal SCC

Table H1: RDL Mammal Species for the Gauteng Province (GDARD 2014).

Scientific Name	Common name	IUCN Status	GDARD Status	POC
Aonyx capensis	African Clawless Otter	NT	-	0
Atelerix frontalis	Southern African Hedgehog	LC	NT	35
Lutra maculicollis	Spotted-necked Otter	NT	NT	0
Mystromys albicaudatus	White-tailed Mouse	EN	EN	0
Neamblysomus julianae	Juliana's Golden Mole	EN	VU	0
BATS				
Miniopterus schreibersii	Scheiber's Long-Fingered Bat	NT	NT	5
Myotis tricolor	Temminck's Hairy Bat	LC	NT	5
Rhinolophus blasii	Blasius's/Peak-Saddle Horseshoe Bat	LC	VU	5
Rhinolophus clivosus	Horseshoe Bat	LC	NT	5
Rhinolophus darlingi	Darling's Horseshoe Bat	LC	NT	5
Rhinolophus hildebrandtii	Hildebrandt's Horseshoe Bat	LC	NT	5

VU = Vulnerable, EN = Endangered, NT = Near Threatened, LC= Least Concern

Table H2: RDL Avifaunal Species for the Gauteng Province (GDARD 2014).

Scientific Name	Common name	IUCN Status	GDARD Status	POC
Alcedo semitorquata	Half-Collared Kingfisher	LC	NT	15
Anthropoides paradiseus	Blue Crane	VU	VU	20
Circus ranivorus	African Marsh-Harrier	LC	VU	15
Eupodotis caerulescens	Blue Korhaan	NT	NT	20
Eupodotis senegalensis	White-bellied Korhaan	LC	VU	15
Gorsachius leuconotus	White-backed Night-Heron	LC	VU	15
Gyps coprotheres	Cape Vulture	EN	VU	25
Mirafra cheniana	Melodious Lark	LC	NT	20
Oxyura maccoa	Maccoa Duck	VU	VU	0
Podica senegalensis	African Finfoot	LC	VU	15
Sagittarius serpentarius	Secretarybird	VU	NT	25
Tyto capensis	African Grass-Owl	LC	VU	15

VU = Vulnerable, NT = Near Threatened, LC = Least Concern, EN = Endangered, Ad mon = Additional Monitoring, End and N-end = Endemic and Near endemic

Table H3: RDL Invertebrates Species for the Gauteng Province (GDARD 2014)

Scientific Name	Common name	IUCN Status	GDARD Status	SANBI status	POC
Aloeides dentatis dentatis	Roodepoort Copper Butterfly	VU	VU	EN	0
Chrysoritis aureus	Heidelberg Copper	NYBA	VU	-	0
Ichnestoma stobbiai	Stobbia's Fruit Chafer Beetle	NYBA	VU	-	0
Lepidochrysops praeterita	Highveld Blue Butterfly	NYBA	VU	EN	0

VU = Vulnerable, NYBA = Not yet been assesses

Table H4: RDL Reptile Species for the Gauteng Province (GDARD 2014)

Scientific Name	Common name	IUCN Status	GDARD Status	POC
Homoroselaps dorsalis	Striped Harlequin Snake	LC	NT	0

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Table H5: Avifaunal Species for the pentad 2615_2755 within the QDS 2627BD

Pentads	Link to pentad summary on the South African Bird Atlas Project 2 web page
2615_2755	http://sabap2.adu.org.za/coverage/pentad/2615_2755

APPENDIX I: Declaration and Specialists CV's

DETAILS, EXPERTISE AND CURRICULUM VITAE OF SPECIALISTS

1. (a) (i) Details of the specialist who prepared the report

Christien Steyn	MSc (Plant Science) (University of Pretoria)
Nelanie Cloete	MSc (Environmental Management) (University of Johannesburg)
Hennie de Beer	National Diploma Nature Conservation (Tshwane University of Technology)

1. (a). (ii) The expertise of that specialist to compile a specialist report including a curriculum vitae

Company of Specialist:	Scientific Terrestrial Services		
Name / Contact person:	Nelanie Cloete		
Postal address:	PO. Box 751779, Gardenview		
Postal code:	2047	Cell:	084 311 4878
Telephone:	011 616 7893	Fax:	011 615 6240/ 086 724 3132
E-mail:	Nelanie@sasenvgroup.co.za		
Qualifications	MSc Environmental Management (University of Johannesburg) MSc Botany (University of Johannesburg) BSc (Hons) Botany (University of Johannesburg) BSc (Botany and Zoology) (Rand Afrikaans University)		
Registration / Associations	Professional member of the South African Council for Natural Scientific Professions (SACNASP) Member of the South African Association of Botanists (SAAB) Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa group Member of the Grassland Society of South Africa (GSSA)		

1. (b) a declaration that the specialist is independent in a form as may be specified by the competent authority

I, Christien Steyn, declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct

---

Signature of the Specialist

I, Nelanie Cloete, declare that -

- I act as the **independent specialist (reviewer)** in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct

---

Signature of the Specialist

SAS ENVIRONMENTAL GROUP OF COMPANIES – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF NELANIE CLOETE

PERSONAL DETAILS

Position in Company	Senior Scientist, Member Botanical Science and Terrestrial Ecology
Joined SAS Environmental Group of Companies	2011

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Professional member of the South African Council for Natural Scientific Professions (SACNASP – Reg No. 400503/14)
Member of the South African Association of Botanists (SAAB)
Member of the International Affiliation for Impact Assessments (IAIAsa) South Africa group
Member of the Grassland Society of South Africa (GSSA)
Member of the Botanical Society of South Africa (BotSoc)
Member of the Gauteng Wetland Forum (GWF)

EDUCATION

Qualifications

MSc Environmental Management (University of Johannesburg)	2013
MSc Botany (University of Johannesburg)	2007
BSc (Hons) Botany (University of Johannesburg)	2005
BSc (Botany and Zoology) (Rand Afrikaans University)	2004

Short Courses

Certificate – Department of Environmental Science in Legal context of Environmental Management, Compliance and Enforcement (UNISA)	2009
Introduction to Project Management - Online course by the University of Adelaide	2016
Integrated Water Resource Management, the National Water Act, and Water Use Authorisations, focusing on WULAs and IWWMPs	2017

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Eastern Cape, Free State
Africa - Democratic Republic of the Congo (DRC)

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Floral Assessments
- Biodiversity Actions Plan (BAP)
- Biodiversity Management Plan (BMP)
- Alien and Invasive Control Plan (AICP)
- Ecological Scan
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting
- Biodiversity Offset Plan

Freshwater Assessments

- Desktop Freshwater Delineation
- Freshwater Verification Assessment
- Freshwater (wetland / riparian) Delineation and Assessment
- Freshwater Eco Service and Status Determination
- Rehabilitation Assessment / Planning
- Plant species and Landscape Plan

Legislative Requirements, Processes and Assessments

- Water Use Applications (Water Use Licence Applications / General Authorisations)
- Environmental and Water Use Audits
- Freshwater Resource Management and Monitoring as part of EMPR and WUL conditions

SAS ENVIRONMENTAL GROUP OF COMPANIES –
SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF CHRISTIEN STEYN

PERSONAL DETAILS

Position in Company	Floral Ecologist
Joined SAS Environmental Group of Companies	2018

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Member of the South African Association of Botanists (SAAB)
Member of the Botanical Society of South Africa (BotSoc)

EDUCATION

Qualifications

MSc (Plant Science) (University of Pretoria)	2017
BSc (Hons) Plant Science (Invasion Biology) (University of Pretoria)	2014
BSc Environmental Science (University of Pretoria)	2013

AREAS OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Northern Cape, Free State

KEY SPECIALIST DISCIPLINES

Biodiversity Assessments

- Terrestrial Ecological and Biodiversity Scoping Assessments
- Terrestrial Ecological and Biodiversity Screening Assessments
- Floral Assessments
- Input into Terrestrial Rehabilitation Plan design with the focus on the re-establishment of vegetation
- Floral Rescue and Relocation Plans
- Alien and Invasive Control Plan (AICP)
- Terrestrial Monitoring
- Protected Tree and Floral Marking and Reporting
- Desktop Studies, Mapping and Background Information Research

Training

- Alien and Invasive Plant Identification and awareness

SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF HENNIE DE BEER

PERSONAL DETAILS

Position in Company	Ecologist – Focusing on Avifaunal species
Date of Birth	20 October 1986
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2014

EDUCATION

Qualifications

National Diploma Nature Conservation (Tshwane University of Technology) 2008

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Eastern Cape, Western Cape, Northern Cape and Free state
Mozambique

SELECTED PROJECT EXAMPLES

Faunal Assessments

- Leandra Colliery (2015) – Faunal assessment as part of the environmental assessment and authorisation process for the proposed the Leandra Coal Project, Gauteng and Mpumalanga Provinces;
- Siyanda Chrome Smelter (2015) - Faunal assessment as part of the environmental assessment and authorisation process for a proposed construction of a ferrochrome smelter, Limpopo province;
- Lace Diamond Mine (2015) – Faunal assessment as part of the environmental assessment and authorisation process for the lace diamond mine near Kroonstad, free state province;
- Duhva Solar Plant (2015) – Avifaunal as part of the Environmental Impact Assessment and authorisation process for the proposed solar photovoltaic power plant with associated infrastructure at the Duvha Coal Fired Power Station, Mpumalanga province;
- Arnot Solar Plant – Avifaunal Assessment as part of the Environmental Impact Assessment and authorisation process for the proposed solar photovoltaic power plant with associated infrastructure at the Arnot coal fired power station, Mpumalanga Province;
- Braakfontein Colliery – Faunal Assessment as part of the Environmental Assessment and authorisation process for the proposed Braakfontein Coal Mine near Newcastle, KwaZulu-Natal Province;
- Kekana Powerline – Faunal Ecological Assessment as part of the Environmental Assessment and authorisation process for the proposed Kekana and Wonderboom 132kv powerlines and substations, Hammanskraal, Gauteng;
- Samrand Phase 3 / Olievenhoutbosch – Floral, Faunal and Wetland Ecological Assessment as part of the Environmental Assessment and authorisation process for the proposed development of the Kosmosdal township on the remainder of portion 2 of the farm Olievenhoutbosch no. 389-jr, Gauteng Province;
- Jeanette Gold Mine – Faunal Assessment as part of the Environmental assessment and authorisation process for Jeanette expansion project at the Taung Gold International mine near Welkom within the Free State Province; and
- PTN 38 Elandspruit Farm – Faunal Assessment as part of the Environmental Assessment and authorisation process for the proposed mining development on portion 38 of the Elandspruit farm. Mpumalanga Province.

Terrestrial scan:

- K77 (2014) - Terrestrial scan Assessment as part of the Environmental Impact Assessment and authorisation process for the proposed development of the Provincial road K77, Gauteng highlands: Elizabeth road to K154; and
- Blue Hills EXT 39 - Biodiversity Assessment Fauna and Flora.

APPENDIX G 1.1 TERRESTRIAL SENSITIVITY SCAN REPORT

TERRESTRIAL SENSITIVITY SCAN AS PART OF THE ENVIRONMENTAL AUTHORISATION PROCESS FOR THE PROPOSED DEVELOPMENT OF THE FARM 751 REGISTRATION DIVISION I.Q., PROVINCE OF GAUTENG;

Prepared for

Seaton Thomson & Associates

September 2016

Prepared by: **Scientific Terrestrial Services**
Report author: **H. de Beer**
Report reviewer: **E. van der Westhuizen**
Report Reference: **STS 160033**
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EXECUTIVE SUMMARY

Based on the findings of the field assessment, one habitat unit was identified namely Transformed Habitat. The habitat sensitivity of the transformed habitat unit is considered to be low as the study area is fragmented from larger natural areas, and surrounded by residential and industrial developments, resulting in a loss of floral diversity and alien proliferation. The habitat unit is also no longer representative of the ecosystem in which it falls.

From the impact assessment tables, the impact associated with the loss of floral and faunal SCC is considered to be low prior to the implementation of mitigation measure. If effective mitigation takes place, all impacts may be reduced to very-low significance impacts.

It is the opinion of the ecologists that from an ecological perspective, the proposed development be considered favorably. However, all essential mitigation measures and recommendations presented in this report should be adhered to so as to ensure that the ecology within the study area along with the surrounding zone of influence is protected or adequately rehabilitated where necessary, in order to minimise the deviations from the Present Ecological State.

MANAGEMENT SUMMARY

Scientific Terrestrial Services (STS) was appointed to conduct a Terrestrial Sensitivity scan as part of the Environmental Impact Assessment (EIA) and authorisation process for the proposed development project on The Farm 751 Registration Division I.Q., Province of Gauteng. The study area is located within a residential and industrial development area.

Specific outcomes required for this report include the following:

- To define the Present Ecological State (PES) of the terrestrial ecological resources within and in the vicinity of the study area;
- To determine the ecological sensitivity of vegetation associated with the study area
- To conduct a Species of Conservation Concern (SCC) assessment, including potential for such species to occur within the study area;
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and any other ecologically important features, if present; and
- To determine the environmental impacts that the development of the development may have on the terrestrial ecology associated with the study area and to develop mitigation and management measures for all phases of the development.

Results of the Desktop Analysis

- According to the National Threatened Ecosystem database (2011), the study area is located within the Soweto Highveld Grassland vegetation type, which is considered to be Endangered (Mucina & Rutherford, 2011)
- According to the Gauteng Conservation (C-Plan, 2011)) the study area is not located within a Critical Biodiversity Area (CBA) or Ecological Support Area (ESA), but the south eastern portion of the study area falls within an ecosystem considered to be critically endangered, known as Kliprivier Highveld Grassland; and
- The study area falls within an area that is currently not protected (NBA, 2011).

Floral Scan

- A single habitat unit was identified during the field assessment, namely the Transformed Habitat Unit. The vegetation structure and composition is severely altered and comprised mainly of alien and invasive species such as *Melia azedarach, Eucalyptus grandis* and *Acacia mearnsii.* The study area is also no longer considered representative of the Klipriviersberg Highveld Grassland nor the Soweto Highveld Grassland vegetation type. This is as a result of historic

and ongoing anthropogenic activities, such as the study area previously been used as a dumping site for building rubble and a through fare for pedestrians. For this reason, the habitat unit is considered to be of low ecological sensitivity;

- The Probability of Occurrence (POC) of all South African National Biodiversity Institute (SANBI) floral SCC, as well as the Gauteng Department of Agriculture and Rural Development (GDARD) Red and Orange listed plants species listed for the Quarter Degree Square (QDS) 2627BD was calculated.
  - During the field assessment none of these SCC were encountered and none of the species listed scored a POC of 60% or higher. It is therefore highly unlikely that any floral SCC will occur within the study area, due to overall lack of suitable habitat and high levels of disturbance and transformation within the study area and surrounding areas.

Faunal Scan

- High levels of historic and ongoing anthropogenic activities associated with the study area and the surrounding areas, have led to the transformation of natural faunal habitat;
- Only commonly occurring faunal species such as *Corvus albus* (Pied Crow), and *Acridotheres tristis* (Common Myna), adapted to urban environments, were observed within the study area;
- No faunal SCC was observed during the field assessment. In terms of conservation, the likelihood that any such species will be encountered in or near the study area is considered low, due to the high levels of historic and ongoing anthropogenic activity and habitat transformation that has taken place within the study area and the immediate vicinity; and
- The proposed development is thus deemed unlikely to pose a conservation threat to faunal species in the region.

Terrestrial Impact Assessment:

The tables below summarise the findings of the impact assessment, indicating the significance of the impact before mitigation takes place and the likely impact if effective management and mitigation takes place. From the tables it is evident that prior to mitigation the impacts on floral and faunal SCC are low level impacts. If effective mitigation takes place, all impacts may be reduced to very low level impacts.

A summary of the results obtained from the impact assessment for the construction phase.

Impact	Unmanaged	Managed
1: Impact on Floral Species of Conservation Concern	Low	Very-Low
2: Impact on Faunal Species of Conservation Concern	Low	Very-Low

A summary of the results obtained from the impact assessment for the operational phase.

Impact	Unmanaged	Managed
1: Impact on Floral Species of Conservation Concern	Low	Very-Low
2: Impact on Faunal Species of Conservation Concern	Low	Very-Low

Sensitivity

From an ecological perspective, the study area is considered to be of low ecological sensitivity, mainly as a result of the increased level of disturbance and habitat transformation within and surrounding the study area, leading to increased loss of ecological connectivity to larger open space areas in the region and the very low probability of floral or faunal SCC occurring within the study area.

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GLOSSARY OF TERMS

Alien vegetation	Plants that do not occur naturally within the area but have been introduced either intentionally or unintentionally. Vegetation species that originate from outside of the borders of the biome -usually international in origin.
Biome	A broad ecological unit representing major life zones of large natural areas – defined mainly by vegetation structure and climate.
CBA (Critical Biodiversity Area)	A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges.
ESA (Ecological Support Area)	An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation
IBA (Important Bird and Biodiversity Area)	The IBA Programme identifies and works to conserve a network of sites critical for the long-term survival of bird species that: are globally threatened, have a restricted range, are restricted to specific biomes/vegetation types or sites that have significant populations.
Indigenous vegetation	Vegetation occurring naturally within a defined
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.
SCC (Species of Conservation Concern)	The term SCC in the context of this report refers to all RDL (Red Data) and IUCN (International Union for the Conservation of Nature) listed species as well as protected species of relevance to the project.

LIST OF ACRONYMS AND ABBREVIATIONS

BGIS	Biodiversity Geographic Information Systems
CARA	Conservation of Agricultural Resources Act
CBA	Critical Biodiversity Area
CR	Critically Endangered
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EN	Endangered
ESA	Ecological Support Area
EW	Extinct in the Wild
GDARD	Gauteng Department of Agriculture and Rural Development
GIS	Geographic Information System
GPS	Global Positioning System
IBA	Important Bird and Biodiversity Area
IUCN	International Union for the Conservation of Nature
MAP	Mean Annual Precipitation
MAPE	Mean Annual Potential for Evaporation
MASMS	Mean Annual Soil Moisture Stress
MAT	Mean Annual Temperature
MFD	Mean Frost Days
NBA	National Biodiversity Assessment (2011)
NEMA	National Environmental Management Act (Act 107 of 1998)
NEMBA	National Environmental Management: Biodiversity Act (Act 10 of 2004)
NPAES	National Protected Areas Expansion Strategy
NT	Near Threatened
PES	Present Ecological State
POC	Probability of Occurrence
PRECIS	Pretoria National Herbarium Computer Information Systems
QDS	Quarter Degree Square (1:50,000 topographical mapping references)
RDL	Red Data Listed
RE	Regionally Extinct
SABAP 2	Southern African Bird Atlas Project 2
SANBI	South African National Biodiversity Institute
SAPAD	South African Protected Areas Database
SCC	Species of Conservation Concern
STS	Scientific Terrestrial Services CC
TSP	Threatened Species Programme
VU	Vulnerable

1. INTRODUCTION

1.1 Background

Scientific Terrestrial Services (STS) was appointed to conduct a Terrestrial Sensitivity scan as part of the Environmental Impact Assessment (EIA) and authorisation process for the proposed development of The Farm 751 Registration Division I.Q., Province of Gauteng**.** The, hereafter referred to as the "study area". (Figures 1 & 2).

The study area is bordered by the N12 national roadway to the north, Aerodrome Road to the west and Chris Hani Road to the southwest. Furthermore, Southgate Road traverses the northern portion of the study area and is situated directly adjacent to Baragwanath South Africa Brewery Depot. The study area is situated approximately 3km east of the Chris Hani Baragwanath Hospital and approximately 800 west of Southgate Mall. The study area is located within moderately high density mixed development area (residential and industrial), however the immediate surrounding areas to the south and west are vacant land and immediate surroundings to the north and east of the study area comprise industrial development.

This report, after consideration and the description of the ecological integrity of the study area, must guide the Environmental Assessment Practitioner (EAP), regulatory authorities and development proponent, by means of the presentation of results and recommendations, as to the ecological viability of the proposed development activities.

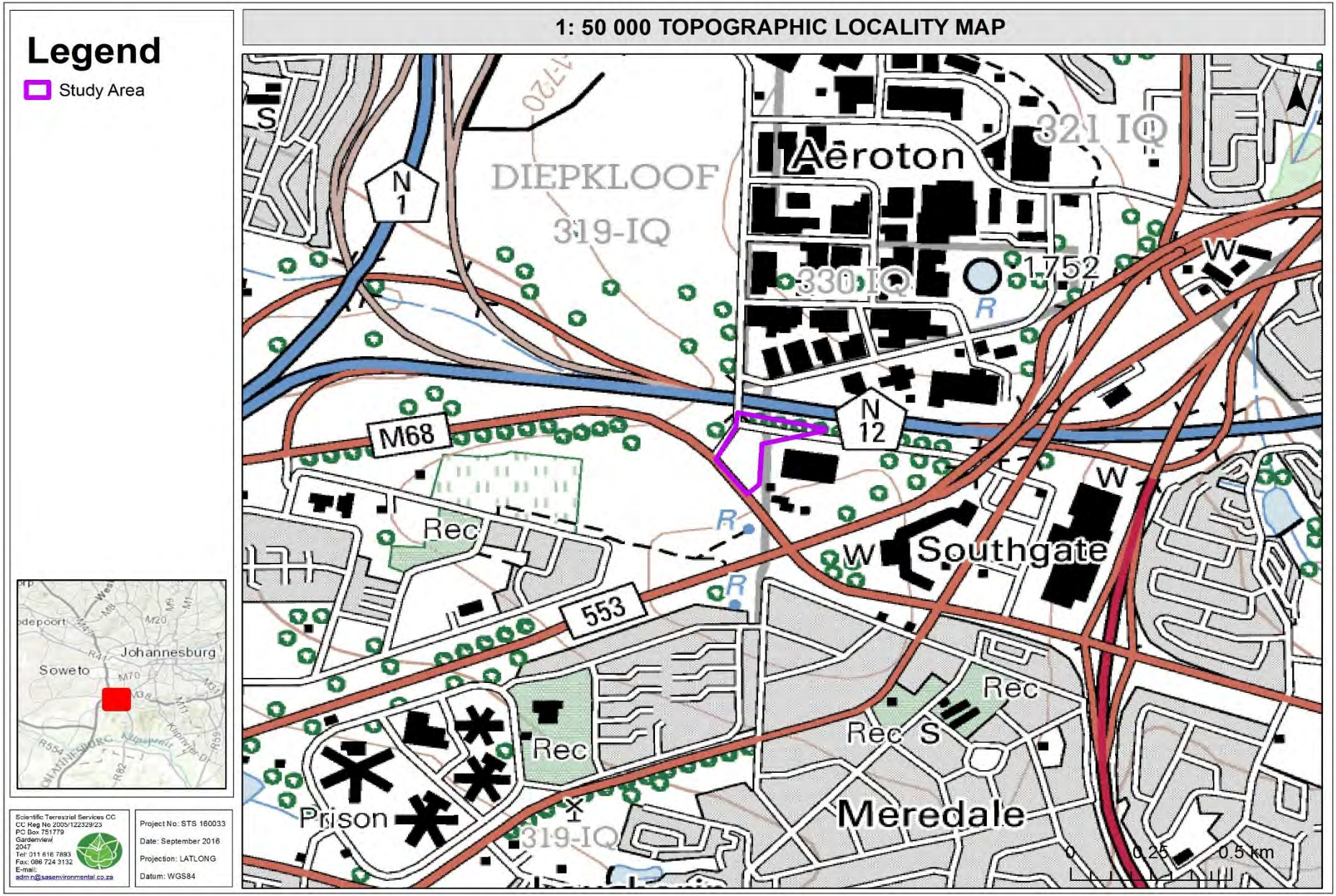


Figure 1: The study area depicted on a 1:50 000 topographical map in relation to the surrounding area.

Figure 2: Digital satellite image depicting the location of the study area in relation to surrounding areas.

1.2 Project Scope

Specific outcomes in terms of this report are outlined below:

- To define the Present Ecological State (PES) of the terrestrial ecological resources within and in the vicinity of the study area;
- To determine the ecological status of the vegetation on-site;
- To conduct a Species of Conservation Concern (SCC) assessment, including potential for such species to occur within the study area;
- To identify and consider all sensitive landscapes including rocky ridges, wetlands and any other ecologically important features, if present; and
- To determine the environmental impacts that the proposed development may have on the terrestrial ecology associated with the study area and to develop mitigation and management measures for all phases of the development.

1.3 Assumptions and Limitations

The following assumptions and limitations are applicable to this report:

- The ecological assessment is confined to the study area and does not include the neighbouring and adjacent properties; these were however considered as part of the desktop assessment;
- With ecology being dynamic and complex, some aspects (some of which may be important) may have been overlooked. It is, however, expected that most floral and faunal communities have been accurately assessed and considered;
- Due to the nature and habits of most faunal taxa and the high level of surrounding anthropogenic activities, it is unlikely that all species would have been observed during a site assessment of limited duration. Therefore, site observations were compared with literature studies where necessary;
- The data presented in this report are based on one field assessment, undertaken in August 2016. A more accurate assessment would require that assessments take place in all seasons of the year. However, on-site data was significantly augmented with all available desktop data, and the findings of this assessment are considered to be an accurate reflection of the ecological characteristics of the study area; and
- The scope of work comprised a scan of the floral and faunal components associated with the study area and did not include a full or detailed ecological assessment of the study area.

1.4 Legislative Requirements

The following legislative requirements were considered during the assessment:

- National Environmental Management Act (NEMA) (Act 107 of 1998);
- National Environmental Management: Biodiversity Act (NEMBA) (Act No. 10 of 2004);
- Conservation of Agricultural Resources Act (CARA, Act 43 of 1983); and

The following documentation was also considered:

- GDARD Requirements for Biodiversity Assessments, Version 3 (GDARD, 2014)

The details of each of the above, as they pertain to this study, are provided in Appendix A of this report.

2. ASSESSMENT APPROACH

2.1 General Approach

In order to accurately determine the PES of the study area and capture comprehensive data with respect to the terrestrial ecology, 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. The results of this analyses were then used to focus the field work on specific areas of concern and to identify areas where target specific investigations were required;
- A literature review with respect to habitats, vegetation types and species distribution was conducted;
- Relevant databases considered during the assessment of the study area included the South African National Biodiversity Institute (SANBI) Threatened Species Programme (TSP), the Gauteng Conservation Plan Version 3.3 (C-Plan; 2011), Mucina and Rutherford (2006), National Biodiversity Assessment, Important Bird Areas in conjunction with the South African Bird Atlas Project (SABAP 1 and 2), International Union for Conservation of Nature (IUCN), and Pretoria National Herbarium Computer Information Systems (PRECIS);
- A visual on-site assessment of the study area was conducted during August 2016 in order to confirm the assumptions made during consultation of the maps and to determine the ecological status of the study area. A ‘walk through’ on foot was undertaken in order to identify the occurrence of the dominant floral species and habitat diversities;

- Specific methodologies for the assessment, in terms of field work and data analysis of faunal and floral ecological assemblages are presented in Appendices B and C; and
- For the methodologies relating to the impact assessment and development of the mitigation measures, please refer to Appendix D of this report.

2.2 Sensitivity Mapping

All the ecological features of the study area were considered and sensitive habitat areas were marked with the use of a Global Positioning System (GPS). In addition, identified locations of SCC and SANBI protected species were also marked by means of GPS. A Geographic Information System (GIS) was used to project these features onto aerial photographs and topographic maps.

3. RESULTS OF THE DESKTOP ANALYSIS

3.1 Conservation Characteristics of the Study Area

The following table contains data accessed as part of the desktop assessment. It is important to note, that although all data sources used provide useful and often verifiable high quality data, the various databases do not always provide an entirely accurate indication of the study area's actual biodiversity characteristics.

Table 1: Summary of the conservation characteristics for the study area.

Details of the study area in terms of Mucina & Rutherford (2006)	
Biome	The study area is situated within the Grassland Biome
Bioregion	The study area is situated within the Mesic Highveld Grassland Bioregion
Vegetation Type	The study area is situated within the Soweto Highveld Grassland vegetation type.
Conservation details pertaining to the study area (Various databases)	
NBA (2011)	The study area falls within an area that is currently not protected.
National Threatened Ecosystems (2011)	The south eastern portion of the study area falls within an ecosystem considered to be critically endangered, known as Klipriver Highveld Grassland (Figure 3).
NPAES (2009) & SAPAD (2016)	According to SAPAD and NPAES there are no protected areas within close proximity (1km) to the study area (Figure 4).
IBA (2015)	There are no IBAs within close proximity to the study area.
Detail of the study area in terms of the Gauteng Conservation Plan (C-Plan V3.3, 2011 & 2014)	
Critical Biodiversity Area (CBA) (Figure 4)	The study area is not located within a CBA, with the nearest CBA being situated ± 42 m southwest of the study area. A CBA is an area considered important for the survival of threatened species and includes valuable ecosystems such as wetlands, untransformed vegetation and ridges.
Ecological Support Area (ESA)	The study area is further not located within an ESA, with the nearest ESA located ± 92 m north. An ESA provides connectivity and important ecological processes between CBAs and is therefore important in terms of habitat conservation.

Description of the vegetation type(s) relevant to the study area (Mucina & Rutherford 2006)	
Vegetation Type	Soweto Highveld Grassland
Climate	Cool-temperate climate, summer rainfall
Altitude (m)	1420-1760
MAP* (mm)	662
MAT* (°C)	14.8
MFD* (Days)	41
MAPE* (mm)	2060
MASMS* (%)	75
Distribution	Mpumalanga and Gauteng Provinces
Geology & Soils	Shale, sandstone or mudstone. Soils are deep, reddish on flat plains and are typically Ea, Ba and Bb land types
Conservation	Endangered. The conservation target for the area is 24%.
Vegetation & landscape features (Dominant Floral Taxa in Appendix E)	Gently to moderately undulating landscape on the Highveld plateau supporting short to medium-high, dense, tufted grassland dominated almost entirely by *Themeda triandra* and accompanied by other grasses such as *Elionurus muticus, Eragrostis racemosa, Heteropogon contortus* and *Tristachya leucothrix*. In places not disturbed, only scattered small wetlands, narrow stream alluvia, pans and occasional ridges or rocky outcrops interrupt the continuous grassland cover.

NBA= National Biodiversity Assessment; NTE = National Threatened Ecosystems, NPAES = National Protected Areas Expansion Strategy; SAPAD = South African Protected Areas Database; IBA = Important Bird Area; CBA = Critical Biodiversity Area; ESA = Ecological Support Area; MAP – Mean annual precipitation; MAT – Mean annual temperature; MAPE – Mean annual potential evaporation; MFD = Mean Frost Days; MASMS – Mean annual soil moisture stress (% of days when evaporative demand was more than double the soil moisture supply)

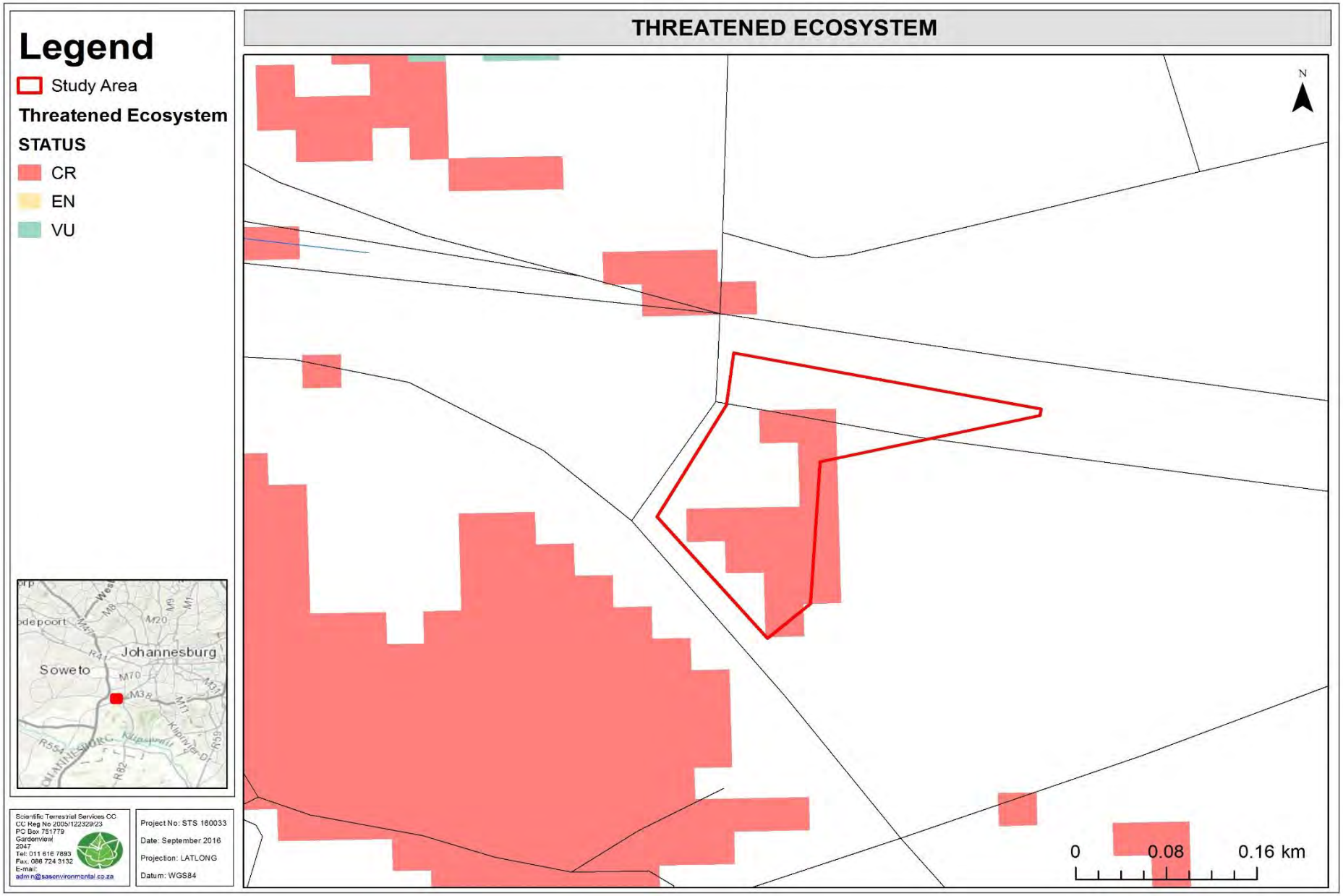


Figure 3: Threatened Ecosystems associated with the study area (NTE, 2011).

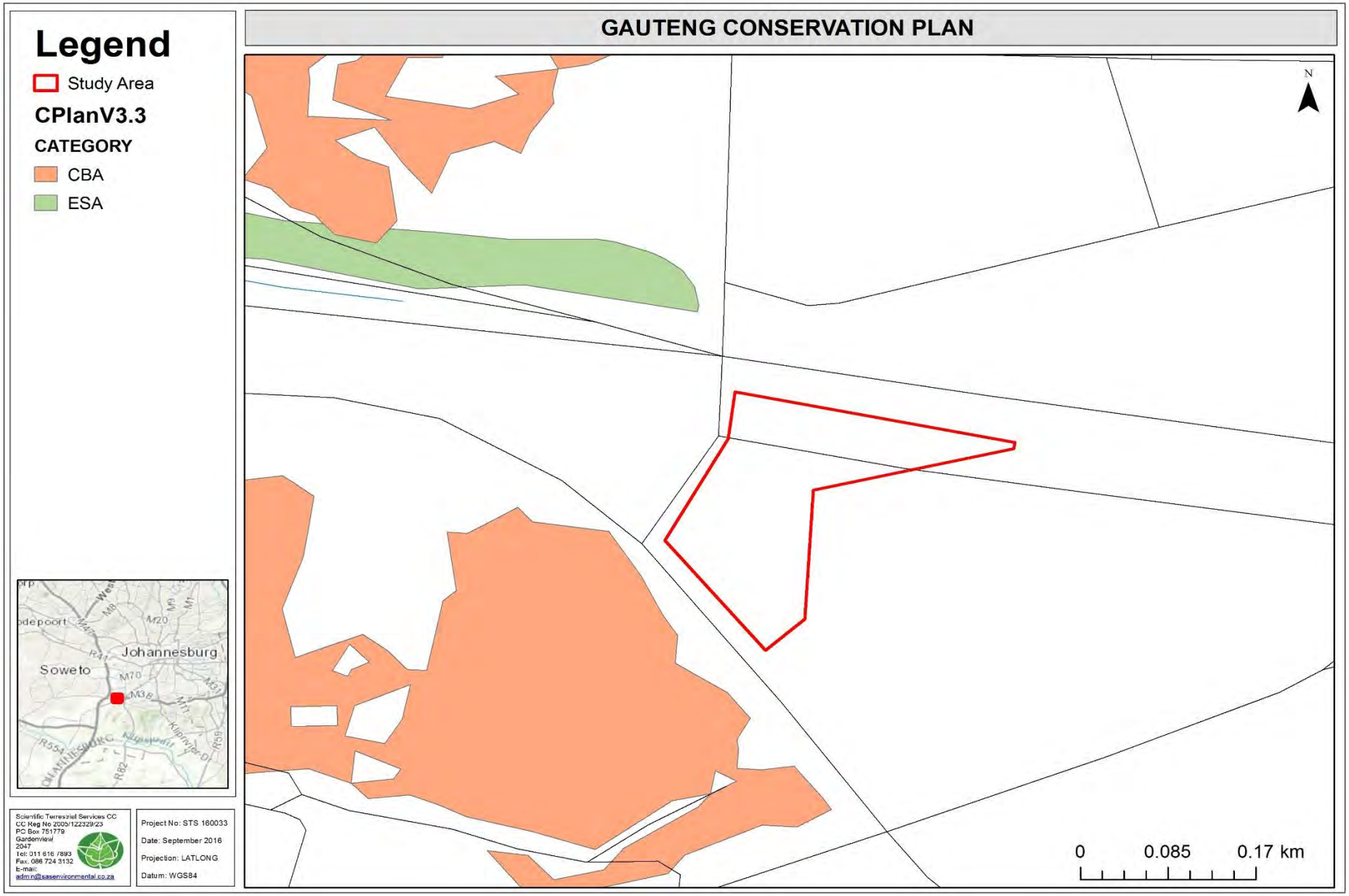


Figure 4: Gauteng C Plan v3.3 indicating a CBA and an ESA associated with the study area (2011 & 2014).

4. RESULTS OF THE FLORAL SCAN

4.1 Habitat Units

One habitat unit was identified during the assessment, namely the Transformed Habitat Unit, with Figure 4 below depicting this habitat unit in relation to the surrounding area. The Transformed Habitat Unit is considered to be in a significantly modified ecological condition, as illegal dumping of building material was present within the study area. Alien and invasive floral species proliferation was also present throughout the habitat unit. For this reason, floral species associated with the study area comprise mainly of alien species and garden ornamentals, with almost no species representative of the Soweto Highveld Grassland and Kliprivier Highveld Grassland vegetation type. The study area is therefore no longer considered representative of this vegetation type. The eastern portion of the study area has been cleared of vegetation and comprises mainly of bare ground in its current condition.

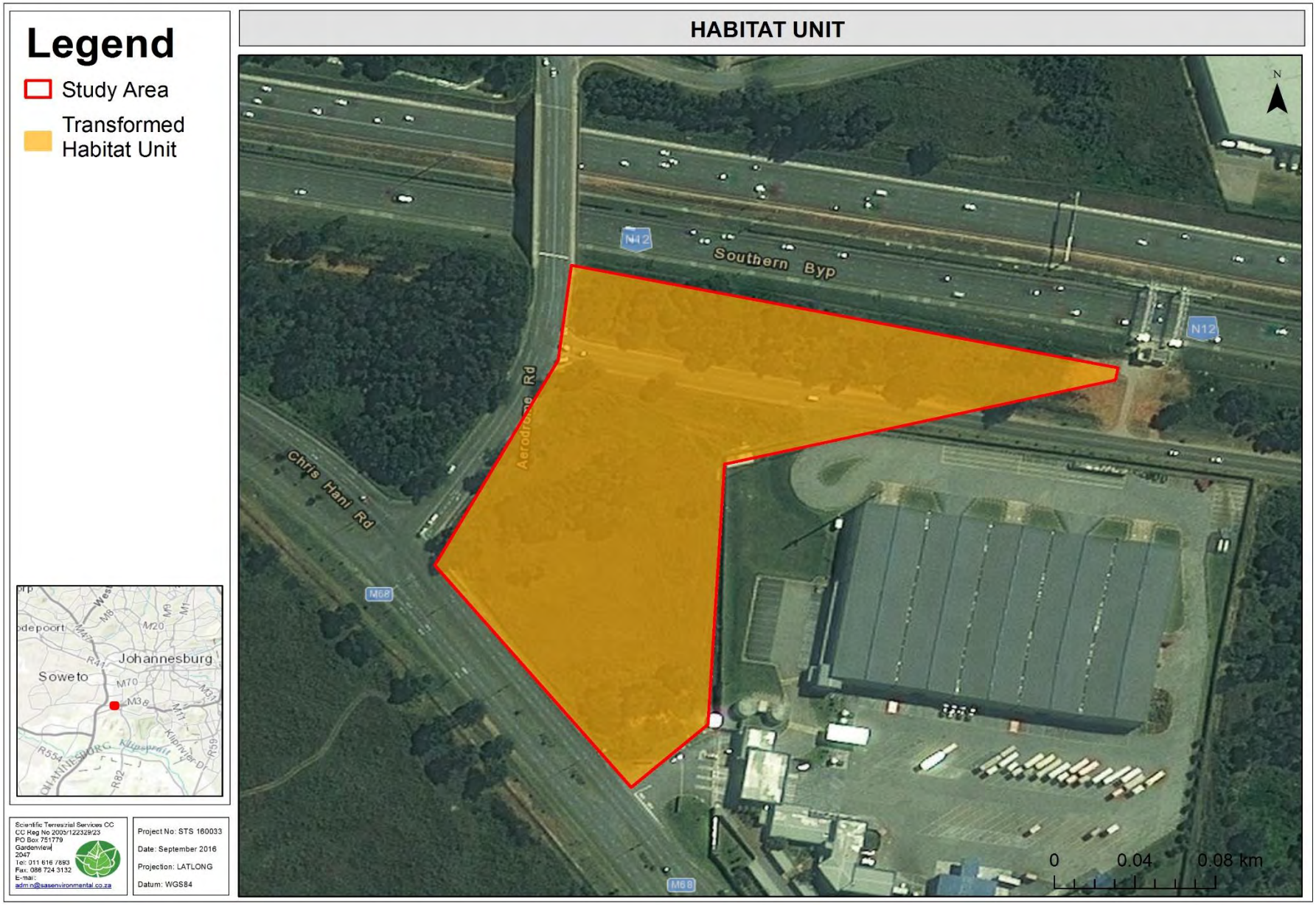
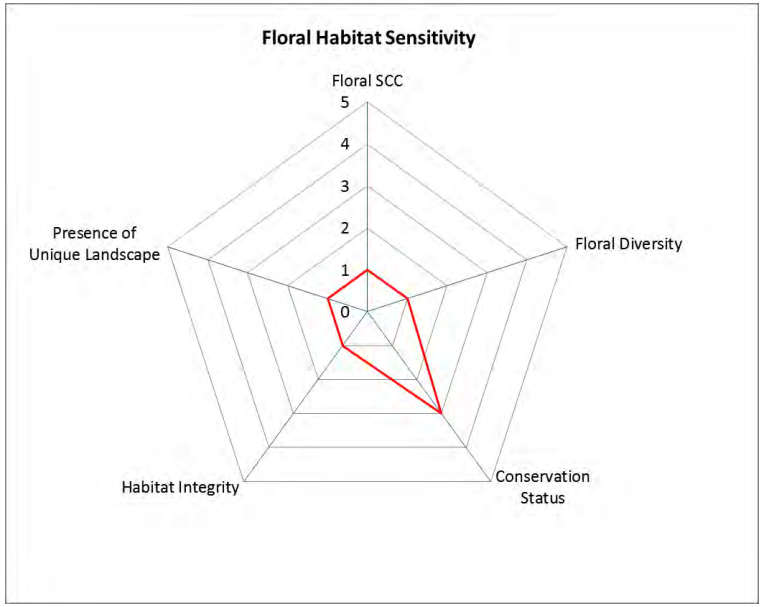


Figure 5: Habitat units encountered within the study area.

