PROPOSED EXPANSION OF THE EXISTING KRIEL ASH DISPOSAL FACILITIES, KRIEL POWER STATION, KRIEL (GA-NALA), EMALAHLENI LOCAL MUNICIPALITY, MPUMALANGA PROVINCE

Heritage Impact Assessment Report

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Reg No 2003/008940/07

Declaration of Independence

The report has been compiled by PGS Heritage (Pty) Ltd, an appointed Heritage Specialist for Aurecon South Africa (Pty) Ltd. The views stipulated in this report are purely objective and no other interests are displayed during the decision making processes discussed in the Heritage Impact Assessment.

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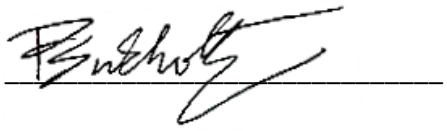
SIGNATURE: 

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Report Title	Heritage Impact Assessment for the Proposed Expansion of the Ash Disposal Facilities, Kriel Power Station, Kriel (Ga-Nala), Emalahleni Local Municipality, Mpumalanga Province		
Control	**Name**	**Signature**	**Designation**
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As indicated in the table below, this Heritage Impact Assessment report was compiled in accordance with the NEMA Appendix 6 requirements for specialist reports.

NEMA REGS (2014) - APPENDIX 6	RELEVANT PAGES AND SECTIONS
Details of the specialist who prepared the report.	Pages i, ii, iii, 1 & 2. Also Appendix B
The expertise of that person to compile a specialist report including a curriculum vitae.	Pages i, ii, iii, 1 & 2. Also Appendix B
A declaration that the person is independent in a form as may be specified by the competent authority.	Page ii
An indication of the scope of, and the purpose for which, the report was prepared.	Page 1 (Section 1.1)
The date and season of the site investigation and the relevance of the season to the outcome of the assessment.	Page 16 (Section 3.1)
A description of the methodology adopted in preparing the report or carrying out the specialised process.	Page 16 (Section 3.1)
The specific identified sensitivity of the site related to the activity and its associated structures and infrastructure.	Sections 4 to 6
An identification of any areas to be avoided, including buffers.	Not applicable
A map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers.	Not applicable
A description of any assumptions made and any uncertainties or gaps in knowledge.	Page 2 & 3 (Section 1.3)
A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment.	Section 5 and 6 Please note that no development alternatives were assessed.
Any mitigation measures for inclusion in the EMPr.	Section 8
Any conditions for inclusion in the environmental authorization.	Sections 8 and 9
Any monitoring requirements for inclusion in the EMPr or environmental authorisation	Sections 8 and 9
A reasoned opinion as to whether the proposed activity or portions thereof should be authorised and	Executive Summary and Section 9
If the opinion is that the proposed activity or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan	
A description of any consultation process that was undertaken during the course of carrying out the study	Not applicable. A public consultation process was handled as part of the EIA and EMP process.
A summary and copies if any comments that were received during any consultation process	Not applicable. To date no comments regarding heritage resources that require input from a specialist have been raised.
Any other information requested by the competent authority.	Not applicable.

EXECUTIVE SUMMARY

PGS Heritage (Pty) Ltd was appointed by Aurecon South Africa (Pty) Ltd to undertake a Heritage Impact Assessment for the proposed Kriel Ash Disposal Facilities in the vicinity of Kriel (Ga-Nala), Mpumalanga Province. The proponent is Eskom.

This Heritage Impact Assessment follows on a long process undertaken by Eskom and the client to identify a suitable site for the proposed expansion project. As part of this process, the author of this report was responsible for two heritage desktop studies and one heritage impact assessment. The two desktop studies comprised two heritage options analyses and formed part of the overall options analysis undertaken by Aurecon for Eskom. The subsequent heritage impact assessment was undertaken on the final two sites earmarked for the impact assessment phase, namely Site 10 and Site 16N. The present heritage impact assessment aims to assess the impact of the proposed development of the ash disposal facility on a new study area, which partially encloses the original Site 10 assessed during the previous heritage impact assessment. This assessment is for the proposed Ash Dams (AD) 4.1 and 4.2.

An archaeological and historical background study was undertaken which revealed various aspects of the archaeology and history of the study area and surrounding landscape. Although a number of archaeological and historical sites are known from the surroundings of the study area, this desktop study could not reveal any such sites within the study area boundaries.

A palaeontological desktop study was also undertaken by Dr Lloyd Rossouw of Palaeo Field Services. This study revealed that the proposed development footprint is underlain by palaeontologically significant fluvial and deltaic deposits of coarse sandstone, conglomerate and coal of the Ecca Group Vryheid Formation. The formation is considered to be of high palaeontological sensitivity, with a moderate to high likelihood that fossil assemblages may be present where outcrops occur. The likelihood of finding fossils in disturbed and old backfilled areas, or before actual excavations into intact sedimentary rocks take place is considered fairly low. Excavations into unweathered/in situ sedimentary bedrock within the proposed development footprint will require palaeontological monitoring with the possibility that this may lead to the identification and removal of fossil material and implementation of appropriate mitigation procedures.

An archaeological and heritage field survey of the study area was undertaken by a very experienced fieldwork team. No heritage resource sites were identified during the fieldwork.

Recommendations

Since no heritage resources besides the likely palaeontological resources were identified, only the palaeontological resources have been addressed in the Recommendations for Mitigation.

With regards to the palaeontological resources, it is recommended that, in the case of possible excavation into fresh sedimentary bedrock, the developer must:

- Employ a qualified palaeontologist to record and remove any fossils;
- Apply for a collection and destruction permit from SAHRA for all fossil material encountered during the process.

The following general recommendations are also required:

- Any additions to the existing study area will have to be surveyed by a suitably qualified heritage specialist.

It is the opinion of the author of this report that in terms of the heritage aspects addressed as part of the defined scope of work of this study and on the condition that the required mitigation measures and recommendations made in this report are undertaken before any development takes place, the development may be allowed to continue.

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1 INTRODUCTION

PGS Heritage (PGS) was appointed by Aurecon South Africa (Pty) Ltd to undertake a Heritage Impact Assessment (HIA), which forms part of the Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) for the proposed expansion of the Ash Disposal Facilities, Kriel Power Station, Kriel (Ga-Nala), Emalahleni Local Municipality, Mpumalanga Province.

The present report was preceded by two heritage desktop studies and one heritage impact assessment also undertaken by PGS Heritage. In the first of these desktop study reports (reference number AUR-KAD-HDS-1 and dated 13 August 2010) three possible sites (Site 10, Site 16C and Site 16N) for the proposed Ash Dam Facility were investigated through available heritage desktop data. In the second desktop study report (reference number AUR-KAD-HDS-3 and dated 10 September 2010) five possible sites (Site 10, Site 16C and Site 16N, Site 15 and the New Site) for the proposed Ash Dam Facility were investigated through available heritage desktop data. These reports formed part of Aurecon‟s options analysis aimed identifying the most suitable site for the proposed Ash Dam Facility, both in terms of its associated environmental and heritage impacts as well as it suitability for the proposed development. In the end, two sites were identified for the heritage assessment phase. These two sites are Site 10 and Site 16N. A heritage impact assessment report (reference number AUR-KAD-HIA-2 and dated 5 September 2011) was undertaken of these two sites as well as a proposed conveyor belt.

The present heritage impact assessment aims to assess the impact of the proposed development of the Ash Dam Facility on a newly defined study area, which partially encloses the original Site 10 assessed during the previous heritage impact assessment.

1.1 Scope of the Study

The aim of the study is to identify possible heritage sites and finds that may occur in the proposed development area. The Heritage Impact Assessment aims to inform the EIA in the development of a comprehensive EMPr to assist the developer in managing the discovered heritage resources in a responsible manner, in order to protect, preserve, and develop them within the framework provided by the National Heritage Resources Act of 1999 (Act 25 of 1999) (NHRA).

1.2 Specialist Qualifications

This Heritage Impact Assessment was compiled by PGS Heritage (Pty) Ltd.

The staff at PGS have a combined experience of nearly 70 years in the heritage consulting industry and have extensive experience in managing HIA processes. PGS will only undertake heritage assessment work where the staff have the relevant expertise and experience to undertake that work competently.

Polke Birkholtz, the Project Manager and author, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is accredited with the CRM Section of ASAPA. He has 18 years' experience in the heritage assessment and management field and holds a B.A. (cum laude) from the University of Pretoria specialising in Archaeology, Anthropology and History as well as a B.A. (Hons.) in Archaeology (cum laude) from the same institution.

Jennifer Kitto, Heritage Specialist and co-author for this project, has 17 years' experience in the heritage sector, a large part of which involved working for a government department responsible for administering the NHRA, (Act No 25 of 1999). Therefore, she is well-versed in the legislative requirements of heritage management. She holds a BA in Archaeology and Social Anthropology and a BA (Hons) in Social Anthropology.

Marko Hutten, the Archaeologist / Heritage Specialist who undertook the field work survey of the study area, is registered with the Association of Southern African Professional Archaeologists (ASAPA) as a Professional Archaeologist and is accredited with the CRM Section of ASAPA. He has 18 years' experience in the heritage assessment and management field.

1.3 Assumptions and Limitations

The following assumptions and limitations to this study exist:

- Not detracting in any way from the comprehensiveness of the fieldwork undertaken, it is necessary to realise that the heritage resources located during the fieldwork do not necessarily represent all the possible heritage resources present within the area. Various factors account for this, including the subterranean nature of some archaeological sites and the. As such, should any heritage features and/or objects be located or observed, a heritage specialist must immediately be contacted. Such observed or located heritage features and/or objects may not be disturbed or removed in any way, until such time that the heritage specialist has been able to make an assessment as to the significance of the

site (or material) in question. This applies to graves and cemeteries as well. In the event that any graves or burial places are located during the development, the procedures and requirements pertaining to graves and burials will apply as set out below.

- The study area assessed for this heritage impact assessment is inter alia defined in Figure 7. This image represents the final development layout plan represents the final plan as received from the client shortly before this report was completed. Please note that a strip of land was added to the southern end of original development layout plan. As this area was also assessed during the fieldwork, this change will have no impact on this report and its recommendations.

1.4 Legislative Context

The identification, evaluation and assessment of any cultural heritage site, artefact or find in the South African context is required and governed by the following legislation:

i. National Environmental Management Act (NEMA) Act 107 of 1998
ii. National Heritage Resources Act (NHRA) Act 25 of 1999
iii. Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
iv. Development Facilitation Act (DFA) Act 67 of 1995

The following sections in each Act refer directly to the identification, evaluation and assessment of cultural heritage resources.

i. GNR 982 (Government Gazette 38282, 14 December 2014) promulgated under the National Environmental Management Act (NEMA) Act 107 of 1998
    a. Basic Assessment Report(BAR) – Regulations 19 and 23
    b. Environmental Scoping Report (ESR) – Regulation 21
    c. Environmental Impacts Assessment (EIA) – Regulation 23
    d. Environmental Management Programme (EMPr) – Regulations 19 and 23
ii. National Heritage Resources Act (NHRA) Act 25 of 1999
    a. Protection of Heritage Resources – Sections 34 to 36; and
    b. Heritage Resources Management – Section 38
iii. Minerals and Petroleum Resources Development Act (MPRDA) Act 28 of 2002
    a. Section 39(3)
    b. The GNR.1 of 7 January 2000: Regulations and rules in terms of the Development Facilitation Act, 1995. Section 31.

The NHRA stipulates that cultural heritage resources may not be disturbed without authorization from the relevant heritage authority. Section 34(1) of the NHRA states that "*no person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority*…". The NEMA (No 107 of 1998) states that an integrated EMP should (23:2 (b)) "…*identify, predict and evaluate the actual and potential impact on the environment, socio-economic conditions and cultural heritage*". In accordance with legislative requirements and EIA rating criteria, the regulations of SAHRA and ASAPA have also been incorporated to ensure that a comprehensive and legally compatible HIA report is compiled.

1.5 Terminology and Abbreviations

Archaeological resources

This includes:

i. material remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years including artefacts, human and hominid remains and artificial features and structures;
ii. rock art, being any form of painting, engraving or other graphic representation on a fixed rock surface or loose rock or stone, which was executed by human agency and which is older than 100 years, including any area within 10m of such representation;
iii. wrecks, being any vessel or aircraft, or any part thereof which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the republic as defined in the Maritimes Zones Act, and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation;
iv. features, structures and artefacts associated with military history which are older than 75 years and the site on which they are found.

Cultural significance

This means aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance

Development

This means any physical intervention, excavation, or action, other than those caused by natural forces, which may in the opinion of the heritage authority in any way result in a change to the nature, appearance or physical nature of a place or influence its stability and future well-being, including:

i. construction, alteration, demolition, removal or change in use of a place or a structure at a place;
ii. carrying out any works on or over or under a place;
iii. subdivision or consolidation of land comprising a place, including the structures or airspace of a place;
iv. constructing or putting up for display signs or boards;
v. any change to the natural or existing condition or topography of land; and
vi. any removal or destruction of trees, or removal of vegetation or topsoil

Early Stone Age

The archaeology of the Stone Age, dating to between roughly 700 000 and 2 500 000 years ago.

Fossil

Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Heritage

That which is inherited and forms part of the National Estate (historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999). For the purposes of this report, the term Heritage includes archaeology as well, whereas a Heritage Specialist is seen as a specialist in archaeology as well.

Heritage resources

This means any place or object of cultural significance

Holocene

The most recent geological time period, which commenced 10 000 years ago.

Later Stone Age

The archaeology of the last 20 000 years, associated with fully modern people.

Late Iron Age (Early Farming Communities)

The archaeology of the last 1000 years up to the 1800's, associated with ironworking and farming activities such as herding and agriculture.

Middle Stone Age

The archaeology of the Stone Age, dating to between 20 000-300 000 years ago, associated with early modern humans.

Palaeontology

Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Study Area

For the purposes of this report, the term 'study area' refers to the area defined as a purple polygon in Figure 20 of this report. This defined polygon represents the study area that was assessed during this impact assessment. All footprints forming part of the proposed development will be located within this defined study area.

An explanation of the abbreviations used in this report will be provided in **Table 1** below.

Table 1: Abbreviations

Abbreviations	*Description*
AIA	Archaeological Impact Assessment
ASAPA	Association of South African Professional Archaeologists
CRM	Cultural Resource Management
DEA	Department of Environmental Affairs
EIA practitioner	Environmental Impact Assessment Practitioner
EIA	Environmental Impact Assessment
ESA	Early Stone Age
GPS	Global Positioning System
HIA	Heritage Impact Assessment
I&AP	Interested & Affected Party
LSA	Later Stone Age
LIA	Late Iron Age
MSA	Middle Stone Age
MIA	Middle Iron Age
NEMA	National Environmental Management Act
NHRA	National Heritage Resources Act
PHRA	Provincial Heritage Resources Authority
PSSA	Palaeontological Society of South Africa
ROD	Record of Decision
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System

Refer to **Appendix B** for further discussion on heritage management and legislative matters.

