PALAEONTOLOGICAL IMPACT ASSESSMENT REPORT

PROPOSED RESIDENTIAL DEVELOPMENT ON ERF 325, THEESCOMBE, NELSON MANDELA BAY METROPOLITAN MUNICIPALITY, GQEBERGHA, EASTERN CAPE, SOUTH AFRICA

PREPARED FOR:

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EXECUTIVE SUMMARY

This report presents the findings of the Palaeontological Impact Assessment (PIA) for the proposed residential development on Erf 325, Theescombe, Nelson Mandela Bay Municipality, Gqeberha. Engineering Advice & Services (Pty) Ltd has been appointed to conduct an environmental impact assessment on the environmental aspects relevant to the current project area. As part of the environmental impact assessment, a palaeontological heritage assessment and site sensitivity verification are deemed essential. This process encompasses a desktop study along with a field-based assessment. The assessment is conducted following the Environmental Impact Assessment (EIA) regulations of 2014, as published in the Government Notice under section 24(5) of the National Environmental Management Act (Act No. 107 of 1998).

The proposed development of Erf 325 Theescombe spans an area of 17.438 hectares. The development intends to accommodate 412 units, with additional provisions for a gatehouse and a community center. The total built-up area will be 34,656 square meters. Parking provisions include 633 bays. 74,800 square meters of open space is provided. Infrastructural development includes the installation of utilities such as water supply, sewage, electrical, and communication lines, ensuring proper drainage systems are in place, and constructing internal roads, pathways, and parking areas.

The proposed development site is in the Schelm Hoek Formation, characterized by Land snails, land vertebrate bones, peats & root casts, shell middens, LSA stone tools. The development plan for this site entails the excavation of superficial sediments, reaching several meters below the surface, which could lead to the exposure of fresh sediment layers. These actions potentially pose a risk to the preservation of any potential palaeontological resources in the immediate vicinity.

Preliminary palaeosensitivity mapping, conducted using the DFFE screening tool, designates the project area as possessing a High palaeosensitivity. Nevertheless, following field assessment and a comprehensive review of existing research findings, the current evaluation is deemed to possess relatively Low paleontological significance.

In view of this assessment, it is essential to highlight that the proposed development is considered both viable and suitable for this location, with no anticipated adverse impacts on the paleontological heritage of the region.

DECLARATION

I, Ryan Nel , declare that –

General declaration:

- I act as the independent Specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting environmental impact assessments, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations, and all other applicable legislation;
- I will take into account, to the extent possible, the matters listed in regulation 8 of the regulations when preparing the application and any report relating to the application;
- I have no, 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;
- I will ensure that information containing all relevant facts in respect of the application is distributed or made available to interested and affected parties and the public and that participation by interested and affected parties is facilitated in such a manner that all interested and affected parties will be provided with a reasonable opportunity to participate and to provide comments on documents that are produced to support the application;
- I will ensure that the comments of all interested and affected parties are considered and recorded in reports that are submitted to the competent authority in respect of the application, provided that comments that are made by interested and affected parties in respect of a final report that will be submitted to the competent authority may be attached to the report without further amendment to the report;
- I will keep a register of all interested and affected parties that participated in a public participation process; and
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not
- all the particulars furnished by me in this form are true and correct.
- will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations; and
- I realise that a false declaration is an offense and is punishable in terms of section 24F of the Act.

Disclosure of Vested Interest (delete whichever is not applicable)

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remuneration for work performed in terms of the Amendments to Environmental Impact Assessment Regulations, 2014 as amended.

Signature of the specialist:

Ryan Nel

Name of company

Date: 24 June 2024

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ABBREVIATIONS

EIA - Environmental Impact Assessment

NEMA - National Environmental Management Act

DFFE - Department of Forestry, Fisheries and the Environment

SAHRA - South African Heritage Resource Agency

ECPHRA - Eastern Cape Province Heritage Resources Authority

IDZ - Industrial Development Zone

ECO - Environmental Compliance Officer

LSA - Later Stone Age

GPS - Global Positioning System

1. INTRODUCTION

1.1. BACKGROUND INFORMATION OF THE PROJECT

Engineering Advice & Services (Pty) Ltd has been appointed to conduct an environmental impact assessment of the environmental aspects relevant to the current project area (Fig. 1). Engineering Advice & Services (Pty) Ltd appointed Mr. Ryan Nel, an independent palaeontology specialist to conduct a Palaeontological Impact Assessment for Erf 325 Theescombe, Gqeberha, Eastern Cape province (Fig. 1). The assessment adheres to the terms of the Environmental Impact Assessment (EIA) regulations 2014, as published in the Government Notice in terms of section 24(5) of the National Environmental Management Act (Act No 107 of 1998).

Project details:

The proposed development on Erf 325 Theescombe encompasses a development plan utilizing the site area of 174,380 square meters (Fig. 2). The development will consist of 412 units, including residential, gatehouse, and community center areas. The unit area will cover 34,346 square meters, the gatehouse will occupy 60 square meters, and the community center will take up 250 square meters, resulting in a total built-up area of 34,656 square meters. The coverage area, including these structures, amounts to 23,068 square meters.

The development plan includes a parking provision strategy. A total of 618 parking bays are needed, broken down into 530 bays for residential units, 103 bays for visitors, and 5 bays for paraplegic use. The open space within the development is 74,800 square meters (Fig. 2).

Construction Activities

- Site preparation, including clearing and excavation.
- Foundation work for residential units, gatehouse, and community center.
- Construction of residential buildings, gatehouse, and community center.
- Installation of utilities (water, electricity, sewage).
- Road and parking area construction.
- Landscaping and creation of open spaces.

The Independent Environmental Practitioner responsible for the coordinating and management of the proposed development is Engineering Advice & Services (Pty) Ltd. Contact details: Ms. Lea Jacobs. Tel: 041 581 2421. E-mail: enviro@easpe.co.za/ Mr. Kurt Wicht. Tel: 041 581 2421. Email: kurtw@easpe.co.za.