Table 2: Summary of results of the floral assessment.

Habitat Unit: Transformed Habitat Unit	Floral Habitat Sensitivity	Low	Photograph:
	Notes on Photograph: The various aspects of the Transformed Habitat Unit, indicating the high level of transformation within the study area.		
Floral Habitat Sensitivity Graph:			
Floral Species of Conservation Concern (SCC)	No floral SCC were encountered in this habitat unit and it is highly unlikely that any such species will occur as a result of historic and ongoing anthropogenic activities associated with the study area.		



Floral Diversity	Floral diversity was low and dominated by alien and invasive floral species as well as garden ornamentals such as, *Acacia mearnsii, Melia azedarach,* and *Melia azedarach*. For a comprehensive species list refer to Appendix F.	General comments: The immediate surrounding area around the study area is used for industrial development and the study area itself is used as a thoroughfare by pedestrians. Illegal dumping of building rubble was present within the study area, including household waste being dumped under trees. Floral community is dominated by ornamental garden plants and alien and invasive floral species. The floral sensitivity is therefore considered low and no longer representative of the natural vegetation type (Soweto Highveld Grassland and Kliprivier Highveld Grassland).	Business Case, Conclusion and Mitigation Requirements: This habitat unit is of low ecological importance and sensitivity. No vegetation representative of the Klipriviersberg and Soweto Highveld Grassland remains as the indigenous species still present on site are species also common to other vegetation types. Development related activities would therefore have a low impact on this habitat unit, as significant transformation has already occurred, and the area is located within an urban and industrial setting. Thus, no significant impact is anticipated should the development proceed.
Conservation Status of Vegetation Type/Ecosystem	Although Soweto Highveld Grassland (EN) Kliprivier Highveld Grassland (CR) was indicated as being present within the study area, no vegetation representative of the vegetation type remains, and the habitat unit is dominated by ornamental garden plants and alien and invasive floral species.		
Habitat integrity/Alien and Invasive species	Habitat is severely transformed and dominated by alien species, particularly alien an invasive tree species and garden ornamentals. Alien species include species such as *Melia azedarach, Eucalyptus grandis Acacia mearnsii and Schinus molle* among other species.		
Presence of Unique Landscapes	No unique landscapes important to flora were present.		

4.2 Floral SCC Assessment

An assessment considering the presence of any plant species of concern, as well as suitable habitat to support any such species was undertaken. The South African National Biodiversity Institute (SANBI) floral SCC, as well as the Gauteng Department of Agriculture and Rural Development (GDARD) Red and Orange listed plants species listed for the Quarter Degree Square (QDS) 2627BD was obtained.

Threatened species are species that are facing a high risk of extinction. Any species classified in the IUCN categories Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) is a threatened species.

SCC are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories Extinct in the Wild (EW), Regionally Extinct (RE), Near Threatened (NT), Critically Rare, Rare and Declining.

The SCC listed for the area together with their calculated Probability of Occurrence (POC) are tabulated in Appendix G.

Based on the results obtained, it is highly unlikely that any floral SCC would be present within the study area, due to the level of habitat transformation already associated with the study area. However, should any floral SCC be encountered during any phase of the proposed development, such species must be removed and relocated under the supervision of a qualified specialist to suitable, similar habitat in close proximity to its original location, but outside of the development footprint.

5. RESULTS OF THE FAUNAL SCAN

5.1 Habitat Description

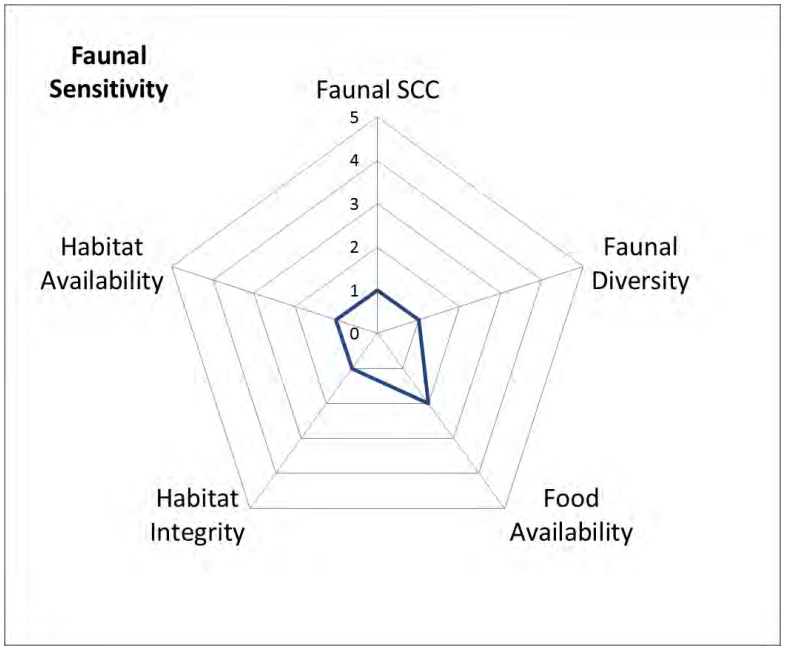
After investigation, it is evident that one faunal habitat unit exists within the study area, namely the Transformed Habitat Unit. The transformed habitat unit is considered to be in a significantly modified ecological condition, with limited natural habitat for faunal species present. As a result of historic and ongoing anthropogenic activities within the study area, only common faunal species adapted to an urban setting are expected to reside within the study area

Table 3: Summary of results of the faunal assessment

All faunal classes	Faunal Habitat Sensitivity	Low

Notes on Photograph:
Species observed during field assessment
Top left:
Trinervitermes (Snouted Harvester Termite) mount
Top right:
Phymateus viridipes (Green Milkweed Locust)
Middle left:
Signs of *Cryptomys hottentotus* (African Mole Rat)
Middle right:
Ploceus cucullatus (Village Weaver)
Bottom left:
Ploceus cucullatus (Village Weaver) nest
Bottom right:
Pontia helice helice (Meadow White)

Faunal Sensitivity Graph:



Photograph:

Faunal SCC/Endemics/TOPS/	No faunal SCC were encountered during the field assessment, and the probability of any such species utilising the study area is highly unlikely, due to the historic use of the study area for dumping purposes and uncontrolled veld fires.		
Faunal Diversity	The faunal diversity within the study area was low and comprised mainly of common avifaunal species. It is further expected that only common invertebrate, reptile and small mammal species adapted to urban areas will utilise the study area. Species encountered during the field assessment include avifaunal species such as *Acridotheres tristis* (Common Myna), *Ploceus cucullatus* (Village Weaver), *Streptopelia semitorquata* (Red-eyed Dove), *Passer domesticus* (House sparrow), *Passer melanurus* (Cape Sparrow), *Streptopelia senegalensis* (Laughing Dove) and *Lanius collaris* (Common Fiscal).	General comments (dominant faunal species/noteworthy records etc.): The study area, as a result of historic and ongoing anthropogenic activities and its location within a low density industrial setting, is unlikely to support any faunal SCC. The study area is further not linked to any larger areas capable of supporting such species, thereby minimising the potential movement of such species to and from the study area.	Business Case, Conclusion and Mitigation Requirements: The faunal habitat associated with the study area is considered to be of a low ecological sensitivity. Development related activities would therefore have a low impact on the faunal habitat, as the habitat integrity is already considered to be highly disturbed and unlikely to support any faunal SCC.
Food Availability	High levels of anthropogenic activities and alien floral species proliferation have resulted in moderately low levels of food availability within the study area. However a number of seed bearing floral species are present within the study area, resulting in food resources for various invertebrate, avifaunal and small mammal species, therefore it is expected that common faunal species will be encountered within the study area.		
Habitat Intactness	The habitat within the study area is considered to be highly transformed and no longer representative of the natural conditions associated with the vegetation type. The high levels of ongoing anthropogenic activity within the study area, such as illegal dumping and veld fires further reduces habitat integrity of the study area. Faunal movement within the study area is also negatively affected due to the increased level of alien floral infestation, as preferred natural habitat for faunal species is lost.		
Habitat Availability	Habitat availability is considered low within the study area. Although habitat depredation and transformation has occurred and alien floral species and garden ornamentals were present and dominant, the study area is still capable of providing habitat to a number of avifaunal and small mammal species (Muridae family), albeit common widespread species and have adapted to live in close proximity to developed areas. However, it is unlikely that the study area will be able to support any faunal SCC.		

5.2 Faunal SCC Assessment

During field assessments it is not always feasible to identify or observe all species within a study area, largely due to the secretive nature of many faunal species, possible low population numbers or varying habits of species. As such, and to specifically assess an area for faunal SCC, a Probability of Occurrence (POC) matrix is used, utilising a number of factors to determine the probability of faunal SCC occurrence within the study area. Species listed in Appendix H whose known distribution ranges and habitat preferences include the study area were taken into consideration.

No faunal SCC were observed during the field assessment. In addition, no faunal SCC are considered to have a POC of 60% or higher to occur within the study area, due to the severe levels of habitat transformation that has taken place within the study area thereby decreasing the ecological integrity of the study area. Due to the fact that no faunal SCC or signs thereof were identified, and the lack of suitable habitat or known occurrences of faunal SCC within the study area, it can be concluded that the proposed development is unlikely to affect faunal SCC conservation in the region. Should any faunal SCC listed in Appendix H of this report, however be encountered during the development of the proposed development, all operations must be stopped immediately and a biodiversity specialist must be consulted and a rescue and relocation plan implemented.

6. SENSITIVITY MAPPING

The figure below conceptually illustrates the ecological sensitivity associated with the study area. The areas are depicted according to their sensitivity in terms of the presence or potential for floral or faunal SCC to occur, habitat intactness and levels of disturbance, threat status of the habitat type, the presence of unique landscapes and overall levels of diversity. The table below presents the sensitivity of the identified habitat unit along with an associated conservation objective and implications for development.

Table 4: A summary of sensitivity of each habitat unit and implications for development.

Habitat Unit	Sensitivity	Conservation Objective	Development Implications
Transformed Habitat Unit	Low	Optimise development potential.	The floral composition of the study area is considered to be highly transformed as a result of alien proliferation particularly alien tree species, thus results in low ecological importance and sensitivity for the habitat unit. Continuity to other larger natural areas in the region is limited. Historic and ongoing anthropogenic activities have resulted in severe degradation and transformation of habitat associated with the study area, and it is therefore highly unlikely to support any faunal or floral SCC. Development related activities would therefore have a low impact on this habitat unit, as the habitat integrity is historically disturbed and located within urban and industrial setting. Thus, no significant impact is anticipated should the development proceed.

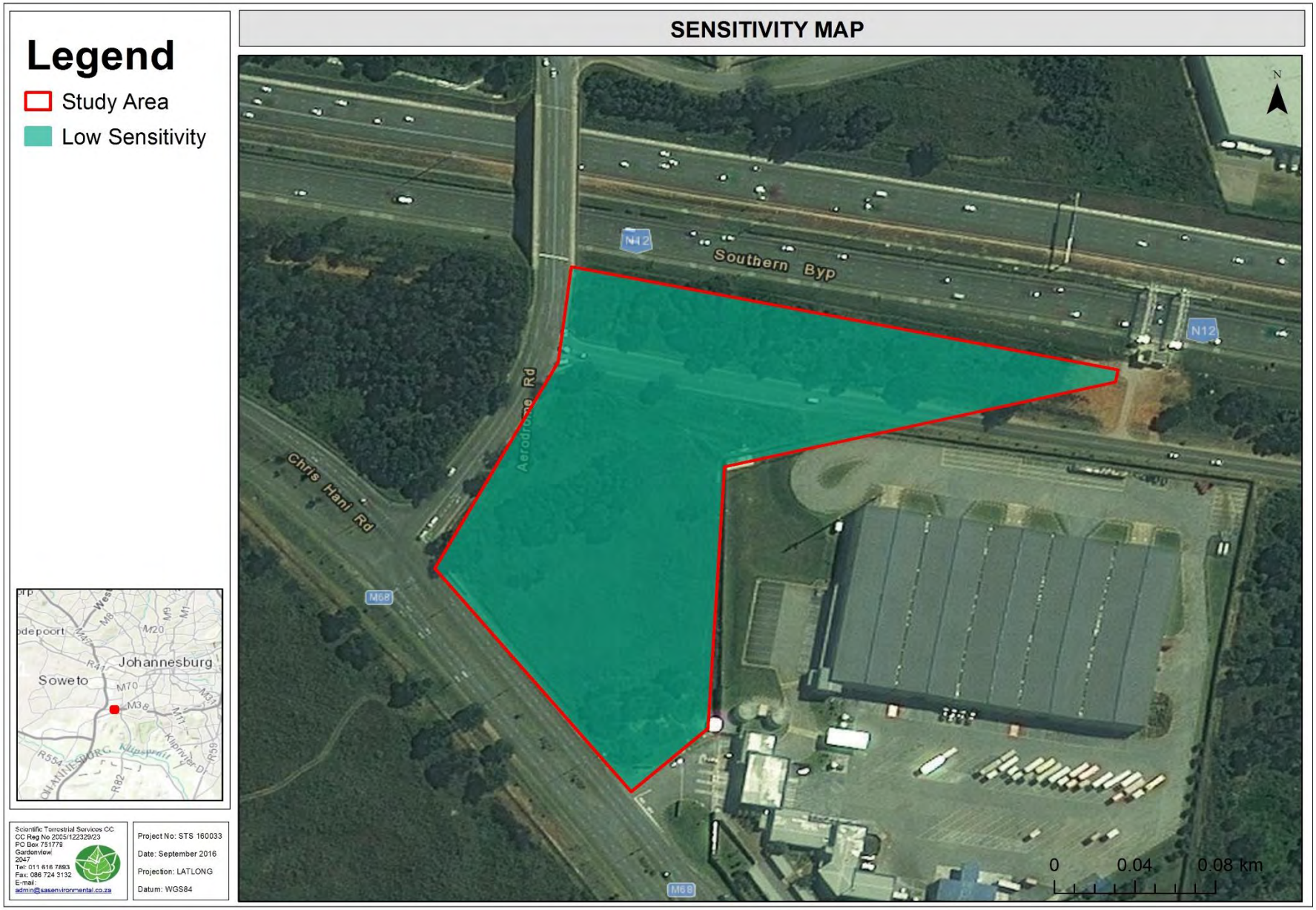


Figure 6: Sensitivity map of the study area.

7. IMPACT ASSESSMENT

The tables below serve to summarise the significance of perceived impacts on the terrestrial ecology of the study area, with each individual impact identified presented in Section 7.1 and 7.2 of this report. A summary of all potential pre-construction, construction and operational impacts is provided in Section 7.3.

The tables below present the impact assessment according to the method described in Appendix D. All impacts are considered without mitigation taking place as well as with mitigation fully implemented. All the required mitigatory measures needed to minimise the impact is presented in Section 7.4.

7.1 IMPACT 1: Impact on Floral Species of Conservation Concern

During the field assessment no floral SCC were encountered and it is unlikely that any such species would be present within the study area due to the high levels of transformation that has taken place as a result of current and historic anthropogenic activities. The impact associated with the loss of habitat for these species is considered to be of low significance during both the construction and operational phases of the project prior to the implementation of mitigation measures. With the implementation of mitigation measures, the impact significance of the loss of important species may be even further reduced to very low levels.

Activities and aspects register

Pre-Construction	Construction	Operational
Lack of planning to relocate potential floral SCC, if any, to suitable habitat outside the development footprint leading to permanent loss of these individuals	Site clearance and removal of indigenous vegetation, including floral SCC	An increase in alien floral species due to edge effects from the development may be promoted within the immediate surrounding areas, including the study area.
	Increased anthropogenic activity within the study area and an increase in the collection of plant material for medicinal and other purposes	
	Potential uncontrolled fires due to increased human activity may impact on floral communities	

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	3	3	2	1	2	6	5	30 (Low)
Operational phase	3	2	2	1	5	5	8	40 (Low)
Managed								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	2	2	2	1	2	4	5	20 (Very-Low)
Operational phase	2	1	2	1	5	3	8	24 (Very-Low)

7.2 IMPACT 2: Impact on Faunal Species of Conservation Concern

No faunal SCC were identified within the study area and there is a low probability of such species occurring permanently within the study area due to loss of suitable habitat, historic and ongoing anthropogenic and construction activity within the study area. The impact associated with the loss of habitat for these species is considered to be of low significance during both the construction and operational phases of the project prior to the implementation of mitigation measures. With the implementation of mitigation measures, the impact significance of the loss of important species may even further reduced to very low levels.

Activities and aspects register

Construction	Operational
Potential uncontrolled fires due to increased human activity may impact on faunal communities within the study area and surrounding area	Loss of potential biodiversity of SCC due to continued habitat loss within the study area and surrounding areas
Increased poaching risk of potential faunal SCC in the surrounding area due to increased human activity associated with the development	Collision of construction vehicles with potential SCC
Site clearing and the removal of vegetation leading to habitat loss of faunal SCC	Increased fire hazard which would lead to potential loss of SCC
Collision of construction vehicles with potential faunal SCC	

Unmanaged								
	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	3	2	3	1	3	5	7	35 (Low)
Operational phase	3	1	2	1	5	4	8	32 (Low)
Managed								
Managed	Probability of Impact	Sensitivity of receiving environment	Severity	Spatial scale	Duration of impact	Likelihood	Consequence	Significance
Construction phase	2	2	2	1	3	4	6	24 (Very Low)
Operational phase	1	1	2	1	5	2	8	16 (Very Low)

7.3 Impact Assessment Summary

The tables below summarises the findings indicating the significance of the impact before mitigation takes place and the likely impact if management and mitigation takes place. In the consideration of mitigation, it is assumed that a high level of mitigation takes place, but which does not lead to prohibitive costs. From the tables it is evident that prior to mitigation the impacts on floral and faunal SCC are low level impacts. If effective mitigation takes place, all impacts may be reduced to even lower level impacts.

Table 5: A summary of the results obtained from the impact assessment for the construction phase.

Impact	Unmanaged	Managed
1: Impact on Floral Species of Conservation Concern	Low	Very-Low
2: Impact on Faunal Species of Conservation Concern	Low	Very-Low

Table 6: A summary of the results obtained from the impact assessment for the operational phase.

Impact	Unmanaged	Managed
1: Impact on Floral Species of Conservation Concern	Low	Very-Low
2: Impact on Faunal Species of Conservation Concern	Low	Very-Low

7.4 Integrated Impact Mitigation

Mitigation Measures

- Should any floral or faunal SCC be encountered within the study area during the construction phase, the following should be ensured:
  - Effective relocation of individuals to suitable similar habitat in the vicinity of the study area must be ensured;
  - A rescue and relocation plan must be implemented and all rescue and relocation activities should be overseen by a suitably qualified specialist;
- It is recommended that site clearing take place in a phased manner (where possible) to allow for any faunal species present to move away from the study area to the surrounding area;
- No trapping or hunting of any faunal species are to take place during the construction phase within the study area or within the surrounding area;
- Upon completion of construction activities, it must be ensured that no bare areas remain and that indigenous grassland species are reintroduced;
- As far as possible, indigenous grassland species, including grasses, should be used as part of the landscaping of the project and it is recommended that *Cynodon dactylon* be used instead of *Pennisetum clandestinum* (Kikuyu) for any lawned areas;

- Informal fires by construction personnel within the study area should be prohibited;
- Edge effect control needs to be implemented within construction areas, with specific consideration to erosion control and alien floral species management;
- Alien vegetation as listed in Appendix F must be removed from the study area during both the construction and operational phases of the development, with specific mention of Category 1b species in line with the NEMBA Alien and Invasive Species Regulations (2014); and
- Establishment of reintroduced vegetation must be monitored during the operational phase.

8. CONCLUSION

Based on the terrestrial impact assessment of potential impacts on floral and faunal SCC within the study area, it is evident that both impacts are low prior to mitigation and very low should mitigation measures be put in place. This is due to no such species being encountered during the field assessment and considered highly unlikely to occur within the study area.

It is the opinion of the ecologists that, from a terrestrial ecological point of view, the proposed development be considered favorably provided that the recommended mitigation measures for the identified impacts (as outlined in Section 7.4) are adhered to.

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APPENDIX A – Legislative Requirements

National Environmental Management Act, 1998

- The National Environmental Management Act (NEMA; Act 107 of 1998) and the associated Environmental Impact Assessment (EIA) Regulations (GN R982 of 2014) and well as listing notices 1, 2 and 3 (GN R983, R984 and R985 of 2014), state that prior to any development taking place which triggers any activity as listed within the abovementioned regulations, 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.

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

The objectives of this act are (within the framework of NEMA) to provide for:

- The management and conservation of biological diversity within the Republic of South Africa and of the components of such diversity;
- The use of indigenous biological resources in a sustainable manner;
- The fair and equitable sharing among stakeholders of the benefits arising from bio prospecting involving indigenous biological resources;
- To give effect to ratify international agreements relating to biodiversity which are binding to the Republic;
- To provide for cooperative governance in biodiversity management and conservation; and
- To provide for a South African National Biodiversity Institute to assist in achieving the objectives of this Act.

This act alludes to the fact that management of biodiversity must take place to ensure that the biodiversity of the surrounding areas is not negatively impacted upon, by any activity being undertaken, in order to ensure the fair and equitable sharing among stakeholders of the benefits arising from indigenous biological resources.

Furthermore, a person may not carry out a restricted activity involving either:

a) A specimen of a listed threatened or protected species;
b) Specimens of an alien species; or
c) A specimen of a listed invasive species without a permit.

Conservation of Agricultural Resources Act (CARA, Act 43 of 1983)

Removal of the alien and weed species encountered in the application area must take place in order to comply with existing legislation (amendments to the regulations under the CARA, 1983 and Section 28 of the NEMA, 1998). Removal of species should take place throughout the construction and operation, phases.

GDARD Requirements for Biodiversity Assessments Version 3 (GDARD, 2014).

The biodiversity assessment must comply with the minimum requirements as stipulated by GDARD Version 3 of 2014 and must contain the following information:

- A location and description of the application site and proposed activities;
- Photographic record and description of the site characteristics and inventories of the faunal and floral species observed on site, with special mention to Red Listed species;
- Sensitivity map displaying all sensitive areas and associated buffers as listed in the Sensitivity Mapping Rules for Biodiversity Assessments section of GDARD V3 (2014); and
- A list of recommendations and mitigation measures to reduce the potential environmental impacts that the proposed development might have on the terrestrial ecology associated with the site.

Indemnity and Terms of use of this Report

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APPENDIX B – Floral Method of Assessment

Floral Method of Assessment

A reconnaissance 'walk through' on foot was undertaken to determine the general habitat types found throughout the study area. Special emphasis was placed on areas that may potentially support floral SCC. Sites were investigated on foot in order to identify the occurrence of the dominant floral communities, species and habitat diversities.

Floral Species of Conservational Concern Assessment

Prior to the field visit, a record of floral SCC and their habitat requirements was acquired from SANBI for the Quarter Degree Square in which the study area is situated, as well as relevant regional, provincial and national lists. Throughout the floral assessment, special attention was paid to the identification of any of these SCC as well as the identification of suitable habitat that could potentially support these species.

The Probability of Occurrence (POC) for each floral SCC was determined using the following calculations wherein the distribution range for the species, specific habitat requirements and level of habitat disturbance were considered. The accuracy of the calculation is based on the available knowledge about the species in question, with many of the species lacking in-depth habitat research.

Each factor contributes an equal value to the calculation.

Distribution						
	Outside of known distribution range					Inside known distribution range
Site score						
EVC 1 score	0	1	2	3	4	5
Habitat availability						
	No habitat available					Habitat available
Site score						
EVC 1 score	0	1	2	3	4	5
Habitat disturbance						
	0	Very low	Low	Moderate	High	Very high
Site score						
EVC 1 score	5	4	3	2	1	0

[Distribution + Habitat availability + Habitat disturbance] / 15 x 100 = POC%

Floral Habitat Sensitivity

The floral habitat sensitivity of each habitat unit was determined by calculating the mean of five different parameters which influence floral communities and provide an indication of the overall floristic ecological integrity, importance and sensitivity of the habitat unit. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Floral SCC:** The confirmed presence or potential for floral SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Unique Landscapes:** The presence of unique landscapes or the presence of an ecologically intact habitat unit in a transformed region;
- **Conservation Status:** The conservation status of the ecosystem or vegetation type in which the habitat unit is situated based on local, regional and national databases;
- **Floral Diversity:** The recorded floral diversity compared to a suitable reference condition such as surrounding natural areas or available floristic databases; and
- **Habitat Integrity:** The degree to which the habitat unit is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contribute equally to the mean score, which determines the floral habitat sensitivity class in which each habitat unit falls. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilization of the habitat unit in question. In order to present the results use is made of spider diagrams to depict the significance of each aspect of floral ecology for each vegetation type. The different classes and land-use objectives are presented in the table below:

Table B1: Floral habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1> and <2	Low	Optimise development potential.
2> and <3	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
3> and <4	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.
4> and <5	Moderately high	Preserve and enhance the biodiversity of the habitat unit limit development and disturbance.
5	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX C – Faunal Method of Assessment

Faunal Assessment Methodology

A reconnaissance 'walk through' on foot was undertaken to determine the general habitat types found throughout the study area. Special emphasis was placed on areas that may potentially support faunal SCC. Sites were investigated on foot in order to identify the occurrence of the dominant faunal communities, species and habitat diversities. The presence of any faunal inhabitants of the study area was also assessed through direct visual observation or identifying such species through calls, tracks, scats and burrows.

It is important to note that faunal species have varied life cycles, breeding patterns, and are subject to seasonal fluctuations. As such, it is unlikely that all faunal species will have been recorded during the site assessment. However, even though some faunal species may not have been identified during the sight assessment, the habitat units and degree of transformation can be used to establish an accurate understanding of faunal assemblages most likely associated with the study area.

Faunal Species of Conservational Concern Assessment

The Probability of Occurrence (POC) for each faunal SCC was determined using the following four parameters:

- Species distribution;
- Habitat availability;
- Food availability; and
- Habitat disturbance.

The accuracy of the calculation is based on the available knowledge about the species in question. Therefore, it is important that the literature available is also considered during the calculation.
Each factor contributes an equal value to the calculation.

Scoring Guideline					
Habitat availability					
No Habitat	Very low	Low	Moderate	Moderately High	High
0	1	2	3	4	5
Food availability					
No food available	Very low	Low	Moderate	Moderately High	High
0	1	2	3	4	5
Habitat disturbance					
Very High	High	Moderately High	Moderate	Low	Very Low
0	1	2	3	4	5
Distribution/Range					
Not Recorded		Historically Recorded			Recently Recorded
0		3			5

[Habitat availability + Food availability + Habitat disturbance + Distribution/Range] / 20 x 100 = POC%

Faunal Habitat Sensitivity

The sensitivity of the study area for each faunal class (i.e. mammals, birds, reptiles, amphibians and invertebrates) was determined by calculating the mean of five different parameters which influence each faunal class and provide an indication of the overall faunal ecological integrity, importance and

sensitivity of the study area for each class. Each of the following parameters are subjectively rated on a scale of 1 to 5 (1 = lowest and 5 = highest):

- **Faunal SCC:** The confirmed presence or potential for faunal SCC or any other significant species, such as endemics, to occur within the habitat unit;
- **Habitat Availability:** The presence of suitable habitat for each class;
- **Food Availability:** The availability of food within the study area for each faunal class;
- **Faunal Diversity:** The recorded faunal diversity compared to a suitable reference condition such as surrounding natural areas or available faunal databases; and
- **Habitat Intactness:** The degree to which the habitat is transformed based on observed disturbances which may affect habitat integrity.

Each of these values contribute equally to the mean score, which determines the suitability and sensitivity of the study area for each faunal class. A conservation and land-use objective is also assigned to each sensitivity class which aims to guide the responsible and sustainable utilization of the study area in relation to each faunal class. The different classes and land-use objectives are presented in the table below:

Table C1: Faunal habitat sensitivity rankings and associated land-use objectives.

Score	Rating significance	Conservation objective
1> and <2	Low	Optimise development potential.
2> and <3	Moderately low	Optimise development potential while improving biodiversity integrity of surrounding natural habitat and managing edge effects.
3> and <4	Intermediate	Preserve and enhance biodiversity of the habitat unit and surrounds while optimising development potential.
4> and <5	Moderately high	Preserve and enhance the biodiversity of the habitat unit limit development and disturbance.
5	High	Preserve and enhance the biodiversity of the habitat unit, no-go alternative must be considered.

APPENDIX D - Impact Assessment Methodology

Ecological Impact Assessment Method

In order for the Environmental Assessment Practitioner (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 infrastructure that is 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 wellbeing, 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 D1. 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 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 necessary[2].

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.

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

[2] Some risks/impacts that have low significance will however still require 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 D1: 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
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 developments affected < 100m	1
Development specific/ within the site boundary / < 100ha impacted / Linear developments affected <	2
Local area/ within 1 km of the site boundary / < 5000ha impacted / Linear developments affected <	3
Regional within 5 km of the site boundary / < 2000ha impacted / Linear developments affected < 3000m	4
Entire habitat unit / Entire system/ > 2000ha impacted / Linear developments affected > 3000m	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 D2: Significance Rating Matrix.

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

Table D3: Positive/Negative Mitigation Ratings.

Significance Rating	Value	Negative Impact Management Recommendation	Positive Impact Management Recommendation
Very high	126-150	Critically consider the viability of proposed projects Improve current management of existing projects significantly and immediately	Maintain current management
High	101-125	Comprehensively consider the viability of proposed projects Improve current management of existing projects significantly	Maintain current management
Medium-high	76-100	Consider the viability of proposed projects Improve current management of existing projects	Maintain current management
Medium-low	51-75	Actively seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Low	26-50	Where deemed necessary seek mechanisms to minimise impacts in line with the mitigation hierarchy	Maintain current management and/or proposed project criteria and strive for continuous improvement
Very low	1-25	Maintain current management and/or proposed project criteria and strive for continuous improvement	Maintain current management and/or proposed project criteria and strive for continuous improvement

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 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:
  - Pre-construction;
  - Construction; and
  - Operation.
- 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.

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 impacts[3] are identified and described in as much detail as possible.
- Measures and actions to address negative impacts will favour avoidance and prevention over minimisation, 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.*

Recommendations

Recommendations were developed to address and mitigate impacts associated with the proposed development. These recommendations also include general management measures which apply to the proposed development as a whole. Mitigation measures have been developed to address issues in all phases throughout the life of the operation from planning, through to construction and operation.

[3] *Mitigation measures should address both positive and negative impacts*

APPENDIX E – Vegetation Type

Soweto Highveld Grassland

Dominant Floral Taxa

The table below presents the key indicator species of this vegetation type:

Table E1: Dominant and typical floristic species of Soweto Highveld Grassland (Mucina and Rutherford, 2006).

Grass species	Forb species	Tree/Shrub Species
Andropogon appendiculatus (d)	*Hermannia depressa* (d)	*Anthospermum hispidulum*
Brachiaria serrata (d)	*Acalypha angustata*	*Anthospermum rigidum* subsp. *pumilum*
Cymbopogon pospischilii (d)	*Berkheya setifera*	*Berkheya annectens*
Cynodon dactylon (d)	*Dicoma anomala*	*Felicia muricata*
Elionurus muticus (d)	*Euryops gilfillanii*	*Ziziphus zeyheriana*
Eragrostis capensis (d)	*Geigeria aspera* var. *aspera*	
Eragrostis chloromelas (d)	*Graderia subintegra*	
Eragrostis curvula (d)	*Haplocarpha scaposa*	
Eragrostis plana (d)	*Helichrysum miconiifolium*	
Eragrostis planiculmis (d)	*Helichrysum nudifolium* var.	
Eragrostis racemosa (d)	*nudifolium*	
Heteropogon contortus (d)	*Helichrysum rugulosum*	
Hyparrhenia hirta (d)	*Hibiscus pusillus*	
Setaria nigrirostris (d)	*Justicia anagalloides*	
Setaria sphacelata (d)	*Lippia scaberrima*	
Themeda triandra (d)	*Rhynchosia effuse*	
Tristachya leucothrix (d)	*Schistostephium crataegifolium*	
Andropogon schirensis	*Selago densiflora*	
Aristida adscensionis	*Senecio coronatus*	
Aristida bipartite	*Vernonia oligocephala*	
Aristida congesta	*Wahlenbergia undulate*	
Aristida junciformis subsp. *galpinii*	*Maemanthus humilis* subsp.	
Cymbopogon caesius	*hirsutus*	
Digitaria diagonalis	*Haemanthus montanus*	
Diheteropogon amplectens	*Rhynchosia totta*	
Eragrostis micrantha		
Eragrostis superba		
Harpochloa falx		
Michrochloa caffra		
Paspalum dilitatum		

*(d) **–** Dominant species for the vegetation type

APPENDIX F - Species List

Table F1: Dominant floral species encountered in the study area. Alien species and garden ornamentals are indicated with an asterisk (*). Also indicated are species falling within an alien invasive category as per the National Environmental Management: Biodiversity Act (Act 10 of 2004): Alien and Invasive Species Regulations, 2014.

Grasses and sedges	Forbs and groundcovers	Trees and shrubs
Cynodon dactylon	**Alternanthera pungens*	**Eucalyptus grandis*
**Chloris virgata*	**Amaranthus hybridus*	**Jacaranda mimosifolia* 1b
**Cortaderia selloana* 1b	**Datura stramonium* 1b	**Melia azedarach* 3
**Cynodon dactylon*	**Portulaca oleracea*	**Pinus patula* 2
Aristida adscensionis	**Tagetes minuta*	**Solanum mauritianum* 1b
Brachiaria serrata	*Asclepias fruticosa*	*Celtis africana*
Eragrostis curvula	*Bidens pilosa*	*Vachellia sieberiana*
Eragrostis plana		**Acacia mearnsii* 2
Hyparrhenia hirta		**Schinus molle*
Melinis repens		
Panicum maximum		
Sporobolus africanus		
Pogonarthria squarrosa		
Digitaria eriantha		
Panicum maximum		

1a: Category 1a – Invasive species that require compulsory control.
1b: Category 1b – Invasive species that require control by means of an invasive species management programme.
2: Category 2 – Commercially used plants that may be grown in demarcated areas, provided that there is a permit and that steps are taken to prevent their spread.
3: Category 3 – Ornamentally used plants that may no longer be planted; existing plants may remain, except within the flood line of watercourses and wetlands, as long as all reasonable steps are taken to prevent their spread (Bromilow, 2001).

Table F2: Mammal species observed

Scientific name	Common Name	IUCN Red List Status
Cryptomys hottentotus	African Mole Rat	LC

LC = Least concerned. NT = Near Threatened, NYBA = Not yet been assessed by the IUCN.

Table F3: Avifaunal species observed

Scientific name	Common Name	Regional Status (2015)	IUCN Red List Status (2016)
Pycnonotus tricolor	Dark-capped Bulbul		NYBA
Phalacrocorax africanus	Reed Cormorant		LC
Corvus albus	Pied crow		LC
Streptopelia senegalensis	Laughing Dove		LC
Streptopelia semitorquata	Red-eyed Dove		LC
Columba livia	Rock Dove		LC
Lanius collaris	Common Fiscal		LC
Threskiornis aethiopicus	African Sacred Ibis		LC
Bostrychia hagedash	Hadeda Ibis		LC
Vanellus coronatus	Crowned Lapwing		LC
Ploceus velatus	Southern Masked Weaver		LC
Colius striatus	Speckled Mousebird		LC
Acridotheres tristis	Common Myna		LC
Cisticola fulvicapilla	Neddicky		LC
Passer melanurus	Cape Sparrow		LC
Passer domesticus	House Sparrow		LC
Streptopelia capicola	Cape Turtle Dove		LC

LC = Least concerned. NT = Near Threatened, NYBA = Not yet been assessed by the IUCN.

Table F4: Insect species observed

Scientific Name	Common Name	IUCN 2015 Status
Belenois aurota	Brown-veined White	NYBA
Junonia hierta	Yellow Pansy	LC
Danaus chrysippus	African Monarch	NYBA
Acanthacris ruficornis	Garden Locust	NYBA
Phymateus viridipes	Green Milkweed Locust	NYBA
Oedaleus sp	N/A	NYBA
Gastrimargus sp	N/A	NYBA
Orthoctha dasycnemis	N/A	NYBA
Anoplolepis custodiens	Pugnacious Ant	NYBA
Trinervitermes sp	Snouted Harvester Termite	NYBA
Musca domestica	House fly	NYBA

NYBA = Not Yet Been Assessed, LC = Least Concern

APPENDIX G – Floral SCC

Table G1: PRECIS SCC plant list for the QDS 2627BD (SANBI, www.posa.sanbi.org).

Family	Species	Threat status	Habitat	POC%
Asteraceae	*Cineraria longipes*	VU	Grassland, amongst rocks and along seepage lines, exclusively on basalt koppies on south-facing slopes.	0
Mesembryanthemaceae	*Lithops lesliei* subsp. *lesliei*	NT	Primarily in arid grasslands, usually in rocky places, growing under the protection of forbs and grasses.	0

VU = Vulnerable; NT = Near Threatened

Table G2: Floral SCC list obtained from GDARD for the QDS 2627BD

Family	Species	Threat status	Habitat	POC%
Dioscoreaceae	*Dioscorea sylvatica*	VU	Wooded and relatively mesic places, such as the moister bushveld areas, coastal bush and wooded mountain kloofs.	0
Orchidaceae	*Habenaria mossii*	EN	Open grassland on dolomite or in black, sandy soil.	0
Mesembryanthemaceae	*Khadia beswickii*	VU	Open shallow soil over rocks in grassland	0
Brassicaceae	*Lepidium mossii*	Data deficient	Unknown	0
Asphodelaceae	*Trachyandra erythrorrhiza*	NT	Black turf marshes	0

VU = Vulnerable; NT = Near Threatened; EN = Endangered

APPENDIX H – Faunal SCC

TableH1: RDL Mammal Species for the Gauteng Province (GDARD 2014).

Scientific Name	Common name	IUCN Status	GDARD Status	POC (%)
Neamblysomus julianae	Juliana's Golden Mole	EN	VU	0
Mystromys albicaudatus	White-tailed Mouse	EN	EN	0
Atelerix frontalis	Southern African Hedgehog	LC	NT	35
Lutra maculicollis	Spotted-necked Otter	NT	NT	0
Miniopterus schreibersii	Scheiber's Long-Fingered Bat	NT	NT	5
Myotis tricolor	Temminck's Hairy Bat	LC	NT	5
Rhinolophus blasii	Blasius's/Peak-Saddle Horseshoe Bat	LC	VU	5
Rhinolophus clivosus	Horseshoe Bat	LC	NT	5
Rhinolophus darlingi	Darling's Horseshoe Bat	LC	NT	5
Rhinolophus hildebrandtii	Hildebrandt's Horseshoe Bat	LC	NT	5

VU = Vulnerable, EN = Endangered, NT = Near Threatened, LC= Least Concern

Table H2: RDL Avifaunal Species for the Gauteng Province (GDARD 2014).

Scientific Name	Common name	IUCN Status	Regional Status	GDARD Status	POC (%)
Gyps coprotheres	Cape Vulture	EN	EN	VU	25
Anthropoides paradiseus	Blue Crane	VU	NT	VU	20
Falco naumanni	Lesser Kestrel	LC	Ad mon	-	25
Tyto capensis	African Grass-Owl	LC	VU	VU	15
Circus ranivorus	African Marsh-Harrier	LC	EN	VU	15
Gorsachius leuconotus	White-backed Night Heron	LC	VU	VU	15
Eupodotis senegalensis	White-bellied Korhaan	LC	VU	VU	15
Podica senegalensis	African Finfoot	LC	VU	VU	15
Mirafra cheniana	Melodious Lark	NT	End and N-end	NT	20
Sagittarius serpentarius	Secretarybird	VU	VU	NT	25
Ciconia nigra	Black Stork	LC	VU	-	20
Eupodotis caerulescens	Blue Korhaan	NT	End and N-end	NT	20
Polemaetus bellicosus	Martial Eagle	VU	EN	-	15
Phoenicopterus minor	Lesser Flamingo	NT	NT	-	15
Phoenicopterus roseus	Greater Flamingo	LC	NT	-	25
Alcedo semitorquata	Half-collared Kingfisher	LC	NT	NT	15

VU = Vulnerable, NT = Near Threatened, LC = Least Concern, EN = Endangered, Ad mon = Additional Monitoring, End and N-end = Endemic and Near endemic

Table H3: RDL Invertebrates Species for the Gauteng Province (GDARD 2014)

Scientific Name	Common name	IUCN Status	GDARD Status	POC (%)
Lepidochrysops praeterita	Highveld Blue Butterfly	NYBA	VU	0
Chrysoritis aureus	Heidelberg Copper	NYBA	VU	0
Ichnestoma stobbiai	Stobbia's Fruit Chafer Beetle	NYBA	VU	0
Aloeides dentatis	Roodepoort Copper Butterfly	NYBA	VU	0

VU = Vulnerable, NYBA = Not yet been assesses

Table H4: RDL Reptile Species for the Gauteng Province (GDARD 2014)

Scientific Name	Common name	IUCN Status	GDARD Status	POC (%)
Homoroselaps dorsalis	Striped Harlequin Snake	NT	NT	0

NT = Neat Threatened

Avifaunal Species for the pentads 2615_2755 within the QDS 2627BD.

http://sabap2.adu.org.za/pentad_info.php?pentad=2615_2755&section=species

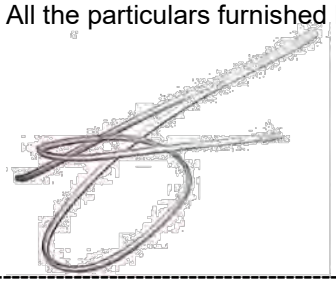
APPENDIX I – Declaration and Specialists CV's

Declaration

Declaration that the specialist is independent in a form as may be specified by the competent authority

I, Emile van der Westhuizen, declare that -

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the relevant legislation and any guidelines that have relevance to the proposed activity;
- I will comply with the applicable legislation;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct



Signature of the Specialist

SCIENTIFIC TERRESTRIAL SERVICES (STS) – SPECIALIST CONSULTANT INFORMATION

CURRICULUM VITAE OF EMILE BASSON VAN DER WESTHUIZEN

PERSONAL DETAILS

Position in Company	Ecologist, Botanist
Date of Birth	30 May 1984
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2008

MEMBERSHIP IN PROFESSIONAL SOCIETIES

Candidate Member of the South African Council for Natural Scientific Professions (SACNASP) (Reg. Number 100008/15).

EDUCATION

Qualifications

BSc (Hons) Plant Science (University of Pretoria)	2012
B.Sc. Botany and Environmental Management (University of South Africa)	2010

Short Courses

Grass Identification – Africa Land Use Training	2009
Wild Flower Identification – Africa Land Use Training	2009

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Free State, Eastern Cape.
Mozambique (Tete, Sofala and Manica Provinces)
Democratic Republic of the Congo (Katanga and Kivu Provinces)
Ghana (Western and Greater Accra Provinces)

SELECTED PROJECT EXAMPLES

Floral Assessments

- Floral assessment for the proposed Modikwa Platinum Mine South 2 Shaft Project, Burgersfort, Limpopo Province.
- Floral assessment for the proposed New Clydesdale Colliery Stoping Project, Vandyksdrift, Mpumalanga Province.
- Floral assessment as part of the EIA process for the proposed Harriet's Wish PGM Project, Limpopo Province.
- Floral assessment as part of the environmental authorisation process for the proposed Shanduka Coal Argent Colliery in the vicinity of Argent, Mpumalanga.
- Floral assessment for the Auroch Resources Manica Gold Mining Project, Manica, Mozambique.
- Floral assessment for the Namoya Gold Mine project in Namoya, Democratic Republic of Congo.
- High level floral risk assessment and alternatives analysis for the proposed new Tete Airport, Tete, Mozambique.
- Floral assessment for the proposed Richardsbay Harbour Compactor Slab development, Richardsbay, Kwa-Zulu-Natal Province.
- Site walkdown and floral ecological input prior to the construction of the proposed 180km Mfolozi-Mbewu powerline, Richardsbay, Kwa-Zulu-Natal Province.
- Floral assessment as part of the EIA process for the proposed Peerboom Colliery, Lephalale, Limpopo Province.
- Floral assessment as part of the EIA process for the proposed Overvaal Underground Coal Mine Project, Ermelo, Mpumalanga Province.
- Floral assessment as part of the EIA process for the proposed King's City Takoradi 3000 hectare development, Takoradi, Ghana

- Floral assessment as part of the EIA process for the proposed Aquarius Platinum Fairway Platinum Mine, Steelpoort, Mpumalanga Province.
- Floral assessment as part of the EIA process for the proposed Geniland Lubumbashi City 4000 hectare development, Likasi, Katanga Province, Democratic Republic of Congo.
- Floral, faunal, aquatic and wetland assessment as part of the EIA process for the proposed Appollonia City Accra 3000 hectare development, Accra, Ghana.
- Floral assessment as part of the EIA process for the proposed Leeuw Colliery, Utrecht, Kwa-Zulu Natal Province.
- Floral assessment as part of the EIA process for the proposed Lubembe Coppermine Project, Lubumbashi, Katanga Province, Democratic Republic of Congo.
- Floral assessment as part of the EIA process for the proposed Kinsenda Coppermine Project, Lubumbashi, Katanga Province, Democratic Republic of Congo.
- Floral assessment as part of the EIA process for the proposed Lonshi Coppermine Project, Lubumbashi, Katanga Province, Democratic Republic of Congo.
- Floral assessment as part of the EIA process for the proposed Jozini Shopping Mall, Jozini, Kwa-Zulu Natal Province.
- Floral assessment as part of the Biodiversity Action Plan for the Assmang Chrome Dwarsrivier Mine, Steelpoort, Mpumalanga Province.