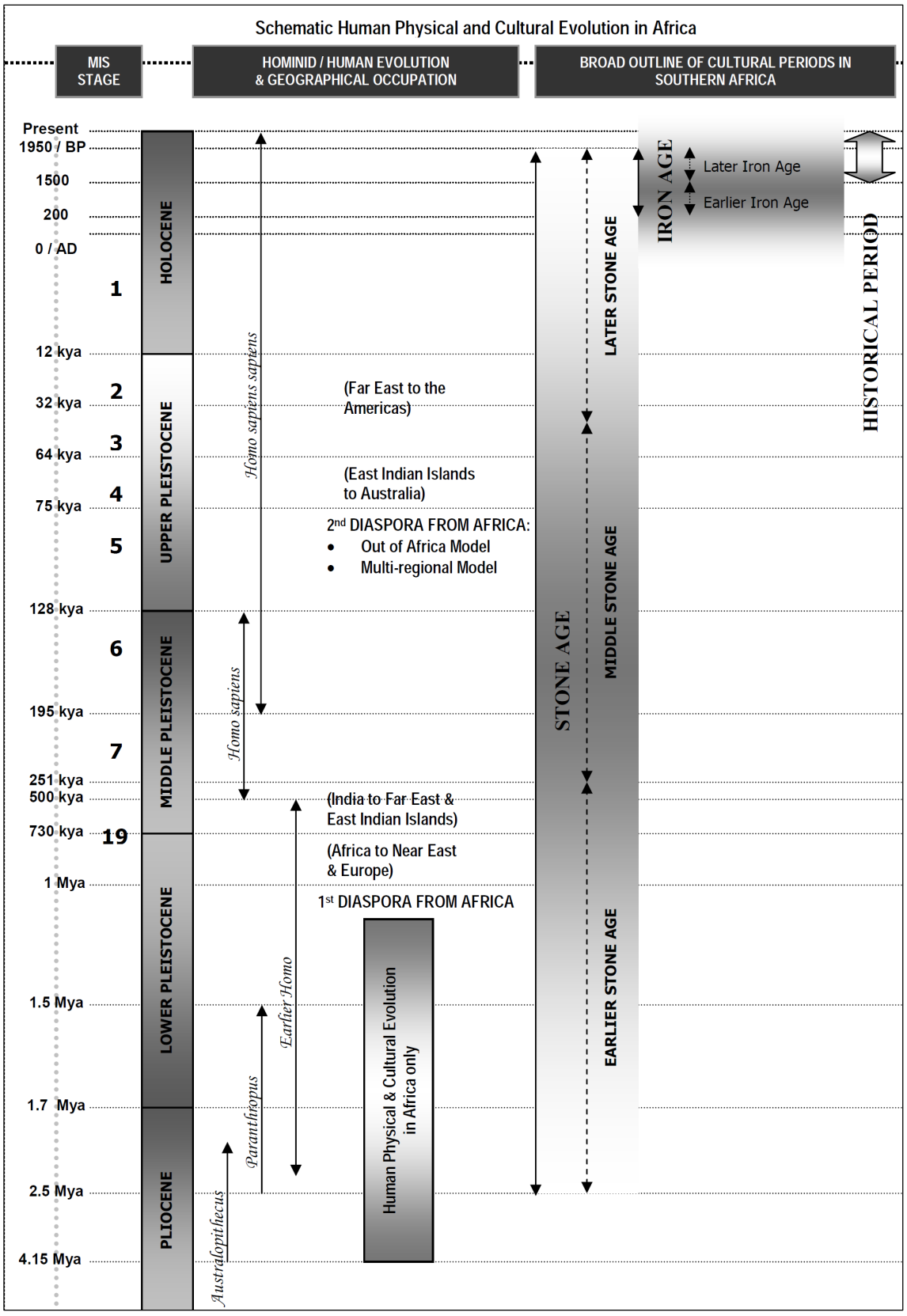

Figure 1–Human and Cultural Time line in Africa (Morris, 2008)

2 TECHNICAL DETAILS OF THE PROJECT

2.1 Site Location and Description

Coordinates	The position of the study area, comprising the proposed Ash Dam 4.1 and 4.2, is defined by the following coordinates: Centre point: S 26.273608 E 29.200499 Northernmost point: S 26.263726 E 29.205250 Easternmost point: S 26.271705 E 29.213011 Southernmost point: S 26.281543 E 29.195617 Westernmost point: S 26.276969 E 29.187220
Location	The study area is located directly south of the Kriel Power Station and is situated 3.4 km south-west of the town of Kriel (Ga-Nala).
Study Area Extent	The site is approximately 359 ha in extent, of which about 172 ha will be affected by the proposed expansion of the Ash Disposal Facility.
Property Description	The study area is located on portions of the farms Driefontein 69 IS, Kriel Power Station 65 IS and Onverwacht 70 IS. These are the properties that will be directly impacted by the project footprint.
Study Area Description	The study area can be described as largely disturbed. The Third Edition of the 2629AC Topographical Map Sheet that was compiled in 1995 (see **Figure 18**) clearly show the level of disturbance found within the study area at the time, with roughly two thirds of the study area completely disturbed by features such as an opencast mine, ash dams, roads as well as return water dams. It is clear that the level of disturbance found within the study area can inter alia be attributed to mining and industrial activities within the study area and its surroundings. Evidence for the disturbed nature of the study area was also observed during the field assessment, with the ash dams, roads and return water dams all identified within the study area. The field assessment also revealed that the opencast pit depicted on the 1995 map sheet is still located within the study area, but had been rehabilitated.

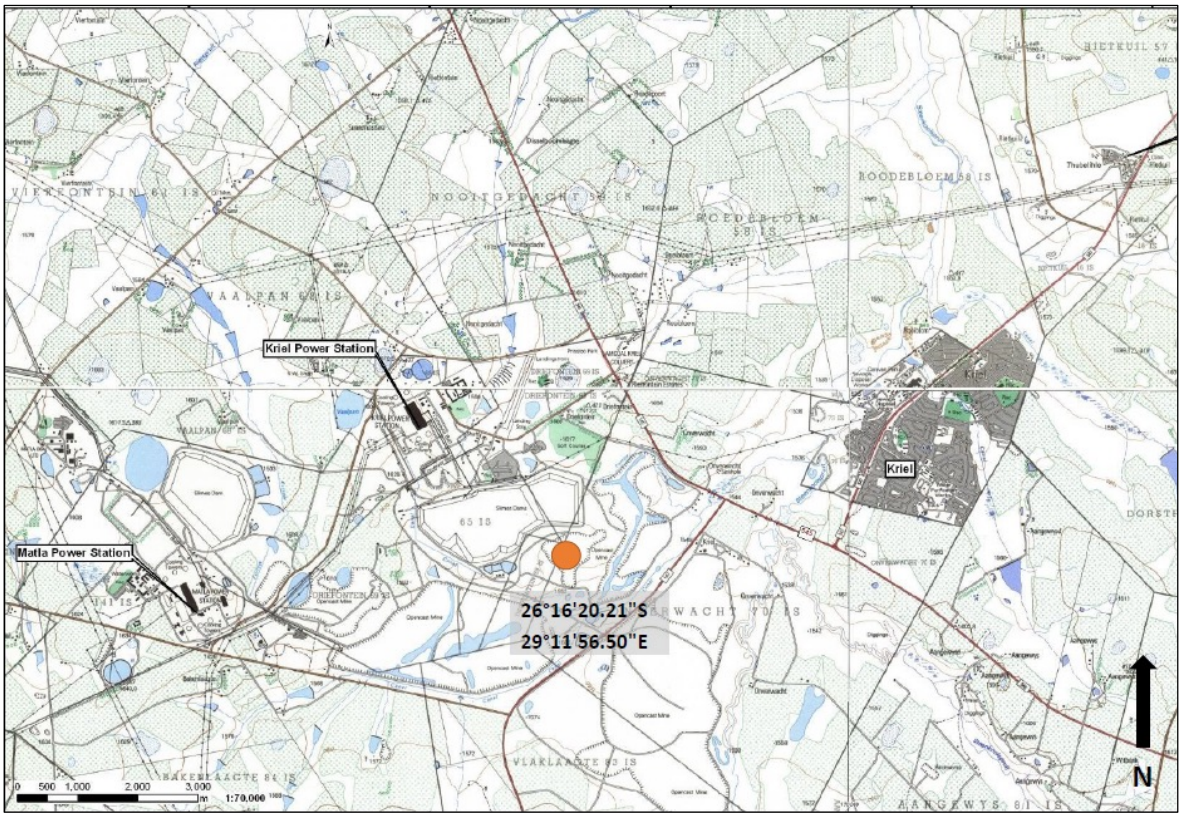

Figure 2 – The study area within its regional landscape (from Aurecon, 2016).

Figure 3 – The study area within its immediate surroundings (Aurecon, 2016).

2.2 Technical Project Description

This section was provided by the client.

The construction of Kriel Power Station (owned by Eskom Holdings SOC Limited, Eskom) was completed in 1979 and was considered to be the largest coal-fired power station in the southern hemisphere at the time. The 38-year-old power station, with an installed capacity of 3 000 MW (Eskom, 2010), is located approximately 7 km west of the small town of Kriel (also known as Ga-nala) in the Mpumalanga Province. Through the process of electricity generation, coarse and fine ash is produced by burning coal. At full capacity, each of the six boilers can produce up to 740 000 tonnes/year of coarse ash/ boiler bottom ash (approximately 20% of total ash produced) ash and 2 960 000 tonnes/year of fly ash/ precipitator fly ash (approximately 80% of total ash produced). Kriel Power Station makes use of a wet ashing process to dispose of its ash. Coarse ash is transferred with a small volume of fine ash (fly ash, to limit pipeline wear) from the Power Station to sumps, from where it is pumped as a slurry mixture to the Wet Ash Disposal Facilities (WADF). These facilities are also referred to as Ash Dams. The fine ash is transported separately to the existing ash dam complex, via two conveyors that are located south-east of Kriel Power Station. As mentioned above, Kriel uses wet ashing system, which involves conditioning fly ash and coarse ash with water for pneumatic transportation to the ash dams through conveyor belts and ash lines, respectively.

Upon reaching the ash dams, conditioning water, from ash, sluices into the designed lowest point of ash dam wherein it gets drained through penstocks. All the water collected from Kriel ash dams through the penstocks is stored in Ash Water Return (AWR) dams. From the AWR dams the ash water gravitates to a manifold and is then pumped back to a High Level AWR dam. From the High Level AWR dam the water gravitates to the pollution control dams known as the Borrow Pits and Swartpan. The Borrow Pits contain mainly excess ash water from High Level AWR dam while Swartpan contains mainly excess overflow ash water from the Borrow Pits. Both Swartpan and the Borrow Pits dams are part of ash water cycle and are used as emergency containment dams. This water is then pumped from Swartpan for re-use by the Power Station for ashing purposes (Kriel Power Station, 2016).

The three existing ash dams will reach their capacity by end July 2021. Eskom is, thus, proposing to expand its existing ash disposal facility by constructing and commission an additional ash disposal facility footprint before the existing ash dams reach their capacity in 2021.

The complete proposed expansion with new ash dams (AD4.1, AD4.2 and AD4.3) (see **Figure 5**) would fulfil the ash disposal requirements for the Power Station's extended -operational life, whereby decommissioning of the six generating units is planned to commence in 2039. AD4.3 is however located on a previously mined and backfilled area, which needs to be tested first for stability. The expansion project is, therefore, divided into two phases, namely Phase 1, which covers construction of AD4.1 and AD4.2 (the subject of this application) (see **Figure 7**) and Phase 2 which covers AD4.3. A Monitored Test Embarkment is underway for AD4.3 and therefore this EIA only deals with Phase 1. Once the stability of AD4.3 has been confirmed, depending on the results, an additional EIA may be undertaken for AD4.3. To smoothen the decommissioning process, a five year contingency has been allowed for, thus it is assumed that the Power Station will be operated for an additional five years, thereby allowing for the power station decommissioning from 2041 to 2045.

The development of ash dam 4 will be sequenced to distribute large immediate capital expenditure cost. Dam 4.2 will be developed first in 2021 and will utilize a ring main system to distribute ash within the ash dam basin. Water generated on the dam will be decanted into solution trenches, running along the toe of the new dams, utilizing penstocks and subsoil drains. Ash water from Dam 4.2 will be gravitated to a transfer dam from where it will be pumped to the AWR dam.

Deposition was split between the existing and new dams in order to reduce the height of the preliminary starter walls, as well as the final height of the new dams. It was assumed that deposition on the existing dams will continue for 4 years after the commissioning of the first phase of AD4 (i.e. until the final phase of AD4 is commissioned). Once AD4.1, AD4.2 and AD4.3 (AD4.3 will be implemented is deemed feasible and needed) are operational, the existing dams will be decommissioned, and rehabilitated. A period of two (2) years was allowed for between the construction phases of AD4 in order to defer large immediate capital costs. Thus, after AD4.2 is commissioned in July 2021, AD4.1 will be commissioned in July 2023, and subsequently AD4.3 in July 2025.

From the AWR dam, ash water will be pumped back to the power station and ash dam pump-house to be reused in the placement of ash from the power station.

This EIA process (including this Heritage Impact Assessment) covers only AD4.1 and AD4.2 as well as the associated infrastructure that will be developed, including a Transfer Dam. The

infrastructure includes pipes and a Transfer Dam that will be located on the mine backfilled area (just South of the proposed siting for AD4.3). A Class C liner has been provided for the ash dams (AD4.1 and AD4.2) and the Transfer Dam, which also has an addition of a concrete liner for maintenance purposes. Geotechnical studies will be conducted in the detail design phase and is expected to provide sufficient information to allow for the appropriate design of the transfer dam and infrastructure.

Stability of the Transfer Dam (vetted by Designer & Chief Engineering Geotechnical Engineering):

- The Transfer Dam is not sized or designed to store any water. The Transfer Dam is designed to collect return water from Dam 4.2 and pump to the AWRD. This will be a continuous process and operations must comply as such;

- The design premise of the Transfer Dam's placement & construction is that the weight of the soil in that position (pre-construction) is heavier than the weight of water;

- The Transfer Dam position abuts the old Starter Wall of the Pit 2 backfills. Therefore, the Starter Wall would have been compacted and consolidated. The Basin of Transfer Dam is founded on the ash behind the Starter Wall, which would have consolidated after 20 years;

- It is also assumed that the soil/ash at that position has caused localised consolidation over time, so no loose soils are expecting directly under the Transfer Dam; and

- Therefore, the Transfer Dam will not add weight to the environment & therefore not induce deep settlements.

Going forward in the design, the Transfer Dam will take the detailed geotechnical information into account to design layer works below the Transfer Dam's base. This should ensure that there are no settlements, as any settlement would misalign the pipeworks.

NB. Within the Transfer Dam design the liner is accessible and can be repaired if compromised.

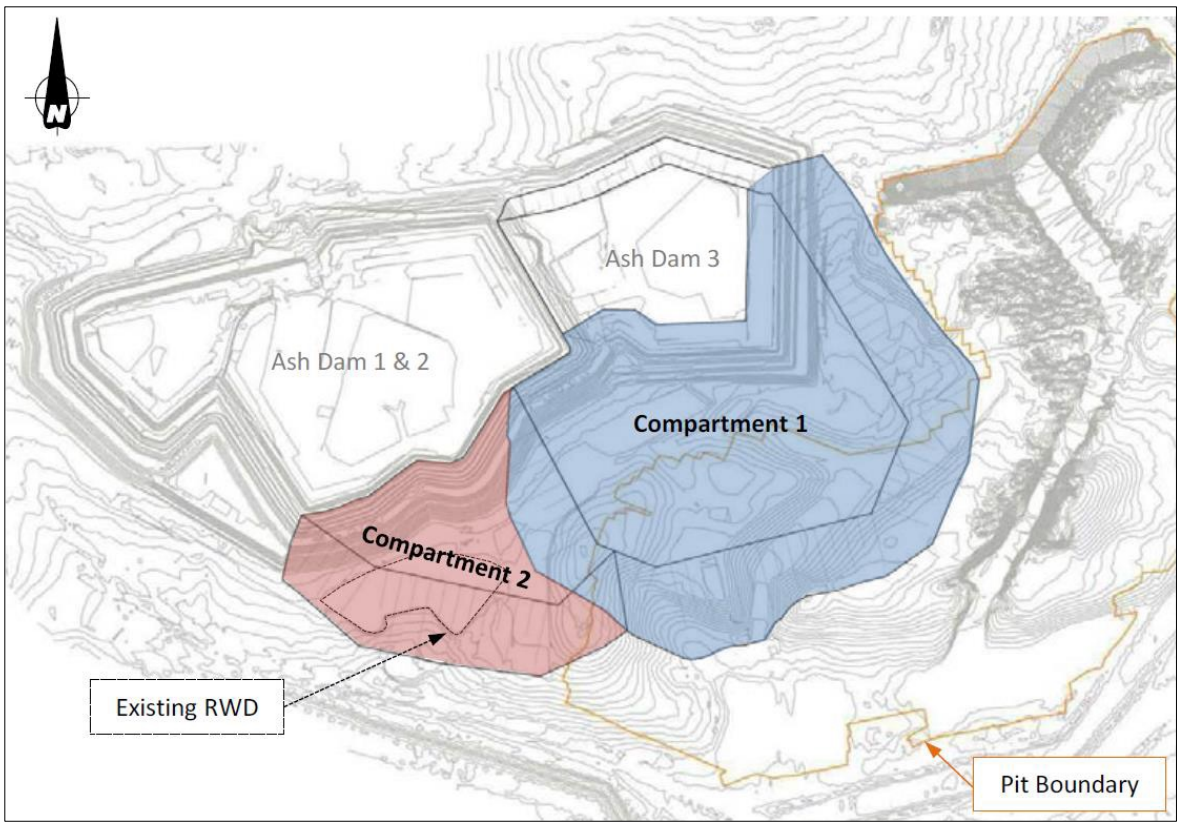

Figure 4 - Ash Dam 4 Concept 2014 (Jones & Wagener, 2014)