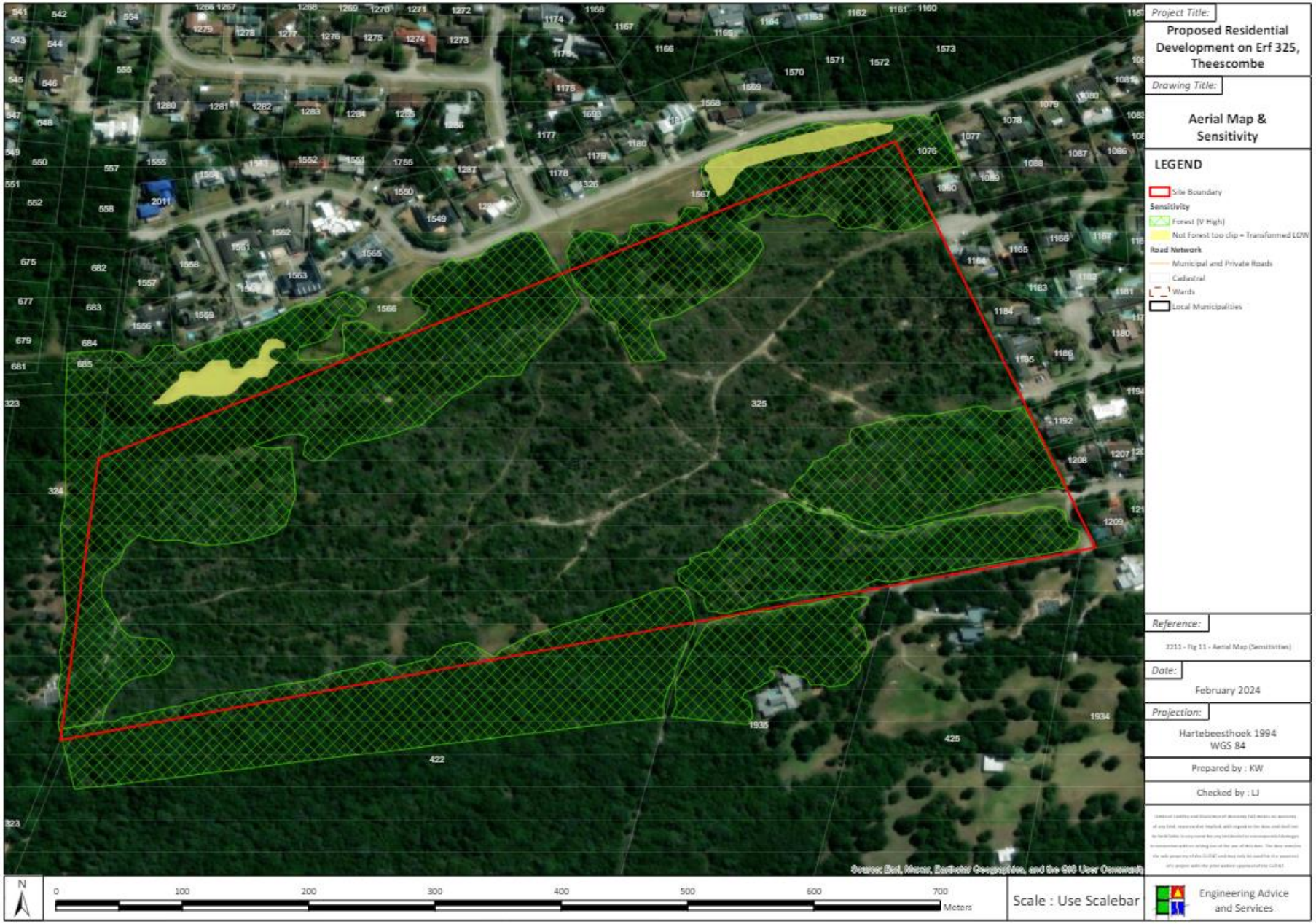

Figure 1: Aerial photograph showing the proposed residential development of Erf 325, Theescombe (Image provided by Engineering Advice and Services).

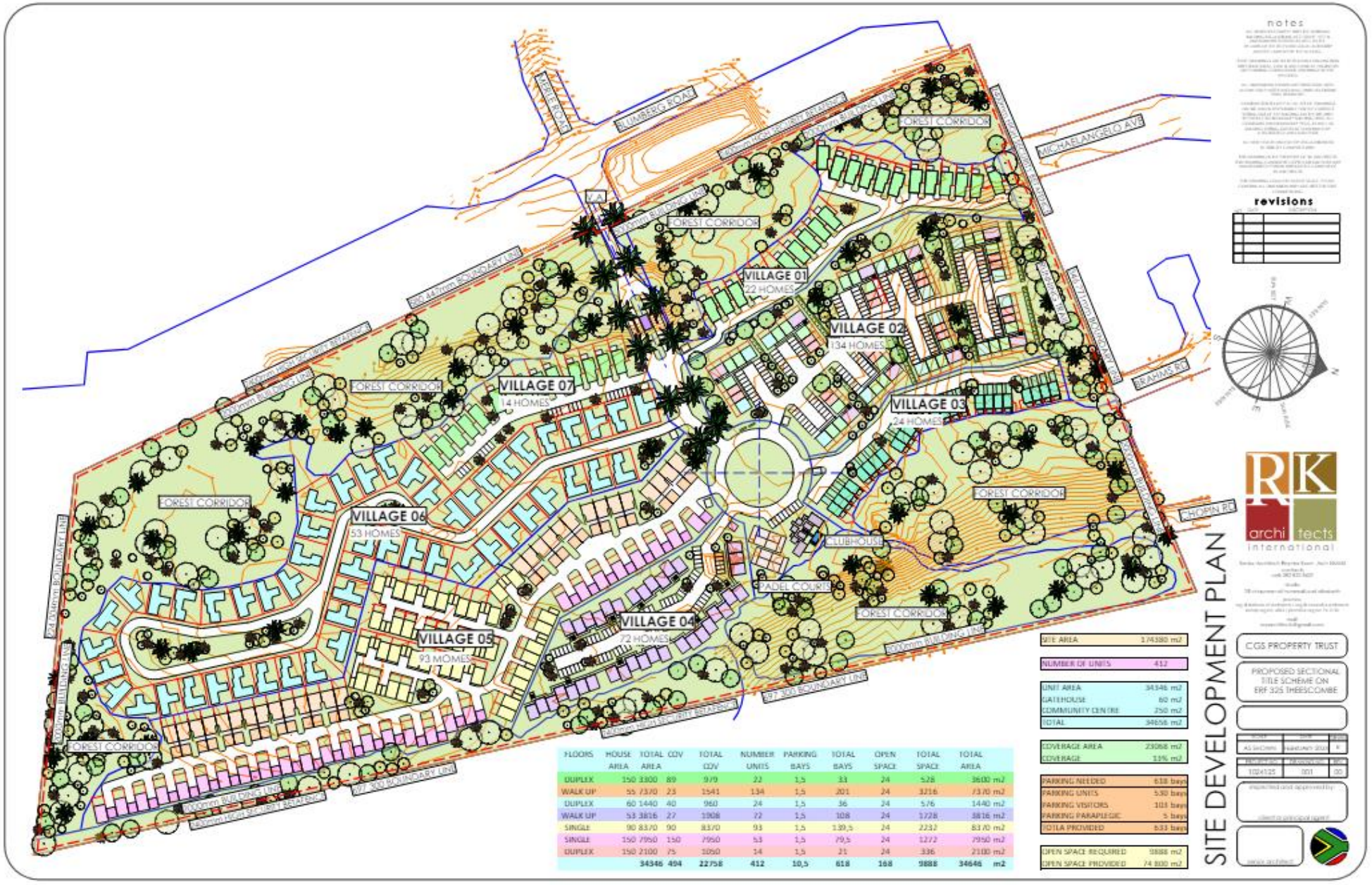

Figure 2: A detailed site layout of the proposed residential development of Erf 325, Theescombe (Image provided by Engineering Advice and Services).

1.2. TERMS OF REFERENCE

The execution of this palaeontological report forms part of the Heritage Impact Assessment in terms of Section 38 (2a) and includes the evaluation process required to identify and assess the palaeosensitivity of the development site, subsequently providing recommendations for mitigation purposes (if applicable).

The palaeontological study will encompass the following terms of reference:

i. Adhere to the content requirements for specialist reports following Appendix 6 of the EIA Regulations 2014, as amended.
ii. Provide a comprehensive summary of the relevant legislation governing palaeontological heritage.
iii. Provide a description of the proposed development property and the affected environment.
iv. Description of the geological setting and the rock units present.
v. Provide a comprehensive background description of the palaeontology anticipated in the area.
vi. Conduct a non-intrusive site inspection by national legislation requirements.
vii. Identify any significant palaeontological remains.
viii. Assess the sensitivity of palaeontological remains present on the site.
ix. Provide a field rating/grading in terms very high, high, medium and low.
x. Propose and outline mitigatory measures designed to safeguard and preserve any valuable palaeontological sites and remains that may be discovered within the proposed site.
xi. Prepare and submit any necessary permit applications to the relevant authorities per regulatory requirements if required.

1.3. LEGISLATIVE CONTEXT FOR PALAEONTOLOGICAL ASSESSMENT

All heritage resources are protected by the National Heritage Act (Act 25 of 1999). The current palaeontological report forms part of the Heritage Impact Assessment under Section 35 and Section 38 of this Act.

According to Section 35 of the National Heritage Resources Act, dealing with archaeology, palaeontology, and meteorites (In reference to palaeontological, archaeological, and meteorite resources found in South Africa):

(1) the protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.

(2) all archaeological objects, palaeontological material and meteorites are the property of the State.

(3) Any person who discovers archaeological or palaeontological objects or material or a meteorite in the course of development or agricultural activity must immediately report the find to the responsible heritage resources authority, or to the nearest local authority offices or museum, which must immediately notify such heritage resources authority.

(4) 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 that assists in the detection or recovery of metals or archaeological and palaeontological material or objects, or use such equipment for the recovery of meteorites.

(5) When the responsible heritage resources authority has reasonable cause to believe that any activity or development that will destroy, damage, or alter any archaeological or palaeontological site is underway, and where no application for a permit has been submitted and no heritage resources management procedure in terms of section 38 has been followed, it may –

(*a*) serve on the owner or occupier of the site or on the person undertaking such development an order for the development to cease immediately for such period as is specified in the order;

(*b*) carry out an investigation to obtain information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary;

(*c*) if mitigation is deemed by the heritage resources authority to be necessary, assist the person on whom the order has been served under paragraph (a) to apply for a permit as required in subsection (4); and

(*d*) recover the costs of such investigation from the owner or occupier of the land on which it is believed an archaeological or palaeontological site is located or from the person proposing to undertake the development if no application for a permit is received within two weeks of the order being served.

