HERITAGE IMPACT ASSESSMENT

In terms of Section 38(8) of the NHRA for the

Proposed development of the 18MW Harmony Joel Solar PV Facility, Theunissen, Free State Province

SAHRIS Ref:

Prepared by CTS Heritage

CTS HERITAGE

For

Savannah Environmental

August 2022

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EXECUTIVE SUMMARY

1. Site Name:

18MW Harmony Joel Solar PV Facility, Theunissen, Free State Province

2. Location:

Farm Name	Portion Number
Leeuwbult 580	0
Leeuwfontein 256	0

3. Locality Plan:

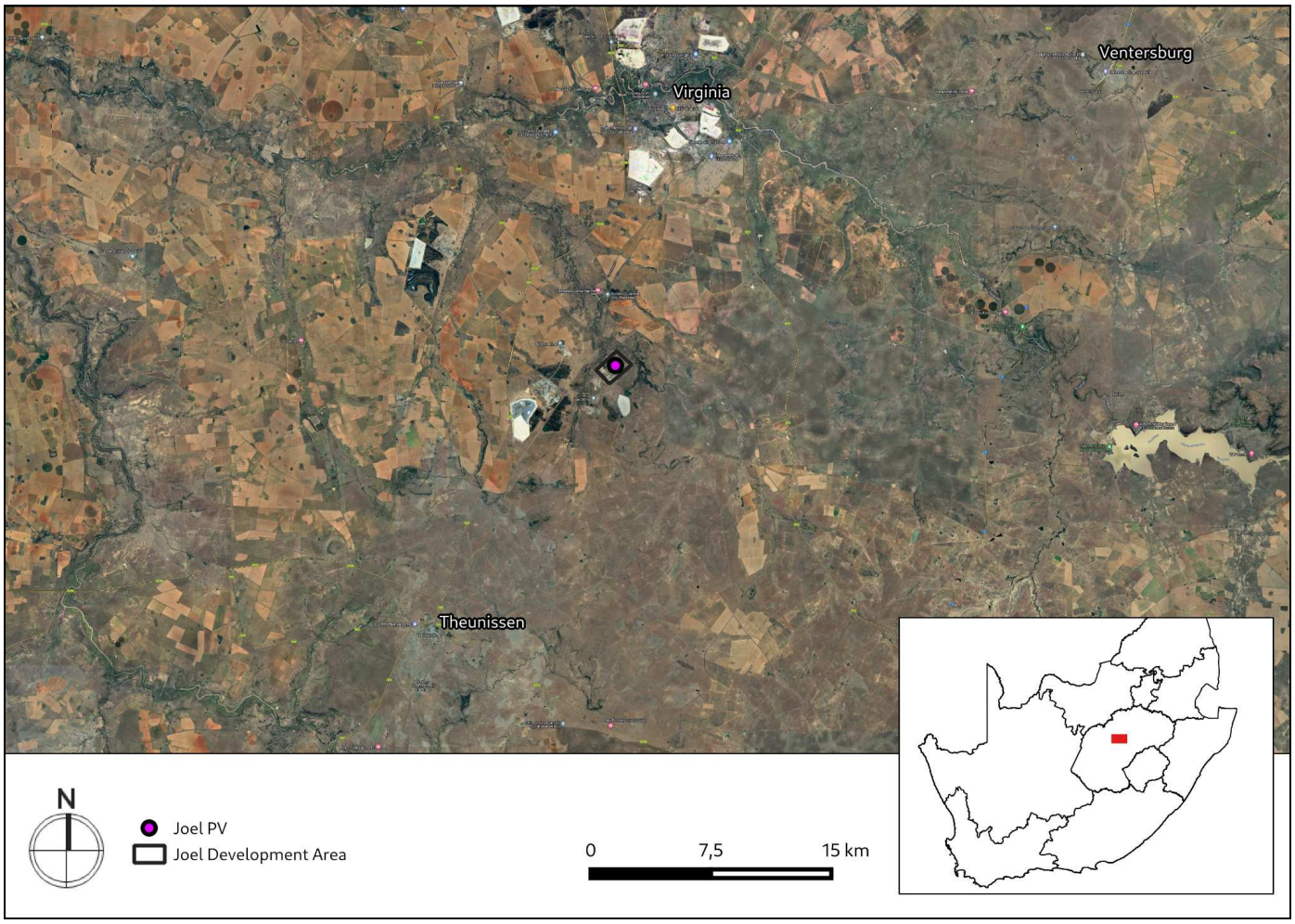

Figure 1: Location of the proposed study area

4. Description of Proposed Development:

Free Gold Harmony (Pty) Ltd, is looking to supplement its energy supply by implementing Photovoltaic (PV) generation, aiding their transition to a more sustainable and environmentally friendly energy mix.

Located north east of the Harmony Joel operations, approximately ~20km northeast of the town of Theunissen within the Masilonyana Local Municipality and within the Lejweleputswa District Municipality, Free State Province. The PV facility is located on Portion 0 of the Farm Leeuwbult 580.

A technically feasible project site, with an extent of 43.2 ha has been identified by Free Gold Harmony (Pty) Ltd as a technically suitable area for the development of the Project. A development area of ~36 ha was demarcated within this project site and allows an adequate footprint for the installation of a solar PV facility with a contracted capacity of up to 18MW, while allowing for the avoidance of environmental site sensitivities.

5. Heritage Resources Identified in and near the study area:

Site No.	Site Name	Description	Period	Co-ordinates		Grading	Mitigation
JL1	Joel 1	Isolated dolerite artefact: bi-directional core, heavily reduced	MSA-LSA	-28.24715199	26.82775296	NCW	NA
JL2	Joel 2	Concentration of artefacts: Anvil, flake fragment, chert outcrop with exploitation evidence	MSA-LSA	-28.24704403	26.83083197	IIIC	20m Buffer
JL3	Joel 3	Isolated quartzite artefacts: poorly preserved core - heavily weathered and rolled, rolled flake	unknown	-28.25327799	26.83493399	NCW	NA
JL4	Joel 4	Isolated chert artefact: flake potentially associated with bladelet production	LSA	-28.24908201	26.82736899	NCW	NA
JL5	Joel 5	Concentration of artefacts in a datable context: 1)single platform chert core; 2) chert flake; 3) chert core; 4) point; 5) silcrete retouched point on a blade; 6) miniature quartz flake; 6) dolorite big flake; 7) silcrete flake; 8) silcrete fragment	MSA-LSA	-28.2505380	26.82795304	IIIB	50m Buffer
JL6	Joel 6	Isolated chert artefacts: two chert cores	LSA	-28.24558499	26.83130203	NCW	NA

6. Anticipated Impacts on Heritage Resources:

The areas surveyed as part of this assessment have been transformed through agricultural interventions and/or mining activity. As such, it is not surprising that the results of the survey only identified two sites of scientific cultural value - JL2, graded IIIC and JL5 graded IIIB within the area proposed for the Joel PV development.

The identified sites of archaeological significance have the potential to provide scientific insight into the past and as such, it is recommended that these areas are not impacted by the proposed development. It is therefore recommended that no-go development buffers as per the recommendations below are implemented. Further, it is recommended that these sites are mapped on all relevant SDPs and that on-going conservation measures are put in place in the EMPrs for the developments.

Furthermore, no impacts to significant palaeontological heritage are anticipated on condition that the attached Chance Fossil Finds Process is implemented and no impacts to the cultural landscape are anticipated.

7. Recommendations:

There is no objection to the proposed development in terms of impacts to heritage resources on condition that:

- The 30m buffer area recommended around site JL2 is implemented
- The 50m buffer area recommended around site JL5 is implemented
- The attached Chance Fossil Finds Procedure is implemented for the duration of construction activities
- Should any buried archaeological resources or human remains or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The South African Heritage Resources Agency (SAHRA) must be contacted immediately in order to determine an appropriate way forward.

Details of Specialist who prepared the HIA

Jenna Lavin, an archaeologist with an MSc in Archaeology and Palaeoenvironments, and currently completing an MPhil in Conservation Management , heads up the heritage division of the organisation, and has a wealth of experience in the heritage management sector. Jenna's previous position as the Assistant Director for Policy, Research and Planning at Heritage Western Cape has provided her with an in-depth understanding of national and international heritage legislation. Her 8 years of experience at various heritage authorities in South Africa means that she has dealt extensively with permitting, policy formulation, compliance and heritage management at national and provincial level and has also been heavily involved in rolling out training on SAHRIS to the Provincial Heritage Resources Authorities and local authorities.

Jenna is a member of the Association of Professional Heritage Practitioners (APHP), and is also an active member of the International Committee on Monuments and Sites (ICOMOS) as well as the International Committee on Archaeological Heritage Management (ICAHM). In addition, Jenna has been a member of the Association of Southern African Professional Archaeologists (ASAPA) since 2009. Recently, Jenna has been responsible for conducting training in how to write Wikipedia articles for the Africa Centre's WikiAfrica project.

Since 2016, Jenna has drafted over 100 Heritage Impact Assessments throughout South Africa.

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APPENDICES

1. INTRODUCTION

1.1 Background Information on Project

Free Gold Harmony (Pty) Ltd, is looking to supplement its energy supply by implementing Photovoltaic (PV) generation, aiding their transition to a more sustainable and environmentally friendly energy mix.

Located north east of the Harmony Joel operations, approximately ~20km northeast of the town of Theunissen within the Masilonyana Local Municipality and within the Lejweleputswa District Municipality, Free State Province. The PV facility is located on Portion 0 of the Farm Leeuwbult 580.

A technically feasible project site, with an extent of 43.2 ha has been identified by Free Gold Harmony (Pty) Ltd as a technically suitable area for the development of the Project. A development area of ~36 ha was demarcated within this project site and allows an adequate footprint for the installation of a solar PV facility with a contracted capacity of up to 18MW, while allowing for the avoidance of environmental site sensitivities. The size of the development footprint within the development area will be confirmed in the EIA Phase once the facility layout is available for assessment.

The development footprint will contain the following infrastructure to enable the Solar PV Facility to generate up to 18MW:

- PV modules and mounting structures
- Inverters and transformers a SCADA room, and maintenance room
- Cabling between the project components, to be laid underground where practical
- Access roads, internal roads and fencing around the development area.
- Temporary and permanent laydown areas and O&M buildings.
- Overhead Power Lines (OHPL)
- Grid connection solution which will tie-in to Shafts 1 & 2 HJ Joel Mining (6.6/132 kV), via a 1.2km South West overhead line with a capacity of 44 kV.