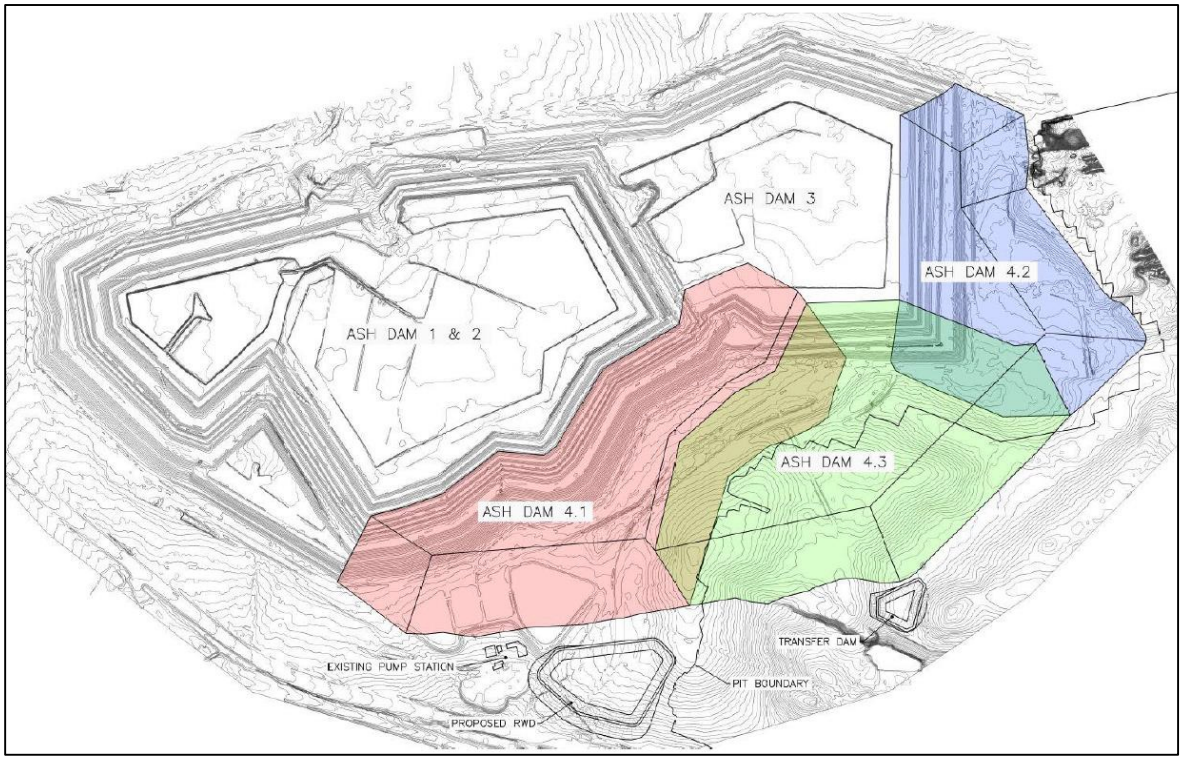

Figure 5 - Ash Dam 4 Concept 2016, consisting of three ash dams (Jones & Wagener, 2016)

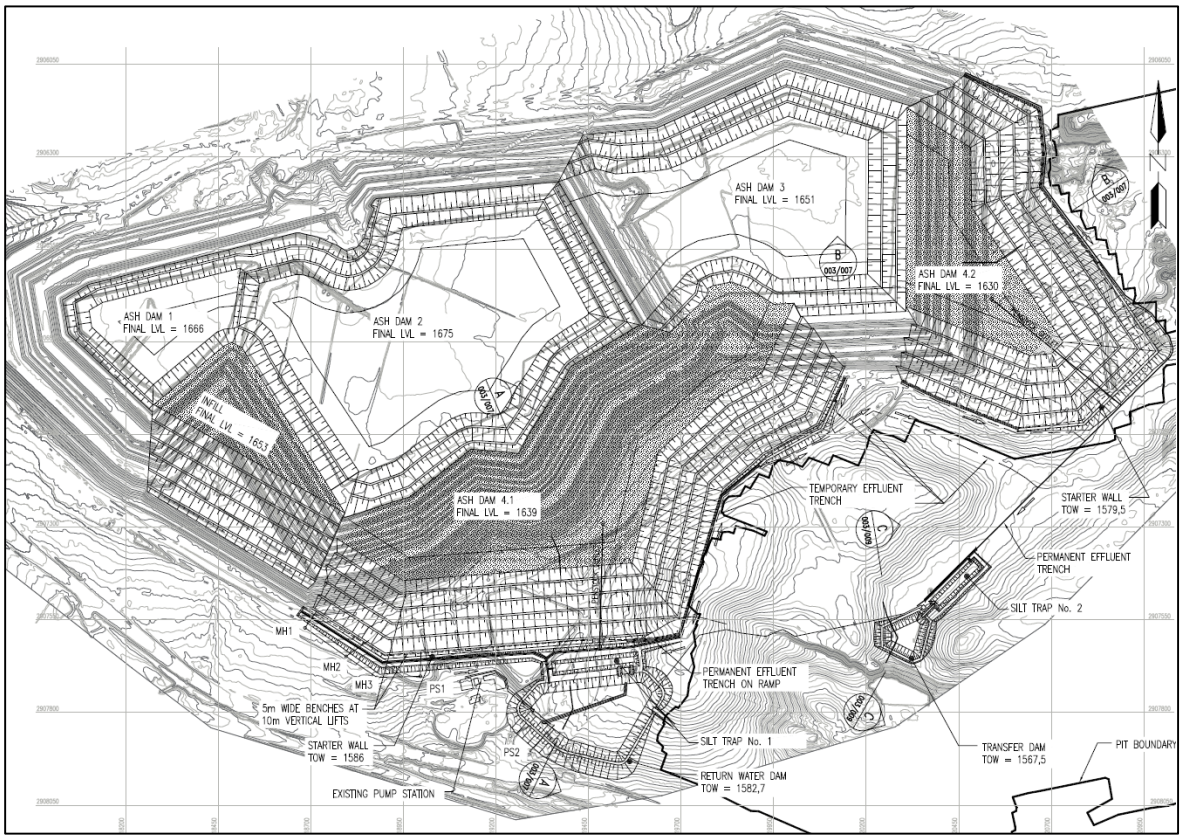

Figure 6 - Ash Dam 4 Concept 2016 preferred alternative, consisting of only AD 4.1 and 4.2 (Jones & Wagener, 2016)

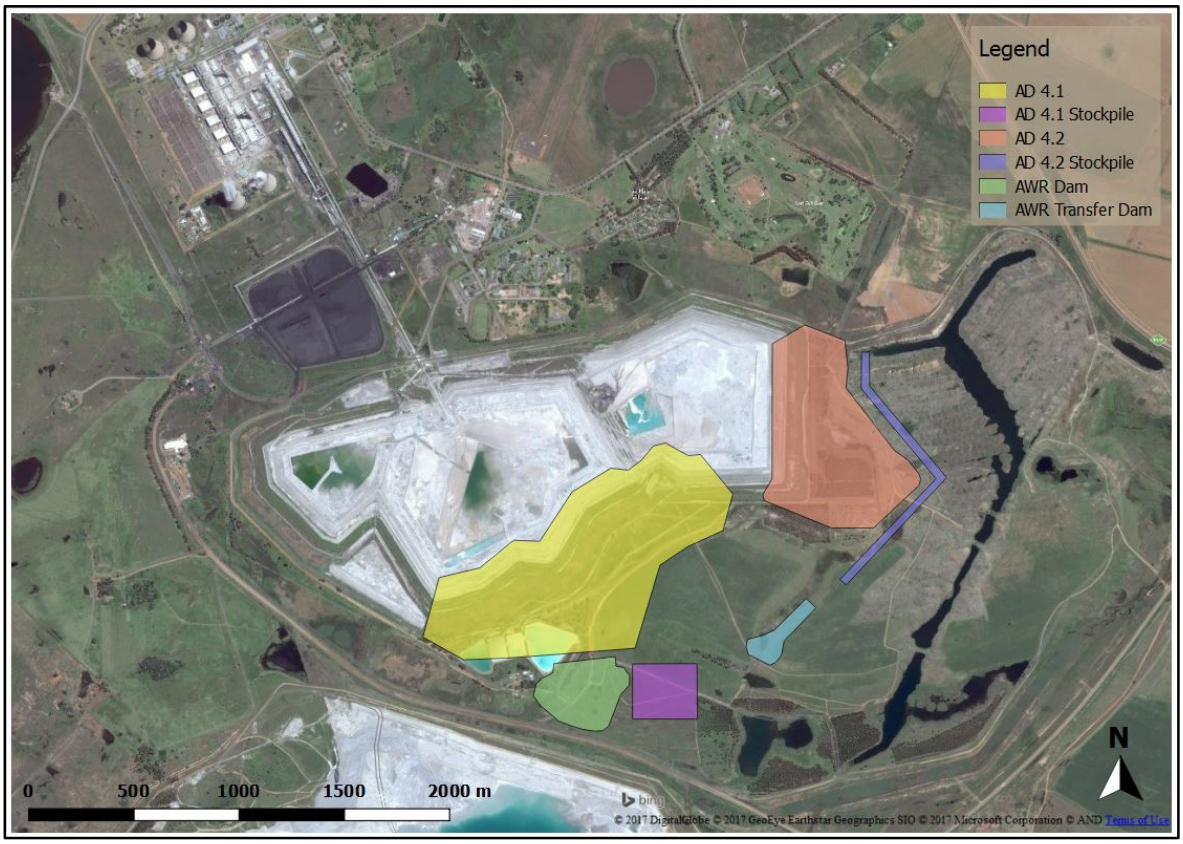

Figure 7 – The latest development layout plan, which is based on the latest layout received from Eskom. These six footprints represent the study area for the present assessment.

3 ASSESSMENT METHODOLOGY

3.1 Methodology for Assessing Heritage Site Significance

This report was compiled by PGS Heritage (Pty) Ltd for the proposed expansion of the existing Ash Dam Facility at the Kriel Power Station near Kriel (Ga-Nala) in the Mpumalanga Province. The applicable maps, tables and figures are included as stipulated in the NHRA (no 25 of 1999) and the National Environmental Management Act (NEMA) (No 107 of 1998). The HIA process consisted of three steps:

Step I – Desktop Studies: A basic historical and archaeological background study was undertaken using available resources accessed at the National Archives in Pretoria as well as published literature. Furthermore, Dr Lloyd Rossouw of Palaeo Field Services was appointed to compile a palaeontological desktop study.

Step II – Physical Survey: A physical survey was conducted by vehicle and on foot of the proposed study area. The fieldwork was aimed at locating and documenting sites falling within the proposed development footprints. The fieldwork was undertaken by an experienced team consisting of an Archaeologist / Heritage Specialist (Marko Hutten) and an Archaeological Field Assistant (John Anderson). The fieldwork was undertaken on Friday, 2 September 2016.

Step III – The final step involved the recording and documentation of relevant heritage resources, as well as the assessment of resources in terms of the heritage impact assessment criteria and report writing, as well as mapping and recommendations.

The significance of heritage sites was based on five main criteria:

- site integrity (i.e. primary vs. secondary context),
- amount of deposit, range of features (e.g., stonewalling, stone tools and enclosures),
- Density of scatter (dispersed scatter)
    - Low - <10/50m2
    - Medium - 10-50/50m2
    - High - >50/50m2
- uniqueness and
- potential to answer present research questions.

Management actions and recommended mitigation, which will result in a reduction in the impact on the sites, will be expressed as follows:

A - No further action necessary;
B - Mapping of the site and controlled sampling required;
C - No-go or relocate development position
D - Preserve site, or extensive data collection and mapping of the site; and
E - Preserve site

Site Significance

Site significance classification standards prescribed by the South African Heritage Resources Agency (2006) and approved by the Association for Southern African Professional Archaeologists (ASAPA) for the Southern African Development Community (SADC) region, were used for the purpose of this report (see **Table 2**).

Table 2: Site significance classification standards as prescribed by SAHRA

FIELD RATING	GRADE	SIGNIFICANCE	RECOMMENDED MITIGATION
National Significance (NS)	Grade 1	-	Conservation; National Site nomination
Provincial Significance (PS)	Grade 2	-	Conservation; Provincial Site nomination
Local Significance (LS)	Grade 3A	High	Conservation; Mitigation not advised
Local Significance (LS)	Grade 3B	High	Mitigation (Part of site should be retained)
Generally Protected A (GP.A)	-	High/Medium	Mitigation before destruction
Generally Protected B (GP.B)	-	Medium	Recording before destruction
Generally Protected C (GP.C)	-	Low	Destruction

3.2 Methodology for Impact Assessment

The impact assessment methodology applied in this report was provided by Aurecon. This section outlines this proposed methodology for assessing the significance of the potential environmental

impacts. These include both operational and construction phase impacts. For each impact, the EXTENT (spatial scale), MAGNITUDE and DURATION (time scale) would be described. These criteria would be used to ascertain the SIGNIFICANCE of the impact, firstly in the case of no mitigation and then with the most effective mitigation measure(s) in place. The mitigation described in the EIR would represent the full range of plausible and pragmatic measures but does not necessarily imply that they would be implemented.

The tables on the following pages show the scale used to assess these variables, and defines each of the rating categories. The impact assessment methodology follows that provided by Aurecon as explained in the Environmental Scoping Report undertaken by Aurecon (2016).

Table 3: Assessment criteria for the evaluation of impacts

Criteria	Category	Description
Spatial influence of impact	**Regional**	Beyond a 10 km radius of the candidate site.
	Local	Between 100m and10 km radius of the candidate site.
	Site specific	On site or within 100 m of the candidate site.
Magnitude of impact (at the indicated spatial scale)	**High**	Natural and/ or social functions and/ or processes are *severely altered*
	Medium	Natural and/ or social functions and/ or processes are *notably* altered
	Low	Natural and/ or social functions and/ or processes are *slightly* altered
	Very Low	Natural and/ or social functions and/ or processes are *negligibly* altered
	Zero	Natural and/ or social functions and/ or processes remain *unaltered*
Duration of impact (temporal)	**Construction period**	From commencement up to 2 years of construction
	Short Term	Between 2and 5 years after construction
	Medium Term	Between 5 and15 years after construction
	Long Term	More than 15 years after construction

The **SIGNIFICANCE** of an impact is derived by taking into account the temporal and spatial scales and magnitude. The means of arriving at the different significance ratings is explained in **Table 4**.

Table 4: Definition of significance ratings

Significance ratings	Level of criteria required
High	• High magnitude with a regional extent and long term duration • High magnitude with either a regional extent and medium term duration or a local extent and long term duration • Medium magnitude with a regional extent and long term duration
Medium	• High magnitude with a local extent and medium term duration • High magnitude with a regional extent and construction period or a site specific extent and long term duration • High magnitude with either a local extent and construction period duration or a site specific extent and medium term duration • Medium magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Low magnitude with a regional extent and long term duration
Low	• High magnitude with a site specific extent and construction period duration • Medium magnitude with a site specific extent and construction period duration • Low magnitude with any combination of extent and duration except site specific and construction period or regional and long term • Very low magnitude with a regional extent and long term duration
Very low	• Low magnitude with a site specific extent and construction period duration • Very low magnitude with any combination of extent and construction or short term duration
Neutral	• Zero magnitude with any combination of extent and duration

Once the significance of an impact has been determined, the **PROBABILITY** of this impact occurring as well as the **CONFIDENCE** in the assessment of the impact, would be determined using the rating systems outlined in **Table 5** and **Table 6**, respectively. It is important to note that the significance of an impact should always be considered in concert with the probability of that impact occurring. Lastly, the **REVERSIBILITY** of the impact is estimated using the rating system outlined in **Table 7.**

Table 5: Definition of probability ratings

Probability ratings	Criteria
Definite	Estimated greater than 95 % chance of the impact occurring.
Probable	Estimated 5 to 95 % chance of the impact occurring.
Unlikely	Estimated less than 5 % chance of the impact occurring.

