

**PALAEONTOLOGICAL IMPACT ASSESSMENT OF THE PROPOSED UPGRADING OF
MAIN ROAD MR450 (R335) FROM MOTHERWELL TO ADDO WITHIN THE NELSON
MANDELS BAY MUNICIPALITY AND SUNDAYS RIVER VALLEY LOCAL
MUNICIPALITY, EASTERN CAPE PROVINCE**

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EXECUTIVE SUMMARY

The Department of Roads and Public Works (DRPW) appointed GIBB (Pty) Ltd as consulting engineers on the Upgrade of the Main Road MR450 (R335) between Motherwell and Addo within the Nelson Mandela Bay Municipality and Sundays River Valley Local Municipality. The upgrade will comprise of storm water drainage upgrades, widening and/or replacement of bridges and culverts and all associated road furniture. According to the National Heritage Resources Act (Act No 25 of 1999, section 38), a palaeontological impact assessment is required to detect the presence of fossil material within the proposed development footprint and to assess the impact of the upgrading of Main Road between Motherwell and Addo on the palaeontological resources.

The development area is completely underlain by sediments of the Sundays River and Kirkwood Formation of the Uitenhage Group as well as the Algoa Group. Although the Palaeontological sensitivity of these areas is rated as very high no fossils have been found during a field survey. Thus the impact on palaeontological material along the Motherwell-Addo upgrade is negligible and regarded as insignificant.

It is therefore recommended that **no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required for the commencement of this development**, pending the discovery or exposure of any fossil remains during the construction phase.

Should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a professional paleontologist.

The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

CONTENTS

1	INTRODUCTION	5
1.1	LEGISLATION	8
2	OBJECTIVE	9
3	GEOLOGICAL AND PALAEOLOGICAL HISTORY.....	10
3.1	GEOLOGY.....	10
3.2	PALAEOLOGY	10
4	GEOGRAPHICAL LOCATION OF THE SITE.....	13
4.1	MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002	13
5	METHODS	13
5.1	Assumptions and Limitations.....	14
6	FIELD OBSERVATIONS.....	14
7	FINDINGS AND RECOMMENDATIONS	19
8	REFERENCES	20

1 INTRODUCTION

Terratest (Pty) Ltd has been appointed as the independent Environmental Assessment Practitioners (EAP) on behalf of the Department of Public Works for the undertaking of the Environmental Impact Assessment process for the proposed Motherwell-Addo Road upgrade. The proposed development footprint is located within the Nelson Mandela Bay Municipality and the Sundays River Valley local Municipality in the Eastern Cape Province.

The project entails the upgrading of MR450 north of WM Maku Street in Motherwell to just south of Addo town (Figure 1-2). The length of the road to be upgraded will be about 30km and crosses the Coega River and Sundays River. It is proposed that the width of the road will be increased from 6m to 12m, thus widening each lane by 3m to create a shoulder with a yellow line. A single lane of traffic in each direction will be maintained.

The proposed road position mostly follows that of the existing road, with no major changes in the horizontal alignment of the road apart from where sharp corners exist. On sharp corners, vegetation may be removed and road construction materials will be utilised from vertical alignment expansions where possible. A fence will be erected on either side of the widened road for the entire length of the upgraded section.

Coega River Bridge

The Coega River Bridge, located on the farm Welbedachtsfontein 300, will be demolished and reconstructed on a new horizontal and vertical alignment close to the existing bridge. The new bridge will have a road width of 9.8m, with the bridge surface area approximately 320m².

Sundays River Bridge

The Sundays River Bridge is located on the farm Addo Drift East 122. The proposed widening of the existing bridge for accommodating the new road cross-section, will involve the demolition of the existing balustrades and sidewalks on top of the spandrel walls, and the construction of a new deck slab on the existing fill between the spandrel walls. The length of the bridge will still be 118.6m, with its three arch spans of 31.39m each and the bridge surface area approximately 1 235m².

