Scoping and EIA for the Provision of Marine Infrastructure, including a General Cargo Berth and Liquid Bulk Berths at the Port of Ngqura, Nelson Mandela Bay Municipality

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Chapter 12:

Heritage Impact Assessment

DRAFT EIA REPORT

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GLOSSARY

Palaeozoic Era	Geological period spanning from roughly 541 to 252 million years ago
Mesozoic Era	Interval of geological time from about 252 to 66 million years ago; also called the Age of Reptiles.
Neogene Period	Interval of geological time subdivided into two epochs, the earlier Miocene and the later Pliocene; succeeded by the Quaternary Period.
Quaternary Period	Follows the Neogene Period and spans the last 2.6 million years ago to very recently.
Stone Age	Broad prehistoric period spanning more than a million years in South Africa, during which stone was widely used to make implements with a sharp edge, a point, or a percussion surface. In South Africa the Stone Age can be divided roughly into three periods, namely the Early Stone Age, Middle Stone Age and Later Stone Age.
Fossil	Any organic trace buried by natural processes and subsequently permanently preserved.
Site	Assemblage of fossil material or cultural objects found on a single location
Artefact	Cultural object
Shell middens	Accumulations of marine shell deposited by human agents that frequently contain stone tools, pottery, bone and occasionally also human remains.

CHAPTER 12: HERITAGE IMPACT ASSESSMENT

12.1 INTRODUCTION AND METHODOLOGY

12.1.1 Scope and Objectives

The proposed development calls for the construction of a General Cargo Berth and Liquid Bulk Berths, as well as associated infrastructure, at the Port of Ngqura within the Coega Industrial Development (IDZ) Zone 8, Nelson Mandela Bay Municipality (**Figure 12-1**). The General Cargo Berth (B101) will be approximately 300m in length while two Liquid Product Berths (A100 and A101), each approximately 350m in length, will be installed at the mouth of the Coega River. Associated infrastructure includes general services and utilities, foreshore stabilization and the construction of a revetment between the quay walls and onshore infrastructure, a navigation channel between the proposed berths, the relocation of the seawater intake pipe to supply Cerebos, and the possible diversion/relocation of the Klub Road causeway and adjacent services. The existing Klub Road Causeway (River Crossing) will be relocated further up the Coega River. Details of the design and locality of the Klub Road Causeway diversion/relocation will be finalised during the detailed engineering phase. However, at this point, it is envisaged that the Klub Road Causeway will be diverted up to approximately 100 m upstream of its existing location. The relocated causeway is planned to contain a similar design to the existing causeway. In terms of phasing, the relocation of the Klub Road Causeway is expected to take place when the proposed Berth A101 is being constructed.

The proposed development will require extensive ground moving activities and excavations into potentially vulnerable archaeological contexts and fossiliferous sediments of Mesozoic and Cenozoic age. As a prerequisite for new development in terms of the National Heritage Resources Act 25 of 1999, this specialist study has been commissioned by the CSIR on behalf of Transnet SOC Ltd as part of the EIA for the proposed project. The task involved identification of possible heritage sites or occurrences in the proposed project area, an assessment of their significance, possible impact by the proposed development and recommendations for mitigation where relevant.

12.1.2 Terms of References

The terms of reference for the heritage impact assessment specialist study consist of the following:

- Identify and map possible heritage resources by conducting a desktop study on the fossil heritage, archaeology, palaeontology and heritage sites within the proposed project area in the Port of Ngqura;
- Determine and assess the potential impacts of the proposed development on potential heritage resources by undertaking a detailed field examination of the archaeology and

representative natural and artificial exposures of potentially fossil-bearing sediments (rock outcrops, quarries, roadcuts etc.) within or in the region of the development area.