Table 6: Definition of confidence ratings

Confidence ratings	Criteria
Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Sure	Reasonable amount of useful information on and relatively sound understanding of the environmental factors potentially influencing the impact.
Unsure	Limited useful information on and understanding of the environmental factors potentially influencing this impact.

Table 7: Definition of reversibility ratings

Reversibility ratings	Criteria
Irreversible	The activity will lead to an impact that is in all practical terms permanent.
Reversible	The impact is reversible within 2 years after the cause or stress is removed.

4 CURRENT STATUS QUO

4.1 Site Description

The surrounding land use is mainly agricultural (including maize and cattle farming) as well as mining. The power station is located adjacent to the Kriel Colliery, which is dedicated to the Kriel and Matla Power Stations. The town of Kriel (Ga-Nala) is approximately 7 km to the east of the power station, with a small informal settlement approximately 5 km to the southeast. The Thubelihle township is approximately 11 km to the northeast. The power station also has a small housing development for employees approximately 1 km to the southeast. The Matla Power Station (also coal fired) is situated 4.5 km to the south west of the Kriel Power Station, with the former's ash dams expanding towards the south. The Exxaro Matla mines (three underground mines) are situated to the east of Kriel with the main facilities about 5.7 km to the east of the Kriel Power Station. A small airfield is located approximately 1 km to the east of the power station and the Kriel Golf Club is approximately 2 km to the southeast. The residential developments Rietstroom Park and Lehlaka Park are approximately 9 km to the north.

The study area can be described as largely disturbed. The Third Edition of the 2629AC Topographical Map Sheet that was compiled in 1995 (see **Figure 18**) clearly show the level of disturbance found within the study area at the time, with roughly two thirds of the study area completely disturbed by features such as an opencast mine, ash dams, roads as well as return water dams. It is clear that the level of disturbance found within the study area can inter alia be attributed to mining and industrial activities within the study area and its surroundings.

Evidence for the disturbed nature of the study area was also observed during the field assessment, with the ash dams, roads and return water dams all identified within the study area. The field assessment also revealed that the opencast pit depicted on the 1995 map sheet is still located within the study area, but had been rehabilitated.

The following photographs provide an indication of the current status quo of the study area (**Figure 7** to **Figure 14**).

Figure 8 – View of the existing Ash Dam on the study area's northern boundary.

Figure 9 – View of the existing Return Water Dam located on the study area's western end.

Figure 10 – The tree plantation at the south-eastern corner of the existing Ash Dam.

Figure 11 - View of the rehabilitated Kriel Pit 1 located on the study area's eastern boundary.

Figure 12 - View of the flat landscape on the study area's eastern boundary.

Figure 13 – View of the flat terrain with an isolated rock outcrop

Figure 14 –View from the study area's southern boundary looking north to the Kriel Ash Dam and power station.

Figure 15 – View of the Matla Ash Dam, located to the south-west of the study area boundary.

5 DESKTOP STUDY FINDINGS

5.1 Cartographic Findings

5.1.1 Major Jackson Series Map

The figure below depicts an enlarged section of the Bethal Sheet of the Major Jackson Series (National Archives, Maps, 3/559). This series was produced during the South African War (1899-1902) by the Mapping Section of the Field Intelligence Department under the supervision of Major R.M. Jackson. The sheet is a revised edition dated to April 1901.

The following observations can be made from the map:

- No heritage sites are depicted within or in close proximity to the study area (AD 4.1 and AD 4.2).
- A number of features are depicted within the farms Driefontein and Onverwacht. However, these features are all located well outside of the study area boundaries. These depicted features comprise farmsteads and associated farm buildings.
- At the time, the farm known as Kriel Power Station had not been established yet.

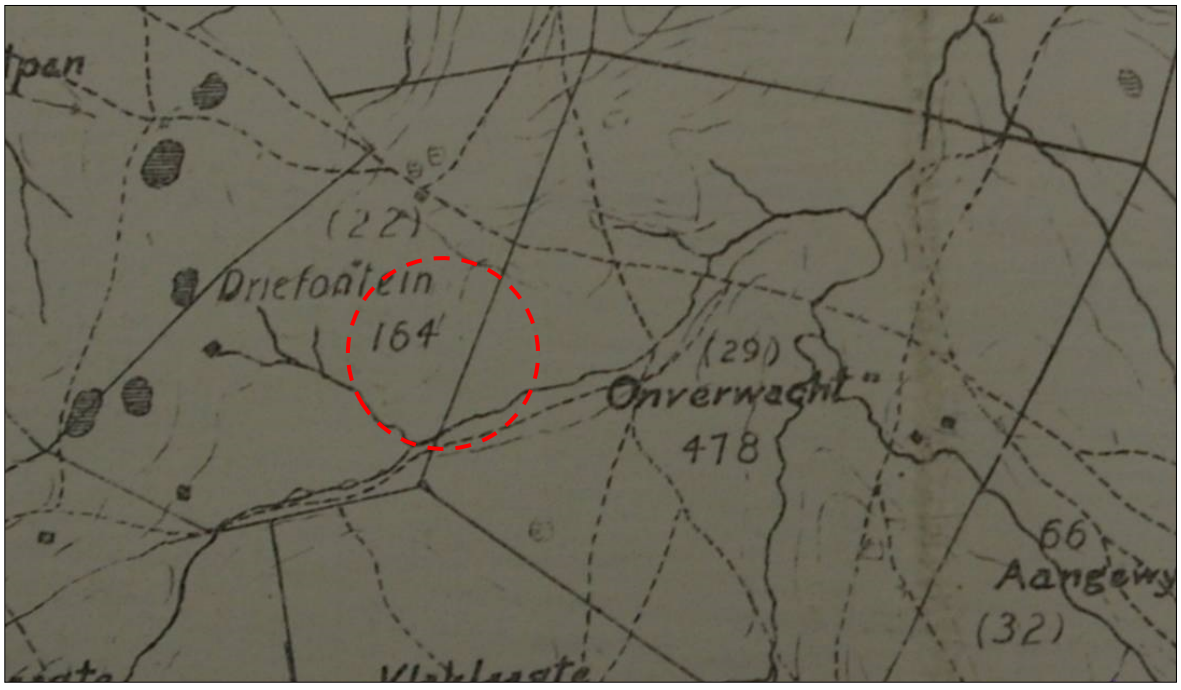

Figure 16 - Enlarged section of the 'Bethal' sheet of the Major Jackson Series. The approximate position of study area is indicated.

5.1.2 First Edition of the 2629AC Topographical Sheet

The figure below depicts an enlarged section of the First Edition of the 2629AC Topographical Sheet. The sheet was based on aerial photography undertaken in 1954. The map was surveyed in 1961 and drawn in 1963.

The following observations can be made:

- No heritage features are indicated within the study area boundaries. The study area boundaries are depicted in blue line in the map figure below.
- Two features that were identified in the previous Heritage Impact Assessment as within the study area boundaries of the previous study, are now indicated as outside the present study area boundaries. These two features are marked as Feature 1 (one hut) and Feature 2 (a cluster comprising old mines, a shed as well as a hut).
- Finally, it is clear that at the time that the map was produced (during the 1950s and 1960s), significant sections of the study area were already disturbed by cultivated lands.

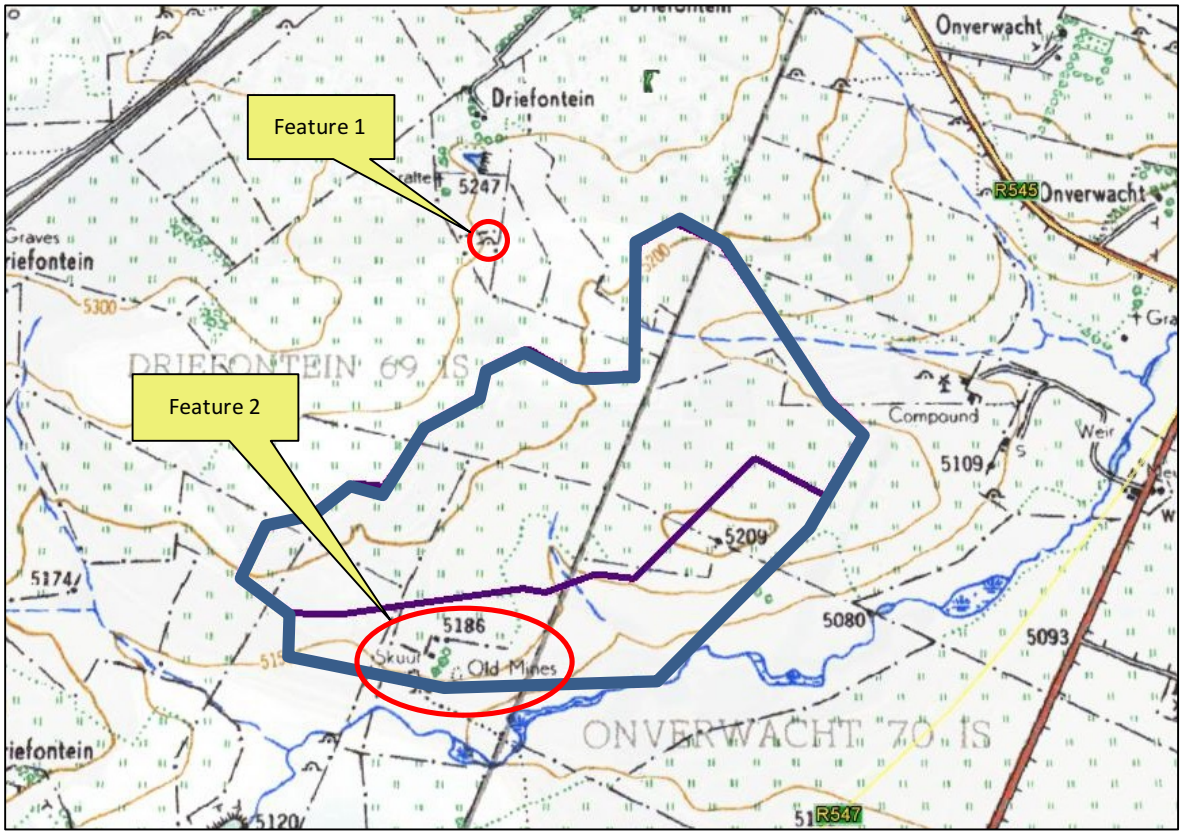

Figure 17 - Enlarged section of the First Edition of the 2629AC Topographical Sheet. The study area boundaries are shown in blue. The purple line represents a previous study area boundary.

5.1.3 *Second Edition of the 2629AC Topographical Sheet*

The image below depicts an enlarged section of the Second Edition of the 2629AC Topographical Sheet. The sheet was printed in 1986.

The following observations can be made:

- No heritage features are indicated within the study area boundaries. The study area boundaries are depicted in blue line in the map figure below.
- This depiction of the study area is significant in that it depicts the extent of disturbance associated with coal mining activities within the study area. This edition of the map also shows that the current study area boundary overlies part of an 'Opencast Mine' (refer Feature 1 below). This opencast mine has since been backfilled and rehabilitated.
- The Kriel Power Station and the associated Ash Dam 1 and Ash Dam 2 are also shown on this edition of the map.

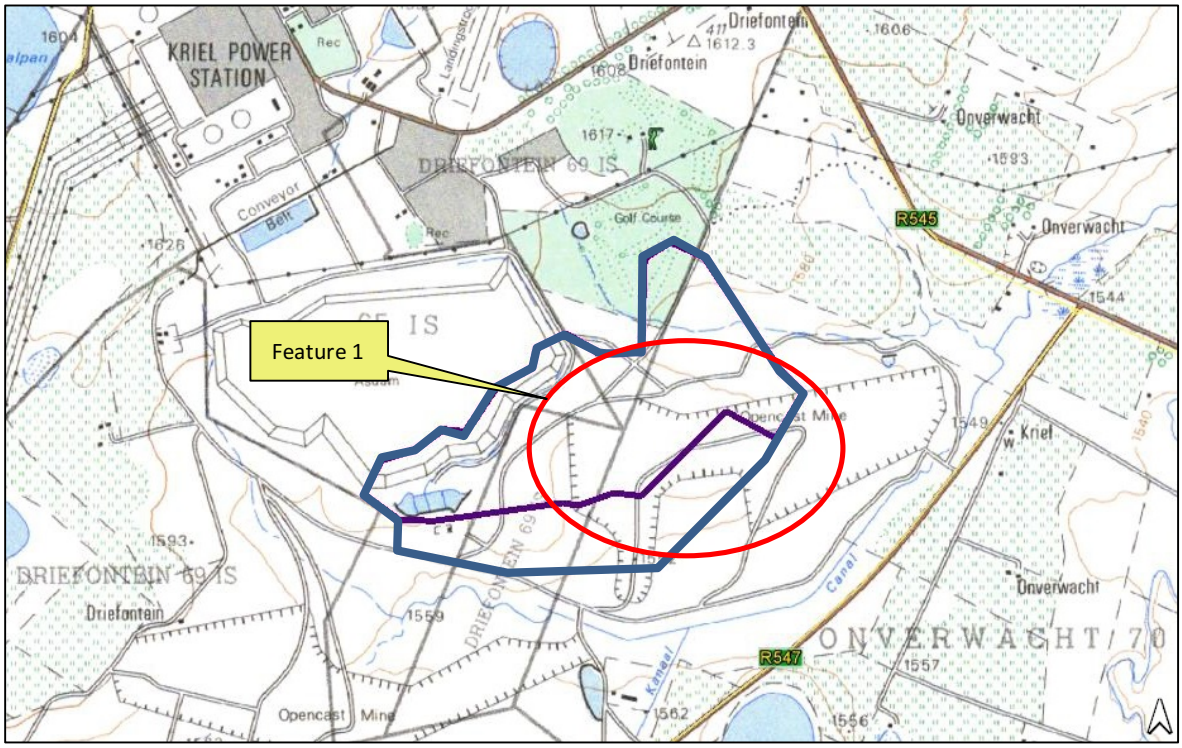

Figure 18 - Enlarged section of the Second Edition of the 2629AC Topographical Sheet. The study area boundaries are shown in blue. The purple line represents a previous study area boundary.

5.1.4 Third Edition of the 2629AC Topographical Sheet

The figure below depicts an enlarged section of the Third Edition of the 2629AC Topographical Sheet. The sheet was printed in 1995.

The following observations can be made:

- No heritage features are indicated within the study area boundaries. The study area boundaries are depicted in blue line in the map figure below.
- This depiction of the study area is also significant in that it depicts the large extent of disturbance associated with coal mining activities within and around the study area.
- The further expansion of the associated ash dam (Ash Dam 3) for the Kriel Power Station is now indicated.
- The opencast mine pit depicted on the previous map sheet is still shown on this edition of map, although the extent of the pit is now reduced (refer Feature 1).