Existing culverts along the road will be upgraded to multi-cell major box culverts at the following locations: km 27.12; km 28.83; km 29.31; km 30.76; and, km 37.33. Material used for the road upgrade will be collected from previously authorised borrow pits.

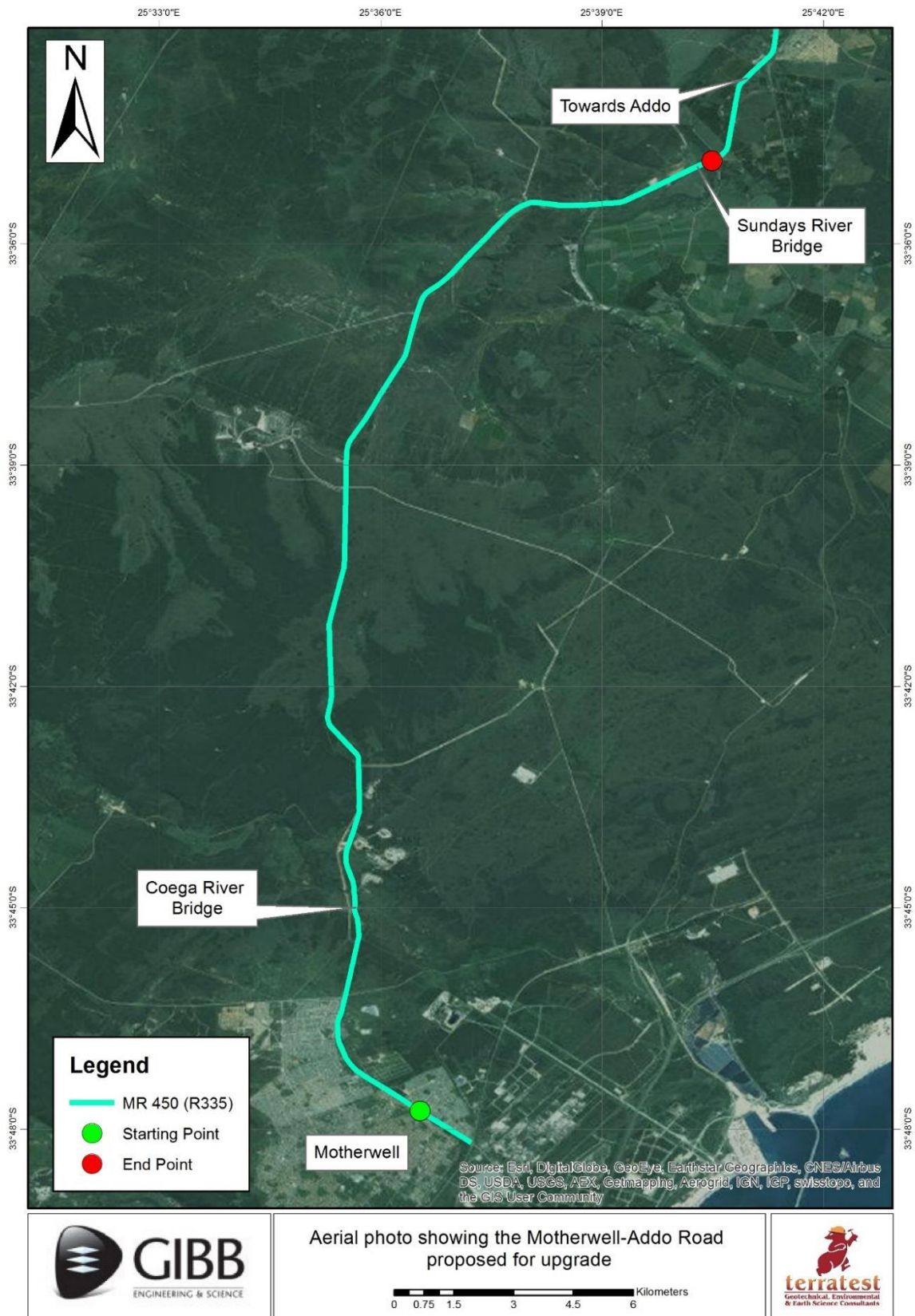


Figure 1: Aerial photo indicating the section of route MR 450 proposed for upgrade. (Map provided by Terratest).