- Describe the type and location of known archaeological and palaeontological features in the study area, and characterize all heritage items that may be affected by the proposed project.
- Describe the baseline environment and determine the status quo in relation to the specialist study.
- Record observed fossils and associated sedimentological features of palaeontological relevance, as well as sites of archaeological relevance (photos, maps, aerial or satellite images, GPS co-ordinates, and stratigraphic columns), and sample fossil material, where warranted.
- Identify and rate potential direct, indirect and cumulative impacts of the proposed project on the archaeological and palaeontological heritage during the construction, operational and decommissioning phases of the project. Study the cumulative impacts of the project by considering the impacts of existing industries within the zone, together with the impact of the proposed project.
- Identify and rank the highlights and sensitivities to development of fossil heritage within study area.
- Provide recommendations and suggestions regarding archaeological and fossil heritage management on site, including conservation measures to ensure that the impacts are limited.
- Provide input to the Environmental Management Programme, including mitigation and monitoring requirements to ensure that the impacts on the archaeology and palaeontology are limited. Provide recommendations in order to protect the surrounding environment from negative impacts resulting from the proposed project.

12.1.3 Approach and Methodology

South Africa's unique and non-renewable archaeological and palaeontological heritage sites are protected in terms of the National Heritage Resources Act 25 of 1999, sections 35, 36 and 38 and may not be disturbed at all without a permit from the relevant heritage resources authority. As such, this study forms part of a Phase 1 Heritage Impact Assessment (HIA), that includes both Archaeological and Palaeontological investigations called for in terms of Section 38(1) of the National Heritage Resources Act, (Act No. 25), 1999.

The heritage report provides an assessment based on a review of relevant palaeontological, archaeological and geological literature, including geological maps and previous reports. This was followed by a two-day pedestrian survey and field assessment on the 5th, 6th and 7th of June 2013. A Garmin Etrex Vista GPS hand model (set to the WGS 84 map datum) and a digital camera, were used to record relevant data (Appendix 12.A and 12.B of this chapter). Relevant archaeological and paleontological information were assimilated for the report and integrated with data obtained during the on-site inspection.

12.1.4 Assumptions and Limitations

Previous investigations offers substantial input with regard to archaeological and palaeontological heritage in the region of the Coega River estuary and mouth (Binneman & Webley 1997; Almond 2013) and it is inferred that previous industrial activities have disturbed

the affected area considerably. In the case of archaeological heritage in particular, it is considered unlikely that significant sites or features will be found within the affected area. However, there is a possibility that thick vegetation and superficial dune cover in yet undisturbed areas may cover up intact archaeological sites.

In the case of palaeontological heritage, it is assumed, for the sake of prudence, that fossil remains are always uniformly distributed in fossil-bearing rock units, although in reality their distribution may vary significantly. In addition, a section of the proposed liquid bulk berths will be located below the waterline, which will hamper the field assessment.

12.1.5 Source of Information

Information sources for the study include published archaeological and palaeontological literature, geological maps, previous heritage assessments of the Coega IDZ and the National Museum Archaeological Database.

12.1.6 Specialist Expertise and Declaration of Independence

Refer to Appendix A of this Draft EIA Report for the Curriculum Vitae of Dr. Lloyd Rossouw, which highlights his expertise. The declaration of independence by the specialist is provided in Box 12.1 below.

BOX 12.1: DECLARATION OF INDEPENDENCE

I, Lloyd Rossouw, declare that I am an independent consultant and have no business, financial, personal or other interest in the proposed Marine Infrastructure 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.

LLOYD ROSSOUW

12.2 DESCRIPTION OF PROJECT ASPECTS RELEVANT TO PALAEONTOLOGICAL AND ARCHAEOLOGICAL IMPACTS

12.2.1 Palaeontological Heritage

Although extensively altered by earlier construction activities, the proposed development area is underlain by potentially fossil-bearing Mesozoic and Quaternary age rocks. Development during the **construction phase** of the berths and the revetment will involve major excavations that could destroy, damage or disturb *in situ* fossils and this will adversely affect potential fossil heritage within the affected area.

12.2.2 Archaeological Heritage

Although extensively altered by earlier construction activities, the affected area is located within a wider area where numerous Later Stone Age shell midden sites have been previously recorded. Development during the **construction phase** of Liquid Bulk Berth A101 and the revetment in particular, may potentially impact on *in situ* shell midden sites along the beachfront.

The proposed project components are described in detail in the Project Description in Chapter 2 of this Draft EIA Report.