As of 2019, the Industrial sector was the leading electricity consumer in South Africa, with up to 56 percent of the total consumption (Ratshomo 2019). Mining and quarrying accounted for 10% of the industrial consumption while non-ferrous metals and non-metallic both accounted for 8% and 5%, respectively (*Chamber of Mines of South Africa, 2017*).

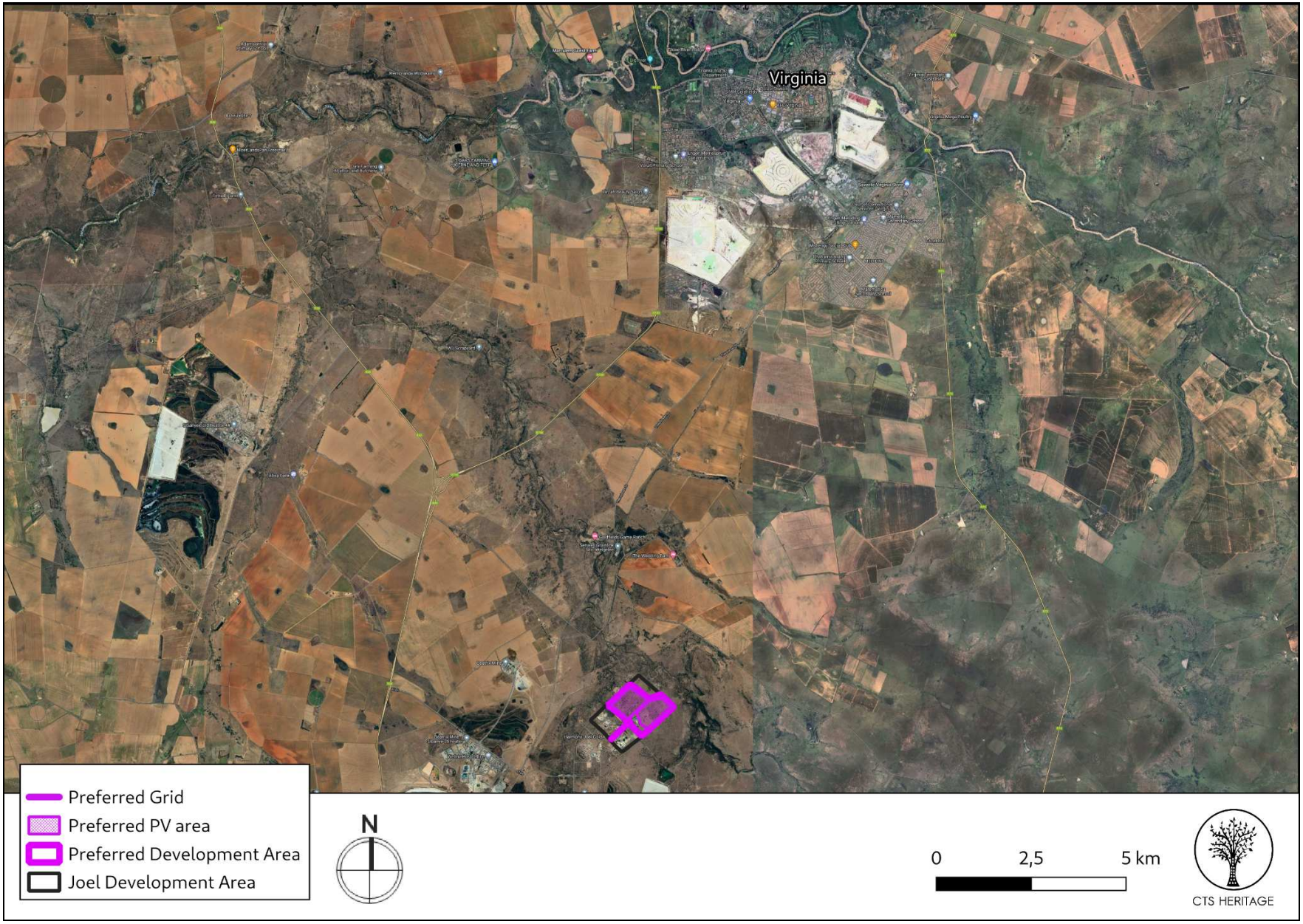
The successful development of the renewable energy projects will enable Harmony Gold to make a valuable and meaningful contribution towards growing the green economy within the province and South Africa. This will assist the Free State in creating green jobs and reducing GreenHouse Gas emissions, whilst reducing the energy demand on the National Grid.

1.2 Description of Property and Affected Environment

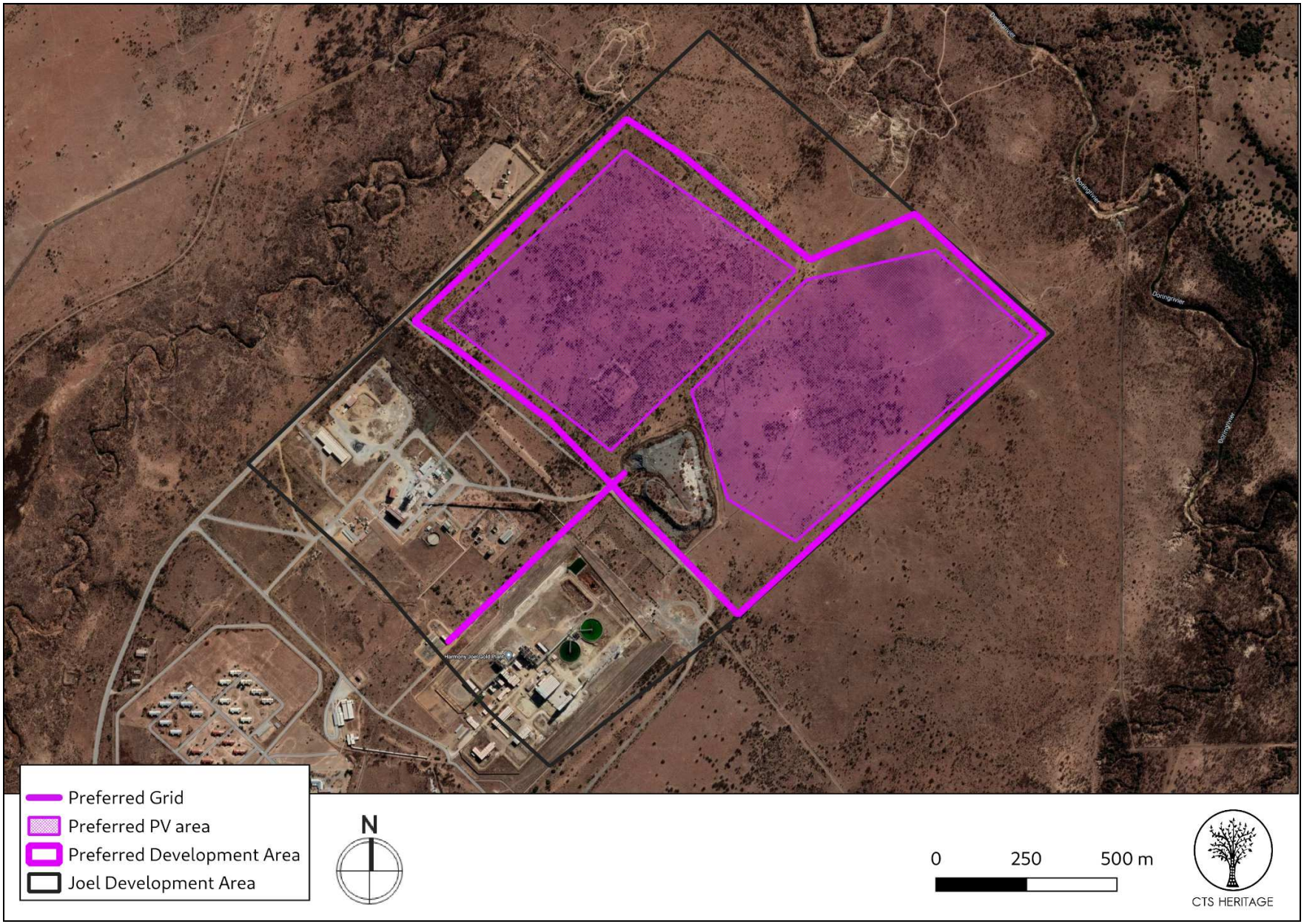
The potentially affected footprint related to the proposed PV facility is located across the Joel mining area, approximately 12 km north-east of the town of Odendaalsrus in the goldfields region of the Lejweleputswa district of the Free State province of South Africa. Relative to the 4 other affected areas discussed in the report, the Joel area is substantially less affected by modern activities and significant portions of the original landscape are retained that have thick shrubs and grasses, although portions of the property owned by the mine look currently to be leased out for cattle grazing, and one small central area has been affected by historical mining (evidenced by an abandoned shaft CJL13).

The footprint is located in the vicinity of the Free State Doring meandering river system. Portions of the affected property are located on the terraces of this drainage system, with evidence of banded chert nodules (4-11cm in maximum diameter – a high quality raw-material for artefact manufacture) (CJL2), and thick fluvially deposited sands (CJL11). Importantly, only marginal topsoil formation was evident in the area, which may be a further indicator of the erosional effects of a past active high-energy river system. Several remnants of dam structures were recorded, implicating the historical anthropogenic capture of naturally available water in the summer rainfall season (CJL3 and CHL6). Although the affected area is relatively flat, there are more resistant raised areas that are richer in archaeological materials relative to the deflated areas between (CJL11). There is also more evidence for soil formation in the raised portions, indicating that parts of the landscape have been differentially eroded by natural (flooding) and/or anthropogenic processes (agriculture) over time.