SCIENTIFIC AQUATIC SERVICES (SAS) – SPECIALIST CONSULTANT INFORMATION
CURRICULUM VITAE OF HENNIE DE BEER

PERSONAL DETAILS

Position in Company	Ecologist – Focusing on Avifaunal species
Date of Birth	20 October 1986
Nationality	South African
Languages	English, Afrikaans
Joined SAS	2014

EDUCATION

Qualifications

National Diploma Nature Conservation (Tshwane University of Technology) 2008

COUNTRIES OF WORK EXPERIENCE

South Africa – Gauteng, Mpumalanga, North West, Limpopo, KwaZulu-Natal, Eastern Cape, Western Cape, Northern Cape and Free state
Mozambique

SELECTED PROJECT EXAMPLES

Faunal Assessments

- Leandra Colliery (2015) – Faunal assessment as part of the environmental assessment and authorisation process for the proposed the Leandra Coal Project, Gauteng and Mpumalanga Provinces;
- Siyanda Chrome Smelter (2015) - Faunal assessment as part of the environmental assessment and authorisation process for a proposed construction of a ferrochrome smelter, Limpopo province;
- Lace Diamond Mine (2015) – Faunal assessment as part of the environmental assessment and authorisation process for the lace diamond mine near Kroonstad, free state province;
- Duhva Solar Plant (2015) – Avifaunal as part of the Environmental Impact Assessment and authorisation process for the proposed solar photovoltaic power plant with associated infrastructure at the Duvha Coal Fired Power Station, Mpumalanga province;
- Arnot Solar Plant – Avifaunal Assessment as part of the Environmental Impact Assessment and authorisation process for the proposed solar photovoltaic power plant with associated infrastructure at the Arnot coal fired power station, Mpumalanga Province;
- Braakfontein Colliery – Faunal Assessment as part of the Environmental Assessment and authorisation process for the proposed Braakfontein Coal Mine near Newcastle, KwaZulu-Natal Province;
- Kekana Powerline – Faunal Ecological Assessment as part of the Environmental Assessment and authorisation process for the proposed Kekana and Wonderboom 132kv powerlines and substations, Hammanskraal, Gauteng;
- Samrand Phase 3 / Olievenhoutbosch – Floral, Faunal and Wetland Ecological Assessment as part of the Environmental Assessment and authorisation process for the proposed development of the Kosmosdal township on the remainder of portion 2 of the farm Olievenhoutbosch no. 389-jr, Gauteng Province;
- Jeanette Gold Mine – Faunal Assessment as part of the Environmental assessment and authorisation process for Jeanette expansion project at the Taung Gold International mine near Welkom within the Free State Province; and
- PTN 38 Elandspruit Farm – Faunal Assessment as part of the Environmental Assessment and authorisation process for the proposed mining development on portion 38 of the Elandspruit farm. Mpumalanga Province.

Terrestrial scan:

- K77 (2014) - Terrestrial scan Assessment as part of the Environmental Impact Assessment and authorisation process for the proposed development of the Provincial road K77, Gauteng highlands: Elizabeth road to K154; and
- Blue Hills EXT 39 - Biodiversity Assessment Fauna and Flora.

Alien Vegetation Monitoring Plan:

- Bokoni Platinum Mine (2015) - Alien vegetation study.

Maintenance and Management Plans:

- Levendal Pearl Valley Phase 2 Roads Bar – Maintenance and Management Plan;
- Sanbona Wildlife Reserve/Dwyka Lodge – Maintenance and Management Plan;
- Pearl Valley Bulk Services – Maintenance and Management Plan;
- Ariadne Eros Powerline – Maintenance and Management Plan; and
- Rhodes Drive/Constantia – Maintenance and Management Plan.

Wetland:

R40 Ring Road Bushbuck Ridge – Wetland delineation and field work.

Previous Work Experience

- Eradication of aquatic plants from water canals using chemicals.
- Junior Research Technician National Rangeland Monitoring Program (NRMP) at Agriculture Research Council (ARC) doing Vegetation Condition Assessment for cattle farmers in the Vryheid area. Also did the following work for the Savanna Ecosystem Project: Vegetation Condition Assessments, Carrying Capacity, and annual game counts were done on 24 reserves in the Lowveld area, also at Gorongoza Mozambique. Rehabilitation monitoring of the mine dumps for Phalaborwa Mining Company.
- Assisted in the following programs doing practical year at Timbavati Private Nature Reserve:
  - Ringing of Ground Hornbill chicks on the reserve;
  - Monitoring project on nesting sites of White backed Vultures at Timbavati Private Nature Reserve by using game census data and visiting the sites to see if the nesting sites were still active or not;
  - Burning programs;
  - Anti-poaching;
  - Hunting;
  - Culling;
  - Bush thinning of *Colophospermum mopane (*Mopane); and
  - Started a Lion identification key for all the Male lions on the reserve.

APPENDIX G 2 GEOTECHNICAL INVESTIGATION REPORT

Geopractica

GEOTECHNICAL CONSULTANTS
NATURAL SCIENTISTS

P. O. Box 227, Maraisburg, 1700
Construction House, 1164 Minnie Postma Street, Florida Ext. 11
Tel. +27 11 674 1325 : Fax. +27 11 674 4513 : Email.all@geopractica.co.za

GEOTECHNICAL INVESTIGATION
for
THE FARM 751, REGISTRATION DIV. I.Q.,
PROVINCE OF GAUTENG
SHELL SERVICE STATION, AERODROME

Client: Boleng Engineering Management Date: July 2020 Job No: 200133

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1. SITE PLAN, LOCALITY PLAN and GEOLOGY PLAN
2. TRIAL HOLE PROFILES (STA December 2005)
3. RAYMOND SPOON PROFILES
4. RAYMOND SPOON PROBE RESULTS
5. LABORATORY TEST RESULTS

1 INTRODUCTION

1.1 Preamble

On the 11th of June 2020, a proposal, reference *Z:\Proposals 2020\Boleng\Aerodrome Service Station (rev 1)* was submitted to Mr. Russell Clarke of Boleng Engineering Management for a supplementary geotechnical investigation of The Farm 751-Registration Div. I.Q, Province of Gauteng, located on the corner of Southgate, Aerodrome and Chris Hani Roads in Baragwanath Extension 5.

1.2 Database

The following information was provided to Geopractica, prior to commencing the fieldwork:-

A Shell SA Site Development Plan number AERODROME SDP 000, indicating the location of the proposed structures and infrastructure of the property.

A Schwartz Tromp and Associates Phase 1 (preliminary) geotechnical investigation report reference 05/130/1 dated December 2005.

The proposed development will comprise:-

Buried fuel tanks
Single storey service station building
Double volume forecourt canopy
Entrance and exit access
Ground level parking

The report prepared below comprises a design level geotechnical investigation, for the proposed service station, resulting from the composition of the Schwartz Tromp and Associates (STA) report and the current supplementary investigation.

1.3 Objectives

The object of the investigation was to complete a design level geotechnical investigation of the site which would:-.

1.3.1 Identify the soil profile across the site to a depth of 3.0m or refusal of previously excavated TLB test pits and current continuous Raymond Spoon Probes.
1.3.2 Determine the engineering parameters of the near surface soils.
1.3.3 Recommend specific foundations for the structures.
1.3.4 Assess the suitability of the near surface soils for use in earthworks and road pavement layers.
1.3.5 Comment on any geotechnical problems that may impact upon the construction.

2 FACTUAL REPORT

2.1 Programme of Work

2.1.1 *Literary Review*

Prior to the commencement of any field work, a literary review was conducted on the data obtained from previous investigations by both Geopractica and other consultants.

2.1.2 *Field Work*

On the 8th and 10th July 2020, six continuously driven Raymond Spoon probes were advanced from ground level to refusal at the locations indicated on the site plan.

These probes were used to supplement the five TLB dug test pits conducted by STA in November 2005 . Their positions are also indicated on the site plan attached as appendix 1 to this report.

The semi disturbed samples recovered from the Raymond Spoon probes were profiled by an engineering geologist according to the “Guidelines for Soil and Rock Logging in South Africa”, sampled as necessary and subsequently loosely backfilled. The detailed soil profiles of both the TLB test pits and the Raymond Spoon probes appear in Appendix 2 and 3 of this report.

2.1.3 *Office & Laboratory Work*

From the soil samples recovered during the current field work the following were selected for testing:

Foundation Indicator Tests
Soil pH and Conductivity

The laboratory test results undertaken by Geopractica for STA in November 2005 are also included in appendix 4 to this report while a summary of the test results appears in section 2.6 below.

The report was finally prepared using the data obtained from all the sources mentioned above.

2.2 Site Description

The 1.7Ha site is situated east of Aerodrome Road, north of Chris Hani Road, south of Southgate Road and west of the SAB Baragwanath depot.

The natural slope of the site is gentle down towards the north west at a gradient of approximately 1:20 (5%), however with the site being bound by roadways which are elevated above natural ground level the site acts as a low lying area into which the

surrounding stormwater drains, resulting in slightly marshy conditions.
Generally the site consist of tufted veld grass with scattered Wattle trees dispersed across the site.

Uncontrolled dumping of rubble on the site has created a significant amount of un-engineered fill “heaps” across the extreme southern portion of the site.

No rock outcropping was observed on the site.

2.3 Site Geology

From available literature as well as the observations during the investigation, it is evident that the site is underlain by the quartzites, conglomerates and shales of the Turfontein Subgroup of the West Rand Group of the Witwatersrand Supergroup.

It is apparent the site is blanketed by a variable thickness of transported Hillwash material which typically contains a ferruginised basal pebblemarker.

2.4 Hydrology

The average annual rainfall in this area is approximately 700mm, most of which occurs in heavy isolated falls between November and March.

In spite of the artificial drainage pattern (low lying sump like nature) there is no direct evidence of a shallow/perched water table in any of the previous TLB test holes and or Raymond Spoon probes.

The natural slope across the site would suggest that stormwater runoff will be in the form of sheet wash towards the north west.

The transported soils appear to be relatively permeable and it is likely that the majority of rainfall will percolate into the near surface soils.

Minor ferruginisation was observed in both the transported and residual quartzite horizons, which suggests that a perched water table may develop during periods of very heavy and prolonged rainfall.

2.5 Observations

While the nature of the soils encountered in the test pits is relatively uniform in terms of the type of material, there is a reasonable degree of variation in the thicknesses of the various horizons. Table 1 gives the maximum, minimum and average depths to the top of the major horizons and their thicknesses.

Table 1 : Soil Horizons						
Material Type	**Depth to top of horizon (m)**			**Thickness (m)**		
	Min	**Max**	**Avg**	**Min**	**Max**	**Avg**
Fill (TP4, TP5 and RS02)	0.00	0.00	0.00	0.30	1.00	0.70
Transported (with pebblemarker)	0.00	0.00	0.00	0.55	1.70	1.00
Residual Quartzite	0.90	2.50	1.20	>0.30	>1.95	>1.22
Very dense to soft rock Quartzite	>1.5	>3.15	>2.3	nd	nd	nd

Note: nd Not determined

Table 2: indicates the maximum depth of each test pit, the material encountered at the base and whether or not water seepage was encountered.

Table 2: Test Pit Depths			
TP No	**Depth of hole (m)**	**Nature of Material at base of pit**	**Water Seepage**
1	**Refusal of TLB @** 1.75m	Very dense Residual Quartzite.	No groundwater seepage observed
2	**Refusal of TLB @** 1.5m	Very dense Hardpan Ferricrete	
3	**Refusal of TLB @** 2.0m	Very dense Hardpan Ferricrete	
4	**No Refusal of TLB @** 3.0m	Medium dense Ferruginised Quartzite	
5	**Refusal of TLB @** 2.0m	Very dense Residual Quartzite.	
RS1	**Refusal of RS @** 3.15m	Dense to very dense residual quartzite.	No groundwater seepage observed
RS2	**Refusal of RS @** 3.15m		
RS3	**Refusal of RS @** 2.25m		
RS4	**Refusal of RS @** 2.70m		
RS5	**Refusal of RS @** 1.35m		
RS6	**Refusal of RS @** 2.25m		

2.6 Laboratory Test Results

A summary of the laboratory results is shown in tables 3, 4, 5 and 6 below, whilst all of the detailed results are presented in Appendix 3 of this report.

Table 3. Summary of Indicator test results							
Test	**Depth (m)**	**Material**	**PI (%)**	**PI (ws)**	**GM**	**MC (%)**	**Activity**
TP2	0.5 - 0.7	Gravelly sand - Hillwash	5	3	1.08	4.45	Low
TP3	1.1 - 1.4	Sand - Ferruginised Hillwash	5	3	1.31	10.60	Low
TP4	1.2 - 1.4	Silty sand - Ferruginised Hillwash	11	7	0.66	10.36	Low
RS01	0.45 - 0.9	Hillwash	np	np	0.80	9.00	Low
RS01	1.2 - 2.25	Reworked residual quartzite	np	np	1.01	12.00	Low
RS01	2.25 - 3.15	Residual quartzite	6	5	0.82	13.00	Low
RS03	1.35 - 2.25	Residual quartzite	np	np	0.98	14.00	Low
RS06	1.35 - 2.25	Residual quartzite	np	np	1.16	17.00	Low

Table 4: Summary of laboratory test results - (roads and earthworks)									
TP No	**Depth (m)**	**Material**	**PI (%)**	**GM**	**CBR Value @ % Mod AASHTO**				**TRH 14 Class**
					90%	**93%**	**95%**	**100%**	
1	0.5 - 1.0	Pebblemarker	NP	2.34	32	65	87	143	G4
2	0.5 - 1.0	Hillwash	NP	1.30	17	51	74	131	G6
2	1.0 - 1.5	Ferruginised Hillwash	5	1.31	31	51	65	98	G6

Table 5: Collapse Tests						
TP No	**Depth (m)**	**Material**	**Dry Density (kg/m^3)**	**Moisture Content %**	**Collapse Potential (%)**	**Initial voids ratio**
2	0.5 - 0.7	Hillwash	1494	13.63	8.8	0.78
4	1.2 - 1.4	Hillwash	1377	14.79	2.6	0.92

Table 6: Soil pH and Conductivity					
Test	**Depth (m)**	**Material**	**pH**	**Resistivity (Ohmn/cm)**	**Degree of Corrosivity**
RS01	0.45 - 0.9	Hillwash	4.2	12151	not generally corrosive
RS01	1.2 - 2.25	Reworked Res quartzite	4.8	15267	
RS01	2.25 - 3.15	Residual quartzite	4.8	20833	
RS03	1.35 - 2.25	Residual quartzite	4.5	14706	
RS06	1.35 - 2.25	Residual quartzite	4.4	9588	

3 INTERPRETIVE REPORT

3.1 Discussion of Results

A general assessment of the soil horizons encountered below the site is given below.

3.1.1 *Fill*

Two of the STA test pits (TP4 and TP5) and one Raymond Spoon probe (RS2) encountered fill from surface.

In general the material has been described as a slightly moist mottled maroon, red and yellow brown, loose to medium dense, silty sand.

The fill was found to vary from 300mm to 1000mm (average 700mm).

Due to the variable composition and consistency it is recommended that this material be removed in its entirety and carted to spoil

3.1.2 *Transported (Hillwash - including the basal pebble marker)*

The hillwash horizon was intersected in all of the trial holes and Raymond spoon probes and has been described as a slightly moist, brown to yellowish brown, loose to medium dense, slightly open textured, silty sand with an average thickness of 1m.

Whilst the indicator test results suggest that the material exhibits a

CBR tests conducted on the various transported materials suggest that in terms of the TRH 14 specification the following can be expected:-

Hillwash	G6 material
Basal pebblemarker/ferruginised	G4 material

. Two collapse potential tests conducted on undisturbed samples of the transported hillwash suggests that the material will exhibit a moderate to high collapse potential as results of 8.8% and 2.6% have been obtained.

According to the work conducted by Jennings and Knight (1975), table 7 below catagorises the severity of damage that may occur to masonry structures, conventionally founded in material which exhibits a collapse potential.

Table 7: Collapse Potential vs Damage Potential	
Collapse potential (%)	**Severity of Problem**
0 - 1	No Trouble
1 - 5	Moderate Trouble
5 - 10	Trouble
10 - 20	Severe Trouble
>20	Very Severe Trouble

It is our opinion that the poor consistency and high collapse potential, precludes the use of the transported hillwash as a founding medium for any of the proposed structures.

Soil ph and conductivity tests on this material suggests that it is strongly acidic and will therefore be potentially aggressive toward buried concrete structures. The high resistivity suggests that it will be generally inert against buried metallic services

3.1.3 *Residual quartzite*

The residual quartzite was intercepted in all trial holes and RS probes and has been described as a slightly moist, mottled yellow, red and maroon, generally loose to medium dense, relic structured, silty fine to coarse sand with nodular ferricrete

This material was intercepted at depths of between 1m and 2.5m below current ground level. The average thickness of the horizon was found to be in the order of 1220mm.

Refusal of the TLB and the Raymond Spoon was achieved in this material which exhibits a consistency of dense to very dense rock.

Foundation indicator tests conducted on the residual quartzite suggests that the material will exhibit a low heave potential. Whilst not tested, it is our opinion that the material is unlikely to exhibit a collapse potential, however in its loose to medium dense state will exhibit a consolidation potential

No CBR tests were conducted on this material, however interpolation undertaken on an indicator sample suggests that the residual quartzite should classify as a G7 material in terms of TRH14.

An allowable bearing capacity of 250kPa has been allocated to this horizon where consistencies of dense to very dense are observed.

Soil ph and conductivity tests on this material suggests that it is strongly acidic and will therefore be potentially aggressive toward buried concrete structures. The high resistivity suggests that it will be generally inert against buried metallic services.

3.2 Design Parameters

Design parameters for the major soil horizons are given in Table 8:-

Table 8: Design Parameters

Material Type	Allowable Bearing Capacity (kPa)	TRH 14 Classification
Fill	na	nd
Transported	na	G4 to G6
Residual Quartzite (dense to very dense)	250	G7*

n/d - not determined
na - not applicable
* - Interpolated

3.3 Design Solutions

3.3.1 *Main Building*

Information obtained from TP3, RS5 and RS6, suggests that the main service station structure should be placed on either a reinforced concrete raft or engineered soil mattress as described below:-

3.3.1.1 Engineered Soil Mattress

It is recommended that this lightly loaded structure (allowable bearing capacity of not more that 150 kPa), be placed on a engineered soil mattress.

A brief construction method is included below:-

An area at least 1m larger than the foot print of the structure will need to be excavated to a depth of not less than 1.5m below future terrace level.

The excavated hillwash, pebblemarker and upper should be stockpiled for use as backfill as it meets the minimum G7 backfill specification

Once the bulk excavation is completed, the base of the excavation should be ripped and re-compacted to 90% Mod AASHTO.

The stockpiled G7 material should be returned to the bulk excavation in 150mm layers and compacted to 93% Mod AASHTO.

The two layers which will be immediately below any proposed

new foundations are to be compacted to 95% Mod AASHTO, while the balance of the fill required to reach terrace level should be compacted to 93% Mod AASHTO.

Foundations for structures, should then be excavated back into the fill, to the minimum depth compatible with the provision of services into the building i.e. approximately 600mm below finished terrace level. Allowable bearing capacities for foundations whose maximum width does not exceed 800mm would then be 150 kPa.

Normally loaded floor slabs should be placed on the imported compacted backfill.

3.3.1.2 Reinforced Concrete Raft

It is our opinion that small (±200m^2) lightly loaded structures can be founded on a suitably designed reinforced concrete raft, placed on the ground. It is recommended that the bearing pressure below the raft should be limited to a maximum of 75kPa.

3.3.2 *Forecourt Canopy*

Information obtained from RS03, RS04 and TP2 suggests that this relatively heavily loaded and settlement sensitive structure, be founded on conventional reinforced column bases at depths between 2.25 and 2.7m below current ground level, on the very dense residual quartzite, where an allowable bearing capacity of 250kPa can be anticipated.

Alternatively the structure could be founded on an engineered soil mattress as discussed above. Cognisance must be taken regarding the relationship between the proposed foundation size and the depth of the bulk excavation.

3.3.3 *Underground Fuel Storage Tanks*

Information obtained from RS01, RS02, TP4 and TP5 suggests that the transported and residual material will classify as “soft excavation” to depths of approximately 3m, where an allowable bearing capacity of at least 250kPa can be expected.

At depths below this, it is expected that the very dense to very soft rock quartzite could grade rapidly into an “intermediate or hard excavation” category.

3.3.4 *Roads and Terraces*

As noted earlier, the near surface soils classify as G6 to G7, with the thin pebblemarker and ferruginised material classifying as a G4.

It is our opinion that material classifying as G7 or better can be used as general back fill.

The design of the pavement layers for any roads and terraces must take into account the traffic intensity, anticipated axle loading and availability of suitable material from local and commercial suppliers.

Table 9 below, summarises the material classes as recommended in TRH 14.

Table 9 : Pavement Material Classes

Pavement Layer	TRH 14 Material Class (natural gravels)
Base	G1, G2, G3, G4
Subbase	G5, G6
Selected Layers	G6, G7
Subgrade	G8, G9, G10

As indicated in section 2.2 above the natural slope of the site is gentle down towards the north west at a gradient of approximately 1:20 (5%), however with the site being bound by roadways which are elevated above natural ground level the site acts as a low lying area into which the surrounding stormwater drains, resulting in slightly marshy conditions.

Cognisance of this artificial truncation of the natural drainage across the site must be taken in the design of the development, in order that the potential for ponding of stormwater is facilitated within the stormwater management system.

3.3.5 *Excavation Classification*

In terms of SABS 1200D:1988 Earthworks, excavations to depths of approximately 3.0m are likely to classify as “soft” across the northern half of the site.

In general the very dense to very soft rock quartzite “shallows” towards the south with “soft” excavation depths of roughly 2.0m .

It is likely that there will be a “sharp” gradation from “soft” through “intermediate” to “hard” excavation within the bedrock quartzite.

All excavations need to be suitably battered back / stepped to a stable angle, or shored where necessary, to ensure the safety of construction personnel working in these excavations.

It is recommended that a safe batter angle of 1 (vertical) to 1.5 (horizontal) be utilised in the overlying transported and residual soils.

The safe batter angles given above are indicative only and as such all bulk exactions (including service trenches) should be examined by a competent person prior to allowing access.

Care must be taken to regularly observe trench sidewall stability, especially if

any of the soils should become wet or saturated.

3.4 Construction Problems

No construction problems are envisaged.

3.5 Additional Investigations

No additional investigations are considered necessary.

4 CONSTRUCTION MONITORING

4.1 Excavation Inspection

It is recommended that all foundations be inspected by a competent person, prior to placing any concrete.

4.2 Control Testing

Regular checks on the quality and compaction of the backfill to the terraces should be made.

REFERENCES

1. Jennings JE et al . "Revised Guide to Soil profiling for Civil Engineering Purposes in Southern Africa" - Civil Engineer in South Africa , January 1973

2. Van der Merwe DH . "The prediction of heave from the Plasticity Index and percentage clay fraction of soils" - Civil Engineer in South Africa Vol 6, 1964

3 TRH 14, "Guidelines for Road Construction Materials" - NITRR, 1985

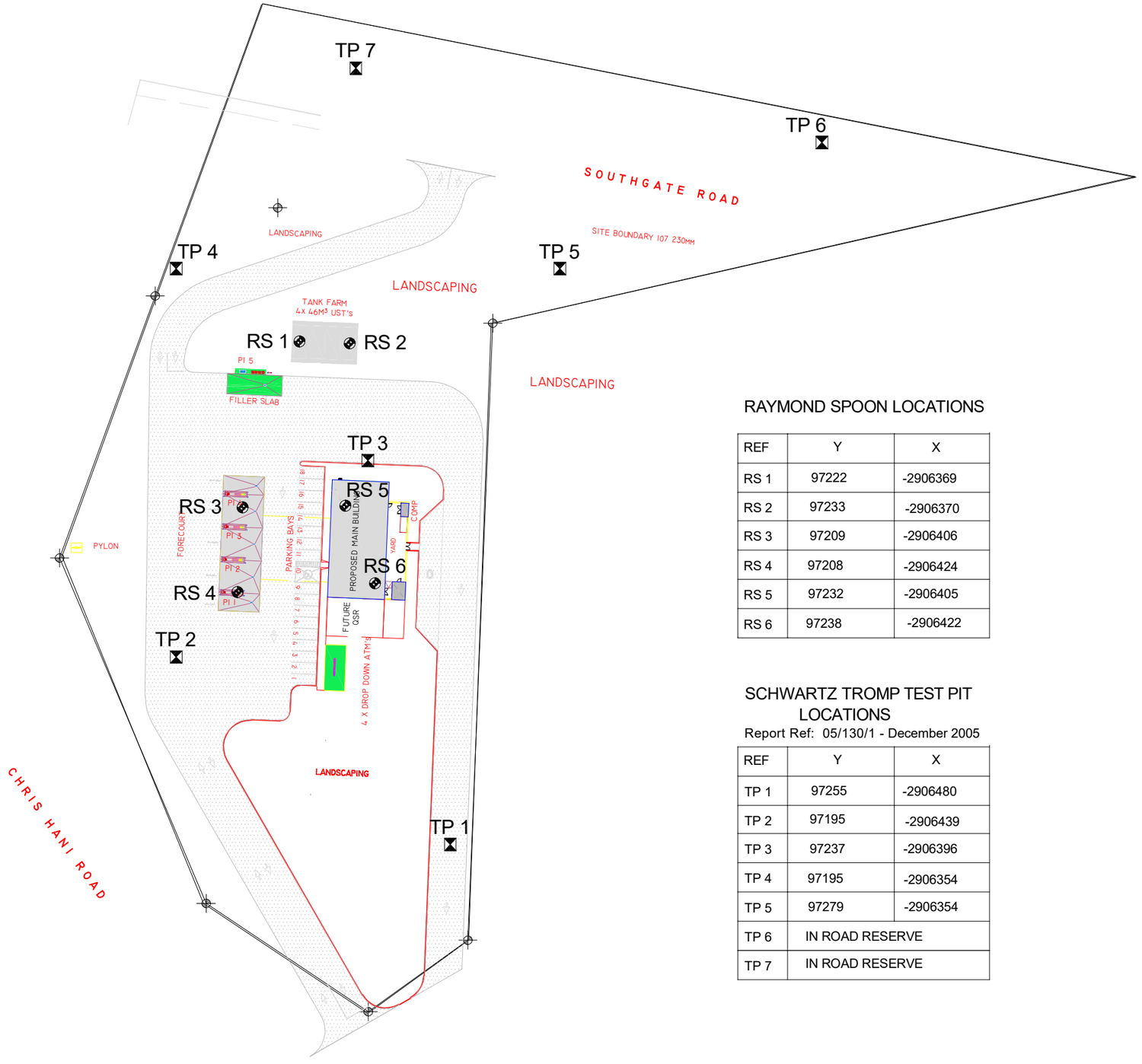
4 Jennings, J and Knight, K. (1975). A guide to construction on or with materials exhibiting additional settlement due to “collapse” of grain structure. Proceedings of the Sixth Regional Conference on Soil Mechanics and Foundation Engineering. Durban

5 Partridge T.C, Wood C.K, Brink A.B.A. “Priorities of urban expansion with in the PWV metropolitan region: “The primacy of geotechnical constraints.” - SAIEG, 1998.

6 Byrne G, Berry A.D “ A Guide to Practical Geotechnical Engineering in Southern Africa fourth edition 2008”

APPENDIX 1

SITE PLAN, LOCALITY PLAN & GEOLOGY PLAN



LEGEND

RS 2	Raymond Spoon Sample Location
TP 6	Schwartz Tromp Test Pit Location

RAYMOND SPOON LOCATIONS

REF	Y	X
RS 1	97222	-2906369
RS 2	97233	-2906370
RS 3	97209	-2906406
RS 4	97208	-2906424
RS 5	97232	-2906405
RS 6	97238	-2906422

SCHWARTZ TROMP TEST PIT LOCATIONS

Report Ref: 05/130/1 - December 2005

REF	Y	X
TP 1	97255	-2906480
TP 2	97195	-2906439
TP 3	97237	-2906396
TP 4	97195	-2906354
TP 5	97279	-2906354
TP 6	IN ROAD RESERVE	
TP 7	IN ROAD RESERVE	

REV	DATE	
A	Jul '20	ISSUED WITH REPORT

Geopractica
GEOTECHNICAL INVESTIGATIONS
SOIL & CONCRETE TESTING
ENGINEERING SURVEYING
FOUNDATION DESIGN

BOX 227, MARAISBURG, 1700
CONSTRUCTION HOUSE
176 MIMOSA/PORTIA STREET
FLORIDA EXT. 17
SOUTH AFRICA
TEL: (011) 674-1325 (8 LINES)
FAX: (011) 674-4513

BOLENG ENGINEERING MANAGEMENT

SHELL AERODROME SERVICE STATION
TEST PIT LOCATIONS

SCALE	DRAWN	CHECKED	DATE
varies	SR	CD	Jul '20
	DRAWING NO.	FILE No.	REV
	200133-01	200133-01	A

Geopractica

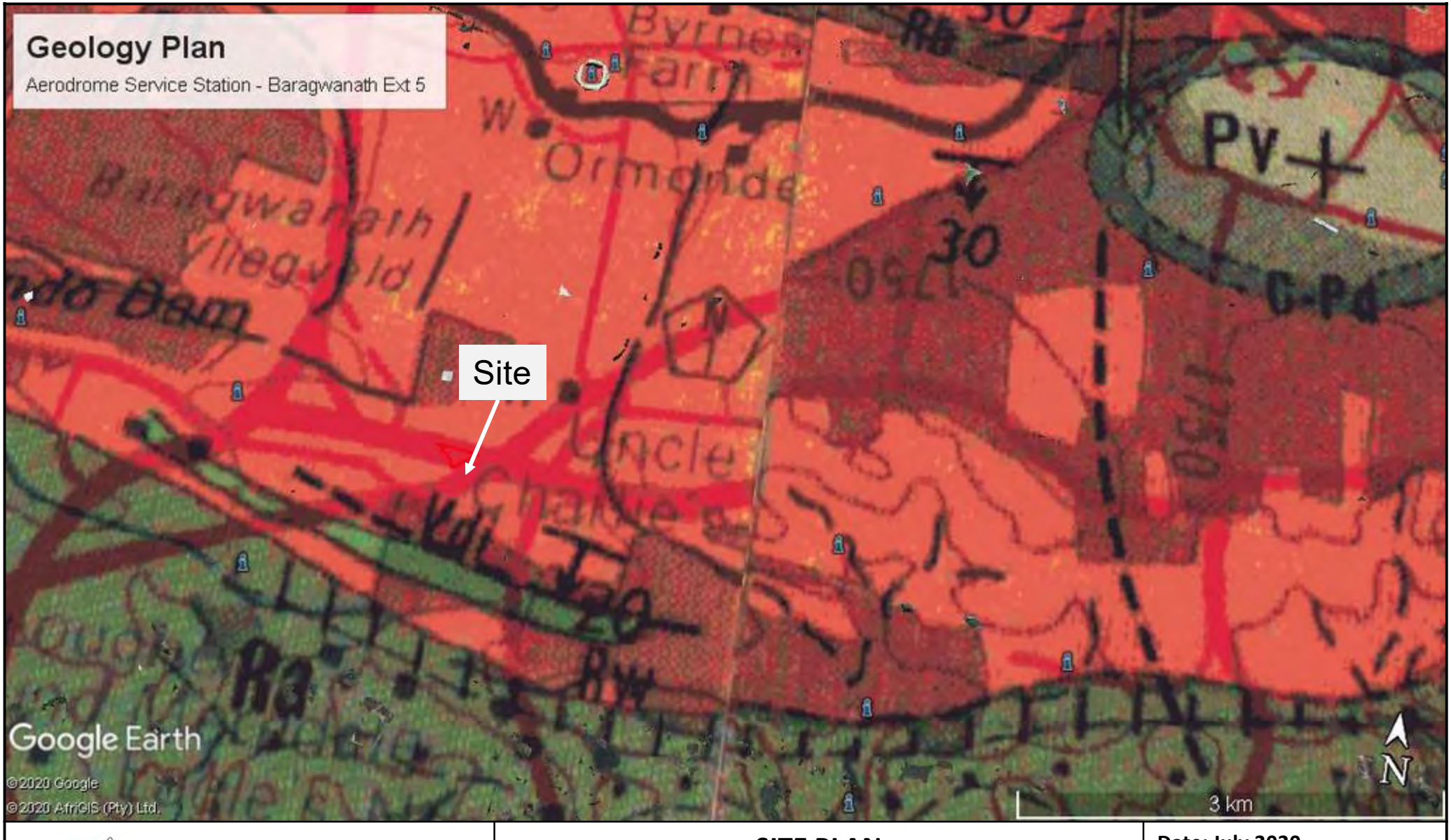
SITE PLAN

Boleng Engineering Management
The Farm 751, Registration Div. I.Q., Province of Gauteng
Shell Aerodrome - Baragwanath Ext 5

Date: July 2020

Job No: 200133

Figure: 1



Geopractica

SITE PLAN

Boleng Engineering Management
The Farm 751, Registration Div. I.Q., Province of Gauteng
Shell Aerodrome - Baragwanath Ext 5

Date: July 2020

Job No: 200133

Figure: 2

APPENDIX 2

TRIAL HOLE PROFILES

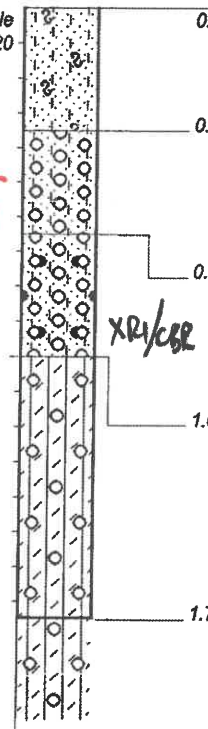
(STA December 2005)

Schwartz Tromp and Associates
Consulting Geotechnical Engineers

BARAGWANATH EXT.5
YE Projects

HOLE No: TP1
Sheet 1 of 1

JOB NUMBER: 05/130



Slightly moist, yellowish brown, loose, porous, silty fine sand, roots.

AEOLIAN

Slightly moist, yellowish brown, loose, porous, silty fine sand hosting local sub angular quartz gravel.

PEBBLE MARKER

Dry to slightly moist, mustard orange blotched black and brown, dense, ferricrete, silty sand with clast supported gravels.

Ferruginised PEBBLE MARKER

Slightly moist, mauve speckled pink and orange blotched mustard khaki, medium dense through dense, relict structured, slightly clayey silt with sub rounded gravel.

Ferruginised Reworked RESIDUAL QUARTZITE

Refusal on above.

NOTES

1) No seepage or water table encountered.

2) No samples taken.

CONTRACTOR : Geoid Earthworks Services
MACHINE : Cat 428C
DRILLED BY : Phillip
PROFILED BY : CS Morgan

TYPE SET BY : Ross
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 3,0 x 0,75m
DATE : 11/11/2005
DATE : 11/11/2005

DATE : 10/07/06 09:56
TEXT : ..\PROFILES\05130B~1.TXT

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP1

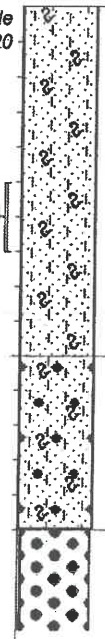
Schwartz Tromp and Associates
Consulting Geotechnical Engineers

BARAGWANATH EXT.5
YE Projects

HOLE No: TP2
Sheet 1 of 1

JOB NUMBER: 05/130

Scale 1:20



G6

L
cl = 9%

0.00	Dry to slightly moist, brown through light orange, loose, porous, silty sand, roots to 0,2m. AEOLIAN
1.00	Matrix as above hosting scattered ferricrete concretions. Ferruginised AEOLIAN
1.50	Refusal on Hardpan FERRICRETE

NOTES

1) No seepage or water table encountered.

2) Undisturbed sample U2/1 taken at 0,5m--0,7m.

CONTRACTOR : Geoid Earthworks Services
MACHINE : Cat 428C
DRILLED BY : Phillip
PROFILED BY : CS Morgan

TYPE SET BY : Ross
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 3,0 x 0,75m
DATE : 11/11/2005
DATE : 11/11/2005

DATE : 10/07/06 09:56
TEXT : ..\PROFILES\05130B~1.TXT

ELEVATION :
X-COORD :
Y-COORD :

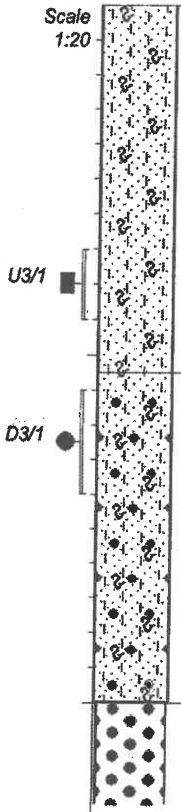
HOLE No: TP2

Schwartz Tromp and Associates
Consulting Geotechnical Engineers

BARAGWANATH EXT.5
YE Projects

HOLE No: TP3
Sheet 1 of 1

JOB NUMBER: 05/130



0.00

Slightly moist, brown through brownish orange, loose, porous, silty sand, roots and ash up to 0,2m.

AEOLIAN

1.05

Matrix as above with local ferricrete nodules.

Ferruginised AEOLIAN

2.00

Refusal on Hardpan FERRICRETE

NOTES

1) No seepage or water table encountered.

2) Undisturbed sample U3/1 taken at 0,7m--0,9m.

3) Disturbed sample taken D3/1 at 1,1m--1,4m.

CONTRACTOR : Geoid Earthworks Services
MACHINE : Cat 428C
DRILLED BY : Phillip
PROFILED BY : CS Morgan

TYPE SET BY : Ross
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 3,0 x 0,75m
DATE : 11/11/2005
DATE : 11/11/2005

DATE : 10/07/06 09:56
TEXT : ..\PROFILES\05130B~1.TXT

ELEVATION :
X-COORD :
Y-COORD :

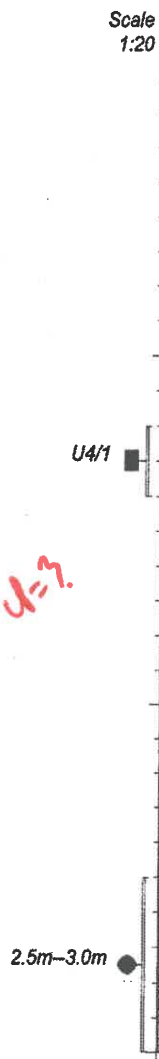
HOLE No: TP3

Schwartz Tromp and Associates
Consulting Geotechnical Engineers

BARAGWANATH EXT.5
YE Projects

HOLE No: TP4
Sheet 1 of 1

JOB NUMBER: 05/130



0.00

Slightly moist, banded orange and brown, loose, porous, mixed soil and gravel.

FILL

1.00

Moist, brown through pinkish orange, loose, porous, slightly clayey silty sand.

AEOLIAN

2.50

Moist, pinkish red blotched khaki and black, loose to medium dense, clayey fine sand hosting ferricrete concretions.

Ferruginised AEOLIAN

3.00

NOTES

1) Not at refusal.

2) No seepage or water table encountered.

3) Undisturbed sample U4/1 taken at 1,2m--1,4m.

4) Disturbed sample D4/1taken at 2,5m--3,0m.

CONTRACTOR : Geoid Earthworks Services
MACHINE : Cat 428C
DRILLED BY : Phillip
PROFILED BY : CS Morgan
TYPE SET BY : Ross
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 3,0 x 0,75m
DATE : 11/11/2005
DATE : 11/11/2005
DATE : 10/07/06 09:56
TEXT : ..\PROFILES\05130B~1.TXT

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP4

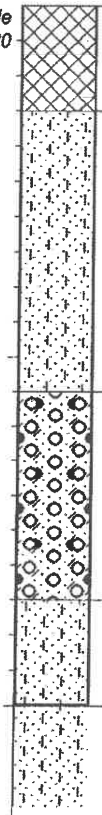
Schwartz Tromp and Associates
Consulting Geotechnical Engineers

BARAGWANATH EXT.5
YE Projects

HOLE No: TP5
Sheet 1 of 1

JOB NUMBER: 05/130

Scale 1:20



0.00	Dry to slightly moist, pale orange speckled off white, loose, mixed soils. FILL
0.30	Slightly moist, brown through yellowish brown, loose, porous, silty fine sand. AEOLIAN
1.10	Slightly moist, pinkish brown blotched dusky red, loose to medium dense, slightly ferruginised, clast supported, sub rounded gravel with clayey fine sand and fill. PEBBLE MARKER
1.70	Slightly moist, pinkish red blotched pale yellow, dense, silty sand. RESIDUAL QUARTZITE
2.00	Effective refusal on very dense RESIDUAL QUARTZITE.

NOTES

1) No seepage or water table encountered.

2) No samples taken.

CONTRACTOR : Geoid Earthworks Services
MACHINE : Cat 428C
DRILLED BY : Phillip
PROFILED BY : CS Morgan

TYPE SET BY : Ross
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM : 3,0 x 0,75m
DATE : 11/11/2005
DATE : 11/11/2005

DATE : 10/07/06 09:56
TEXT : ..\PROFILES\05130B~1.TXT

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: TP5

APPENDIX 3

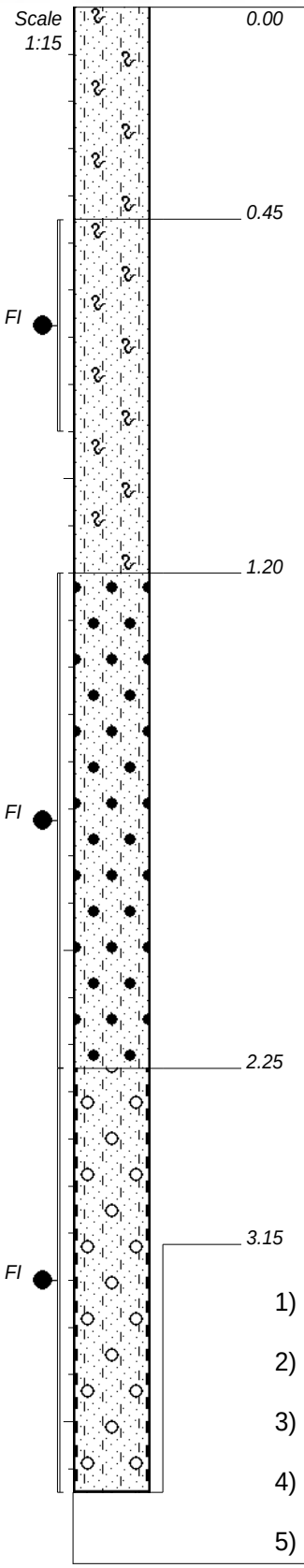
RAYMOND SPOON PROFILES

Geopractica

Boleng Engineering Management
Shell Aerodrome

HOLE No: RS1
Sheet 1 of 1

JOB NUMBER: 200133



0.00 Slightly moist, dark brown, loose, intact, silty sand with scattered fine roots: Topsoil.

0.45 Slightly moist, brown, loose, intact, silty sand with scattered fine roots: Hillwash.

1.20 Moist, light brown mottled maroon, loose, intact, silty sand with soft ferricrete nodules: Reworked Residual Quartzite.