12.3 DESCRIPTION OF THE AFFECTED ENVIRONMENT

12.3.1 Description of Locality

The affected area is located at the mouth and east side of the Coega River, below a low-relief coastal plateau that is covered by densely vegetated sand dunes along the coastline (**Figure 12-2**).

12.3.2 Geology

The area has been described by Engelbrecht *et al*. (1962), Toerien and Hill (1989), Le Roux (1989, 1990, 1991, 1992, 2000), Maud and Botha (1999), Thamm and Johnson (2006) and Roberts *et al*. (2006). The Algoa Basin is geologically complex. The region is underlain by Palaeozoic, Mesozoic and late Cenozoic sediments (1: 250 000 scale geological map 3324 Port Elizabeth, Council for Geoscience, Pretoria, 1991). These are sediments of widely different geological ages (see **Figure 12-3**). A general account of the geology of Coega IDZ region is provided below.

12.3.2.1 Cape Supergroup

The Palaeozoic Cape Supergroup represents a record of approximately 170 million years from the Early Ordovician (~ 500 Ma) to the Early Carboniferous (~ 330 Ma). Cape Supergroup sediments and meta-sediments in the study area are made up of sandstone and shale from the Table Mountain Group and the basal part of the Bokkeveld Group form the uppermost part of

the sequence. From oldest to youngest, the Table Mountain Group in the footprint area is represented by the Peninsula Formation (*Op*), and the Goudini (*Sg*), Skurweberg (*Ss*) and Baviaanskloof (*Db*) Formations of the Nardouw Subgroup. Fossil evidence from the Cederberg Formation, the uppermost Baviaanskloof Formation and the overlying Bokkeveld shales in the Western Cape suggests that the Table Mountain Group is of Early Ordovician to earliest Devonian age. The Peninsula Formation is the main unit of the Table Mountain Group. It consists of weathering-resistant quartzitic sandstones with minor pebbly conglomerates and subordinate, lenticular shale layers. The Cederberg Formation is made up of shale and arenaceous siltstones towards the top of the sequence. This formation has yielded a diverse assemblage of marine invertebrate fossils, early vertebrates and some of the earliest known primitive fishes. The Nardouw Subgroup embraces the uppermost three units of the Table Mountain Group. The Goudini Formation forms the basal unit of the Nardouw Subgroup and overlies the Cederberg Formation. A Silurian age is assigned to this formation. The unit consists of quartzose sandstone which also contains thin shale and siltstone lenses. A fluvial environment is postulated for the origin of the bulk of the unit in the east. In the Western Cape worm trails are closely related to bluish-grey siltstones near the top of the formation, while bioturbated siltstone have been recorded two thirds of the way up from the base of the formation near Bredasdorp. The Goudini Formation weathers positively with respect to the underlying Cederberg shales and siltstones. The Skurweberg Formation overlies the Goudini Formation and constitutes the central and most prominent sandstone unit of the Nardouw Subgroup. An Early Silurian age is assigned to this formation. Depositional history is interpreted as shoreline or shallow marine and braided stream environments. The formation weathers positively with respect to the underlying Goudini Formation. The Baviaanskloof Formation conformably overlies the Skurweberg Formation and is regarded as Early Devionian in age. It consists mainly of medium to dark grey, fine-grained sandstone and subordinate mudrock. Wave ripples and marine invertebrates suggest that low-energy conditions and shallow marine shelf environments prevailed during the formation of the unit.

Undifferentiated strata (*Dc*) of the basal part of the Bokkeveld Group (Ceres Subgroup) make up the uppermost part of the Palaeozoic sequence in the study area. The subgroup consists of an alternation of three thick shale and three thinner sandstone formations of early Middle Devonian age. The sandstone formations are interpreted as having been deposited along an epicontinental sea margin and the shale formations in the off-shore regions. The Ceres Subgroup is characterized by a wide variety of benthic invertebrate fossils, including brachiopods, bivalves and trilobites. Cephalopods, crinoids, ophioroids, hyoliths, cricoconarids, corals and gastropods have also been recorded. Trace fossils are rare, becoming more common towards the top of the Bokkeveld succession. Fossils regularly occur as internal moulds or external impressions and are in places much distorted by tectonic deformation.