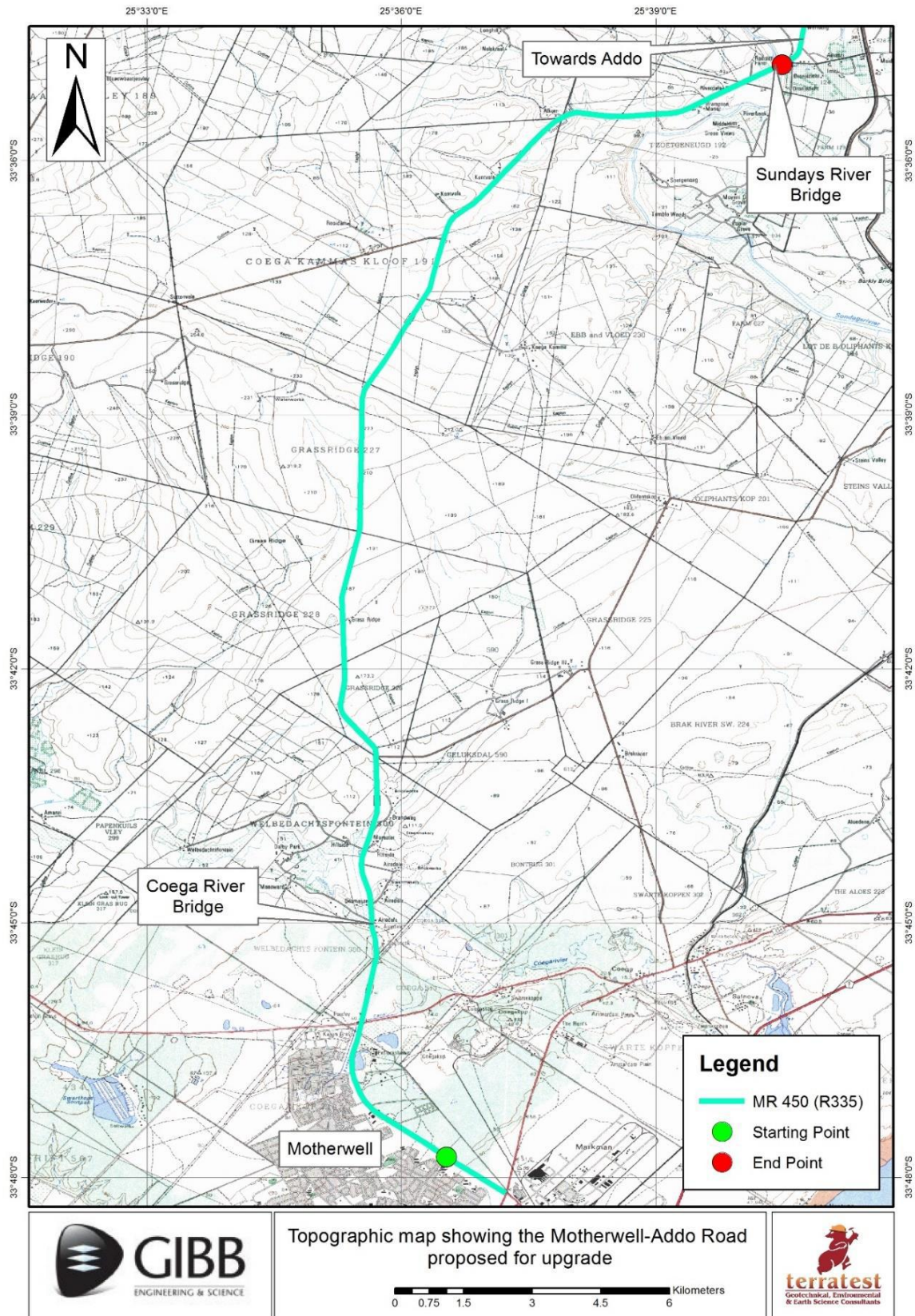


Figure 2. Topographic map indicating the location of the section of route MR 450 proposed for upgrade. (Map provided by Terratest).