2.25 Slightly moist, yellow brown blotched and mottled maroon with black specks, medium dense becoming very dense at the bottom, partially cemented, ferruginised gravelly silty sand: Residual Quartzite.

3.15

NOTES

1) EOH @ 3.15m, refusal of SPT
2) No water seepage observed
3) Disturbed sample FI @ 0.45--0.9m
4) Disturbed sample FI @ 1.20--2.25m
5) Disturbed sample FI @ 2.25--3.15m

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : TS

INCLINATION : Vertical
DIAM :
DATE : 17/07/2020
DATE : 23/07/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: RS1

TYPE SET BY : Sofia
SETUP FILE : STANDARD.SET

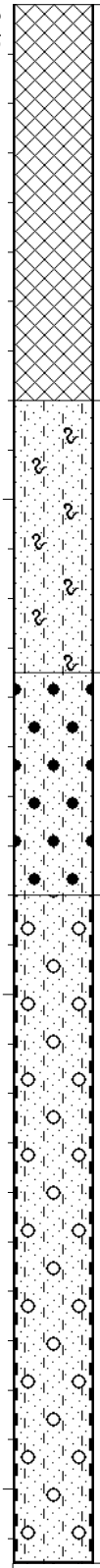
DATE : 23/07/2020 14:01
TEXT : ..0133ShellAerodromeRS.txt

Boleng Engineering Management
Shell Aerodrome

HOLE No: RS2
Sheet 1 of 1

JOB NUMBER: 200133

Scale 1:15



0.00	Slightly moist, maroon red, silty sand: Fill.
0.80	Slightly moist, brown, loose, intact, silty sand with scattered fine roots: Hillwash.
1.35	Moist, light brown mottled maroon, loose, intact, silty sand with soft ferricrete nodules: Reworked Residual Quartzite.
1.80	Slightly moist, yellow brown blotched and mottled maroon with black specks, medium dense becoming very dense at the bottom, partially cemented, ferruginised gravelly silty sand: Residual Quartzite.
3.15	

NOTES

1) EOH @ 3.15m, refusal of SPT

2) No water seepage observed

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : TS

INCLINATION :
DIAM :
DATE : 17/07/2020
DATE : 23/07/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: RS2

TYPE SET BY : Sofia
SETUP FILE : STANDARD.SET

DATE : 23/07/2020 14:01
TEXT : ..0133ShellAerodromeRS.txt

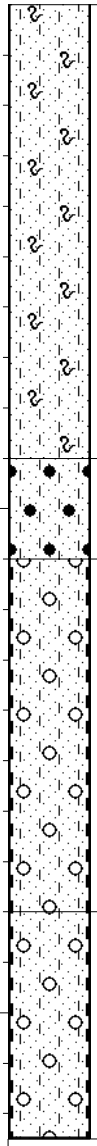
Geopractica

Boleng Engineering Management
Shell Aerodrome

HOLE No: RS3
Sheet 1 of 1

JOB NUMBER: 200133

Scale 1:15



0.00	Slightly moist, brown, loose, intact, silty sand with scattered fine roots: Hillwash.
0.90	Moist, light brown mottled maroon, loose, intact, silty sand with soft ferricrete nodules: Reworked Residual Quartzite.
1.10	Slightly moist, yellow brown blotched and mottled maroon with black specks, medium dense, partially cemented, ferruginised gravelly silty sand: Residual Quartzite.
PH/COND 1.80	As above but dense to very dense.
2.25	

NOTES

1) EOH @ 2.25m, refusal of SPT
2) No water seepage observed
3) Undisturbed sample PH/COND @ 1.35--2.25m

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : TS

INCLINATION :
DIAM :
DATE : 17/07/2020
DATE : 23/07/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: RS3

TYPE SET BY : Sofia
SETUP FILE : STANDARD.SET

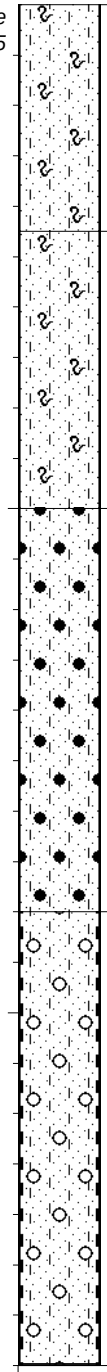
DATE : 23/07/2020 14:01
TEXT : ..0133ShellAerodromeRS.txt

Boleng Engineering Management
Shell Aerodrome

HOLE No: RS4
Sheet 1 of 1

JOB NUMBER: 200133

Scale 1:15



0.00	Slightly moist, dark brown, loose, intact, silty sand with scattered fine roots: Topsoil.
0.45	Slightly moist, brown, loose, intact, silty sand with scattered fine roots: Hillwash.
1.00	Moist, light brown mottled maroon, loose, intact, silty sand with soft ferricrete nodules: Reworked Residual Quartzite.
1.80	Slightly moist, yellow brown blotched and mottled maroon with black specks, medium dense becoming very dense at the bottom, partially cemented, ferruginised gravelly silty sand: Residual Quartzite.
2.70	

NOTES

1) EOH @ 2.7m, refusal of SPT

2) No water seepage observed

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : TS

INCLINATION :
DIAM :
DATE : 17/07/2020
DATE : 23/07/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: RS4

TYPE SET BY : Sofia
SETUP FILE : STANDARD.SET

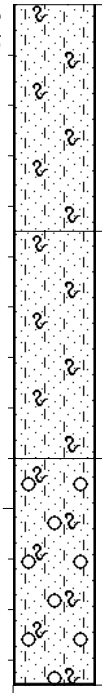
DATE : 23/07/2020 14:01
TEXT : ..0133ShellAerodromeRS.txt

Boleng Engineering Management
Shell Aerodrome

HOLE No: RS5
Sheet 1 of 1

JOB NUMBER: 200133

Scale 1:15



0.00	Slightly moist, dark brown, loose, intact, silty sand with scattered fine roots: Topsoil.
0.45	Slightly moist, brown, loose, intact, silty sand with scattered fine roots: Hillwash.
0.90	Slightly moist, brown, dense to very dense, intact, silty sand with quartz gravel and fine roots: Reworked Residual Quartzite.
1.35	

NOTES

1) EOH @ 1.35m, refusal of SPT

2) No water seepage observed

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : TS

TYPE SET BY : Sofia
SETUP FILE : STANDARD.SET

INCLINATION :
DIAM :
DATE : 17/07/2020
DATE : 23/07/2020

DATE : 23/07/2020 14:01
TEXT : ..0133ShellAerodromeRS.txt

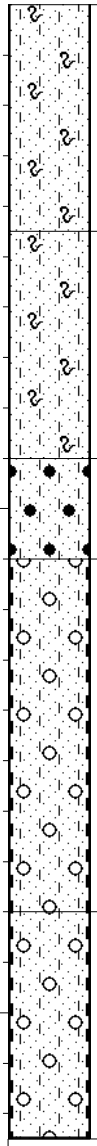
ELEVATION :
X-COORD :
Y-COORD :

HOLE No: RS5

Boleng Engineering Management
Shell Aerodrome

HOLE No: RS6
Sheet 1 of 1

JOB NUMBER: 200133



0.00	Slightly moist, dark brown, loose, intact, silty sand with scattered fine roots: Topsoil.
0.45	Slightly moist, brown, loose, intact, silty sand with scattered fine roots: Hillwash.
0.90	Moist, light brown mottled maroon, loose, intact, silty sand with soft ferricrete nodules: Reworked Residual Quartzite.
1.10	Slightly moist, yellow brown blotched and mottled maroon with black specks, medium dense, partially cemented, ferruginised gravelly silty sand: Residual Quartzite.
1.80	As above but dense to very dense.
2.25	

NOTES

1) EOH @ 2.25m, refusal of SPT
2) No water seepage observed
3) Undisturbed sample FI/PH/COND @ 1.35--2.25m

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY : TS

INCLINATION :
DIAM :
DATE : 17/07/2020
DATE : 23/07/2020

ELEVATION :
X-COORD :
Y-COORD :

HOLE No: RS6

TYPE SET BY : Sofia
SETUP FILE : STANDARD.SET

DATE : 23/07/2020 14:01
TEXT : ..0133ShellAerodromeRS.txt

Boleng Engineering Management
Shell Aerodrome

LEGEND
Sheet 1 of 1

JOB NUMBER: 200133

	GRAVELLY	{SA03}
	SAND	{SA04}
	SILTY	{SA07}
	FERRICRETE NODULES	{SA24}
	PARTIALLY CEMENTED	{SA30}
	FILL	{SA32}
Name	UNDISTURBED SAMPLE	{SA37}
Name	DISTURBED SAMPLE	{SA38}
	ROOTS	{SA40}

CONTRACTOR :
MACHINE :
DRILLED BY :
PROFILED BY :

INCLINATION :
DIAM :
DATE :
DATE :

ELEVATION :
X-COORD :
Y-COORD :

TYPE SET BY : Sofia
SETUP FILE : STANDARD.SET

DATE : 23/07/2020 14:01
TEXT : ..0133ShellAerodromeRS.txt

LEGEND
SUMMARY OF SYMBOLS

APPENDIX 4

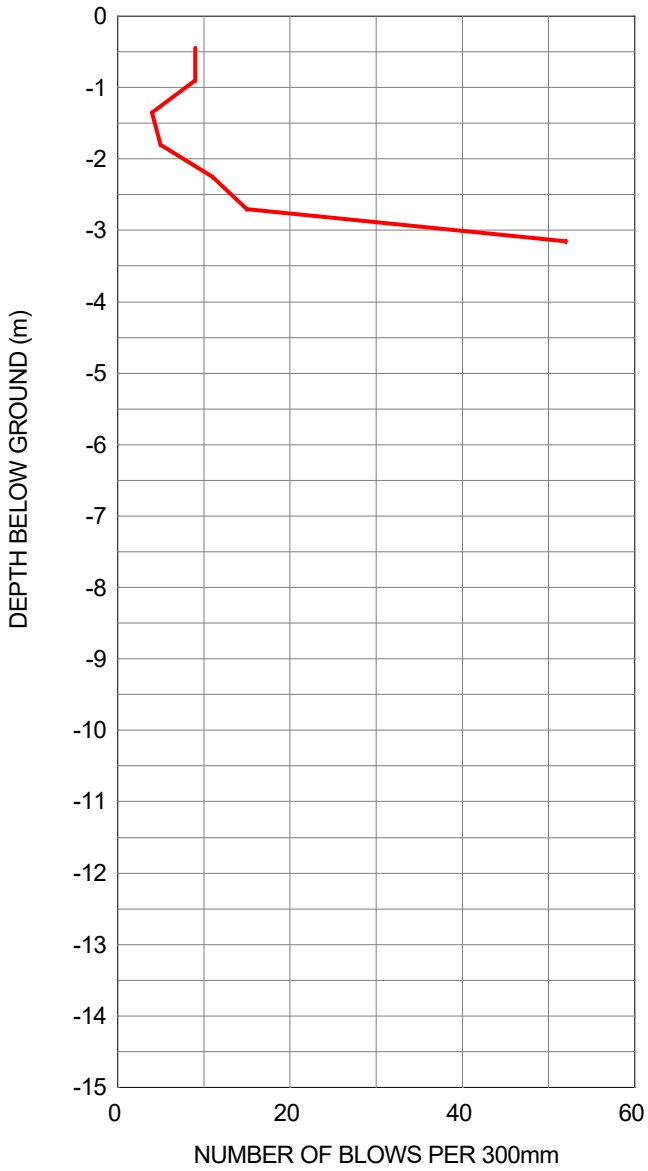
RAYMOND SPOON PROBE RESULTS

Geopractica
SOILS & MATERIALS TESTING
P.O.BOX 227, MARAISBURG, 1700
TEL: (011) 674 1325
FAX: (011) 674 4513
e mail: lab@geopractica.co.za

SPT - CONTINUOUS RAYMOND SPOON

Client	Boleng Engineering Management		
Location	Shell Aerodrome Service Station		
Date	8th July 2020	Test No	RS1
Job No	200133	Checked By	cd

Depth (m)	BLOWS			N"VALUE	
	0-150 :	150-300 :	300-450		
0.45	1	4	5		9
0.90	4	5	4		9
1.35	2	2	2		4
1.80	1	2	3		5
2.25	3	5	6		11
2.70	5	6	9		15
3.15	10	14	38		52
3.60					
4.05					
4.50					
4.95					
5.40					
5.85					
6.30					
6.75					
7.20					
7.65					
8.10					
8.55					
9.00					
9.45					
9.90					
10.35					
10.80					
11.25					
11.70					
12.15					
12.60					
13.05					



NOTES:

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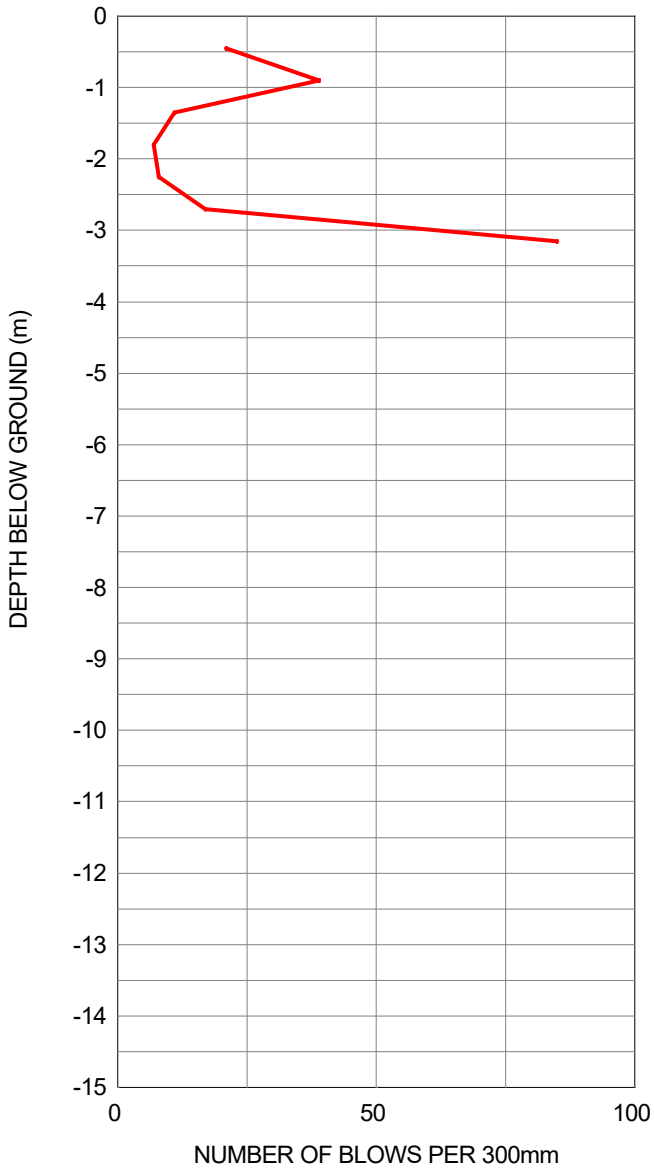
SPT - CONTINUOUS RAYMOND SPOON

Client	Boleng Engineering Management		
Location	Shell Aerodrome Service Station		
Date	8th July 2020	Test No	RS2
Job No	200133	Checked By	cd

Depth (m)	BLOWS			N"VALUE	
	0-150 :	150-300 :	300-450		
0.45	2	10	11		21
0.90	16	24	15		39
1.35	9	6	5		11
1.80	4	4	3		7
2.25	3	4	4		8
2.70	5	5	12		17
3.15	22	40	45		85
3.60					
4.05					
4.50					
4.95					
5.40					
5.85					
6.30					
6.75					
7.20					
7.65					
8.10					
8.55					
9.00					
9.45					
9.90					
10.35					
10.80					
11.25					
11.70					
12.15					
12.60					
13.05					



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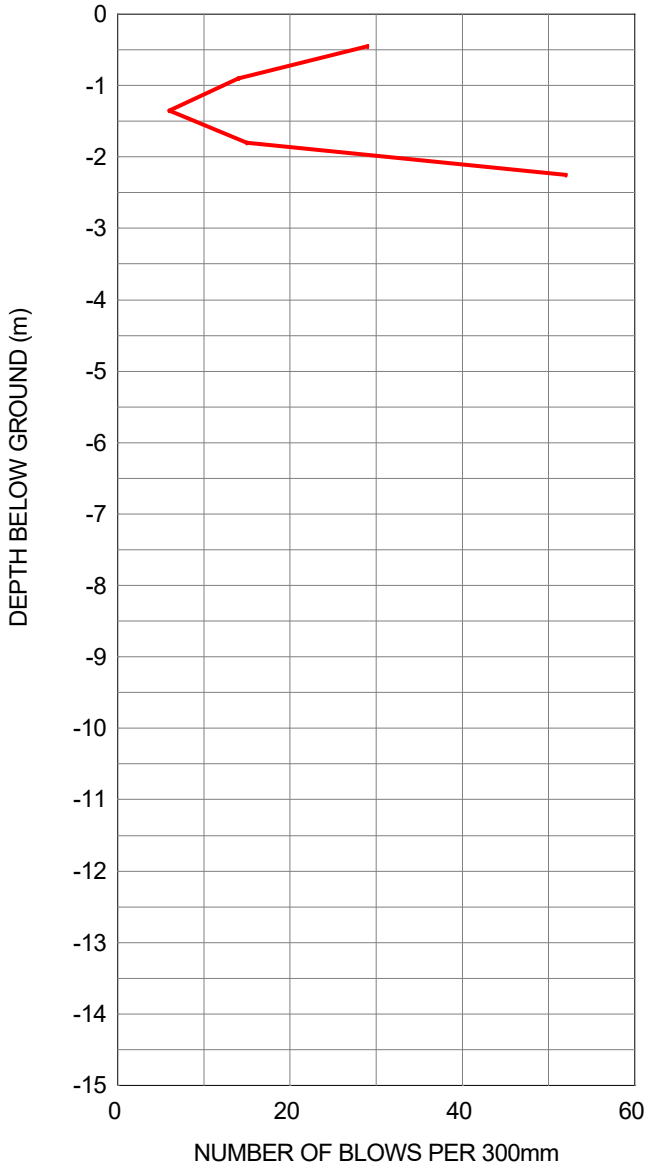
SPT - CONTINUOUS RAYMOND SPOON

Client	Boleng Engineering Management		
Location	Shell Aerodrome Service Station		
Date	8th July 2020	Test No	RS3
Job No	200133	Checked By	cd

Depth (m)	BLOWS			N"VALUE	
	0-150 :	150-300 :	300-450		
0.45	5	14	15		29
0.90	11	8	6		14
1.35	3	3	3		6
1.80	5	5	10		15
2.25	10	17	35		52
2.70					
3.15					
3.60					
4.05					
4.50					
4.95					
5.40					
5.85					
6.30					
6.75					
7.20					
7.65					
8.10					
8.55					
9.00					
9.45					
9.90					
10.35					
10.80					
11.25					
11.70					
12.15					
12.60					
13.05					



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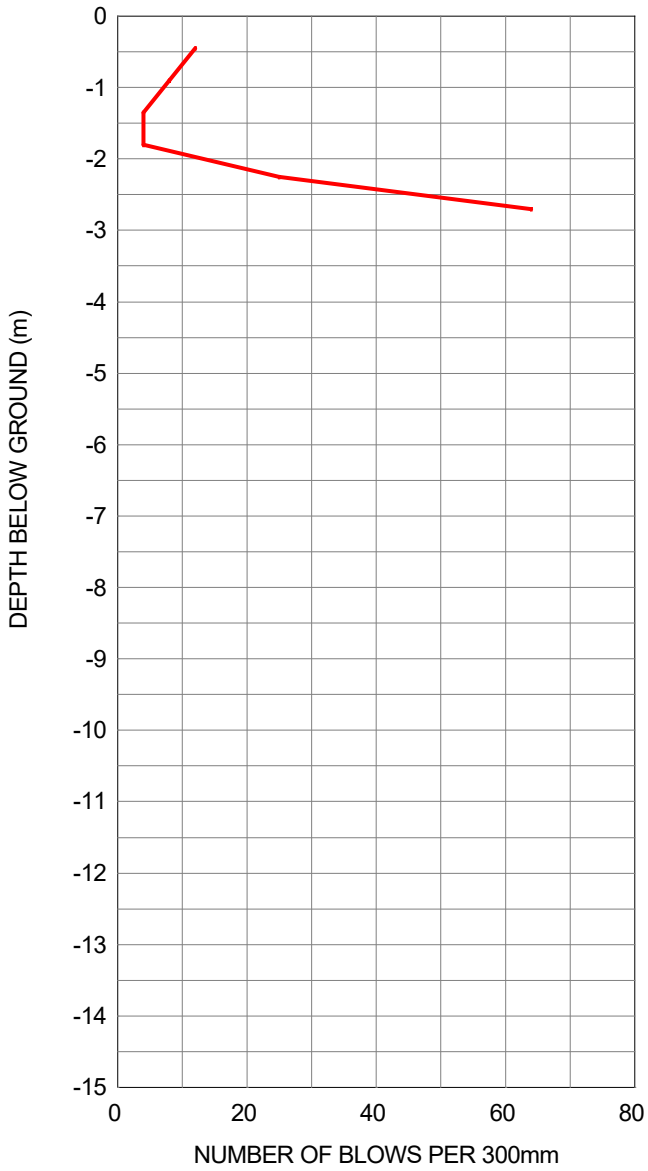
SPT - CONTINUOUS RAYMOND SPOON

Client	Boleng Engineering Management		
Location	Shell Aerodrome Service Station		
Date	8th July 2020	Test No	RS4
Job No	200133	Checked By	cd

Depth (m)	BLOWS			N"VALUE	
	0-150 :	150-300 :	300-450		
0.45	2	5	7		12
0.90	7	5	3		8
1.35	2	2	2		4
1.80	1	2	2		4
2.25	6	9	16		25
2.70	24	25	39		64
3.15					
3.60					
4.05					
4.50					
4.95					
5.40					
5.85					
6.30					
6.75					
7.20					
7.65					
8.10					
8.55					
9.00					
9.45					
9.90					
10.35					
10.80					
11.25					
11.70					
12.15					
12.60					
13.05					



NOTES:

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SPT - CONTINUOUS RAYMOND SPOON

Client	Boleng Engineering Management		
Location	Shell Aerodrome Service Station		
Date	10th Juy 2020	Test No	RS5
Job No	200133	Checked By	cd

Depth (m)	BLOWS			N"VALUE	
	0-150 :	150-300 :	300-450		
0.45	2	6	5		11
0.90	6	5	3		8
1.35	3	4	44		48
1.80					
2.25					
2.70					
3.15					
3.60					
4.05					
4.50					
4.95					
5.40					
5.85					
6.30					
6.75					
7.20					
7.65					
8.10					
8.55					
9.00					
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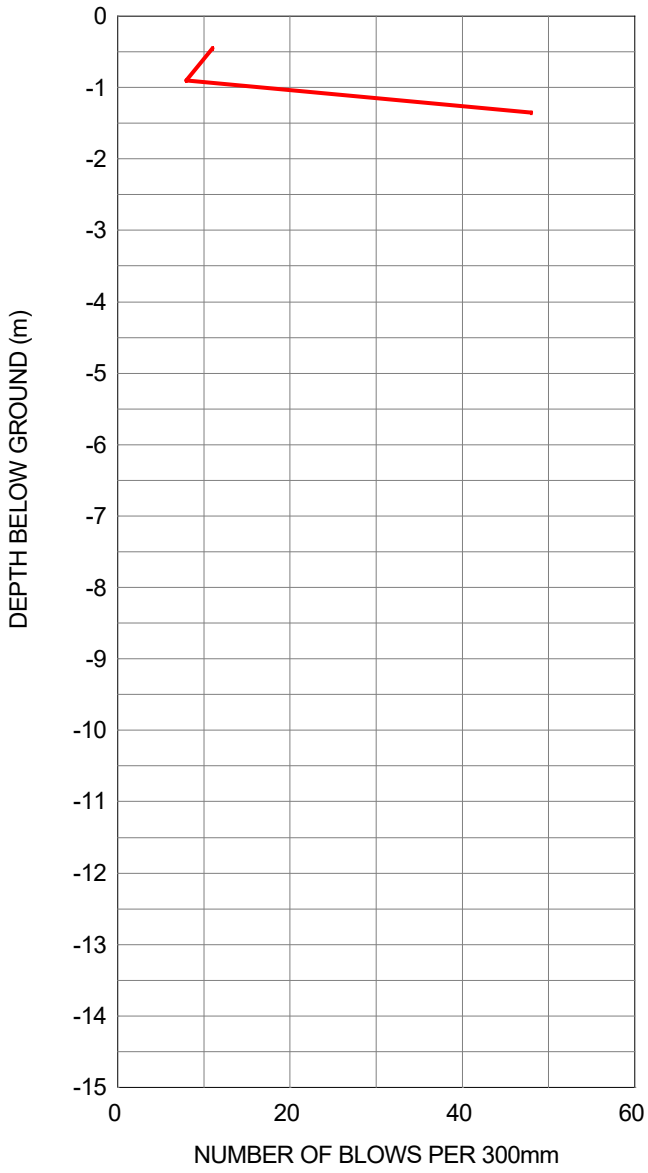
9.90					
10.35					
10.80					
11.25					
11.70					
12.15					
12.60					
13.05					



NOTES:

APPENDIX 5

LABORATORY TEST RESULTS

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FOUNDATION INDICATOR

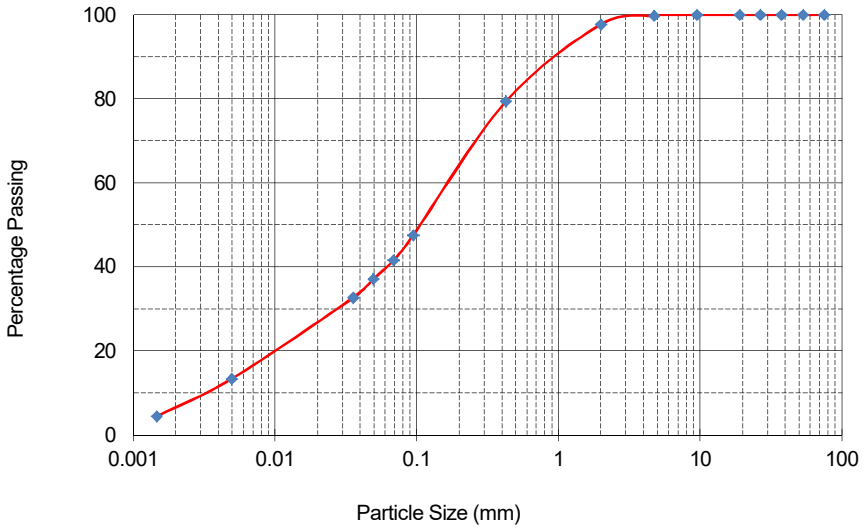
Client	BOLENG ENGINEERING MANAGEMENT		
Location	SHELL AERODROME RS 01 @ 0,45 - 0,9m		
Date	22-Jul-20	Test No	1331
Job No	200133	Checked By	MM

SIEVE ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
75	100.00
53	100.00
37.5	100.00
26.5	100.00
19	100.00
9.5	100.00
4.75	99.83
2	97.78
0.425	79.45

GRADING ANALYSIS



HYDROMETER ANALYSIS

(TMH 1 Method A6)
Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
0.0946	47.61
0.0687	41.66
0.0495	37.20
0.0356	32.73
0.0049	13.39
0.0015	4.46

ATTERBERG LIMITS & OTHER VALUES

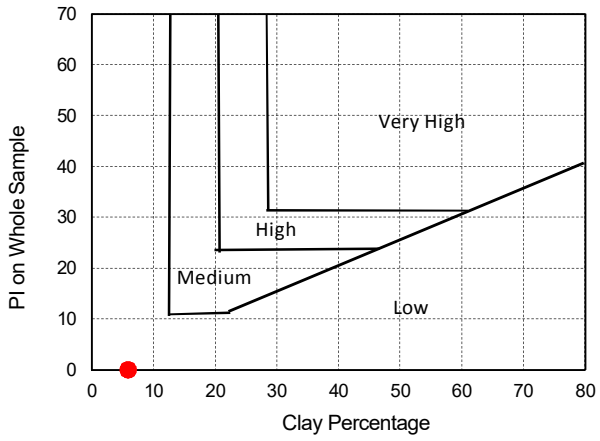
(SANS 3001 - GR10)

Liquid Limit	Non Plastic
Plastic Limit	Non Plastic
Plastic Index	Non Plastic
Linear Shrinkage	0
Grading Modulus	0.80
Moisture Content	9
PI on Whole Sample	Non Plastic
PRA Classification	A.4
Unified Classification	SM
Coefficient of Curvature Cc	1.50
Coefficient of Uniformity Cu	51.52

ESTIMATED COMPOSITION (As BS 1377)

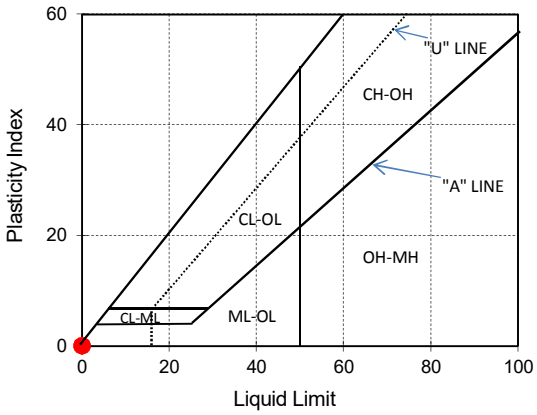
Clay (<0.002)	5.83
0.002 < Silt < 0.06	33.82
0.06 < Sand < 2.0	58.13
Gravel > 2.0	2.22
% less than 0.075	43.11

ACTIVITY CHART



PLASTICITY CHART

Fine Grained Soils: >50% passes 0.075



Revision Number	1	Revised By	sr		Page No.	Page 1 of 1
Date	15-Sep-18		10-Jun-20	Compiled by	Steve Robinson	
Document Number	GTR 021			Authorised by	Colin Dalton	

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FOUNDATION INDICATOR

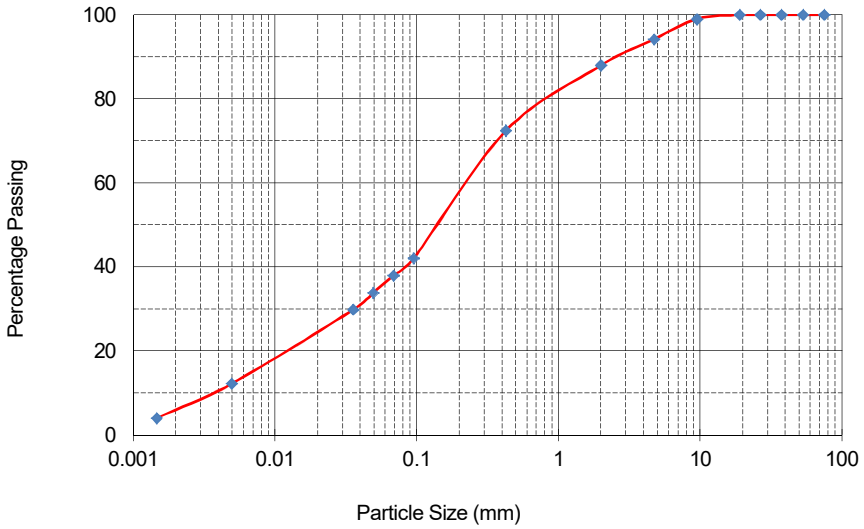
Client	BOLENG ENGINEERING MANAGEMENT		
Location	SHELL AERODROME RS 01 @ 1,2 - 2,25m		
Date	22-Jul-20	Test No	1332
Job No	200133	Checked By	MM

SIEVE ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
75	100.00
53	100.00
37.5	100.00
26.5	100.00
19	100.00
9.5	99.03
4.75	94.26
2	88.01
0.425	72.46

GRADING ANALYSIS



HYDROMETER ANALYSIS

(TMH 1 Method A6)
Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
0.0953	42.07
0.0687	38.00
0.0495	33.92
0.0356	29.85
0.0049	12.21
0.0015	4.07

ATTERBERG LIMITS & OTHER VALUES

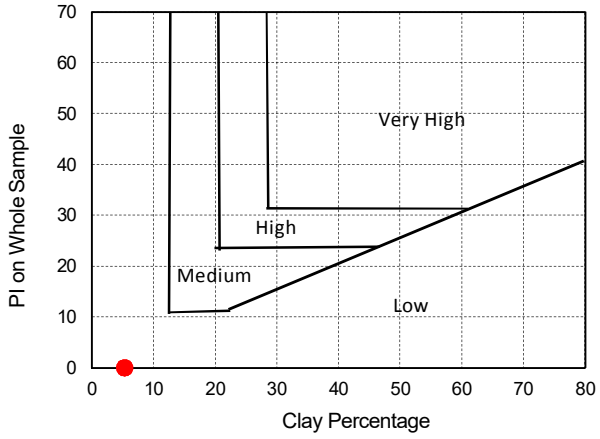
(SANS 3001 - GR10)

Liquid Limit	Non Plastic
Plastic Limit	Non Plastic
Plastic Index	Non Plastic
Linear Shrinkage	0
Grading Modulus	1.01
Moisture Content	12
PI on Whole Sample	Non Plastic
PRA Classification	A.4
Unified Classification	SM
Coefficient of Curvature Cc	1.06
Coefficient of Uniformity Cu	61.11

ESTIMATED COMPOSITION (As BS 1377)

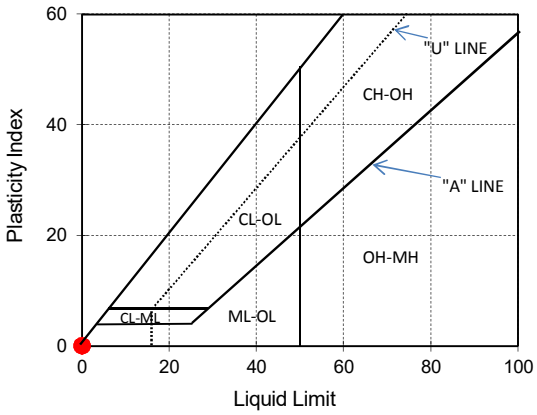
Clay (<0.002)	5.31
0.002 < Silt < 0.06	30.84
0.06 < Sand < 2.0	51.85
Gravel > 2.0	11.99
% less than 0.075	38.96

ACTIVITY CHART



PLASTICITY CHART

Fine Grained Soils: >50% passes 0.075



Revision Number	1	**Revised By**	sr		**Page No.**	Page 1 of 1
Date	15-Sep-18		10-Jun-20	**Compiled by**	Steve Robinson	
Document Number	GTR 021			**Authorised by**	Colin Dalton	

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FOUNDATION INDICATOR

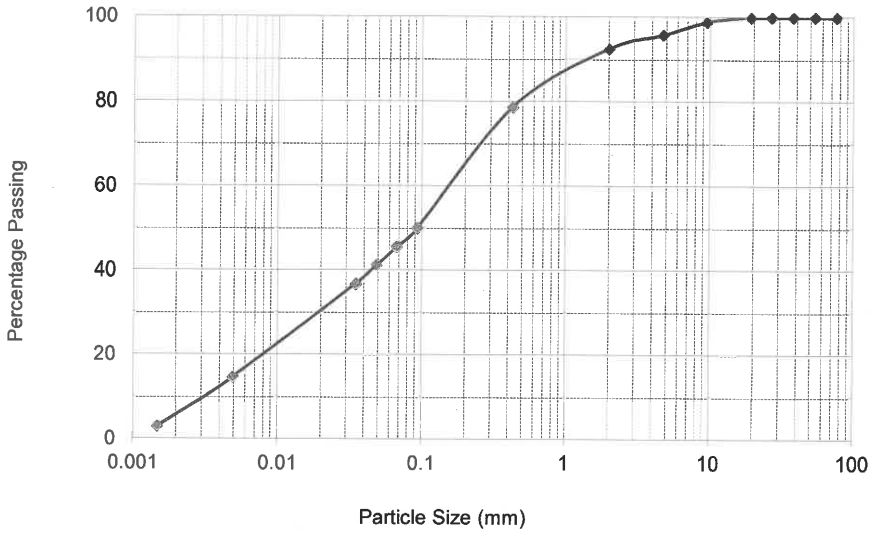
Client	BOLENG ENGINEERING MANAGEMENT		
Location	SHELL AERODROME RS 01 @ 2,25 - 3,15m		
Date	22-Jul-20	Test No	1333
Job No	200133	Checked By	MM

SIEVE ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
75	100.00
53	100.00
37.5	100.00
26.5	100.00
19	100.00
9.5	98.84
4.75	95.81
2	92.54
0.425	78.64

GRADING ANALYSIS



HYDROMETER ANALYSIS

(TMH 1 Method A6)
Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
0.0934	50.07
0.0674	45.65
0.0486	41.23
0.0350	36.82
0.0049	14.73
0.0015	2.95

ATTERBERG LIMITS & OTHER VALUES

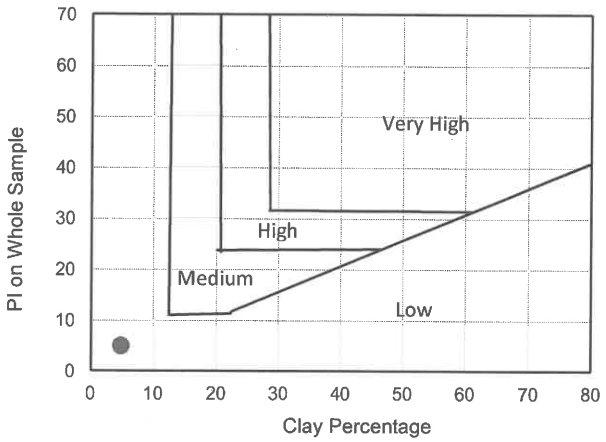
(SANS 3001 - GR10)

Liquid Limit	30
Plastic Limit	24
Plastic Index	6
Linear Shrinkage	3
Grading Modulus	0.82
Moisture Content	13
PI on Whole Sample	5
PRA Classification	A.4
Unified Classification	SM - SC
Coefficient of Curvature Cc	0.67
Coefficient of Uniformity Cu	60.00

ESTIMATED COMPOSITION (As BS 1377)

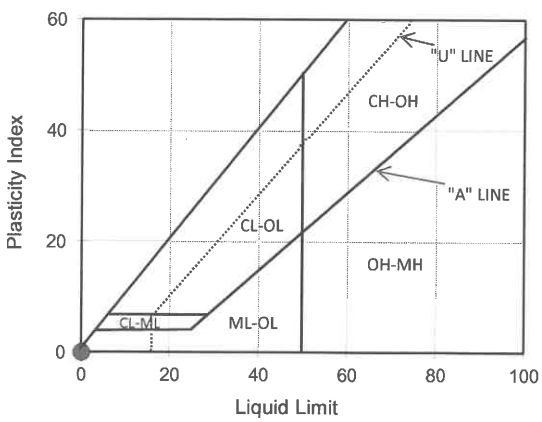
Clay (<0.002)	4.76
0.002 < Silt < 0.06	39.16
0.06 < Sand < 2.0	48.61
Gravel > 2.0	7.46
% less than 0.075	46.95

ACTIVITY CHART



PLASTICITY CHART

Fine Grained Soils: >50% passes 0.075



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Date	15-Sep-18		10-Jun-20	Compiled by	Steve Robinson	
Document Number	GTR 021			Authorised by	Colin Dalton	

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FOUNDATION INDICATOR

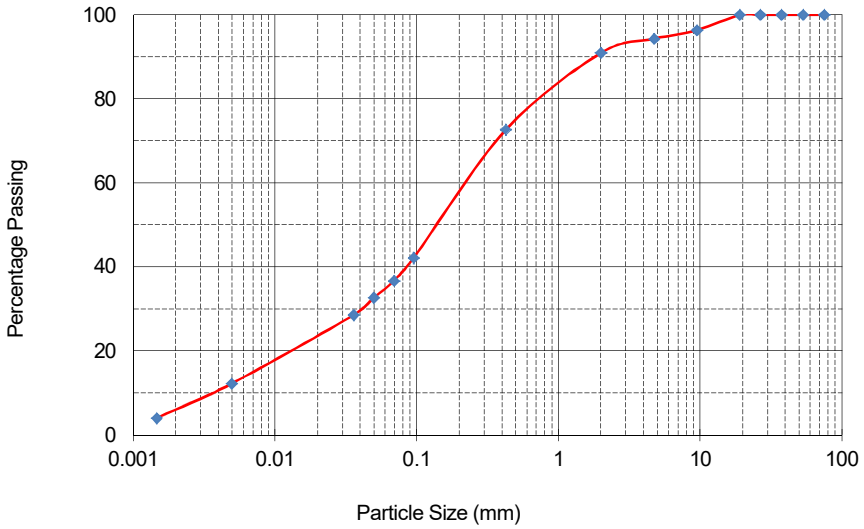
Client	BOLENG ENGINEERING MANAGEMENT		
Location	SHELL AERODROME RS 03 @ 1,35 - 2,25m		
Date	22-Jul-20	Test No	1334
Job No	200133	Checked By	MM

SIEVE ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
75	100.00
53	100.00
37.5	100.00
26.5	100.00
19	100.00
9.5	96.37
4.75	94.35
2	90.97
0.425	72.72

GRADING ANALYSIS



HYDROMETER ANALYSIS

(TMH 1 Method A6)
Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
0.0953	42.22
0.0691	36.77
0.0498	32.69
0.0358	28.60
0.0049	12.26
0.0015	4.09

ATTERBERG LIMITS & OTHER VALUES

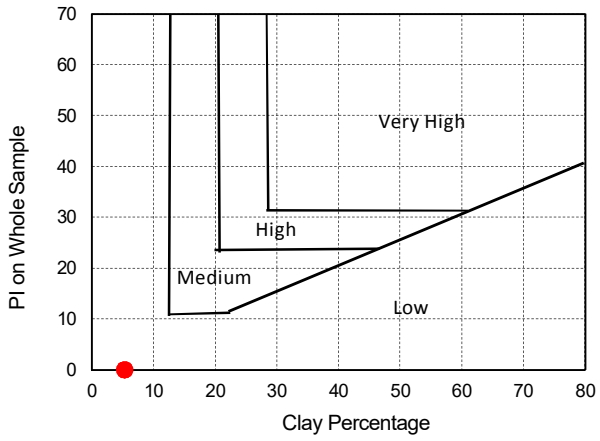
(SANS 3001 - GR10)

Liquid Limit	Non Plastic
Plastic Limit	Non Plastic
Plastic Index	Non Plastic
Linear Shrinkage	0
Grading Modulus	0.98
Moisture Content	14
PI on Whole Sample	Non Plastic
PRA Classification	A.4
Unified Classification	SM
Coefficient of Curvature Cc	1.03
Coefficient of Uniformity Cu	60.53

ESTIMATED COMPOSITION (As BS 1377)

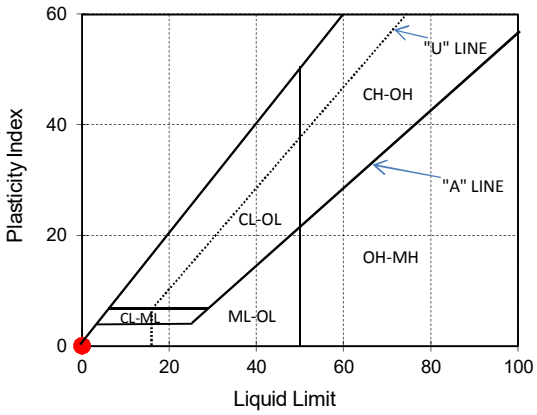
Clay (<0.002)	5.33
0.002 < Silt < 0.06	29.52
0.06 < Sand < 2.0	56.12
Gravel > 2.0	9.03
% less than 0.075	38.00