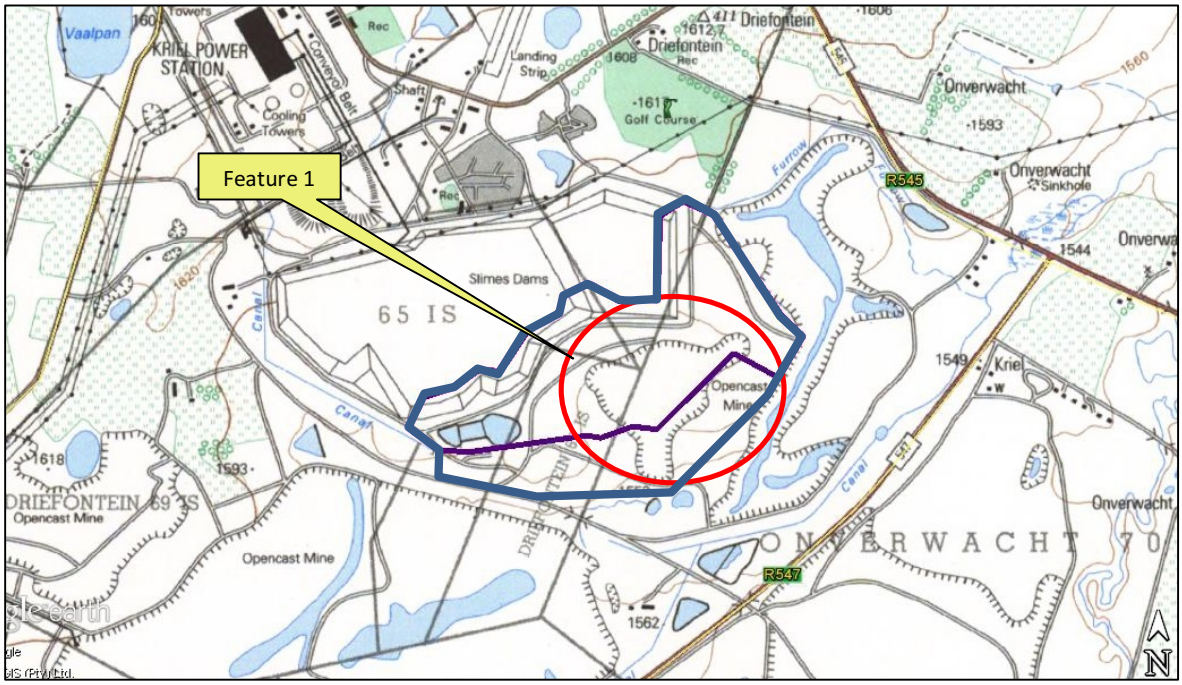

Figure 19 - Enlarged section of the Third Edition of the 2629AC Topographical Sheet. The study area boundaries are shown in blue. The purple line represents a previous study area boundary.

5.2 Historical Overview of the Study Area and Surroundings

DATE	DESCRIPTION
2.5 million to 250,000 years ago	The Earlier Stone Age is the first and oldest phase identified in South Africa's archaeological history and comprises two technological phases. The earliest of these technological phases is known as Oldowan, which is associated with crude flakes and hammer stones and dates to approximately 2 million years ago. The second technological phase in the Earlier Stone Age of Southern Africa is known as the Acheulian and comprises more refined and better made stone artefacts such as the cleaver and bifacial handaxe. The Acheulian phase dates back to approximately 1.5 million years ago. No information with regard to Early Stone Age sites from the study area and surrounding landscape could be found. However, it seems likely for such sites to exist here.
250,000 to 40,000 years ago	The Middle Stone Age is the second oldest phase identified in South Africa's archaeological history. This phase is associated with flakes, points and blades manufactured by means of the so-called prepared core technique. A large number of Middle Stone Age materials are found around the general vicinity of the study area. Unfortunately, these are mostly in the form of surface material which has been eroded out of dongas and riverbeds. As a result the primary context of these sites and associated material is often in doubt (Van Schalkwyk, 2001).
40,000 years ago to the historic past	The Later Stone Age is the third phase identified in South Africa's Stone Age history. This phase in human history is associated with an abundance of very small stone artefacts or microliths. A large number of Later Stone Age materials are found around the general vicinity of the study area. Unfortunately, these are mostly in the form of surface material which has been eroded out of dongas and riverbeds. As a result the primary context of these sites and associated material is often in doubt (Van Schalkwyk, 2001). One rock painting site (which is also associated with the Later Stone Age) is mentioned by Bergh (1999) to be located on the eastern bank of the confluence of the Steenkoolspruit and the Olifants River. This site is situated approximately 23.3 km north of Site 16 N.
1450 – 1650	This period is associated with a Late Iron group referred to as the Ntsuanatsatsi facies of the Urewe Tradition and was associated with the Fokeng. Its name is derived from the Ntsuanatsatsi Hill located between Vrede and Frankfort in the Free State where the earliest examples of this facies were located. The Fokeng also associate this hill with their place of origin. The Ntsuanatsatsi later moved north across the Vaal River into the Balfour, Suikerboschrand, Klipriviersberg and Vredefort areas. This movement was likely as a result of severe climatic conditions in the Free State at the time. The pottery is characterised by the predominance of comb stamping and finger pinching as decoration techniques. The necks of these pottery vessels bear broad bands of stamping and stamped arcades are also characteristic. The settlement layout has been classified as Type N or Group I and comprises a few central cattle enclosures with an enclosing wall in which a number of smaller enclosures may be located. The settlement layout may also comprise an enclosing wall with a small enclosure in the centre giving it the appearance

	of a 'fried egg' (Huffman, 2007).
1700 – 1820	During the early Historic Period the Ntsuanatsatsi south of the Vaal River developed into the Makgwareng facies. Though still associated with the Fokeng, this pottery is characterised by the predominance of comb-stamped triangles, finger pinching and rim notching. The settlement pattern of this group is known as Type V which is named after Vegkop near Heilbron. Type V settlements comprise cattle enclosures surrounded by beehive houses and grain bins without the presence of an enclosing wall. This type is also associated with the first appearance of corbelled huts (Huffman, 2007). An example of a Type V site from the wider landscape is the site Wildebeestfontein (5 km east of Kinross and 17km south-west of Kriel) that was excavated by M.O.V. Taylor. The site was located on a domed hill surrounded by flat plateaus. The work undertaken here has revealed a stone-walled site associated with the post-*difaqane* Iron Age. It comprised circular shallow depressions around which a line of small stones interposed by big stones were packed. The site contained archaeological deposits and ceramics (Taylor, 1979).
1821-1823	After leaving present-day KwaZulu-Natal the Khumalo Ndebele (more commonly known as the Matabele) of Mzilikazi migrated through the general vicinity of the study areas under discussion before reaching the central reaches of the Vaal River in the vicinity of Heidelberg in 1823 (http://www.sahistory.org.za/people/king-mzilikazi). Two different settlement types have been associated with the Khumalo Ndebele. The first of these is known as Type B walling and was found at Nqabeni in the Babanango area of KwaZulu-Natal. These walls stood in the open without any military or defensive considerations and comprised an inner circle of linked cattle enclosures (Huffman, 2007). The second settlement type associated with the Khumalo Ndebele is known as Doornspruit, and comprises a layout which from the air has the appearance of a 'beaded necklace'. This layout comprises long scalloped walls (which mark the back of the residential area) which closely surround a complex core which in turn comprises a number of stone circles. The structures from the centre of the settlement can be interpreted as kitchen areas and enclosures for keeping small stock. It is important to note that the Doornspruit settlement type is associated with the later settlements of the Khumalo Ndebele in areas such as the Magaliesberg Mountains and Marico and represents a settlement under the influence of the Sotho with whom the Khumalo Ndebele intermarried. The Type B settlement is associated with the early Khumalo Ndebele settlements and conforms more to the typical Zulu form of settlement. As the Khumalo Ndebele passed through the general vicinity of the study areas shortly after leaving Kwazulu-Natal, one can assume that their settlements here would have conformed more to the Type B than the Doornspruit type of settlement.
Early 1860s	While the exact date for the permanent settlement of the first white farmers in the areas surrounding the study areas are not known, adjacent districts such as Standerton and Ermelo were both permanently settled by white farmers during the early 1860s. The permanent settlement of white farmers in the general vicinity of the study area would have resulted in the proclamation of individual farms and

	the establishment of permanent farmsteads. Features that can typically be associated with early farming history of the area include farm dwellings, sheds, rectangular kraals, farm labourer accommodation and cemeteries. While very few heritage sites associated with the very first establishment of white farmers in the study area would likely still be found, a number of farmsteads dating from the 1890s are still in existence in the general vicinity of the study area. One such an example is the original farmstead on the farm Nooitgedacht 94 IS which was used as a headquarters by the No. 3 Flying Column during the South African War. This farmstead is located approximately 8.2 km south-west of Site 10. These early farmsteads were often constructed of stone and usually had a corrugated iron roof, although the earliest farmsteads would certainly have had thatch roofs. The other sites often associated with these early farms are graves and cemeteries for both white farmers and black farm labourers. A large number of such cemeteries are located in the general vicinity of the study area.
1899 – 1902	Although no evidence for battles or skirmishes within the study areas during the South African War could be found, it is known that a significant battle took place in the general vicinity. Known as the Battle of Bakenlaagte, it was one of the last significant battles of the war. On 30 October 1901 the combined forces of Generals Grobler, Brits, Viljoen and Louis Botha attacked the rear guard of Colonel G.E. Benson's No. 3 Flying Column. Although the British soldiers were outnumbered almost four to one, they established themselves on a hill known as Gun Hill and fought heroically until they were almost annihilated. Of the original 210 troops, 73 were killed and 134 wounded. Colonel Benson, who was also wounded during the battle, succumbed to his wounds a few days later. The Boer losses amounted to approximately 14 killed (including General Opperman) and 48 wounded. The brave rear guard action of Colonel Benson's troops ensured that the main column under Lieutenant-Colonel Wools-Sampson had enough time to establish a defensive perimeter which deterred any further Boer attacks (http://alh-research.tripod.com/Light_Horse/index.blog/1889262/bakenlaag-te-south-africa-october-30-1901/). While the events of the battle stretched over the farms Nooitgedacht 94 IS, Bakenlaagte 84 IS, Kruisementfontein 95 IS and Onverwacht 97 IS, the final action took place on the farm Nooitgedacht. This point is located approximately 8.2 km south-west of the study area (www.angloboerwar.com).
Early 1970s	The town of Kriel was established on the farms Roodebloem and Onverwacht and was named after the first resident magistrate of Bethal, D.J. Kriel (www.mpumalanga.com).
March 1975	The first coal was mined at the Kriel mine during this time. At the time it operated as an underground mine aimed at supplying the Kriel Power Station with coal. To maximise production the mine was subsequently turned into an opencast colliery (Lang, 1995).
1979	The Kriel Power Station was completed in this year. At the time of its completion it was the largest coal-fired power station in the southern hemisphere (www.eskom.co.za).

5.2 Previous Heritage Impact Assessment (HIA) Reports from the Study Area and Surroundings

An assessment of the South African Heritage Resources Information System (SAHRIS) of the South African Heritage Resources Agency (SAHRA) has revealed several previous heritage and archaeological studies from within the study area and its immediate surroundings. Only reports that covered the immediate study area or its direct surroundings are included. These previous studies will be briefly discussed in ascending date order below.

5.2.1 HIA Reports within or immediately adjacent to the Study Area

Van Schalkwyk JA and Naude M. 1992. Report on an Archaeological Survey Done for Amcoal in the Kriel Area of the Eastern Transvaal. Survey conducted and Report prepared by the National Cultural History Museum. SAHRA Report No 1992-SAHRA-0015. MAPID_00653

The survey was conducted of Kriel Colliery, in order to establish the nature, extent and precise location of any archaeological or historical occurrence in the specific area, prior to proposed strip mining of certain portions of the farms Onverwacht 70 IS and Aangewys 81 IS, in the Bethal district. A couple of historical buildings and 8 grave yards or burial places were identified. The grave yards were recommended to be relocated before strip mining of the area could be started.

The copy of this report obtained from SAHRIS did not have any site coordinates or a location map, so it was not possible to check whether any of the sites were located in the present study area. However, the study area did include a small section of the farm Onverwacht on its north-western side. The centre point of the study area for this HIA report is roughly 1.16 km to the south-east of the current study area.

Van Schalkwyk, J et al. 1996. A Survey of Cultural Resources in the Proposed Coal Mining Areas for Kriel Colliery. Survey Conducted and Report Prepared by the National Cultural History Museum. SAHRA Report No. 1996-SAHRA-0018 SAHRIS MAPID_00707

The National Cultural History Museum was contracted by Kriel Colliery to identify and assess the archaeological and historical remains on portions of the farm Onverwacht 70 IS in the Standerton district (Mpumalanga). This area was to be mined (open cast) for coal. No visual evidence of sites, objects or features of archaeological significance was discovered. Thirteen buildings, some dating back to 1902, of the former Kriel police station are located on the site. However, this portion of

land was not under direct threat of the mining operations, although there was a possibility of damage during blasting operations. The remains of a farm school and residence across the road from the police station were also identified as being of local historic significance.

This report covered the farm Onverwacht 70 IS but the sites identified fall outside the present study area, which lies roughly 3.13 km to the north-west of the location of the study area of this 1996 report. The police station and school identified in this 1996 report are both located roughly 3-4 km from the present study area.

Van Schalkwyk, J. 2003. Kriel Mine Extension, Mpumalanga: Archaeological and Cultural Historical Survey and Impact Assessment. For Oryx Environmental. Survey Conducted and Report Prepared by the National Cultural History Museum. SAHRA Report No. 2003-SAHRA-0028. SAHRIS MAPID_00656

The National Cultural History Museum was contracted by Oryx Environmental to survey an area in which it was proposed to extend underground coal mining operations. Unfortunately, the version of the report that is available on SAHRIS does not include the section dealing with the study's survey results. The available copy of the report does however have a locality map on which known heritage sites had been plotted. From this map it is clear that a high number of cemeteries are known from the surroundings of the present study area, with some historical sites also known. Approximately 10 Iron Age sites are also depicted on this locality map, the closest of which is roughly 8 km south-east of the present study area. The report also indicates that a number of Middle and Stone Age lithics are known from the surroundings of the its study area, but that these lithics are all in the form of surface material only.

Unfortunately, the copy of the report available on SAHRIS does not provide a description of the affected properties. The report's general location map does however indicate that its study area comprised two extensive components, the nearest of which is located roughly 3.4 km east of the present study area.

Van Vollenhoven, AC. 2012. A Report on a Heritage Impact Assessment for the Proposed Benefication Plant at Kriel Colliery, Mpumalanga Province. For SRK. By Archaetnos Culture & Cultural Resource Consultants. SAHRA CaseID 166.

Archaetnos cc was appointed by SRK to conduct a cultural heritage study for the proposed

benefication plant at the Kriel Colliery. This is located on the farm Driefontein 69 IS, which is situated to the south-west of the town of Kriel in the Mpumalanga Province. During the survey one graveyard was located in the development footprint. No Stone or Iron Age sites were identified.

The study area for this development is located within 3 km from the current study area for Ash Dam 4. The farm Driefontein 69 IS is located immediately adjacent and to the west of the current study area. The graveyard identified in this report is located outside the current study area for Ash Dam 4 and is roughly 2-3 km to the west.

Mngomezulu M. 2013. Phase 1 Heritage Impact Assessment for the proposed Kriel Power Station – Monitored Trial Embankment. Prepared for Eskom Holdings Limited By Nemai Consulting. SAHRIS CaseID 3102.

Nemai Consulting was appointed by Eskom to obtain environmental authorization from the Department of Environmental Affairs (DEA) for the proposed construction of a Monitored Trial Embankment (MTE). The proposed sites for the construction of the MTE are located in close proximity to Kriel Power Station, in Mpumalanga Province. The mine lease area falls within the farms: Portion 15 of the farm Driefontein 69 IS, Remaining Portion of the Kriel Power Station 65 IS, Portions 3 and 4 of the farm Vaalpan 68 IS and Portion 9 of the farm Onverwacht 70 IS. The proposed MTE consists of building an embankment from un-rehabilitated opencast mining spoil and monitoring the effect of the pressure on the underlying spoil and virgin ground. Monitoring will be carried out with instruments built into the embankment. The MTW is associated with the proposed construction of a new ash dam at Kriel Power Station. The objective of the study was to identify any cultural heritage resources occurring on sites which may be impacted upon by the proposed construction. No heritage resources were found within the proximity of the proposed sites.

The study area for this report falls inside the current study area. However, similar to the findings of the present study, no heritage resources were found during this 2013 assessment.

5.2.2 HIA Reports Adjacent to the Study Area

Van Schalkwyk, J. 1997. A Survey of Cultural Resources in the Pit 5 & 6 Mining Areas, Kriel Colliery, Kriel District, Mpumalanga Province. For Kriel Colliery. Survey Conducted and Report Prepared by the National Cultural History Museum. SAHRIS MAPID_00654

The National Cultural History Museum was requested by Kriel Colliery to survey two farms, Frischgewaagd 60IS and Vierfontein 61IS. It was planned to strip-mine these areas for coal. A few Middle and Late Stone Age tools were noticed in the Rietspruit and one MSA core was found amongst the sandstone outcrops on the north eastern border of the study area on the farm Frischgewaagd. A few structures of historical age (8) were identified which were mostly demolished. A number of informal cemeteries (11) were identified.