1.1 LEGISLATION

Cultural Heritage in South Africa is governed by the National Heritage Resources Act (Act 25 of 1999). This Palaeontological Environmental Impact Assessment forms part of the Heritage Impact Assessment (HIA) and complies with the requirements of the above mentioned Act. In accordance with Section 38, an HIA is required to assess any potential impacts to palaeontological heritage within the development footprint.

SECTION 35 OF THE NATIONAL HERITAGE RESOURCES ACT 25 OF 1999

- The protection of archaeological and palaeontological sites and material and meteorites is the responsibility of a provincial heritage resources authority.
- All archaeological objects, palaeontological material and meteorites are the property of the State.
- 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.
- No person may, without a permit issued by the responsible heritage resources authority—
 - destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or palaeontological site or any meteorite;
 - destroy, damage, excavate, remove from its original position, collect or own any archaeological or palaeontological material or object or any meteorite;
 - 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
 - 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.
- When the responsible heritage resources authority has reasonable cause to believe that any activity or development which will destroy, damage or alter any archaeological or palaeontological site is under way, 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—
 - 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; and/or
 - carry out an investigation for the purpose of obtaining information on whether or not an archaeological or palaeontological site exists and whether mitigation is necessary.

2 OBJECTIVE

According to the SAHRA APM Guidelines: Minimum Standards for the Archaeological and Palaeontological Components of Impact Assessment Reports' the aims of the palaeontological impact assessment are:

- to identify exposed and subsurface rock formations that are considered to be palaeontologically significant;
- to assess the level of palaeontological significance of these formations;
- to comment on the impact of the development on these exposed and/or potential fossil resources; and
- To make recommendations as to how the developer should conserve or mitigate damage to these resources.

The objective is thus to conduct a Palaeontological Impact Assessment, which forms of part of the Heritage Impact Assessment (HIA) and the EIA Report, to determine the impact of the development on potential palaeontological material at the site.

When a palaeontological desktop/scoping study is conducted, the potentially fossiliferous rocks (i.e. groups, formations, members, etc.) represented within the study area are determined from geological maps. The known fossil heritage within each rock unit is collected from published scientific literature; fossil sensitivity map; consultations with professional colleagues, previous palaeontological impact studies in the same region and the databases of various institutions may be consulted. This data is then used to assess the palaeontological sensitivity of each rock unit of the study area on a desktop level. The likely impact of the proposed development on local fossil heritage is subsequently established on the basis of the palaeontological sensitivity of the rocks and the nature and scale of the development itself (extent of new bedrock excavated).

If rocks of moderate to high palaeontological sensitivity are present within the study area, a Phase 1 field-based assessment by a professional palaeontologist is necessary. Generally, damaging impacts on palaeontological heritage occur during the construction phase. These excavations will modify the existing topography and may disturb damage, destroy or permanently seal-in fossils at or below the ground surface that are then no longer available for scientific study.

When specialist palaeontological mitigation is suggested, it may take place prior to construction or, even more successfully, during the construction phase when new, potentially fossiliferous bedrock is still exposed and available for study. Mitigation usually involves the careful sampling, collection and recording of fossils as well as relevant data concerning the surrounding sedimentary matrix. Excavation of the fossil heritage will require a permit from SAHRA and the material must be housed in a permitted institution. With appropriate mitigation, many developments involving bedrock excavation will have a *positive* impact on our understanding of local palaeontological heritage.

3 GEOLOGICAL AND PALAEOLOGICAL HISTORY

3.1 GEOLOGY

The proposed development area is located in the Algoa Basin and is underlain by sediments of the Cretaceous aged (approximately 140 million years old) Kirkwood and Sundays River Formations of the Uitenhage Group as well as the Algoa Group. The Kirkwood Formation consists of readily-weathered variegated (reddish-brown and green) silty mudrocks and subordinate sandstones of fluvial origin while the Sundays River Formation consists largely of grey coloured mudstone, siltstone and subordinate sandstone. The geology of the Algoa Group consists of clastic limestone and conglomerates (Johnson et al, 2009).

