

CHAPTER EIGHT: HERITAGE IMPACT ASSESSMENT

8.1 INTRODUCTION

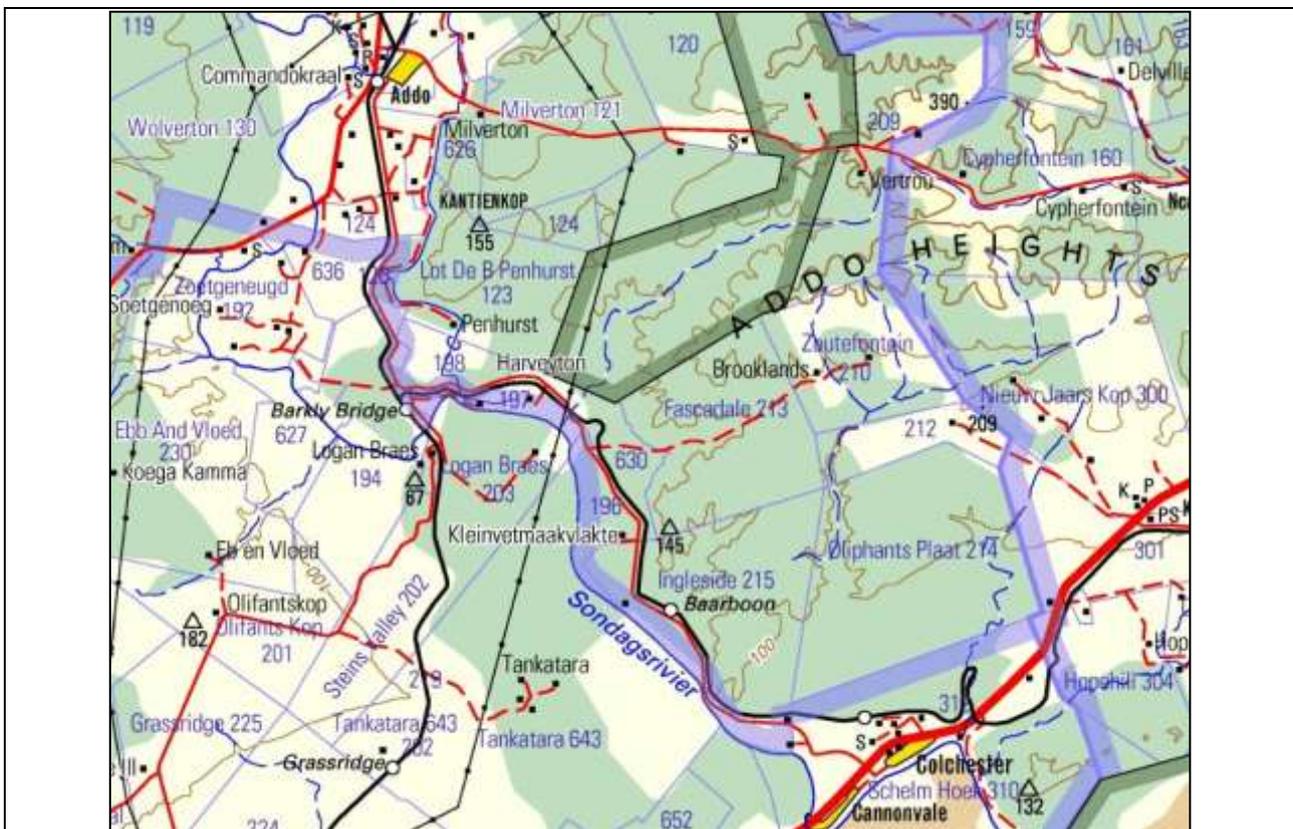
Certain cultural and heritage resources are protected under the National Heritage Resources Act (Act 25 of 1999). These may include structures older than 60 years; archaeological and paleontological sites and materials, and meteorites; certain burial grounds and graves; declared heritage objects; and declared heritage sites.

This Chapter of the report provides an overview of the heritage attributes, both paleontological and archaeological, of Portion 15 of Farm 203 Logan Braes, in the Nelson Mandela Bay Municipality. This includes a Phase 1 Archaeological Assessment undertaken by Dr Johan Binneman and Mr Kobus Reichert of Eastern Cape Heritage Consultants, as well as a Desktop Paleontological Assessment conducted by Dr John Almond of Natura Viva.

8.2 DESKTOP PALAEOLOGICAL ASSESSMENT

8.2.1 Project Information

The applicant, Habata Boerdery, is proposing to expand the existing agricultural activities by transforming approximately 36ha of indigenous vegetation on Portion 15 of the Farm 203 Logan Braes, currently zoned for agriculture. The study area is situated within the Nelson Mandela Bay Municipal area (NMBM), Eastern Cape, c. 13km south of Addo. It lies just to the east of the R335, c. 1.5km SE of Barkly Bridge across the Sundays River, and the railway line to Port Elizabeth runs along its western border (Maps 8.1 & 8.2). The Addo Elephant National Park is located approximately 2.8km north east of the site.



Map 8.1 Extract from 1: 250 000 topographical sheet 3324 Port Elizabeth (Courtesy of the Chief Directorate Surveys and Mapping, Mowbray) showing the approximate location of the study area near Barkly Bridge on Farm 203 Logan Braes, c. 13 km south of Addo, Eastern Cape (blue rectangle).

The following short project outline has been provided by Public Process Consultants, Port Elizabeth:

“The project applicant, Habata Boerdery, intends to expand existing agricultural activities on the farm known as Badlands, by transforming the indigenous vegetation on Portion 15 of Farm 203 Logan Braes (~44.6 ha in extent), for the rotational planting of a variety of crops for the local market, as well as for export (e.g. melons, butternut, cabbage, maize, variety of citrus). The proposed additional agricultural area can be readily tied into the access and irrigation infrastructure of the existing farming operations on the adjacent farm.

The proposed development will entail the following activities on the site:

- *Clearing of vegetation from portions of the site proposed for agriculture;*
- *Levelling and landscaping the site to provide runoff control;*
- *Establishment of internal roads to provide access to cultivated area;*
- *Installation of a drip irrigation system;*
- *Installation of a pivot irrigation system; and*
- *Planting crops.*

The final design and layout of the development has been informed by technical and environmental specialist input throughout the assessment process.”

The company, Public Process Consultants (Contact details: Marisa Jacoby, Public Process Consultants, 120 Diaz Road, Adcockvale, Port Elizabeth. Phone: 041 374 8426. Fax: 041 373 2002. E-mail: marisa@publicprocess.co.za) has been appointed by the applicant as the independent Environmental Assessment Practitioner (EAP) to undertake the Scoping and Environmental Impact Assessment for this agricultural project.

The study area is underlain by potentially fossiliferous sediments of the Sundays River Formation (Uitenhage Group) of Early Cretaceous age. In accordance with the National Heritage Resources Act, 1999, a palaeontological heritage assessment is required for this project, since important fossil material (e.g. marine shells, dinosaur remains) has previously been recorded from the Kirkwood – Addo area within this formation. In view of the very limited exposure of Cretaceous bedrocks within the study area, a basic desktop assessment of the fossil heritage resources in the study region was commissioned by Public Process Consultants. The present report is largely based on the previous desktop study by the author, covering the adjoining Portions 16 and 17 of Farm 203 Logan Braes (Almond, 2014).



Map 8.2 Google earth© satellite image of the Logan Braes study area (Portion 15 of Farm 203) situated c. 13 km south of Addo, Eastern Cape (red polygon).