(6) The responsible heritage resources authority may, after consultation with the owner of the land on which an archaeological or palaeontological site or a meteorite is situated, serve a notice on the owner or any other controlling authority, to prevent activities within a specified distance from such site or meteorite.

According to Section 38 (1), a Heritage Impact Assessment is necessary to assess any potential impacts on palaeontological heritage within the development footprint where:

(a) the construction of a road, wall, power line, pipeline, canal, or other similar form of linear development or barrier exceeding 300 m in length;
(b) the construction of a bridge or similar structure exceeding 50 m in length;
(c) any development or other activity which will change the character of a site—
    i. exceeding 5 000 m2 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
v. the re-zoning of a site exceeding 10 000 m² in extent;
vi. or any other category of development provided for in regulations by SAHRA or a Provincial heritage resources authority.

1.4. METHODOLOGY

1.4.1. DESKTOP STUDY

A comprehensive literature review was conducted to identify the geology and significant fossil-bearing layers within the study area. This study incorporates data from published scientific materials (see reference list), previous palaeontological impact assessments (see reference list), and consultations with palaeontology specialists. Based on the collected literature, a preliminary assessment is made to determine the palaeontological sensitivity of the strata.

1.4.2. FIELD SURVEY

The field survey for this assessment was conducted on the 26th of February 2024. It involved a non-intrusive site inspection to identify and document potential palaeontological resources. Thirty representative Global Positioning System (GPS) points were recorded to capture data points across the project area. The site, characterized by moderately sloped undulating hills and valleys covered with dense grassland and trees, presented physical challenges such as dense vegetation and limited exposed bedrock, which restricted detailed observation and direct access to some areas.

Data acquisition for the PIA report incorporated various methods and tools:

- Satellite Imagery: Google Earth satellite imagery and geological maps (CGS) were used to identify areas of interest. Palaeontology sensitivity map was obtained from the SAHRIS website.
- GPS Mapping: During the field survey, GPS coordinates were recorded and later imported into Google Earth. This map helped document and analyze the spatial distribution of palaeontological resources within the site.
- Field Equipment: Standard field survey equipment, including GPS devices and digital cameras, was used to document the site and capture photographic evidence of the findings at each GPS point.

1.4.3. FIELD RATING

Based on the field survey a field rating is provided for the project (Appendix 1).

1.4.4. EVALUATION OF IMPACT

Based on the project description and field survey a rating is calculated (Appendix 2).

1.5. ASSUMPTIONS AND LIMITATIONS

The effectiveness and precision of palaeontological specialist studies, as integral components of heritage impact assessments, are limited by several factors, as outlined by Almond (2014).

1.5.1. ASSUMPTIONS

- Palaeontological desktop studies often require extrapolation of fossil data from comparable rock units in other locations due to the limited number of palaeontological studies in most regions of South Africa.
- Field assessments by experienced palaeontologists can significantly improve the reliability of palaeontological impact assessments, especially in areas with substantial bedrock or fossil-rich sediments.
- Areas outside the immediate project site, such as riverbanks, erosional gullies, and burrowing pits, can provide essential information about the underlying strata.
- Fossils are often found in subsurface strata and may be covered by surface deposits like soil and vegetation.
- Observing subsurface strata often involves examining exposed bedrock in nearby locations or even from exposures further away from the study site.

1.5.2. LIMITATIONS

- The absence of a comprehensive South African fossil heritage database.
- Varying accuracy levels in geological maps, affecting the reliability and precision of desktop studies.
- Insufficient explanations accompanying geological maps.
- Unavailability of published palaeontological materials.
- Lack of a dependable database cataloging fossil collections within South African institutions.
- Neglecting on-site walkovers during palaeontological desktop studies, which can undermine the reliability and precision of the study.
- Limited palaeontological studies conducted in most regions of South Africa, leading to reliance on extrapolation from other locations.

**It should be noted that not all assessed areas yield fossils. In most cases, fossils are primarily found embedded in subsurface strata, often covered by surface deposits such as soil and vegetation. Therefore, to observe the subsurface strata, a palaeontologist may examine exposed bedrock in nearby locations, preferably within the vicinity of the study area. Additionally, data obtained from exposures further away from the site can also provide valuable information about the underlying strata.*

2. DESCRIPTION OF PROPERTY OR AFFECTED ENVIRONMENT

2.1. GENERAL LOCATION

Table 1: General location of Erf 325 (refer to figure 3, figure 4, and figure 5 for reference images).

Property information	
Farm and Number	Erf 325
Property type	Erven
Local Municipality	Nelson Mandela Bay Metropolitan Municipality
District Municipality	Nelson Mandela Bay Metropolitan Municipality
Nearest Town	Gqeberha
Province	Eastern Cape
Country	South Africa
Current Use	None
Previous Use	-
Coordinates	
Erven	34° 0'19.46"S 25°32'33.61"E.
Topography	
Elevation	130m
Slope	Low
Landforms	Gently in areas
Hydrology	
Water bodies	-
Wetland	-
Drainage patterns	-
Boreholes	-
Vegetation	
Type of vegetation	Shrubs, trees and grass
Built Environment	
Buildings & structures	None on the project site
Property boundaries	None, fences towards the south
Nearby infrastructure (50m zone)	Glendore Road is located to the east, Blumberg Road is to the north.
Additional notes	The property is in the southern outskirts of Gqeberha, amidst urban and suburban zones, characterised by a mixed park and residential development areas. The property can be accessed via Glendore Road or Blumberg Road. Noticeable roads in the area include the M9 to the north, Victoria Drive to the east and Sardinia Bay Road to the south. To the north, Mount Pleasant Primary School, to the west, Craig Bertram Smith Studio is marked, to the east, The Bush Camp, with Stone Castle in the southeast. The property I also bordered by the Sardinia Bay Nature Reserve to the south and Sylvic Nature Reserve to the southwest.