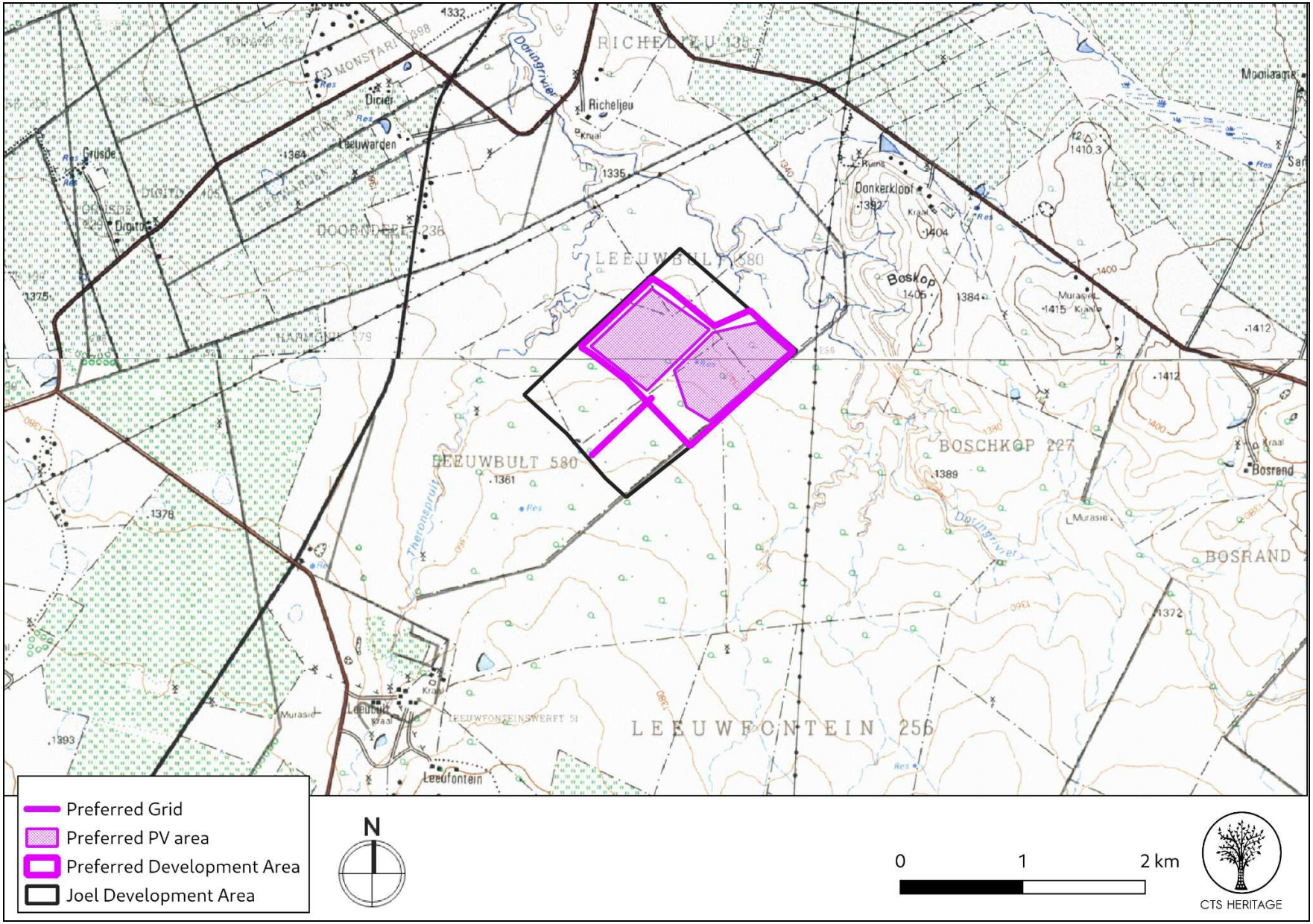
The natural vegetation comprises Savanna Grassland typical of the southern African summer-rainfall region interspersed with abundant acacia, and dense grasses among the shrubs, with small open patches of sand dispersed between the thicker vegetation (which were extensively examined, although archaeological visibility was poor) (CJL1, CJL2, CJL4, CJL10, CJL12, and JL1 and 2) . There is abundant evidence of indigenous and invasive fauna including smaller to medium sized buck (Bushbuck, Duiker and Steenbok), Suids including various bushpig species (and modern traps set for their capture), abundant Vervet monkeys, indigenous and feral fowl including herds of Ostrich, francolin, spurfowl and guineafowl, as well as traces of burrowing rodents (molerats, hares and meerkats).



Map 1.1: The proposed development area



Map 1.2: The proposed development area



Map 1.3: Study Area reflected on the 1:50 000 Topo Map

2. METHODOLOGY

2.1 Purpose of HIA

The purpose of this Heritage Impact Assessment (HIA) is to satisfy the requirements of section 38(8), and therefore section 38(3) of the National Heritage Resources Act (Act 25 of 1999).

2.2 Summary of steps followed

- A Desktop Study was conducted of relevant reports previously written (please see the reference list for the age and nature of the reports used) (Appendix 1)
- An archaeologist conducted an assessment of the broader study area in order to determine the archaeological resources likely to be disturbed by the proposed development. The archaeologist conducted her site visit on 15 June and 1 July 2022 (Appendix 2)
- A Desktop Palaeontology Assessment was completed 6 July 2022, Appendix 3)
- The identified resources were assessed to evaluate their heritage significance and potential impacts to these resources were interrogated
- Alternatives and mitigation options were discussed with the Environmental Assessment Practitioner

2.3 Assumptions and uncertainties

- The *significance* of the sites and artefacts is determined by means of their historical, social, aesthetic, technological and scientific value in relation to their uniqueness, condition of preservation and research potential. It must be kept in mind that the various aspects are not mutually exclusive, and that the evaluation of any site is done with reference to any number of these.

- It should be noted that archaeological and palaeontological deposits often occur below ground level. Should artefacts or skeletal material be revealed at the site during construction, such activities should be halted, and it would be required that the heritage consultants are notified for an investigation and evaluation of the find(s) to take place.

However, despite this, sufficient time and expertise was allocated to provide an accurate assessment of the heritage sensitivity of the area.

2.4 Constraints & Limitations

Substantial acacia and other shrubs cover portions of the project area, which are interspersed with dense grasses. This coverage significantly inhibited the visibility of surface archaeology. Given the presence of an archaeological site occurring in a dateable context, this vegetation coverage has to be considered a significant hindrance to assessing the Stone Age sensitivity of the project area.

The inability to assess some of the footprint area at ground surface level in some portions (due to modern vegetation cover), should also be regarded as a constraint to the documentation of potential graves.

High energy flooding may have affected evidence of surface archaeology including the possible above-surface presence of material evidence of graves (i.e. the removal of surface stone structures).

Access was inhibited in areas that are actively mined; however, any archaeology occurring in these areas would be *ex situ* in any case, and of limited scientific importance.

The team is confident that, despite these challenges, the work completed has provided a sufficient assessment of the heritage sensitivity of the area proposed for development.

2.5 Savannah Impact Assessment Methodology

Direct, indirect and cumulative impacts of the issues identified through the Basic Assessment process were assessed in terms of the following criteria:

- The nature, which shall include a description of what causes the effect, what will be affected and how it will be affected.
- The extent, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 will be assigned as appropriate (with 1 being low and 5 being high).
- The duration, wherein it will be indicated whether:
    - The lifetime of the impact will be of a very short duration (0 – 1 years) – assigned a score of 1.
    - The lifetime of the impact will be of a short duration (2 – 5 years) – assigned a score of 2.
    - Medium-term (5 – 15 years) – assigned a score of 3.
    - Long term (> 15 years) – assigned a score of 4.
    - Permanent – assigned a score of 5.
- The consequences (magnitude), quantified on a scale from 0 – 10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
- The probability of occurrence, which shall describe the likelihood of the impact actually occurring. Probability will be estimated on a scale of 1 – 5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).

- The significance, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high.
- The status, which will be described as either positive, negative or neutral.
- The degree to which the impact can be reversed.
- The degree to which the impact may cause irreplaceable loss of resources.
- The degree to which the impact can be mitigated.

The significance is calculated by combining the criteria in the following formula:

S = (E + D + M) x P

S = Significance weighting

E = Extent

D = Duration

M = Magnitude

P = Probability

The significance weightings for each potential impact are as follows:

- < 30 points: Low (i.e. where this impact would not have a direct influence on the decision to develop in the area).
- 30 – 60 points: Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated).
- > 60 points: High (i.e. where the impact must have an influence on the decision process to develop in the area).