8.2.2 Legislative Context of this Paleontological Assessment

The various categories of heritage resources recognised as part of the National Estate in Section 3 of the National Heritage Resources Act (1999) include, among others:

- geological sites of scientific or cultural importance;
- palaeontological sites;
- palaeontological objects and material, meteorites and rare geological specimens.

According to Section 35 of the National Heritage Resources Act, dealing with archaeology, palaeontology and meteorites:

- (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 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.

- (5) 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—
- (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 for the purpose of obtaining 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.

Minimum standards for the palaeontological component of heritage impact assessment reports have been developed by SAHRA (2013).

8.2.3 Approach to the Paleontological Assessment

The information used in this desktop study was based on the following:

1. A project outline and maps provided by Public Process Consultants;
2. A review of the relevant scientific literature, including published geological maps, satellite images, and previous fossil heritage assessments in the region (e.g. Almond 2010, 2011, 2012, 2013a, 2013b, 2014); and
3. The author's database on the formations concerned and their palaeontological heritage.

In preparing a palaeontological desktop study the potentially fossiliferous rock units (groups, formations *etc.*) represented within the study area are determined from geological maps and satellite images. The known fossil heritage within each rock unit is inventoried from the published scientific literature, previous palaeontological impact studies in the same region, and the author's field experience (Consultation with professional colleagues, as well as examination of institutional fossil collections may play a role here, or later following field assessment during the compilation of the final report). This data is then used to assess the palaeontological sensitivity of each rock unit to development. The potential impact of the proposed development on local fossil heritage is then determined on the basis of (1) the palaeontological sensitivity of the rock units concerned and (2) the nature and scale of the development itself, most significantly the extent of fresh bedrock excavation envisaged. When rock units of moderate to high palaeontological sensitivity are present within the development footprint, a Phase 1 field assessment study by a professional palaeontologist is usually warranted to identify any palaeontological hotspots and make specific recommendations for any mitigation required before or during the construction phase of the development.

On the basis of the desktop and Phase 1 field assessment studies, the likely impact of the proposed development on local fossil heritage and any need for specialist mitigation are then determined. Adverse palaeontological impacts normally occur during the construction rather than the operational or decommissioning phase. Phase 2 mitigation by a professional palaeontologist – normally

involving the recording and sampling of fossil material and associated geological information (e.g. sedimentological data) may be required (a) in the pre-construction phase where important fossils are already exposed at or near the land surface and / or (b) during the construction phase when fresh fossiliferous bedrock has been exposed by excavations. To carry out mitigation, the palaeontologist involved will need to apply for a palaeontological collection permit from the relevant heritage management authority, i.e. ECPHRA for the Eastern Cape (Contact details: Mr Sello Mokhanya, 74 Alexander Road, King Williams Town 5600; Email: smokhanya@ecphra.org.za). It should be emphasized that, *providing appropriate mitigation is carried out*, the majority of developments involving bedrock excavation can make a *positive* contribution to our understanding of local palaeontological heritage.

8.2.3.1 Assumptions & Limitations

The accuracy and reliability of palaeontological specialist studies as components of heritage impact assessments are generally limited by the following constraints:

1. Inadequate database for fossil heritage for much of the RSA, given the large size of the country and the small number of professional palaeontologists carrying out fieldwork here. Most development study areas have never been surveyed by a palaeontologist.
2. Variable accuracy of geological maps which underpin these desktop studies. For large areas of terrain these maps are largely based on aerial photographs alone, without ground-truthing. The maps generally depict only significant (“mappable”) bedrock units as well as major areas of superficial “drift” deposits (alluvium, colluvium) but for most regions give little or no idea of the level of bedrock outcrop, depth of superficial cover (soil *etc.*), degree of bedrock weathering or levels of small-scale tectonic deformation, such as cleavage. All of these factors may have a major influence on the impact significance of a given development on fossil heritage and can only be reliably assessed in the field.
3. Inadequate sheet explanations for geological maps, with little or no attention paid to paleontological issues in many cases, including poor locality information;
4. The extensive relevant palaeontological “grey literature” - in the form of unpublished university theses, impact studies and other reports (e.g. of commercial mining companies) - that is not readily available for desktop studies;
5. Absence of a comprehensive computerized database of fossil collections in major RSA institutions which can be consulted for impact studies. A Karoo fossil vertebrate database is now accessible for impact study work.

In the case of palaeontological desktop studies without supporting Phase 1 field assessments these limitations may variously lead to either:

- (a) *underestimation* of the palaeontological significance of a given study area due to ignorance of significant recorded or unrecorded fossils preserved there, or
- (b) *overestimation* of the palaeontological sensitivity of a study area, for example when originally rich fossil assemblages inferred from geological maps have in fact been destroyed by tectonism or weathering, or are buried beneath a thick mantle of unfossiliferous “drift” (soil, alluvium *etc.*).

Since most areas of the RSA have not been studied paleontologically, a palaeontological desktop study usually entails *inferring* the presence of buried fossil heritage within the study area from relevant fossil data collected from similar or the same rock units elsewhere, sometimes at localities far away. Where substantial exposures of bedrocks or potentially fossiliferous superficial sediments are present in the study area, the reliability of a palaeontological impact assessment may be significantly enhanced through field assessment by a professional palaeontologist.

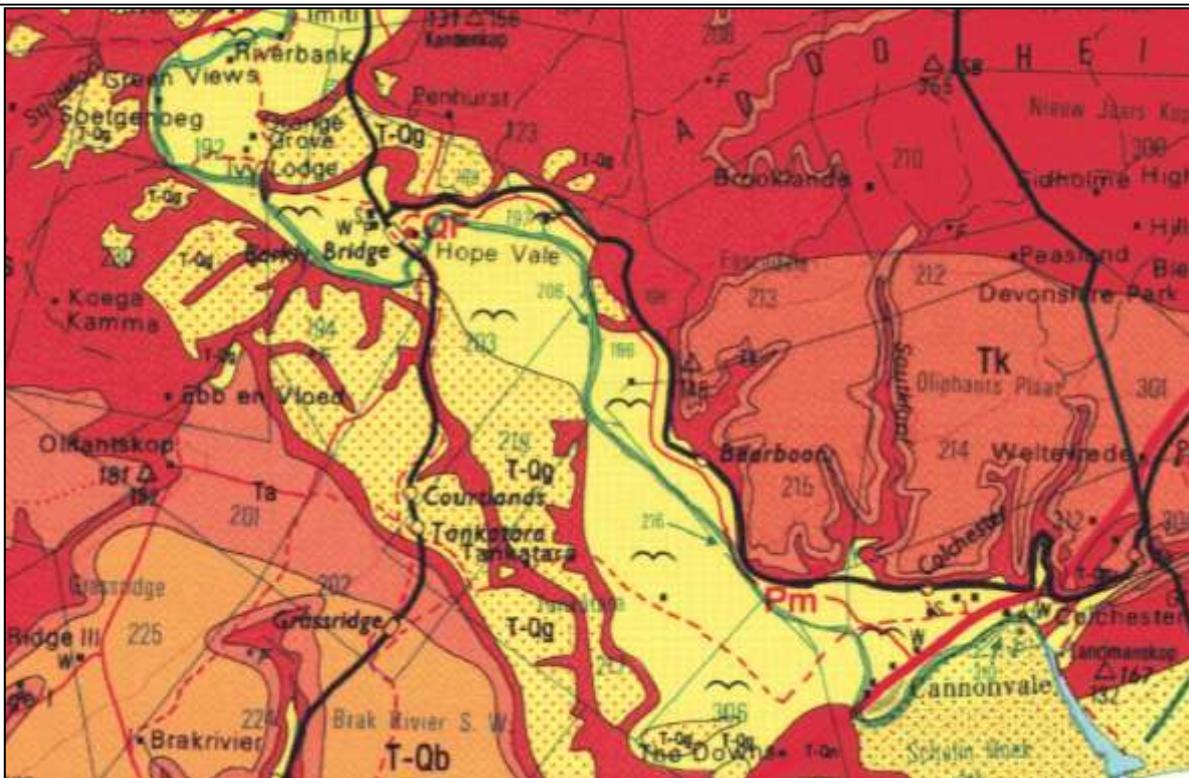
In the case of Portion 15, the major limitation for fossil heritage assessment is the low level of Mesozoic bedrock exposure due to cover by largely unfossiliferous superficial sediments. For this reason, a field-based assessment was not considered warranted. Several previous desktop and field-based studies in the area by the author (see reference list) permit a confident palaeontological heritage assessment of the current project.