ACTIVITY CHART



PLASTICITY CHART

Fine Grained Soils: >50% passes 0.075



Revision Number	1	**Revised By**	sr		**Page No.**	Page 1 of 1
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FOUNDATION INDICATOR

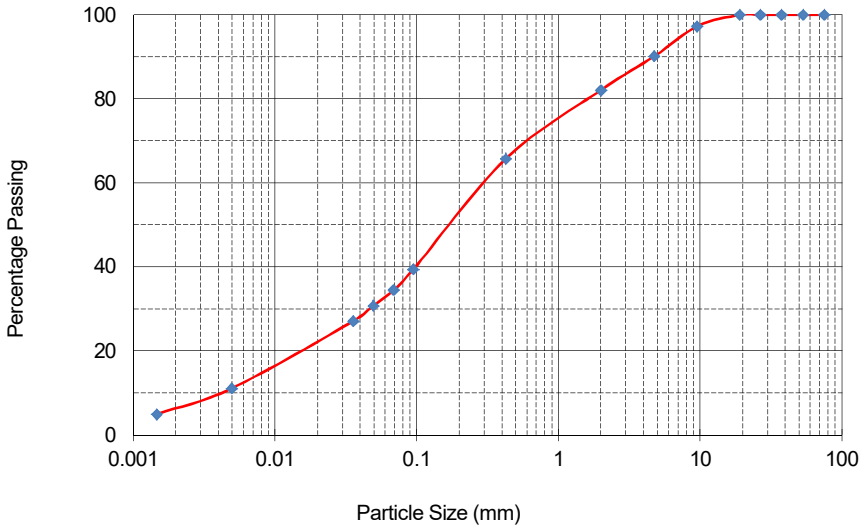
Client	BOLENG ENGINEERING MANAGEMENT		
Location	SHELL AERODROME RS 06 @ 1,35 - 2,25m		
Date	22-Jul-20	Test No	1335
Job No	200133	Checked By	MM

SIEVE ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
75	100.00
53	100.00
37.5	100.00
26.5	100.00
19	100.00
9.5	97.28
4.75	90.20
2	82.15
0.425	65.80

GRADING ANALYSIS



HYDROMETER ANALYSIS

(TMH 1 Method A6)
Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
0.0946	39.43
0.0687	34.50
0.0495	30.81
0.0356	27.11
0.0049	11.09
0.0015	4.93

ATTERBERG LIMITS & OTHER VALUES

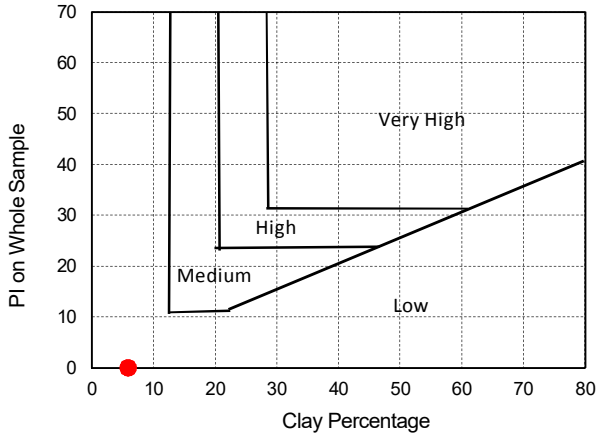
(SANS 3001 - GR10)

Liquid Limit	Non Plastic
Plastic Limit	Non Plastic
Plastic Index	Non Plastic
Linear Shrinkage	0
Grading Modulus	1.16
Moisture Content	17
PI on Whole Sample	Non Plastic
PRA Classification	A.4
Unified Classification	SM
Coefficient of Curvature Cc	1.79
Coefficient of Uniformity Cu	68.89

ESTIMATED COMPOSITION (As BS 1377)

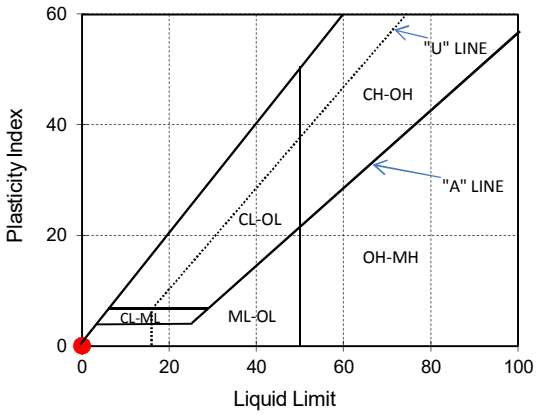
Clay (<0.002)	5.89
0.002 < Silt < 0.06	26.95
0.06 < Sand < 2.0	49.31
Gravel > 2.0	17.85
% less than 0.075	35.71

ACTIVITY CHART



PLASTICITY CHART

Fine Grained Soils: >50% passes 0.075



Revision Number	1	**Revised By**	sr		**Page No.**	Page 1 of 1
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SOIL pH and CONDUCTIVITY TEST RESULT

Client	BOLENG ENGINEERING MANAGEMENT		
Location	SHELL AERODROME		
Date	22 JULY 2020	Test No	
Job No	200133	Checked By	MM

Sample Description	pH	Electrical Conductivity EC (µS/cm)	Total Dissolved Salts TDS (ppm)	Resistivity R (Ohms/cm)
RS 01 @ 0,45 - 0,9m	4.2	82	41	12151
RS 01 @ 1,2 - 2,25m	4.8	66	33	15267
RS 01 @ 2,25 - 3,15,m	4.8	48	24	20833
RS 03 @ 1,35 - 2,25m	4.5	68	34	14706
RS 06 @ 1,35 - 2,25m	4.4	104	52	9588
				ERR
				ERR
				ERR
				ERR
				ERR

pH	Degree of Acidity
<4	Extremely Acidic
4.0 - 5.4	Strongly Acidic
5.5 - 6.4	Moderately Acidic
6.5 - 7.0	Slightly Acidic
7.1 - 7.4	Slightly Alkaline
7.5 - 8.4	Moderately Alkaline
>8.4	Strongly Alkaline

Resistivity (Ohmn/cm)	Degree of Corrosivity
0 - 2 000	Extremely Corrosive
2 000 - 4 000	Very Corrosive
4 000 - 5 000	Corrosive
5 000 - 6 000	Mildly Corrosive
>10 000	Not Generally Corrosive

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ROAD INDICATOR

Client	SCHWARTZ TROMP & ASSOCIATES		
Location	AEROTON	B1/1 @ 0, 5 - 1,0m	
Date	21 NOV 2005	Test No	1794
Job No	05476	Checked By	EB

SIEVE ANALYSIS

Values are expressed as a percentage of the total sample

Sieve Size (mm)	Total Passing (%)
63.00	100.00
53.00	100.00
37.50	96.73
26.50	94.62
19.00	86.45
13.20	74.17
4.75	47.36
2.00	31.76
0.425	24.54
0.075	9.82
0.050	6.87

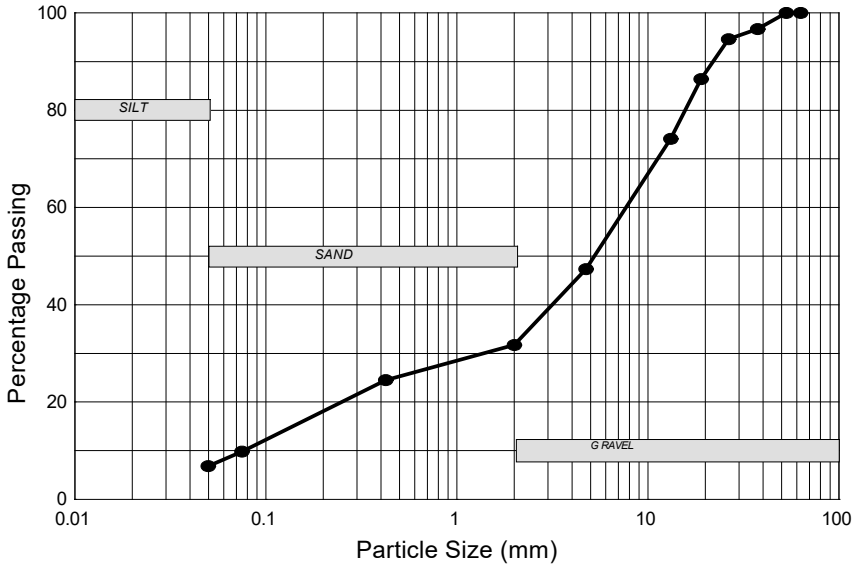
SOIL MORTAR ANALYSIS

Values are expressed as a percentage of the soil mortar

Coarse Sand : 2.0>CS>0.425	22.71
Fine Sand : 0.425>FS>0.05	55.65
Silt : 0.05>S>0.005	21.64
Clay : 0.005>C	0.00

ATTERBERG LIMITS & OTHER VALUES

Liquid Limit	Non Plastic
Plastic Limit	Non Plastic
Plastic Index	Non Plastic
Linear Shrinkage	1
Grading Modulus	2.34
PI on Whole Sample	Non Plastic



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ROAD INDICATOR

Client	SCHWARTZ TROMP & ASSOCIATES		
Location	AEROTON B2/1 @ 0, 5 - 1,0m		
Date	21 NOV 2005	Test No	1795
Job No	05476	Checked By	EB

SIEVE ANALYSIS

Values are expressed as a percentage of the total sample

Sieve Size (mm)	Total Passing (%)
63.00	100.00
53.00	100.00
37.50	100.00
26.50	100.00
19.00	100.00
13.20	99.33
4.75	96.83
2.00	81.95
0.425	66.66
0.075	21.33
0.050	12.00

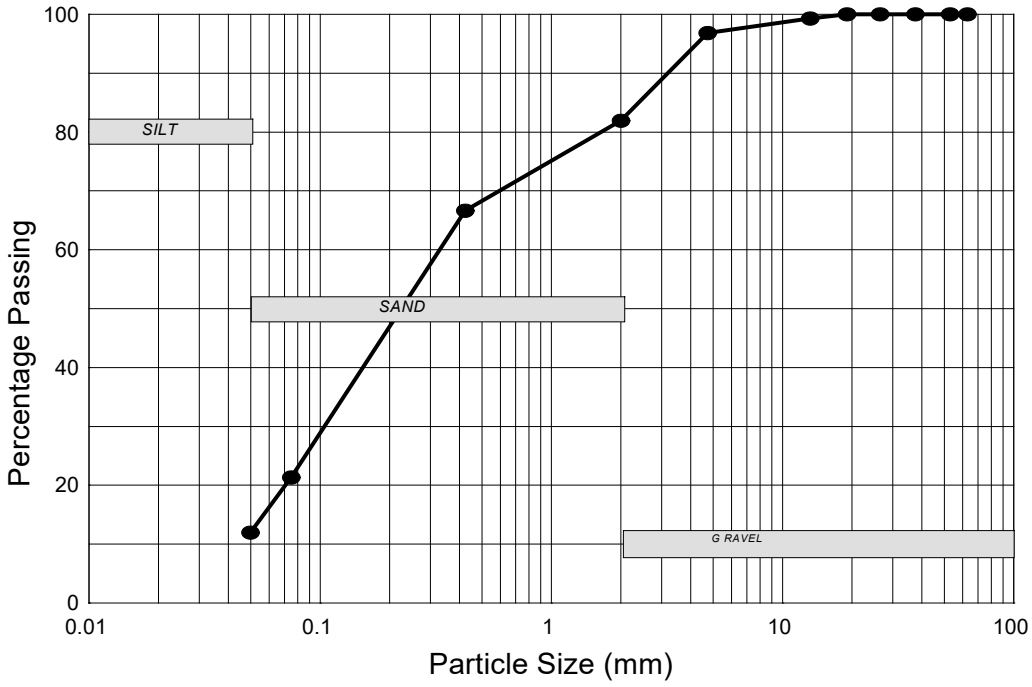
SOIL MORTAR ANALYSIS

Values are expressed as a percentage of the soil mortar

Coarse Sand : 2.0>CS>0.425	18.66
Fine Sand : 0.425>FS>0.05	66.70
Silt : 0.05>S>0.005	14.64
Clay : 0.005>C	0.00

ATTERBERG LIMITS & OTHER VALUES

Liquid Limit	Non Plastic
Plastic Limit	Non Plastic
Plastic Index	Non Plastic
Linear Shrinkage	1
Grading Modulus	1.30
PI on Whole Sample	Non Plastic



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ROAD INDICATOR

Client	SCHWARTZ TROMP & ASSOCIATES		
Location	AEROTON	B2/2 @ 1, 0 - 1,5m	
Date	21 NOV 2005	Test No	1796
Job No	05476	Checked By	EB

SIEVE ANALYSIS

Values are expressed as a percentage of the total sample

Sieve Size (mm)	Total Passing (%)
63.00	100.00
53.00	100.00
37.50	100.00
26.50	100.00
19.00	100.00
13.20	98.11
4.75	85.15
2.00	76.82
0.425	65.78
0.075	26.31
0.050	17.76

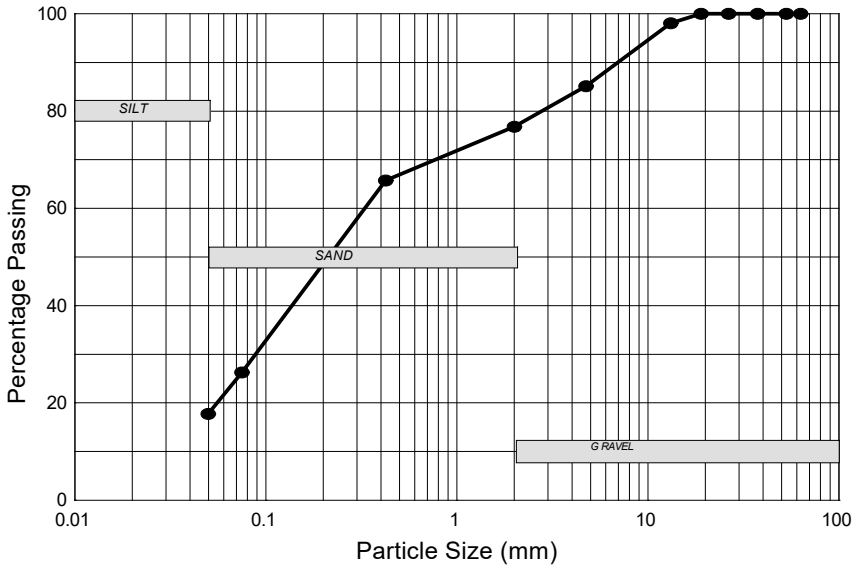
SOIL MORTAR ANALYSIS

Values are expressed as a percentage of the soil mortar

Coarse Sand : 2.0>CS>0.425	14.37
Fine Sand : 0.425>FS>0.05	62.51
Silt : 0.05>S>0.005	23.12
Clay : 0.005>C	0.00

ATTERBERG LIMITS & OTHER VALUES

Liquid Limit	19
Plastic Limit	14
Plastic Index	5
Linear Shrinkage	2
Grading Modulus	1.31
PI on Whole Sample	3



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FOUNDATION INDICATOR

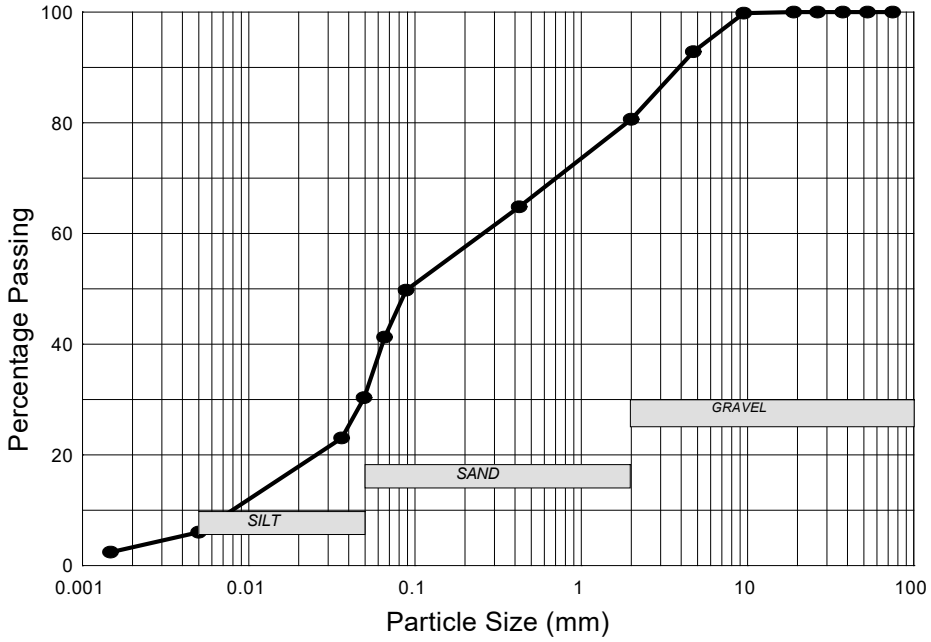
Client	SCHWARTZ TROMP & ASSOCIATES		
Location	AEROTON	D3/1 @ 1,1 - 1,4m	
Date	11 NOV 2005	Test No	1767
Job No	05476	Checked By	EB

SIEVE ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
75.00	100.00
53.00	100.00
37.50	100.00
26.50	100.00
19.00	100.00
9.50	99.86
4.75	92.91
2.00	80.69
0.425	64.85

GRADING ANALYSIS

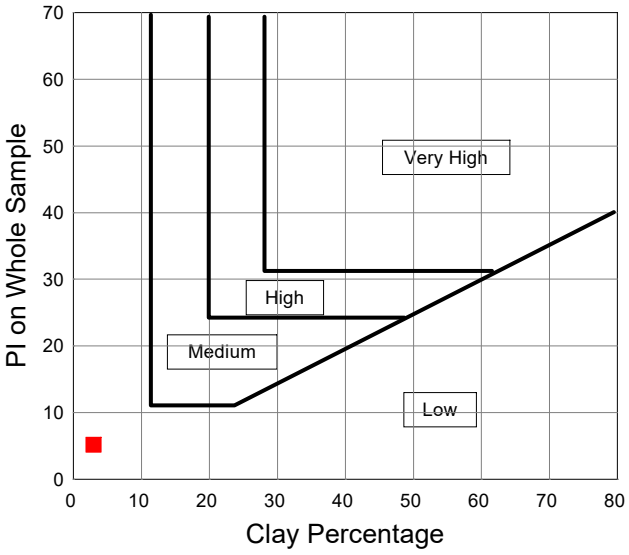


HYDROMETER ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
0.0888	49.80
0.0660	41.29
0.0495	30.36
0.0362	23.08
0.0050	6.07
0.0015	2.43

ACTIVITY CHART



ATTERBERG LIMITS & OTHER VALUES

Liquid Limit	23
Plastic Limit	15
Plastic Index	8
Linear Shrinkage	4
Grading Modulus	1.05
Moisture Content	10.60
PI on Whole Sample	5

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FOUNDATION INDICATOR

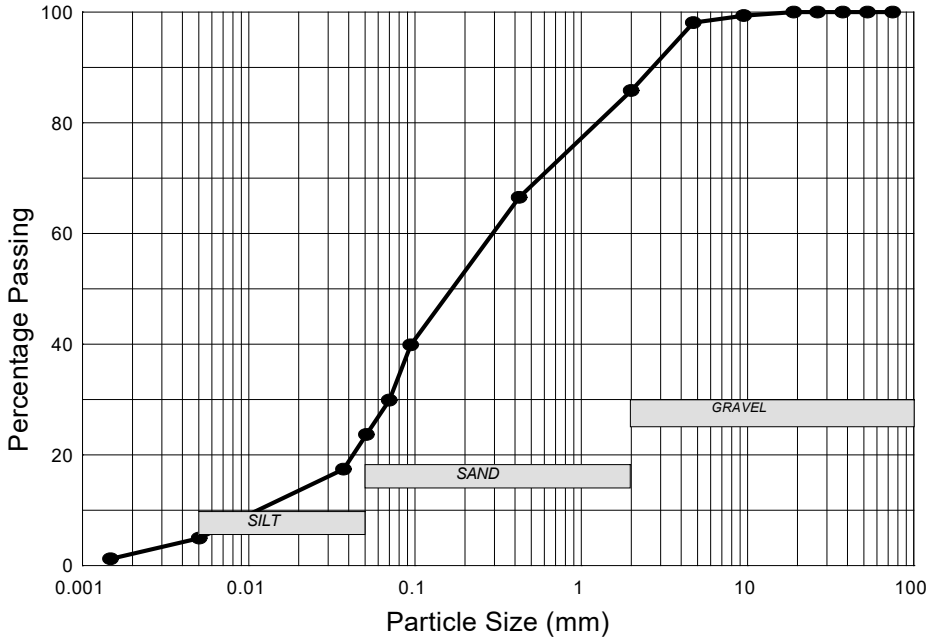
Client	SCHWARTZ TROMP & ASSOCIATES		
Location	AEROTON	U2/1 @ 0,5 - 0,7m	
Date	11 NOV 2005	Test No	1766
Job No	05476	Checked By	EB

SIEVE ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
75.00	100.00
53.00	100.00
37.50	100.00
26.50	100.00
19.00	100.00
9.50	99.41
4.75	98.16
2.00	85.87
0.425	66.58

GRADING ANALYSIS

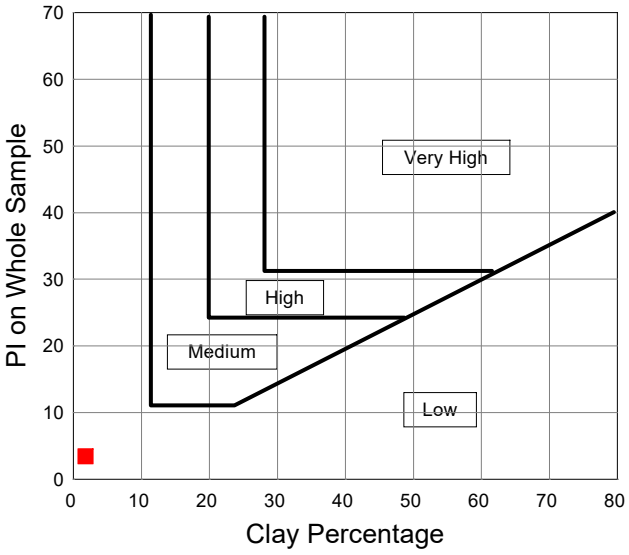


HYDROMETER ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
0.0946	39.90
0.0704	29.92
0.0512	23.69
0.0372	17.46
0.0051	4.99
0.0015	1.25

ACTIVITY CHART



ATTERBERG LIMITS & OTHER VALUES

Liquid Limit	18
Plastic Limit	13
Plastic Index	5
Linear Shrinkage	2
Grading Modulus	1.08
Moisture Content	4.45
PI on Whole Sample	3

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FOUNDATION INDICATOR

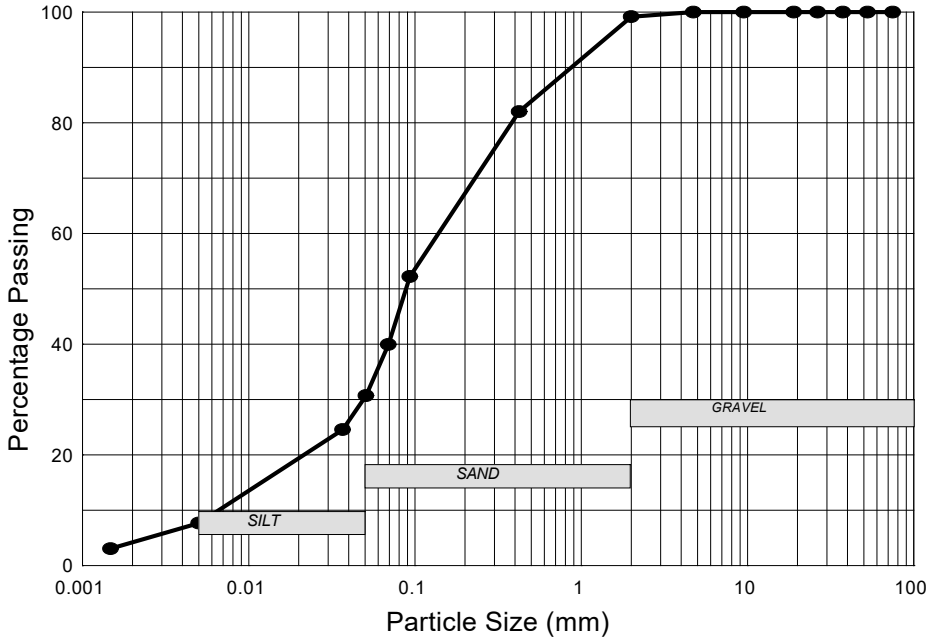
Client	SCHWARTZ TROMP & ASSOCIATES		
Location	AEROTON U4/1 @ 1,2 - 1,4m		
Date	11 NOV 2005	Test No	1768
Job No	05476	Checked By	EB

SIEVE ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
75.00	100.00
53.00	100.00
37.50	100.00
26.50	100.00
19.00	100.00
9.50	100.00
4.75	100.00
2.00	99.21
0.425	82.08

GRADING ANALYSIS

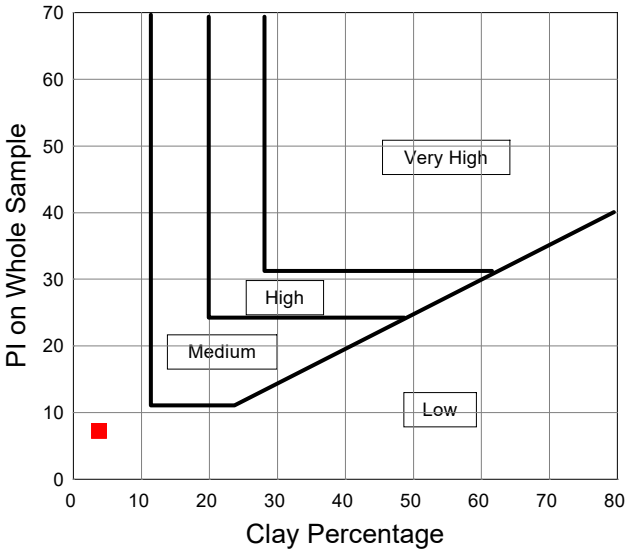


HYDROMETER ANALYSIS

Values are expressed as a percentage of total sample

Sieve Size (mm)	Total Passing (%)
0.0934	52.26
0.0695	39.97
0.0509	30.74
0.0368	24.59
0.0050	7.69
0.0015	3.07

ACTIVITY CHART



ATTERBERG LIMITS & OTHER VALUES

Liquid Limit	20
Plastic Limit	11
Plastic Index	9
Linear Shrinkage	4
Grading Modulus	0.66
Moisture Content	10.36
PI on Whole Sample	7

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C.B.R. DETERMINATION

Client	SCHWARTZ TROMP & ASSOCIATES		
Location	AEROTON	B1/1 @ 0,5 - 1,0m	
Date	21 NOV 2005	Test No	1794
Job No	05476	Checked By	EB

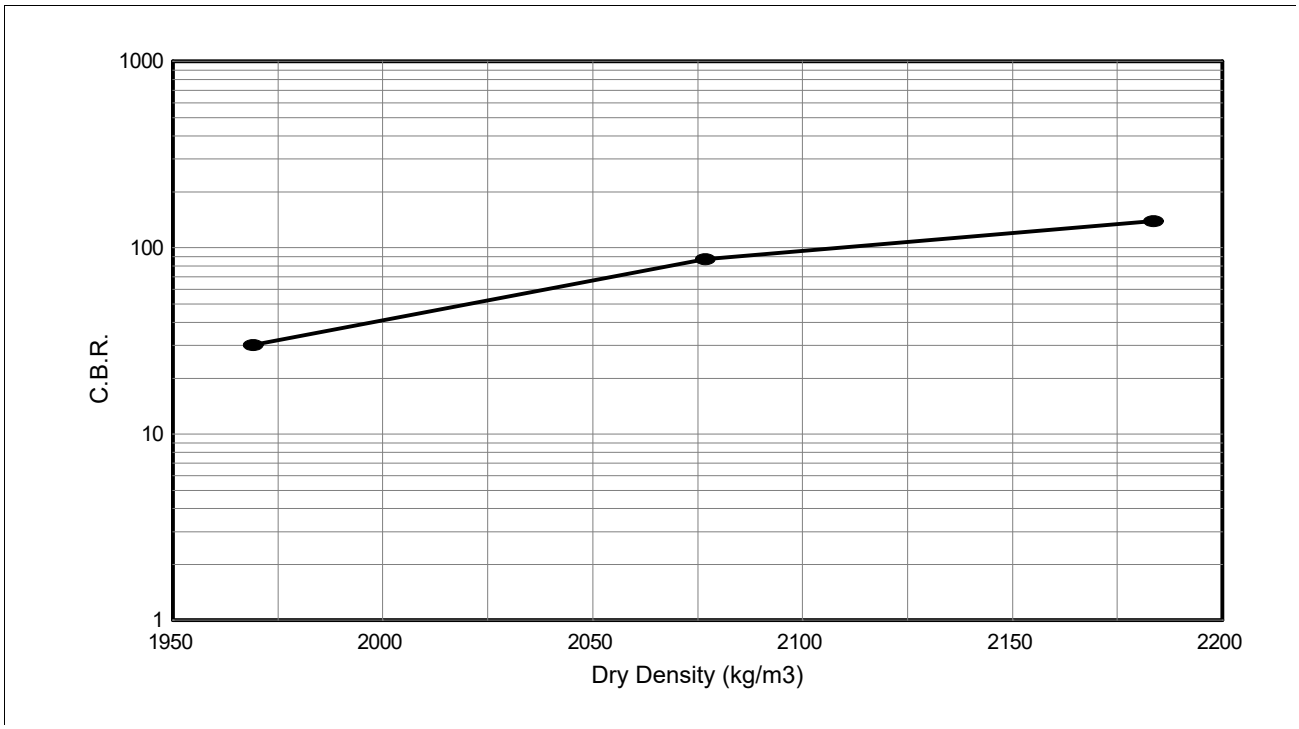
Direct Results from Test Procedure

Maximum Dry Density (kg/m3)	2190	Optimum Moisture Content (%)	6.8

Percentage Mod AASHTO	99.7	94.8	89.9
CBR	139	87	30
Average Moisture Content (%)	7.1		
Percentage Swell	0.06	0.08	0.10

Interpolated Results

Percentage Mod AASHTO	90	93	95	98	100
CBR	32	65	87	121	143



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C.B.R. DETERMINATION

Client	SCHWARTZ TROMP & ASSOCIATES		
Location	AEROTON	B2/1 @ 0,5 - 1,0m	
Date	21 NOV 2005	Test No	1795
Job No	05476	Checked By	EB

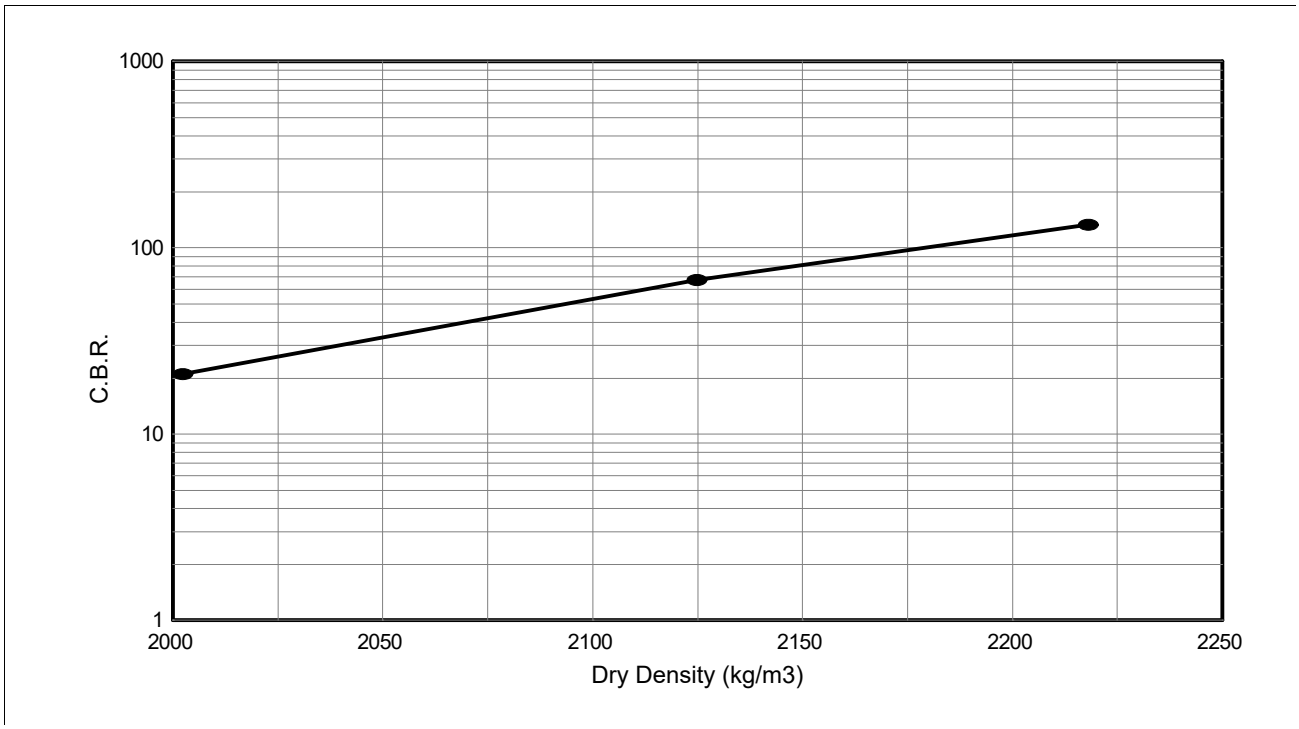
Direct Results from Test Procedure

Maximum Dry Density (kg/m3)	2227	Optimum Moisture Content (%)	6.3

Percentage Mod AASHTO	99.6	95.4	89.9
CBR	133	67	21
Average Moisture Content (%)	6.0		
Percentage Swell	0.04	0.06	0.08

Interpolated Results

Percentage Mod AASHTO	90	93	95	98	100
CBR	17	51	74	108	131



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C.B.R. DETERMINATION

Client	SCHWARTZ TROMP & ASSOCIATES		
Location	AEROTON	B2/2 @ 0,1 - 1,5m	
Date	21 NOV 2005	Test No	1796
Job No	05476	Checked By	EB

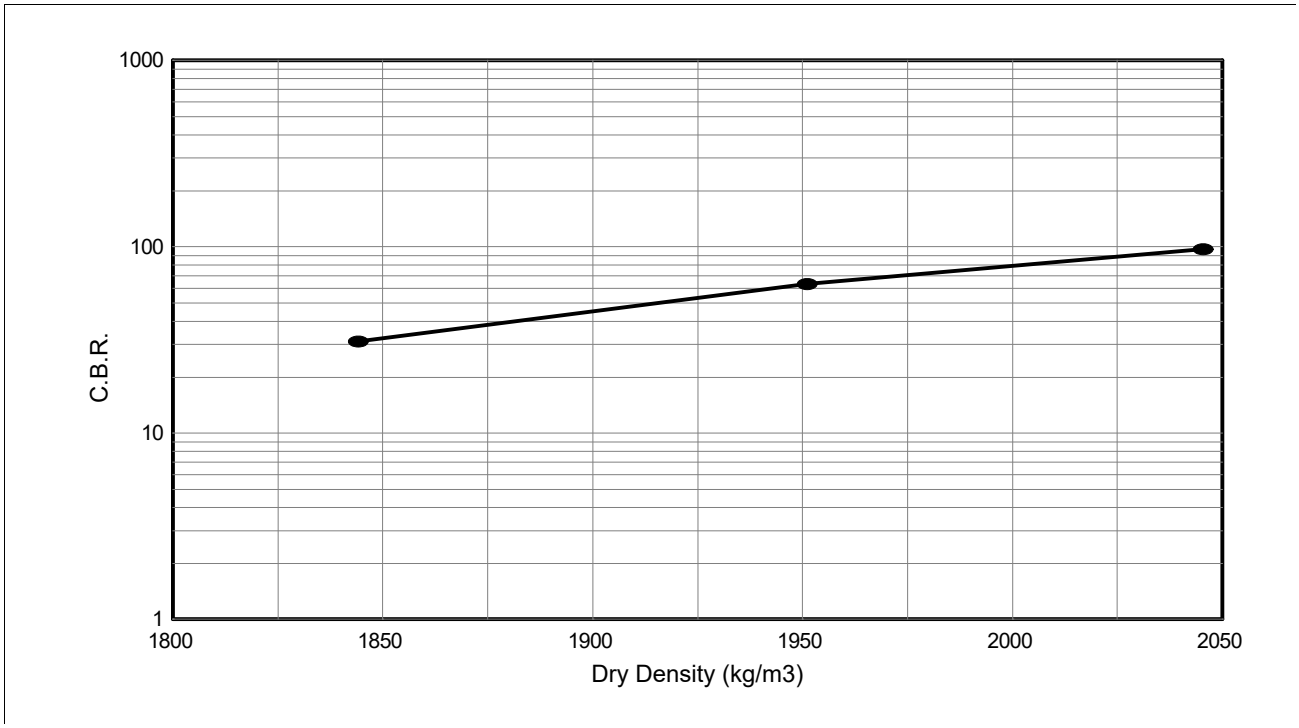
Direct Results from Test Procedure

Maximum Dry Density (kg/m3)	2053	Optimum Moisture Content (%)	11.0

Percentage Mod AASHTO	99.6	95.0	89.8
CBR	97	63	31
Average Moisture Content (%)	10.8		
Percentage Swell	0.04	0.12	0.16

Interpolated Results

Percentage Mod AASHTO	90	93	95	98	100
CBR	31	51	65	85	98



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COLLAPSE POTENTIAL at 200 kPa

Client	SCHWARTZ TROMP & ASSOCIATES		
Location	AEROTON U2/1 @ 0,5 - 0,7m		
Date	11 NOV 2005	Test No	1766
Job No	05476	Checked By	EB

Sample Height (mm)	20	Sample Diameter (mm)	64	Sample Specific Gravity	2.657

Sample Preparation	NMC

Effective Stress (kPa)	Time (mins)	Consolidation Reading	Voids Ratio	Strain (%)
10	10	679	0.779	0.00
10	70	680	0.778	0.05
33	130	691	0.768	0.60
65	250	704	0.757	1.25
127	340	727	0.736	2.40
200	490	745	0.720	3.30
200	1930	922	0.563	12.15
498	2170	998	0.495	15.95
993	2410	1044	0.454	18.25
1868	3850	1089	0.414	20.50
743	3970	1085	0.418	20.30
118	4090	1080	0.422	20.05
10	4210	1070	0.431	19.55

Moisture Content Calculations

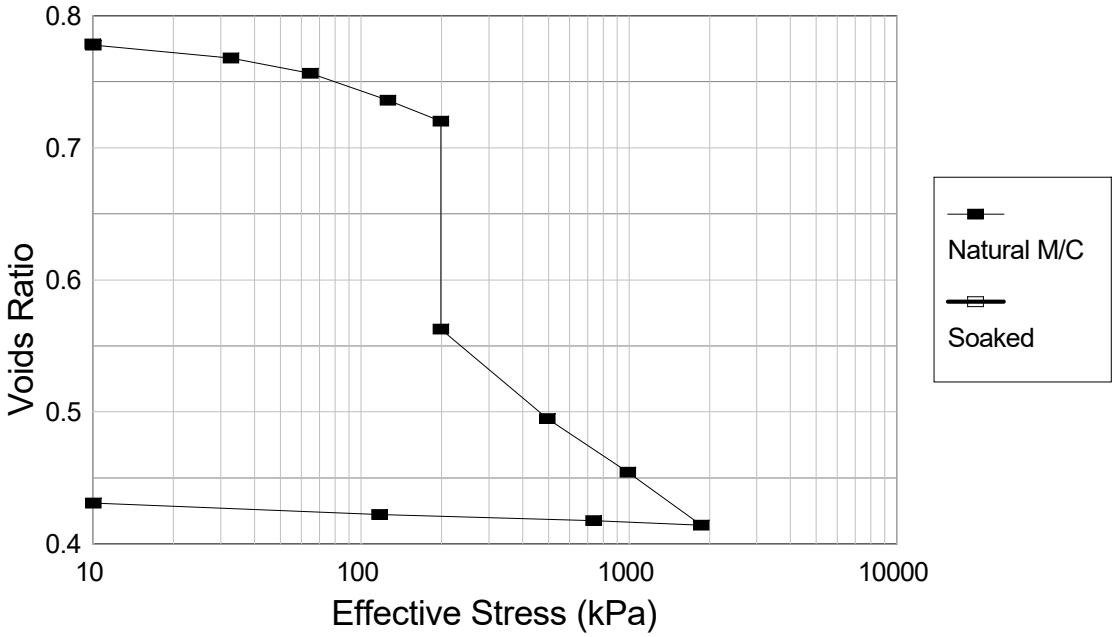
Mass wet sample plus ring before test (gms)	321.70
Mass wet sample plus ring after test (gms)	329.00
Mass dry sample plus ring (gms)	315.90
Mass ring (gms)	219.80
Moisture content before test (%)	**6.04**
Moisture content after test (%)	**13.63**

Other Data

Initial Dry Density (kg/m3)	**1494**
Initial Void Ratio	**0.78**

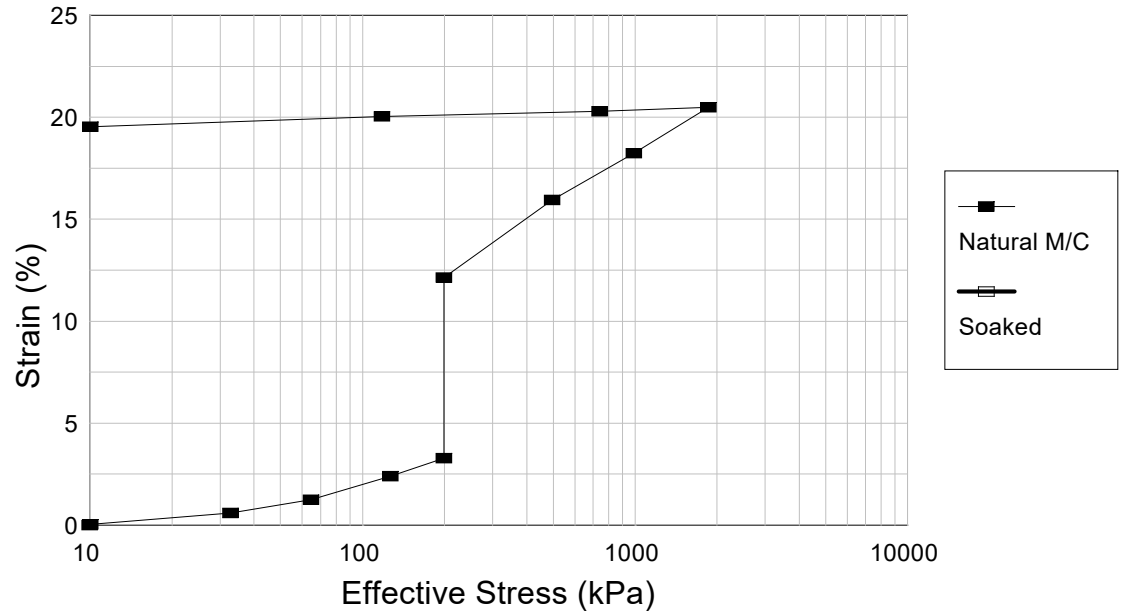
VOIDS RATIO v EFFECTIVE STRESS

Test No: 1766



STRAIN v EFFECTIVE STRESS

Test No: 1766



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COLLAPSE POTENTIAL at 200 kPa

Client	SCHWARTZ TROMP & ASSOCIATES		
Location	AEROTON U4/1 @ 1,2 - 1,4m		
Date	11 NOV 2005	Test No	1768
Job No	05476	Checked By	EB

