



PHASE 1 ARCHAEOLOGICAL IMPACT ASSESSMENT

**for the Proposed Amendment to the Existing 2-Seam Mine
on Portions of the Farms Vlakraagte 45 IS and Lourens 472
IS, Kriel, Mpumalanga**

For:

Elemental Sustainability (Pty) Ltd

Project Ref:

2-Seam Amendment

Date:

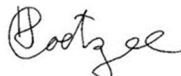
16/09/2022

Phase 1 Archaeological Impact Assessment for the Proposed Amendment to the Existing 2-Seam Mine on Portions of the Farms Vlaklaagte 45 IS and Lourens 472 IS, Kriel, Mpumalanga

Project Ref: 2-Seam Amendment
 Report No: ES-0109221
 Report Version: 2

I, Tobias Coetzee, declare that –

- I act as the independent specialist;
- I am conducting any work and activity relating to the proposed 2-Seam Project in an objective manner, even if this results in views and findings that are not favourable to the client;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have the required expertise in conducting the specialist report and I will comply with legislation, regulations and any guidelines that have relevance to the proposed activity;
- I have not, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this declaration are true and correct.

Author	Qualification	Email	Date	Signature
Tobias Coetzee	MA (Archaeology – UP)	tcoetzee.heritage@gmail.com	16/09/2022	



Executive Summary

The author was appointed by Elemental Sustainability (Pty) Ltd to undertake a Phase 1 Archaeological Impact Assessment for the proposed amendment to the existing 2-Seam Mine on several portions of the Farms Vlaklaagte 45 IS and Lourens 472 IS near Kriel in the Mpumalanga Province. The 2-Seam Mine is located approximately 12 km northeast of Kriel and falls within the eMalahleni Local Municipality. The aim of the study is to determine the scope of archaeological resources that could be impacted by the proposed amendment to the existing 2-Seam Mine.

The proposed amendment areas measure approximately 60.12 ha and consist of the following: Additional Opencast Mining Area, River Diversion, Tailings Facility, Run-of-Mine (ROM) Stockpile, Processing Plant Area, Plant Pollution Control Dam (PCD), PCD, Contractors Yard. The associated areas have been disturbed by previous/current mining/cultivation and are not considered to be significant or sensitive from a heritage perspective. Also, no potential sites of heritage significance were identified on historical aerial imagery, historical topographical maps, or during the site inspection and consultation with the mine manager.

Subject to adherence to the recommendations and approval by the South African Heritage Resources Agency (SAHRA), the proposed amendment to the existing 2-Seam Mine as per the indicated boundaries may continue. Should skeletal remains be exposed during development and construction phases, all activities must be suspended, and the relevant heritage resources authority must be contacted (See National Heritage and Resources Act, 25 of 1999 section 36 (6)). Also, should culturally significant material be discovered during the course of the said development, all activities must be suspended pending further investigation by a qualified archaeologist.



List of Abbreviations

AIA – Archaeological Impact Assessment

CRM – Cultural Resource Management

DMR – Department of Mineral Resources

EIA – Environmental Impact Assessment

ESA – Early Stone Age

ha – Hectare

HIA – Heritage Impact Assessment

km – Kilometre

LIA – Late Iron Age

LSA – Later Stone Age

m – Metre

MASL – Metres Above Sea Level

MEC – Member of the Executive Council

MSA – Middle Stone Age

NHRA – National Heritage Resources Act

PCD – Pollution Control Dam

ROM – Run-of-Mine

SAHRA – South African Heritage Resources Agency



NEMA Appendix 6

NEMA Specialist reports	
Item	Section / Page No
1. (1) A specialist report prepared in terms of these Regulations must contain—	
(a) details of-	
(i) the specialist who prepared the report; and	P2
(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	P2
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	P2
(c) an indication of the scope of, and the purpose for which, the report was prepared;	1.1, 2.2
(cA) an indication of the quality and age of base data used for the specialist report;	2.1, 3
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	2, 3.2
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	3
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	3
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	5, 7.1, P22
(g) an identification of any areas to be avoided, including buffers;	7.2, P39
(h) 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;	P39
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	3.2
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment]or activities;	5 – 7
(k) any mitigation measures for inclusion in the EMPr;	7.2
(l) any conditions for inclusion in the environmental authorisation;	7.2
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	7.2, Appendix C
(n) a reasoned opinion—	
(i)[as to] whether the proposed activity, activities or portions thereof should be authorised	7.2
(iA) regarding the acceptability of the proposed activity or activities; and	7.2
(ii) if the opinion is that the proposed activity, activities 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;	7.2, Appendix C



NEMA Specialist reports	
Item	Section / Page No
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	None
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	
(q) any other information requested by the competent authority.	Nothing received to date
(2) Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Noted



Table of Contents

Executive Summary	3
List of Abbreviations	4
NEMA Appendix 6	5
1. Project Background	9
1.1 Introduction.....	9
1.2 Legislation	11
1.2.1 The EIA (Environmental Impact Assessment) and AIA processes	11
1.2.2 Legislation regarding archaeology and heritage sites	12
2. Study Area and Project Description	15
2.1 Location & Physical Environment	15
2.2 Project Description	19
3. Methodology	21
3.1 Sources of information.....	30
3.1.1 Previous Heritage Studies.....	30
3.1.2 Historical topographical maps & aerial images	30
3.1.3 Personal Communication	31
3.2 Limitations	31
4. Archaeological Background	31
4.1 The Stone Age.....	31
4.2 The Iron Age & Historical Period	32
4.2.1 The South African War	33
4.2.2 Coal mining general history near eMalahleni, Middelburg, Bethal, Hendrina, Ermelo and Carolina.....	34
5. Archaeological and Historical Remains	35
5.1 Stone Age Remains.....	35
5.2 Iron Age Farmer Remains	36
5.3 Historical Remains.....	36
5.4 Contemporary Remains.....	36
5.5 Graves/Burial Sites.....	37
6. Evaluation	37
6.1 Field Ratings.....	37
7. Statement of Significance & Recommendations	38
7.1 Statement of Significance.....	38
7.2 Recommendations.....	40
8. Conclusion	41
9. Addendum: Terminology	41
10. References	42
Appendix A: Historical Aerial Imagery & Topographical Maps	A
Appendix B: NEMA Risk Assessment Methodology	a
Appendix C: Monitoring – Heritage	i



List of Figures

Figure 1: Regional and Provincial location of the study area	10
Figure 2: Segment of SA 1: 50 000 2629 AB indicating the study area	17
Figure 3: Study area portrayed on a 2021 satellite image.....	18
Figure 4: Proposed amendment to the existing 2-Seam Mine (supplied by Elemental Sustainability 2022).....	20
Figure 5: Study area with survey track portrayed on a 2021 satellite image.....	22
Figure 6: Environment associated with the proposed Additional Opencast Mining Area seen from the southwest	23
Figure 7: Eastern perspective the proposed Additional Opencast Mining Area	23
Figure 8: Northern perspective of the proposed Additional Opencast Mining Area.....	24
Figure 9: South-eastern perspective of the proposed River Diversion.....	24
Figure 10: North-western perspective of the proposed River Diversion.....	25
Figure 11: Southern perspective of the proposed Tailings Facility.....	25
Figure 12: Western perspective of the proposed Tailings Facility.....	26
Figure 13 Eastern perspective of the proposed Tailings Facility.....	26
Figure 14: Environment associated with the proposed ROM Stockpile	27
Figure 15: Environment associated with the proposed Processing Plant	27
Figure 16: Environment associated with the proposed Plant PCD.....	28
Figure 17: Environment associated with the proposed PCD – southern perspective.....	28
Figure 18: Environment associated with the proposed PCD – northern perspective	29
Figure 19: Environment associated with the Contractors Yard	29
Figure 20: ESA artefacts from Sterkfontein (Volman 1984).....	36
Figure 21: MSA artefacts from Howiesons Poort (Volman 1984).....	36
Figure 22: LSA scrapers (Klein 1984).....	36
Figure 23: Study area and potentially sensitive areas portrayed on a 2021 satellite image.....	39
Figure 24: Study area superimposed on a 1954 aerial image.....	B
Figure 25: Study area superimposed on a 1956 aerial image.....	C
Figure 26: Study area superimposed on a 1962 topographical map.....	D
Figure 27: Study area superimposed on a 1967 aerial image.....	E
Figure 28: Study area superimposed on a 1975 aerial image.....	F
Figure 29: Study area superimposed on a 1978 aerial image.....	G
Figure 30: Study area superimposed on a 1984 topographical map.....	H
Figure 31: Study area superimposed on a 1991 aerial image.....	I
Figure 32: Study area superimposed on a 1996 topographical map.....	J
Figure 33: Study area superimposed on a 2005 aerial image.....	K
Figure 34: Study area superimposed on a 2009 topographical map.....	L

List of Tables

Table 1: Development & Coordinates	15
Table 2: Prescribed Field Ratings.....	37



1. Project Background

1.1 Introduction

Elemental Sustainability (Pty) Ltd appointed the author to undertake a Phase 1 Archaeological Impact Assessment for the proposed amendment to the existing 2-Seam Mine intersecting Portions 6, 29, 31, 36, and the Remaining Extent of the Farm Vlaklaagte 45 IS, as well as the Farm Lourens 472 IS (**Table 1**) near Kriel in the Mpumalanga Province (**Figure 1**). The proposed amendment project falls within the eMalahleni Local Municipality and is located approximately 12 km northeast of Kriel. The purpose of this study is to examine the demarcated study areas in order to determine if any archaeological resources of heritage value will be impacted by the proposed project, as well as to archaeologically contextualise the general study area. The aim of this report is to provide the developer with information regarding the potential location of heritage resources within the demarcated footprint areas.

In the following report, the implications for the proposed amendment to the existing 2-Seam Mine on the demarcated portions regarding heritage resources are discussed: Additional Opencast Mining Area, River Diversion, Tailings Facility, Run-of-Mine (ROM) Stockpile, Processing Plant Area, Plant Pollution Control Dam (PCD), PCD and Contractors Yard on Portions 6, 29, 31, 36, and the Remaining Extent of the Farm Vlaklaagte 45 IS; the Farms Lourens 472 IS. The legislation section included serves as a guide towards the effective identification and protection of heritage resources and will apply to any such material unearthed during development and construction phases of the project.



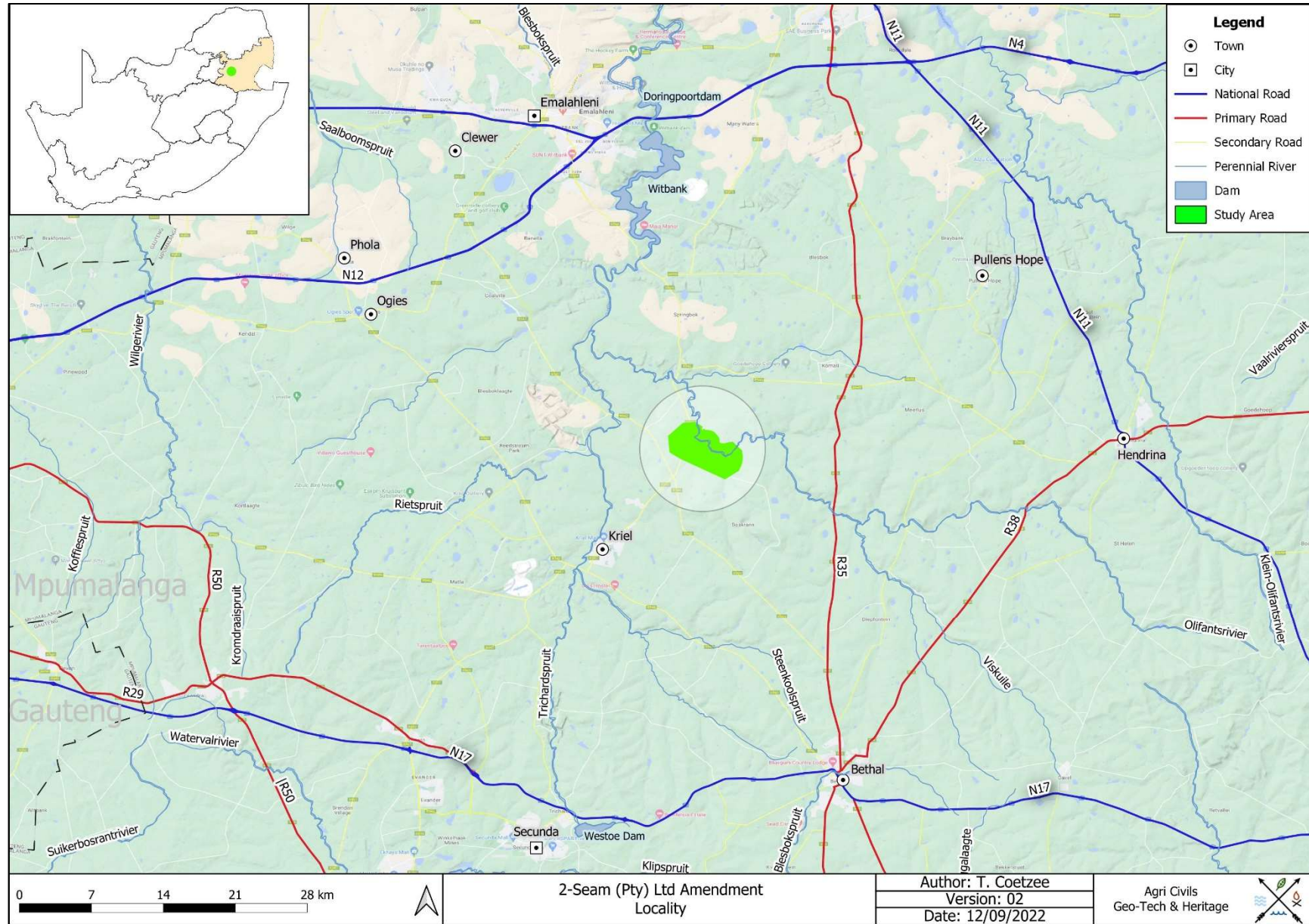


Figure 1: Regional and Provincial location of the study area.