8.2.4 Geological Background

The Farm 203 Logan Braes' study area is situated on gently sloping terrain between c. 10 and 30 m amsl. on the southern side of the Sundays River which meanders some 2km to the north of Portion 15. The geology of the Addo area is shown on 1: 250 000 geological map 3324 Port Elizabeth (Council for Geoscience, Pretoria; Toerien & Hill 1989) (Map 8.3). The area lies within the extensive Algoa Basin that is infilled with a 3.5km - thick succession of alluvial fan, fluvial and estuarine to marine shelf sediments of Late Jurassic to Early Cretaceous age (c. 150-125 Ma) that are referred to as the **Uitenhage Group** (McLachlan & Anderson 1976, Shone 2006).

The study area is underlain at depth by marine sediments of the **Sundays River Formation** (Ks, pink in Map 8.3). Judging from satellite images as well as earlier field studies in the Grassridge – Tankatara area less than 10km to the south (e.g. Almond 2011, 2012, 2013b), the recessive-weathering Sundays River beds are very poorly exposed within the study area. A low escarpment or terrace of Sundays River rocks runs just west of the railway line but, as usual in this region, the bedrocks here are largely obscured by dense vegetation and soil.

The Sundays River Formation is of Early Cretaceous (Valanginian-Hauterivian) age, *i.e.* around 136 Ma (million years old). It comprises a thick (up to 2km) succession of thin-bedded grey sandstones, siltstones and finer-grained mudrocks that are often highly fossiliferous (Shone 2006). Depositional settings range from estuarine through littoral (shoreline) to marine outer shelf (McMillan 2003). These beds are differentiated from the older Kirkwood Formation of the Uitenhage group by (a) the absence of reddish-hued mudrocks, (b) the presence of prominent-weathering calcareous sandstones, and (c) the frequent occurrence of fossil marine shells. The latter are commonly, but not invariably, associated with the thin, calcareous sandstone beds, many of which are tempestites (*i.e.* storm deposits). Key geological accounts of the Sundays River Formation include those by Du Toit (1954), Rigassi & Dixon (1972), Winter (1973), McLachlan & McMillan (1976), Tankard *et al.* (1982), Dingle *et al.*, (1983), McMillan (2003) and Shone (1976, 2006). For the study area the geological sheet explanations by Haughton (1928), Engelbrecht *et al.* (1962), Toerien and Hill (1989) and Le Roux (2000) are most relevant.



Map 8.3 Extract from 1: 250 000 geological map 3324 Port Elizabeth (Council for Geoscience, Pretoria). The study area on Farm 203 Logan Braes, some 13 km south of Addo, Eastern Cape (green rectangle), lies on the southern side of the Sundays River. It is underlain at depth by Early Cretaceous sediments of the Sundays River Formation (Ks, pink) that are mostly mantled here by Plio-Pleistocene pediment gravels of the Kudus Kloof Formation (pale yellow with red stipple) as well as by Holocene finer-grained alluvium (yellow with flying bird symbol).

In the southern sector of the Logan Braes Farm 203 study area at elevations of some 30 to 50m amsl the Cretaceous bedrocks are incised by a river-cut pediment surface and are mantled with ancient alluvial gravels (“High Level Gravels”; yellow with red stipple in Map 8.3). This surface forms one of a series of terrace deposits of Miocene to Holocene age bordering the Sundays River that have been grouped into the **Kudus Kloof Formation** by Hattingh (1994, 2001). According to the detailed map of Hattingh (2001, Appendix 2), the gravels on Portion 15 belong to Terrace 9 of inferred Late Pliocene age (through correlation with fossil-dated equivalent wave-cut terraces along the coast). These older terrace deposits of the Kudus Kloof Formation are mainly composed of clast-supported, horizontally- and cross-bedded gravels interbedded by thinner packages of coarse sand. They are often well-consolidated due to secondary calcification (Hattingh 1994, 2001, Partridge *et al.* 2006). Younger Quaternary terrace deposits of the Kudus Kloof succession are mainly composed of unconsolidated, flat-bedded alluvial sand and silt with subordinate coarse sand and gravel horizons showing limited pedogenic modification (Hattingh 1994, 2001, Partridge *et al.* 2006).

8.2.5 Palaeontological Heritage

A brief account of fossil heritage associated with each of the main rock units mapped within the Logan Braes study area near Addo is given in this section of the report.

8.2.5.1 Fossils in the Sundays River Formation

In palaeontological terms the Sundays River Formation (Uitenhage Group) contains one of the most prolific and scientifically important marine biotas of Mesozoic age in southern Africa (See brief review by Almond, 2010, from which the following section is largely abstracted). Fossils have been recorded

from the Sundays River beds in the Algoa Basin since the early nineteenth century (1837). Cooper (1981) provides a good review of the earlier literature. Important collections were made, for example, by the famous Eastern Cape geologists W.G. Atherstone and A.G. Bain (see Sharpe 1856) and there has been a long history of palaeontological publications dealing with the Sundays River fauna since then. Among the key papers are those by Sharpe (1856), Kitchin (1908), Spath (1930), Du Toit (1954), Engelbrecht *et al.* (1962), Haughton (1969), McLachlan & McMillan (1976, 1979), Klinger & Kennedy (1979), Cooper (1981, 1991), Dingle *et al.* (1983), McMillan (2003) and Shone (1986, 2006). An accessible, well-illustrated account of Sundays River fossils has recently been given by MacRae (1999). The ammonites and microfossils are of particular biostratigraphic (rock dating) importance, while the foraminiferans (a group of protozoans) are useful for palaeoenvironmental analysis (See extensive discussion in McMillan 2003).

The main invertebrate macrofossils recorded from the Sundays River Formation are a rich variety of molluscs. These include several cephalopod subgroups - mainly ammonites, *plus* much rarer nautiloids and belemnites. The cephalopod fauna has been revised recently by Cooper (1981, 1983) and is dominated by a series (14 spp.) of strongly ribbed, coiled ammonites of the Genus *Olcostephanus* (Figure 8.1), also well-known from Early Cretaceous marine faunas elsewhere in the world. Interestingly, clear examples of well-developed sexual dimorphism (male and female shells of different size and form) are shown in this genus. Much rarer partially coiled ammonites (*Distoloceras*) and straight-shelled, obliquely ribbed forms (*Bochianites*) also occur.