12.3.2.2 Uitenhage Group

The Cape Supergroup strata in turn are unconformably overlain by Mesozoic rocks of Cretaceous age. These are represented by a diverse sediment fill, comprising the Enon, Kirkwood and Sundays River Formations of the Uitenhage Group. The study area includes deposits of both the Kirkwood and Sundays River Formations. The Kirkwood Formation (*J-Kk*) consists of porous and permeable, coarse- to medium-grained sandstones which were accumulated as a result of fluvial sedimentation, which probably represent an early marine incursion into the Algoa Basin. The age of the Kirkwood Formation is estimated to be Late Jurasic to Early Cretaceous. The Sundays River Formation (*Ks*) overlies and grade laterally into the Kirkwood Formation. It consists of thin grey fine- to medium-grained sandstones, siltstone and mudrocks. Fossil fauna association within the formation points to a shallow marine

depositional environment. The ammonite fauna suggest an Early Cretaceous age for the Sundays River Formation.

12.3.2.3 Algoa Group

The Cretaceous strata are unconformably overlain by late Neogene Algoa Group sediments of the Alexandria Formation (*Ta*), which occur extensively in the region. It comprises a basal conglomerate of oyster shells, covered by interbedded calcareous sandstones, pebbly coquina and thin conglomerates. The Alexandria Formation is regarded as mainly a littoral deposit and its deposition is related to a series of Middle Miocene to Pliocene marine transgression/regression cycles. The paraconformably overlying Nanaga Formation (*T-Qn*) consists of Pliocene to Early Pleistocene aeolian sand and dune rock. It also unconformably overlies the Palaeozoic Cape Supergroup and Mesozoic Uitenhage Group in places.

The Bluewater Bay Formation (*T-Qg*) consists of alluvial gravels and sand linked to older gravels and fluvial deposits that disconformably overlies the Alexandria Formation (*Ta*). The Bluewater Bay Formation is also, occasionally, in direct contact with the Cretaceous Sundays River Formation (*Ks*) as a result of channels that were scoured through Alexandria Formation deposits. The age of the Bluewater Bay Formation is probably Late Pliocene – Early Pleistocene.

The Salnova Formation (*T-Qg*) occurs as discontinuous outcrops along the present coastline and the lower courses of the Swartkops and Coega Rivers. It truncates rocks of the Uitenhage Group north, and Table Mountain Group rocks south of latitude 33° 57'S. The formation is thought to represent calcareous sand, coquina and shelly limestone deposits of marine or estuarine origin, accumulated at high sea level stands during one or more Quaternary interglacials.

The Nahoon Formation (*Qn*) occurs within the first few hundred meters inland from the high-water mark and was deposited during regressions associated with the last two glacial periods. It consists of calcareous sandstones with interbedded palaeosols.

The Schelm Hoek Formation represents modern aeolian sands dunes of Holocene age that are either unvegetated near the coast or stabilized by dense dune thicket further inland.

12.3.3 Palaeontological Context

12.3.3.1 Mesozoic sediments

The majority of the Coega IDZ is covered by late Neogene to Recent sediments, while good exposures of the Uitenhage Group are mainly confined to the valleys of the Swartkops River, Coega River, Bezuidenhouts River and Sundays Rivers (**Figure 12-4**).

12.3.3.1.1 Kirkwood Formation (J-Kk)

Relatively abundant vertebrate remains and plant fragments have been found in Kirkwood Formation (**Table 12-1**). Vertebrate fossil remains, wood and leaf localities have been recorded along the junction of the Bezuidenhouts, Wit and Sundays River and the Sundays River valley. Plant fossils include numerous fern, cycad and conifer taxa. The invertebrate fossils associated with the Kirkwood Formation (*J-Kk*) plant bed localities seem to be commonly either fresh-water or estuarine origin.