3.2 PALAEOLOGY

All the geological formations underlying the development footprint belongs to the Uitenhage and Algoa Group. Fossils present in these groups include the remains of rich marine and estuarine invertebrate fauna, diverse molluscs, corals, bryozoans, brachiopods, echinoids, crustaceans, microfossils, sharks' teeth, trace fossils (human & mammal tracks) and land snails.

The **Kirkwood Formation** (Early Cretaceous) is known for its terrestrial biotas. Fossils include vascular plants (petrified logs, lignite beds, charcoal), tetrapod vertebrates (especially dinosaurs) and freshwater invertebrates (Du Toit 1954, McLachlan & McMillan 1976, Almond 2010). Numerous dinosaur remains are known from the Kirkwood Formation and include isolated vertebrae, leg bones and teeth. The most completely preserved Kirkwood dinosaur is the small coelurosaur theropod *Nquebasaurus* (De Klerk et al., 2000), but most of the Kirkwood dinosaur fossils found so far is highly fragmentary. Woody vegetation was dominated by gymnosperms which include conifers, extinct cycad-like bennettitaleans and true cycads. An advanced group of freshwater algae charophytes (stoneworts), bryophytes (liverworts) and pteridophytes (ferns), pollens and spores are abundantly found (McLachlan & McMillan 1976, 1979, Anderson & Anderson 1985, Bamford 1986, MacRae 1999). Amber and charcoal are also common, but thus far no fossil insects have been noted within the amber, which represents the oldest Cretaceous material recorded from Gondwana. Other vertebrate fossil groups from the Kirkwood Formation include frogs, crocodiles, turtles, sphenodontid and other lizards, mammals and freshwater fish (De Klerk et al., 1998, Rich et al., 1983, Ross et al., 1999). Non-marine invertebrate fossils in the Kirkwood Formation include freshwater or estuarine molluscs, unusual insects such as beetles, and several groups of small crustaceans (McLachlan & McMillan 1976, Dingle et al. 1983, MacRae 1999, Rich et al. 1983, Ross et al. 1999, Mostovski & Muller 2010). Trace fossils include borings into petrified tree trunks which is attributed to bivalves and insects (possibly beetles).

The **Sundays River Formation** is known for its shallow-marine deposits which may also have included estuarine, lagoonal and even shallow shelf settings. Invertebrate shells, plant remains, vertebrate fragments and microfossils are common. Most fossils

remains are fragmentary but almost complete skeletons of the marine plesiosaur were recovered from this formation. Ammonites, commonly found in the Sundays River Formation have been extensively studied (Klinger and Kennedy, 1979).