The Sundays River molluscs include a number of mainly small-bodied gastropods (*c.* 6 genera, including limpets), and over forty genera of bivalves (mussels, clams *etc.*). In terms of abundance as well as biodiversity the bivalve molluscs are also the dominant group. The commonest form is the thick-shelled “Devil’s toenail” oyster *Aetostreon* (previously known as *Exogyra* or *Gryphaea*) which is often preserved in dense *coquinas* (shell beds) at the base of storm sandstones (Figure 8.2). Some of the other bivalves, such as the strongly-ribbed or knobbed trigoniids (eleven species in seven genera, recently revised by Cooper 1979, 1991) and the elongate-shelled *Gervillella* – all shallow infaunal forms - are also quite substantial (20-30 cm long or more) with robust shells. Encrusting oysters cemented onto shells, rocks or hardgrounds are common. Dense storm-transported accumulations of scaphopod molluscs (tusk shells) were discovered during a recent field study by Almond (2011). Most of these South African fossils are badly in need of taxonomic and palaeobiological revision along the lines of recent work on similar-aged South America molluscs by Lazo (2007 and earlier papers).

More minor invertebrates – including stenohaline as well as euryhaline taxa - from the Sundays River Formation are solitary and branching colonial corals, tube-dwelling serpulid polychaetes, bryozoans, echinoderms (usually fragmentary crinoids or sea lilies, ophiuroids or brittle stars, sea cucumbers, regular echinoids) and shrimp-like crustaceans. However, more intensive collecting from these beds is likely to reveal further invertebrate taxa. This is suggested by the recent discovery of two new crustaceans (including several specimens of strongly tuberculate crabs) within Sundays River concretions (Dr Billy de Klerk, pers. comm., 2010), the scaphopods or tusk shells mentioned earlier, and recent new records of beetle remains south of Addo (Mostovski & Muller 2010). Sundays River trace fossils are poorly studied, but are locally abundant. They range from dense banks of cylindrical intrasediment burrows to a range of borings into wood, shells and hardgrounds (*i.e.* cemented substrata on the sea floor including, for example, exhumed early diagenetic concretions). A spectrum of microfossils from this stratigraphic unit include foraminiferans, ostracods, dinoflagellates and land-derived pollens and spores (Dingle *et al.*, 1983, McMillan 2003). Among the rarer microfossil groups recorded are radiolarians, shrimps, and fragments of echinoderms (ossicles of crinoids, ophiuroids, holothurians and echinoids).

The Sundays River beds contain sparse, often unidentifiable plant fossils such as fragments of driftwood (sometimes insect- or perhaps mollusc-bored), leaf and twig debris, amber (fossil resin), lignite, charcoal and the reproductive structures of charophyte algae (stoneworts).

Fossil vertebrates from the Sundays River Formation are very rare indeed. The best-known example is the partial skeleton of a 3m-long plesiosaur (an extinct group of large marine reptiles), *Leptocleidus capensis* (Figure 8.3). This comes from the famous, but poorly-localized, site of Picnic Bush on the Swartkops River near Port Elizabeth (Andrews 1910; see MacRae 1999 for good illustrations). Isolated dinosaur bones and teeth have also been mentioned (e.g. a dinosaur vertebra from Barclay Bridge south of Addo; Engelbrecht *et al.* 1962), though several earlier records probably stem from the older Kirkwood Formation. Gess (undated report) recently reported small vertebrate remains associated with marine molluscs and drift-wood from a site in the Sundays River Valley.



Figure 8.1 Well-preserved specimen of the ammonite *Olcostephanus* from the Sundays River Formation (Albany Museum, Grahamstown). This is a macroconch (female) and c. 25cm across (Image from Almond 2010).

Figure 8.2 Well-preserved specimen (“Devil’s toenail”) of the common free-living oyster *Aetostreon* from the Sundays River Formation, main brick pit at Coega (Image from Almond 2010).

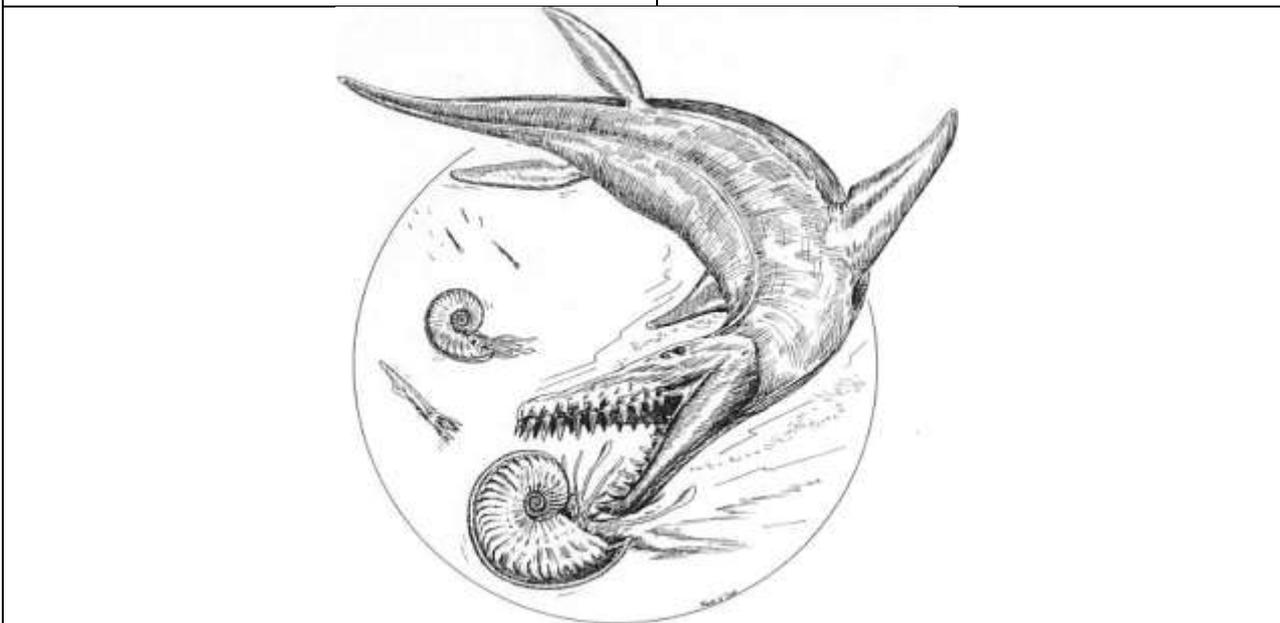
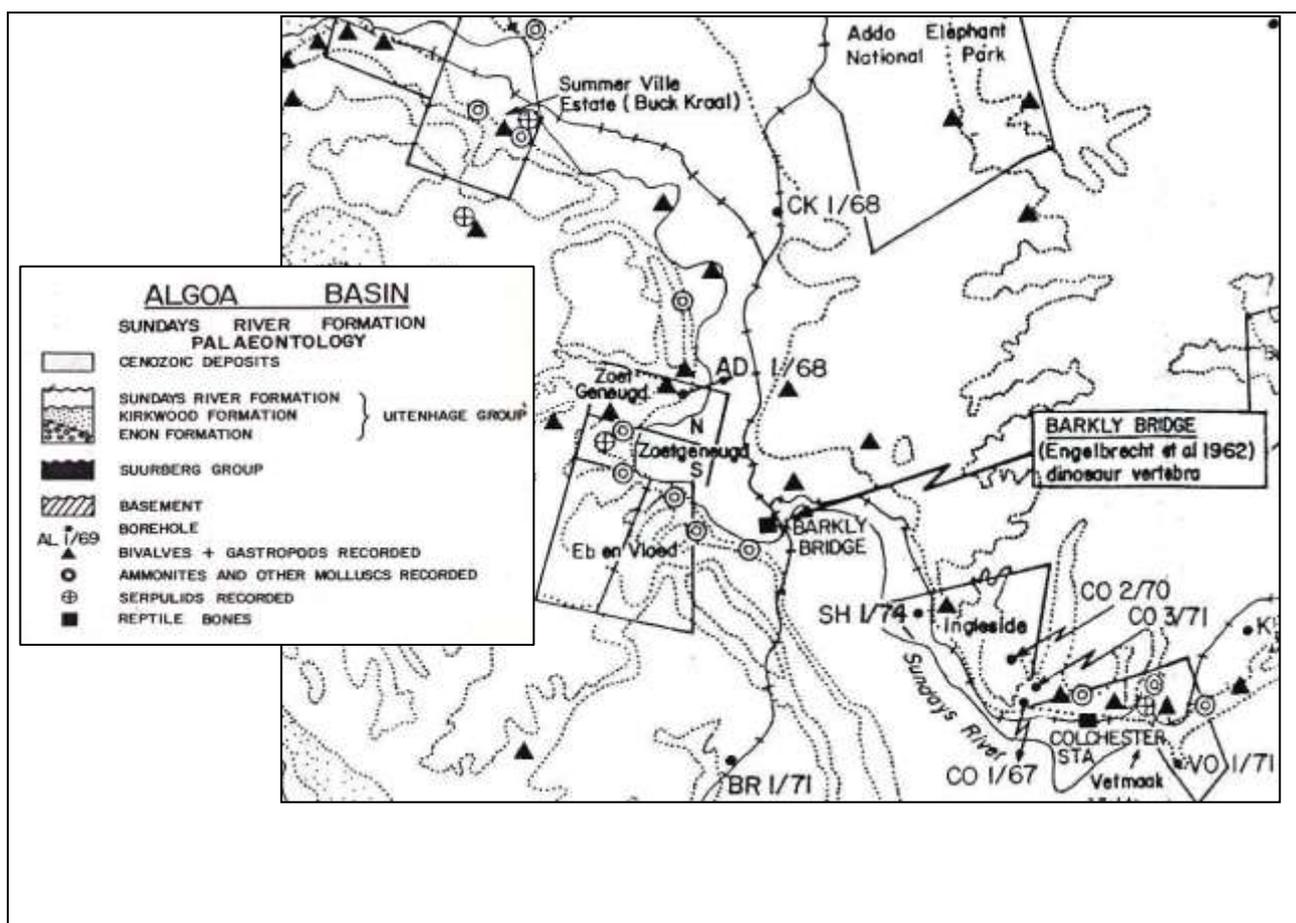