1.2 Legislation

The South African Heritage Resources Agency (SAHRA) aims to conserve and control the management, research, alteration and destruction of cultural resources of South Africa and to prosecute if necessary. It is therefore crucially important to adhere to heritage resource legislation contained in the Government Gazette of the Republic of South Africa (Act No.25 of 1999), as many heritage sites are threatened daily by development. Conservation legislation requires an impact assessment report to be submitted for development authorisation that must include an AIA if triggered.

Archaeological Impact Assessments (AIAs) should be done by qualified professionals with adequate knowledge to (a) identify all heritage resources that might occur in areas of development and (b) make recommendations for protection or mitigation of the impact of the sites.

1.2.1 The EIA (Environmental Impact Assessment) and AIA processes

Phase 1 Archaeological Impact Assessments generally involve the identification of sites during a field survey with assessment of their significance, the possible impact that the development might have, and relevant recommendations.

All Archaeological Impact Assessment reports should include:

- a. Location of the sites that are found;
- b. Short descriptions of the characteristics of each site;
- c. Short assessments of how important each site is, indicating which should be conserved and which mitigated;
- d. Assessments of the potential impact of the development on the site(s);
- e. In some cases a shovel test, to establish the extent of a site, or collection of material, to identify the associations of the site, may be necessary (a pre-arranged SAHRA permit is required); and
- f. Recommendations for conservation or mitigation.

This AIA report is intended to inform the client about the legislative protection of heritage resources and their significance and make appropriate recommendations. It is essential to also provide the heritage authority with sufficient information about the sites to enable the authority to assess with confidence:

- a. Whether or not it has objections to a development;
- b. What the conditions are upon which such development might proceed;
- c. Which sites require permits for mitigation or destruction;



- d. Which sites require mitigation and what this should comprise;
- e. Whether sites must be conserved and what alternatives can be proposed to relocate the development in such a way as to conserve other sites; and
- f. What measures should or could be put in place to protect the sites which should be conserved.

When a Phase 1 AIA is part of an EIA, wider issues such as public consultation and assessment of the spatial and visual impacts of the development may be undertaken as part of the general study and may not be required from the archaeologist. If, however, the Phase 1 project forms a major component of an AIA it will be necessary to ensure that the study addresses such issues and complies with Section 38 of the National Heritage Resources Act.

1.2.2 Legislation regarding archaeology and heritage sites

National Heritage Resource Act No.25 of April 1999

Buildings are among the most enduring features of human occupation, and this definition therefore includes all buildings older than 60 years, modern architecture as well as ruins, fortifications and Farming Community settlements. The Act identifies heritage objects as:

- 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;
- any other prescribed category.



With regards to activities and work on archaeological and heritage sites this Act 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.” (34. [1] 1999:58)

and

“No person may, without a permit issued by the responsible heritage resources authority:

- (a) destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;*
- (b) destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;*
- (c) trade in, sell for private gain, export or attempt to export from the Republic any category of archaeological or palaeontological material or object, or any meteorite; or*
- (d) bring onto or use at an archaeological or palaeontological site any excavation equipment or any equipment which assist in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.”(35. [4] 1999:58)*

and

“No person may, without a permit issued by SAHRA or a provincial heritage resources authority:

- (a) destroy, damage, alter, exhume or remove from its original position or otherwise disturb the grave of a victim of conflict, or any burial ground or part thereof which contains such graves;*
- (b) destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority;*
- (c) bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) and excavation equipment, or any equipment which assists in the detection or recovery of metals.” (36. [3] 1999:60)*

On the development of any area the gazette states that:

“...any person who intends to undertake a development categorised as:

- (a) the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;*
- (b) the construction of a bridge or similar structure exceeding 50m in length;*
- (c) any development or other activity which will change the character of a site-*



- i. *exceeding 5000m² in extent; or*
 - ii. *involving three or more existing erven or subdivisions thereof; or*
 - iii. *involving three or more erven or divisions thereof which have been consolidated within the past five years; or*
 - iv. *the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;*
- (d) *the re-zoning of a site exceeding 10000m² in extent; or*
- (e) *any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.” (38. [1] 1999:62-64)*

and

“The responsible heritage resources authority must specify the information to be provided in a report required in terms of subsection (2)(a): Provided that the following must be included:

- (a) *The identification and mapping of all heritage resources in the area affected;*
- (b) *an assessment of the significance of such resources in terms of the heritage assessment criteria set out in section 6(2) or prescribed under section 7;*
- (c) *an assessment of the impact of the development on such heritage resources;*
- (d) *an evaluation of the impact of the development on heritage resources relative to the sustainable social and economic benefits to be derived from the development;*
- (e) *the results of consultation with communities affected by the proposed development and other interested parties regarding the impact of the development on heritage resources;*
- (f) *if heritage resources will be adversely affected by the proposed development, the consideration of alternatives; and*
- (g) *plans for mitigation of any adverse effects during and after the completion of the proposed development.” (38. [3] 1999:64)*



The Human Tissues Act (65 of 1983) and Ordinance on the Removal of Graves and Dead Bodies (Ordinance 7 of 1925) protects graves younger than 60 years. These fall under the jurisdiction of the National Department of Health and the Provincial Health Departments. Approval for the exhumation and re-burial must be obtained from the relevant Provincial MEC as well as the relevant Local Authorities. Graves 60 years or older fall under the jurisdiction of the National Heritage Resources Act as well as the Human Tissues Act, 1983.

2. Study Area and Project Description

2.1 Location & Physical Environment

The proposed amendment to the existing 2-Seam Mine consists of the following development (**Table 1**):

Table 1: Development & Coordinates.

Development Area	Farm Name	Farm Portion	Map Reference (1:50 000)	Lat	Lon	Development Extent (ha)
Additional Opencast Mining Area	Lourens 472 IS; Vlaklaagte IS	472; RE/45; 31/45	2629 AB	-26.157423	29.342318	10.8
River Diversion	Vlaklaagte 45 IS	31/45; 36/45; RE/45	2629 AB	-26.156976	29.344329	1.27
Tailings Facility	Vlaklaagte 45 IS	31/45; 29/45	2629 AB	-26.163945	29.348600	37.9
ROM Stockpile	Vlaklaagte 45 IS	6/45	2629 AB	-26.175797	29.354691	1.51
Processing Plant Area	Vlaklaagte 45 IS	6/45	2629 AB	-26.175499	29.353532	1.25
Plant PCD	Vlaklaagte 45 IS	6/45; 29/45	2629 AB	-26.174075	29.352109	0.66
PCD	Vlaklaagte 45 IS	31/45	2629 AB	-26.164309	29.350056	3.54
Contractors Yard	Vlaklaagte 45 IS	29/45	2629 AB	-26.148360	29.341018	3.19
Total						60.12

The study area is located 12 km northeast of Kriel, while Ogies is located 32 km to the west-northwest, Hendrina 37 km to the east and eMalahleni 34 km to the northwest (**Figure 1**). The study area falls within the Nkangala District Municipality and the eMalahleni Local Municipality in the Mpumalanga Province. In terms of vegetation, the study area falls within the Grassland Biome, which is typically associated with summer rainfall regions. This Biome covers approximately 28% of South Africa. According to the vegetation classification by Mucina & Rutherford (2006), the study area falls within the Eastern Highveld Grassland vegetation unit.

Eastern Highveld Grassland's conservation status is considered to be endangered with a conservation target of 24%. Only a small portion is conserved in statutory and private reserves. This vegetation unit consists of the plains between Belfast / eMakhazeni in the east and the eastern side of Johannesburg in the west and also



extends towards Bethal, Ermelo and to the west of Piet Retief / eMkhondo. This vegetation type is associated with slightly to moderately undulating plains and includes low hills and pan depressions. The general vegetation is short dense grassland with small, scattered rocky outcrops and some woody species. About 44% of this vegetation unit has been transformed by cultivation, plantations, mines, urbanisation and the building of dams. Although no serious alien invasions are reported, *Acacia mearnsii* may become dominant in disturbed areas. Erosion associated with this vegetation unit is considered to be low (Mucina & Rutherford 2006).

The average elevation for Eastern Highveld Grassland varies between 1520 and 1780 MASL (metres above sea level). The average elevation of the project area is 1547 MASL and slopes from the more elevated southern section to the lower northern section.

The study area falls within the summer rainfall region and the average annual rainfall is roughly 760 mm. The average annual temperature is 16.3 °C. The average summer temperature is 19.9 °C, while the winter temperature averages 10.1 °C (Climate-data.org accessed 20/08/2022).

The study area falls within the B11B Quaternary Catchment that forms part of the Olifants Water Management Area (WMA). The closest perennial river to the study area is the Olifants River that forms the northern boundary of the existing Mining Right. Several non-perennial offshoots also intersect the study area. The Rietspruit Dam is located approximately 10 km to the west.

When the surrounding environment is considered, the region is associated with extensive mining development and crop cultivation. Access to the study area is via a tertiary road tuning from the R547/R544 secondary road (**Figures 2 & 3**). In terms of existing Mining Right area, the R547/R544 secondary road runs in a north-south direction and splits the Farm Lourens 472 IS into an eastern and western section. The existing Mining Right area is associated with a combination of mining activities, crop cultivation, open veldt, and previously mined and cultivated land, while the proposed amendment areas are all associated with a combination of previously/currently mined/cultivated areas.



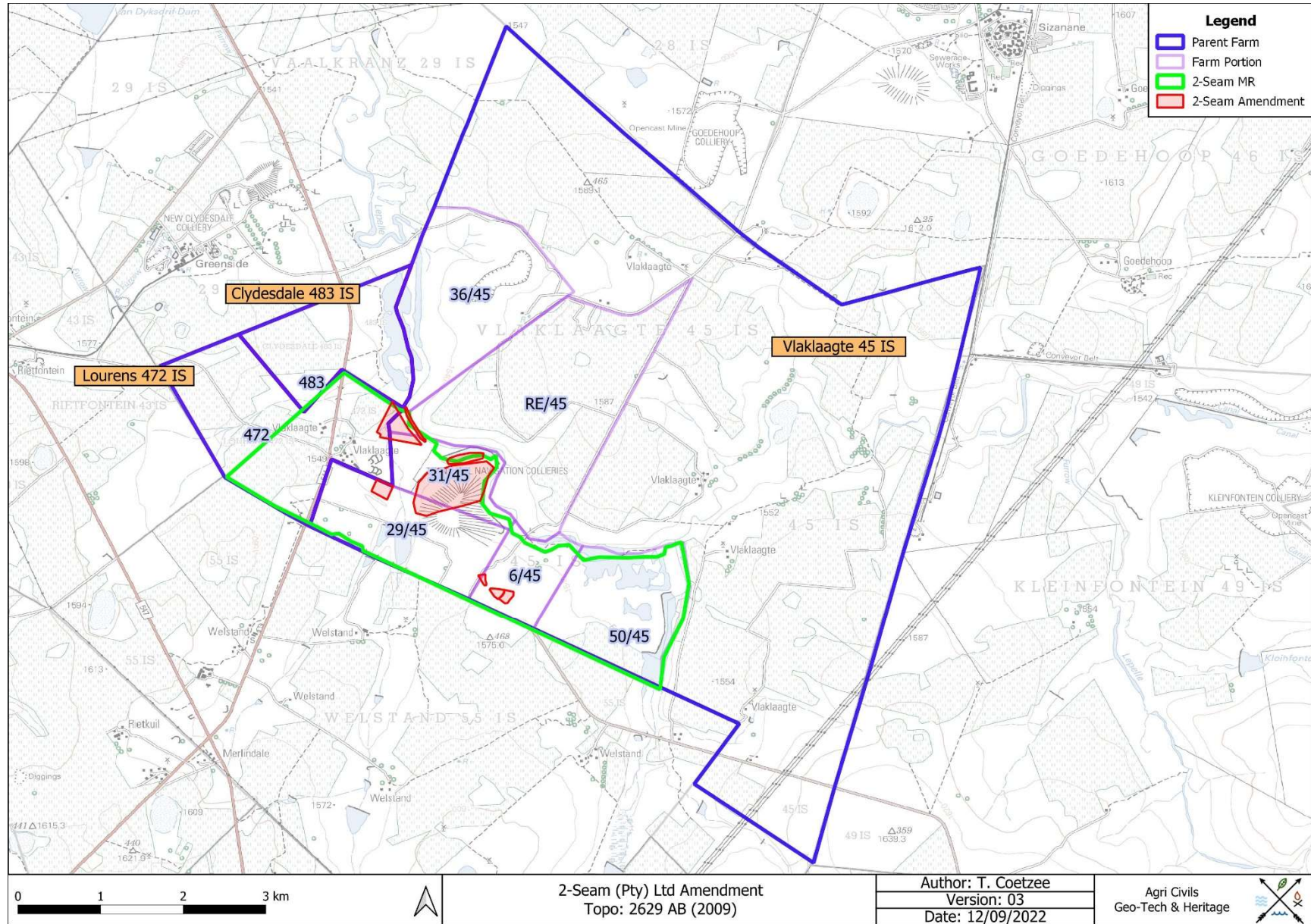


Figure 2: Segment of SA 1: 50 000 2629 AB indicating the study area.