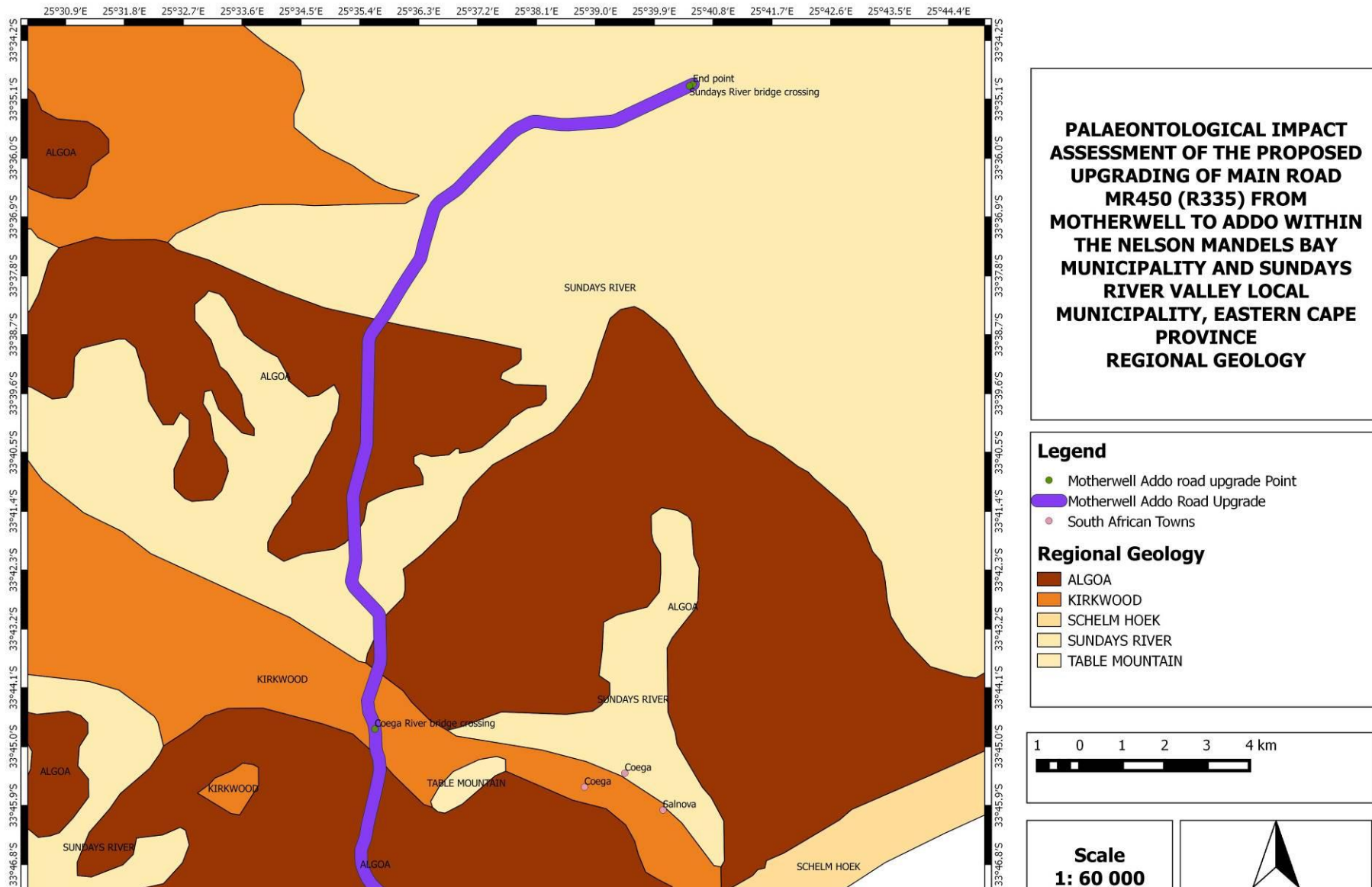


Figure 3. The surface geology of the proposed Motherwell-Addo upgrade within the Nelson Mandela Bay Municipality and Sundays River Valley Local Municipality, Eastern Cape Province. The development area is completely underlain by the Uitenhage Group (Kirkwood and Sundays River Formations) and Algoa Group.

4 GEOGRAPHICAL LOCATION OF THE SITE

Location : Start 33° 47' 45.01" S and 25° 36' 31.74" E
 End 33° 34' 51.97" S and 25° 40' 29.78" E

The proposed development involves the upgrade of approximately 30 km of the MR450 north of WM Maku Street in Motherwell to just south of Addo town. The road will cross the Coega and Sundays River. The three vegetation types (Mucina and Rutherford, 2006) in the proposed upgrade area is

- Sundays Thicket;
- Coega Bontveld; and,
- Albany Alluvial Vegetation.

4.1 MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002

(information provided by Terratest)

Section 106(1) of the Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) (MPRDA) specifies that the Minister may, by notice in the Gazette, exempt any organ of state from the provisions of Section 27, amongst others, in respect of any activity to remove any mineral for road construction. Such exemption was published in Government Notice (GN) R762 in Government Gazette (GG) 26501 of 24 June 2004. This notice specifically exempts the National Roads Agency (SANRAL) and all provincial governments (including the DRPW), from the provisions of Section 27 of the MPRDA (amongst others). As such, the project applicants are **exempted from the requirement to apply for a Mining Permit**.