Figure 8.3 Artist’s reconstruction of a Cretaceous plesiosaur hunting ammonites.

Early records of Cretaceous fossil remains from the Sundays River Formation of the Algoa Basin near Addo – including several reports of fossil molluscs (ammonites, bivalves, gastropods), as well as tubicolous serpulid worms - have been collated by McLachlan and Anderson (1976) (Map 8.4 herein), based in part on fossil tabulations in Engelbrecht *et al.* (1962, Table 1). These include a wide range of fossil invertebrate taxa (serpulid worm tubes, crustaceans, gastropods, belemnites and ammonites and bivalves) on farms *Zeutgeneugd* and *Eb en Vloed* as well as the dinosaur remains from Barkly Bridge itself. Almond (2011) reported rich shelly fossil assemblages from Sundays River beds in the Grassridge area to the southwest of Logan Braes (Map 8.3) while near Tankatara the Cretaceous bedrocks are largely obscured by superficial deposits (Almond 2012). Within the areas of Farm 203 Logan Braes that are earmarked for agricultural development the Sundays River Formation bedrocks are largely or entirely mantled by Quaternary river gravels and significant impacts on Cretaceous fossil heritage are therefore not anticipated here.

Despite the long history of palaeontological work on Sundays River fossils, there has been little systematic collection of fossils – especially macrofossils - from these beds in recent decades and most taxa remain poorly studied (e.g. most invertebrate groups, apart from the ammonites, trioniid bivalves and foraminiferans). Much further research remains to be done here, however, and a lot of palaeontologically valuable material is undoubtedly being destroyed in the currently active brick pits in the Algoa Basin region.



Map 8.4 Fossil localities in the Sundays River Formation of the Algoa Basin near Barkly Bridge to the south of Addo (Farm 203 Logan Braes study area marked by red triangle). Several groups of marine invertebrates (crustaceans and molluscs, including bivalves, gastropods, belemnites and ammonites, as well as serpulid worm tubes) are reported from Sundays River Formation beds on farms just to the west of Barkly Bridge, while dinosaur remains are recorded from Barclay Bridge itself (Figure modified from McLachlan & Anderson 1976, their Fig. 8).

8.2.5.2 Fossils in Late Caenozoic High Level Gravels

Quaternary to Recent colluvial, alluvial and lag gravel, sand and clay deposits may also contain fossil remains of various types. In coarser sediments like river conglomerates these tend to be robust, highly disarticulated and abraded (e.g. rolled bones, teeth and horn cores of mammals and other vertebrates) but well-preserved skeletal remains of plants (e.g. wood, roots) and invertebrate animals (e.g. freshwater molluscs and crustaceans) as well as various trace fossils may be found within fine-grained alluvium. Embedded human artefacts such as stone tools that can be assigned to a specific interval of the archaeological time scale (e.g. Middle Stone Age) can be of value for constraining the age of Pleistocene to Recent drift deposits like alluvial terraces. Ancient to modern “High Level Gravels” tend to be coarse and to have suffered extensive reworking (e.g. winnowing and erosional downwasting), so they are generally unlikely to contain useful fossils. No fossils are reported from the Kudus Kloof Formation by Hattingh (1994, 2001); these fluvial terraces are dated by reference to correlated fossiliferous marine terraces along the coast. Fine-grained carbonaceous muds associated with *vlei* areas may contain peats, palynomorphs (pollens, spores) and other microfossils as well as the bones and teeth of mammals and other fauna that died in the area. No fossils are reported from the Kudus Kloof Formation by Hattingh (1994, 2001); these fluvial terraces are dated by reference to correlated fossiliferous marine terraces along the coast.

8.2.6 Conclusions & Recommendations

The study area on the Farm 203 Logan Braes located near Barkly Bridge, c. 13km south of Addo in the Sundays River Valley, Eastern Cape, is largely underlain by Early Cretaceous marine sediments of the Sundays River Formation (Uitenhage Group). This mudrock-dominated succession with subordinate sandstones has yielded rich fossil assemblages of marine invertebrates (notably molluscs, such as ammonites and bivalves), plant remains (e.g. driftwood), as well as very rare vertebrate remains (e.g. dinosaurs) from the Algoa Basin of the Eastern Cape. Several important Cretaceous fossil localities have been recorded in the Barkly Bridge area by McLachlan and Anderson (1976), Engelbrecht *et al.* (1962) and earlier authors. Fossil groups recorded here include a wide range of invertebrates, as well as rare dinosaur remains.

However, in the low-lying areas of Farm 203 that are earmarked for development, the Sundays River Formation is largely or entirely mantled by Pliocene to Pleistocene river sediments of the Kudus Kloof Formation that may be up to several meters thick and are, at most, very sparsely fossiliferous. **Significant impacts on fossil heritage are therefore not anticipated here.**

It is concluded that **no further palaeontological heritage studies or specialist mitigation are required** for this agricultural project, **pending** the discovery or exposure of any substantial fossil remains (e.g. vertebrate bones and teeth, large blocks of petrified wood, fossil plant-rich horizons, buried laminated shales) during the construction phase. The ECO responsible for these developments should be alerted to the possibility of important fossil remains being found either on the surface or exposed by fresh excavations during construction.