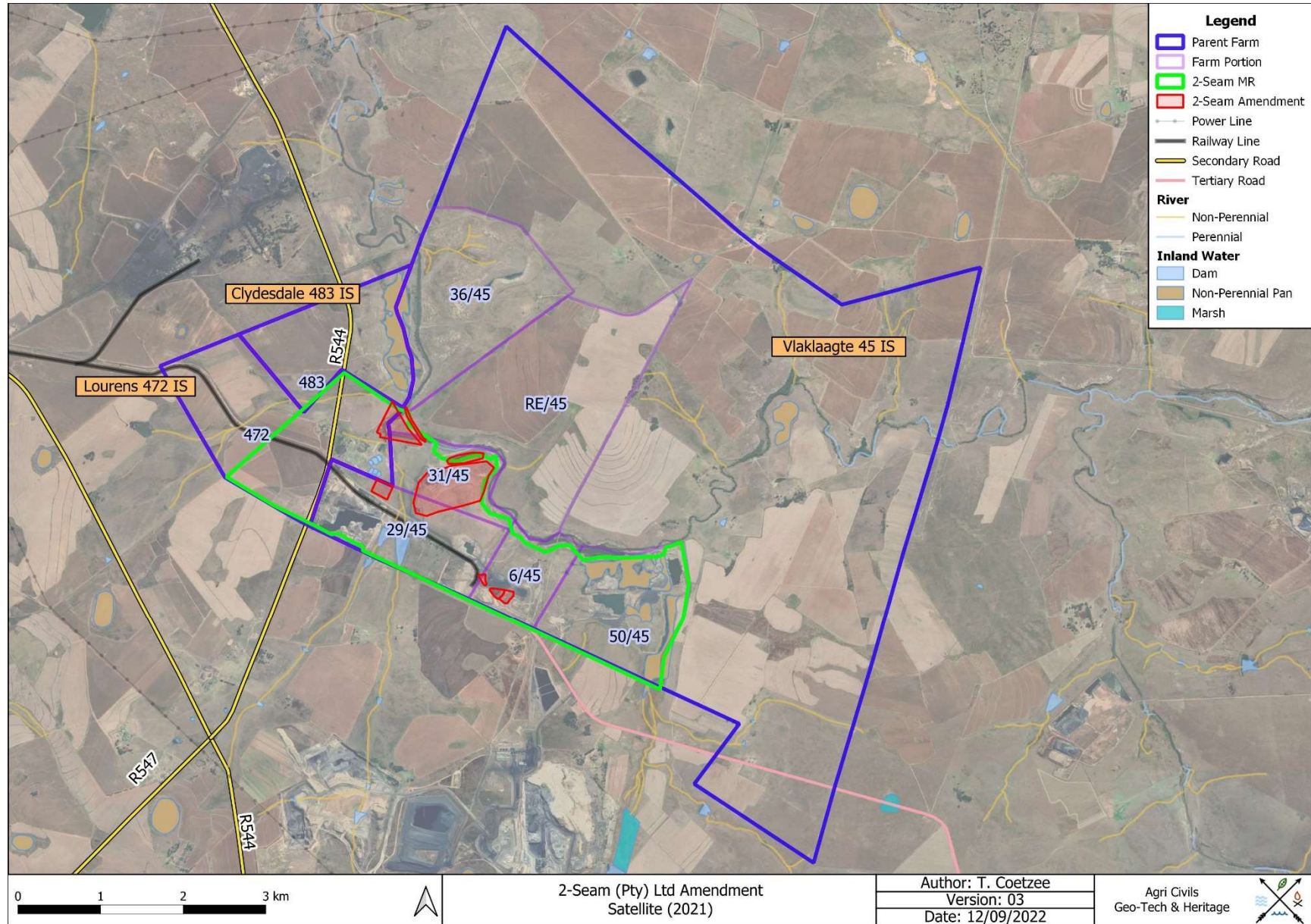


Figure 3: Study area portrayed on a 2021 satellite image.



2.2 Project Description

The development associated with proposed amendment to the existing 2-Seam Mine measures approximately 60.12 ha. The proposed development will consist of the following infrastructure/areas (**Figure 4**):

- Additional opencast mining area
- River Diversion
- Tailings Facility
- ROM Stockpile
- Processing Plant Area
- Plant Pollution Control Dam (PCD)
- Pollution Control Dam (PCD)
- Contractors Yard



Map: Proposed Layout
Project: 2-Seam (Pty) Ltd
Date: May 2022
Datum: D_WGS_1984
Spheroid: WGS_1984

Legend

Proposed Layout

- Additional Opencast Mining Area
- River Diversion
- Tailings Facility
- ROM Stockpile
- Processing Plant Area
- Plant Pollution Control Dam (PCD)
- Pollution Control Dam (PCD)
- Contractors Yard
- Opencast Pits and associated Infrastructure

2-Seam (Pty) Ltd

- Mining Right (MR) Boundary
- Major Roads

NBA Rivers 2018

- Olifants

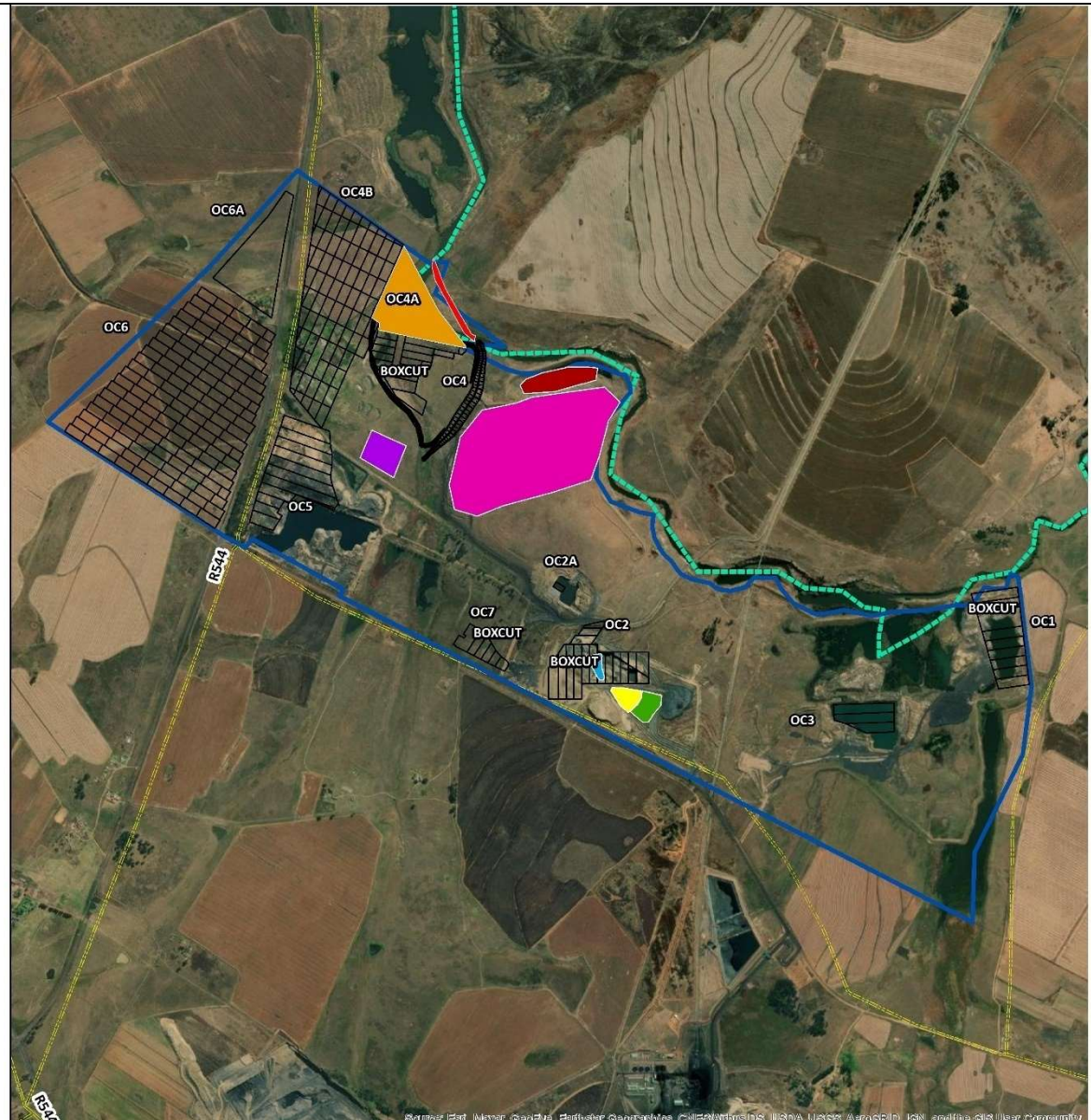
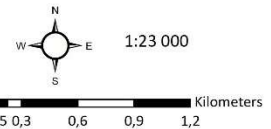


Figure 4: Proposed amendment to the existing 2-Seam Mine (supplied by Elemental Sustainability 2022).



3. Methodology

Archaeological reconnaissance of the demarcated areas were conducted during September 2022 through unsystematic pedestrian and vehicular surveys (**Figure 5**) and general site conditions were recorded via photographic record (**Figures 6 – 19**). Also, the demarcated areas were inspected on Google Earth, historical topographical maps, and historical aerial imagery in order to identify potential heritage remains (**Appendix A**). The historical topographical maps dating to 1962, 1984, 1996, and 2009, as well as the historical aerial images dating to 1954, 1956, 1967, 1975, 1978, 1991, and 2005, proved useful in terms of providing an indication of potential heritage sites and past land uses associated with the demarcated areas. No potential sites, however, were noted within the demarcated areas and no sites were identified during the site inspection. The total area inspected was approximately 60.12 ha. Since heritage resources are often associated with perennial and non-perennial rivers, the rivers and streams located within close proximity of the study area were buffered by a distance of 500 m, indicating a potentially sensitive area. The majority of this buffer zone, however, has been disturbed by previous/current mining and agricultural activities. Areas previously/currently associated with cultivated land and mining development that intersect the study area were traced and plotted as shown on topographical maps and aerial imagery, indicating disturbed areas that are less sensitive from a heritage perspective (**Figure 5**).

The reconnaissance of the area under investigation served a twofold purpose:

- To obtain an indication of heritage material found in the general area as well as to identify or locate archaeological sites on the areas demarcated for development. This was done in order to establish a heritage context and to supplement background information that would benefit developers through identifying areas that are sensitive from a heritage perspective.

- All archaeological and historical events have spatial definitions in addition to their cultural and chronological context. Where applicable, spatial recording of these definitions were done by means of a handheld GPS (Global Positioning System) during the site visit, as well as by plotting the boundaries from aerial imagery and topographical maps.



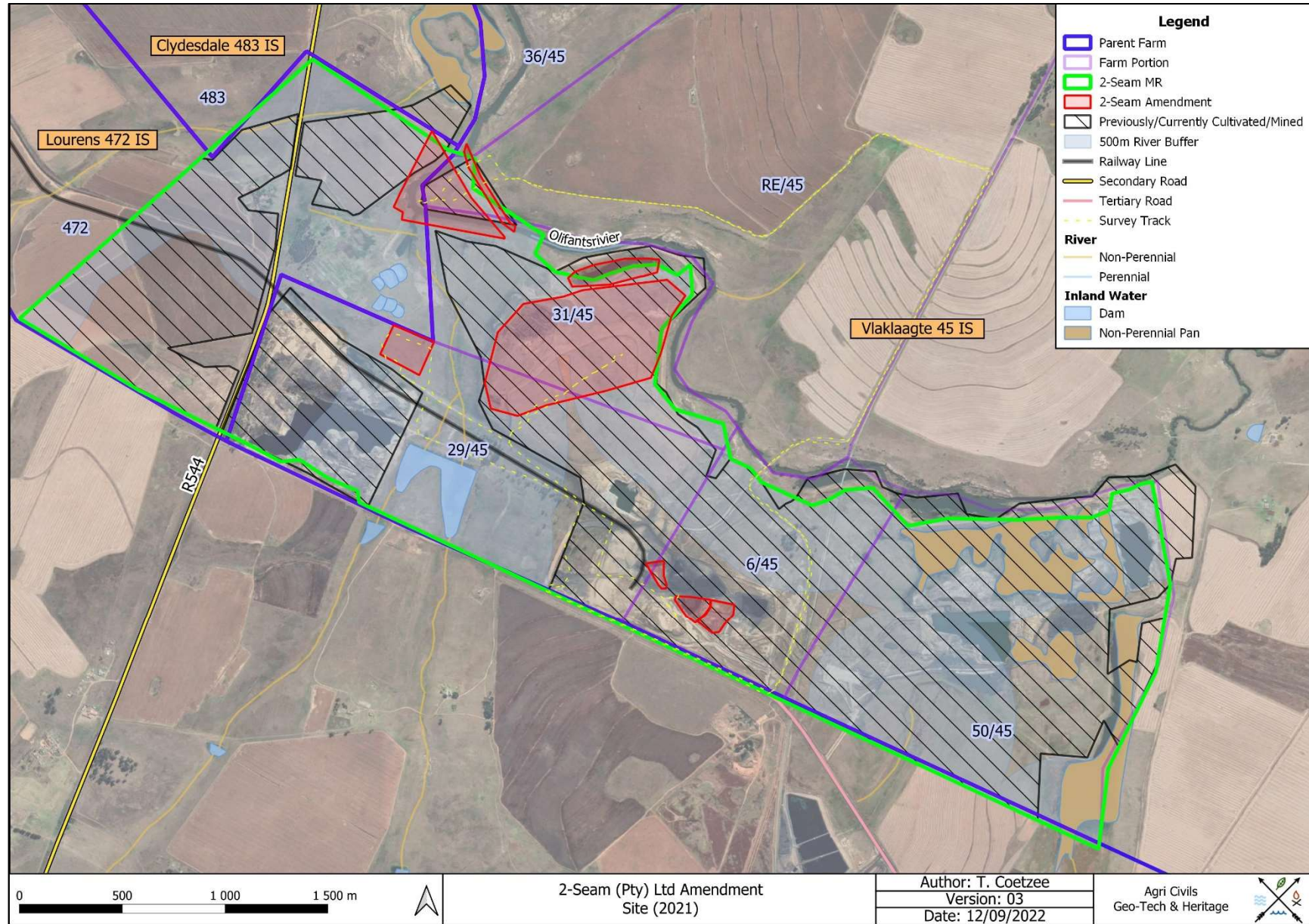


Figure 5: Study area with survey track portrayed on a 2021 satellite image.





Figure 6: Environment associated with the proposed Additional Opencast Mining Area seen from the southwest.



Figure 7: Eastern perspective the proposed Additional Opencast Mining Area.





Figure 8: Northern perspective of the proposed Additional Opencast Mining Area.



Figure 9: South-eastern perspective of the proposed River Diversion.





Figure 10: North-western perspective of the proposed River Diversion.



Figure 11: Southern perspective of the proposed Tailings Facility.





Figure 12: Western perspective of the proposed Tailings Facility.



Figure 13 Eastern perspective of the proposed Tailings Facility.





Figure 14: Environment associated with the proposed ROM Stockpile.



Figure 15: Environment associated with the proposed Processing Plant.





Figure 16: Environment associated with the proposed Plant PCD.



Figure 17: Environment associated with the proposed PCD – southern perspective.





Figure 18: Environment associated with the proposed PCD – northern perspective.



Figure 19: Environment associated with the Contractors Yard.