Section 106(2) of the above-mentioned Act however specified that even if exempted from the need to apply for a Mining Permit, the relevant party was still required to submit an EMPr for approval in terms of Section 39(4). During the previous authorisation process, these EMPr's were compiled, submitted and approved. As such, should the Applicant propose to make use of these same, previously authorised material sources, and if these borrow pits/quarries have been established, and then there should be no requirement to make any additional applications in this regard.

It is understood that this applies to the mining activities proposed for the project; therefore, **no additional authorisations are required** from the Department of Mineral Resources.

5 METHODS

As part of the Palaeontological Impact Assessment, a field-survey of the proposed road upgrade between Motherwell and Addo was conducted on 13 August 2016, to assess the potential risk to palaeontological material in the proposed development footprint. A physical field-survey was conducted on foot and by car within the proposed development footprint. The results of the field-survey, the author's experience, aerial photos (using Google Earth, 2016) topographical and geological maps and other reports from the same

area were used to assess the proposed development footprint. No consultations were undertaken for this Impact Assessment.

5.1 ASSUMPTIONS AND LIMITATIONS

The accuracy and reliability of desktop Palaeontological Impact Assessments as components of heritage impact assessments are normally limited by the following restrictions:

- Old fossil databases that have not been kept up-to-date or are not computerised. These databases do not always include relevant locality or geological information. South Africa has a limited number of professional palaeontologists that carry out fieldwork and most development study areas have never been surveyed by a palaeontologist
- The accuracy of geological maps where information may be based solely on aerial photographs and small areas of significant geology have been ignored. The sheet explanations for geological maps are inadequate and little to no attention is paid to palaeontological material.
- Impact studies and other reports (*e.g.* of commercial mining companies) - is not readily available for desktop studies.

Large areas of South Africa have not been studied palaeontologically. Fossil data collected from different areas but in similar Assemblage Zones might however provide insight on the possible occurrence of fossils in an unexplored area. Desktop studies of this nature therefore usually assume the presence of unexposed fossil heritage within study areas of similar geological formations. Where considerable exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a Palaeontological Impact Assessment may be significantly improved through field-survey by a professional palaeontologist.

6 FIELD OBSERVATIONS

The following photographs were taken on a site visit to the proposed Motherwell-Addo Road upgrade on 13 August 2016.



Figure 4. Beginning of the Motherwell Addo road upgrade (Algoa Group).



Figure 5. Vegetation seen from the Couga Bridge (Kirkwood Formation).



Figure 6. Example of the typical vegetation and exposures at the development site.



Figure 7. Sediments along the road.



Figure 8. Sundays River Formation exposed in the road cutting near the end of the upgrade.



Figure 9. Loose sediments of the Sundays River Formation.



Figure 9. Thick vegetation seen from the Sundays River Bridge.

7 FINDINGS AND RECOMMENDATIONS

The development area is completely underlain by sediments of the Algoa Basin, Sundays River and Kirkwood Formation of the Uitenhage Group as well as the Algoa Group. Although the Palaeontological sensitivity of these areas is rated as very high no fossils have been found during a field survey. Thus the impact on palaeontological material along the Motherwell-Addo upgrade is negligible and regarded as insignificant.

It is therefore recommended that **no further palaeontological heritage studies, ground truthing and/or specialist mitigation are required for the commencement of this development**, pending the discovery or exposure of any fossil remains during the construction phase.

Should fossil remains be discovered during any phase of construction, either on the surface or exposed by fresh excavations, the ECO responsible for these developments should be alerted. Such discoveries ought to be protected (preferably *in situ*) and the ECO should alert SAHRA (South African Heritage Research Agency) so that appropriate mitigation (*e.g.* recording, sampling or collection) can be taken by a professional paleontologist. The specialist involved would require a collection permit from SAHRA. Fossil material must be curated in an approved collection (*e.g.* museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA.

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