Should fossil remains be discovered during construction, these should be safeguarded (preferably *in situ*) and the ECO should alert the Eastern Cape Provincial Heritage Resources Authority (ECPHRA. Contact details: Mr Sello Mokhanya, 74 Alexander Road, King Williams Town 5600; Email: smokhanya@ecphra.org.zaso) so that appropriate mitigation (e.g. recording, sampling or collection) can be taken by a professional palaeontologist. The specialist involved would require a collection permit from ECPHRA. Fossil material must be curated in an approved repository (e.g. museum or university collection) and all fieldwork and reports should meet the minimum standards for palaeontological impact studies developed by SAHRA (2013).

8.2.7 Acknowledgements

Ms Marisa Jacoby of Public Process Consultants, Port Elizabeth, is thanked for commissioning this desktop study and for providing the necessary background information. I am grateful to Dr Billy de Klerk (Albany Museum, Grahamstown) for discussions on the Uitenhage Group palaeontology of the Algoa Basin.

8.2.8 Qualifications & Experience of the Author

Dr John Almond has an Honours Degree in Natural Sciences (Zoology) as well as a PhD in Palaeontology from the University of Cambridge, UK. He has been awarded post-doctoral research fellowships at Cambridge University and in Germany, and has carried out palaeontological research in Europe, North America, the Middle East as well as North and South Africa. For eight years he was a scientific officer (palaeontologist) for the Geological Survey / Council for Geoscience in the RSA. His current palaeontological research focuses on fossil record of the Precambrian - Cambrian boundary and the Cape Supergroup of South Africa. He has recently written palaeontological reviews for several 1: 250 000 geological maps published by the Council for Geoscience and has contributed educational material on fossils and evolution for new school textbooks in the RSA.

Since 2002 Dr Almond has also carried out palaeontological impact assessments for developments and conservation areas in the Western, Eastern and Northern Cape, Limpopo, Northwest and the Free State under the aegis of his Cape Town-based company *Natura Viva cc*. He has served as a long-standing member of the Archaeology, Palaeontology and Meteorites Committee for Heritage Western Cape (HWC) and an advisor on palaeontological conservation and management issues for the Palaeontological Society of South Africa (PSSA), HWC and SAHRA. He is currently compiling technical reports on the provincial palaeontological heritage of Western, Northern and Eastern Cape for SAHRA and HWC. Dr Almond is an accredited member of PSSA and APHP (Association of Professional Heritage Practitioners – Western Cape).

Declaration of Independence

I, John E. Almond, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed development project, application or appeal in respect of which I was appointed other than fair remuneration for work performed in connection with the activity, application or appeal. There are no circumstances that compromise the objectivity of my performing such work.



Dr John E. Almond
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8.3 PHASE 1 ARCHAEOLOGICAL ASSESSMENT

8.3.1 Project Information

The proposed development area, Portion 15 of Farm 203 Logan Braes (~44.6ha in extent), forms part of an existing farming unit referred to as Badlands. The applicant proposes to clear approximately 36ha of natural vegetation on Portion 15, in the Nelson Mandela Bay Municipality of the Eastern Cape Province, with the purpose of expanding the existing agricultural activities on Farm Badlands, for the cultivation of a variety of crops (melons, cabbage, maize and citrus) and associated infrastructure (Maps 8.5-8.6).

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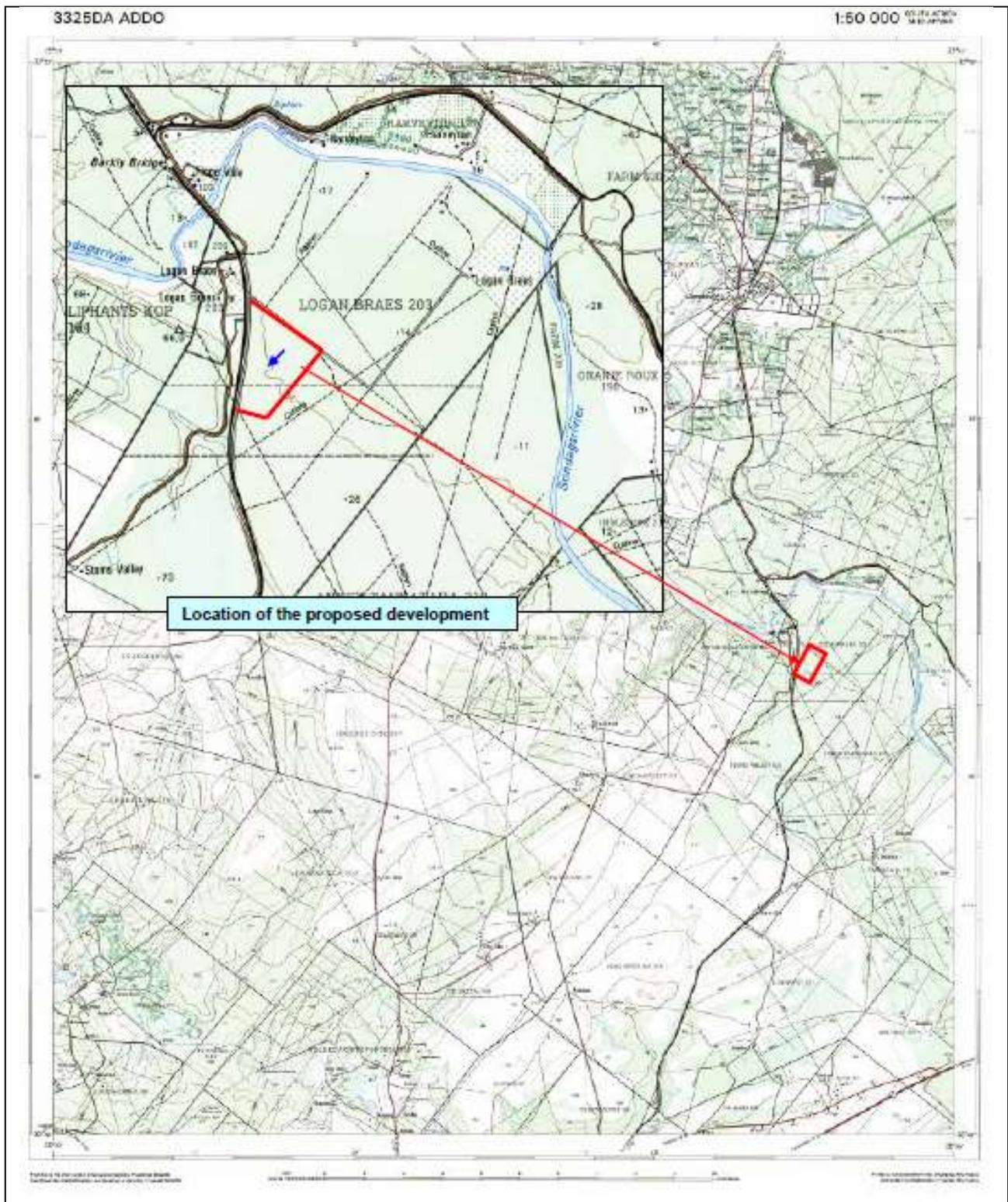
8.3.1.1 Purpose of the Study

The purpose of the study was to conduct a Phase 1 Archaeological Impact Assessment (AIA) of the proposed agricultural expansion on Portion 15 of Farm 203 Logan Braes in the Nelson Mandela Bay Municipality of the Eastern Cape Province. The survey was conducted to establish:

- the range and importance of possible exposed and *in situ* archaeological sites, features and materials;
- the potential impact of the development on these resources; and
- to make recommendations to minimize possible damage to these resources.