3. HISTORY AND EVOLUTION OF THE SITE AND CONTEXT

3.1 Desktop Assessment

Background

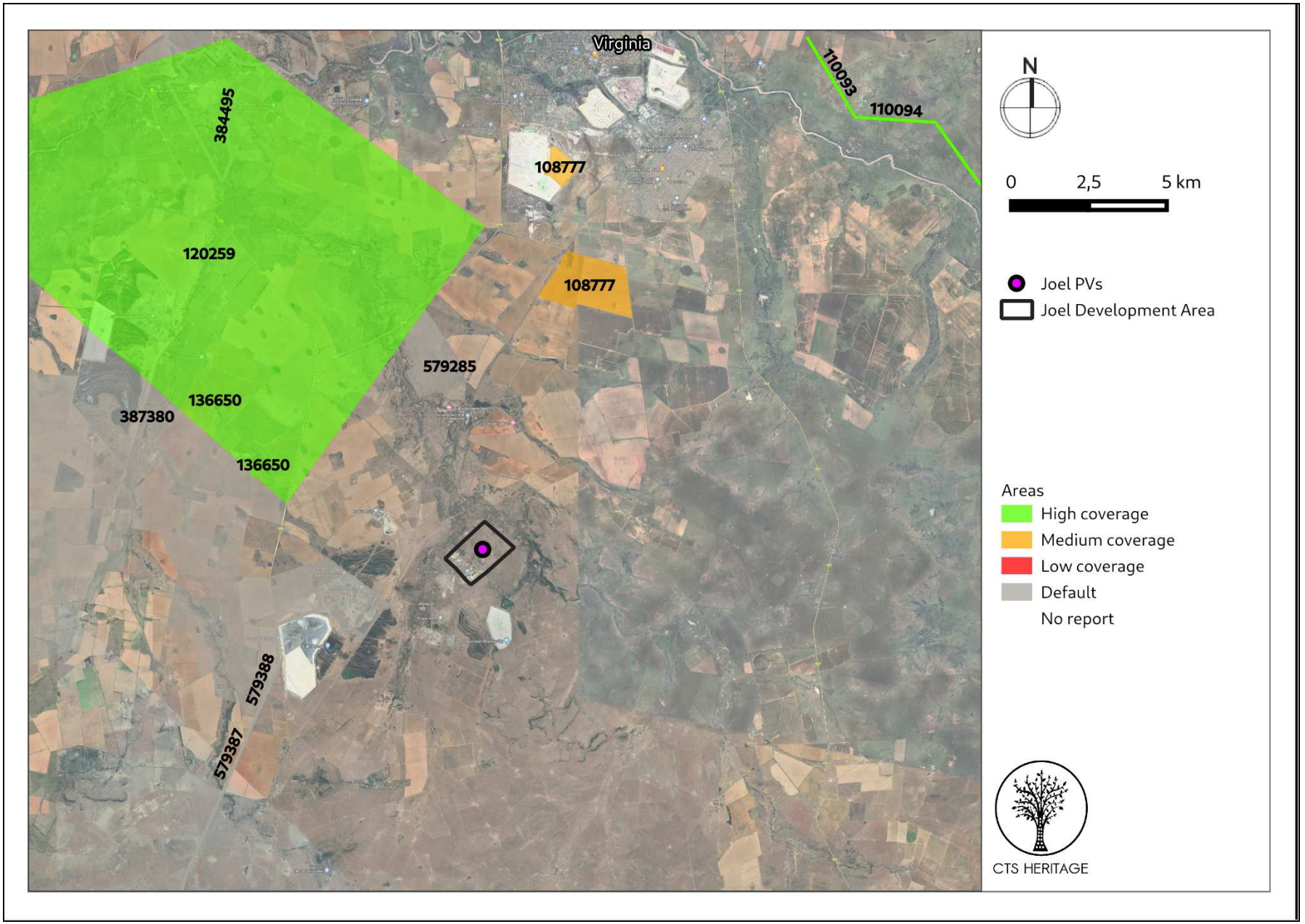
This application is for the proposed development of a PV facility and associated grid infrastructure located approximately south of Virginia in the Free State Province. In 1890, two railway surveyors from the state of Virginia in the United States etched the name of their birthplace on a boulder near the farm Merriespruit. When a railway siding was eventually established at this spot, the name was adopted, and it stuck after the discovery of gold in 1949 which resulted in a mushrooming settlement on the banks of the Sand River.

According to Van der Walt (2013) who conducted an assessment on a nearby property, "The study area falls within the bioregion described by Mucina et al (2006) as the Dry Highveld Grassland Bioregion with the vegetation described as Vaal-Vet Sandy Grassland within a Grassland Biome. Land use in the general area is characterised by mining and agriculture, dominated by crops and cattle farming. The study area is characterised by deep sandy to loamy soils based on the extensive agricultural activities."

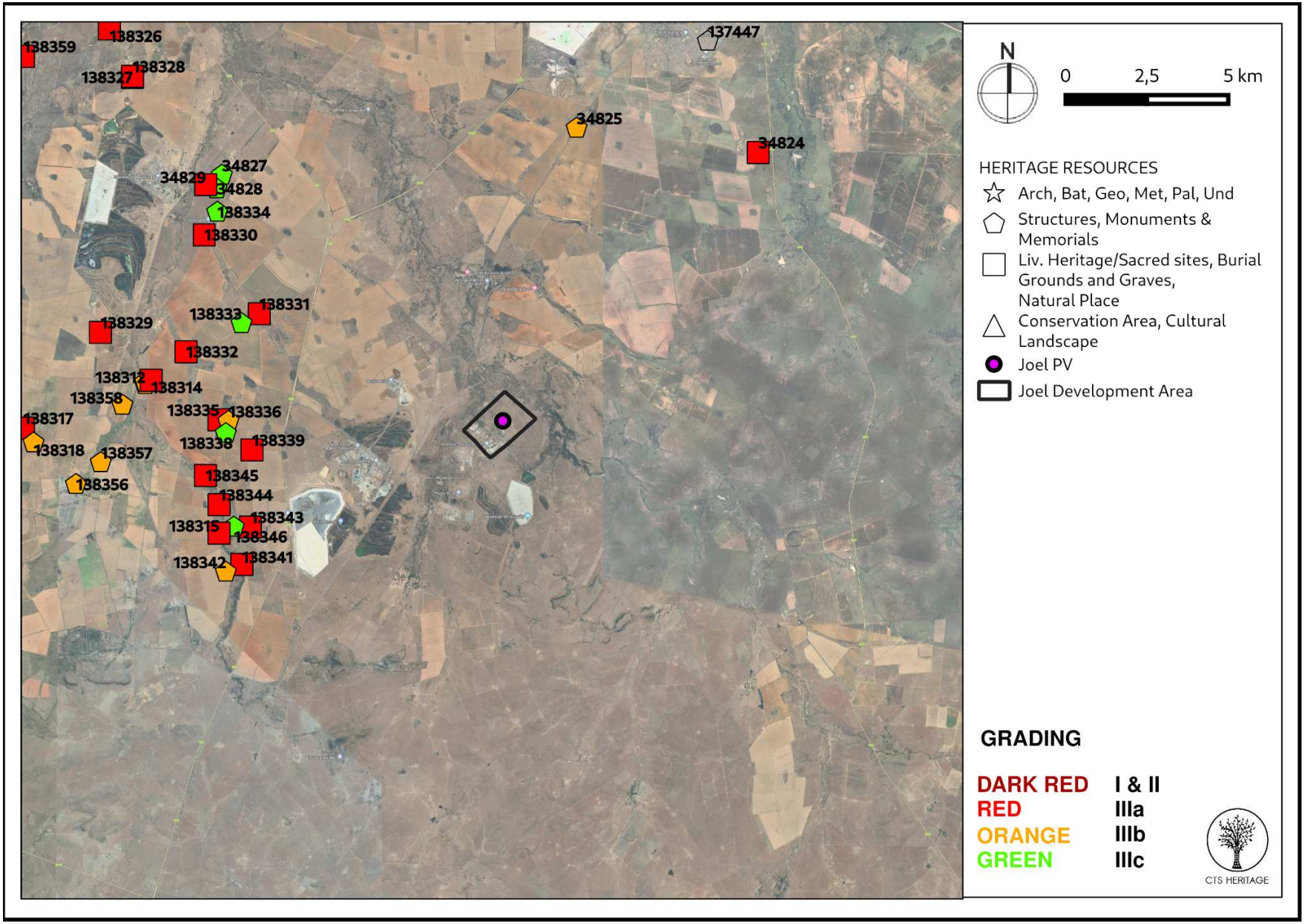
Archaeology

According to Fourie (2021), "The Free State has a rich archaeological and historical history going back millions of years and includes significant aspects such as Later Stone Age rock art, Battlefields and Iron Age stonewalled enclosures. The general surroundings of the study area became a melting pot of contact and conflict as it represents one of many frontiers where San hunter-gatherers, Nguni and Sotho-Tswana agro-pastoralists, Dutch Voortrekkers and British Colonists all came together. The ravages of war also swept across these plains, and in particular the South African War (1899-1902) as well as the Boer Rebellion (1914-1915)." No heritage resources of significance were identified by Van der Walt (2013) in his assessment of a nearby farm. Van der Walt (2013) notes that "some MSA finds might be possible around pans on the farm. It is important to note that the lack of sites can be attributed to a lack of sustainable water sources (no pans exist in the development footprint) in the development area as well as the lack of raw material for the manufacturing of stone tools. No Sites dating to the Early or Middle Iron Age have been recorded or are expected for the study area. The same goes for the Later Iron Age period where the study area is situated outside the western periphery of the distribution of Late Iron Age settlements in the Free State. However to the north of the study area, ceramics from the Thabeng facies belonging to the Moloko branch of the Urewe tradition were recorded at Oxf 1 and Platberg 32/71 (Maggs 1976, Mason 1986)".

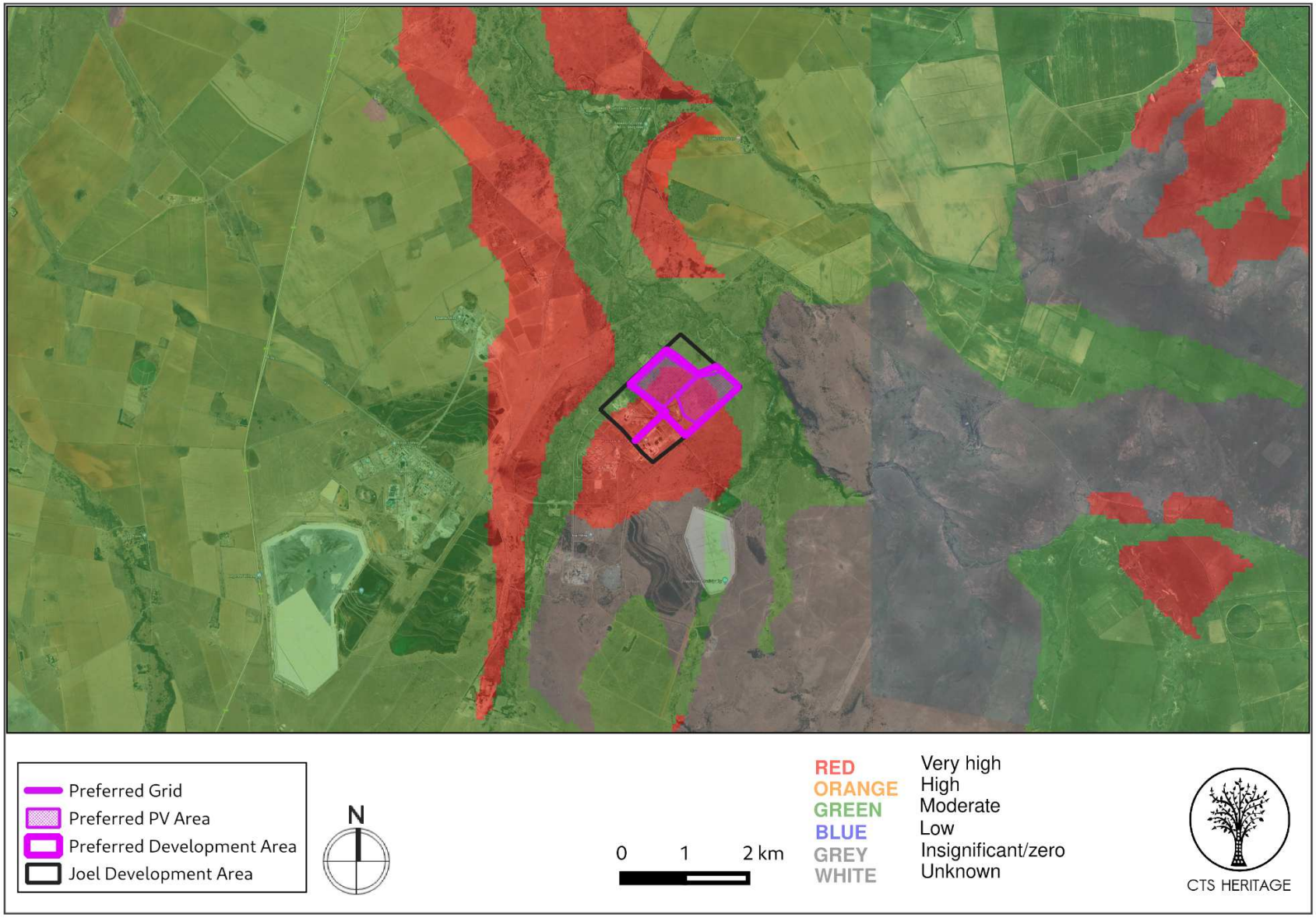
Based on the known archaeological sensitivity of the broader context, it is unlikely that the proposed development will impact on significant Stone Age or Iron Age archaeological heritage; however it is possible that informal or unmarked graves may be present within the development area.