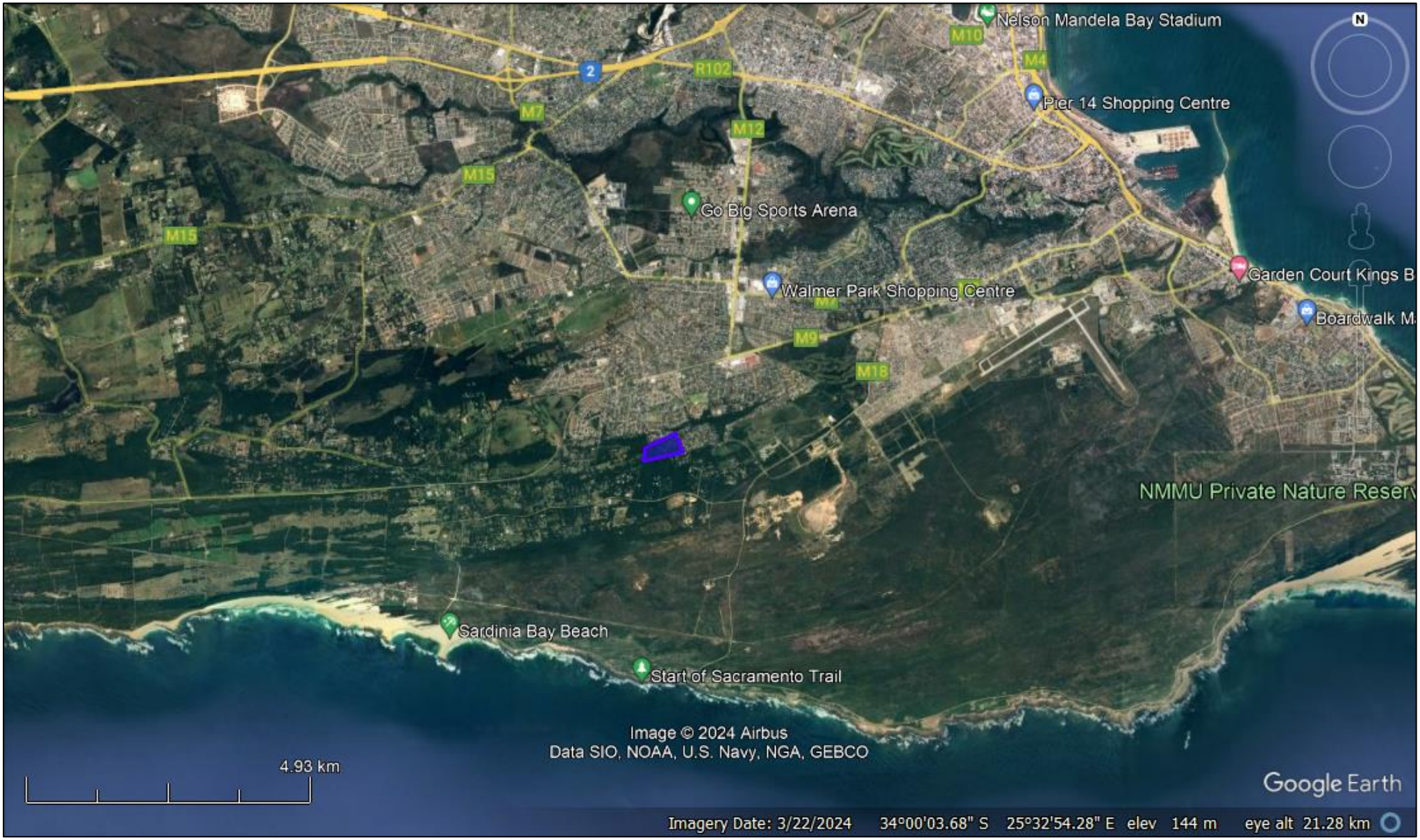

Figure 3: Aerial photograph of the development site (blue polygon) relative to its larger surroundings.

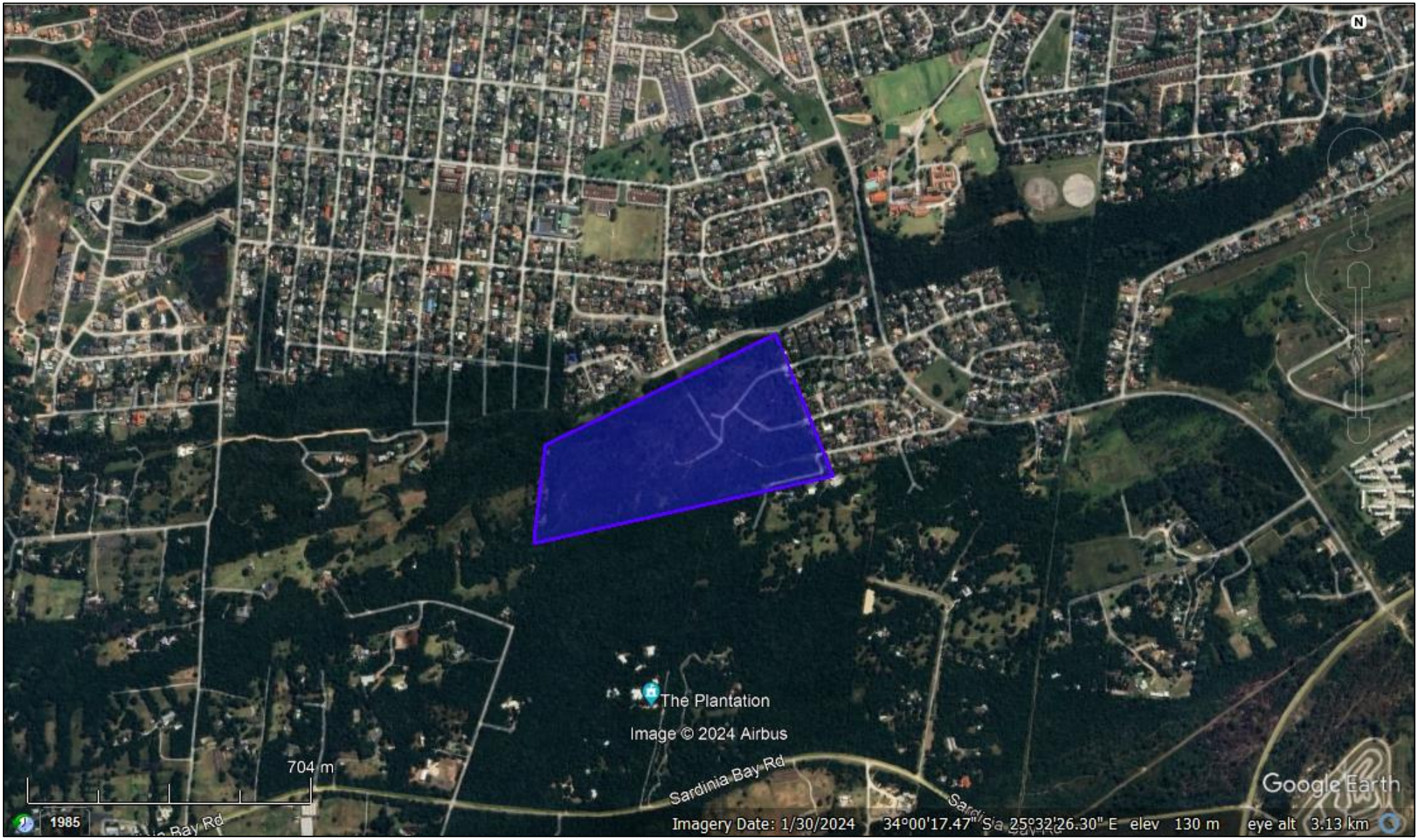

Figure 4: Aerial photograph of the development site (blue polygon) relative to its immediate surroundings.

Figure 5: A section of the 1:250 000 topographic map, sheet 3324 Port Elizabeth, highlighting the project (blue polygon) relative to its geographic surroundings.

3. GEOLOGY

The geology in the study area is shown on the 1:250 000 scale geological map, Port Elizabeth sheet 3324, as documented by the Council for Geoscience in Pretoria (Toerien & Hill, 1989) (Fig. 6 & Table 2)). The area is completely underlain by sediments of the Schelm Hoek Formation (Qw) of the Algoa Group. Sedimentary deposits of the Nanaga Formation (T-Qn), Algoa Group, are present towards the north, outside of the development area.

3.1. ALGOA GROUP

The Algoa Group forms part of the upper lithological unit of deposits in the larger Algoa Basin. The Algoa Basin is one of several Mesozoic sedimentary basins located along the southeastern margin of South Africa, forming a 3900 km² onshore extension of the large offshore Outeniqua basin (Chabangu, et al., 2014). The Algoa Basin is characterised by several extensional-rift-related half-graben structures that formed between approximately 155–135 Ma (Watkeys, 2006), during the initial breakup of Gondwana in the Mid-Jurassic.

The Algoa Group consists of a complex mix of sedimentary deposits and constitutes one of several onshore coastal units situated along the South African coastline. These deposits formed because of recurrent marine transgression and regression events during the late Cenozoic period (Ruddock, 1968; Roberts, et al., 2006; Hassan, et al., 2022). The dominant sediment types found within the Algoa Group formations include marine and aeolian-derived calcareous sandstones, sandy and shelly clastic limestones, conglomerates, and coquinite (Almond, 2010). A number of these deposits contain a dense assemblage of finely fragmented marine shell material. Diagenetic processes modified these sediments over time, leading to the formation of well-consolidated calcareous rocks, characterised by white surface calcretes, or pedogenic limestone, which are often referred to as "coastal limestones." (Almond, 2010).

The Algoa Group comprises six distinct and unconformable calcareous formations: the Bathurst, Alexandria, Nanaga, Salnova, Nahoon, and Schelm Hoek formations. The Bathurst, Alexandria, and Salnova formations are associated with beach, nearshore, and estuarine deposits (Le Roux, 1990), whereas the Nanaga, Nahoon, and Schelm Hoek formations represent deposits from coastal dune fields (Le Roux, 2000). The marine-dominated formations are characterized by relatively thin deposits, with thicknesses ranging from 1 12 to 14 meters. The Bathurst Formation ranges from 1 to 12 meters, the Alexandria Formation from 3 to 14 meters, and the Salnova Formation from 1.5 to 6.5 meters. In contrast, the aeolian deposits are notably thicker, with measurements ranging from 150 meters to 140 meters. The Nanaga Formation varies from 150 to 250 meters, the Nahoon Formation from 6 to 50 meters, and the Schelm Hoek Formation reaches up to 140 meters (Le Roux, 1987).