The study area for this report is located approximately 11 km to the north-west of the present study area.

Van Vollenhoven, A. 2012. A Report on the Heritage Impact Assessment related to the Exxaro Matla Project near Kriel in the Mpumalanga Province. For GCS on behalf of Exxarro. By Archaetnos Culture & Cultural Resource Consultants. SAHRA CaseID 102.

Archaetnos cc was appointed by GCS to conduct a heritage study for the Exxaro Matla Project. This was for a coal mining operation on various farms, close to Kriel in the Mpumalanga Province. The project was a coal mining operation, including opencast and underground mining as well as associated infrastructure. The mining rights area covers approximately 22 000 ha. The rights were situated on the following farms: Bakenlaagte 84 is, Haasfontein 85 IS, Kruisementfontein 95 IS, Moedverloren 88 IS, Nooitgedacht 94 IS, Onverwacht 97 IS, Schaapkraal 93 IS, Weltevreden 307 IR, Matla Power Station 141 IS, Vierfontein 61 IS, Grootpan 86 IS, Kortlaagte 67 IS, Uitvlugt 225 IS, Nasmanus 132 IS, Onverwacht 66 IS, Rietvlei 62 IS, Strehla 261 IR, Vaalpan 68 IS and Vlakpan 89 IS.

The fieldwork undertaken revealed 30 sites of cultural heritage significance. Fifteen sites were graves or cemeteries; two sites were historical structures and two sites contained dilapidated structures. The site of a battle dating to the Second South African War was also identified (Battle of Bakenlaagte), although no feature or structure from the battle remains. The centre point of the study area for this report is located approximately 11 km immediately west of the current study area for Ash Dam 4. Although a large number of sites were identified, the study area does not overlap the boundary of the current study area.

Van Vollenhoven, AC and C de Bruyn. 2014. A Report on a Cultural Heritage Impact Assessment for the Proposed Isibonelo Colliery Block Z Opencast Mine, close to Kriel, Mpumalanga Province. For WSP Environmental (Pty) Ltd. By Archaetnos cc. SAHRA CaseID 5914

Archaetnos cc was requested by WSP Environmental (Pty) Ltd to conduct a cultural heritage impact assessment (HIA) for the Isibonelo Colliery Block Z Opencast Mine. This was done as part of the Impact Assessment and Management Programme amendment. The project was situated on different portions of the farm Witbank 80 IS, Alexander 102 IS, Rietfontein 101 IS, Aangewys 81 IS and Brakfontein 117 IS, close to Kriel in the Mpumalanga Province. During the survey one cemeterycontaining nine graves was identified, but this was located outside of the area of direct impact. It was noted that extremely dense vegetation during the survey period however made archaeological visibility almost impossible. The centre point of study area for this report is located roughly 13 km south-east of the current study area for Ash Dam 4. The cemetery that was identified is located roughly 5 km outside the study area.

5.3 Palaeontological Desktop Study

PGS Heritage sub-contracted Paleo Field Services to undertake a Palaeontological Desktop Study as part of the HIA study (see **Appendix D** for a full copy of this report). The Palaeontological Desktop Study revealed that the study area is underlain by palaeontologically significant fluvial and deltaic deposits of coarse sandstone, conglomerate and coal of the Vryheid Formation (Ecca Group, Karoo Supergroup). The formation is considered to be of high palaeontological sensitivity, with a moderate to high likelihood that plant and ichno fossil assemblages may be present where outcrops occur (**Figure 19**). The likelihood of finding fossils in disturbed and old backfilled areas, or before actual excavations into intact sedimentary rocks take place is considered fairly low.

Excavations into unweathered/*in situ* sedimentary bedrock within the proposed development footprint will require palaeontological monitoring with the possibility that this may lead to the identification and removal of fossil material and implementation of appropriate mitigation procedures. It is recommended that, in the case of possible excavation into fresh sedimentary bedrock, the developer:

- Must employ a qualified palaeontologist to record and remove any fossils;
- Must apply for a collection and destruction permit from SAHRA for all fossil material encountered during the process.

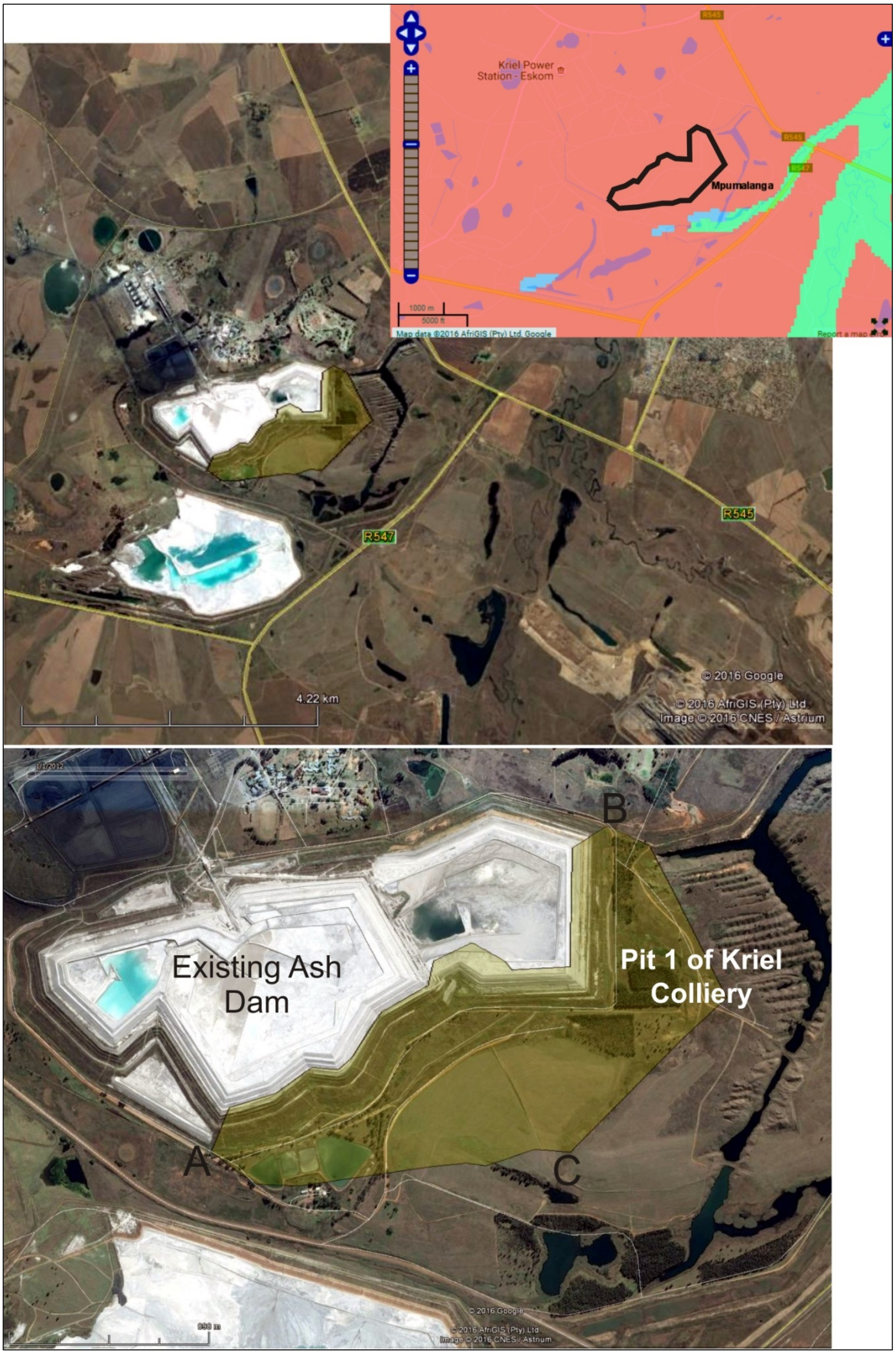

Figure 20 – Aerial view of the proposed new ash disposal facility site (green area). The study area is underlain by palaeontologically significant sedimentary rocks of the Vryheid Formation (SAHRIS PalaeoSensitivity Map insert).

6 FIELDWORK FINDINGS

6.1 Introduction

The fieldwork focussed on the study area as provided by the client by way of Google Earth polygons.

A physical survey was conducted by vehicle and on foot of the proposed study area. The fieldwork was aimed at locating and documenting sites falling within and adjacent to the proposed development footprints and was undertaken over the course of one day, namely Friday, 2 September 2016. The fieldwork was undertaken by an experienced team comprising an archaeologist / heritage specialist (Marko Hutten) and fieldwork assistant (John Anderson).

GPS coordinates were taken of identified heritage sites and such sites were recorded photographically. Hand-held GPS devices were used to record track logs of the fieldwork undertaken by PGS Heritage (**Figure 20**).

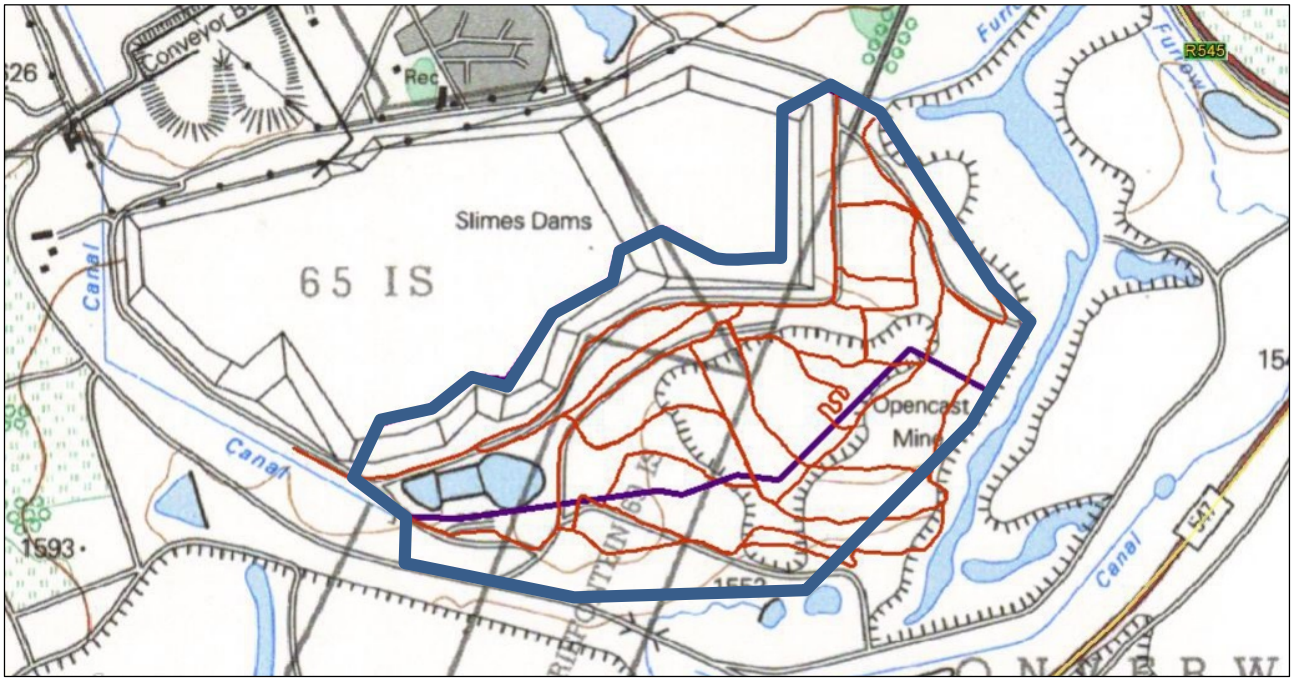

Figure 21 – The tracklog of the fieldwork (orange lines) and the study area (blue polygon).

6.2 Fieldwork Findings

Due to the previous mining activities, extensive sections of the study area can be described as disturbed. No heritage sites were identified during the fieldwork within the study area.

7 IMPACT OF PROPOSED DEVELOPMENT ON HERITAGE RESOURCES

With the exclusion of palaeontological resources, no heritage resource sites were identified within the study area. As a result, there is no need for an impact assessment analysis for the non-palaeontological heritage resources of this area.

As indicated above, the palaeontological desktop study has revealed that the study area is underlain by palaeontologically significant fluvial and deltaic deposits of coarse sandstone, conglomerate and coal of the Ecca Group Vryheid Formation. The impact of the proposed development on palaeontological resources has been evaluated by the palaeontologist, Dr Lloyd Rossouw and is presented below.

7.1 Risk Calculation for the Impact of the Proposed Development on palaeontological resources

Table 8. Overall assessment with regard to potential palaeontological impacts.

Criteria	Rating (without mitigation)	Motivation/Description
Spatial influence of impact	Local	Between 100m and10 km radius of the candidate site
Magnitude (at the indicated spatial scale)	Medium	Natural and/ or social functions and/ or processes are notably altered
Duration of impact (temporal)	Long term	More than 15 years after construction
Significance	High	Medium magnitude with a regional extent and long term duration
Probability	Probable	Estimated 5 to 95 % chance of the impact occurring.
Confidence	Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Reversibility	Irreversible	The activity will lead to an impact that is in all practical terms permanent.
Irreplaceability	High	Where the activity results in an irreplaceable loss of a resource.
Mitigatability	High	High extent to which impacts can be mitigated (see Recommendations)

Criteria	Rating (with mitigation)	Motivation/ Description
Spatial influence of impact	Local	Between 100m and10 km radius of the candidate site
Duration	Long term	The ash dam will be in existence for a long term, even after rehabilitation it will still be a recognisable man-made structure
Magnitude	Low	The introduction of an additional ash dam facility won't notable change the existing processes on site
Significance	Low	The introduction of an additional facility won't notable change the existing sense of place
Probability of occurrence	Probable	The impacts will probably take place
Confidence levels	Certain	With 3D GIS modelling confidence levels are increased
Reversibility	Irreversible	The activity will lead to an impact that is in all practical terms permanent.
Irreplaceability	High	Where the activity results in an irreplaceable loss of a resource.

Mitigation and management measures

In the case of possible excavation into fresh sedimentary bedrock, the developer:

- Must employ a qualified palaeontologist to record and remove any fossils;
- Must apply for a collection and destruction permit from SAHRA for all fossil material encountered during the process.

8 MITIGATION MEASURES AND GENERAL RECOMMENTATIONS

As no non-palaeontological heritage resource sites were found during the survey of the study area for AD 4.1 and 4.2, there is no requirement for mitigation measures for such heritage resources. However, the desktop palaeontological study revealed that the study area is underlain by palaeontologically significant fluvial and deltaic deposits of coarse sandstone, conglomerate and coal of the Vryheid Formation (Ecca Group, Karoo Supergroup). As a result, mitigation measures would be required to mitigate the expected impact of the proposed development on palaeontology.

8.1 Required Mitigation Measures for palaeontological resources

It is recommended that, in the case of possible excavation into fresh sedimentary bedrock, the developer:

- Must employ a qualified palaeontologist to record and remove any fossils;
- Must apply for a collection and destruction permit from SAHRA for all fossil material encountered during the process.

8.2 General Recommendations

Apart from the site-specific mitigation measures, the following general mitigation measure would also be required:

- Any changes to the existing layout of any of the proposed development footprints will have to be surveyed by a suitably qualified heritage specialist.

9 CONCLUSIONS AND RECOMMENDATIONS

PGS Heritage (Pty) Ltd was appointed by Aurecon South Africa (Pty) Ltd to undertake a Heritage Impact Assessment for the proposed Kriel Ash Disposal Facilities in the vicinity of Kriel (Ga-Nala), Mpumalanga Province. The proponent is Eskom.

This Heritage Impact Assessment follows on a long process undertaken by Eskom and the client to identify a suitable site for the proposed expansion project. As part of this process, the author of this report was responsible for two heritage desktop studies and one heritage impact assessment. The two desktop studies comprised two heritage options analyses and formed part of the overall options analysis undertaken by Aurecon for Eskom. The subsequent heritage impact assessment was undertaken on the final two sites earmarked for the impact assessment phase, namely Site 10 and Site 16N. The present heritage impact assessment aims to assess the impact of the proposed development of the ash disposal facility on a new study area, which partially encloses the original Site 10 assessed during the previous heritage impact assessment. This assessment is for the proposed Ash Dams (AD) 4.1 and 4.2.