Sample Height (mm)	20	Sample Diameter (mm)	64	Sample Specific Gravity	2.638

Sample Preparation	NMC

Effective Stress (kPa)	Time (mins)	Consolidation Reading	Voids Ratio	Strain (%)
10	10	804	0.916	0.00
10	70	807	0.913	0.15
33	130	826	0.895	1.10
65	250	850	0.872	2.30
127	340	894	0.829	4.50
200	490	935	0.790	6.55
200	1930	986	0.741	9.10
498	2170	1095	0.637	14.55
993	2410	1154	0.580	17.50
1868	3850	1209	0.528	20.25
743	3970	1204	0.533	20.00
118	4090	1202	0.534	19.90
10	4210	1193	0.543	19.45

Moisture Content Calculations

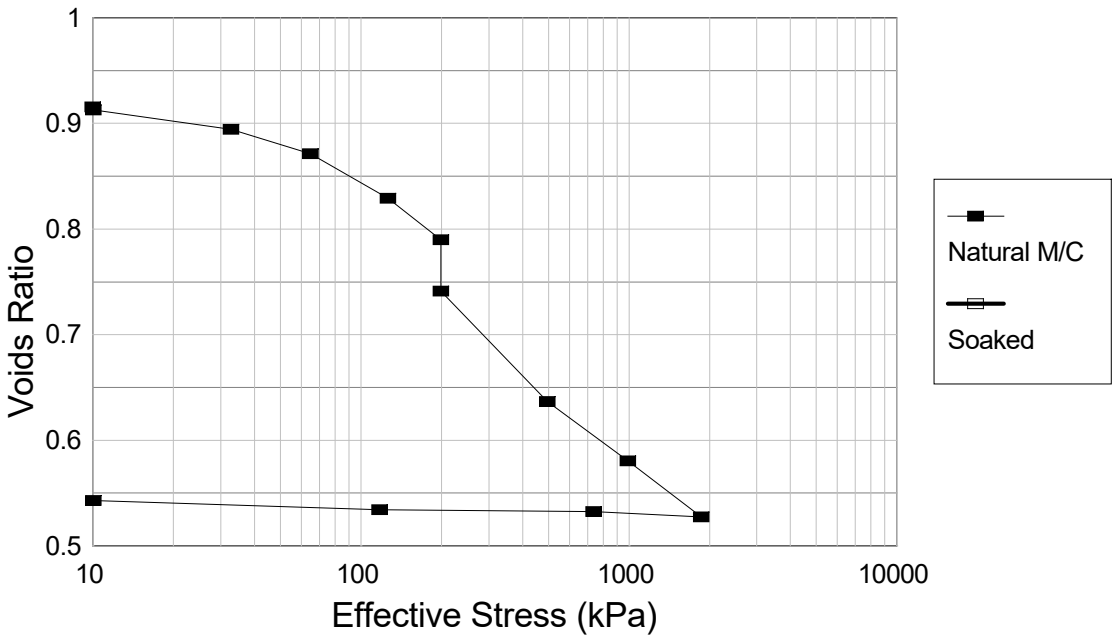
Mass wet sample plus ring before test (gms)	319.60
Mass wet sample plus ring after test (gms)	322.00
Mass dry sample plus ring (gms)	308.90
Mass ring (gms)	220.30
Moisture content before test (%)	**12.08**
Moisture content after test (%)	**14.79**

Other Data

Initial Dry Density (kg/m3)	**1377**
Initial Void Ratio	**0.92**

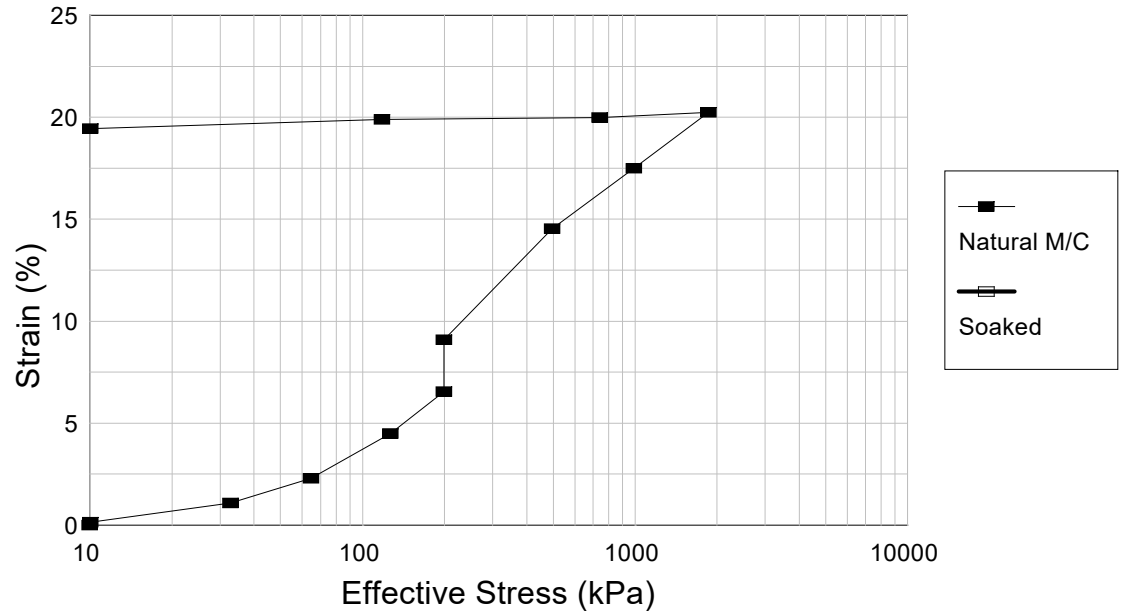
VOIDS RATIO v EFFECTIVE STRESS

Test No: 1768



STRAIN v EFFECTIVE STRESS

Test No: 1768



APPENDIX G 3 TRAFFIC & ACCESS ASSESSMENT

KANTEY & TEMPLER
CONSULTING ENGINEERS
ESTABLISHED 1953

PROPOSED FILLING STATION

ON

THE FARM 751
REGISTRATION DIVISION I.Q.
PROVINCE OF GAUTENG

BOLENG (PTY) LTD

TRAFFIC AND ACCESS ASSESSMENT

JUNE 2021

K&T PROJECT REFERENCE: 8101

REVISION 0

KANTEY & TEMPLER (PTY) LTD, REG NO. 1966/009839/07
410 Jan Smuts Avenue, 9 Burnside Island, Craighall, Johannesburg, P O Box 412541, Craighall, 2024
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www.kanteys.co.za

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CONSULTING ENGINEERS
ESTABLISHED 1953

Details of this report

Client Name	Boleng (Pty) ltd
Document Title	Traffic & Access Assessment
K&T Project Reference	8101
File Name	8101_The Farm 751_TIA Revision 0
Prepared By	P Naidoo
Reviewed By	

Report Revision Record

Revision	Date	Description
0	June 2021	Draft

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For and on behalf of Kantey & Templer (Pty) Ltd

For and on behalf of

Kantey & Templer (Pty) Ltd

Approved by: _____

Signed: _____

Position: _____

Date: _____

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THE FARM 751

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ANNEXURE A: FIGURES

ANNEXURE B: LATENT UPGRADES

ANNEXURE C: DIAGRAMS

ANNEXURE D: SIDRA SUMMARIES

ANNEXURE E: PHOTOGRAPHS

1. BACKGROUND

Kantey & Templer Consulting Engineers (K&T) were appointed by Boleng (Pty) Ltd (referred to herein as **"the client**") to obtain approval of the proposed access to a filling station which will be situated on The Farm 751 Registration Division I.Q, province of Gauteng.

The previous zoning of the site allowed for commercial and residential land-uses. In 2008, PD Naidoo & Associates (Pty) Ltd prepared a Traffic Impact Assessment (TIA) in support of a proposed warehouse development on Aeroton Extensions 32, 33 and the site. The TIA was approved by the Johannesburg Roads Agency (JRA) in 2010. A proposed full access off Southgate Road to the site was approved by the JRA. In 2013, Moyeni Professional Engineering (MPE) prepared an Addendum Traffic Impact Assessment which at the time addressed a residential development (worst-case trip generator) and a proposed additional access via the existing access point to SAB which is situated to the east of the site.

Since then, Shell SA has purchased the property to develop a filling station. FJC Consulting have been appointed as the Town Planners to undertake the proposed rezoning of the site which will permit rights for a filling station. Details of the proposed rezoning application was not available at the time of preparing this study since approval of the application was still pending.

2. PURPOSE

The purpose of this report is to obtain approval of the proposed accesses to the filling station development on The Farm 751 Registration Division I.Q, province of Gauteng, hereafter referred to as **"the site"**.

3. THE SITE

3.1 LOCALITY

The site falls within jurisdiction of the City of Johannesburg (COJ) Metropolitan Municipality and Johannesburg Roads Agency (JRA).

The locality and aerial plans of the site are shown on figures **8101 – TIA – FIG 1** and **8101 – TIA – FIG 2** in **Annexure A**.

The land use surrounding the site is a mix of Residential and Commercial. The site boundaries are described in **Table 1** below.

Table 1: Site Boundaries

Boundary	Boundary Description
North	N12 road reserve
East	Baragwanath Extension 1
South	Chris Hani Road (M68)
West	Aerodrome Road

Southgate Road passes through the site on the north. The site area for the filling station will therefore be approximately 12 885m^2 in extent.

Two (2) accesses are proposed to the site. A marginal (left-in and left-out only) access is proposed off Chris Hani Road (Access 1) and a full access is proposed of Southgate Road (Access 2).

3.2 PROPOSED DEVELOPMENT

The intention is to develop a filling station with a convenience store and fast food with a floor area limited to 30% of the total built floor area or 150m², whichever is the lesser as per COJ Land-Use Scheme (2018).

4. ROAD NETWORK

4.1 EXISTING ROAD NETWORK

The classification of the roads in the study area was obtained from the RISFSA Road Master Plan(2).

The filling station will be bound by Chris Hani Road to the south which is a class 2 road. The road is currently a dual carriageway with three lanes per direction and a posted speed limit of 70km/h.

Southgate Road will border the filling station to the north. Southgate Road is a class 5 road with a speed limit of 60km/h.

Aerodrome Road is a class 3 road with a posted speed limit of 60km/h which will border the filling station to the west.

The aforementioned roads fall within the jurisdiction of the JRA. The site is not affected by any future roads planning.

The aerial plan showing the existing road network is included in **Annexure A** as figure **8109 – TIA – FIG 2.**

5. LATENT DEVELOPMENTS

A meeting was held with Mr P Peska from the JRA on 3 June 2021 where the proposed conceptual access drawing was discussed. Future developments in the area were also discussed. The proposed road upgrades for Aeroton Extensions 53 to 56 at the intersections of Chris Hani Road with Aerodrome Road and Chris Hani Road with Southgate Road were obtained from Moyeni Professional Engineering (MPE). The latent road upgrades (as shown in **Annexure B**) were considered to be in place before the filling station is developed.

6. SITE ACCESSES

The filling station will have a marginal (left-in, left out only) access off Chris Hani Road and a full access off Southgate Road. The proposed accesses are indicated in the accompanying drawing **8101 – TIA – FIG 3** attached in **Annexure A** of this report.

6.1 DESIGN CRITERIA

The Guidelines for Access to Filling Stations in the Greater Pretoria Area(1) by ITS (March 2001) were followed in the conceptual design. It was confirmed in the meeting with JRA that the aforementioned guidelines are also used for designing filling station accesses off JRA roads as well.

6.2 CLASSIFICATION OF ROADS AND DESIGN SPEED

Chris Hani Road is a class 2 road with a posted speed limit of 70km/h and Southgate Road is class 5 road with a posted speed limit of 60km/h. The ITS guidelines uses a Level Of Access (LOA) classification when designing filling station accesses. Chris Hani Road will have a LOA of 2 and Southgate Road will have a LOA of 9. It also supported in guidelines that the posted speed limit should be used as the design speed of the filling station accesses.

6.3 MARGINAL ACCESS OFF CHRIS HANI ROAD (ACCESS 1)

A median barrier is recommended for roads with LOA 1,2,3,4 and 5. It should be noted that Chris Hani Road is a dual carriageway road which is already separated by a median barrier. According to the guidelines, the criteria for determining a filling station access downstream of an intersection is based on the deceleration length and shoulder sight distance. The marginal access will be located to east of the signalised Chris Hani Road / Aerodrome Road intersection.

6.3.3 SHOULDER SIGHT DISTANCE

According to Table 8.3 from the ITS Guidelines, the minimum shoulder sight distance required on a road with a design speed of 70km/h is 138m which is considered adequate in this case.

6.3.4 ACCELERATION & DECELERATION LANES

Provision of deceleration lanes at access points to reduce speed differential is an acceptable principle to reduce conflict A detailed survey for the relevant longitudinal section of Chris Hani Road was not available at the time of this study, therefore the typical standard was used for the design. Table 9.3 from the ITS guidelines was used to determine a taper length of 40m for the deceleration lane. It is however recommended in the guidelines that a 35m taper and 5m deceleration lane should be provided.

The detailed design of the filling access will address the impact of the gradient on the site access once the surveys have been obtained. The basic access distance requirements will be adjusted if necessary, according to Table 10.1 from the guidelines.

It should be noted that adjusting the deceleration lane distance will be possible, if necessary.

6.4 FULL ACCESS OFF SOUTHGATE ROAD (ACCESS 2)

As mentioned in Section 1, the full access off Southgate Road was previously approved. It is proposed that the access should be located 50m east from the Aerodrome Road / Southgate Road intersection. The queue length on Southgate Road was taken into consideration when determining the position of the access. This is discussed in detail in the following Section 10.

6.5 GEOMETRIC DESIGN

The design of the marginal access will conform to the requirements as shown on the typical drawings. The typical drawing **FIG: C3** contained in ITS(1) guidelines are included herewith in **Annexure C** of this report were used.

7. SITE LAYOUT

A Site Development Plan (SDP) was not available at the time of this study. A detailed SDP still needs to be prepared by an Architect and should be reviewed by the Traffic Engineer for compliance with the following requirements of the ITS Guidelines for access to filling station(1).

7.1 HEAVY VEHICLES

Sufficient manoeuvring and loading space should be provided to accommodate trucks at the entry and within the site. The entry radii as per the drawing **8101 – TIA – FIG 3** attached in **Annexure A** should be sufficient to accommodate heavy vehicles at the access. The SDP should be evaluated, using AutoTurn (or similar software) to ensure that truck turning movements can be accommodated on the proposed layout.

7.2 PARKING

Parking should be provided in terms of the relevant Town-Planning Scheme. Details of the parking requirements will be addressed as part of the Site Development Plan (SDP) submission.

8. STUDY AREA INVESTIGATED

The traffic engineer previously conducted a site visit on 11 March 2021 to investigate the road infrastructure and intersections. The relevant photographs of the study area are shown in **Annexure E**.

9. TRAFFIC VOLUMES

9.1 TRAFFIC DATA

Classified traffic count surveys were conducted by Unitraf on 13 April 2021 and 20 April 2021. 24 Hour traffic counts were conducted at the Chris Hani Road / Aerodrome Road intersection (Intersection 1). Weekday AM and PM peak period traffic counts were conducted at the Aerodrome Road / Southgate Road intersection (Intersection 2).

The filling station is proposed to have a marginal access off Chris Hani Road and a full access off Southgate Road.

2018 traffic count data for Chris Hani Road / Aerodrome Road intersection was made available to K&T. The historic data was escalated over 3 years at an annual growth rate of 3% to obtain the 2021 volumes. The 2021 traffic counts were compared for the intersection and it was found that the northbound traffic volumes from the Chris Hani Road / Aerodrome Road intersection towards Aerodrome Road / Southgate Road intersection was much higher.

After consultation with Mr P Peska from the JRA, it was decided that the historic data would be used for Chris Hani Road / Aerodrome Road intersection. The traffic counts at intersections 1 and 2 were increased proportionally to obtain a worst-case scenario.

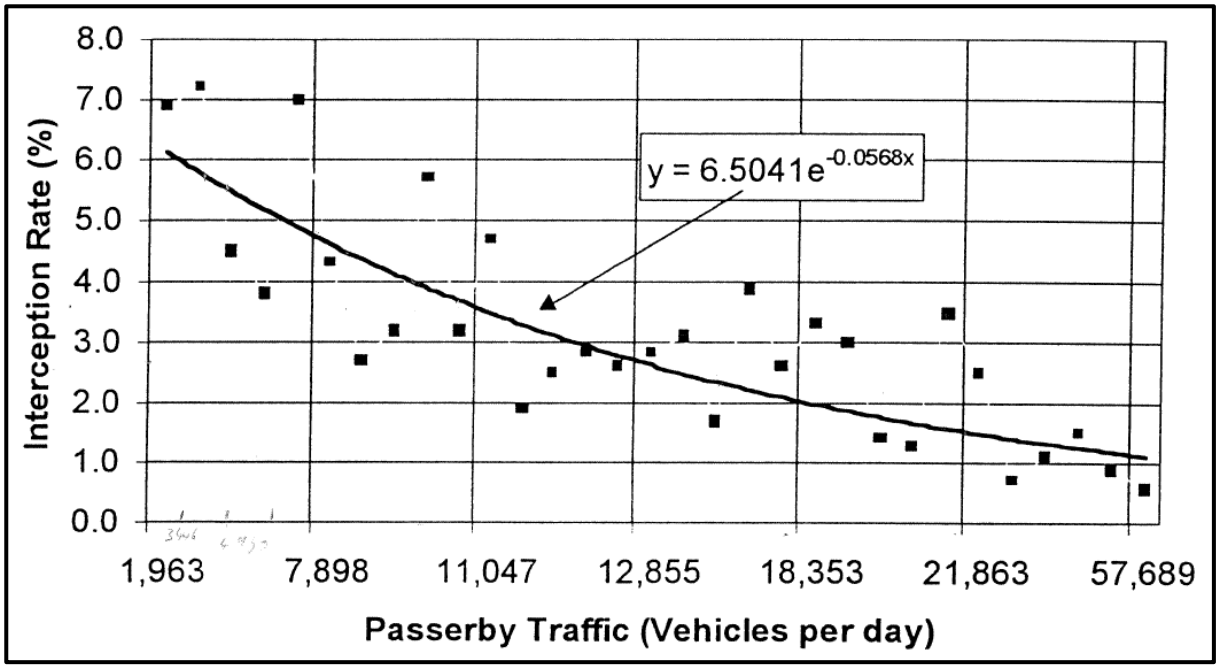
The link traffic volumes for the worst-case scenario are summarised in **Table 2** below.

Table 2: Surveyed Traffic Volumes

Road Name	Travel Direction	AM Peak Hour Volume (vehicles)	PM Peak Hour Volume (vehicles)
Chris Hani Road	Eastbound	678	1117
Aerodrome Road	Northbound	1232	623
	Southbound	538	927
Southgate Road	Eastbound	202	345
	Westbound	105	364

9.2 TRIP GENERATION

Filing stations in general do not generate new trips, but intercept the daily traffic from the adjacent road. Therefore, in terms of BB2[(1)], the traffic report is not required to consider the trip generation, distribution and assignment of trips. **Layout 1** shows the graph extracted from the ITS Guidelines for access to filling station was used to estimate the interception rate.



Layout 1: Interception Rate versus Passerby Traffic

The interception rates and design volumes are summarised in **Table 3**.

Table 3: Filling Station Trip Interception

Road Name	Travel Direction	AM Peak Interception Rate	AM Peak Volume	PM Peak Interception Rate	PM Peak Volume
Chris Hani Road	Eastbound	7.13	48	6.91	77
Aerodrome Road	Northbound	6.86	85	7.16	45
	Southbound	7.21	39	7.01	65
Southgate Road	Eastbound	7.38	15	7.31	25
	Westbound	7.43	8	7.30	27

10. TRAFFIC OPERATIONS

10.1 ANALYSIS SCENARIOS

The critical peak hours (weekday AM and PM) were considered in the SIDRA analysis. The following analysis scenarios were considered for each of the aforementioned peak hours:

- **Base Year:** 2021 AM and PM peak hour existing traffic demand (refer to **Diagrams A1** & **A2** in **Annexure C**);
- **Scenario 1:** 2026 AM and PM peak hour background traffic volumes (refer to **Diagrams B1** & **B2** in **Annexure C**);

10.2 SIDRA ANALYSIS

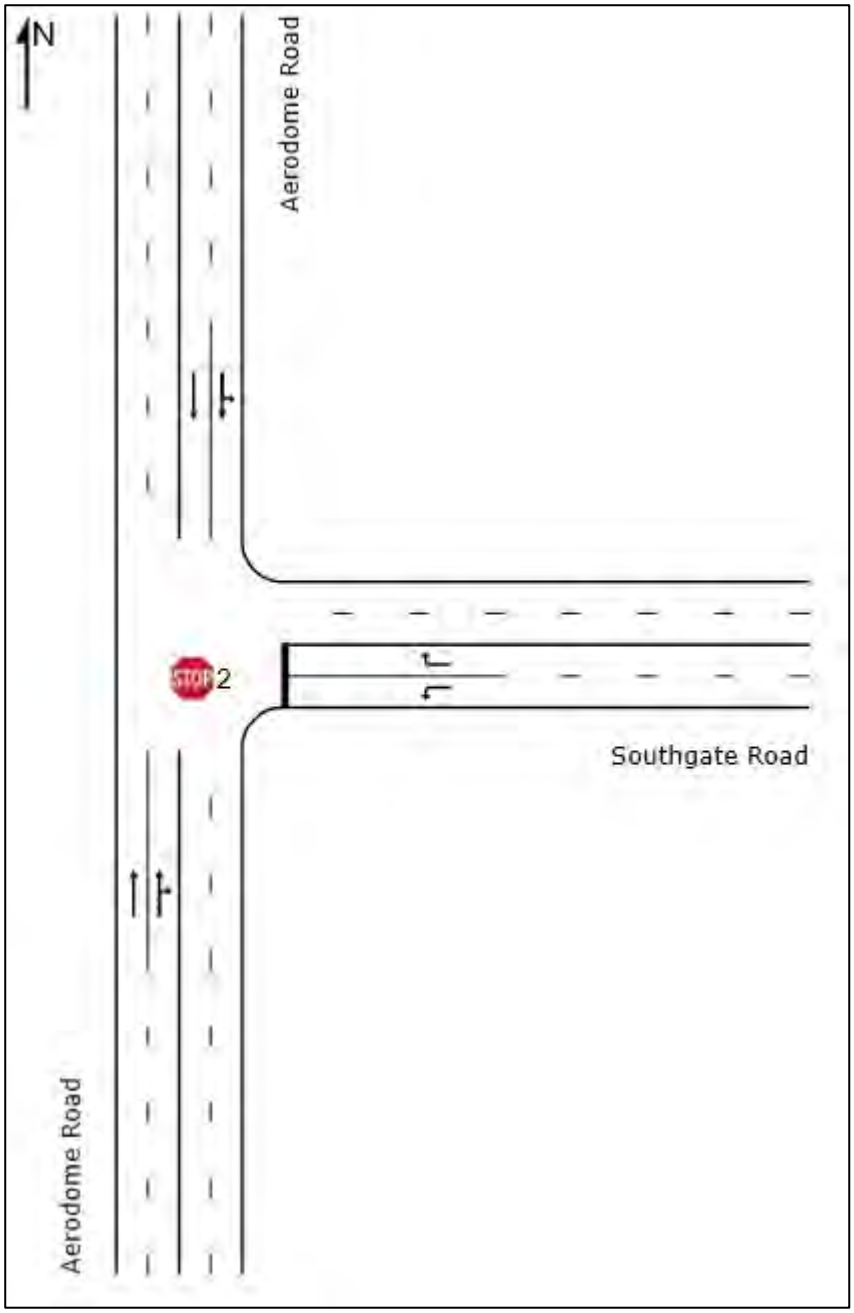
The traffic operations at the Chris Hani Road / Aerodrome Road intersection are not expected to affect the traffic operations at the marginal access (Access 1) therefore SIDRA analysis was done for the Aerodrome Road / Southgate Road intersection with the aforementioned scenarios to determine if there will be a significant queue along Southgate Road that could potentially affect the full access (Access 2).

10.2.1 Aerodrome Road / Southgate Road intersection

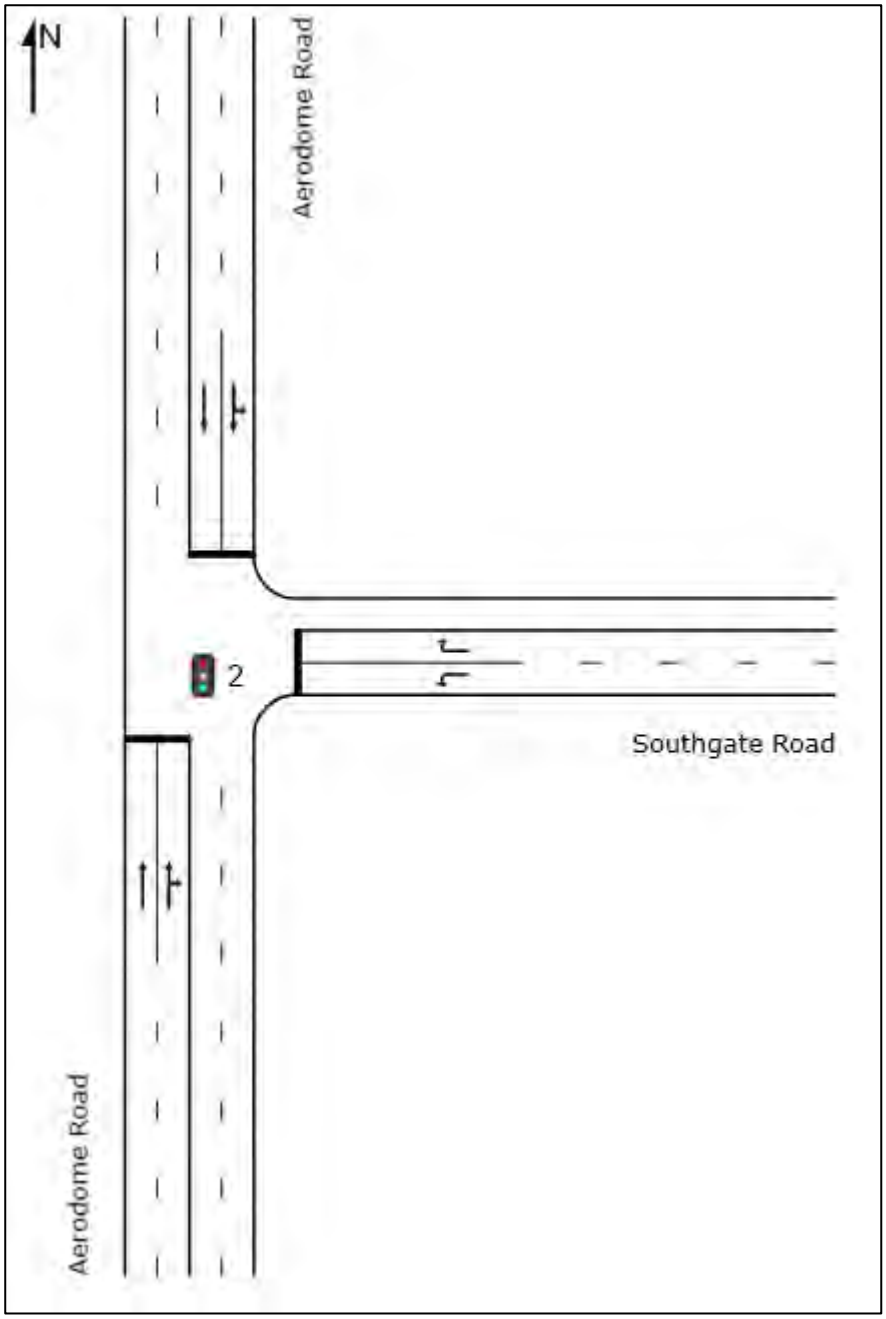
The Aerodrome Road / Southgate Road intersection is a T-junction with priority stop on the eastern approach. The intersection is proposed to be signalised by latent developments. The existing configuration (**Layout 2**) was analysed for the base year and the proposed latent upgrades (**Layout 3**) were analysed for scenario 1.

The capacity analyses indicates that the right-turn movement will operate at LOS F during both peak hours for the base year. The proposed signalisation by the latent developments will improve the LOS of the aforementioned movement to within acceptable ranges for Scenario 1. The 95th percentile queue length along Southgate Road is expected to be 42m in the PM peak hour (worse case). The proposed access will be located 50m from the eastern approach of Aerodrome Road / Southgate Road intersection which is considered sufficient in this case.

The SIDRA summaries are included **Annexure D**.



Layout 2: Aerodrome Road / Southgate Road Existing Configuration



Layout 3: Aerodrome Road / Southgate Road Latent Configuration

11. CONCLUSIONS & RECOMMENDATIONS

11.1 CONCLUSIONS

The following can be concluded from the report:

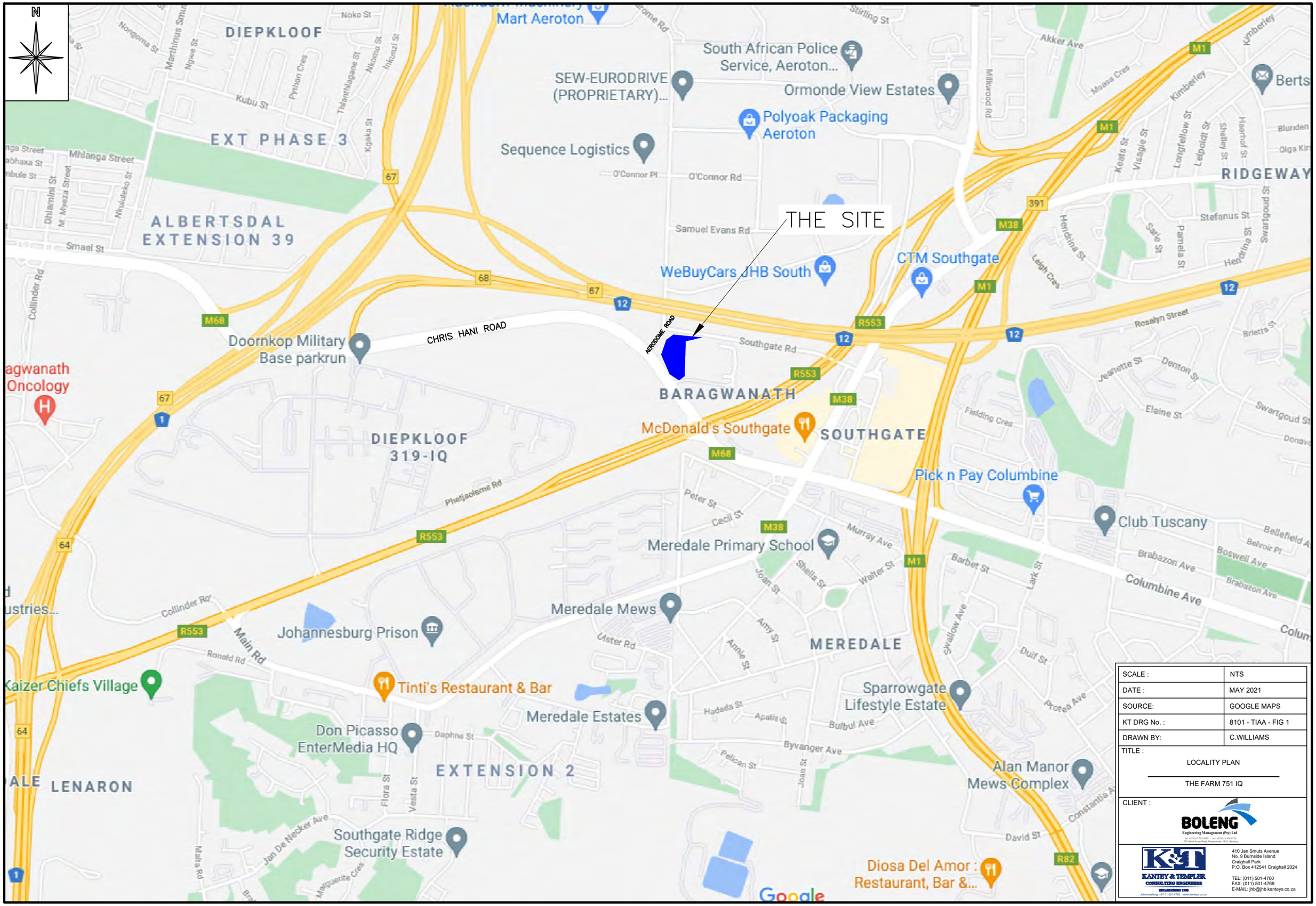
1. A filling station is proposed on The Farm 751 Registration Division I.Q, province of Gauteng.
2. A marginal access (Access 1) to the filling station is proposed off Chris Hani Road, which is a class 2 route and the access was designed in terms of ITS(1) guidelines. The access was designed in line with typical drawing **FIG No: C3** from ITS(1) guidelines. The proposed access point is sufficiently far away from the adjacent intersection and is not expected to have an impact on or be impacted by the operating conditions at the adjacent intersection.
3. A full access (Access 2) is proposed off Southgate Road which is a class 5 route. The access was previously approved. It is proposed that the access should be located at a minimum distance of 50m east measured from the edge of the bellmouth along Southgate Road. The SIDRA capacity analysis for Aerodrome Road / Southgate Road intersection indicates that there will not be a queue spillback past the proposed access position.

11.2 RECOMMENDATIONS

Taking the report and above conclusions into account, it is recommended that the proposed access layout as per figure **8101 - TIA - FIG 3** should be approved.

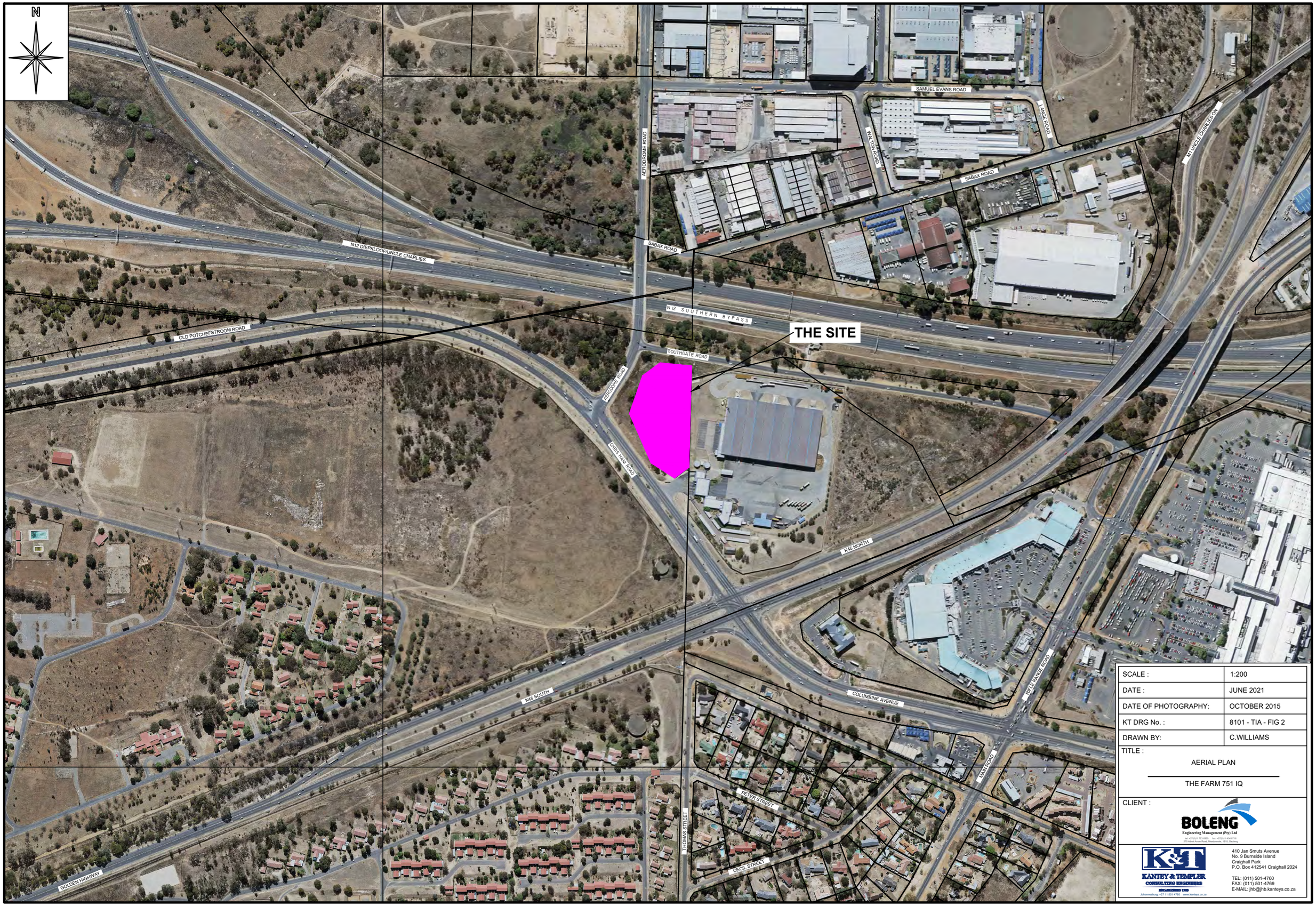
ANNEXURE A

FIGURES



SCALE :	NTS
DATE :	MAY 2021
SOURCE:	GOOGLE MAPS
KT DRG No. :	8101 - TIAA - FIG 1
DRAWN BY:	C.WILLIAMS
TITLE :	LOCALITY PLAN THE FARM 751 IQ
CLIENT :	BOLENG Engineering Management (Pty) Ltd

KANTEY & TEMPLER CONSULTING ENGINEERS
ESTABLISHED 1948
410 Jan Smuts Avenue
No. 9 Burnside Island
Craighall Park
P.O. Box 412541 Craighall 2024
TEL: (011) 501-4760
FAX: (011) 501-4769
E-MAIL: jhb@jhb.kanteys.co.za



SCALE :	1:200
DATE :	JUNE 2021
DATE OF PHOTOGRAPHY:	OCTOBER 2015
KT DRG No. :	8101 - TIA - FIG 2
DRAWN BY:	C.WILLIAMS

TITLE :

AERIAL PLAN

THE FARM 751 IQ

CLIENT :

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Engineering Management (Pty) Ltd

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SCALE :	1 : 1000
DATE :	MAY 2021
DATE OF PHOTOGRAPHY :	OCTOBER 2015
KT DRG No. :	8101 - TIA - FIG 3
DRAWN BY:	C.WILLIAMS

TITLE :

ACCESS PLAN

THE FARM 751 IQ

CLIENT :

BOLENG
Engineering Management (Pty) Ltd
tel: +27(0)11 723 6500 fax: +27(0)11 454 6716
270 Albert Amon Road, Meadowvale, 1610, Gauteng

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E-MAIL: jhb@jhb.kanteys.co.za

ANNEXURE B

LATENT UPGRADES

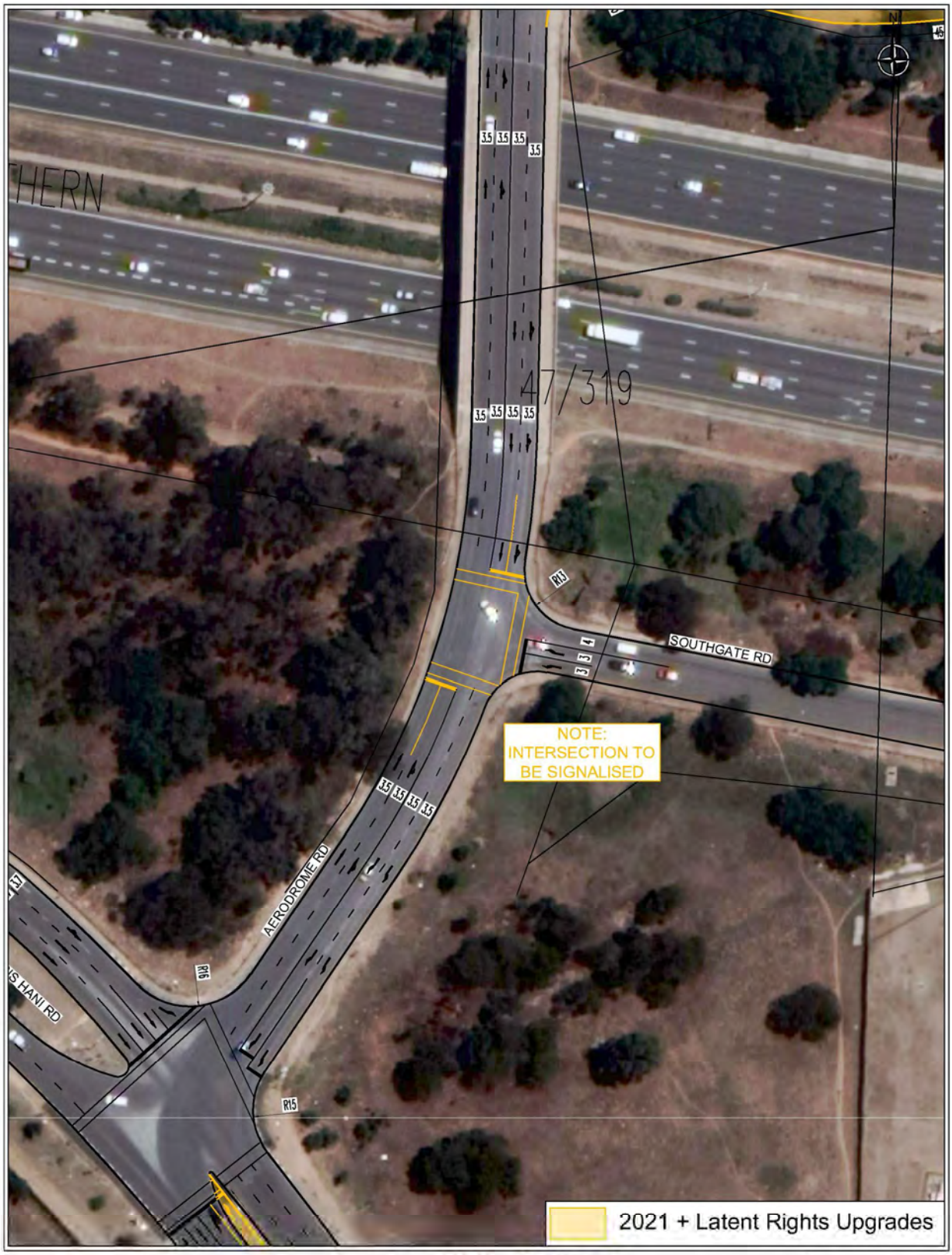
mpe

Aeroton X53 - X56 TIA

Proposed 2021 Developer Upgrades of
Aerodrome Rd and Chris Hani Rd

A9-3

SCALE 1:1000



mpe

Aeroton X53 - X56 TIA

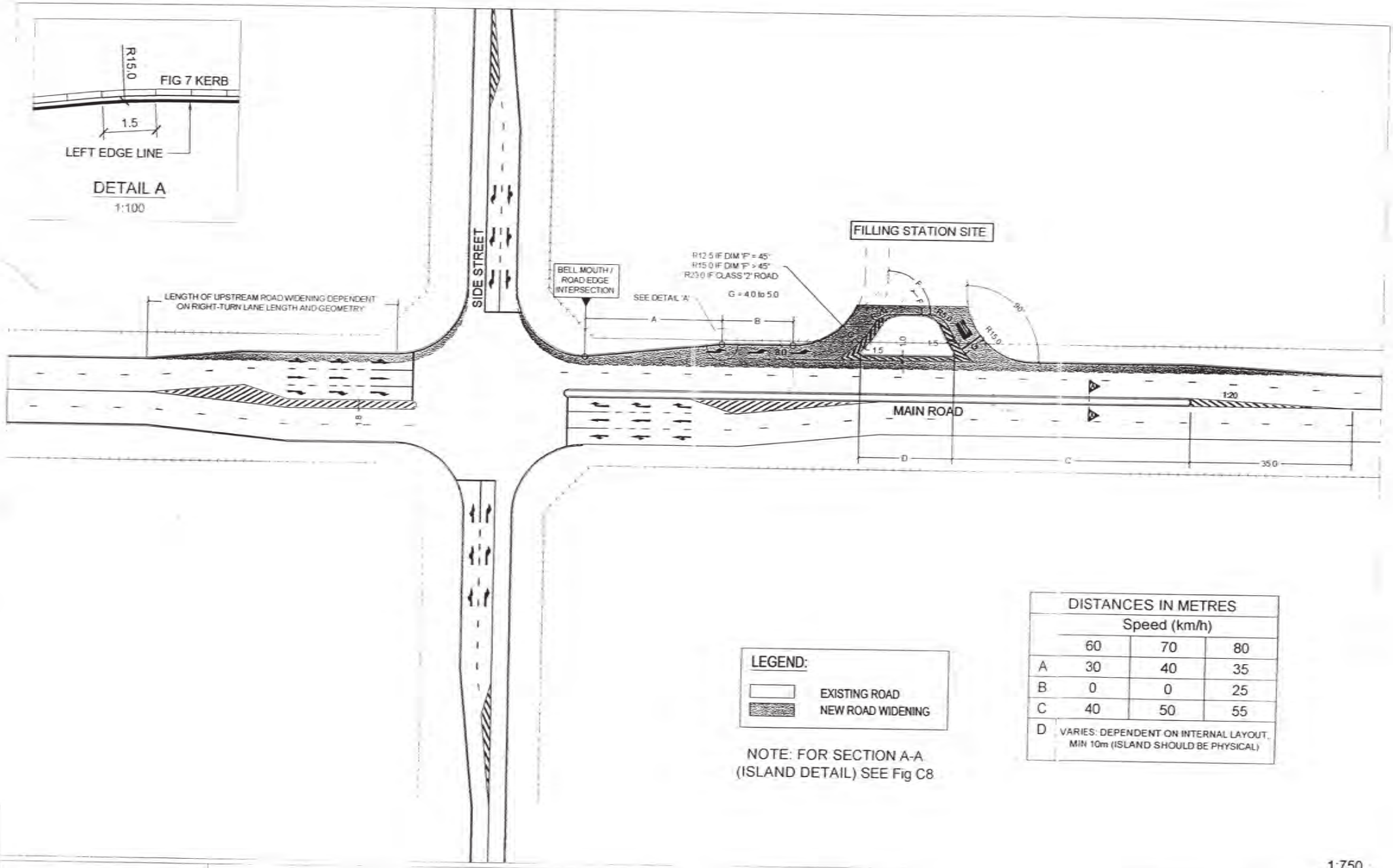
Proposed 2021 + Latent Rights Upgrades of
Aerodrome Rd and Southgate Rd