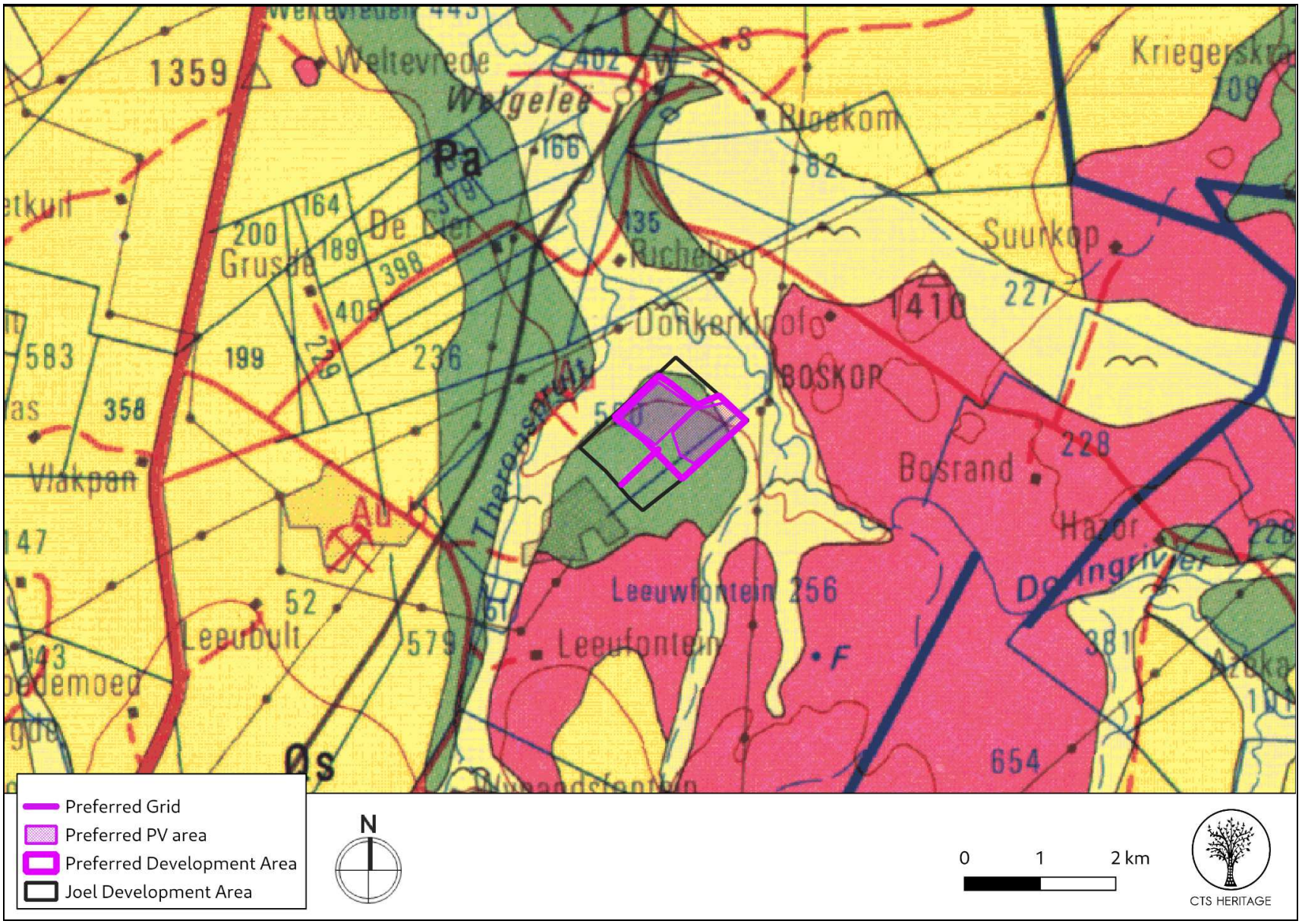
Map 2.1: Spatialisation of heritage assessments conducted in proximity to the broader study area



Map 2.1: Spatialisation of heritage resources known in proximity to the broader study area



Map 3.1: Palaeontological sensitivity of the area surrounding the broader study area



Map 3.2: Geology Map. Extract from the CGS 2826 Winberg Geology Map indicating that the development area is underlain by sediments of the Adelaide Subgroup of the Beaufort Group (Pa) and Quaternary Sands (Qs)

3.2 Palaeontology

According to the SAHRIS Palaeosensitivity Map the development sites are underlain by sediments of moderate and very high fossil sensitivity (Figure 4a). The Adelaide Subgroup of the Beaufort Group is the very highly sensitive formation and caenozoic regolith is the moderately sensitive formation underlying the development area according to the extract from the CGS 2826 Winberg Geology Map (Figure 4b). According to the updated biostratigraphy (Smith et al., 2020), the whole of the Adelaide Subgroup has been divided into five Assemblage Zones based on the dominant or temporally exclusive vertebrate fossils. If vertebrate fossils were common in this region and had been well mapped then the specific Assemblage Zone would have been indicated in the literature. Common names for the fossils that could occur here are fish, amphibians, reptiles, therapsids, terrestrial and freshwater tetrapods, as well as freshwater bivalves, trace fossils including tetrapod trackways and burrows. Where the vertebrates do not occur it is possible to find sparse to rich assemblages of vascular plants of the late Glossopteris Flora, including some petrified logs), and insects are also prevalent at some sites.

A desktop Palaeontological assessment (2013) was completed by Millsteed for an adjacent development which is of relevance here. Millsteed (2013) notes that “The Cainozoic regolith and the Adelaide Subgroup are both potentially fossiliferous and their stratigraphic equivalents are known to contain scientifically important fossil assemblages elsewhere in South Africa. Accordingly, it may be reasonably expected that significant fossils may be present within the project area.” He goes on to note that “Thus, the historical farming processes have probably destroyed any fossil materials that may have been present at surface in these areas. Similarly, where present the regolith cover would hide any fossils contained within the underlying Adelaide Subgroup from discovery. The potential for a negative impact on the fossil heritage of the area can be quantified in the following manner. Any fossil materials that may have been present at/or near the surface in the cultivated regolith will have been historically destroyed and the likelihood of any negative impact is categorised as negligible. The possibility of a negative impact on the depth interval between the maximum depth of ploughing and the maximum depth of excavations within the regolith is categorised as low (due to the scarcity of fossils in general).”

4. IDENTIFICATION OF HERITAGE RESOURCES

4.1 Summary of findings of Specialist Reports

4.1.1 Archaeology

The survey was conducted primarily on foot but also involved driving between key targeted areas, and sought to assess the presence and significance of archaeological occurrences within the project area. Overall field assessment documented a sparse number of isolated stone artefacts in secondary and surface contexts and one denser occupational context in a potentially dateable context, suggesting the area may have been traversed intermittently by Stone Age groups through periods in both the Middle Stone Age (MSA – ~300ka:~40ka), the Later Stone Age (LSA: ~40ka: ~2ka) in addition to individual bifacial tools potentially associated with the later ESA (~400-~200ka), although artefacts that could be clearly linked with chrono-cultural periods were scarce.

The presence of small nodules of artefact-quality chert rocks, homogenous quartzites as well as high-quality riverine Hornfels and Quartz in the project areas in addition to relatively abundant standing water, were likely the resources that attracted groups to the broader region, and resulted in them leaving behavioural traces in the form of stone artefacts. Indeed the majority of the stone artefacts identified look to be the result of expedient 'testing' of rocks for quality, although several cores and tools associated with more extensive investment in production were identified. In this sense – apart from the single site at Joel (see below) - no evidence of substantial densities of finds or occupational debris were identified, and the stone artefacts present look to have been produced by mobile forager groups moving through the area.

Chert artefacts were exposed in several patches indicating that the vegetation cover may be inhibiting visibility of more extensively distributed archaeological materials. Importantly, no graves were identified within the survey, and there would not be evidence of graves within the areas of the footprint extensively affected by flooding. In addition, there was no evidence for historical dwelling structures that would make potential burials more likely. The dense grass and acacia cover, however, was a pertinent constraint to documenting potential graves in the areas that were not disturbed. Extensive grass cover made potential grave locations impossible to exhaustively assess across the project area although their presence seems unlikely given the paucity of archaeological evidence for historical domestic activities such as dwellings.