An archaeological and historical background study was undertaken which revealed various aspects of the archaeology and history of the study area and surrounding landscape. Although a number of archaeological and historical sites are known from the surroundings of the study area, this desktop study could not reveal any such sites within the study area boundaries.

A palaeontological desktop study was also undertaken by Dr Lloyd Rossouw of Palaeo Field Services. This study revealed that the proposed development footprint is underlain by palaeontologically significant fluvial and deltaic deposits of coarse sandstone, conglomerate and coal of the Ecca Group Vryheid Formation. The formation is considered to be of high palaeontological sensitivity, with a moderate to high likelihood that fossil assemblages may be present where outcrops occur. The likelihood of finding fossils in disturbed and old backfilled areas, or before actual excavations into intact sedimentary rocks take place is considered fairly low. Excavations into unweathered/in situ sedimentary bedrock within the proposed development footprint will require palaeontological monitoring with the possibility that this may lead to the identification and removal of fossil material and implementation of appropriate mitigation procedures.

An archaeological and heritage field survey of the study area was undertaken by a very

experienced fieldwork team. No heritage resource sites were identified during the fieldwork.

Recommendations

Since no heritage resources besides the likely palaeontological resources were identified, only the palaeontological resources have been addressed in the Recommendations for Mitigation.

With regards to the palaeontological resources, it is recommended that, in the case of possible excavation into fresh sedimentary bedrock, the developer must:

- Employ a qualified palaeontologist to record and remove any fossils;
- Apply for a collection and destruction permit from SAHRA for all fossil material encountered during the process.

The following general recommendations are also required:

- Any additions to the existing study area will have to be surveyed by a suitably qualified heritage specialist.

It is the opinion of the author of this report that in terms of the heritage aspects addressed as part of the defined scope of work of this study and on the condition that the required mitigation measures and recommendations made in this report are undertaken before any development takes place, the development may be allowed to continue.

10 PREPARERS

Polke Birkholtz (Author) – Project Manager / Archaeologist / Heritage Specialist
Jennifer Kitto (Co-Author) - Heritage Specialist

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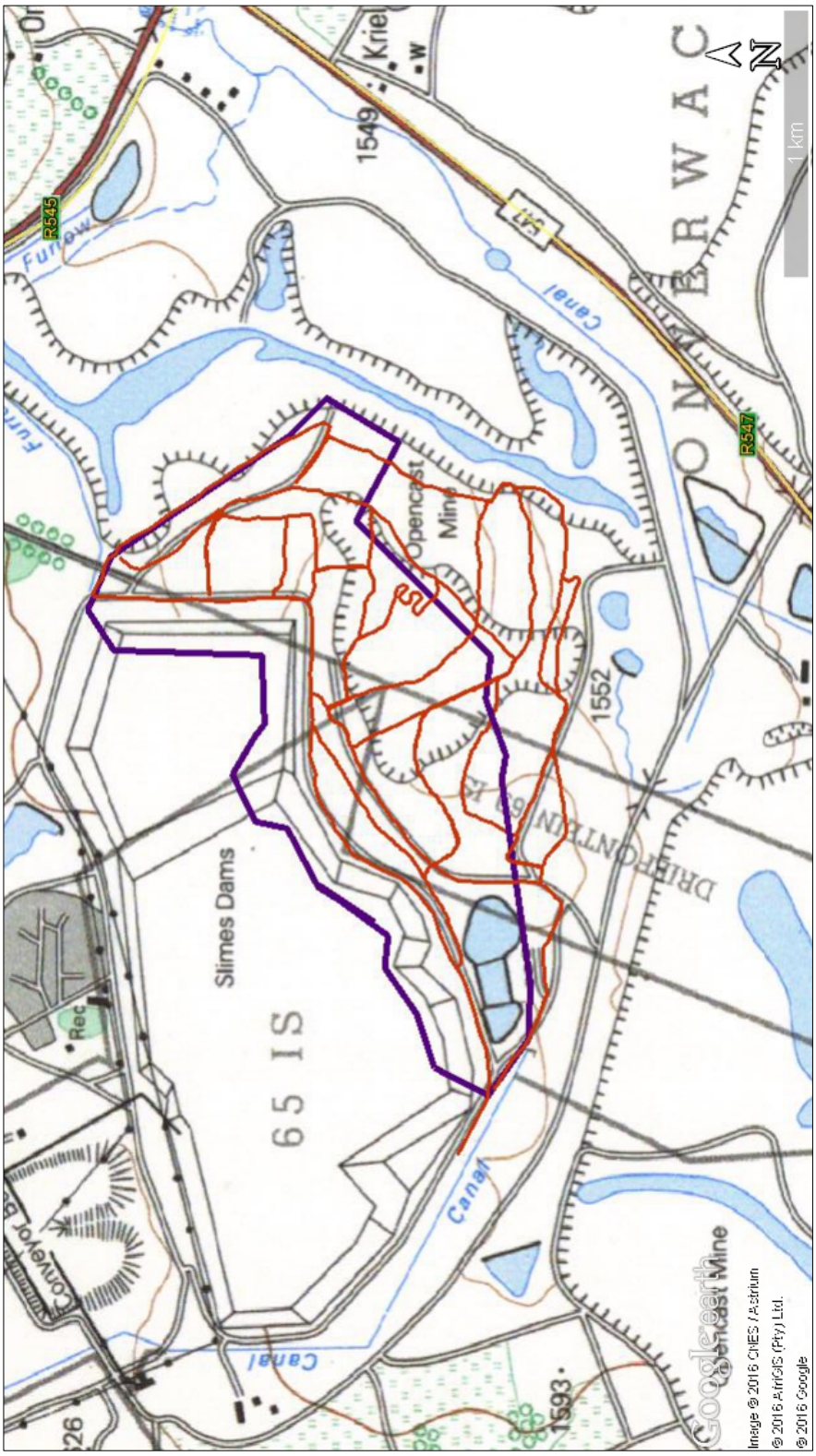
Appendix A

STUDY AREA WITH TRACKLOG MAP



Map showing the tracklogs (orange lines) that were recorded during the heritage field survey of the study area (purple polygon).

Appendix B

LEGISLATIVE REQUIREMENTS – TERMINOLOGY AND ASSESSMENT CRITERIA

General principles

In areas where there has not yet been a systematic survey to identify conservation worthy places, a permit is required to alter or demolish any structure older than 60 years. This will apply until a survey has been done and identified heritage resources are formally protected.

Archaeological and palaeontological sites, materials, and meteorites are the source of our understanding of the evolution of the earth, life on earth and the history of people. In terms of the heritage legislation, permits are required to damage, destroy, alter, or disturb them. Furthermore, individuals who already possess heritage material, are required to register it. The management of heritage resources is integrated with environmental resources and this means that, before development takes place, heritage resources are assessed and, if necessary, rescued.

In addition to the formal protection of culturally significant graves, all graves which are older than 60 years and are not located in a cemetery (such as ancestral graves in rural areas), are protected. The legislation also protects the interests of communities that have an interest in the graves: they should be consulted before any disturbance takes place. The graves of victims of conflict and those associated with the liberation struggle are to be identified, cared for, protected and memorials erected in their honour.

Anyone who intends to undertake a development must notify the heritage resources authority and, if there is reason to believe that heritage resources will be affected, an impact assessment report must be compiled at the construction company's cost. Thus, the construction company will be able to proceed without uncertainty about whether work will have to be stopped if an archaeological or heritage resource is discovered.

According to the National Heritage Act (Act 25 of 1999 section 32) it is stated that:
An object or collection of objects, or a type of object or a list of objects, whether specific or generic, that is part of the national estate and the export of which SAHRA deems it necessary to control, may be declared a heritage object, including –

- Objects recovered from the soil or waters of South Africa, including archaeological and palaeontological objects, meteorites and rare geological specimens;
- visual art objects;
- military objects;
- numismatic objects;

- objects of cultural and historical significance;
- objects to which oral traditions are attached and which are associated with living heritage;
- objects of scientific or technological interest;
- books, records, documents, photographic positives and negatives, graphic material, film or video or sound recordings, excluding those that are public records as defined in section 1 (xiv) of the National Archives of South Africa Act, 1996 (Act No. 43 of 1996), or in a provincial law pertaining to records or archives; and
- any other prescribed category.

Under the National Heritage Resources Act (Act No. 25 of 1999), provisions are made that deal with, and offer protection to, all historic and prehistoric cultural remains, including graves and human remains.

Graves and cemeteries

Graves younger than 60 years fall under Section 2(1) of the Removal of Graves and Dead Bodies Ordinance (Ordinance no. 7 of 1925) as well as the Human Tissues Act (Act 65 of 1983) and are under the jurisdiction of the National Department of Health and the relevant Provincial Department of Health and must be submitted for final approval to the Office of the relevant Provincial Premier. This function is usually delegated to the Provincial MEC for Local Government and Planning, or in some cases the MEC for Housing and Welfare. Authorisation for exhumation and reinternment must also be obtained from the relevant local or regional council where the grave is situated, as well as the relevant local or regional council to where the grave is being relocated. All local and regional provisions, laws and by-laws must also be adhered to. In order to handle and transport human remains, the institution conducting the relocation should be authorised under Section 24 of Act 65 of 1983 (Human Tissues Act).

Graves older than 60 years, but younger than 100 years, fall under Section 36 of Act 25 of 1999 (National Heritage Resources Act) as well as the Human Tissues Act (Act 65 of 1983) and are under the jurisdiction of the South African Heritage Resources Agency (SAHRA). The procedure for Consultation Regarding Burial Grounds and Graves (Section 36(5) of Act 25 of 1999) is applicable to graves older than 60 years that are situated outside a formal cemetery administrated by a local authority. Graves in the category located inside a formal cemetery administrated by a local authority will also require the same authorisation as set out for graves younger than 60 years, over and above SAHRA authorisation.

If the grave is not situated inside a formal cemetery but is to be relocated to one, permission from the local authority is required and all regulations, laws and by-laws set by the cemetery authority must be adhered to.

Appendix C

CURRICULUM VITAE

PROFESSIONAL CURRICULUM
FOR POLKE DOUSSY BIRKHOLTZ

Name: *Polke Doussy Birkholtz*

Date & Place of Birth: *9 February 1975 – Klerksdorp, North West Province, South Africa*

Place of Tertiary Education & Dates Associated:

Institution: University of Pretoria
Qualification: BA (Cum Laude) - Bachelor of Arts Specializing in Archaeology, History & Anthropology
Date: 1996

Institution: University of Pretoria
Qualification: BA Hons (Cum Laude) - Bachelor of Arts with Honours Degree Specializing in Archaeology
Date: 1997

Qualifications:

BA	-	Degree specialising in Archaeology, History and Anthropology
BA Hons	-	Professional Archaeologist

Memberships:

Association of Southern African Professional Archaeologists (ASAPA)
Professional Member of the CRM Section of ASAPA

Overview of Post Graduate Experience:

1997 – 2000 – Member/Archaeologist – Archaeo-Info
2001 – 2003 – Archaeologist/Heritage Specialist – Helio Alliance
2000 – 2008 – Member/Archaeologist/Heritage Specialist – Archaeology Africa
2003 - Present – Director / Archaeologist / Heritage Specialist – PGS Heritage

Languages: English: Speak, Read & Write & Afrikaans: Speak, Read & Write

Total Years' Experience: 17 Years

Experience Related to the Scope of Work:

- Polke has worked as a **HERITAGE SPECIALIST / ARCHAEOLOGIST / HISTORIAN** on more than 275 projects, and acted as **PROJECT MANAGER** on almost all of these projects. His experience include the following:

    - Development of New Sedimentation and Flocculation Tanks at Rand Water's Vereeniging Pumping Station, Vereeniging, Gauteng Province. Heritage Impact Assessment for *Greenline*.

- EThekwini Northern Aqueduct Project, Durban, KwaZulu-Natal. Heritage Impact Assessment for *Strategic Environmental Focus*.
- Johannesburg Union Observatory, Johannesburg, Gauteng Province. Heritage Inventory for *Holm Jordaan*.
- Development at Rand Water's Vereeniging Pumping Station, Vereeniging, Gauteng Province. Heritage Impact Assessment for *Aurecon*.
- Comet Ext. 8 Development, Boksburg, Gauteng Province. Phase 2 Heritage Impact Assessment for *Urban Dynamics*.
- Randjesfontein Homestead, Midrand, Gauteng Province. Baseline Heritage Assessment with Nkosinathi Tomose for Johannesburg City Parks.
- Rand Leases Ext. 13 Development, Roodepoort, Gauteng Province. Heritage Impact Assessment for *Marsh*.
- Proposed Relocation of the Hillendale Heavy Minerals Plant (HHMP) from Hillendale to Fairbreeze, KwaZulu-Natal. Heritage Impact Assessment for *Goslar Environmental*.
- Portion 80 of the farm Eikenhof 323 IQ, Johannesburg, Gauteng Province. Heritage Inventory for *Khare Incorporated*.
- Comet Ext. 14 Development, Boksburg, Gauteng Province. Heritage Impact Assessment for *Marsh*.
- Rand Steam Laundries, Johannesburg, Gauteng Province. Archival and Historical Study for *Impendulo* and *Imperial Properties*.
- Mine Waste Solutions, near Klerksdorp, North West Province. Heritage Inventory for *AngloGold Ashanti*.
- Consolidated EIA and EMP for the Kroondal and Marikana Mining Right Areas, North West Province. Heritage Impact Assessment for *Aquarius Platinum*.
- Wilkoppies Shopping Mall, Klerksdorp, North West Province. Heritage Impact Assessment for *Centre for Environmental Management*.
- Proposed Vosloorus Ext. 24, Vosloorus Ext. 41 and Vosloorus Ext. 43 Developments, Ekurhuleni District Municipality, Gauteng Province. Heritage Impact Assessment for *Enkanyini Projects*.
- Proposed Development of Portions 3, 6, 7 and 9 of the farm Olievenhoutbosch 389 JR, City of Tshwane Metropolitan Municipality, Gauteng Province. Heritage Impact Assessment for *Marsh*.
- Proposed Development of Lotus Gardens Ext. 18 to 27, City of Tshwane Metropolitan Municipality, Gauteng Province. Heritage Impact Assessment for *Pierre Joubert*.
- Proposed Development of the site of the old Vereeniging Hospital, Vereeniging, Gauteng Province. Heritage Scoping Assessment for *Lekwa*.
- Proposed Demolition of an Old Building, Kroonstad, Free State Province. Phase 2 Heritage Impact Assessment for *De Beers Consolidated Mines*.
- Proposed Development at Westdene Dam, Johannesburg, Gauteng Province. Heritage Impact Assessment for *Newtown*.
- West End, Central Johannesburg, Gauteng Province. Phase 1 Heritage Impact Assessment for the *Johannesburg Land Company*.
- Kathu Supplier Park, Kathu, Northern Cape Province. Heritage Impact Assessment for *Synergistics*.
- Matlosana 132 kV Line and Substation, Stilfontein, North West Province. Heritage Impact Assessment for *Anglo Saxon Group* and *Eskom*.