The Algoa Group deposits unconformably or paraconformably overlie the tectonised metasedimentary rocks of the Cape Supergroup and parts of the Karoo Supergroup (Hassan et al., 2022).

3.1.1. SCHELM HOEK FORMATION

The Schelm Hoek Formation (Qw) is characterized by Holocene-aged sediments (Le Roux, 1990; Illenberger, 1992). The deposits mostly consist of unconsolidated calcareous aeolian sands (aeolianites). These sands continuously contribute to the development of dunes along the South Coast. While most dunes within this formation remain unconsolidated, some exhibit varying degrees of semi-consolidation, which can make it challenging to distinguish the formation from the underlying consolidated Nahoon Formation aeolianites.

The deposition of the Schelm Hoek Formation took place during the regression phase following the Mid Holocene transgressive peak, specifically known as the Flandrian transgression (Ramsay & Cooper, 2001). This transgression occurred approximately 4000-3000 years B.P and led to a rise in sea levels to approximately 2-3 meters above mean sea level. Dunes within this formation can reach a maximum thickness of 140 meters. Those located near the coast typically lack vegetation cover, while dunes situated further inland are stabilized by dense dune thicket vegetation, as documented by Almond (2010).

3.1.2. NANAGA FORMATION

The Nanaga Formation comprises high-angle cross-bedded calcareous sandstone and sandy limestone layers, with a thickness reaching approximately 150 meters (Maud & Botha , 2000). These sedimentary deposits are often visible along road cuttings on the N10 and R72 highways (Norman & Whitfield, 2006). Within these deposits, the sands range from semi-consolidated to well-consolidated, and the upper surface has undergone weathering, resulting in the formation of calcrete and soil rich in red clay (Almond, 2010).

The ancient dunes of the Nanaga Formation are typically preserved as rounded hills, often aligned parallel to the modern shoreline. The progressive decrease in sediment age towards the modern coastline suggests a period of marine regression during the deposition. Most of the Nanaga Formation deposits are covered by indigenous vegetation (Almond, 2010).

Table 2: Summary of the geology within the vicinity of the project area.

Age	**Group**	**Formation**	**Legend**	**Lithology**
Cenozoic, Quaternary, Holocene age	Algoa Group	Schelm Hoek Formation		Unconsolidated wind-blown sand
Cenozoic, Terriary, Pleistocene	Algoa Group	Nanaga Formation		Palaeosols, well-consolidated calcareous sandstone, aeolian cross-bedding

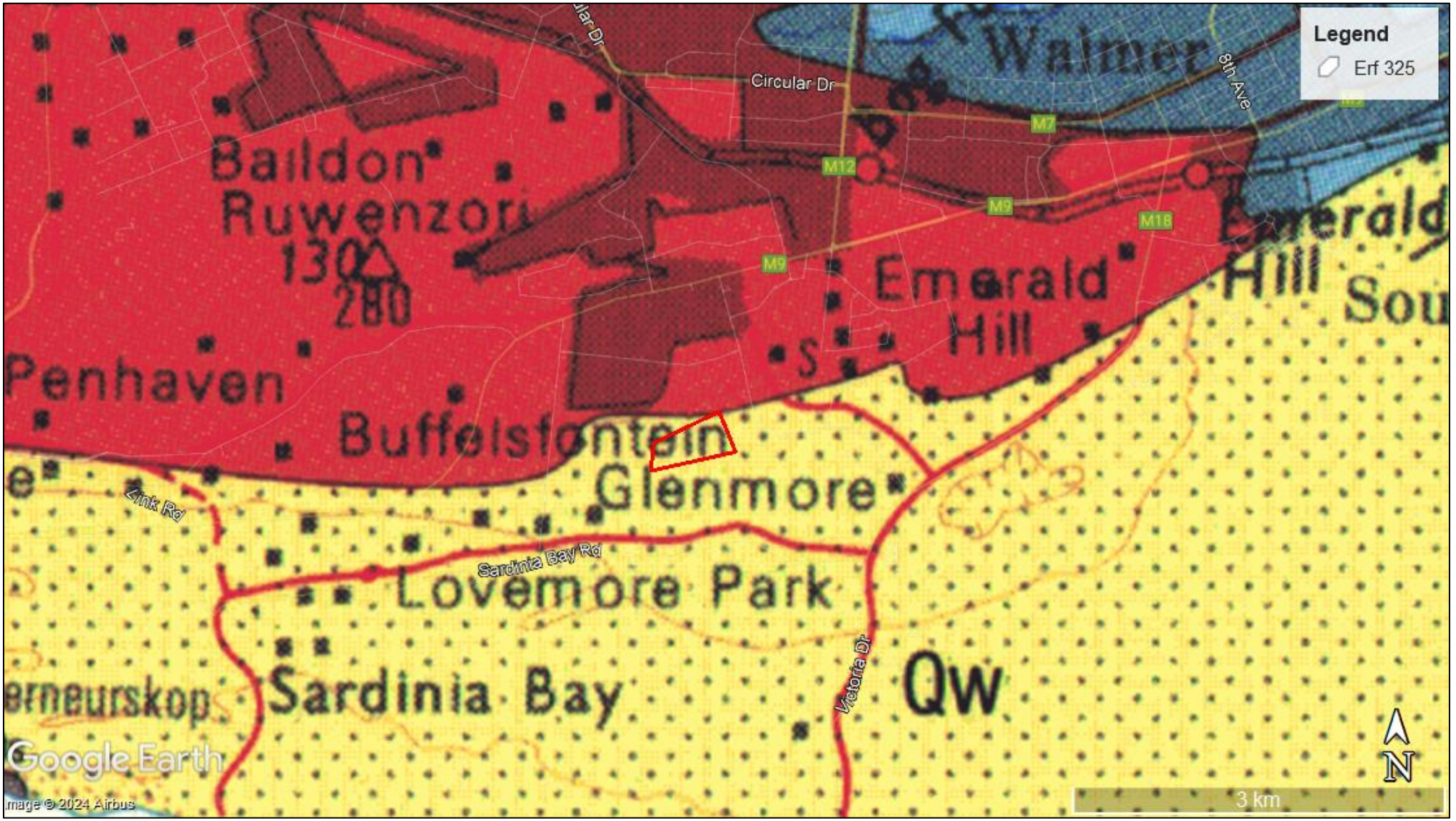

Figure 6: 1:250 000 scale geological map, Port Elizabeth, sheet 3324 (Council for Geoscience, Pretoria; (Toerien & Hill, 1989) indicating the underlying and surrounding geological units for the proposed development area (red polygon – Erf 325).

4. PALAEONTOLOGY

The proposed development site is largely located within the Schelm Hoek Formation, of the Algoa Group (Fig. 6). According to the PalaeoMap, obtained from the DFFE National Web-Based Environmental Screening Tool, the project area has been classified as having High palaeontological significance (Fig. 7).

In this section, an overview of all geological units present will be provided with a particular focus on the Schelm Hoek Formation and nearby Nanaga Formation. The project area is largely underlain by sparse fossil strata of the Holocene-aged Schelm Hoek Formation, and to the north, by Pliocene Nanaga Formation. A comprehensive record of the palaeontological heritage of the Coega area has been conducted by Almond (2010), which include the palaeontology of the Schelm Hoek Formation. A review of the fossil record in the project area follows below.