3.1 Sources of information

At all times during the survey, standard archaeological procedures for the observation of heritage resources were followed. As most archaeological material occur in single or multiple stratified layers beneath the soil surface, special attention was paid to disturbances; both man-made such as roads and clearings, and those made by natural agents such as burrowing animals and erosion. Locations associated with archaeological material remains, as well as general environmental conditions, were recorded by means of a Garmin Oregon 750 GPS and were photographed with a Samsung S7 mobile phone. A literature study, which incorporated previous work done in the region, was conducted in order to place the study area into context from a heritage perspective.

3.1.1 Previous Heritage Studies

Nokuhle Colliery, Ogies

An Archaeological Impact Assessment was conducted for Nokuhle Coal (Pty) Ltd for the mining operations on the farm Oogiesfontein 4 IS about 1 km north of Ogies. During the surveys that covered roughly 180 ha, three cemeteries and six ruins were located within the development footprints. A further five cemeteries and three ruins were located in the area adjacent to the demarcated footprint areas (PGS 2010). The colliery referred to is located approximately 33 km northwest of the study area concerned in this report.

Klipspruit Extension: Weltevreden

The Heritage Impact Assessment (HIA) survey for the Klipspruit Extension: Weltevreden project was conducted by Digby Wells (Du Piesanie 2014). The project entailed an assessment of the built environment that included a field reconnaissance survey that identified, recorded, and documented all structures and burials in the project area, in addition to the sites identified by Cultmatrix cc (De Jong 2009). The HIA recorded 57 heritage sites within the project area: 20 burial grounds, 34 built structures and 1 palaeontology and meteorites sites. The Klipspruit Extension project is located approximately 31 km northwest of the proposed 2-Seam amendment project.

Vlaklaagte Block 6 Open Pit on the Farm Lourens 472 IS

The Phase 1 HIA for the Vlaklaagte Block 6 Open Pit on the Farm Lourens 472 IS was conducted by Pelsier (2019). The Block 6 area falls within the existing 2-Seam Mining Right and is located on the western side of the R544 secondary road and approximately 600 m west of the proposed amendment areas. The HIA recorded one cemetery and recommended that the graves be protected *in situ*. As an alternative, a grave relocation process was recommended.

3.1.2 Historical topographical maps & aerial images

The historical aerial images dating to 1954 and 1956, as well as the topographical map dating to 1962 show that the majority of the proposed Tailings Facility, Rom Stockpile, Processing Plant Area, Plant PCD and a section of the proposed Additional Opencast Mining Area used to consist of cultivated land (**Appendix A: Figures 24 – 26**), while the remaining areas (River Diversion, PCD) were located on open areas. By 1967 (**Appendix A: Figure**



27) a section of the proposed River Diversion area was cultivated as well, while a section of the proposed Tailings Facility area was impacted by mining activities. Between 1975, 1978 and 1984, the mining activities intersecting the proposed Tailings Facility area expanded (**Appendix A: Figures 28 – 30**). The 1991 aerial image (**Appendix A: Figure 31**) indicated that the areas demarcated for the Additional Opencast Mining Area, River Diversion, and PCD, as well as the entire extent of the proposed Tailings Facility were characterised by mining activities. The expanding mining activities associated with the proposed Tailings Facility area are also indicated on the 1996 and 2009 topographical maps, and are visible on the 2005 aerial image (**Appendix A: Figures 32 – 34**), while the majority of the cultivated fields are no longer indicated on the topographical maps and are no longer visible on the aerial images.

3.1.3 Personal Communication

Personal communication with Mr Tim Erskine, the 2-Seam Mine Manager, confirmed that the proposed amendment areas have been disturbed by a combination of previous/current mining/agricultural activities and that to his knowledge, no potential heritage sites exist within these areas (Tim Erskine, pers. comm. 2022).

3.2 Limitations

The general visibility was considered to be good during the time of the site visit and no access constraints were encountered.

4. Archaeological Background

Southern African archaeology is broadly divided into the Early, Middle and Later Stone Ages; Early, Middle and Later Iron Ages; and Historical or Colonial Periods. This section of the report provides a general background to archaeology in South Africa.

4.1 The Stone Age

The earliest stone tool industry, the Oldowan, was developed by early human ancestors which were the earliest members of the genus *Homo*, such as *Homo habilis*, around 2.6 million years ago. It comprises tools such as cobble cores and pebble choppers (Toth & Schick 2007). Archaeologists suggest these stone tools are the earliest direct evidence for culture in southern Africa (Clarke & Kuman 2000). The advent of culture indicates the advent of more cognitively modern hominins (Mitchell 2002: 56, 57).

The Acheulean industry completely replaced the Oldowan industry. The Acheulian industry was first developed by *Homo ergaster* between 1.8 to 1.65 million years ago and lasted until around 300 000 years ago. Archaeological evidence from this period is also found at Swartkrans, Kromdraai and Sterkfontein. The most typical tools of the ESA (Early Stone Age) are handaxes, cleavers, choppers and spheroids. Although hominins seemingly used handaxes often, scholars disagree about their use. There are no indications of hafting, and some artefacts are far too large for it. Hominins likely used choppers and scrapers for skinning and butchering



scavenged animals and often obtained sharp ended sticks for digging up edible roots. Presumably, early humans used wooden spears as early as 5 million years ago to hunt small animals.

Middle Stone Age (MSA) artefacts started appearing about 250 000 years ago and replaced the larger Early Stone Age bifaces, handaxes and cleavers with smaller flake industries consisting of scrapers, points and blades. These artefacts roughly fall in the 40-100 mm size range and were, in some cases, attached to handles, indicating a significant technical advance. The first *Homo sapiens* species also emerged during this period. Associated sites are Klasies River Mouth, Blombos Cave and Border Cave (Deacon & Deacon 1999).

Although the transition from the Middle Stone Age to the Later Stone Age (LSA) did not occur simultaneously across the whole of southern Africa, the Later Stone Age ranges from about 20 000 to 2000 years ago. Stone tools from this period are generally smaller, but were used to do the same job as those from previous periods; only in a different, more efficient way. The Later Stone Age is associated with: rock art, smaller stone tools (microliths), bows and arrows, bored stones, grooved stones, polished bone tools, earthenware pottery and beads. Examples of Later Stone Age sites are Nelson Bay Cave, Rose Cottage Cave and Boomplaas Cave (Deacon & Deacon 1999). These artefacts are often associated with rocky outcrops or water sources.

4.2 The Iron Age & Historical Period

The Early Iron Age marks the movement of farming communities into South Africa in the first millennium AD, or around 2500 years ago (Mitchell 2002:259, 260). These groups were agro-pastoralist communities that settled in the vicinity of water in order to provide subsistence for their cattle and crops. Archaeological evidence from Early Iron Age sites is mostly artefacts in the form of ceramic assemblages. The origins and archaeological identities of this period are largely based upon ceramic typologies. Some scholars classify Early Iron Age ceramic traditions into different “streams” or “trends” in pot types and decoration, which emerged over time in southern Africa. These “streams” are identified as the Kwale Branch (east), the Nkope Branch (central) and the Kalundu Branch (west). Early Iron Age ceramics typically display features such as large and prominent inverted rims, large neck areas and fine elaborate decorations. This period continued until the end of the first millennium AD (Mitchell 2002; Huffman 2007). Some well-known Early Iron Age sites include the Lydenburg Heads in Mpumalanga, Happy Rest in the Limpopo Province and Mzonjani in Kwa-Zulu Natal.

The Middle Iron Age roughly stretches from AD 900 to 1300 and marks the origins of the Zimbabwe culture. During this period cattle herding appeared to play an increasingly important role in society. However, it was proved that cattle remained an important source of wealth throughout the Iron Age. An important shift in the Iron Age of southern Africa took place in the Shashe-Limpopo basin during this period, namely the development of class distinction and sacred leadership. The Zimbabwe culture can be divided into three periods based on certain capitals. Mapungubwe, the first period, dates from AD 1220 to 1300, Great Zimbabwe from AD 1300 to 1450, and Khami from AD 1450 to 1820 (Huffman 2007: 361, 362).



The Late Iron Age (LIA) roughly dates from AD 1300 to 1840. It is generally accepted that Great Zimbabwe replaced Mapungubwe. Some characteristics include a greater focus on economic growth and the increased importance of trade. Specialisation in terms of natural resources also started to play a role, as can be seen from the distribution of iron slag which tend to occur only in certain localities compared to a wide distribution during earlier times. It was also during the Late Iron Age that different areas of South Africa were populated, such as the interior of KwaZulu Natal, the Free State, the Gauteng Highveld and the Transkei. Another characteristic is the increased use of stone as building material. Some artefacts associated with this period are knife-blades, hoes, adzes, awls, other metal objects as well as bone tools and grinding stones.

The Historical period mainly deals with Europe's discovery, settlement and impact on southern Africa. Some topics covered by the Historical period include Dutch settlement in the Western Cape, early mission stations, Voortrekker routes and the Anglo Boer War. This time period also saw the compilation of early maps by missionaries, explorers, military personnel, etc.

4.2.1 The South African War

Several small skirmishes took place in the general area. However, no artefacts or features relating to the South African War were found during the survey. The phase in the South African War that is significant in terms of the study area relates to the period after the British occupied Pretoria on 5 June 1900. During this time the republican forces retreated towards the eastern boundary of the *Zuid-Afrikaansche Republiek* under General Louis Botha and started employing guerrilla tactics (Matakoma Heritage Consultants 2007).

One of the more important and well-known South African War sites in the vicinity of the study area is the Battle of Bakenlaagte, located approximately 27 km southwest of the study area. The battle took place on 30 October 1901 between Lieutenant Colonel George Benson's Flying Column and the joint forces of General Louis Botha and General Sarel Grobler. Benson's Flying Column continuously threatened Boer commandos that caused the commandos to move camp every two days. Grobler had been following Benson's trail and harassed his rearguard, but it was only after Botha and his commando joined Grobler's commando that an attack could be launched. Benson's column was enroute from Syferfontein to Balmoral to resupply his men and horses. The column, consisting of more than 300 wagons, 800 horses and 600 infantry, aimed to camp at Bakenlaagte farmstead (Von der Heyde 2013: 208-209).

During the march, the column stretched out over a distance of approximately 2 km. The advance guard reached the Bakenlaagte farmstead at 09:00, but one of the rearguard wagons got stuck in mud when crossing a drift. Because the Boers were close by and visibility was poor, Benson rode back towards the rearguard and ordered two field guns be placed on a stony ridge between the camp and the rearguard. Benson was on his way to rescue the wagon when Botha with 800 men launched his attack. Upon seeing the attack, Benson ordered a retreat to Gun Hill, where the field guns were positioned. Two companies were also on their way from the camp to Gun Hill.



At this stage Benson ordered some of the rearguard toward the northeast to protect the camp, creating a gap through which the Boers attacked. The position was overrun and of the 280 soldiers, the British suffered 231 casualties. Before Benson succumbed to his wounds, he ordered the camp to fire their guns at the hill, despite the danger to him and his men. The shelling drove the Boers back, but ambulance wagons provided cover and they managed to capture the two field guns. The Boers lost almost 100 men and decided not to follow up with an attack. The 73 British soldiers, including Benson, who were killed in the Battle were buried on Gun Hill, but were later exhumed and reburied in Germiston's Primrose Cemetery (Von der Heyde 2013: 208-209).

4.2.2 Coal mining general history near eMalahleni, Middelburg, Bethal, Hendrina, Ermelo and Carolina

Mpumalanga, especially the area between eMalahleni, Middelburg, Bethal, Hendrina, Ermelo and Carolina, is associated with vast coal fields. These coal fields formed between 200 and 300 million years ago from rotten forests in swamps. During this period, Africa was still attached to South America, India and Antarctica as part of the Gondwana supercontinent. By 250 million years ago, the climate changed to dry warm conditions and the swamps in Mpumalanga were replaced by desert-like conditions around 200 million years ago. By 180 million years ago, when the Gondwana supercontinent started to split up, volcanic lava fields covered areas in Mpumalanga (De Wit 2007: 37).

With the rich coal deposits in Mpumalanga, it was only a matter of time before its value was realised and the coal extracted. Coal mining is Mpumalanga's most important industrial activity and produces about 80% of South Africa's coal. The earliest coal mining in the area dates to 1868 when farmers extracted coal for personal use in the Middelburg district. Large-scale coal mining around eMalahleni, however, only started after the discovery of gold on the Witwatersrand in 1886. Due to the discovery of coal in the Brakpan and Springs surroundings in 1887 and no railway linking eMalahleni with the Rand, these early eMalahleni coal mines closed down. It was more cost effective to exploit the closer Brakpan and Springs coal deposits than the coal found at eMalahleni (Schirmer 2007: 316).

After the construction of the railway line between the Rand and eMalahleni the deposits were exploited on large scale again. The coal fields, which are about 40 km wide, are concentrated around eMalahleni and run towards Belfast in the east. The first collieries around eMalahleni were Douglas, Transvaal and Delagoa Bay, Witbank and Landau and are of a higher quality compared to the coal found at Brakpan and Springs. During the 1890s some of the coal was exported via Delagoa Bay. In addition, the coal was readily accessible as the deposits occurred at a depth of 100 m or less (Schirmer 2007: 316-317). It should also be noted that the railway line between Pretoria and Lorenzo Marques (Maputo) was completed on 2 November 1894 and the connection between eMalahleni and Johannesburg during the 1910s (Heydenrych 1999).



Between 1900 and 1920 many new collieries were established and the coal price dropped. This led to the establishment of the Transvaal Coal Owners' Association with the main aim to regulate output coal prices. This also acted to counter possible competition. It should also be noted that not all collieries joined this association. The establishment of the Transvaal Coal Owners' Association had positive as well as negative influences. On the one hand eliminating the competition might have impacted negatively on efficiency and the workers. On the other hand, it is possible that the capacity of coal mines was enhanced and facilitated further development in the industry. One positive point was that the association eased interaction with international buyers. During the 1930s, however, the coal price continued to drop and resulted in mechanisation. This introduced electric coal cutters and eliminated the need for high number of unskilled workers. By 1946 eMalahleni and Middelburg saw the emergence of a modern coal industry. The Transvaal had 34 large collieries that were responsible for 99.7% of the province's coal (Schirmer 2007: 317-319).