A8-2

SCALE 1:1000

ANNEXURE C

DIAGRAMS



DISTANCES IN METRES			
	Speed (km/h)		
	60	70	80
A	30	40	35
B	0	0	25
C	40	50	55
D	VARIES: DEPENDENT ON INTERNAL LAYOUT, MIN 10m (ISLAND SHOULD BE PHYSICAL)		

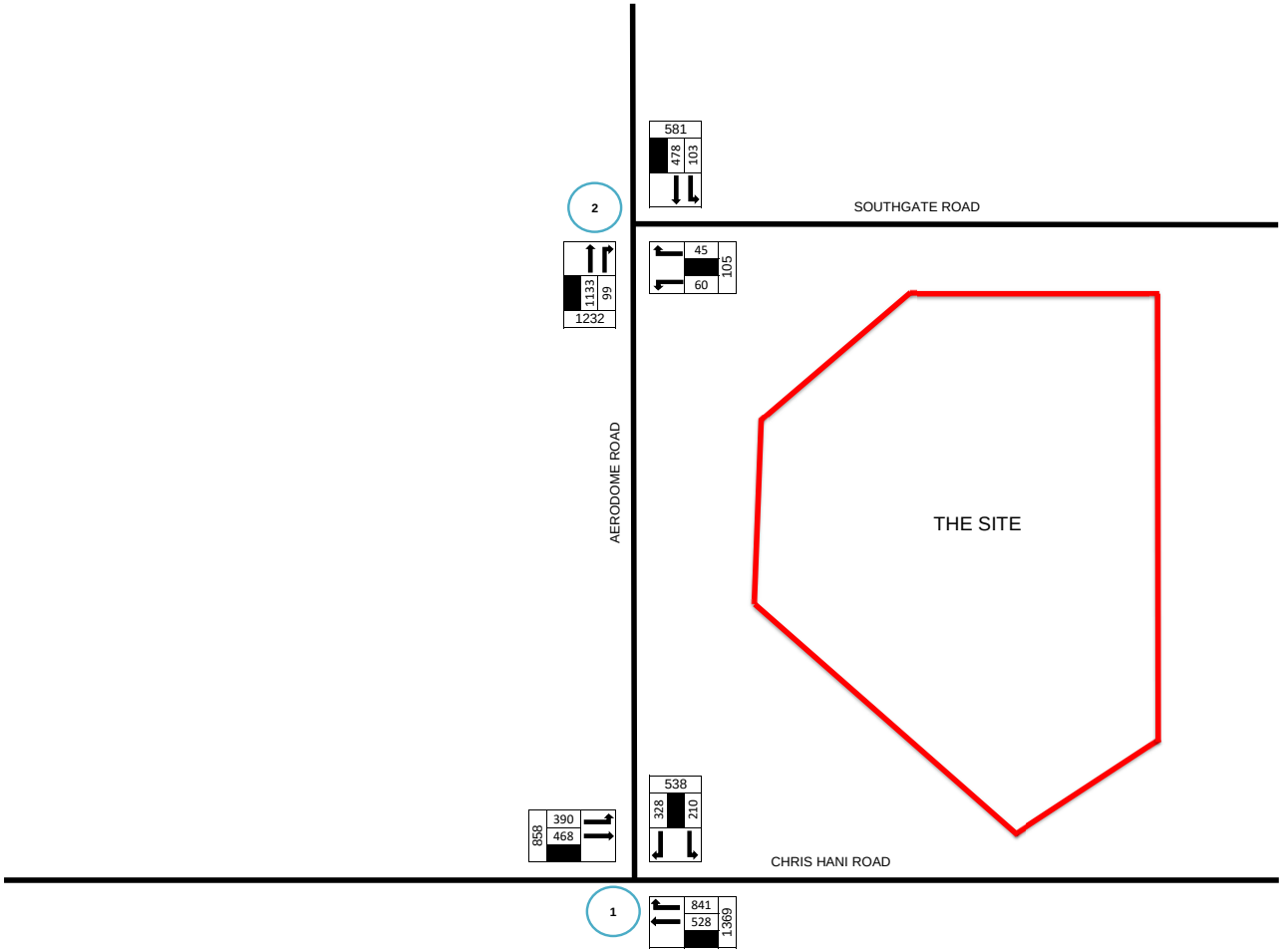
1:750

CITY COUNCIL OF PRETORIA

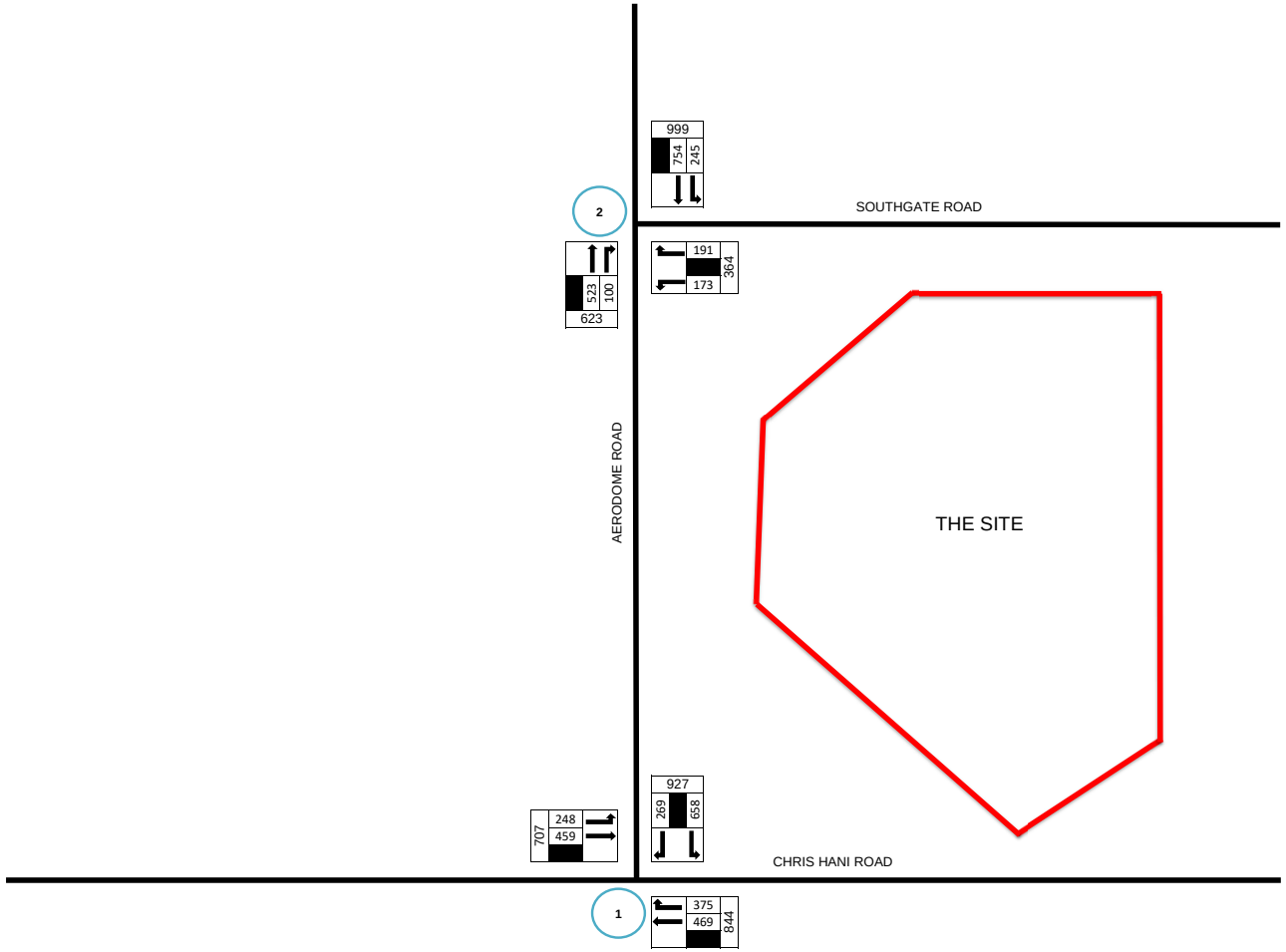
GUIDELINES FOR ACCESS TO FILLING STATIONS

DOWNSTREAM LEFT-IN LEFT-OUT ACCESS WITH MEDIAN

Fig C3

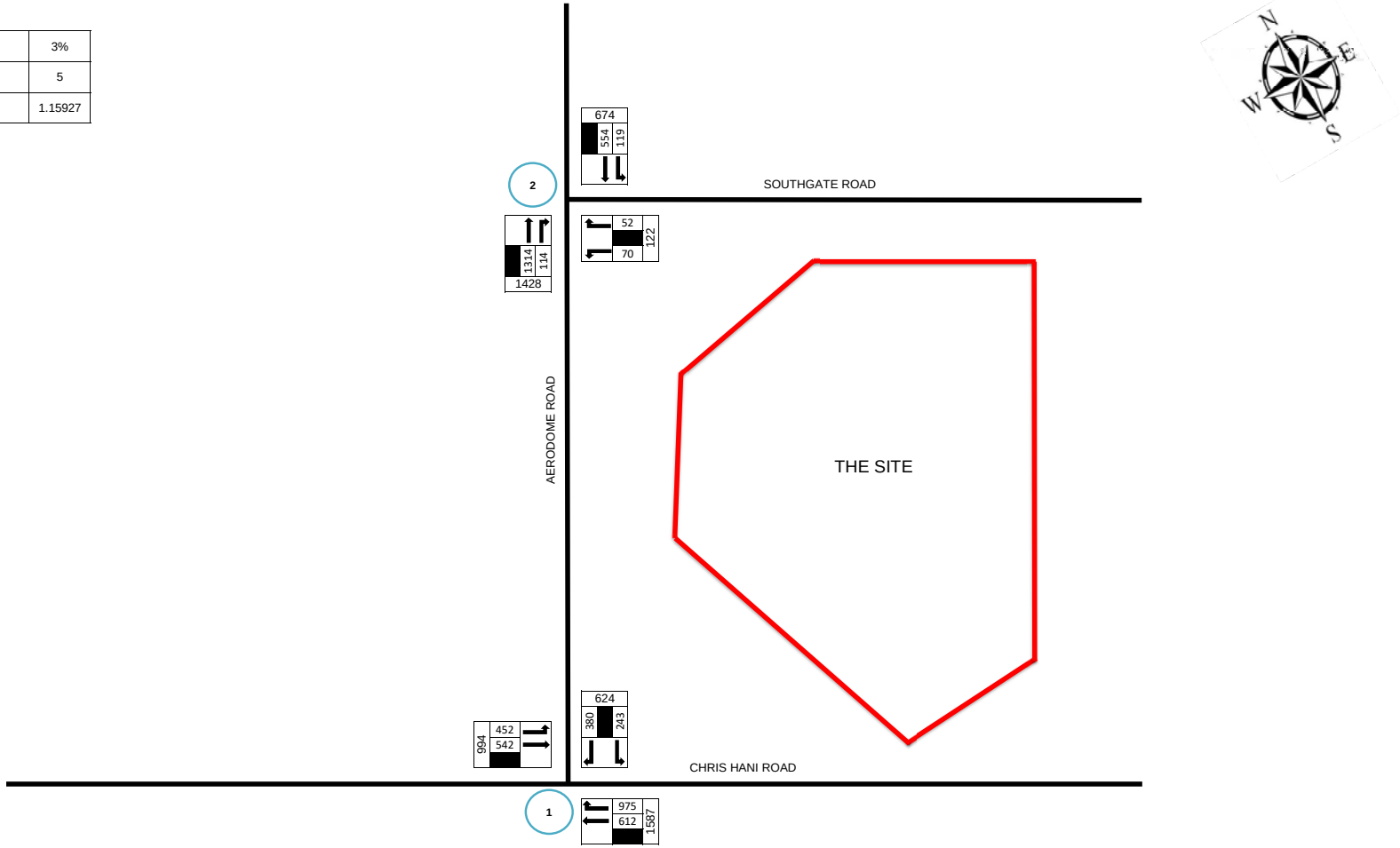


CONSULTANT:	CLIENT:	PROJECT:	PROJECT NO:
KANTEY & TEMPLER CONSULTING ENGINEERS ESTABLISHED 1922	BOLENG Engineering Management (Pty) Ltd	**THE FARM 751-IQ**	**8101**
		TITLE: **BASE YEAR 2021 AM TRAFFIC COUNTS**	DIAGRAM: **A1**



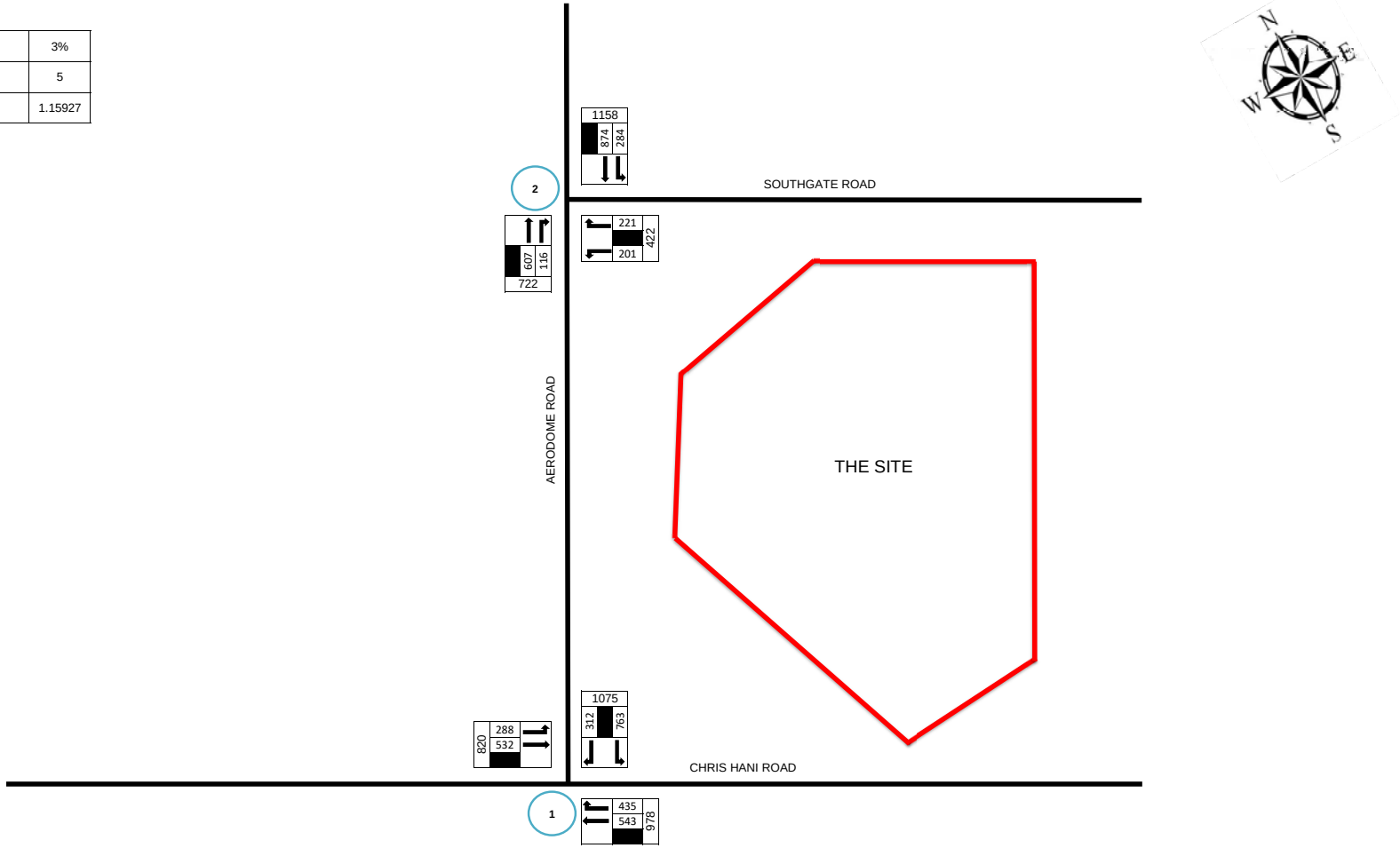
CONSULTANT:	CLIENT:	PROJECT:	PROJECT NO:
KANTEY & TEMPLER CONSULTING ENGINEERS ESTABLISHED 1922	BOLENG Engineering Management (Pty) Ltd	**THE FARM 751-IQ**	**8101**
		TITLE: **BASE YEAR - 2021 PM TRAFFIC COUNTS**	DIAGRAM: **A2**

ESCALATION RATIO	3%
YEAR(S)	5
ESCALATION FACTOR	1.15927



CONSULTANT: K&T KANTEY & TEMPLER CONSULTING ENGINEERS ESTABLISHED 1922	CLIENT: BOLENG Engineering Management (Pty) Ltd	PROJECT: **THE FARM 751-IQ**	PROJECT NO: **8101**
		TITLE: **SCENARIO 1 - 2026 AM BACKGROUND TRAFFIC**	DIAGRAM: **B1**

ESCALATION RATIO	3%
YEAR(S)	5
ESCALATION FACTOR	1.15927



CONSULTANT: K&T KANTEY & TEMPLER CONSULTING ENGINEERS ESTABLISHED 1922	CLIENT: BOLENG Engineering Management (Pty) Ltd	PROJECT: **THE FARM 751-IQ**	PROJECT NO: **8101**
		TITLE: **SCENARIO 1 - 2026 PM BACKGROUND TRAFFIC**	DIAGRAM: **B2**

ANNEXURE D

SIDRA SUMMARIES

MOVEMENT SUMMARY

Site: 2 [Aerodome Road / Southgate Road - 2021 AM Base Year]

2021 AM Base Year
Existing Configuration
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Aerodome Road												
2	T1	1133	0.0	0.350	0.7	LOS A	1.9	13.4	0.13	0.05	0.15	55.1
3	R2	99	0.0	0.350	10.0	LOS A	1.9	13.4	0.33	0.14	0.40	52.7
Approach		1232	0.0	0.350	1.4	NA	1.9	13.4	0.14	0.06	0.17	54.7
East: Southgate Road												
4	L2	60	0.0	0.060	8.9	LOS A	0.2	1.5	0.29	0.88	0.29	46.2
6	R2	45	0.0	1.304	327.0	LOS F	7.6	53.0	1.00	1.33	2.50	6.0
Approach		105	0.0	1.304	145.2	LOS F	7.6	53.0	0.59	1.07	1.24	11.6
North: Aerodome Road												
7	L2	103	0.0	0.148	5.5	LOS A	0.0	0.0	0.00	0.22	0.00	54.8
8	T1	478	0.0	0.148	0.0	LOS A	0.0	0.0	0.00	0.08	0.00	57.0
Approach		581	0.0	0.148	1.0	NA	0.0	0.0	0.00	0.11	0.00	56.1
All Vehicles		1918	0.0	1.304	9.2	NA	7.6	53.0	0.12	0.13	0.18	38.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2 [Aerodome Road / Southgate Road - 2021PM Base Year]

2021 PM Base Year
Existing Configuration
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Aerodome Road												
2	T1	523	0.0	0.237	0.8	LOS A	1.3	9.2	0.07	0.06	0.08	55.6
3	R2	100	0.0	0.237	13.9	LOS B	1.3	9.2	0.76	0.62	0.83	43.6
Approach		623	0.0	0.237	2.9	NA	1.3	9.2	0.18	0.15	0.20	51.0
East: Southgate Road												
4	L2	173	0.0	0.187	9.5	LOS A	0.7	5.2	0.38	0.90	0.38	45.8
6	R2	191	0.0	2.535	740.5	LOS F	44.5	311.4	1.00	2.33	6.76	2.9
Approach		364	0.0	2.535	393.1	LOS F	44.5	311.4	0.70	1.65	3.72	5.0
North: Aerodome Road												
7	L2	245	0.0	0.256	5.5	LOS A	0.0	0.0	0.00	0.30	0.00	53.7
8	T1	754	0.0	0.256	0.0	LOS A	0.0	0.0	0.00	0.10	0.00	56.4
Approach		999	0.0	0.256	1.4	NA	0.0	0.0	0.00	0.14	0.00	55.2
All Vehicles		1986	0.0	2.535	73.6	NA	44.5	311.4	0.19	0.42	0.75	13.7

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Minor Road Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2 [Aerodome Road / Southgate Road - 2026 AM Scenario 1]

2026 AM Scenario 1
Latent Road Upgrades
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Aerodome Road												
2	T1	1314	0.0	0.527	3.7	LOS A	12.0	83.8	0.41	0.40	0.41	46.7
3	R2	114	0.0	0.527	9.2	LOS A	9.0	63.2	0.41	0.44	0.41	51.0
Approach		1428	0.0	0.527	4.1	LOS A	12.0	83.8	0.41	0.40	0.41	47.5
East: Southgate Road												
4	L2	70	0.0	0.516	47.1	LOS D	2.9	20.0	1.00	0.76	1.01	25.4
6	R2	52	0.0	0.383	46.4	LOS D	2.1	14.6	0.99	0.74	0.99	26.6
Approach		122	0.0	0.516	46.8	LOS D	2.9	20.0	1.00	0.75	1.00	25.9
North: Aerodome Road												
7	L2	119	0.0	0.219	8.1	LOS A	3.5	24.3	0.29	0.40	0.29	51.7
8	T1	554	0.0	0.219	2.6	LOS A	3.5	24.7	0.29	0.31	0.29	48.6
Approach		673	0.0	0.219	3.6	LOS A	3.5	24.7	0.29	0.33	0.29	49.7
All Vehicles		2223	0.0	0.527	6.3	LOS A	12.0	83.8	0.41	0.40	0.41	43.9

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2 [Aerodome Road / Southgate Road - 2026 PM Scenario 1]

2026 PM Scenario 1
Latent Road Upgrades
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 60 seconds (Site Optimum Cycle Time - Minimum Delay)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Aerodome Road												
2	T1	607	0.0	0.509	8.9	LOS A	10.3	72.4	0.66	0.59	0.66	36.6
3	R2	116	0.0	0.509	20.5	LOS C	3.4	23.8	0.78	0.76	0.78	38.0
Approach		723	0.0	0.509	10.7	LOS B	10.3	72.4	0.68	0.62	0.68	37.1
East: Southgate Road												
4	L2	201	0.0	0.476	27.8	LOS C	5.3	37.0	0.91	0.80	0.91	32.7
6	R2	221	0.0	0.523	28.0	LOS C	5.9	41.2	0.92	0.81	0.92	33.8
Approach		422	0.0	0.523	27.9	LOS C	5.9	41.2	0.92	0.80	0.92	33.3
North: Aerodome Road												
7	L2	284	0.0	0.517	14.2	LOS B	10.3	72.2	0.66	0.68	0.66	44.9
8	T1	874	0.0	0.517	8.6	LOS A	10.6	74.0	0.66	0.62	0.66	36.0
Approach		1158	0.0	0.517	10.0	LOS A	10.6	74.0	0.66	0.63	0.66	39.7
All Vehicles		2303	0.0	0.523	13.5	LOS B	10.6	74.0	0.71	0.66	0.71	36.9

Site Level of Service (LOS) Method: Delay & v/c (HCM 2010). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay and v/c ratio (degree of saturation) per movement.
LOS F will result if v/c > 1 irrespective of movement delay value (does not apply for approaches and intersection).
Intersection and Approach LOS values are based on average delay for all movements (v/c not used as specified in HCM 2010).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

ANNEXURE E

PHOTOGRAPHS

Photograph 1: Aerodrome Road / Southgate Road Intersection – Northern leg

Photograph 2: Aerodrome Road / Southgate Road Intersection – Eastern leg

Photograph 3: Chris Hani Road / Aerodrome Road Intersection – Northern leg

Photograph 4: Chris Hani Road / Aerodrome Road Intersection – Eastern leg

Photograph 5: Chris Hani Road / Aerodrome Road Intersection – Western leg

Access Alternatives Explored: Scenario 2 being the most feasible one for the site

Scenarios	Access Description	Pros	Cons
Scenario 1 (Drawing 8101 – TIAA – FIG 1) As per SDP drawing	• Full access off Southgate Road • Full access off Chris Hani Road	Can intercept all streams of traffic from Chris Hani Road and Southgate Road.	The proposed full access off Chris Hani Road will be shared with SAB and this poses a safety concern.
Scenario 2 (Drawing 8101 – TIAA – FIG 2)	• Full Access off Southgate Road • Marginal Access off Chris Hani Road	Dedicated access to filling station off Chris Hani Road. Less conflict points which benefits safety. Cost saving as there is already a physical median along Chris Hani Road.	Can only intercept eastbound traffic from Chris Hani Road.
Scenario 3 (Drawing 8101 – TIAA – FIG 3)	• Marginal Access off Aerodome Road • Marginal Access off Chris Hani Road	Access off Aerodome Road could be possible.	Costly option as it would require a physical median barrier to be built along Aerodome Road. Can only intercept southbound traffic from Aerodome Road and eastbound traffic from Chris Hani Road.

SCALE :	1 : 1000
DATE :	MAY 2021
DATE OF PHOTOGRAPHY :	OCTOBER 2015
KT DRG No. :	8101 - TIA - FIG 1
DRAWN BY:	C.WILLIAMS

TITLE :

SITE ACCESS ALTERNATIVES - SCENARIO 1

BARAGWANATH EXT. 5

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K&T
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SCALE :	1 : 1000
DATE :	MAY 2021
DATE OF PHOTOGRAPHY :	OCTOBER 2015
KT DRG No. :	8101 - TIA - FIG 2
DRAWN BY:	C.WILLIAMS

TITLE :

SITE ACCESS ALTERNATIVES - SCENARIO 2

BARAGWANATH EXT. 5

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N

SOUTHGATE ROAD

AERODOME ROAD

CHRIS HANI ROAD

78m

123m

164m

30

30

R12

R13

1.2

17

4

4

R15

28

R14

35

R20

4

4

25

R15

42

R15

LEGEND

- NEW KERB
- EXISTING KERB
- NEW ROAD MARKINGS
- CENTER LINE
- EXISTING PAVED ISLAND
- EXISTING PAINTED ISLAND
- NEW PAINTED ISLAND
- NEW ISLAND KERBED
- PROPOSED ROAD UPGRADES

SCALE :	1 : 1000
DATE :	MAY 2021
DATE OF PHOTOGRAPHY :	OCTOBER 2015
KT DRG No. :	8101 - TIA - FIG 3
DRAWN BY:	C.WILLIAMS

TITLE :

SITE ACCESS ALTERNATIVES - SCENARIO 3

BARAGWANATH EXT. 5

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APPENDIX G 4 HERITAGE IMPACT ACCESSMENT REPORT

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7 December 2021

Attention: Mr Andrew Solomon

SAHRA Case Officer Gauteng

South African Heritage Resources Agency (SAHRA)

Dear Mr Solomon

Application for exemption from a Heritage Impact Assessment for a service station on farm 751-IQ Baragwanath Extension 5, Gauteng

Introduction

ERM was appointed by Shell as the Environmental Assessment Practitioner to manage the Environmental Impact Assessment process for a new retail service station located on the corner of Aerodrome and Chris Hani Roads, Baragwanath, Gauteng (Figure 1.1 to 1.3). As part of the process Beyond Heritage was appointed to provide an assessment of the possible impacts on heritage resources. The assessment consists of a desktop study as well a site visit to the study area.

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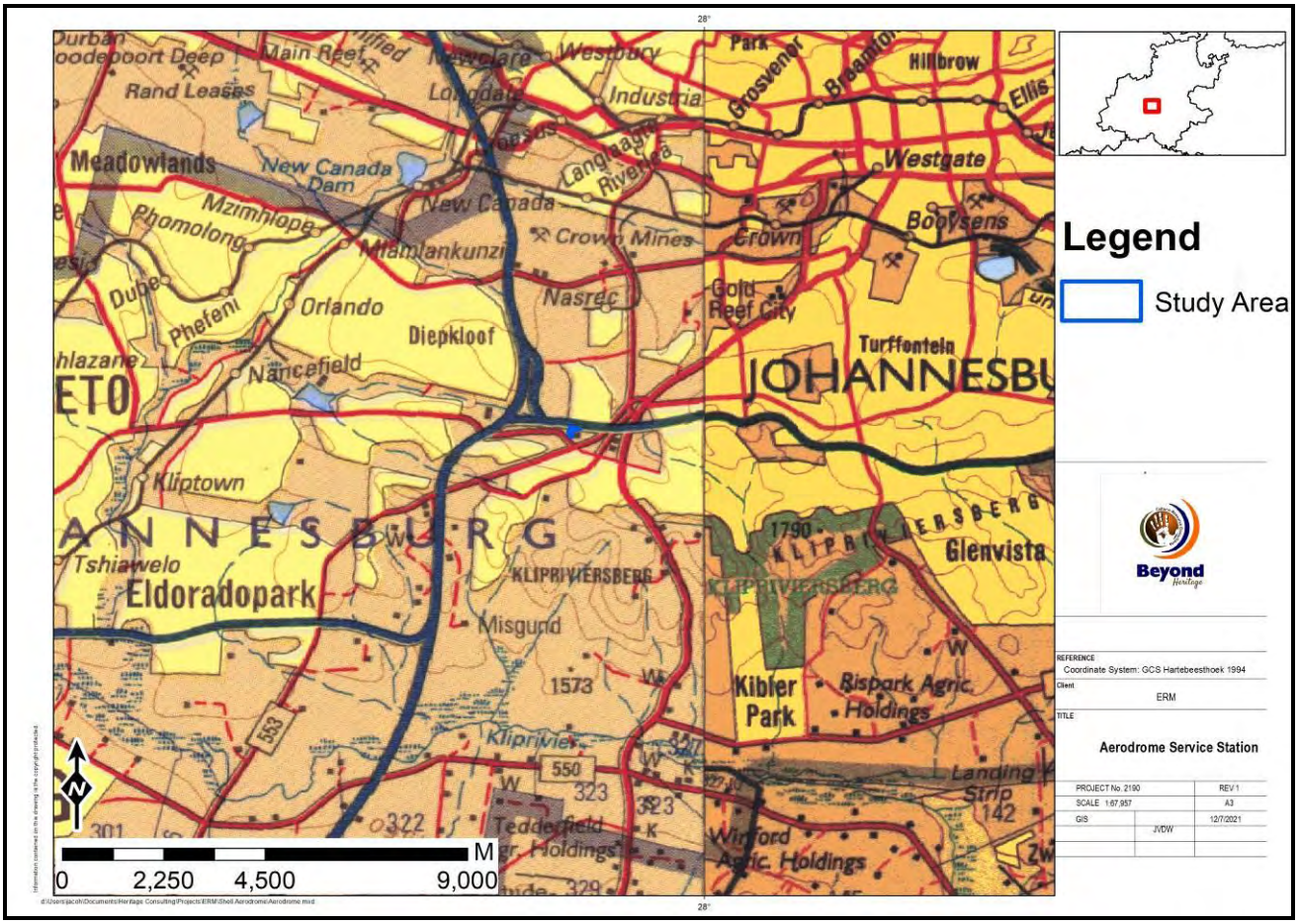

Figure 0.1. Regional setting of the project (1: 250 000 topographical map).

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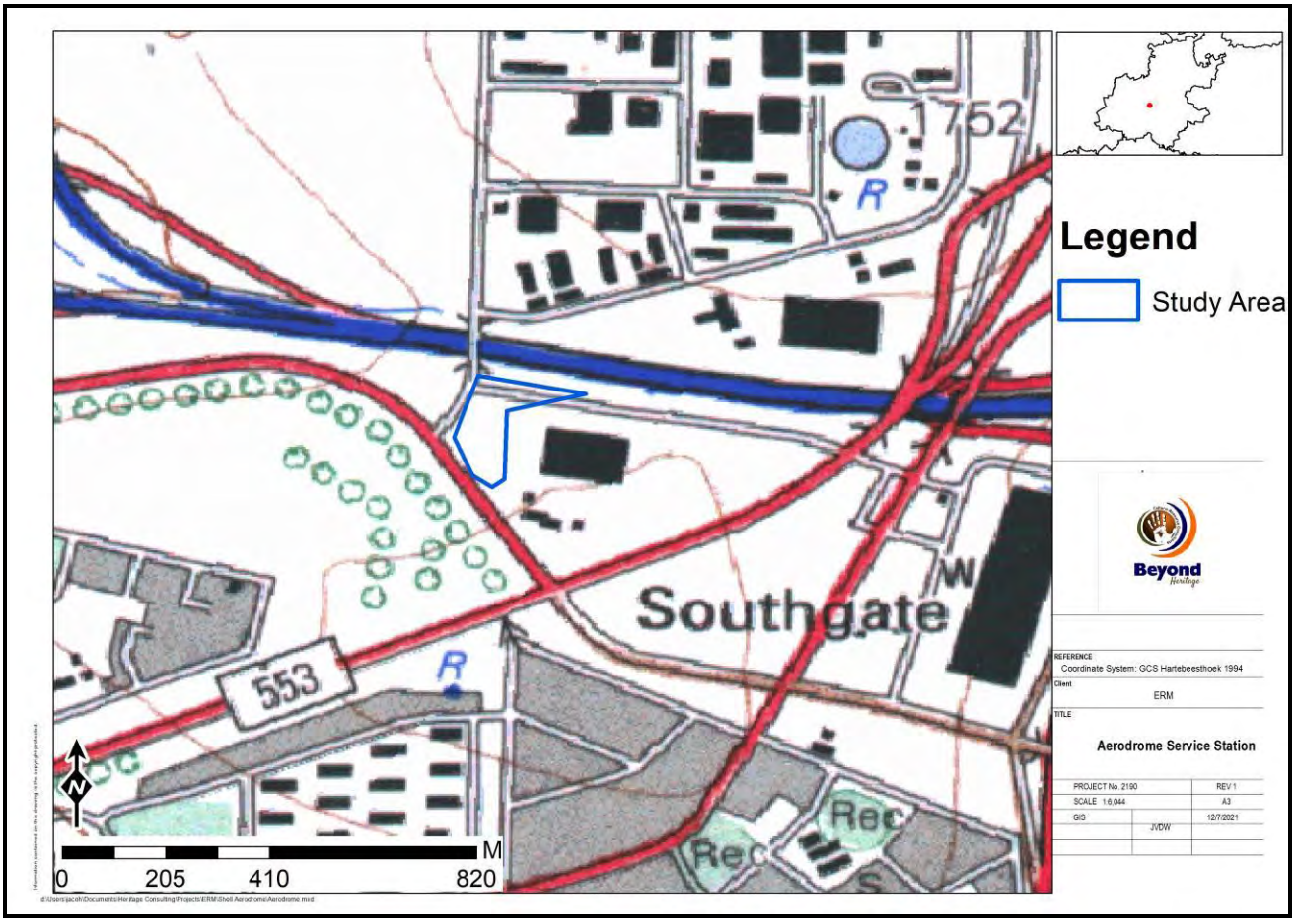

Figure 0.2. Local setting of the project (1: 50 000 topographical map).

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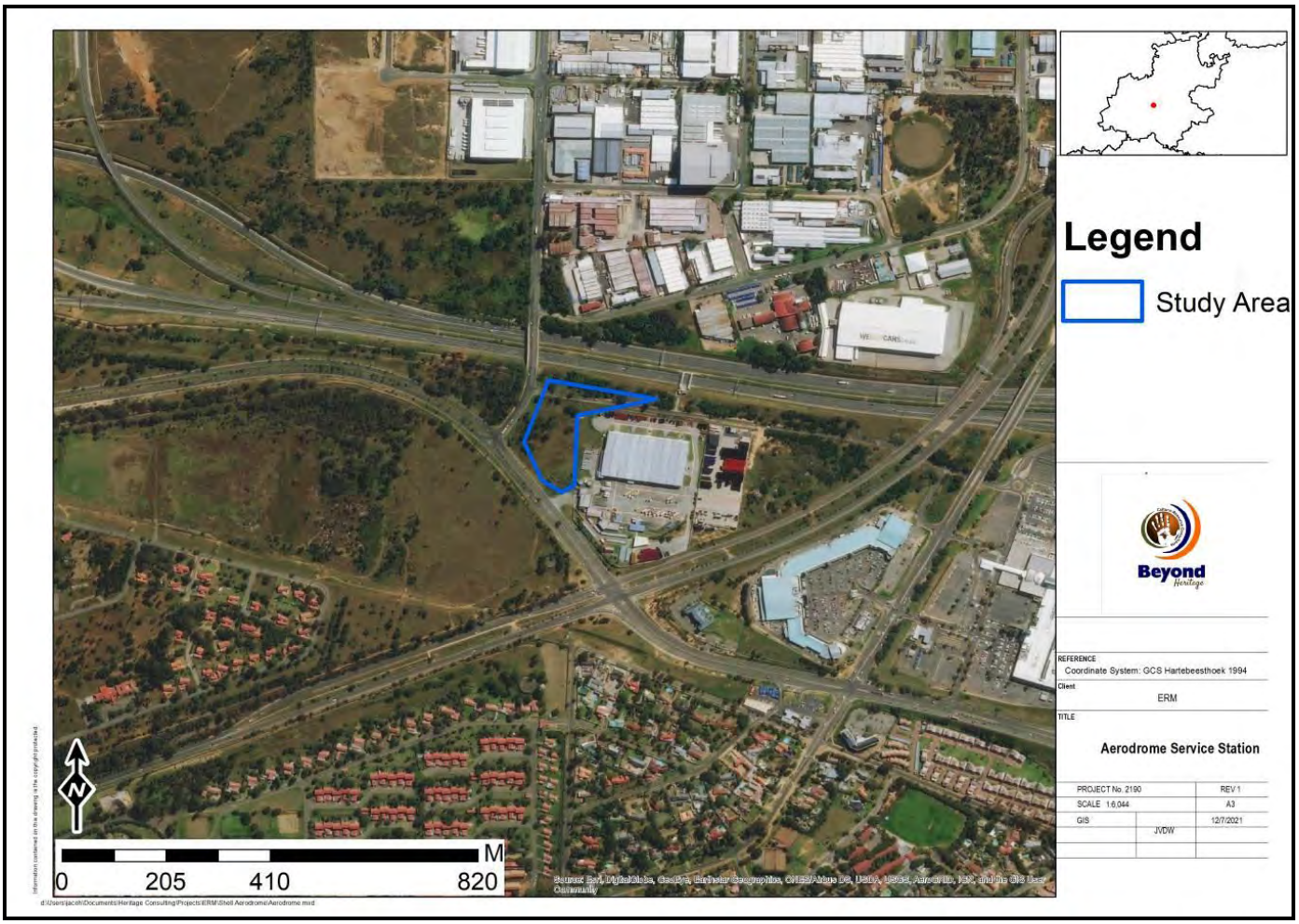

Figure 0.3. Aerial image of the study area.

1. The Heritage Character of the Study area

2.1. Literature review

A brief survey of available literature was conducted to extract data and information on the area in question to provide general heritage context into which the development would be set. This literature search included published material, unpublished commercial reports and online material, including reports sourced from the South African Heritage Resources Information System (SAHRIS).

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2.2. Background to the general area

South Africa has a long and complex Stone Age sequence of more than 2 million years. The broad sequence includes the Later Stone Age, the Middle Stone Age and the Earlier Stone Age. Each of these phases contain sub-phases or industrial complexes, and within these we can expect regional variation regarding characteristics and time ranges. The three main phases can be divided as follows;

∗ Later Stone Age; associated with Khoi and San societies and their immediate predecessors. Recently to ~30 thousand years ago

∗ Middle Stone Age; associated with Homo sapiens and archaic modern humans. 30-300 thousand years ago.

∗ Earlier Stone Age (ESA); associated with early Homo groups such as Homo habilis and Homo erectus. 400 000- > 2 million years ago.

Although there are no well-known Stone Age sites located on or around the study area there is evidence of the use of the larger area by Stone Age communities for example along the Kliprivier where ESA and MSA tools where recorded. LSA material is recorded along ridges to the south of the current study area (Huffman 2008). Petroglyphs occur at Redan as well as along the Vaal River (Berg 1999).

The Iron Age

The Iron Age as a whole represents the spread of Bantu speaking people and includes both the pre-Historic and Historic periods. It can be divided into three distinct periods:

- The Early Iron Age: Most of the first millennium AD.
- The Middle Iron Age: 10th to 13th centuries AD
- The Late Iron Age: 14th century to colonial period.

Extensive Stone walled sites are recorded at Klipriviersberg Nature reserve belonging to the Late Iron Age period. A large body of research is available on this area. These sites (Taylor's Type N, Mason's Class 2 & 5) are now collectively referred to as Klipriviersberg (Huffman 2007). These settlements are complex in that aggregated settlements are common, the outer wall sometimes includes scallops to mark back courtyards, there are more small stock kraals, and straight walls separate households in the residential zone. These sites date to the 18th and 19th centuries and was built by people in the Fokeng cluster. In this area the Klipriviersberg walling would have ended at about AD 1823, when Mzilikazi entered the area (Rasmussen 1978). This settlement type may have lasted longer in other areas because of the positive interaction between Fokeng and Mzilikazi.

The Difaqane (Sotho), or Mfekane ("the crushing" in Nguni) was a time of bloody upheavals in Natal and on the Highveld, which occurred around the early 1820's until the late 1830's (Bergh 1999: 10). It came about in response to heightened competition for land and trade, and caused population groups like gun-carrying Griquas and Shaka's Zulus to attack other tribes (Bergh 1999: 14; 116-119). It seems that, in 1827, Mzilikazi's Ndebele started moving through the area where Johannesburg is located today. This group went on raids to various other areas in order to expand their area of influence (Bergh 1999: 11).

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2.2.1. CRM reports

The following CRM reports were conducted in the vicinity of the study area and consulted for this study:

Author	Year	Project name	Findings
Mathoho, E & Magoma, M	2010	Archaeological investigation of a proposed substation at SOWETO, Gauteng Province.	No sites.
Fourie, W.	2007	Proposed development on Portion 12 of the farm Misgund 322 IQ Johannesburg,Gauteng Province	No sites
Huffman, T. N & Calabrese, J. A.	1997	Archaeological survey of the Baralink Node Development.	Two intangible heritage sites and one site that might date to the Boer War.
Coetzee, F. P.	2015	Cultural Heritage Assessment for the Proposed Construction of the Additional Meredale Reservoir (210 Ml) (Eikenhof System), City of Johannesburg District Municipality, City of Johannesburg Metropolitan Municipality, Gauteng.	Modern Built features and an Iron Age Site away from the study area.
Van Schalkwyk, J.	2003	A survey of cultural resources for the proposed Aeroton Cemetery, Johannesburg	No Sites

Google Earth and 1:50 000 maps of the area were utilised to identify possible places where archaeological and historical sites might be located. LIA sites can be expected along foothills and dolerite dykes.