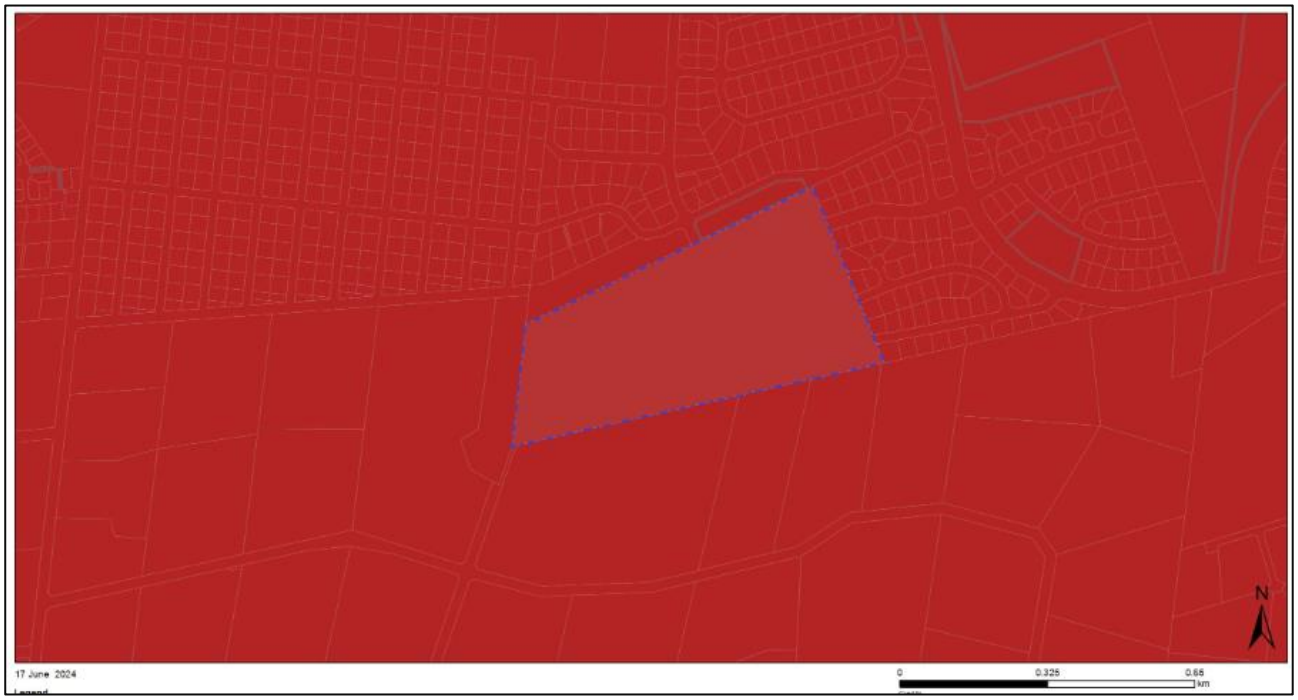

Figure 7: Palaeontological sensitivity map for Erf 325 Theescombe (blue polygon), obtained from the DFFE National Web-Based Environmental Screening Tool. The palaeontological sensitivity of the area has been classified as having a Very High palaeosensitivity. The sensitivity mapping is opposed in the current report and finds the area to have a Low palaeosensitivity.

4.1. ALGOA GROUP

4.1.1. SCHELM HOEK FORMATION

The palaeontological findings in this formation include land snails, land vertebrate bones, peats and root casts, shell middens, and Late Stone Age (LSA) stone tools (Almond, et al., 2008; Almond, 2010). The palaeosensitivity of the Schelm Hoek Formation is categorized as low (Almond, et al., 2008; Almond, 2010), suggesting that the potential for significant palaeontological discoveries impacting the project is minimal.

4.1.2. NANAGA FORMATION

Palaeontological evidence from this formation includes common land snails, calcified root casts, and possible termitaria (termite nests) (Almond, et al., 2008; Almond, 2010). These findings provide insights into the terrestrial environments that existed during the Pleistocene epoch. Like the Schelm Hoek Formation, the palaeosensitivity of the Nanaga Formation is considered low (Almond, et al., 2008; Almond, 2010), indicating a reduced likelihood of encountering significant palaeontological resources that could affect the project.

Table 3: Summary of the palaeontology within the vicinity of the project area.

Age	**Group**	**Formation**	**Palaeontology** (Almond, et al., 2008; Almond, 2010) & SAHRIS Palaeosensitivity map	**Palaeosensitivity**
Cenozoic, Quaternary, Holocene age	Agloa Group	Schelm Hoek Formation	Land snails, land vertebrate bones, peats & root casts, shell middens, LSA stone tools	High
Cenozoic, Terriary, Pleistocene	Agloa Group	Nanaga Formation	Common land snails, calcretised root casts, possible termitaria	High

5. FIELD SURVEY

A non-intrusive site investigation was conducted on the 26th of February 2024 by Mr. R. Nel. During the site survey, a comprehensive record of data on the geology and palaeontology was obtained, whereby 30 representative global positioning system points were documented (Fig. 8 & Fig. 9).

The assessment revealed that the project area is largely covered with dense grass, trees and bushes, often cross-cut by gravel roads or footpaths (Fig. 10, Fig. 11, Fig. 12, Fig. 13). Unconsolidated dune sand from the Schelm Hoek Formation was exposed along various abandoned gravel roads and footpaths (Fig. 14 - Fig. 19). Outcrops of the Schelm Hoek Formation dune sands were particularly well exposed along deep eroded footpaths and excavated areas in the central, eastern, southern and western part of the project area (Fig. 14 -Fig. 16 & Fig. 19 – Fig. 20).

Calcretised plant rootlets (rhizolith) were identified at the surface within the Schelm Hoek Formation dune sands (Fig. 21). The structures are preserved as individual columns within the unconsolidated sands.

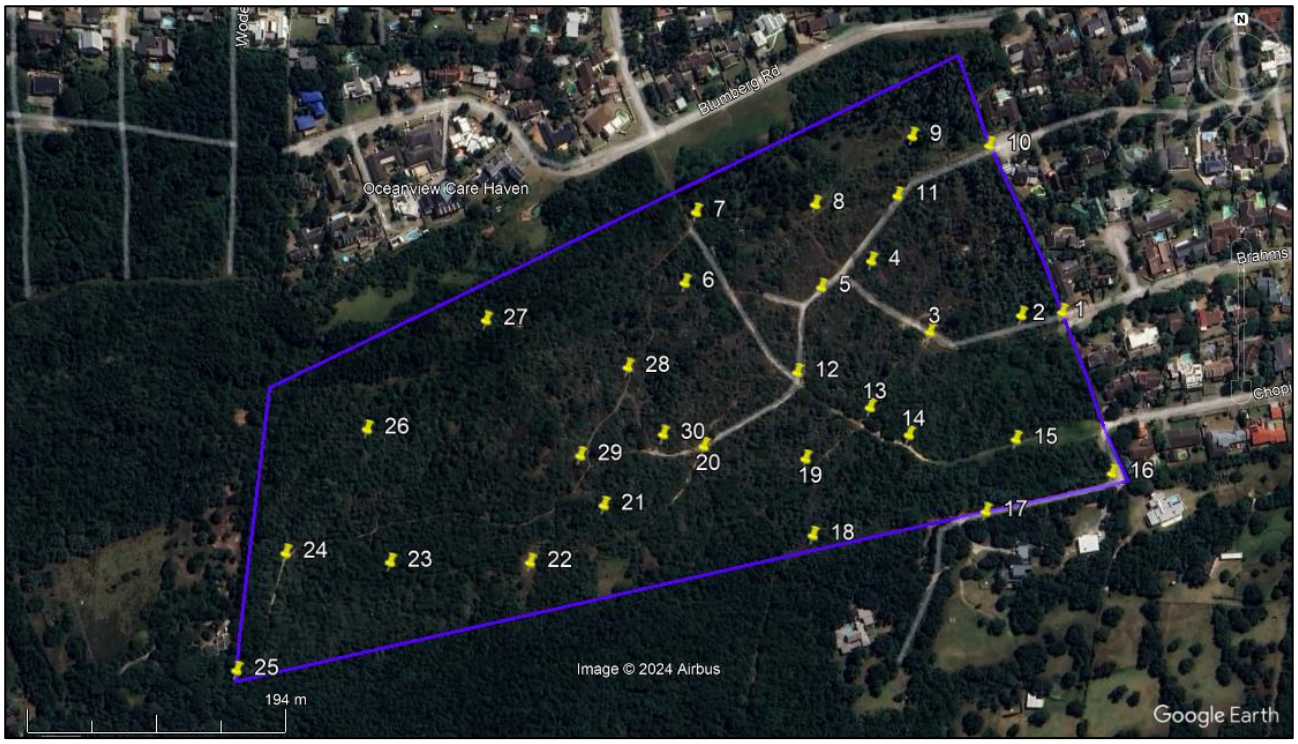

Figure 8: Aerial photograph of the proposed development site showing the recorded GPS coordinates (yellow pins).