Between 1940 and 1960 coal output in the Eastern Transvaal increased from 13 million to 25 million tons. Although industrialisation expanded throughout this time in South Africa and a demand existed for coal both locally and internationally, a steady shift to oil as the dominant form of energy was noted. In light of these developments Anglo American Corporation launched three research programmes in the 1960s. As a result of these programmes the region's coal mines became export orientated. This trend continued throughout the 1980s. During these times a series of coal-burning power stations around the eastern Highveld coal deposits were constructed (Schirmer 2007: 321).

5. Archaeological and Historical Remains

5.1 Stone Age Remains

No Stone Age archaeological remains were located within the demarcated areas.

These artefacts are often associated with rocky outcrops or water sources. **Figures 20 – 22** below are examples of stone tools often associated with the Early, Middle and Later Stone Age of southern Africa.

Archaeological studies conducted in the surrounding areas also did not locate Stone Age artefacts.

According to Bergh (1999: 5), no major Stone Age archaeological sites are located in the direct vicinity of Kriel, but some rock art have been noticed in the area to the south of eMalahleni (Bergh 1999: 6).



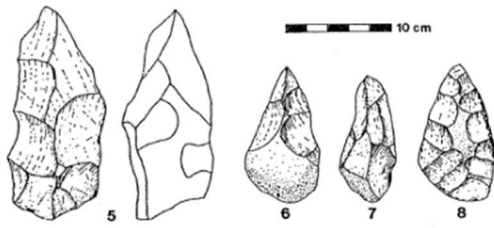


Figure 20: ESA artefacts from Sterkfontein (Volman 1984).

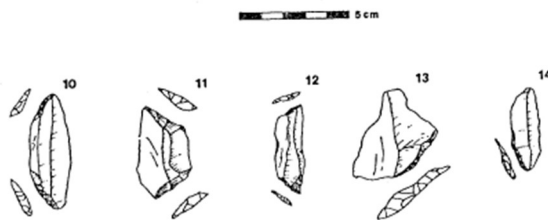


Figure 21: MSA artefacts from Howiesons Poort (Volman 1984).



Figure 22: LSA scrapers (Klein 1984).

5.2 Iron Age Farmer Remains

No Iron Age Farmer remains were located within the demarcated areas.

Archaeological studies conducted in the surrounding areas also did not locate Iron Age material.

5.3 Historical Remains

No sites dating to the Historic Period were located within the demarcated areas.

Heritage studies conducted in the surrounding areas recorded historical buildings and homesteads. See PGS (2010) and Du Piesanie (2014).

5.4 Contemporary Remains

No contemporary sites were identified within the demarcated areas.

The heritage study conducted by Pelsler (2019) noted the presence of a farmstead. However, the site is not discussed and the age is therefore unknown.



5.5 Graves/Burial Sites

No graves or cemeteries were identified within the demarcated areas.

The heritage studies conducted in the area, PGS (2010), Du Piesanie (2014) and Pelser (2019), recorded the presence of several graves and cemeteries.

6. Evaluation

The significance of an archaeological site is based on the amount of deposit, the integrity of the context, the kind of deposit and the potential to help answer present research questions. Historical structures are defined by Section 34 of the National Heritage Resources Act, 1999, while other historical and cultural significant sites, places and features, are generally determined by community preferences.

A fundamental aspect in the conservation of a heritage resource relates to whether the sustainable social and economic benefits of a proposed development outweigh the conservation issues at stake. There are many aspects that must be taken into consideration when determining significance, such as rarity, national significance, scientific importance, cultural and religious significance, and not least, community preferences. When, for whatever reason the protection of a heritage site is not deemed necessary or practical, its research potential must be assessed and if appropriate mitigated in order to gain data / information which would otherwise be lost. Such sites must be adequately recorded and sampled before being destroyed.

6.1 Field Ratings

All sites should include a field rating in order to comply with section 38 of the National Heritage Resources Act (Act No. 25 of 1999). The field rating and classification in this report are prescribed by SAHRA.

Table 2: Prescribed Field Ratings.

Rating	Field Rating/Grade	Significance	Recommendation
National	Grade 1		National site
Provincial	Grade 2		Provincial site
Local	Grade 3 A	High	Mitigation not advised
Local	Grade 3 B	High	Part of site should be retained
General protection A	4 A	High/Medium	Mitigate site
General Protection B	4 B	Medium	Record site
General Protection C	4 C	Low	No recording necessary

* No sites of heritage significance were identified.



7. Statement of Significance & Recommendations

7.1 Statement of Significance

The study area: The Proposed amendment to the existing 2-Seam Mine

The following proposed areas are partially located within 500 m of rivers/streams, a zone that is generally associated with a higher heritage site probability: Additional Opencast Mining Area, River Diversion, Tailings Facility, PCD and Contractors Yard. However, all the areas associated with the proposed amendment to the existing 2-Seam Mine have been disturbed by previous/current mining/agricultural activities and are therefore not considered to be significant or sensitive from a heritage perspective (**Figure 23**). Also, the 2-Seam Mine Manager, Mr Tim Erskine, confirmed that to his knowledge, no potential heritage resources are located within the proposed boundaries: Additional Opencast Mining Area, River Diversion, Tailings Facility, ROM Stockpile, Processing Plant Area, Plant PCD, PCD, Contractors Yard.



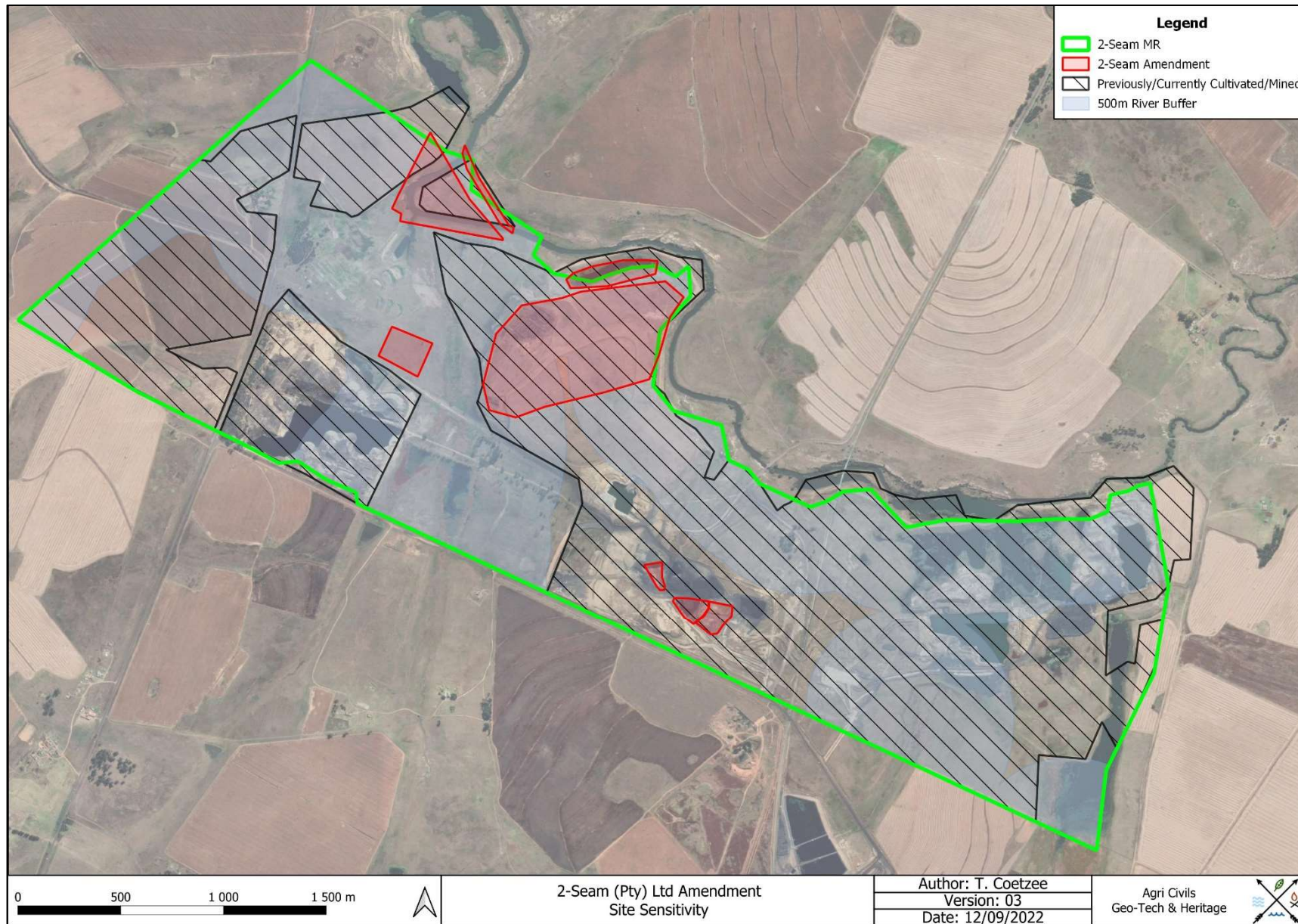


Figure 23: Study area and potentially sensitive areas portrayed on a 2021 satellite image.



7.2 Recommendations

The following recommendations are made in terms with the National Heritage Resources Act (25 of 1999) in order to avoid the destruction of heritage remains associated with the areas demarcated for the proposed amendment to the existing 2-Seam Mine:

- No sites of heritage significance were identified within the proposed boundaries and all the areas are considered to be disturbed. The demarcated areas associated with the proposed amendment to the existing 2-Seam Mine are therefore not considered to be sensitive or significant from a heritage perspective.
- Since the recommendations are based on the current layout of the proposed project, it is recommended that should alterations occur, the report be revised and updated to ensure the safeguarding of heritage resources.
- Should additional areas be considered for mining development, a qualified archaeologist must inspect the identified areas and update to report and recommendations accordingly in order to ensure the safeguarding of heritage resources.
- Should uncertainty regarding the presence of heritage remains exist, or if heritage resources are discovered by chance, it is advised that the potential site be avoided and that a qualified archaeologist be contacted as soon as possible.
- Since archaeological artefacts generally occur below surface, the possibility exists that culturally significant material may be exposed during the development and construction phases, in which case all activities must be suspended pending further archaeological investigations by a qualified archaeologist. Also, should skeletal remains be exposed during development and construction phases, all activities must be suspended and the relevant heritage resources authority must be contacted (See National Heritage Resources Act, 25 of 1999 section 36 (6)).
- From a heritage point of view, development may proceed on the demarcated areas, subject to the abovementioned conditions, recommendations, and approval by the South African Heritage Resources Agency.



8. Conclusion

The proposed amendment to the existing 2-Seam Mine measures approximately 60.12 ha and consists of the following areas: Additional Opencast Mining Area, River Diversion, Tailings Facility, ROM Stockpile, Processing Plant Area, Plant PCD, PCD, Contractors Yard. These areas have all been disturbed by previous/current mining/agricultural activities and are therefore not considered to be sensitive or significant from a heritage perspective.

Should the recommendations made in this study be adhered to and with the approval of the South African Heritage Resources Agency, the proposed amendment to the existing 2-Seam Mine may proceed.

9. Addendum: Terminology

Archaeology:

The study of the human past through its material remains.

Artefact:

Any portable object used, modified, or made by humans; e.g. pottery and metal objects.

Assemblage:

A group of artefacts occurring together at a particular time and place, and representing the sum of human activities.

Context:

An artefact's context usually consist of its immediate *matrix* (the material surrounding it e.g. gravel, clay or sand), its *provenience* (horizontal and vertical position within the matrix), and its *association* with other artefacts (occurrence together with other archaeological remains, usually in the same matrix).

Cultural Resource Management (CRM):

The safeguarding of the archaeological heritage through the protection of sites and through salvage archaeology (rescue archaeology), generally within the framework of legislation designed to safeguard the past.

Excavation:

The principal method of data acquisition in archaeology, involving the systematic uncovering of archaeological remains through the removal of the deposits of soil and other material covering and accompanying it.

Feature:

An irremovable artefact; e.g. hearths or architectural elements.

Ground Reconnaissance:

A collective name for a wide variety of methods for identifying individual archaeological sites, including consultation of documentary sources, place-name evidence, local folklore, and legend, but primarily actual fieldwork.

Matrix:

The physical material within which artefacts is embedded or supported, i.e. the material surrounding it e.g. gravel, clay or sand.



Phase 1 Assessments:

Scoping surveys to establish the presence of and to evaluate heritage resources in a given area.

Phase 2 Assessments:

In-depth culture resources management studies which could include major archaeological excavations, detailed site surveys and mapping / plans of sites, including historical / architectural structures and features. Alternatively, the sampling of sites by collecting material, small test pit excavations or auger sampling is required.

Sensitive:

Often refers to graves and burial sites although not necessarily a heritage place, as well as ideologically significant sites such as ritual / religious places. *Sensitive* may also refer to an entire landscape / area known for its significant heritage remains.

Site:

A distinct spatial clustering of artefacts, features, structures, and organic and environmental remains, as the residue of human activity.

Surface survey:

There are two kinds: (1) unsystematic and (2) systematic. The former involves field walking, i.e. scanning the ground along one's path and recording the location of artefacts and surface features. Systematic survey by comparison is less subjective and involves a grid system, such that the survey area is divided into sectors and these are walked all, thus making the recording of finds more accurate.

10. References

Climate-Data.org. eMalahleni Climate. <https://en.climate-data.org/africa/south-africa/mpumalanga/emalahleni-641/>.

Accessed 20-08-2022.

Clarke, R.J. & Kuman, K. 2000. *The Sterkfontein Caves Palaeontological and Archaeological Sites*. Johannesburg: University of the Witwatersrand.

De Wit, M. 2007. A History of Deep Time. In: Delius, P. (ed.) *Mpumalanga History and Heritage*: 27-38. Scottsville: University of KwaZulu-Natal Press.

Du Piesanie, J. 2014. Environmental Authorisation for the KPSX: Weltevreden Project. Heritage Impact Assessment. Johannesburg: Digby Wells Environmentals

Deacon, H. & Deacon, J. 1999. *Human beginnings in South Africa*. Cape Town: David Philip.