2.1.3. Society and Google Earth Monuments

No known grave sites are indicated close to the study area.

2.3. Cultural Landscape

The landscape setting in which the project is located is urban in character but used to be rural with road infrastructure from the 1940's onwards. The surrounding area is now densely developed (Figure 2.1 – 2.4) and characterised by the intensive residential developments.

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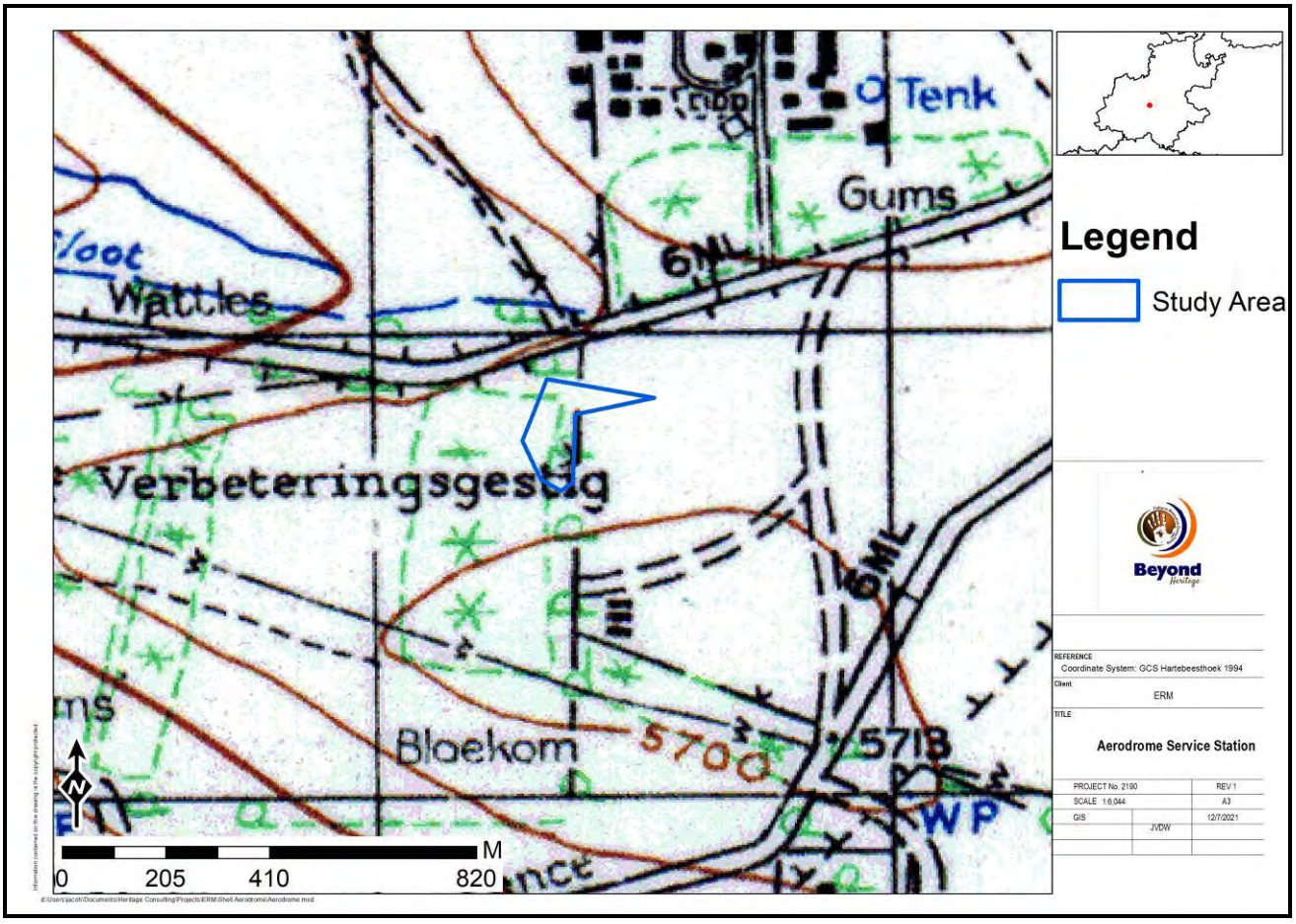

Figure 1.1. 1944 Topographical map of the project area and surrounds showing limited development.

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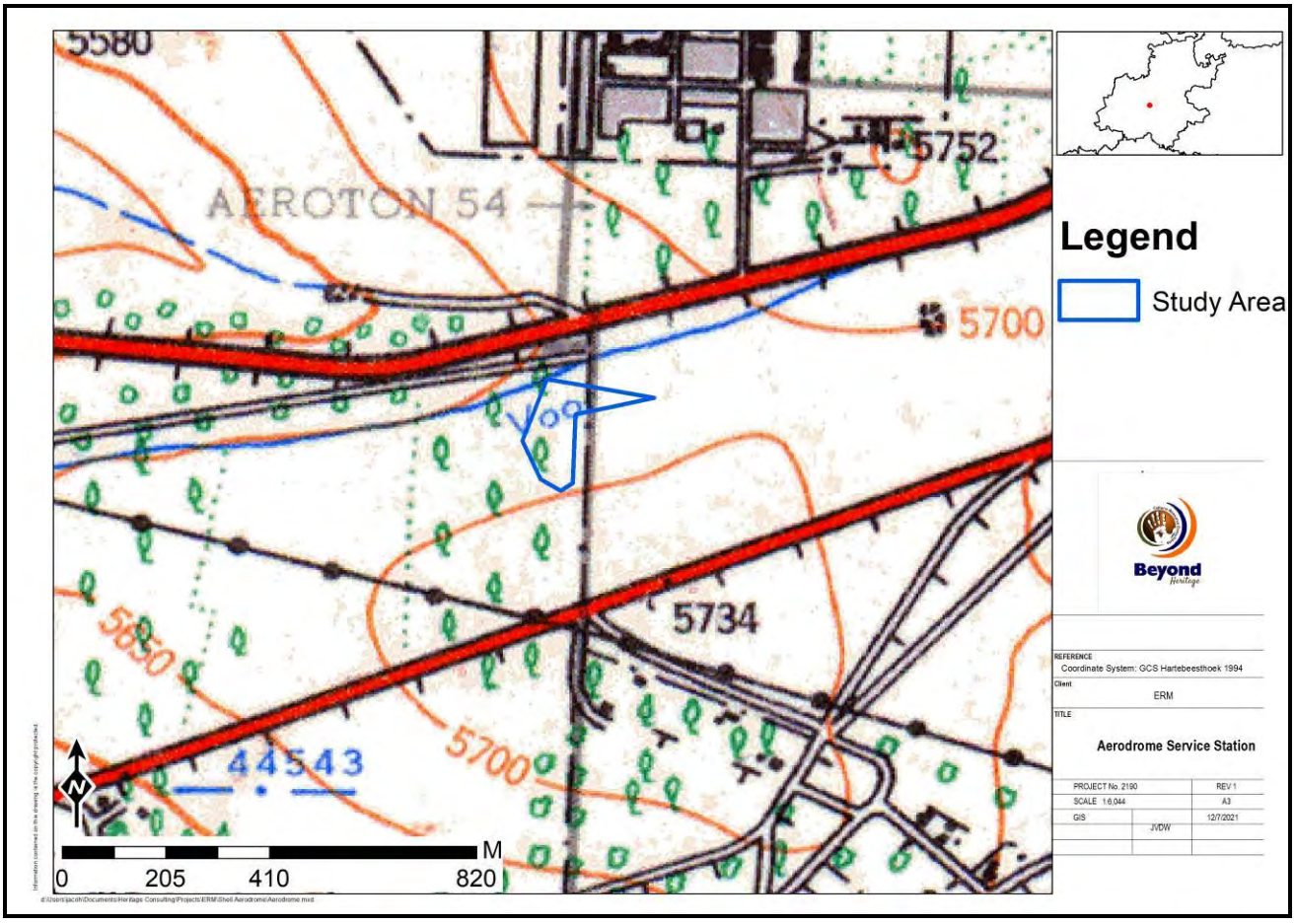

Figure 1.2. 1956 Topographical map of the impact area indicating the development of the project area surrounded by road developments with water bodies/reservoirs in the study area.

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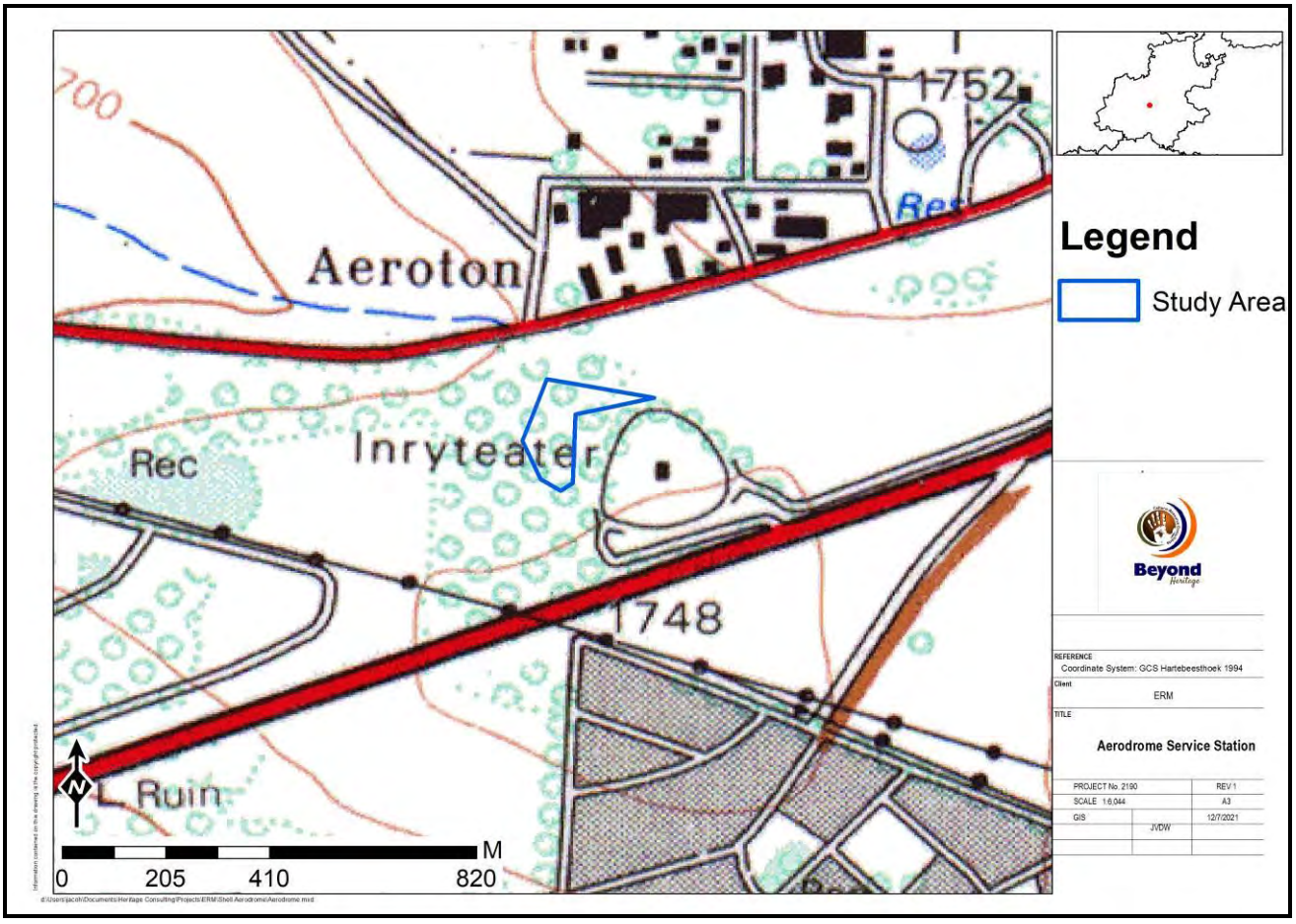

Figure 1.3. 1976 map of the study area indicating a drive-in theatre close by with the study area sitl being undeveloped.

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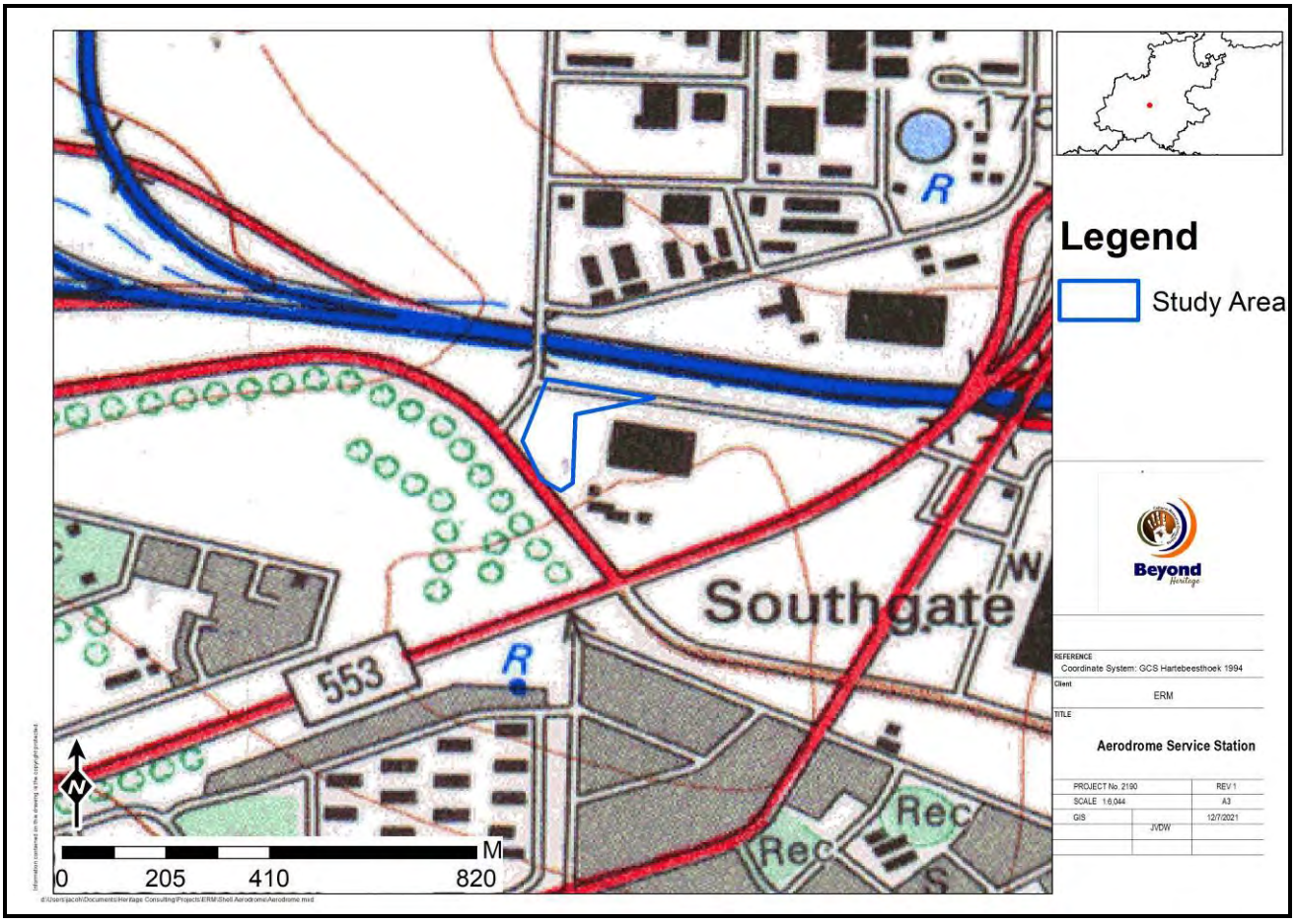

Figure 1.4. 1995 Topographic map indicating development of the surrounding area.

3. Findings

The project area was visited on the 9th of September and was sufficiently covered to understand the heritage character of the area (Figure 3.1). The project footprint measures approximately 2 hectares and is located adjacent to Aerodrome and Chris Hani Roads. The surrounding areas have been developed between the 1970's and 1990's and these developments would have impacted on surface indicators of heritage resources if any were present in the area. This was evident during the site visit that showed the study area to be disturbed from a heritage point of view (Figure 3.2 to 3.5). The study area is considered to be of low heritage potential and no structures, historical sites or archaeological artefacts were noted during the site visit.

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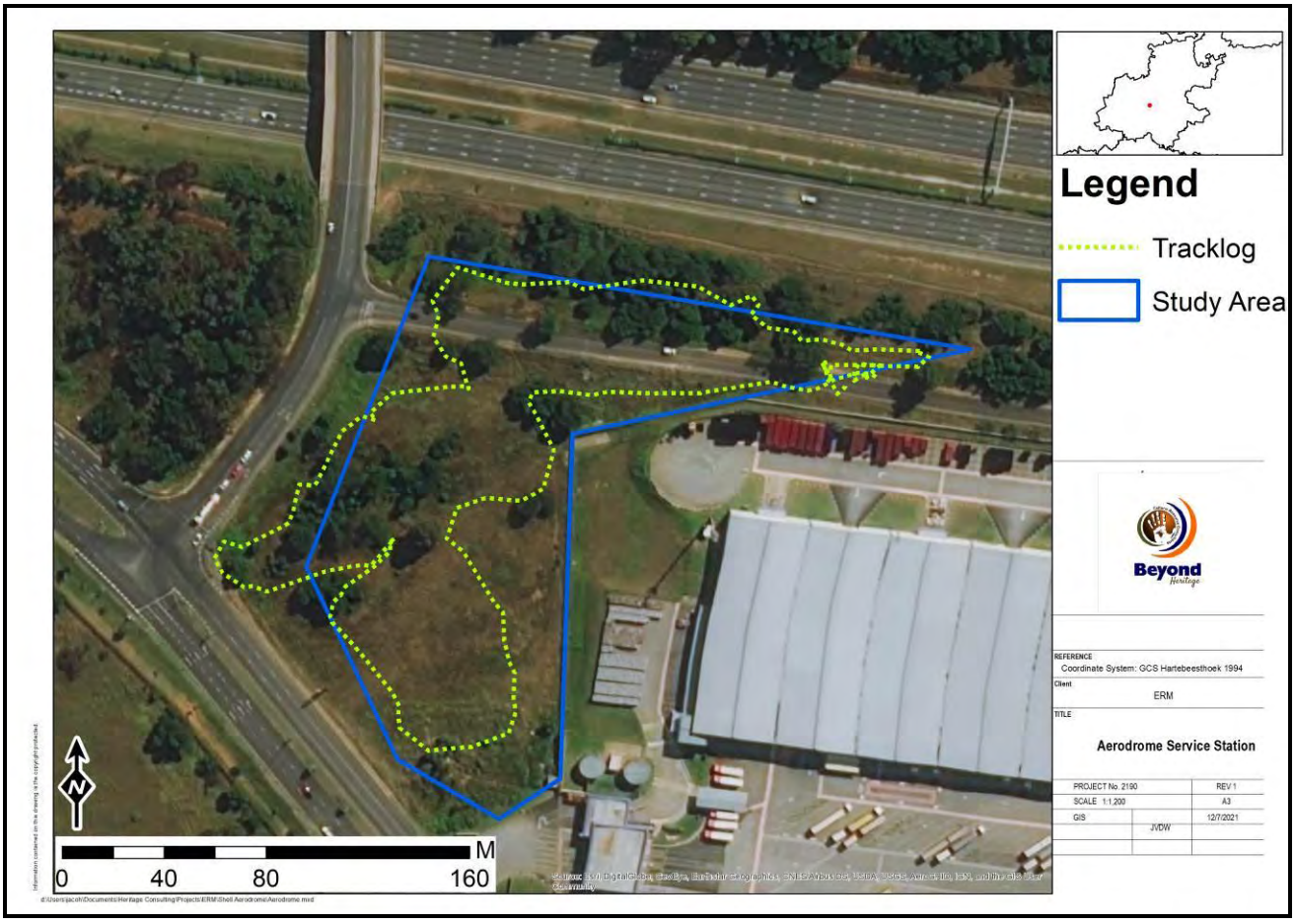

Figure 3.1. Track logs of the site visit.

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Figure 3.2. General site conditions.

Figure 3.3. General site conditions.

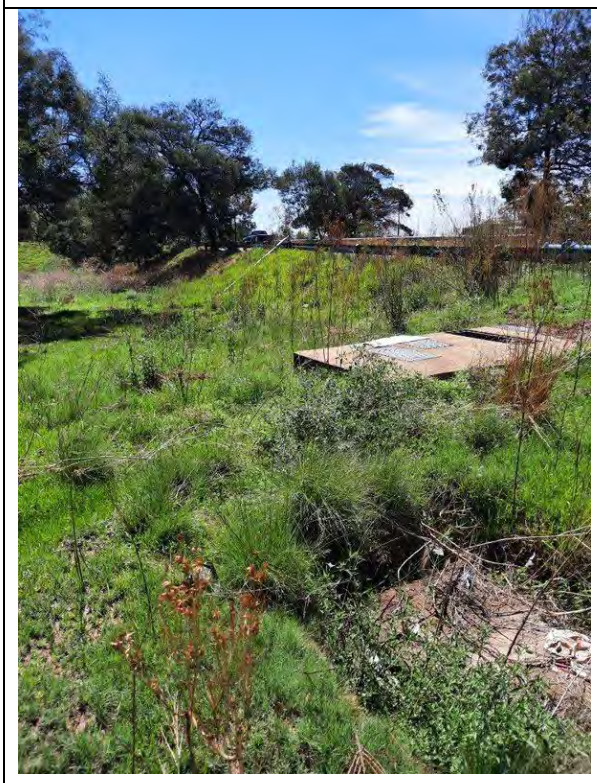

Figure 3.4. General site conditions.

Figure 3.5. General site conditions.

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3.1. Paleontology

Based on the SAHRA paleontological map the study area is of low senstivity (Figure 3.6) and no further studies are required for this aspect.

Figure 3.6. Paleontological sensitivity of the approximate study area (yellow polygon) as indicated on the SAHRA Paleontological Map (Key below)

Colour	Sensitivity	Required Action
RED	VERY HIGH	Field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	Desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	Desktop study is required
BLUE	LOW	No palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	No palaeontological studies are required
WHITE/CLEAR	UNKNOWN	These areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

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4. Conclusion

The study area has been impacted upon by the extensive development of the surrounding areas and the area is considered to be of low heritage potential. The impact of clearing, levelling and construction activities from surrounding developments would have obliterated any indicators of heritage resources if any ever occurred in the study area. This was confirmed during a site visit to the project area where no archaeological sites or standing structures were recorded, and it is unlikely that the project would impact on significant heritage resources. Therefore, an application for exemption from further heritage studies is supported.

Any further queries can be forwarded to Jaco van der Walt on Cell: +27 82 373 8491 or to jaco@heritageconsultants.co.za.

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APPENDIX G 5 OUTLINE SCHEME REPORT

OUTLINE SCHEME REPORT

PROPOSED FILLING STATION

ON

THE FARM 751 REGISTRATION DIVISION I.Q

FEBRUARY 2022

K&T PROJECT REFERENCE: 8101A

OUTLINE SCHEME REPORT

REVISION 0

KANTEY & TEMPLER (PTY) LTD, REG NO. 1966/009839/07
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Details of this report

Client Name	Shell
Document Title	Outline Scheme Report (OSR)
K&T Project Reference	8101
File Name	8101 OSR Rev 0
Prepared By	L Maritz
Reviewed By	F Bain

Report Revision Record

Revision	Date	Description
A	July 2020	For Review
0	Feb 2022	For Client Review

This report has been prepared by Kantey & Templer (Pty) Ltd, with all reasonable skill, care, and diligence within the terms of the Contract with the client, incorporating our General Terms and Conditions of Business and taking account of the resources devoted to it by agreement with the client.

We disclaim any responsibility to the client and others in respect of any matters outside the scope of the above.

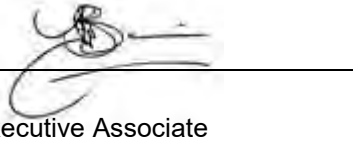
This report is confidential to the client, and we accept no responsibility of whatsoever nature to third parties to whom this report, or any part thereof, is made known. Any such party relies on the report at their own risk.

For and on behalf of Kantey & Templer (Pty) Ltd

For and on behalf of

Kantey & Templer (Pty) Ltd

Approved by: Francois Bain

Signed: 

Position: Executive Associate

Date: 22 Feb 2022

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1. INTRODUCTION

1.1 BACKGROUND

Kantey & Templer Consulting Engineers (K&T) have been appointed by Shell (Pty) Ltd to compile an Outline Services Scheme Report in support of the proposed township of The Farm 751 Registration Division I.Q, province of Gauteng, hereafter referred to as "**The Site**". The Site will be zoned as Commercial 2 with an area of 12 885 m².

The above-mentioned site is bound by Southgate Road to the North, Aerodrome Road to the West, and Chris Hani Road (M68) to the South-West.

The site locality is shown on drawing no. **8101 – OSR – 01-A: SITE LOCALITY** in **Annexure A**

1.2 SCOPE OF REPORT

The scope of this report is:

- Identify location of available existing services.
- Determine if existing services need to be extended.
- Determine connection points for site services.
- Specify design standards of proposed services.
- Assess impact of the rezoned site on existing services and determine if upgrades are required.
- If upgrades are required, determine size, and extend of upgrades to existing services.

The engineering services addressed in this report are:

- Potable water and fire water supply
- Sewerage
- Solid waste removal
- Stormwater drainage
- Road infrastructure

1.3 PROJECT TEAM

Client:	Shell (Pty) Ltd
Town planner:	FJC Consulting
Architect:	Boleng SA (Pty) Ltd
Civil Engineer:	Kantey & Templer (Pty) Ltd
Transportation Engineer:	Kantey & Templer (Pty) Ltd

2. SITE DESCRIPTION

2.1 TOPOGRAPHY & LOCATION

Location:	Situated along the Chris Hani Road (M68). The Golden Highway (R553) is approximately 350m to the South and the Southern Bypass (N12) to the North of the proposed site. The South Gate Mall is located approximately 950m from the development and is to the East.	
Current Land Use Zoning:	Agricultural	
Existing structures:	No buildings on the site.	
Area of Site	12 885 m^2	
Level & fall of terrain:	The site has an altitude of approximately 1 728 m to 1 735 m above mean sea level. The slope is falling in a north westerly direction, with an approximate gradient of 5 %. The low point is located in the north-western corner of the site.	
Vegetation:	Site covered by natural grasses and a few scattered shrubs and small trees.	
Surrounding Land Use:	North	Southgate Road
	East	SAB Baragwanath Distribution Centre
	South	Chris Hani Road (M68)
	West	Aerodrome Road

2.2 PROPOSED ZONING & LAND USE

Proposed Land Use Zoning:	The intention is to develop a filling station with a convenience store and fast food with a floor area limited to 30% of the total built floor area or 150m², whichever is the lesser as per COJ Land-Use Scheme (2018).
Height Zone:	As per scheme:
Coverage:	As per scheme
Floor Area Ratio (FAR):	As per scheme: 0.3 or 150m², whichever is the lesser
Density:	As per scheme

3. WATER

3.1 EXISTING WATER INFRASTRUCTURE

3.1.1 DESCRIPTION

According to the Johannesburg Water GIS there is an existing 110 mmØ uPVC water pipe link to the South of the site, extending from Thomas Street on the southern side of the K45 Golden Highway to a point to the north of the K45 Golden Highway just north of the Golden Highway. There is an existing 110mmØ ring main in Thomas Avenue and Murray Ave. The locality of these pipes can be seen on **8101 – OSR – 02-A: EXISTING SERVICES** in **Annexure A.**

3.2 WATER DEMAND

The water demand, excluding the fire flow, was determined for the following:

1. 150m² total built floor area filling station with a convenience store and fast food

3.2.1 DESIGN CONSUMPTION

For the proposed development, the 2017 Johannesburg Water standards illustrate that the average water demand for the site is:

ZONING	FLOOR AREA / NO OF UNITS	DESIGN CONSUMPTION	FLOW l/d	FLOW l/s
Fuel Station, Convenience Store and Fast Food Outlet	150 m²	400 l/d per 100 m² floor area	600	0.007

The total water demand required to support the development is 0.007 l/s.

3.2.2 DESIGN PEAKFLOW

The peak factor was taken as 4.0, which is in accordance with the Johannesburg Water Standards.

TOTAL FLOW l/s	PEAK FACTOR	TOTAL PEAK FLOW l/s
0.007	4	**0,028**

The **design peak flow** for the proposed development, taking the peak factor of 4 into account, amounts to **0,028 l/s.**

Johannesburg Water recommends a minimum size of 110 mm Ø for pipe water mains with a class 16 pressure rating to adequately service any new development for both domestic and fire requirements for new connections. The anticipated water connection is shown on the attached drawing: **8101 – OSR – 02-A: PROPOSED SERVICES** in **Annexure A.**

Determination of velocity in pipe at peak flow demand:

PIPE SIZE	OUTSIDE Ø mm	T WALL mm	INSIDE Ø mm	INSIDE AREA mm2	DESIGN PEAK FLOW l/s	V m/s
110mm HI uPVC	110	6.7	96.6	7328.99	0.028	0.00382

The pipe velocity of the water pipe falls below the permissible range which is between 1.0 to 3.5 m/s. A smaller pipe size may be considered for domestic supply, however fire flow should first be assessed.

3.3 FIRE FLOW

The Johannesburg Water guidelines & standards for the design of water and sanitation services were used for the determination of the fire flow. SANS 10400 T standards are also applicable.

The requirements are summarized as follows:

FIRE RISK CATEGORY/AREA	TOTAL FIRE FLOW (L/s)	MIN. FLOW FOR EACH HYDRANT (L/s)	MINIMUM RESIDUAL PRESSURE AT FIRE NODE (m)	DURATION OF FIRE (Hours)	SPACING OF HYDRANTS
Moderate Risk 1	50	25	15	4	180 m max

New fire hydrants will be installed to satisfy the fire requirements and adequately protect the development. One hydrant will be installed at the site entrance as is illustrated on drawing no. **8101 – OSR – 02-A: PROPOSED SERVICES** in **Annexure A** as well as at an appropriate position within the site.

Determination of velocity in pipe at peak flow demand including fire flow:

PIPE SIZE	OUTSIDE Ø mm	T WALL mm	INSIDE Ø mm	INSIDE AREA mm2	FIRE FLOW l/s	TOTAL FLOW l/s	V m/s
110mm Ø	110	6.7	96.6	7328.99	50	50	6.8222
160mm Ø	160	9.7	140.6	15526.03	50	50	3.22

The anticipated Peak Fire Flow velocity for the 110 mm Ø is in excess of the maximum of 3.5 m/s. Therefore the 110 mm Ø pipe will not be sufficient. However, the 160 mm Ø pipe's velocity is less than the maximum of 3.5 m/s and the pipe's diameter falls within the minimum allowable for fire flow, as specified by Johannesburg Water. Therefore, the connection of a 160 mm Ø pipe will be sufficient.

The existing 110 mm Ø link pipe from Thomas Street on the southern side of the K45 Golden Highway to a point to the north of the K45 Golden Highway will have insufficient capacity to supply the site and will be replaced with a new 160mm Ø link connecting the site to the existing 110mm Ø ring main in Thomas Avenue and Murray Ave will be used to service the proposed site. A new crossing of the K45 Golden Highway by directional drilling will be required.

3.4 PROPOSED SERVICES

3.4.1 CONNECTION POINT

For the purpose of this report, the anticipated water connection point for the proposed development will be at a point to the South of the site off the existing 110mm Ø ring main in Thomas Avenue and Murray Ave, as shown in the accompanied drawing: **8101 – OSR – 02-A: PROPOSED SERVICES** in **Annexure A**. The proposed connection will be a 160 mm Ø H.I. uPVC Class 16 pipe and will replace the existing

110 mm Ø link pipe from Thomas Street on the southern side of the K45 Golden Highway to a point to the north of the K45 Golden Highway.

3.4.2 FLOW METER

The flow meter will be situated on the proposed pipeline close to the site boundary as can be seen in the drawing **8101 – OSR – 02-A: PROPOSED SERVICES** in **Annexure A.**

The high flow rate necessitated by the fire requirements will require a 160 mm Ø compound flow meter. A final decision regarding the preferred compound flow meter will be made at a later stage of the development under the guidance of Johannesburg Water depot.

3.4.3 EXTERNAL SERVICES

The existing 110 mm Ø link pipe from Thomas Street on the southern side of the K45 Golden Highway to a point to the north of the K45 Golden Highway will have insufficient capacity to supply the site in terms of fire and will be replaced with a new 160mm Ø H.I. uPVC Class 16 link pipe connecting the site to the existing 110mm Ø ring main in Thomas Avenue and Murray Ave will be used to service the proposed site. A new crossing of the K45 Golden Highway by directional drilling will be required.

Johannesburg Water will confirm whether sufficient flow and pressure is available for the site, from this connection point.

3.4.4 INTERNAL SERVICES

The internal water reticulation network will be designed once the internal Site Development Plan (SDP) is finalised by the Architect and it will be submitted separately to Johannesburg Water for scrutiny and comment.

3.4.5 SERVITUDES

No servitudes are required for the water services.

3.4.6 COST ESTIMATE

All internal and external water costs associated with the proposed development will be for the developer's account. This includes any bulk contributions that the developer might be required to make.

4. SEWER

4.1 EXISTING INFRASTRUCTURE

As shown in drawing no. **8101 – OSR – 02-A: EXISTING SERVICES** in **Annexure A,** there is an existing 250 mm Ø sewer line, running in a north westerly direction along Sabax Road to the North of the site. This sewer line increases in size to a 300 mm Ø pipe approximately 80 m down the line from the proposed connection point.

4.2 DESIGN DISCHARGE

According to the Johannesburg Water Standards the following parameters are applicable:

- Percentage due to extraneous inflow: 15%
- Sewer discharge (excluding peak factors) to be approximately 80% of the water consumption.

The site will generate an additional **0.007 l/s** of sewerage into the existing network.

ZONING	FLOOR AREA / NO OF UNITS	DESIGN CONSUMPTION	SEWER DISCHARGE l/d	PEAK FACTOR	FLOW l/s
Fuel Station, Convenience Store and Fast Food Outlet	150 m²	220 l/d per 100m² floor area	330	1.8	0.007

4.3 PROPOSED SERVICES

4.3.1 CONNECTION POINT

For the purpose of this report, the anticipated sewer connection point for the proposed development will be at a point along Sabax Road, as shown in the accompanied drawing: **8101 – OSR – 02-A: PROPOSED SERVICES** in **Annexure A.** The proposed connection point will be 160 mm Ø uPVC Class 34 pipe. The proposed pipeline will run underneath the N12 Southern Bypass by means of directional drilling at a minimum slope of 1:100.

It is also proposed that, for the fuel station part of the site, an oil-water separator be constructed on site to split any oil residue from the sewer line before discharging into the existing pipeline.

4.3.2 EXTERNAL SERVICES

A new 160mm Ø pipe connecting to an existing 250 mm Ø pipe along Sabax Road will be used to service the proposed site. No further upgrades to the existing sewer main will be required.

Johannesburg Water will confirm if there is sufficient downstream capacity to accept this additional sewer.

4.3.3 INTERNAL SERVICES

The internal sewer reticulation network will be designed once the internal Site Development Plan (SDP) is finalised by the Architect and it will be submitted separately to Johannesburg Water for scrutiny and comment.

4.3.4 SERVITUDES

No servitudes are required for the sewer services.

4.3.5 COST ESTIMATE & BULK CONTRIBUTIONS

All internal and external sewer costs associated with the proposed development will be for the developer's account. This includes any bulk contributions that the developer might be required to make.

5. SOLID WASTE REMOVAL

There will be a dedicated refuse yard facility for the proposed development, located at a position internal to the site. The proposed site access will be designed and constructed to standard requirements for refuse vehicle access. A minimum 4m wide lane will be provided at the main entrance for refuse vehicle to access the refuse yard. Details and positions of the refuse yard will be shown on the Architect's Site Development Plan (SDP) for approval.

6. STORMWATER

6.1 EXISTING INFRASTRUCTURE

There is an existing 450 mm Ø stormwater pipe culvert beneath Southgate Road in the north western corner of the site
This is shown on drawing no. **8101 – OSR – 02-A: EXISTING SERVICES** in **Annexure A.**

6.2 PROPOSED INFRASTRUCTURE

For the purpose of this report, the anticipated stormwater connection point for the proposed development will be at the existing 450 mm Ø stormwater pipe culvert beneath Southgate Road in the north western corner of the site.
Since the stormwater discharge from the site will be attenuated, the post development 1:5 and 1:25 year mean return period storm discharge will be equal to- or less than the predevelopment 1:5 and 1:25 year mean return period storm discharges respectively.

See the accompanied drawing: **8101 – OSR – 02-A: PROPOSED SERVICES** in **Annexure A.** The proposed connection will be a 450 mm Ø Class 100D stormwater pipe.

It is also proposed that, for the fuel station part of the site, an oil-water separator be constructed on site to split any oil residue from the stormwater line before entering the attenuation facility and discharging into the existing stormwater infrastructure.

6.3 ATTENUATION

6.3.1 REQUIREMENTS

We propose to apply the guidelines as set out by The Johannesburg Roads Agency (JRA).

The Johannesburg Roads Agency (JRA) requires on-site attenuation for developments larger than 4 000 m² in area. Stormwater attenuation is not required for land given off for road reserve servitudes and undeveloped public and private open spaces. Since the developable area of the site is **12 300 m²**, which is greater than the threshold, a stormwater attenuation facility will be required for this development.

An attenuation pond is proposed in the north westerly corner of the site as can be seen on the drawing **8101 – OSR – 02-A: PROPOSED SERVICES** in **Annexure A.** An attenuation pond with a total attenuation volume of about 430 m³ will be constructed. There is sufficient volume to attenuate the site and discharge at no more than the 1:5 and 1:25 year pre-development flows. The preferred solution for attenuation is and open pond that is environmentally friendly with bio retention capabilities.

6.4 PROPOSED SERVICES

6.4.1 MINOR SYSTEM

The minor system refers to the internal stormwater infrastructure on the site.
The following measures are proposed in terms of the design of the minor system:

- The run-off will be captured by kerb inlets and grid inlets and conveyed to the connection point via an underground stormwater pipe network towards the attenuation dam.
- The internal stormwater pipe network will be designed to accommodate the runoff generated by storm events with a recurrence interval of up to 5 years.

The layout of the proposed stormwater system is shown on drawing **8101 – OSR – 02-A: PROPOSED SERVICES** in **Annexure A.** Internal stormwater will be designed once the internal Site Development

Plan (SDP) is finalised by the Architect and it will be submitted separately to JRA for scrutiny and comment.

6.4.2 MAJOR SYSTEM

The major system acts as a backup emergency system in case of a major storm events with a recurrence interval of greater than 5 years. Its function is to protect the properties and infrastructure from damage and flooding during such events.

The following measures are proposed in terms of the design of the major system:

- All runoff generated by the proposed development during the major system will drain overland towards the kerb inlets. All parking areas and internal road networks will be designed accordingly. Stormwater that cannot be accommodated within the pipework will be directed as surface flow along paving and kerbing into the stormwater attenuation facility.
- There will be sufficient weepholes along the western boundary wall of the site for overland drainage of the runoff.

7. ROADS

7.1 EXISTING INFRASTRUCTURE

A filling station is proposed on The Farm 751 Registration Division I.Q, province of Gauteng. The site is located along Chris Hani Road (M68). The Golden Highway (R533) is approximately 350 m to the South and the Southern Bypass (N12) to the North of the proposed site. The site falls within jurisdiction of the City of Johannesburg (COJ) Metropolitan Municipality and Johannesburg Roads Agency (JRA).

7.2 GEOMETRY

7.2.1 STANDARDS

The road infrastructure for the site will be configured in accordance with the COJ and JRA requirements.

7.3 DESCRIPTION

7.3.1 SITE ACCESS

Two (2) accesses are proposed to the site. A marginal (left-in and left-out only) access is proposed off Chris Hani Road (Access 1) and a full access is proposed of Southgate Road (Access 2).

A marginal access (Access 1) to the filling station is proposed off Chris Hani Road, which is a class 2 route, and the access was designed in terms of ITS [(1)] guidelines. The proposed access point is sufficiently far away from the adjacent intersection and is not expected to have an impact on or be impacted by the operating conditions at the adjacent intersection.

A full access (Access 2) is proposed off Southgate Road which is a class 5 route. The access was previously approved. It is proposed that the access should be located at a minimum distance of 50m East measured from the edge of the bell mouth along Southgate Road. The SIDRA capacity analysis for Aerodrome Road / Southgate Road intersection indicates that there will not be a queue spillback past the proposed access position.

The site access plan can be seen on drawing no. **8101-OSR-04: PROPOSED ROAD LAYOUT**

7.3.2 PARKING

Parking should be provided in terms of the relevant Town-Planning Scheme. Details of the parking requirements will be addressed as part of the Site Development Plan (SDP) submission.

8. RECOMMENDATIONS & CONCLUSION

8.1 RECOMMENDATIONS

8.1.1 WATER

The existing 110 mm Ø link pipe from Thomas Street on the southern side of the K45 Golden Highway to a point to the north of the K45 Golden Highway will have insufficient capacity to supply the site in terms of fire supply and will be replaced with a new 160mm Ø link connecting the site to the existing 110mm Ø ring main in Thomas Avenue and Murray Ave. A new crossing of the K45 Golden Highway by directional drilling will be required.

A new 160 mm Ø external water main with a valve, water meter and fire hydrant are proposed to service the site.
Johannesburg Water will confirm whether sufficient flow and pressure is available for the site, from this proposed connection point.

Internal water reticulation will be submitted separately to Johannesburg Water as soon as the internal Site Development Plan (SDP) is finalised by the Architect.

8.1.2 SEWER

The existing 250 mm Ø sewer main to the North of the site, running along Sabax Road, will have sufficient capacity to cater for the proposed development. The site connection will be by means of a new 160 mm Ø sewer pipe. This pipe will route beneath the N12 highway by means of directional drilling and connect to the existing 250 mm Ø sewer main to the North of the site, running along Sabax Road.
Internal sewer reticulation will be submitted separately to Johannesburg Water as soon as the internal Site Development Plan (SDP) is finalised by the Architect.

Johannesburg Water will confirm if there is sufficient downstream capacity to accept this additional sewer.

8.1.3 SOLID WASTE REMOVAL

A dedicated refuse yard facility at a position internal to the site will be allocated. This facility must be constructed to comply with the Local Municipality's requirements.

8.1.4 STORMWATER

The existing 450 mm Ø stormwater pipe culvert beneath Southgate Road will have sufficient capacity to cater for the proposed development.
Since the stormwater discharge from the site will be attenuated, the post development 1:5 and 1:25 year mean return period storm discharge will be equal to or less than the predevelopment 1:5 and 1:25 year mean return period storm discharges respectively aalready running through this pipe culvert. The site connection will be by means of a 450 mm Ø Class 100D pipe.

8.1.5 ROADS

It is proposed that the site have 2 access points. One off of Chris Hani Road and one off of Southgate Road. The entrance off of Chris Hani Road will be a marginal access (left-in and left-out only), while the entrance off of Southgate Road will be a full access

8.2 CONCLUSION

Provided the proposed infrastructure mentioned in this report is constructed, this development of Baragwanath extension 5 and rezoning should be supported by the local authority, as there is sufficient capacity in the existing municipal infrastructure.

APPENDIX A

DRAWINGS
8101-OSR-01: Site Locality
8101-OSR-02: Existing Services
8101-OSR-03: Proposed Services
8101-OSR-04: Proposed Roads Layout

ANNEXURE B:

TOWN PLANNING DOCUMENTATION

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