8.3.1.2 Site and Location

The proposed agricultural expansion on Portion 15 of Farm 203 Logan Braes is located within the 1:50 000 topographic reference map 3325 DA Addo (Map 8.5). The proposed property for development is situated within Badlands Farm, approximately 36 kilometres northeast of Port Elizabeth and 11 kilometres south of Addo (Maps 8.5-8.6). It is located south of the Sunday's River, approximately 3 kilometres south-east of Barkly Bridge and the gravel road to Colchester. On the south-western side the property borders on the main railway line to Port Elizabeth. The property is situated on an old flood plain of thick alluvial red soil covered with dense grass and thicket vegetation with a gentle gradient towards the Sundays River. The closest point from the development to the river is about one kilometre. Ad hoc grazing of cattle is currently taking place on site.



Location of the proposed development

Map 8.5 1:50 000 Maps indicating the approximate location of the proposed development (outlined in red). The 20 metre contour line which runs through the property represents the old river embankment (blue arrow).



Map 8.6 Aerial images indicating the location of the proposed development (outlined in red). The yellow dot marks the location of where Middle Stone Age stone tools were observed and also the old river embankment.

8.3.1.3 Relevant Impact Assessments from the Wider Region, Databases and Collections

- Binneman, J. 2014 A phase 1 archaeological heritage impact assessment for the proposed agricultural development of Portion 16 and 17 of Farm 203 Logan Braes, Nelson Mandela Bay Municipality, Eastern Cape Province. Prepared for Public Process Consultants. Greenacres. Eastern Cape Heritage Consultants. Jeffreys Bay.
- Binneman, J. 2011a. A phase 1 archaeological heritage impact assessment for the proposed agricultural development of portion 18 and 19 of farm 203 Logan Braes, Nelson Mandela Bay Municipality, Eastern Cape Province. Prepared for Public Process Consultants Greenacres. Eastern Cape Heritage Consultants. Jeffreys Bay.
- Binneman, J. 2011b. A phase 1 archaeological impact assessment for the proposed agricultural development of Portion 4, 5 and 6 of farm no. 194 Lot De B Olifants Kop, Nelson Mandela Bay Municipality, Eastern Cape Province. Prepared for Public Process Consultants Greenacres. Eastern Cape Heritage Consultants. Jeffreys Bay.

Binneman, J. 2010. A phase 1 archaeological heritage impact assessment for the proposed development of a leisure estate in the Sundays River Valley Area, Sundays River Municipality, Eastern Cape Province. Prepared for CEN Integrated Environmental Management Unit, Port Elizabeth. Eastern Cape Heritage Consultants. Jeffreys Bay.

The Albany Museum in Grahamstown houses collections and information from the wider region.

8.3.2 Brief Archaeological Background

8.3.2.1 Literature Review

In general, little systematic archaeological research and regional surveys/ recordings have been conducted in the Addo area. The oldest evidence of the early inhabitants are large stone tools, called hand axes and cleavers, which can be found amongst river gravels and in old spring deposits in the region. These large stone tools are from a time period called the Earlier Stone Age (ESA) and may date between 1,5 million and 250 000 years old. In a series of spring deposits at Amanzi Spring a large number of stone tools were found *in situ* to a depth of 3-4 metres. Remarkably, wood and seed material preserved in the spring deposits, possibly dating to between 250 000 to 800 000 years old (Deacon 1970).

The large hand axes and cleavers were replaced by smaller stone tools called the Middle Stone Age (MSA) flake and blade industries. Evidence of MSA sites occur throughout the region and date between 250 000 and 30 000 years old. These stone artefacts, like the Earlier Stone Age tools are also found in the gravels along the banks of the Sunday's River and like hand axes are mainly in secondary context. Fossil bone may in rare cases be associated with MSA occurrences. One such occurrence of fossil bone remains and Middle Stone Age stone tools was reported south of Coega Kop (Gess 1969). During excavations, the remains were found in the surface limestone, but the bulk of the bone remains were found some 1-1,5 metres below the surface. The excavations exposed a large number and variety of bones, teeth and horn cores. The bone remains included warthog, leopard, hyena, rhinoceros and ten different antelope species. A radiocarbon date of greater than 37 000 years was obtained for the site.

The majority of archaeological sites found in the area date from the past 10 000 years (called the Later Stone Age) and are associated with the campsites of San hunter-gatherers and Khoi pastoralists. These sites are difficult to find because they are in the open veld and often covered by vegetation and sand. Sometimes these sites are only represented by a few stone tools and fragments of bone. The preservation of these sites is poor and it is not always possible to date them. There are many San hunter-gatherer's sites in the nearby Groendal Wilderness Area and adjacent mountains. Here caves and rock shelters were occupied by the San during the Later Stone Age and contain paintings along the walls. The last San/ KhoiSan group was killed by Commando's in the Groendal area in the 1880s.

Some 2 000 years ago Khoi pastoralists occupied the region and lived mainly in small settlements. They were the first food producers in South Africa and introduced domesticated animals (sheep, goat and cattle) and ceramic vessels to southern Africa. Often archaeological sites are found close to the banks of large streams and rivers. Large piles of freshwater mussel shell (called middens) usually mark these sites. Prehistoric groups collected the freshwater mussel from the muddy banks of the rivers as a source of food. Mixed with the shell and other riverine and terrestrial food waste are also cultural materials. Human remains are often found buried in the middens.

8.3.3 Archaeological Investigation

8.3.3.1 Methodology

The landowner was contacted prior to the investigation to inform him about the visit and to gain access to the property. During the field study the manager pointed out the proposed area for development and he was also consulted on possible locations of archaeological remains, graves and historical buildings and features. It was not possible to do a complete survey of the large property due to the dense/ impenetrable thicket and alien (prickly pear) vegetation. Areas that have been cleared in the past are also covered by dense short grass and shrubs (Plate 8.1). All previous relevant survey information for the immediate and adjacent areas was consulted before the survey started. A Google Earth aerial image study was also conducted of the area prior to the investigation (Map 8.6). To cover as much of the terrain as possible the tracks which run through the property were followed on foot by two archaeologists and spot checks were also conducted from a vehicle. GPS readings were taken and all important features were digitally recorded. Spot checks on foot were also conducted in adjacent areas cleared recently for agricultural activities.

8.3.3.2 Limitations and Assumptions

Due to the dense impenetrable vegetation, the archaeological visibility was poor and made it difficult to locate archaeological sites/ materials. The property is situated on a relatively flat old flood plain of the Sundays River and due to the gentle gradient little surface erosion resulted which could have exposed archaeological material. Notwithstanding, the experiences and knowledge gained from other investigations in the immediate area and wider surrounding region provided background information to make assumptions and predictions on the incidences and the significance of possible pre-colonial archaeological sites/material which may be located in the area, or which may be covered by the soil and vegetation.

8.3.3.3 Finds and Results

The southern part of the area earmarked for clearing is a relatively flat flood plain composed of thick reddish alluvial deposits covered by dense thicket vegetation. No archaeological sites/ materials were observed in this area, but material may be covered by soil and vegetation. From the yellow peg the flood plain suddenly drops several metres to another flat plain which stretches all the way to the Sundays River (Plate 8.1, middle left insert). This drop must represent an old river embankment and is visible on Map 8.5 as the 20 metre contour.