- Heydenrych, D. H. 1999. Mynbou-, landbou-en spoorwegontwikkeling in die 19de en 20ste eeu. In: Bergh, J. (ed.) *Geskiedenisatlas Van Suid-Afrika: Die Vier Noordelike Provinsies*: 327-332. Pretoria: J. L. van Schaik Uitgewers
- Huffman, T.N. 2007. *Handbook to the Iron Age*. Pietermaritzburg: UKZN Press.
- Klein, R. G. (ed.) 1984. *South African prehistory and paleoenvironments*. Rotterdam: Balkema.
- Matakoma – ARM, 2007. Digby Wells & Associates Heritage Impact Assessment – Certain portions of the farms Zondagsvlei, Schoongezicht, Leeuwfontein, Klippoortje, Springboklaagte, Cologne, Bombardie and Smithfield, Nkangala District, Mpumalanga. University of the Witwatersrand: Matakoma – ARM Heritage Contract Unit
- Mitchell, P. 2002. *The archaeology of southern Africa*. Cambridge: Cambridge University Press.
- Mucina, L. & Rutherford, M. C. 2006. *The Vegetation of South Africa, Lesotho and Swaziland*. Strelitzia 19. South African National Biodiversity Institute, Pretoria.
- Pelser, A. 2019. Phase 1 HIA Report for the proposed Vlakraagte Block 6 Open Pit Area located on the farm Lourens 472 IS near Kriel in the Province of Mpumalanga. Pretoria: Apelser Archaeological Consulting.
- Professional Grave Solutions (Pty) Ltd. 2010. Archaeological Impact Assessment (AIA) Report for Nokuhle Colliery. Pretoria: Professional Grave Solutions (Pty) Ltd.
- Schirmer, S. 2007. Enterprise and Exploitation in the 20th Century. In: Delius, P. (ed.) *Mpumalanga History and Heritage*: 291-346. Scottsville: University of KwaZulu-Natal Press
- Toth, N. & Schick, K. 2007. *Handbook of paleoanthropology*. Berlin: Springer.
- Volman, T. P. 1984. Early Prehistory of southern Africa. In: Klein, R. G. (ed.) *Southern African prehistory and paleoenvironments*. Rotterdam: Balkema.
- Von der Heyde, N. 2013. *Field Guide to the Battlefields of South Africa*. Century City: Struik Travel & Heritage.
- Human Tissue Act No. 65 of 1983, Government Gazette, Cape Town*
- National Heritage Resource Act No.25 of 1999, Government Gazette, Cape Town*
- Removal of Graves and Dead Bodies Ordinance No. 7 of 1925, Government Gazette, Cape Town*



Appendix A: Historical Aerial Imagery & Topographical Maps



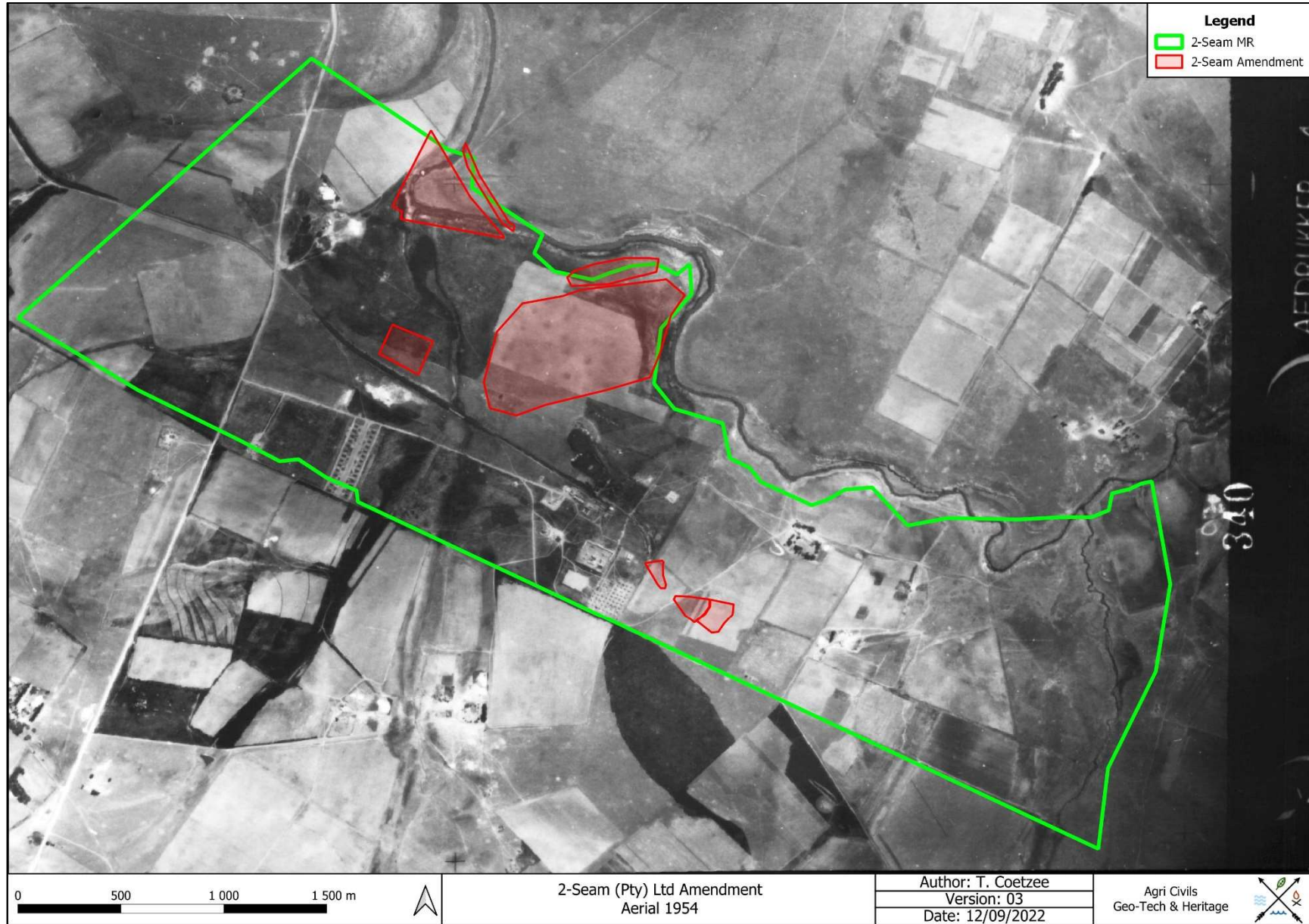


Figure 24: Study area superimposed on a 1954 aerial image.



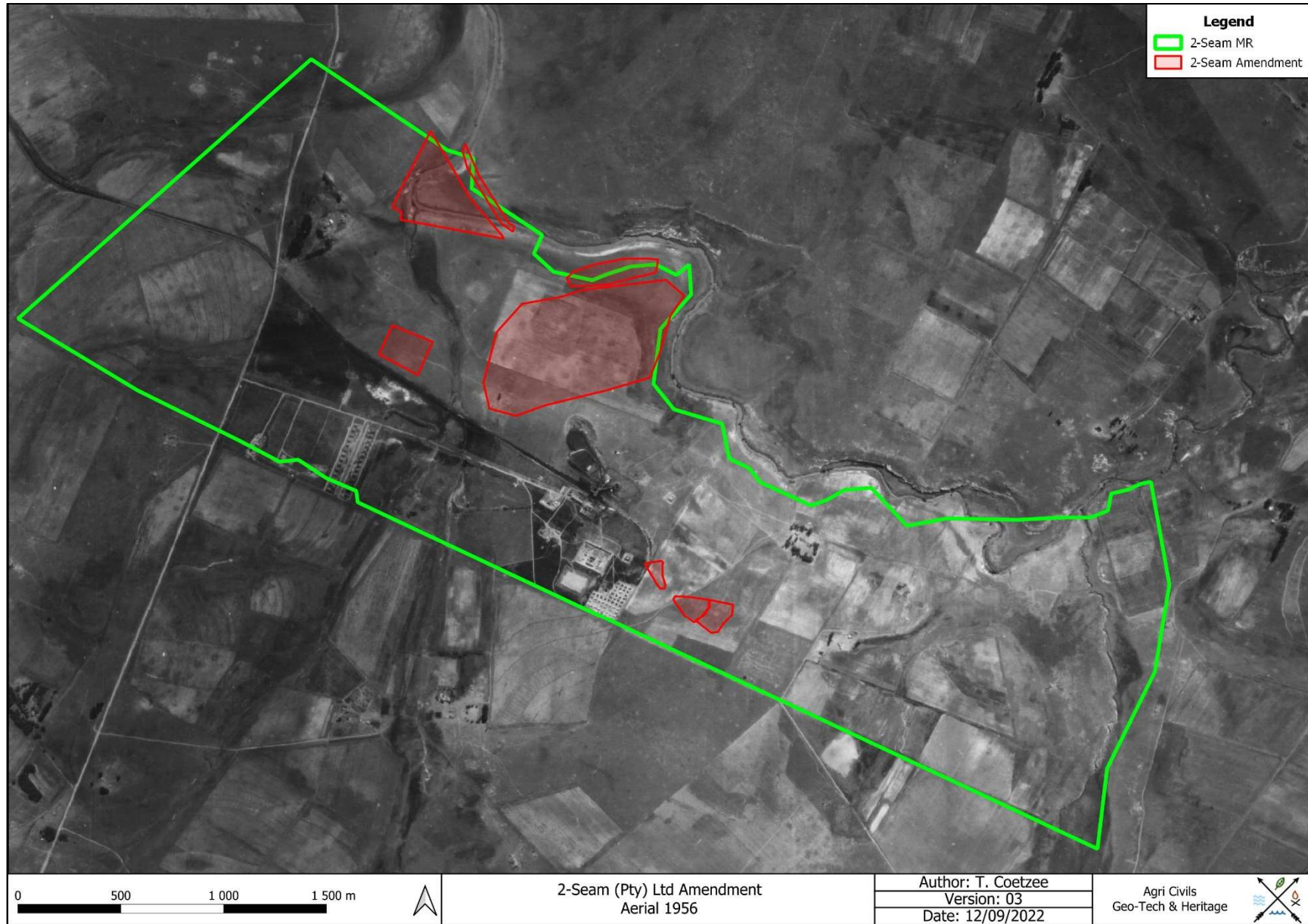


Figure 25: Study area superimposed on a 1956 aerial image.



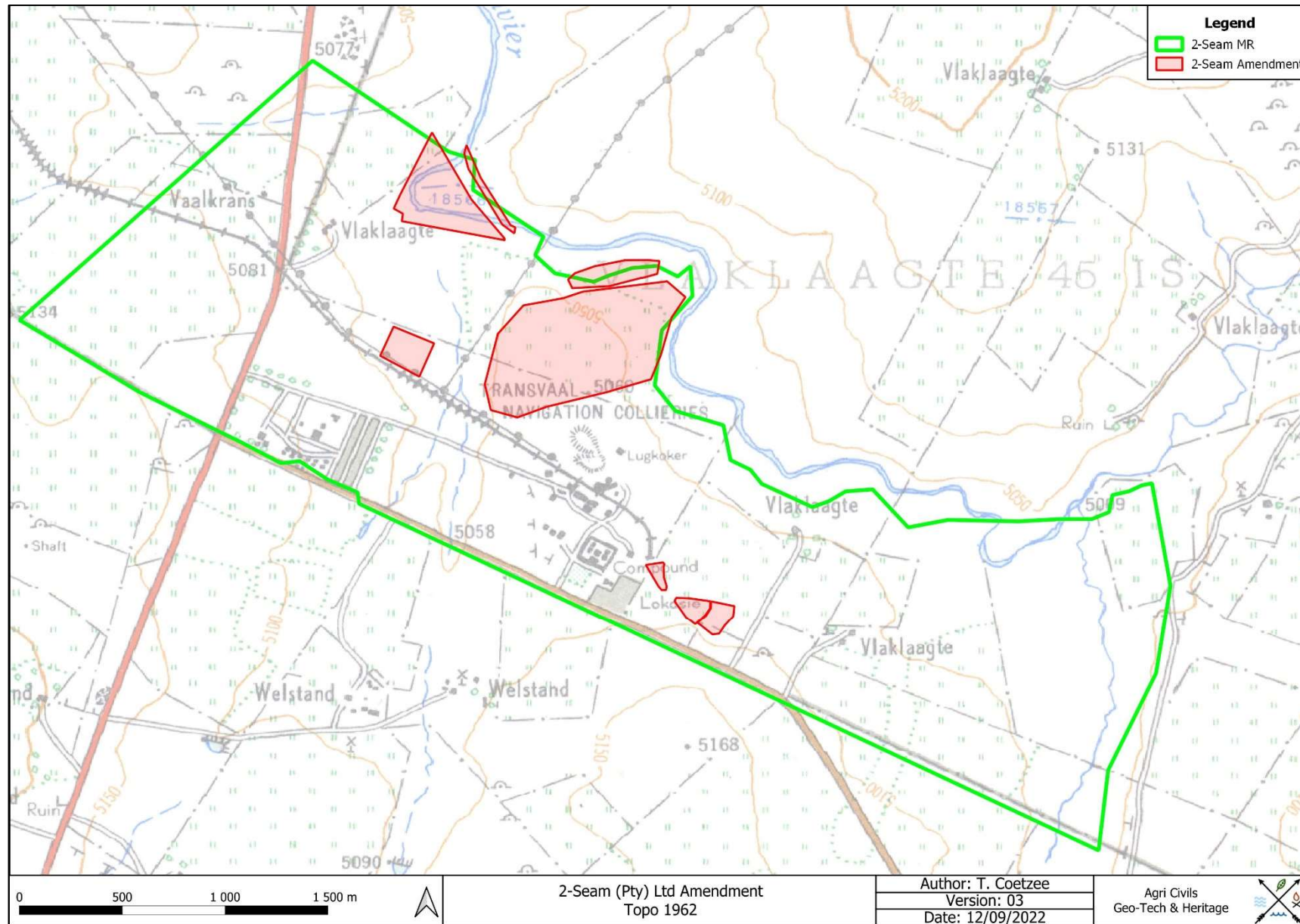


Figure 26: Study area superimposed on a 1962 topographical map.