4.1.2 Palaeontology

The site for development is on the Adelaide Subgroup with the margins on the Quaternary Kalahari Group sands. The Adelaide Subgroup can be divided into four vertebrate assemblage zones if there are fossils present but this has not been indicated in the geological map. Extrapolating from the recently updated biostratigraphy (Smith et al., 2020), the site is probably in the Balfour Formation and so is represented by the *Daptocephalus* Assemblage Zone

The *Daptocephalus* Assemblage Zone is recognised by the co-occurrence of the dicynodontoid *Daptocephalus leoniceps*, the therocephalian *Theriognathus microps*, and the cynodont *Procynosuchus delaharpeae* (Viglietti, 2020). This has been further divided into two subzones, the lower *Dicynodon -Theriognathus* Subzone (in co-occurrence with Daptocephalus), and the upper *Lystrosaurus maccaigi – Moschorhinus kitchingi* Subzone (ibid). Other taxa include fish, amphibians, parareptiles, eureptiles, biarmosuchians, anomodontians, gorgonopsians, therocephaleans, cynodonts and molluscs. The flora is more diverse than the older Assemblage Zones and comprises glossopterids, mosses, ferns, sphenophytes, lycopods, cordaitaleans and gymnosperm woods (Plumstead, 1969; Anderson and Anderson, 1985; Bamford, 2004).

Six formations are recognised in the Kalahari Group but they are not often indicated on the geological maps. A more recent review by Botha (2021) attempts to correlate the Quaternary sediments but they are difficult to date or to determine their source. In this part of the Free State the Hoopstad Aeolian sands are present. According to Harmse (1963, in Botha, 2021) this extensive red and grey sandy soil cover is associated with three generations of aeolian sand sheets. Moreover, these generations of aeolian sand form the soil substrate in the heart of the nation's maize cultivation region, yet their geological origin and age remains understudied (Botha, 2021, p. 825).

Quaternary sands and alluvium do not preserve fossils because they are transported and porous. For preservation of fossils, a low energy deposit with sedimentation of fine grained silts or muds that exclude decomposing organisms such as bacteria, fungi and invertebrates is required to maintain a highly reducing environment (Cowan, 1995). Only if there are traps such as palaeo-pans or palaeo-springs that provide traps for water and fine sediments, would plants or bones be preserved and fossilised. No such features are visible in the satellite imagery in the project footprint.

Figure 4.1:Areas of Joel affected by mining activities CJL13

Figure 4.2:Acacia and other shrubs cover portions of the project area at Joel, which are interspersed with dense grasses: CJL1, CJL2, CJL10, CJL12.

Figure 4.3: The natural Savanna Grassland vegetation at Joel: CJL4.

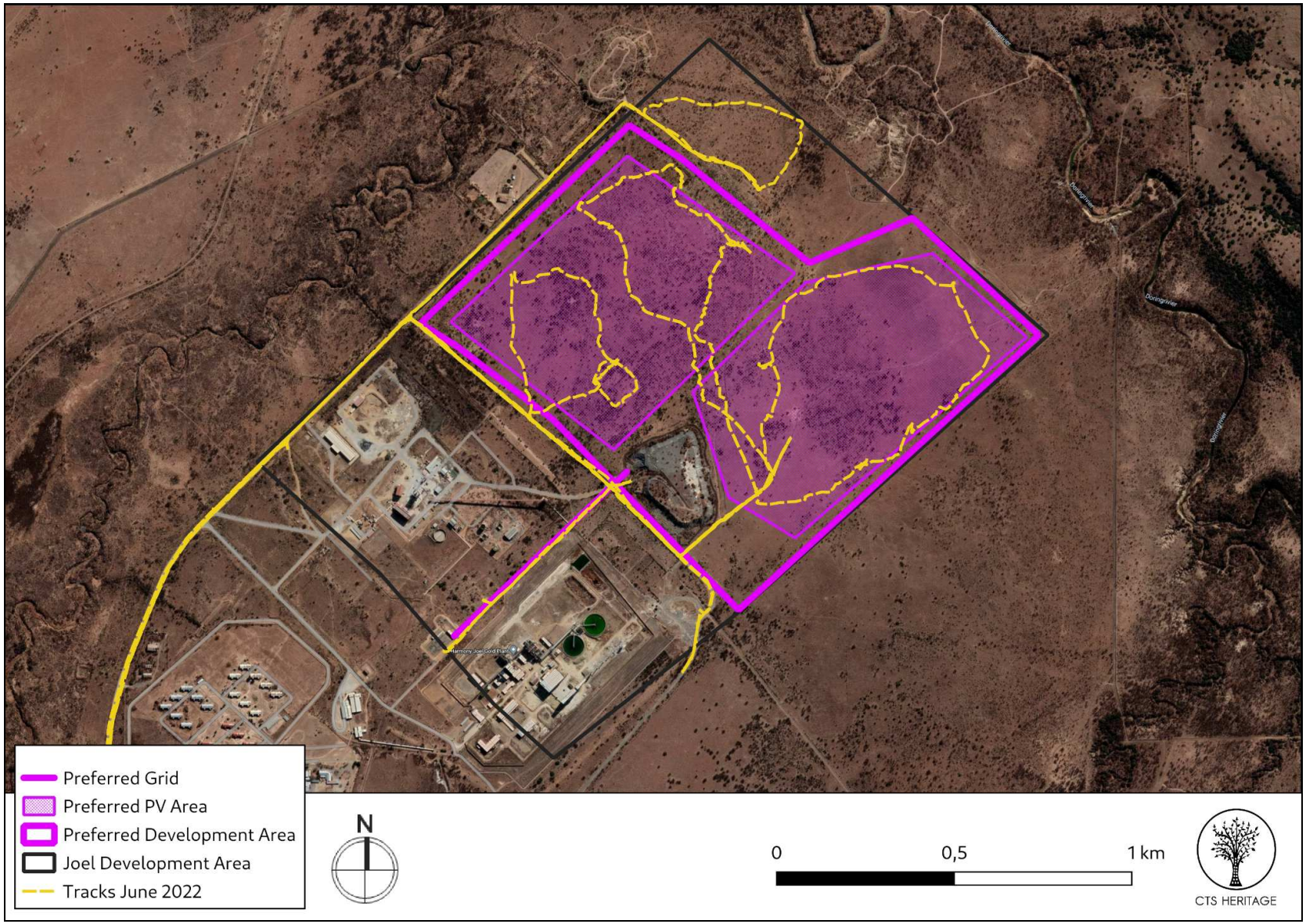


Figure 5: Overall track paths of foot survey - Joel PV Facility

4.2 Heritage Resources identified

Field assessment at Joel documented several stone artefact scatters in secondary contexts and one site in a potentially dateable context that needs to be avoided. Cumulatively these finds suggest the area was occupied or traversed intermittently by Stone Age groups through periods in the Middle Stone Age (JL1, JL2, JL5), and the Later Stone Age (JL4, JL6), as well as potentially by groups in periods associated with herder and early historical occupations of the region. JL1 has a dolerite bi-directionally reduced core from initial nodule testing that is characteristic of the MSA. JL2 represents a site that accumulated because of the chert raw-material source nearby, so flakes are largely primary. JL2 also has a hammerstone with visible pitting associated with percussion activities – probably knapping. JL3 has heavily weathered quartzite artefacts including a single platform core (probably MSA given the degree of patination and probable Pleistocene age). JL4 has high-quality chert artefacts, which are also patinated, likely associated with bladelet production, thus indicative of a terminal Pleistocene or Holocene age. At JL6 there is a single platform bladelet core with evidence of crest production and unipolar bladelet production, certainly LSA, and probably indicative of Holocene technological activity.

The relatively more scientifically significant sites/finds are associated with J5, which has later MSA lithics (prepared core technologies), a diversity of raw-materials, as well as a unifacially retouched point potentially indicative of the post-Howiesons Poort period (~55ka-35ka). At JL5, artefacts are eroding out of quaternary sediments, and have been brought to the current land surface through rodent borrowing and other forms of bioturbation. As this site appears to be in a potentially close to primary context (at least an *in situ* context that is potentially dateable), it should be avoided with at least a ~50m buffer zone for development.

Table 2: Heritage resources identified from fieldwork 2022

Site No.	Site Name	Description	Period	Co-ordinates		Grading	Mitigation
JL1	Joel 1	Isolated dolerite artefact: bi-directional core, heavily reduced	MSA-LSA	-28.24715199	26.82775296	NCW	NA
JL2	Joel 2	Concentration of artefacts: Anvil, flake fragment, chert outcrop with exploitation evidence	MSA-LSA	-28.24704403	26.83083197	IIIC	20m Buffer
JL3	Joel 3	Isolated quartzite artefacts: poorly preserved core - heavily weathered and rolled, rolled flake	unknown	-28.25327799	26.83493399	NCW	NA
JL4	Joel 4	Isolated chert artefact: flake potentially associated with bladelet production	LSA	-28.24908201	26.82736899	NCW	NA
JL5	Joel 5	Concentration of artefacts in a datable context: 1)single platform chert core; 2) chert flake; 3) chert core; 4) point; 5) silcrete retouched point on a blade; 6) miniature quartz flake; 6) dolorite big flake; 7) silcrete flake; 8) silcrete fragment	MSA-LSA	-28.2505380	26.82795304	IIIB	50m Buffer

JL6	Joel 6	Isolated chert artefacts: two chert cores	LSA	-28.24558499	26.83130203	NCW	NA

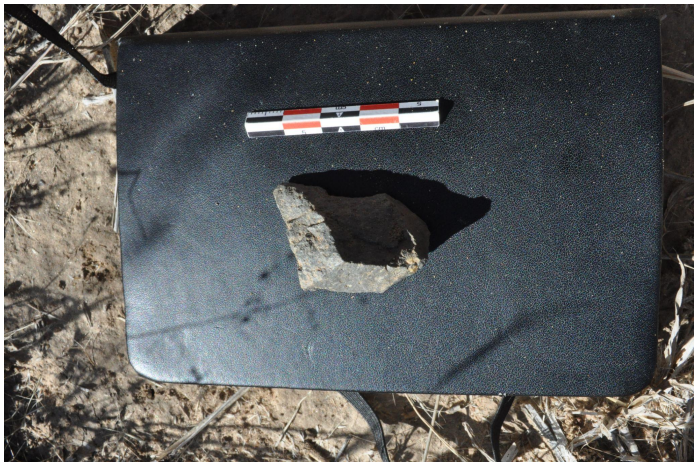





Figure 6.1: Ex-situ archaeological remains from Joel: JL1-bi-directional core, JL2-hammerstone-anvil, JL3-core and flake, JL4- flake potentially associated with bladelet production, JL6-two cores.