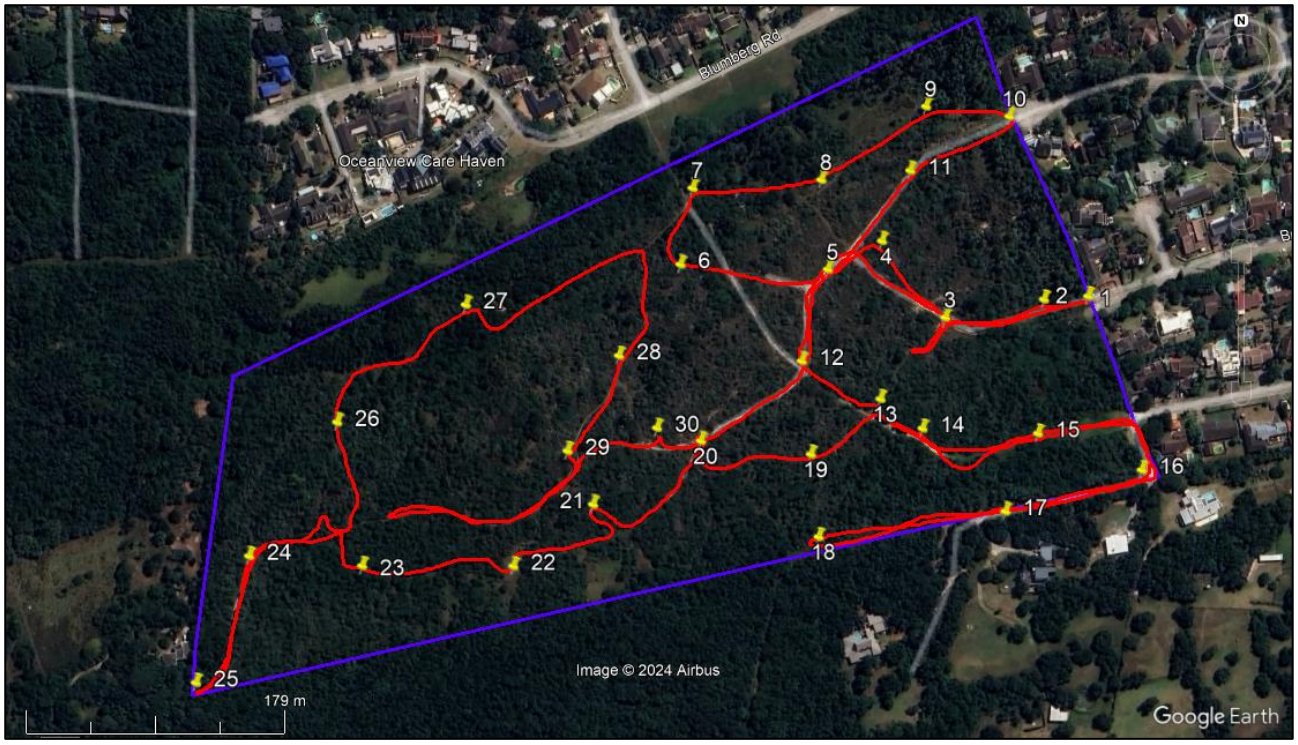

Figure 9: Aerial photograph of the proposed development site showing the recorded GPS coordinates (yellow pins) with the GPS track (red polygon).

Figure 10: Facing west, this image shows an abandoned gravel road with patches of underlying aeolian sand from the Schelm Hoek Formation visible amidst the vegetation (Point 3).

Figure 11: Dense vegetation covering the project area limiting the identification of the underlying strata. Image facing south (Point 20).

Figure 12: Dense vegetation covers the project area, limiting the identification of the underlying strata. The image is facing east (Point 8),

Figure 13: A view facing west from point 15 in the southeastern part of the study area, showcasing a green pathway flanked by dense vegetation.

Figure 14: Excavated material of the Schelm Hoek Formation dune sand in the central part of the study area, facing north. (Point 5)

Figure 15: Facing south along a footpath that forks at Point 7, exposing the dune sands of the Schelm Hoek Formation.

Figure 16: View facing west along a gravel road at Point 10 on the eastern side of the development area, exposing Schelm Hoek Formation dune sands.

Figure 17: This exposure of a hard cemented outcrop appears to be a remnant of previous construction activities rather than natural geological formations, as suggested by historical images of the area. The distinct lack of typical sedimentary layering and the presence of scattered debris further support that this feature is anthropogenic in origin. Point 30.

Figure 18: Outcrop of unconsolidated Schelm Hoek Formation dune sand along a footpath, illustrating loose sediment accumulation (Point 14).

Figure 19: Outcrop of the Schelm Hoek Formation dune sand showing unconsolidated light-coloured sand with root penetration at the top (Point 13).

Figure 20: Outcrop of the Schelm Hoek Formation dune sand next to a deeply eroded footpath on the southwestern side of the project area (Point 25), illustrating significant erosion and exposure of sediment layers.

Figure 21: Calcretized rootlet traces (rhizoliths) preserved near the surface in the Schelm Hoek Formation dune sands, Point 3. The image shows detailed structures and sediment composition, with a scale for size reference.

5. PALAEOSENSITIVITY RATING

The current assessment classifies the area as having a Low level of palaeontological significance (Tabel 4). Although the occurrence of rhizolith is present, these do not provide valuable information for scientific purposes (Fig. 21).

Table 4: Palaeontological sensitivity for the current project area (see Appendix 1).

Very High sensitivity	**High sensitivity**	**Medium sensitivity**	**Low sensitivity**
			X
Sensitivity	**Feature (s)**		
Low	Features with a Low palaeontological sensitivity		
Medium	Features with a Medium palaeontological sensitivity		
High	Features with a High palaeontological sensitivity		
Very High	Features with a Very High palaeontological sensitivity		

6. EVALUATION OF IMPACT ON PALAEONTOLOGICAL HERITAGE

The construction of the proposed residential development on Erf 325 and associated infrastructures will involve minor earthworks in localised construction footprints e.g. around each Erven or along interlinking access roads, water pipes or electricity. The proposed development activity may have a negative direct impact on the degradation of the underlying rocks and the palaeontology resources. There are no negative indirect impacts expected from a palaeontological perspective in the project area. It should be noted that the level of severity or the significance of the impacts is related to the nature and extent of the activity.

The main concern is during the construction phase, where direct impact on the underlying geological formations who has the potential to contain fossils, is likely. During construction, the development activities will entail excavations into the superficial sediment cover (e.g. soil) or even into the underlying bedrock. Excavations for foundations, underground cabling, and access roads in areas with underlying geological formations can negatively impact the bedrock. These activities may displace, destroy, or seal in fossil resources, making them unavailable for research.

However, the impact of such construction is not only negative. From a palaeontological perspective, the excavation processes also offer an opportunity to access fossil materials that might not be exposed to the surface. As rocks are uncovered and sediment layers are removed, previously hidden fossil resources may be exposed, providing new insights and data for scientific research. Careful management and monitoring of construction activities (see recommendations) can help mitigate negative impacts while maximizing the chances of uncovering new and valuable fossil information.

The current assessment assessed the proposed development on Erf 325, Theescombe, without mitigation measures is classified as low (negative). Assessment of the proposed development with mitigation measures remains low (negative). There are no anticipated adverse effects expected from a palaeontological perspective as no fossils were recorded during the current study which corresponds to previous work by Almond et al., 2009. Furthermore, excavations are likely to be

restricted and to a depth of less than a few meters which will have minimal effect on the surroundings. Alternative sites or site plans are not under consideration at this stage.

6.1. IMPACT ASSESSMENT RATING

Only the site will be affected (1). The impact of both the finding and the loss of fossils is assessed as permanent (5). The magnitude of the impact is low due to the scarce potential of fossil findings (4). It is improbable but possible that the impact will occur (2). The cumulative effect of the impact is considered Low (20). See Table 5 for the assessment rating.

Should the recommended mitigation measures for the construction phase of the development – as outlined in the Chance Fossil Finds Procedure (Appendix 1) – be fully implemented, the impact significance of the project remains Low.

Table 5: Impact assessment rating (Appendix 2 for Impact assessment rating methodology).