- Marakele National Park, Thabazimbi, Limpopo Province. Cultural Resources Management Plan for *SANParks*.
- Cullinan Diamond Mine, Cullinan, Gauteng Province. Heritage Inventory for *Petra Diamonds*.
- Highveld Mushrooms Project, Pretoria, Gauteng Province. Heritage Impact Assessment for *Mills & Otten*.
- Development at the Reserve Bank Governor's Residence, Pretoria, Gauteng Province. Archaeological Excavations and Mitigation for the *South African Reserve Bank*.
- Proposed Stones & Stones Recycling Plant, Johannesburg, Gauteng Province. Heritage Scoping Report for *KV3*.
- South East Vertical Shaft Section of ERPM, Boksburg, Gauteng Province. Heritage Scoping Report for *East Rand Proprietary Mines*.
- Proposed Development of the Top Star Mine Dump, Johannesburg, Gauteng Province. Detailed Archival and Historical Study for *Matakoma.*
- Soshanguve Bulk Water Replacement Project, Soshanguve, Gauteng Province. Heritage Impact Assessment for *KWP*.
- Biodiversity, Conservation and Participatory Development Project, Swaziland. Archaeological Component for *Africon*.
- Camdeboo National Park, Graaff-Reinet, Eastern Cape Province. Cultural Resources Management Plan for *SANParks*.
- Main Place, Central Johannesburg, Gauteng Province. Phase 1 Heritage Impact Assessment for the *Johannesburg Land Company*.
- Modderfontein Mine, Springs, Gauteng Province. Detailed Archival and Historical Study for *Consolidated Modderfontein Mines.*
- Proposed New Head Office for the Department of Foreign Affairs, Pretoria, Gauteng Province. Heritage Impact Assessment for *Holm Jordaan Group*.
- Proposed Modification of the Lukasrand Tower, Pretoria, Gauteng Province. Heritage Assessment for IEPM.
- Proposed Road between the Noupoort CBD and Kwazamukolo, Northern Cape Province. Heritage Impact Assessment for *Gill & Associates*.
- Proposed Development at the Johannesburg Zoological Gardens, Johannesburg, Gauteng Province. Detailed Archival and Historical Study for *Matakoma.*

- Polke's **KEY QUALIFICATIONS:**

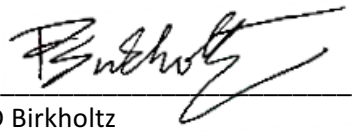
  - Project Management
  - Archaeological and Heritage Management
  - Archaeological and Heritage Impact Assessment
  - Archaeological and Heritage Fieldwork
  - Archival and Historical Research
  - Report Writing

- Polke's **INFORMATION TECHNOLOGY EXPERIENCE:**

  - *MS Office – Word, Excel, & Powerpoint*
  - *Google Earth*

- *Garmin Mapsource*
- *Adobe Photoshop*
- *Corel Draw*

I, Polke Doussy Birkholtz, hereby confirm that the above information contained in my CV is true and correct.



PD Birkholtz

5 January 2016
Date

Appendix D

PALAEONTOLOGICAL DESKTOP STUDY

Palaeontological desktop study of the proposed new Ash Disposal Facility at the Kriel Power Station near Kriel, Mpumalanga Province.

Report prepared for PGS Heritage by Paleo Field Services, PO Box 38806 Langenhovenpark 9330.

Summary

The proposed development footprint is underlain by palaeontologically significant fluvial and deltaic deposits of coarse sandstone, conglomerate and coal of the Ecca Group Vryheid Formation. The formation is considered to be of high palaeontological sensitivity, with a moderate to high likelihood that fossil assemblages may be present where outcrop occur. The likelihood of finding fossils in disturbed and old backfilled areas, or before actual excavations into intact sedimentary rocks take place is considered fairly low. Excavations into unweathered/*in situ* sedimentary bedrock within the proposed development footprint will require palaeontological monitoring with the possibility that this may lead to the identification and removal of fossil material and implementation of appropriate mitigation procedures.

Introduction

The report is a preliminary desktop assessment of potential palaeontological impact with regard to the proposed construction of an additional Ash Disposal Facility at the Kriel Power Station near the town of Kriel, Mpumalanga Province, referred to as Dam 4 (Fig. 1). In order to expand the Power Station's ash disposal facility, the following components are required:

- An Ash Disposal Facility that would have sufficient capacity to store ash volumes produced up to 2045;
- Ash Water Return dam from where decant and drained water will be pumped back to the power station for re-use;
- Ash Water Return transfer dam;
- Delivery and return infrastructure, including conveyor belts and/ or pipelines, transfer houses, pump stations;
- Clean and dirty water channels;

- Powerlines; and access roads.

The task involved identification of possible paleontological sites or occurrences within the proposed development footprint, an assessment of their significance, possible impact by the proposed development and recommendations for mitigation where relevant.

Methodology

The assessment was carried out in accordance with National Heritage Resources Act 25 of 1999 with the aim to assess the potential impact on palaeontological heritage resources that may result from the proposed development. The palaeontological significance of the affected areas were evaluated through a desktop study and carried out on the basis of existing field data, database information and published literature.

Locality Data

1 to 50 000 topographic map: 2629AC Evander
1 to 250 000 scale geological map 2826 East Rand
General site coordinates:
A) 26°16'36.66"S 29°11'13.99"E
B) 26°15'49.89"S 29°12'19.13"E
C) 26°16'37.17"S 29°12'12.62"E
The proposed site is located south of the existing ash complex, partly overlying the backfilled Pit 1 of Kriel Colliery (Fig. 2).

Palaeontology

The study area is underlain by palaeontologically significant fluvial and deltaic deposits of coarse sandstone, conglomerate and coal of the Vryheid Formation (Ecca Group, ca. 290 to 270 million years old) (Fig. 2). The Vryheid Formation is known for its abundant coal deposits. It is divided into three main depositional intervals, namely, the lower fluvial-dominated deltaic interval, the middle fluvial interval and the upper fluvial-dominated deltaic interval (Johnson *et al.,* 2006). Well-preserved plant fossils are commonly found in the shales associated with the coal seams (Anderson and Anderson 1985; Bamford 2011). A wealth of plant fossils is recorded from this formation, including the well-known *Glossopteris* Flora (abundant glossopterids including lycopods, rare ferns

and horsetails, cordaitaleans, conifers and ginkgoaleans). No vertebrate fossils have been recorded from the Vryheid Formation but abundant, low diversity invertebrate trace fossils, rare insects, possible conchostracans, non-marine bivalves and fish scales have also been reported from this formation (MacRae, 1999).

There are currently no records of Quaternary fossil localities in the vicinity of the study area, but it should be noted that small and localized fossil-rich alluvial exposures (Cornelia Formation) have been recorded in the Vaal River basin to the south of Delmas. One of these sites is known as the Cornelia-Uitzoek vertebrate locality, and is the type site of the Cornelian Land Mammal Age (Butzer *et al.* 1974; Brink & Rossouw 2000). The site consists of a pocket of Quaternary alluvial and colluvial gravels that have yielded several distinct fossil mammal species, including *Stylochoerus compactus, Connochaetes laticornutus* and *Megalotragus eucornutus.*

Impact Statement and Recommendations

The study area is underlain by Permian aged sandstone, mudstone and shale of the palaeontologically sensitive Vryheid Formation (Ecca Group, Karoo Supergroup). There is a high likelihood that the rocks of the Vryheid Formation will contain plant and ichno fossils, but the chances of finding fossils in disturbed and old backfilled areas, or before actual excavations into intact sedimentary rocks take place, is fairly low.

According to the proposed plans, “the project will excavate and fill certain areas to level out the terrain in order to construct the starter walls (compacted) and liner for the ash dams. This will include 1000 mm x 500 mm anchor trenches for liner system on starter wall around perimeter. There will also be excavations where they build the new ash water return dam and ash water return transfer dam, but over backfilled areas so should not be issue from heritage point of view). Trenches will also be excavated for the clean and dirty water channels around the new ash dams of which the excavations will be around 2m deep 1m wide and 1 in 3 side slope.”

It is recommended that, in the case of possible excavation into fresh sedimentary bedrock, the developer:

- Must employ a qualified palaeontologist to record and remove any fossils;
- Must apply for a collection and destruction permit for all fossil material encountered during the process.

References

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SAHRIS PalaeoSensitivity Map 2015 (http://www.sahra.org.za/sahris/map/palaeo).

Tables and Figures

Table 1. Overall assessment with regard to potential palaeontological impacts.

Criteria	**Category**	**Description**
Spatial influence of impact	Local	Between 100m and10 km radius of the candidate site
Magnitude of impact (at the indicated spatial scale)	medium	Natural and/ or social functions and/ or processes are *notably* altered
Duration of impact (temporal)	Long term	More than 15 years after construction
Significance	High	Medium magnitude with a regional extent and long term duration
Probability	Probable	Estimated 5 to 95 % chance of the impact occurring.
Confidence	Certain	Wealth of information on and sound understanding of the environmental factors potentially influencing the impact.
Reversibility	Irreversible	The activity will lead to an impact that is in all practical terms permanent.
Irreplaceability	High	Where the activity results in an irreplaceable loss of a resource.
Mitigatability	High	High extent to which impacts can be mitigated (see Recommendations)

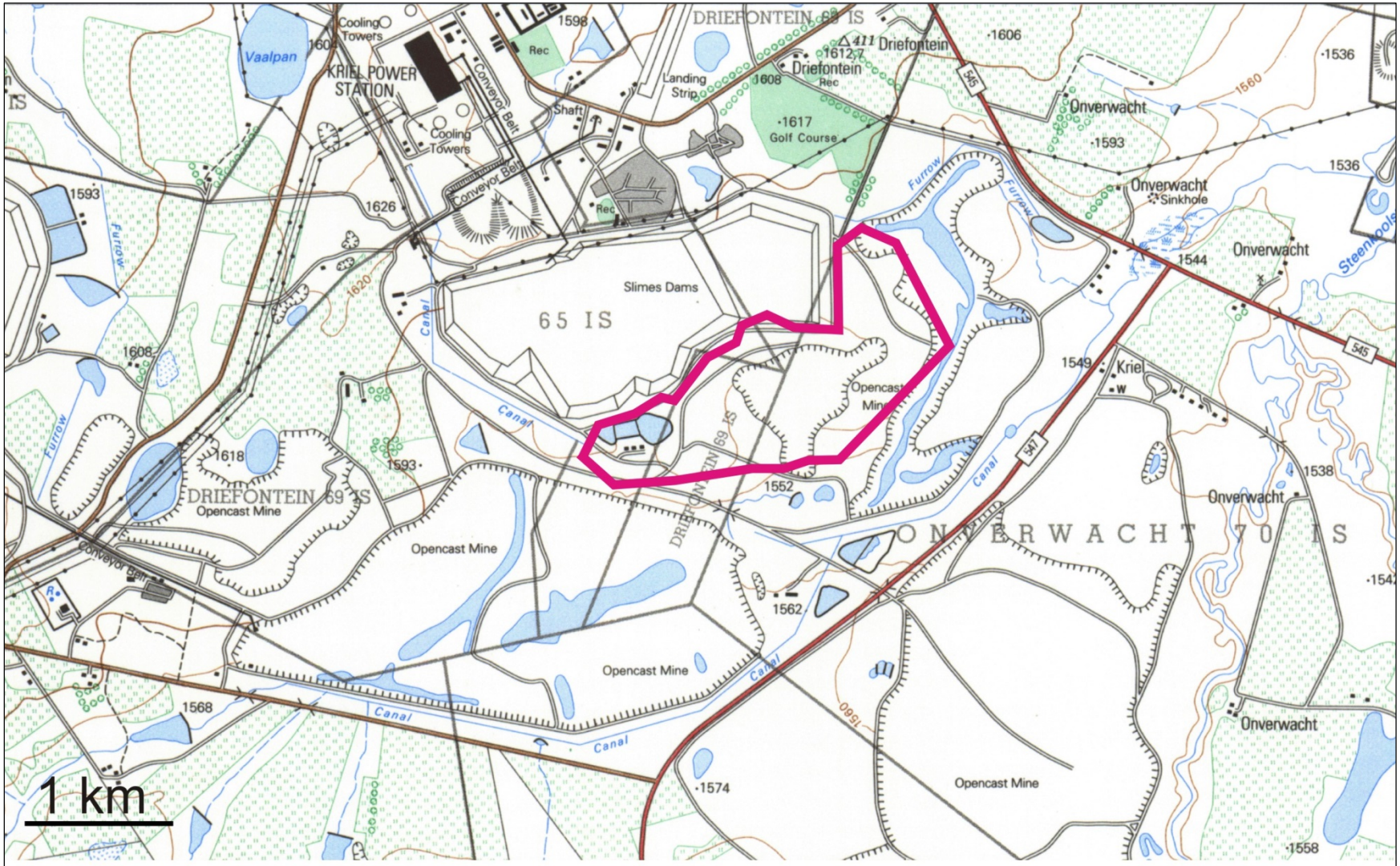

Figure 1. Map of the proposed new ash dam site at the Kriel Power Station (portion of 1: 50 000 scale topographic map 2629AC Evander).

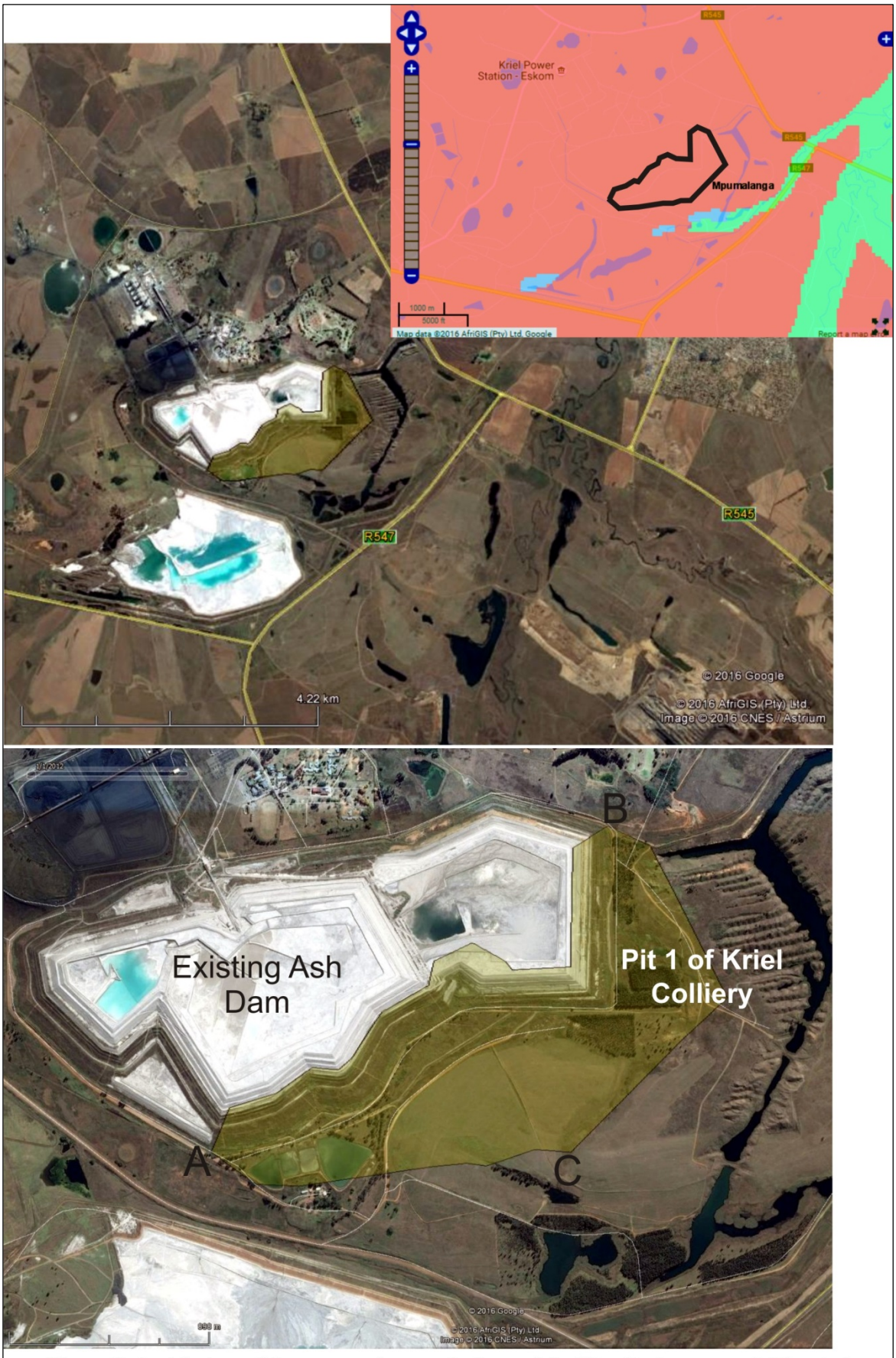

Figure 2. Aerial view of the proposed new ash disposal facility site (green area). The study area is underlain by palaeontologically significant sedimentary rocks of the Vryheid Formation (SAHRIS PalaeoSensitivity Map, insert).