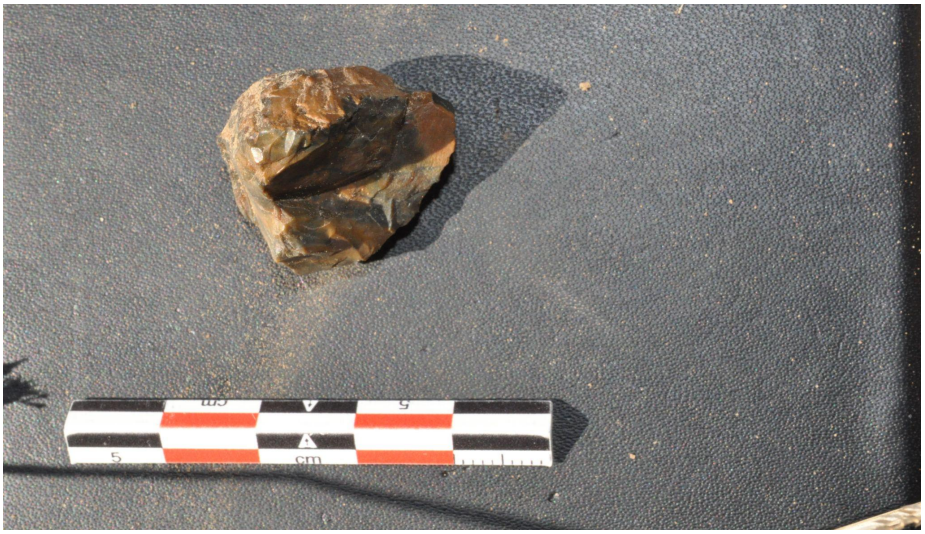


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Figure 6.2: Concentration of artefacts in a datable context: 1)single platform chert core; 2) chert flake; 3) chert core; 4) point; 5) silcrete retouched point on a blade; 6) miniature quartz flake; 6) dolorite big flake; 7) silcrete flake; 8) silcrete fragment

Figure 6.3: Burrows associated with artefacts at JL5.

4.3 Mapping and spatialisation of heritage resources

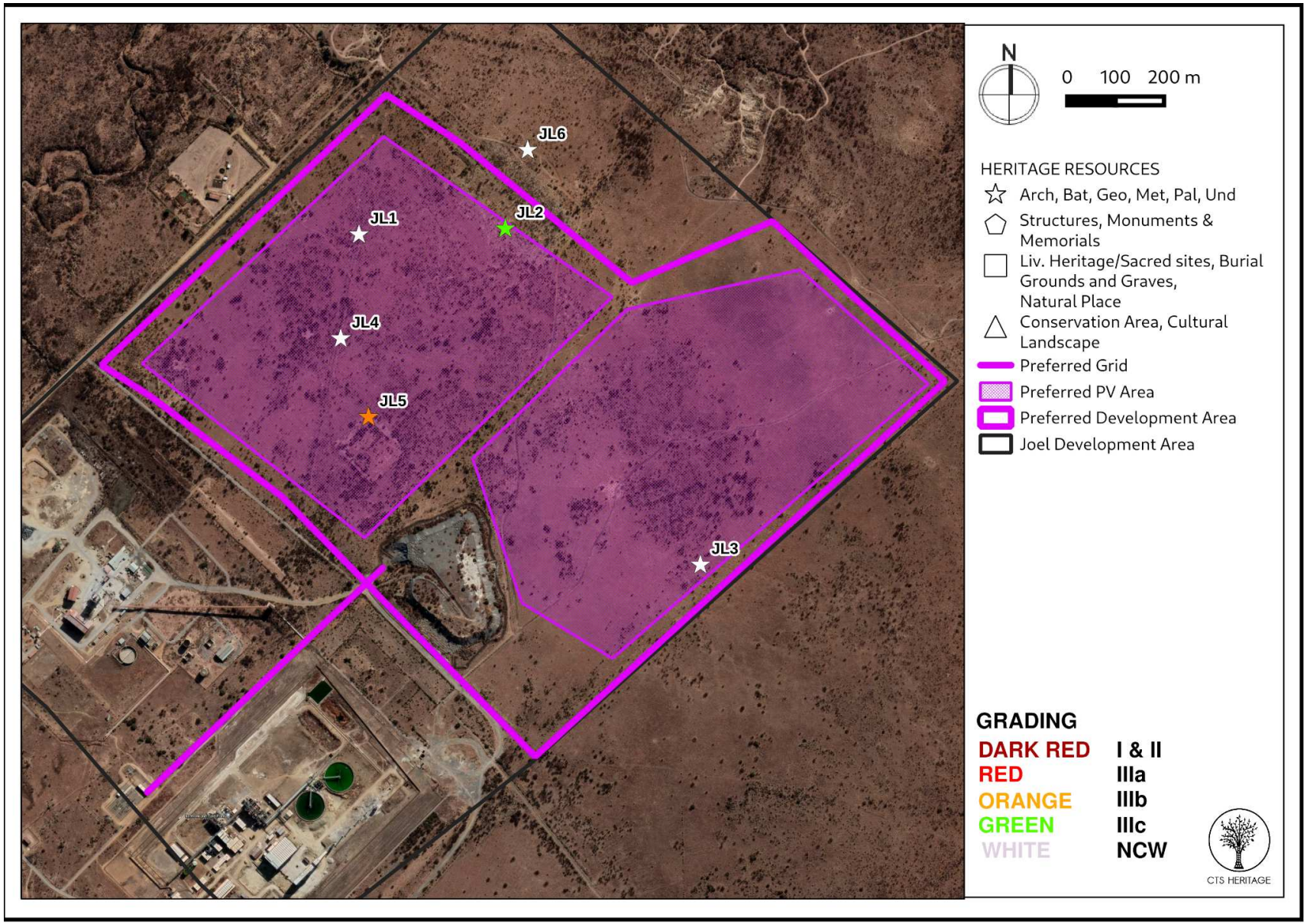

Figure 7.1: Map of significant heritage resources identified during the field assessment, relative to the proposed development.

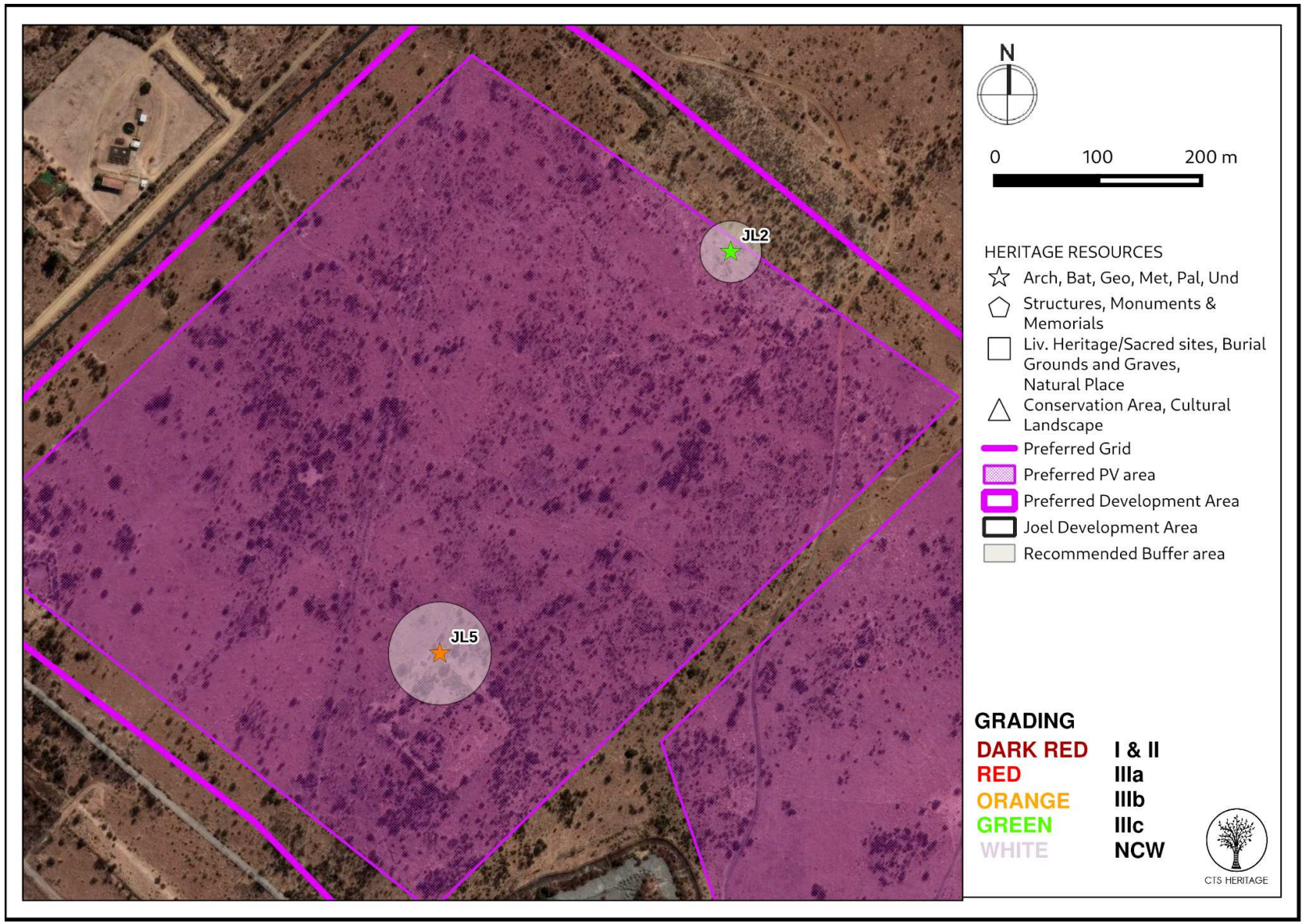

Figure 7.2: Map of significant sites relative to proposed development with recommended mitigation for JL2 (30m Buffer) and JL5 (50m Buffer)

5. ASSESSMENT OF THE IMPACT OF THE DEVELOPMENT

5.1 Assessment of impact to Heritage Resources

5.1.1 Archaeology

All archaeological finds at Joel were documented in what appear to be *ex-situ* surface contexts. However, the absence of evidence for trampling of artefacts, particularly at JL5, suggests that post-depositional effects on surface stone scatters may be marginal, and artefacts may have been exposed relatively recently. Further, the presence of artefacts that are currently eroding out of quaternary sediments at JL5 suggests that there may be sub-surface archaeological occurrences within the footprint. The potential for finding a preserved and dateable *in-situ* archaeological horizon based on surface observations and based on the availability of current dating techniques (luminescence would be the only set of applicable methods to this context), however, is low based on the absence of dateable organic materials and the bioturbated nature of sediments partially encompassing some of the artefacts (JL5). This site is graded IIIB for its potential to contribute to the body of scientific knowledge.