Nature: Palaeontology impact on the proposed residential development on Erf 325, Theescombe.		
	Without mitigation	**With mitigation**
Extend (E)	1	1
Duration (D)	5	5
Magnitude (M)	4	4
Probability (P)	2	2
Significance (E+D+M) P	20	20
Status	Low (Negative)	Low (Negative)
Reversibility	Irreversible	Irreversible
Irreplaceable loss of resources	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation	The ECO and supervisors must be aware of potential fossils during excavation. Report significant findings to authorities and involve a palaeontologist for assessment.	The ECO and supervisors must be aware of potential fossils during excavation. Report significant findings to authorities and involve a palaeontologist for assessment.

7. RECOMMENDATIONS

While mitigation measures are not mandatory, it is strongly recommended to follow the ensuing guidelines to ensure the discovery, preservation, and proper management of palaeontological resources during the proposed excavation and construction activities:

- The Environmental Compliance Officer responsible for project oversight should possess a comprehensive understanding of the potential presence of fossils within the project area. They must be well-informed about the likelihood of uncovering fossils when excavating into the underlying strata.
- Construction managers and supervisory personnel involved in the project should also be informed about the potential discovery of significant fossils on-site.
- During the excavation process, it is critical to conduct thorough inspections of any geological exposures encountered to identify the presence of fossil remains.
- If any fossils of significance, including trace fossils or invertebrates, are discovered, the ECO should promptly notify the appropriate authorities for further investigation (Appendix 3: Chance Fossil Finds Procedure).

8. CONCLUSIONS

The study area is primarily underlain by the Schem Hoek Formation, Algoa Group. The formation is characterized as having a **High** palaeontological sensitivity, however herein assessed as having a **Low** palaeontological sensitivity.

The potential impact of the proposed development on palaeontological resources is assessed as minimal. The risk of significant fossil discoveries that could be affected by the development activities is low.

However, to ensure that any unforeseen palaeontological resources are protected, a precautionary approach is recommended. This includes the implementation of a chance find protocol during construction to manage any unexpected fossil discoveries appropriately. Workers and contractors should be briefed on the importance of reporting any potential fossil finds immediately to a qualified palaeontologist. This recommendation aims to mitigate any unforeseen impacts on palaeontological heritage, ensuring that any significant discoveries are preserved and documented.

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APPENDIX 1: FIELD RATING

Rating category	Description
Very High	Formations/sites known or likely to include vertebrate fossils pertinent to human ancestry and palaeoenvironmental studies, and which are of international significance.
High	Assigned to geological formations known to contain paleontological resources that include rare, well-preserved fossil materials important to ongoing palaeoclimatic, palaeobiological, and/or evolutionary studies. Fossils of land-dwelling vertebrates are typically considered significant. Such formations have the potential to produce, or have produced, vertebrate remains that are the particular research focus of palaeontologists and can represent important educational resources as well.
Medium	Formations known to contain palaeontological localities that have yielded fossils that are common elsewhere, and/or that are stratigraphically long-ranging, would be assigned a moderate rating. This evaluation can also be applied to strata that have an unproven but strong potential to yield fossil remains based on its stratigraphy and/or geomorphologic setting.
Low	Formations that are relatively recent or that represent a high-energy subaerial depositional environment where fossils are unlikely to be preserved, or are judged unlikely to produce unique fossil remains. A low abundance of invertebrate fossil remains can occur, but the palaeontological sensitivity would remain low due to their being relatively common and their lack of potential to serve as significant scientific resources. However, when fossils are found in these formations, they are often very significant additions to our geologic understanding of the area. Other examples include decalcified marine deposits that preserve casts of shells and marine trace fossils, and fossil soils with terrestrial trace fossils and plant remains (burrows and root fossils).
Insignificant/Zero	Assigned to geologic formations that are composed entirely of volcanic or plutonic igneous rock, such as basalt or granite, and therefore do not have any potential for producing fossil remains. These formations have no paleontological resource potential.

Adapted from Society of Vertebrate Paleontology. 1995. Assessment and Mitigation of Adverse Impacts to Nonrenewable Paleontologic Resources - Standard Guidelines. News Bulletin, Vol. 163, pp. 22-27.

APPENDIX 2: IMPACT EVALUATION

EFFECT	**GEOGRAPHIC EXTENT/SPATIAL SCALE (E)**		
	Localized	At a localized scale and a few hectares in extent.	1
	Study area	The proposed site and its immediate environs.	2
	Regional	District and Provincial level.	3
	National	Country.	4
	International	Internationally.	5
	DURATION/TEMPORAL SCALE (D)		
	Very short term	Less than 1 year.	1
	Short term	Between 2 to 5 years.	2
	Medium-term	Between 5 and 15 years.	3
	Long term	Exceeding 15 years and from a human perspective almost permanent.	4
	Permanent	Resulting in a permanent and lasting change.	5
	MAGNITIDE/INTENSITY (M)		
	No potential	Formations entirely lacking fossils such as igneous rocks.	0
	Marginal	Limited probability for producing fossils from certain contexts at localized outcrops.	2
	Low	Depositional environment where fossils are unlikely to be preserved or are judged unlikely to produce unique fossil remains.	4
	Medium	Strong potential to yield fossil remains based on stratigraphy and/or geomorphologic setting.	6
	High	Formations known to contain palaeontological resources that include rare, well-preserved fossil materials.	8
	Very High	Formations/sites known or likely to include vertebrate fossils pertinent to human ancestry and palaeoenvironments and which are of international significance.	10
	PROBABILITY/LIKELIHOOD (P)		
	Very improbably	Probably will not happen.	1
	Improbable	Some possibility, but low likelihood.	2
	Probable	Distinct possibility of these impacts occurring.	3
	Highly probable	The impact is most likely to occur.	4
	Definite	The impact will occur regardless of prevention measures.	5

SIGNIFICANCE = (E+D+M) P		
<30	Low	The impact would not have a direct influence on the decision to develop in the area.
30-60	Medium	The impact could influence the decision to develop in the area unless it is effectively mitigated.
>60	High	The impact must have an influence on the decision process to develop in the area.

APPENDIX 3: CHANCE FOSSIL FIND PROCEDURE

Province & region	Eastern Cape, Nelson Mandela Bay Metropolitan Municipality
Responsible Heritage Resources Authority	ECPHRA (Eastern Cape Province Heritage Resources Authority
Rock unit(s)	Peninsula Formation, Table Mountain Group, Cape Supergroup
Potential fossils	Small marine invertebrates & trace fossils
ECO protocol	1. Once alerted to fossil occurrence(s): alert the site foreman, stop work in the area immediately (N.B. safety first!), safeguard site with security tape / fence / sandbags if necessary. _____ 2. Record key data while fossil remains are still in situ: • Accurate geographic location – describe and mark on site map / 1: 50 000 map/satellite image / aerial photo • Context – describe the position of fossils within stratigraphy (rock layering), depth below the surface • Photograph fossil(s) in situ with scale, from different angles, including images showing context (e.g. rock layering) _____ 3. If **feasible** to leave fossils in situ: • Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation • Ensure the fossil site remains safeguarded until clearance is given by the Heritage Resources Authority for work to resume 4. If **not feasibl**e to leave fossils in situ (emergency procedure only): • Carefully remove fossils, as far as possible still enclosed within the original sedimentary matrix (e.g. entire block of fossiliferous rock) • Photograph fossils against a plain, level background, with scale • Carefully wrap fossils in several layers of newspaper / tissue paper / plastic bags • Safeguard fossils together with locality and collection data (including collector and date) in a box in a safe place for examination by a palaeontologist • Alert Heritage Resources Authority and project palaeontologist (if any) who will advise on any necessary mitigation _____ 5. If required by Heritage Resources Authority, ensure that a suitably-qualified specialist palaeontologist is appointed as soon as possible by the developer. _____ 6. Implement any further mitigation measures proposed by the palaeontologist and Heritage Resources Authority.
Specialist palaeontologist	Record, describe, and judiciously sample fossil remains together with relevant contextual data (stratigraphy/sedimentology/taphonomy). Ensure that fossils are curated in an approved repository (e.g. museum/university / Council for Geoscience collection) together with full collection data. Submit Palaeontological Mitigation report to Heritage Resources Authority. Adhere to best international practice for palaeontological fieldwork and Heritage Resources Authority minimum standards.