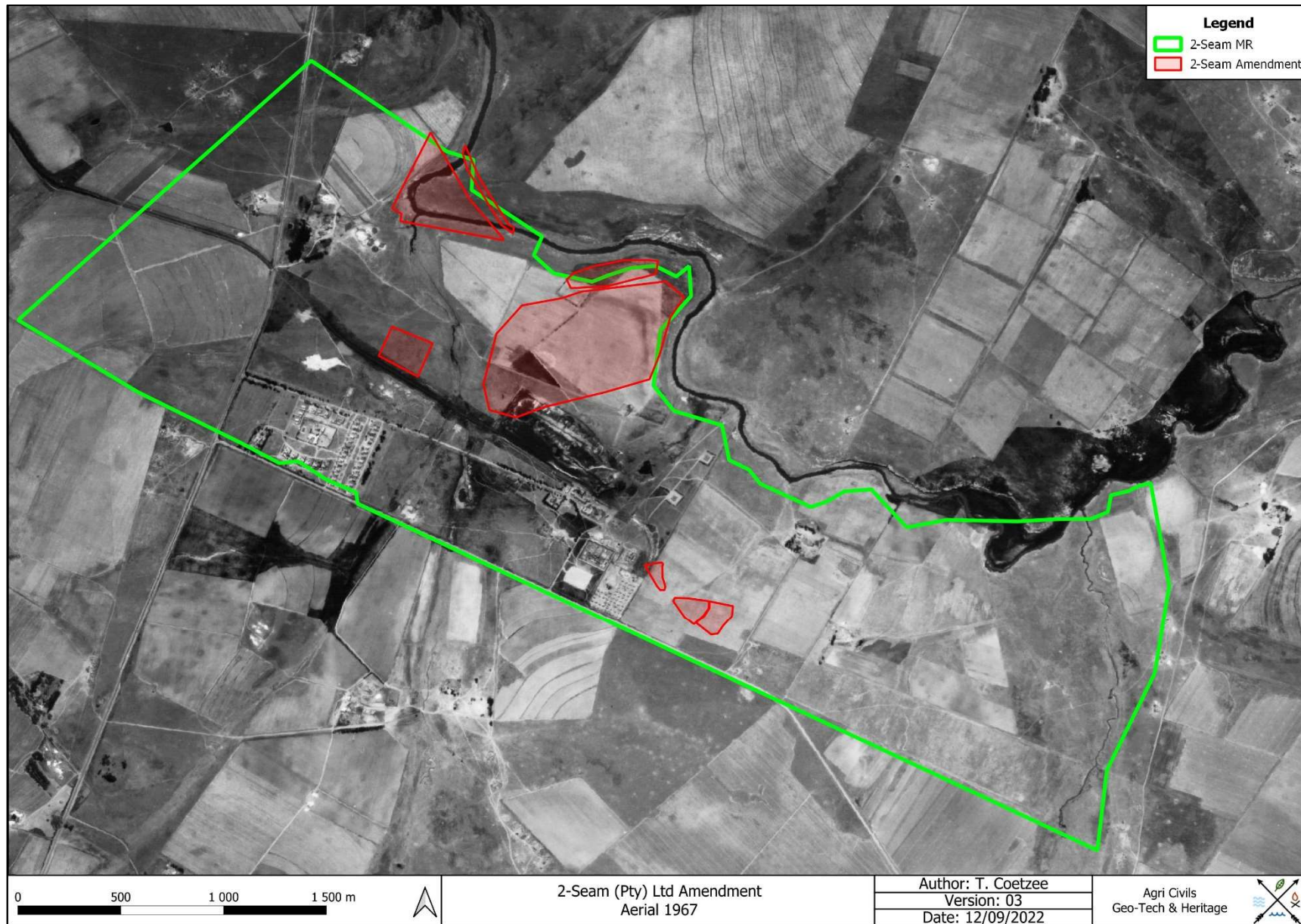


Figure 27: Study area superimposed on a 1967 aerial image.



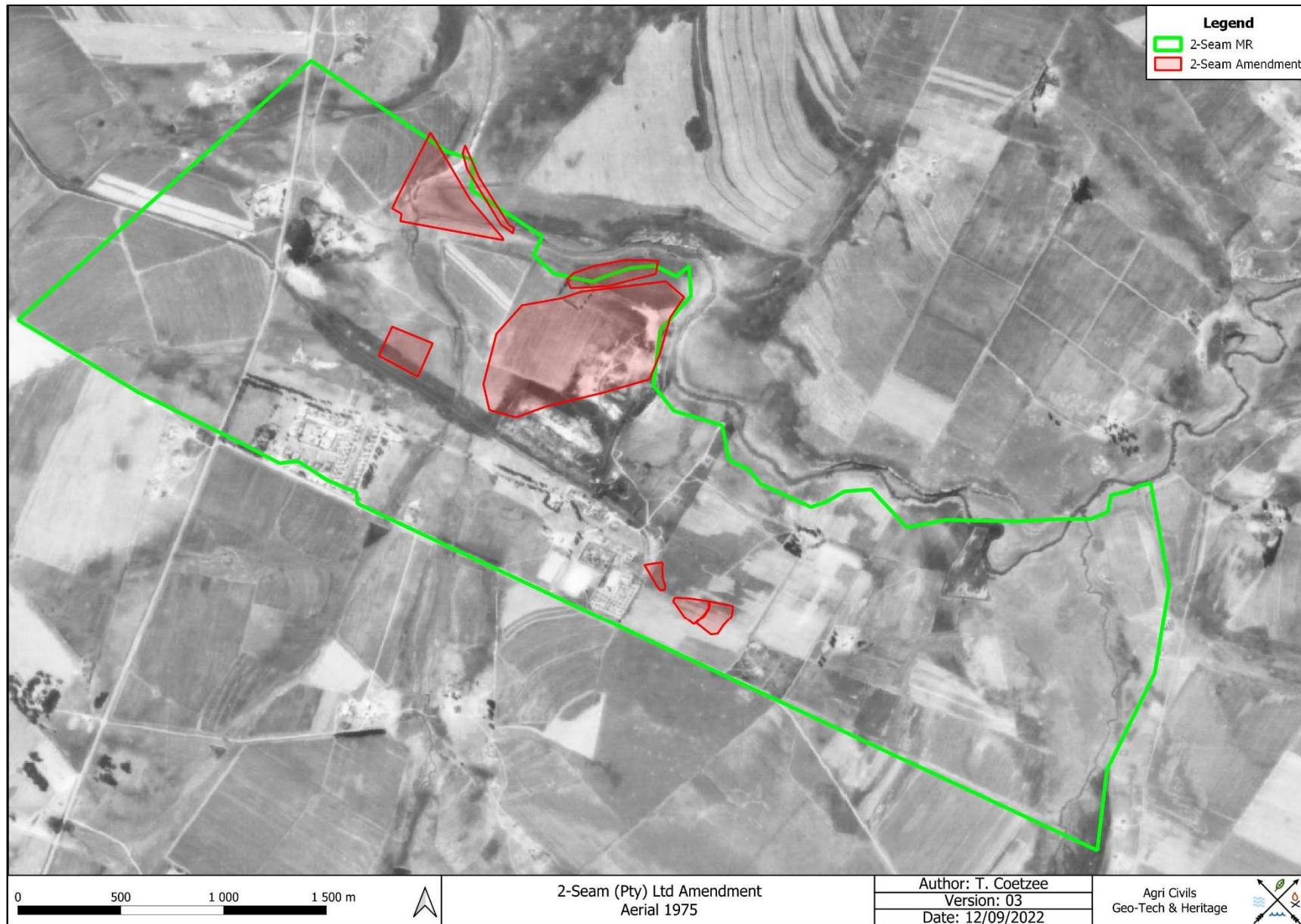


Figure 28: Study area superimposed on a 1975 aerial image.





Figure 29: Study area superimposed on a 1978 aerial image.



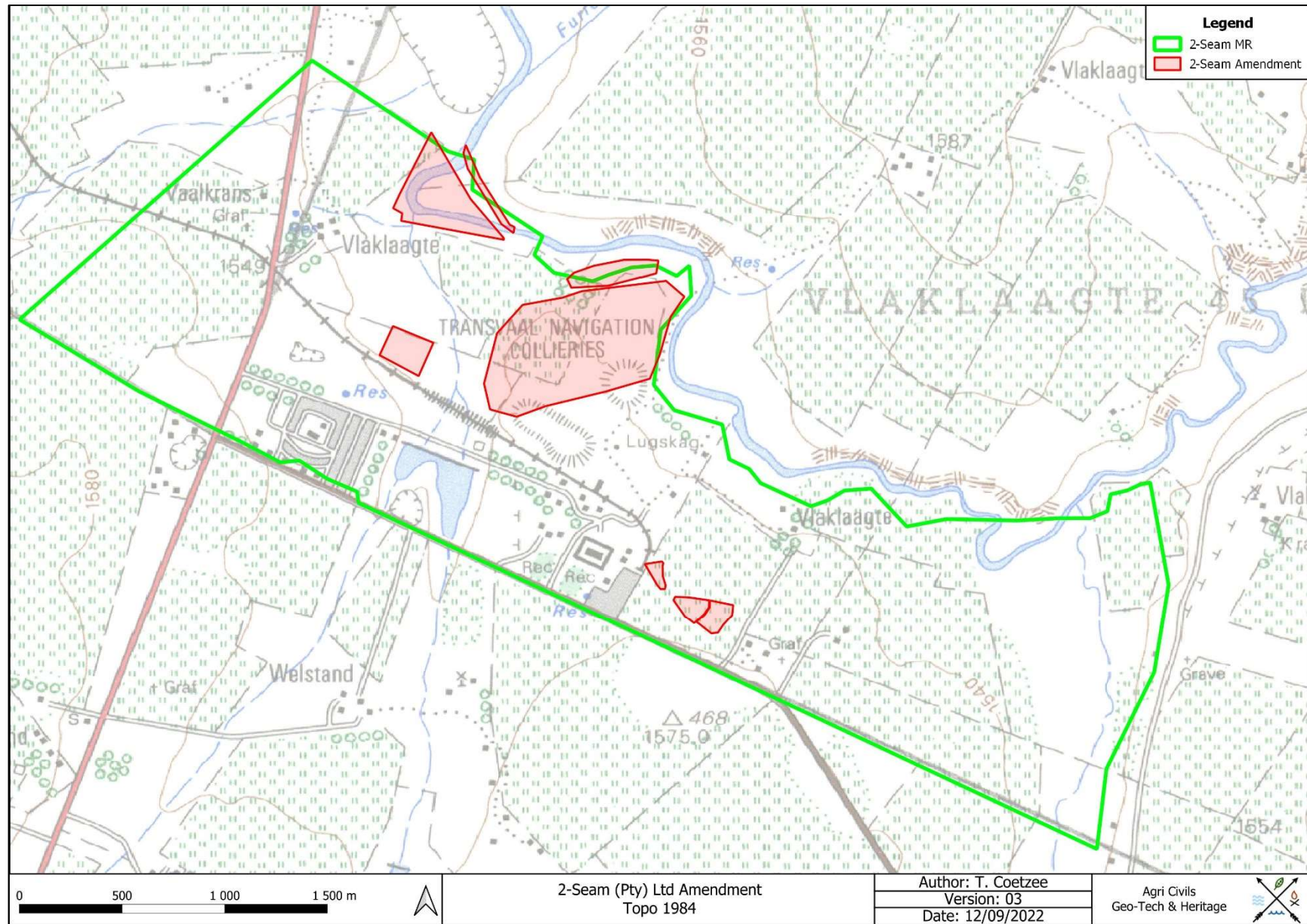


Figure 30: Study area superimposed on a 1984 topographical map.





Figure 31: Study area superimposed on a 1991 aerial image.



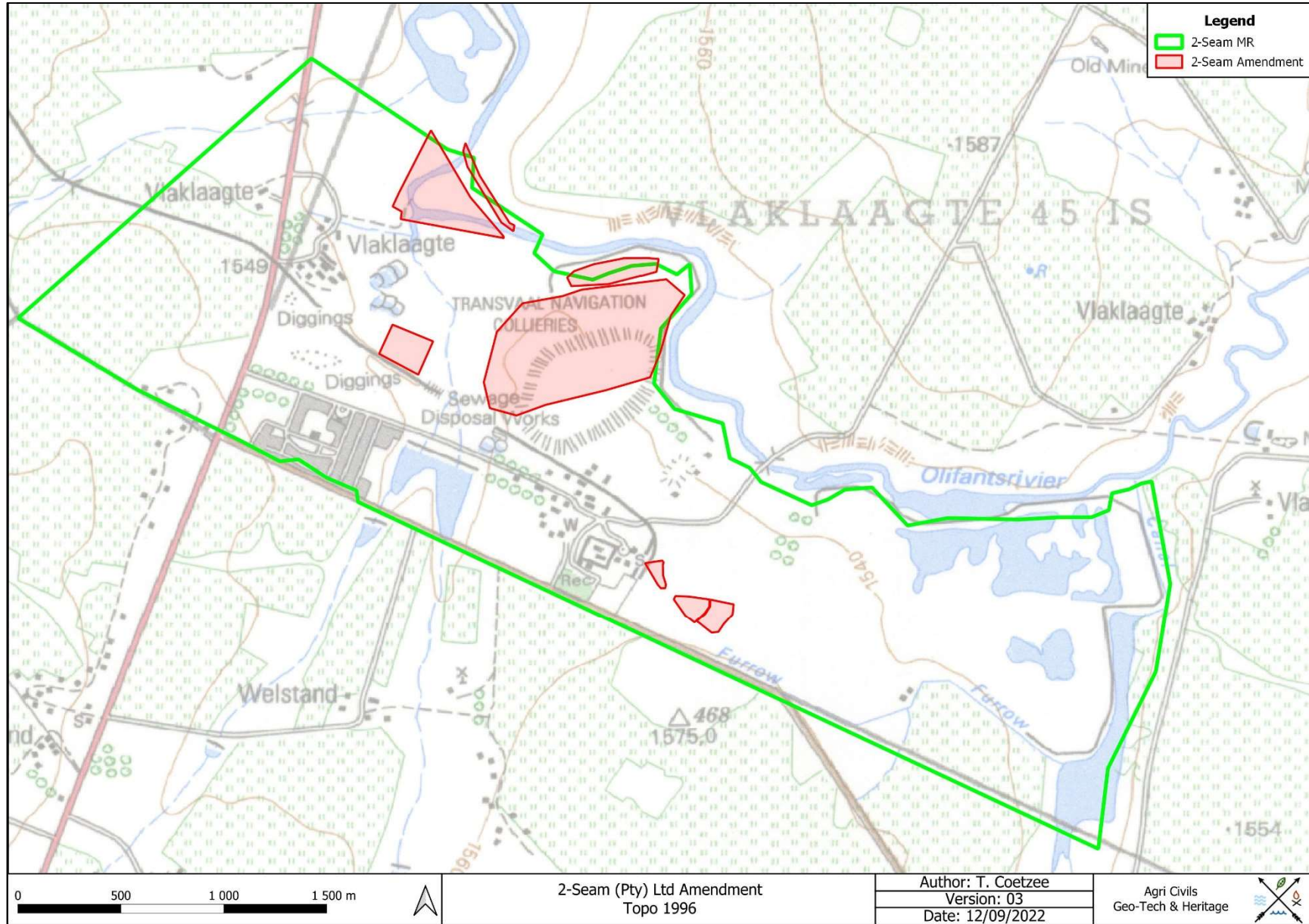


Figure 32: Study area superimposed on a 1996 topographical map.