Based on the surface observations outlined above, the presence of sub-surface contextualised materials at Joel cannot be excluded as a possibility. Excavation associated with the development should therefore be aware of the potential for sub-surface Stone Age materials. As such, it is recommended that a no-development area of 50m is implemented around site JL5 (Figure 7.2).

JL2 represents a site that accumulated because of the chert raw-material source nearby, so flakes are largely primary. JL2 also has a hammerstone with visible pitting associated with percussion activities – probably knapping. This site has been graded IIIC and it is recommended that a no-development area of 30m is implemented around this site to ensure that it is conserved.

The documented archaeology at Joel is classified as scientifically LOW SIGNIFICANCE apart from the site at JL5 which is classified as MODERATE SIGNIFICANCE.

Concerning the Stone Age archaeology at Joel, there are no objections to the authorization of the proposed development, *provided that the monitoring recommendations outlined above are adhered to*, and provided that if any evidence of human remains are exposed during excavation, that development activities cease in the area of the identified remains.

Table 4.1: Impacts of the proposed development on archaeological resources

NATURE: It is possible that buried archaeological resources may be impacted by the proposed development in the preferred location				
		Without Mitigation		**With Mitigation**
MAGNITUDE	**M (6)**	Two archaeological resources of significance were identified within the development area	**M (6)**	Two archaeological resources of significance were identified within the development area
DURATION	**H (5)**	Where manifest, the impact will be permanent.	**H (5)**	Where manifest, the impact will be permanent.
EXTENT	**L (1)**	Limited to the development footprint	**L (1)**	Limited to the development footprint
PROBABILITY	**H (5)**	It is likely that significant will be impacted	**L (1)**	It is unlikely that significant resources will be impacted
SIGNIFICANCE	**L**	(6+5+1)x5 = 60	**L**	(6+5+1)x1 = 12
STATUS		Negative		Negative
REVERSIBILITY	**L**	Any impacts to heritage resources that do occur are irreversible	**L**	Any impacts to heritage resources that do occur are irreversible
IRREPLACEABLE LOSS OF RESOURCES?	**H**	Likely	**L**	Not Likely
CAN IMPACTS BE MITIGATED		Yes		
MITIGATION: ● A no-impact buffer of 30m is implemented around Site JL2 and a 50m buffer around site JL5 as per Figure 7.2 ● Should any previously unrecorded archaeological resources or possible burials be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward.				
RESIDUAL RISK: None				

Palaeontology

According to the Desktop Palaeontology Assessment, "Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the sandstones, shales and sands are typical for the country and might contain trapped fossils. The sands of the Quaternary period would not preserve fossils. The area has been disturbed from farming and mining so no fossils would be present on the surface. No vertebrates or plants have been recorded so the lithology and assemblage zone can only be extrapolated."

"Based on the nature of the project, surface activities may impact upon the fossil heritage if preserved in the development footprint. The geological structures suggest that the rocks are the right age to contain fossils but are covered by soils. Furthermore, the material to be excavated are soils and this does not preserve fossils. Since there is a small chance that vertebrate fossils typical of the *Daptocephalus* Assemblage Zone or plant or bone fragments were trapped in pans that might occur below the soils and may be disturbed a Fossil Chance Find Protocol has been added to this report. Taking account of the defined criteria, the potential impact to fossil heritage resources is low."

"Based on experience and the lack of any previously recorded fossils from the area, it is extremely unlikely that any fossils would be preserved in the overlying sands and soils of the Quaternary. There is a very small chance that fossils may occur in pans or springs but no such feature is visible in the satellite imagery. Vertebrate fossils may occur but there is no outcrop. Nonetheless, a Fossil Chance Find Protocol should be added to the EMPr."

Table 4.2: Impacts of the proposed development to palaeontological resources

NATURE: It is possible that buried palaeontological resources may be impacted by the proposed development in the preferred location				
		Without Mitigation		**With Mitigation**
MAGNITUDE	**H (8)**	According to the SAHRIS Palaeosensitivity Map (Figure 3.1), the area proposed for development of the PV facilities is underlain by sediments that have moderate and very high palaeontological sensitivity.	**H (8)**	According to the SAHRIS Palaeosensitivity Map (Figure 3.1), the area proposed for development of the PV facilities is underlain by sediments that have moderate and very high palaeontological sensitivity.
DURATION	**H (5)**	Where manifest, the impact will be permanent.	**H (5)**	Where manifest, the impact will be permanent.
EXTENT	**L (1)**	Limited to the development footprint	**L (1)**	Limited to the development footprint
PROBABILITY	**L (1)**	It is unlikely that significant fossils will be impacted	**L (1)**	It is unlikely that significant fossils will be impacted
SIGNIFICANCE	**L**	(8+5+1)x1=14	**L**	(8+5+1)x1=14
STATUS		Negative		Negative
REVERSIBILITY	**L**	Any impacts to heritage resources that do occur are irreversible	**L**	Any impacts to heritage resources that do occur are irreversible
IRREPLACEABLE LOSS OF RESOURCES?	**L**	Unlikely	**L**	Not Likely
CAN IMPACTS BE MITIGATED		Yes		

MITIGATION: • The attached Chance Fossil Finds Procedure must be implemented for the duration of construction activities • Should any previously unrecorded palaeontological resources be identified during the course of construction activities, work must cease in the immediate vicinity of the find, and SAHRA must be contacted regarding an appropriate way forward.
RESIDUAL RISK: None

5.2 Sustainable Social and Economic Benefit

TBA

5.3 Proposed development alternatives

No alternatives have been proposed as part of this application. Based on the outcomes of this analysis, the preferred alternative from a heritage perspective is the alternative that avoids impacts to Sites JL2 and JL5 as per the recommendations below.

5.4 Cumulative Impacts

This application is for the proposed development of a solar energy facility and associated grid connection to facilitate activities at the Central Harmony Mine. The location of the proposed PV facility within an area with existing mining activities may lend itself to cumulative impacts. However, in terms of cumulative impacts to heritage resources, it is preferable that industrial-type infrastructure is clustered within an area in order to prevent the sprawl of industrial development across otherwise sensitive cultural landscapes.

As such, it is not anticipated that the proposed development will have a negative cumulative impact on significant heritage resources.

6. RESULTS OF PUBLIC CONSULTATION

The public consultation process will be undertaken by the EAP during the EIA. No heritage-related comments have been received to-date. SAHRA is required to comment on this HIA and make recommendations prior to the granting of the Environmental Authorisation.

7. CONCLUSION

The areas surveyed as part of this assessment have been transformed through agricultural interventions and/or mining activity. As such, it is not surprising that the results of the survey only identified two sites of scientific cultural value - JL2, graded IIIC and JL5 graded IIIB within the area proposed for the Joel PV development.

The identified sites of archaeological significance have the potential to provide scientific insight into the past and as such, it is recommended that these areas are not impacted by the proposed development. It is therefore

recommended that no-go development buffers as per the recommendations below are implemented. Further, it is recommended that these sites are mapped on all relevant SDPs and that on-going conservation measures are put in place in the EMPrs for the developments.

Furthermore, no impacts to significant palaeontological heritage are anticipated on condition that the attached Chance Fossil Finds Process is implemented and no impacts to the cultural landscape are anticipated.

8. RECOMMENDATIONS

There is no objection to the proposed development in terms of impacts to heritage resources on condition that:

- The 30m buffer area recommended around site JL2 is implemented
- The 50m buffer area recommended around site JL5 is implemented
- The attached Chance Fossil Finds Procedure is implemented for the duration of construction activities
- Should any buried archaeological resources or human remains or burials be uncovered during the course of development activities, work must cease in the vicinity of these finds. The South African Heritage Resources Agency (SAHRA) must be contacted immediately in order to determine an appropriate way forward.

9. REFERENCES

Heritage Impact Assessments				
NID	**Author(s)**	**Date**	**Type**	**Title**
108777	Heritage Impact Assessment Specialist Reports	Anton van Vollenhoven	30/11/2011	A REPORT ON A CULTURAL HERITAGE IMPACT ASSESSMENT FOR THE PROPOSED WITS GOLD DBM PROJECT CLOSE TO VIRGINIA, FREE STATE PROVINCE
120259	PIA Desktop	Barry Millsteed		Desktop Palaeontological Heritage Impact Assessment Report for the Oryx Solar Energy Facility
124729	Heritage Scoping	Jaco van der Walt	08/05/2013	Archaeological Scoping Report for the Proposed Oryx Energy Facility
136650	Archaeological Specialist Reports	Jaco van der Walt	30/08/2013	Archaeological Impact Assessment report for the Oryx Solar Energy Facility
110093	PIA Desktop	Job M. Kibii		Palaeontological Impact Assessmnent Deskop Study Report for the Proposed Merapi (Excelsior) PV Solar Energy Facilities
110094	HIA Phase 1	Nkosinathi Godfrey Tomose		Heritage Imapct Assessment Study for the Proposed PV Solar Energy Facilities, near Excelsior, Free State Province
384495	Heritage Scoping	Nkosinathi Godfrey Tomose	20/12/2016	Heritage Scoping Study for the Proposed Prospecting Rights Application on Farms Adamsons Vley 655, Jonkers Rust 72, Du Preez Leger 324 and Stillewoning 703

APPENDICES

APPENDIX 1: Heritage Screening Assessment (2022)

APPENDIX 2: Archaeological Assessment (2022)

APPENDIX 3: Palaeontological Assessment (2022)

APPENDIX 4: Chance Fossil Finds Procedure