12.3.3.1.2 Sundays River Formation (Ks)

Fossil content in the Sundays River Formation is high. Coquinoid sandstones with abundant invertebrate shells often form prominent layers in outcrops. Plant remains, vertebrate fragments, ammonites and microfossils are also common. Trace fossils are also abundant and include typical gastropod tracks and a variety of burrows. Vertebrate remains include an almost complete skeleton of a marine plesiosaur recovered near Redhouse (Picnic Bush, Swartkops River). Other vertebrate fossils include a femur of a lacertilian reptile from the marine beds along the lower Swartkops River at Amsterdamhoek (Swartkop River Heights), reptile vertebrae from Barkley Bridge.

12.3.3.2 Late Cenozoic sediments (Algoa Group to Recent)

Late Neogene to Recent sediments include the Alexandria, Bluewater Bay and Salnova Formations (**Figure 12-5**).

12.3.3.2.1 Alexandria Formation (Ta)

Numerous species of different marine macrofossils have been described from the deposits of the late Neogene Alexandria Formation. (*Ta*). Basal oyster-shell conglomerates are well-developed at Grassridge, Motherwell and along the lower Swartkops River, and at Spring Valley, *Echinodiscus* fossils ("pansy shells") occur abundantly in flat laminated sandstone.

12.3.3.2.2 Nanaga (T-Qn), Bluewater (T-Qb), Salnova (T-Qg) , Nahoon (Qn) and Schelm Hoek Formations

Semi- to well-consolidated aeolianites and sandy limestones of the Plio-Pleistocene Nanaga Formation (*T-Qn*) sporadically contain fossilized terrestrial gastropods (*Tropidophora*), fragmentary marine shells and foraminifera. Macrofossils are generally rare in the Plio-Pleistocene Bluewater Bay Formation (*T-Qb*). Fossil content mainly comprises occasional freshwater shells (*Unio* sp. and other species) as well as fragments of terrestrial shells (*Achatina*). Occurrences of fossil bone remains were reported from limestone deposits near Aloes south of Coega Kop (Gess 1969; Wells 1970). Excavations exposed Florisian–aged fossil bone, teeth and horn cores belonging to a variety of mammal species, including equids, suids (*P. aethiopicus*), bovids (*A. marsupialis, Connochaetes sp.*) and carnivores (C. *crocuta*). Similar deposits, including ancient hyena lairs, may be present along the coast. The Late Pleistocene Salnova Formation (T-Qg) sand / sandstone are made up of between ten to 60 percent comminuted shell fragments. With over three hundred species of molluscs identified, fossils in this formation comprise a diverse assembly of gastropods and pelecypods, as well as broken echinoid and crustacean remains preserved in coquina and sandstone. Minute fragments of marine shells and foraminifera occur in the Nahoon Formation. Terrestrial gastropods such as Tropidophora, Achatina and Trigonephris are present in palaeosol horizons. Fossil bone fragments have been observed in aeolinites at Black Rock between Port Alfred and Kleinemonde. Human and other animal footprints have been found in the calcareous sandstone at Nahoon Point near East London. Recent thermoluminescence and U-Th dating of shelly material in the sandstone provided an age of ~200 ka BP. Last Glacial vertebrate faunal remains have been exposed at regular intervals below the unconsolidated dune fields between Oyster Bay and St. Francis Bay. The fossils derive from older deflated and wind-eroded palaeosols, which also contain fossilized hyena coprolites rich in pollen and phytoliths. Root casts and land snail shells (Achatina) are common in the overlying coastal dune fields of the Schelm Hoek Formation. Marine shell and skeletal algal fragments, echinoid spines and foraminifera are found in the calcareous component of the sand. Shell middens are commonly found within the dune fields which often contain fossil mammal remains.

Table 12.1. Additional site information on Uitenhage Group fossils and fossil localities in the region (after McClachlan, and Mcmillan 1976).