A small number of 'informal' Middle Stone Age stone tools eroded from the edge of the embankment (Plate 8.1, bottom right insert) (GPS reading: 33.38.446S; 25.42.521E). These stone tools date between 250 000 to 30 000 years old and the flakes displayed typical faceted striking platforms manufactured from river pebbles/ cobbles. Most of the tools were thick 'informal' flakes and chunks. No spatial patterning or activity areas such as 'manufacturing' sites were located. All stone tools were in secondary context and not associated with any other remains. Although the property is near the Sundays River, no freshwater shell middens /materials were observed (see discussion below). There are no known graves or buildings older than 60 years on the property surveyed and in general it would appear that the area is of **low cultural sensitivity and that it is unlikely that any sensitive archaeological remains will be exposed during the development.**

8.3.3.4 Discussions

The proposed property for development is situated near the Sundays River (closest point to the river is approximately one kilometre) and it is possible that freshwater mussel midden material may be found on the site. Unfortunately, little research has been conducted on these features along the

Sunday's River and therefore the archaeological contexts of these features are largely unknown. Many years ago, several of these features were observed along the immediate embankments of the Sundays River upstream from Barkly Bridge, but it is unknown how far the middens would be situated from the river. Although these features may date from the past 8 000 years or older, the stone tools observed at these features included large quartzite backed segments which has been ascribed to the Kabeljous Industry (Binneman 2007) and may date as old as 4 500 years.



Plate 8.1 A view of the flat flood plain area towards the Sundays River in the far background (main image and middle right insert), the deep deposits of reddish alluvial soil that covers the area (top left insert), the dense thicket vegetation and a sample of Middle Stone Age stone tools observed exposed along the embankment (bottom right insert).

8.3.4 Discussion and Mitigation

The proposed area investigated for vegetation clearing is large and most of it is covered with dense thicket vegetation which made it difficult to find archaeological sites. Notwithstanding, occasional Middle Stone Age stone tools were observed along a river terrace, but these are in secondary context and of low significance. Furthermore, usually one would expect to find Earlier Stone Age stone tools near river areas, but none were observed. The site is about one kilometre from the river and it is

possible that freshwater mussel middens/material may also be present, and if so, special care must be taken that these sites are not destroyed during development.

The main impact on archaeological sites/remains will be the physical disturbance of the material and its context. The clearing of the vegetation to expand the existing agricultural activities (approximately 36 ha) will expose, disturb and displace archaeological sites/material. However, from the investigation, it would appear that the proposed area earmarked for development is of **low archaeological sensitivity and the visual impact on the surrounding cultural landscape will also be low**. It is recommended that:

1. Although it would seem unlikely that any significant archaeological remains will be exposed during the development, there is always a possibility that human remains and/or other archaeological such as freshwater shell middens and historical material may be uncovered during the development. Should such material be exposed during construction, all work must cease in the immediate area (depending on the type of find) and it must be reported to the archaeologist at the Albany Museum in Grahamstown (Tel: 046 6222312) or to the Eastern Cape Provincial Heritage Resources Authority (Tel: 043 6422811), so that a systematic and professional investigation can be undertaken. Sufficient time should be allowed to investigate and to remove/collect such material. Recommendations will follow from the investigation (See Section 8.3.7 for a list of possible archaeological sites that maybe found in the area).
2. All clearing activities and other developments must be monitored. Managers/foremen should be informed before clearing/construction starts on the possible types of heritage sites and cultural material they may encounter and the procedures to follow when they find sites. Alternatively, it is suggested that a person must be trained (ECO) as a site monitor to report to the foreman when heritage sites/materials are found.
3. It is suggested that an archaeologist should conduct a walkthrough of the area after the vegetation is cleared and before development starts to check if any significant sites/materials were exposed. Further recommendations will follow after the investigation.

8.3.5 General Remarks and Condition

Note: This is an Archaeological Impact Assessment (AIA) report compiled for the Eastern Cape Provincial Heritage Resources Authority (ECPHRA) to enable them to make informed decisions regarding the heritage resources assessed in this report and only they have the authority to revise the report. This Report must be reviewed by the ECPHRA where after they will issue their Review Comments to the EAP/ applicant. The final decision rests with the ECPHRA who must grant permits if there will be any impact on cultural sites/ materials as a result of the development.

This report is a Phase 1 Archaeological Impact Assessment and does not exempt the developer from any other relevant heritage impact assessments as specified below:

In terms of the National Heritage Resources Act, No. 25 of 1999 (section 38) ECPHRA may require a full Heritage Impact Assessment (HIA) to assess all heritage resources, that includes *inter alia*, all places or objects of aesthetical, architectural, historic, scientific, social, spiritual, linguistic, or technological significance that may be present on a site earmarked for development. A full Heritage Impact Assessment (HIA) should assess all these heritage components, and the assessment may include archaeology, shipwrecks, battlefields, graves, and structures older than 60 years, living heritage, historical settlements, landscapes, geological sites, palaeontological sites and objects.

It must be emphasized that this Phase 1 AIA is based on the visibility of archaeological sites/ material and may not therefore reflect the true state of affairs. Sites and material may be covered by soil and

vegetation and will only be located once this has been removed. In the event of such finds being uncovered during construction activities, ECPHRA or an archaeologist must be informed immediately so that they can investigate the importance of the sites and excavate or collect material before it is destroyed (see attached list of possible archaeological sites and material). The developer must finance the costs should additional studies be required as outlined above. The *onus* is on the developer to ensure that the provisions of the National Heritage Resources Act No. 25 of 1999 and any instructions from ECPHRA are followed. The EAP/ applicant must forward this report to ECPHRA in order to obtain their Review Comments, unless alternative arrangements have been made with the heritage specialist to submit the report.

8.3.6 Brief Legislative Requirements

Parts of sections 35(4), 36(3) and 38(1) (8) of the National Heritage Resources Act 25 of 1999 apply:

Archaeology, palaeontology and meteorites

35. (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;*
 - (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.*

Burial grounds and graves

36. (3) (a) *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; or*
 - (c) *bring onto or use at a burial ground or grave referred to in paragraph (a) or (b) any excavation equipment, or any equipment which assists in the detection or recovery of metals.*

Heritage resources management

38. (1) *Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorized as –*
- (a) *the construction of a road, wall, powerline, 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 the site –*
 - (i) *exceeding 5000m² in extent, or*
 - (ii) *involving three or more 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 resources authority;*
- (d) the re-zoning of a site exceeding 10 000m² in extent; or*
- (e) any other category of development provided for in regulations by SAHRA or a provincial heritage resources authority, must as 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.*

8.3.7 Identification of Archaeological Features and Material from Inland Areas: Guidelines and Procedures for Developers

Human Skeletal material

Human remains, whether the complete remains of an individual buried during the past, or scattered human remains resulting from disturbance of the grave, should be reported. In general, the remains are buried in a flexed position on their sides, but are also found buried in a sitting position with a flat stone capping and developers are requested to be on the alert for this.

Freshwater mussel middens

Freshwater mussels are found in the muddy banks of rivers and streams and were collected by people in the past as a food resource. Freshwater mussel shell middens are accumulations of mussel shell and are usually found close to rivers and streams. These shell middens frequently contain stone tools, pottery, bone, and occasionally human remains. Shell middens may be of various sizes and depths, but an accumulation which exceeds 1 m² in extent, should be reported to an archaeologist.

Stone artefacts

These are difficult for the layman to identify. However, large accumulations of flaked stones which do not appear to have been distributed naturally should be reported. If the stone tools are associated with bone remains, development should be halted immediately and archaeologists notified.

Fossil bone

Fossil bones may be found embedded in geological deposits. Any concentrations of bones, whether fossilized or not, should be reported.

Large stone features

They come in different forms and sizes, but are easy to identify. The most common are roughly circular stone walls (mostly collapsed) and may represent stock enclosures, remains of wind breaks or cooking shelters. Others consist of large piles of stones of different sizes and heights and are known as *isisivane*. They are usually near river and mountain crossings. Their purpose and meaning is not fully understood, however, some are thought to represent burial cairns while others may have symbolic value.

Historical artefacts or features

These are easy to identify and include foundations of buildings or other construction features and items from domestic and military activities.

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