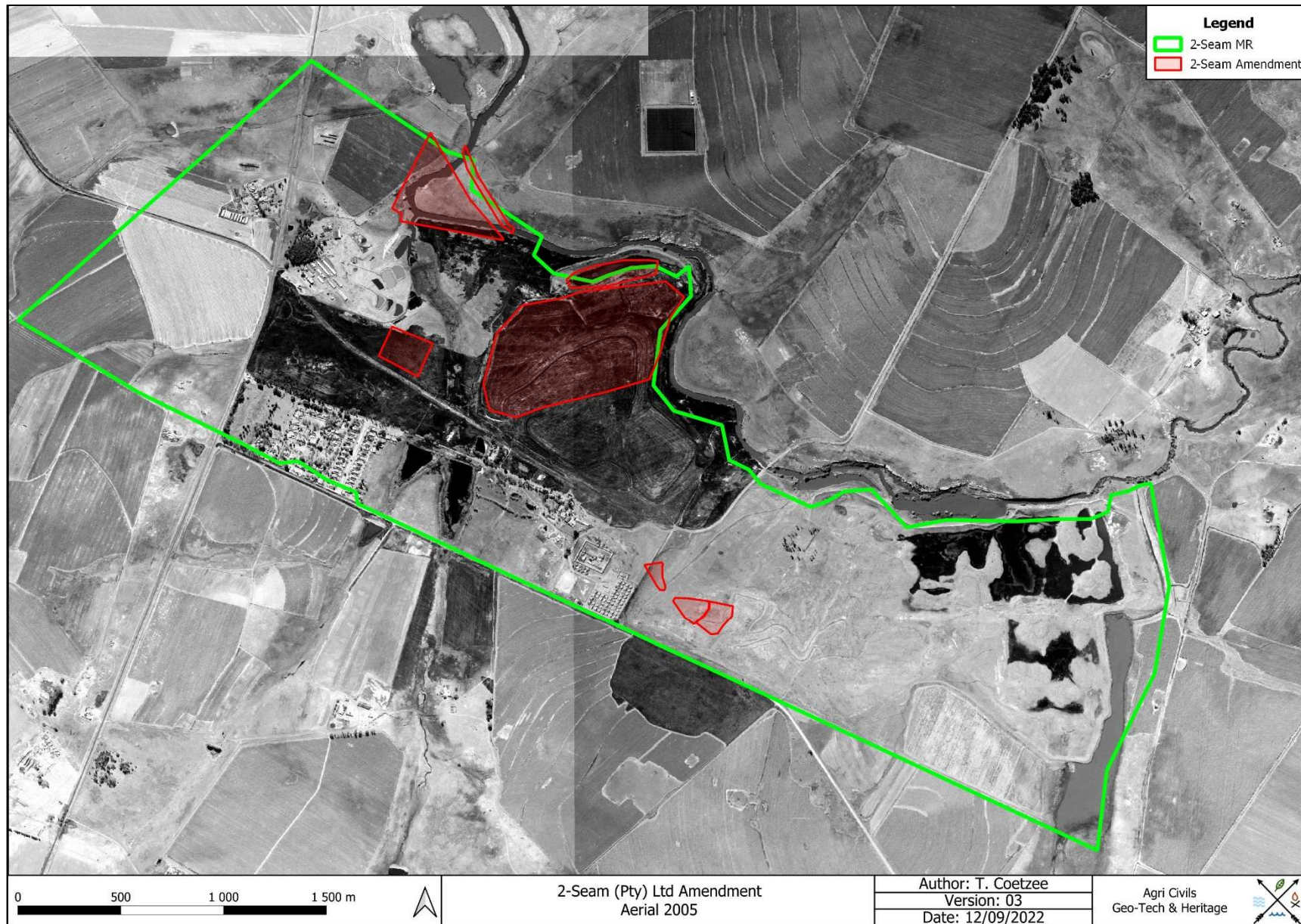


Figure 33: Study area superimposed on a 2005 aerial image.



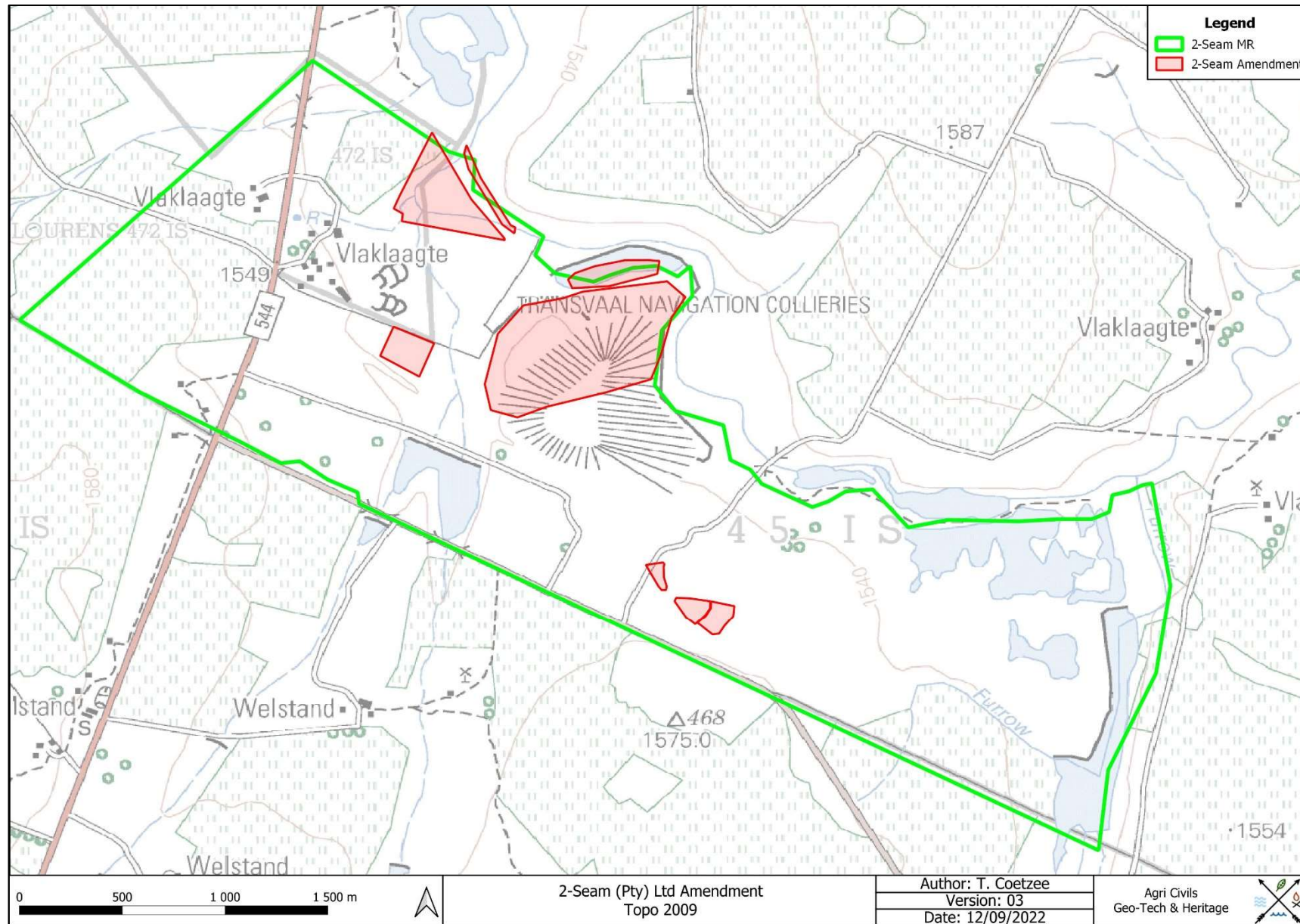


Figure 34: Study area superimposed on a 2009 topographical map.



Appendix B: NEMA Risk Assessment Methodology

1.1 RISK ASSESSMENT

The first stage of impact assessment is the identification of environmental activities, aspects and impacts. The receptors and resources are also identified, which allows for an understanding of the impact pathway and assessment of the sensitivity to change.

The purpose of the rating is to develop a clear understanding of influences and processes associated with each impact. The values for the likelihood and consequence (severity, spatial scope and duration) of the impact are then used to determine whether mitigation is necessary.

1.1.1 Methodology used in Determining the Significance of Environmental impacts

The Environmental Impact Assessment (EIA) 2014 Regulations [as amended] promulgated in terms of Sections 24 (5), 24M and 44 of the National Environmental Management Act, 1998 (Act No. 107 of 1998) [as amended] (NEMA), requires that all identified potential impacts associated with the project be assessed in terms of their overall potential significance on the natural, social and economic environments. The criteria identified in the EIA Regulations (2014) include the following:

- Nature of the impact;
- Extent of the impact;
- Duration of the impact
- Probability of the impact occurring;
- Degree to which impact can be reversed;
- Degree to which impact may cause irreplaceable loss of resources;
- Degree to which the impact can be mitigated; and
- Cumulative impacts.

The impact assessment methodology used to determine the significance of impacts prior and after mitigation is presented below



Extent of the impact

The EXTENT of an impact is the physical extent/area of impact or influence.

Score	Extent	Description
1	Footprint	The impacted area extends only as far as the actual footprint of the activity.
2	Site	The impact will affect the entire or substantial portion of the site/property.
3	Local	The impact could affect the area including neighbouring properties and transport routes.
4	Region	Impact could be widespread with regional implication.
5	National	Impact could have a widespread national level implication.

Duration of the impact

The DURATION of an impact is the expected period of time the impact will have an effect.

Score	Duration	Description
1	Short term	The impact is quickly reversible within a period of less than 2 y limited to the construction phase, or immediate upon the commencing of floods.
2	Short to medium term	The impact will have a short term lifespan (2–5 years).
3	Medium term	The impact will have a medium term lifespan (6 – 10 years)
4	Long term	The impact will have a medium term lifespan (10 – 25 years)
5	Permanent	The impact will be permanent beyond the lifespan of the development

Intensity of the impact

The INTENSITY of an impact is the expected amplitude of the impact.

Score	Intensity	Description
1	Minor	The activity will only have a minor impact on the affected environment in a way that the natural processes or functions are not affected.
2	Low	The activity will have a low impact on the affected environment.
3	Medium	The activity will have a medium impact on the affected environment function and process continue, albeit in a modified way.
4	High	The activity will have a high impact on the affected environment which be disturbed to the extent where it temporarily or permanently ceases
5	Very High	The activity will have a very high impact on the affected environment may be disturbed to the extent where it temporarily or permanently ceases



Reversibility of the impact

The REVERSIBILITY of an impact is the severity of the impact on the ecosystem structure

Score	Reversibility	Description
1	Completely reversible	The impact is reversible without any mitigation measures and management measures
2	Nearly completely reversible	The impact is reversible without any significant mitigation management measures. Some time and resources required.
3	Partly reversible	The impact is only reversible with the implementation of mitigation management measures. Substantial time and resources required.
4	Nearly irreversible	The impact is can only marginally be reversed with the implementation of significant mitigation and management measures. Significant time resources required to ensure impact is on a controllable level.
5	Irreversible	The impact is irreversible.

Probability of the impact

The PROBABILITY of an impact is the severity of the impact on the ecosystem structure

Score	Probability	Description
1	Improbable	The possibility of the impact occurring is highly improbable (less than 5% of impact occurring).
2	Low	The possibility of the impact occurring is very low, due either to circumstances, design or experience (5% to 30% of impact occurring).
3	Medium	There is a possibility that the impact will occur to the extent that provision must be made therefore (30% to 60% of impact occurring).
4	High	There is a high possibility that the impact will occur to the extent that provision must be made therefore (60% to 90% of impact occurring).
5	Definite	The impact will definitely take place regardless of any prevention plan and there can only be relied on migratory actions or contingency plans to contain the effect (90% to 100% of impact occurring).

Calculation of Impacts – Significance Rating of Impact






Significance is determined through a synthesis of the various impact characteristics and represents the combined effect of the Irreplaceability (Magnitude, Extent, Duration, and Intensity) multiplied by the Probability of the impact.

The significance of an impact is rated according to the scores as presented below:

Equation 1:

$$\text{Significance} = \text{Irreplaceability (Reversibility + Intensity + Duration + Extent)} \times \text{Probability}$$



Significance Rating		
Score	Significance	Colour Code
1 to 20	Very low	
21 to 40	Low	
41 to 60	Medium	
61 to 80	High	
81 to 100	Very high	

Mitigation Efficiency	
Degree to which the impact can be mitigated: <i>The effect of mitigation measures on the impact and its degree of effectiveness:</i>	
<i>Equation 2:</i>	
$Significance\ Rating = Significance \times Mitigation\ Efficiency$	
High	0,2
Medium to High	0,4
Medium	0,6
Low to Medium	0,8
Low	1,0

Confidence rating: *Level of certainty of the impact occurring.*

- **Certain**
- **Sure**
- **Unsure**

Cumulative impacts: *The effect the combination of past, present and “reasonably foreseeable” future actions have on aspects.*

- Very Low cumulative impact
- Low cumulative impact
- Medium cumulative impact
- High cumulative impact



Appendix C: Monitoring – Heritage

Site	Impact	Applicable Phase	Action	Frequency	Responsible person
All surface impacts	None foreseen	Construction/Development	Chance finds procedure	N/A	Mine