The numbers correspond to the map in **Figure 12-3.**

Number	Formation	Location	Fossil Occurrence
1	Kirkwood	Bezuidenhouts River	Marine invertebrates
2	Kirkwood	Bezuidenhouts River	Plant material, Reptile bones
3	Kirkwood	Bezuidenhouts River	Marine invertebrates
4	Kirkwood	Bezuidenhouts River	Reptile bones, freshwater bivalves
5	Kirkwood	Bezuidenhouts / Sundays River	Reptile bones, plant material, freshwater bivalves
6	Kirkwood	Despatch Brick Quarry	Reptile Bones / *Algoasaurus bauri* (Broom 1904)
7	Kirkwood *Colchester Shale Member*	Bethelsdorp Pan	Marine / estuarine invertebrates
8	Kirkwood *Colchester Shale Member*	North End Lake	Marine / estuarine invertebrates
9	Kirkwood	Swartkops River Mouth	Marine / estuarine / freshwater invertebrates
10	Kirkwood	Coegas Kop	Marine invertebrates
11	Sundays River	Picnic Bush, Amsterdam Hoek	Reptile bones
12	Sundays River	Fish Water Flats, Amsterdam Hoek	Reptile bones, teeth
13	Sundays River	Swartkops River Heights	Reptile bones
14	Sundays River	Zoedgenoegd Cliff	Marine ostracods
15	Sundays River	Old Coega brick-pit	Marine ostracods
16	Sundays River	Colchester Cliff	Marine ostracods
17	Sundays River	Barkley Bridge	Reptile bones

12.3.4 Archaeological Context

Early human habitation along the coastal plain near Port Elizabeth is indicated by the presence of Early Stone Age (bifacial stone tools) as well as Middle Stone Age (prepared core, flake-blade industries) in the Sundays River Valley. This also includes well-preserved sites like Amanzi Springs, west of Grassridge near Addo, where *in situ,* Early Stone Age (ESA) artefacts were found along with well-preserved plant and faunal remains within spring sediments (Deacon 1970). Cave and rock shelters in the Cape Fold Mountains to the north and east frequently contain archaeological remains and rock art associated with San hunter-gatherers who inhabited the area during the last ten thousand years (Deacon & Deacon 1963; Deacon 1976; Hall & Binneman 1985; Binneman 1997). The Melkhoutboom Cave, located in the Suurberg Mountains, is a Later Stone Age site that dates back 15000 years. Nearby rock paintings in the Suurberge confirm that this area was inhabited by San hunter-gatherers.

In general, the Algoa Bay region has historic significance due to its frontier location acting as an interface between hunter-gatherers, pastoralists and European settlers. Khoi pastoralists

occupied the region some 2000 years ago and introduced domesticated animals and pottery to the region (Deacon 1984). Khoi pastoralist sites are often found close to the banks of large streams and rivers. The Suurberg area is also known for numerous skirmishes that took place between the Xhosa inhabitants, European settlers, British military and Khoi pastoralists during the 18th and 19th centuries and some historical remains related to these events may still be preserved.

Stone tools have been recorded in secondary context in the gravels from older river terraces along the banks of the Coega River near the estuary (Binneman & Webley 1997). A sample of stone tools collected from the river gravels is housed at the Albany Museum. The majority of archaeological sites found along coastline around Port Elizabeth are associated with Later Stone Age and Pastoralist shell midden and burial sites (ca. last 10 000 years) (Rudner 1968; Binneman 2001). The middens are generally located in the shifting sand dunes along the south-eastern Cape coast (Rudner 1968) and include man-made accumulations of marine shell deposits, fish remains, OES, faunal remains and stone tools.

High concentrations of shell middens were reported near Port Elizabeth at Humewood, St. George's Strand and Hougham Park Beach near the Coega River Mouth (Rudner 1968), while Binneman & Webley (1997) reported on thirteen shell middens and stone tool scatters located about 500 m east of the river mouth (**Figure 12-6**).

12.4 IDENTIFICATION OF KEY ISSUES

Palaeontology

1. The Coega River Mouth area is underlain by terrestrial sediments of the upper Kirkwood formation and overlying shallow marine sediments of the Sundays River Formation. These rock units are known to contain fossil heritage, with well-known sites located outside the Industrial Development Zone area. They are rated as of high palaeontological significance.

2. The fossil bone accumulation found during the late 1960s in limestone deposits near Aloes suggest that similar accumulations may be found elsewhere in the Coega IDZ. In addition, Last Glacial vertebrate faunal remains have been exposed at regular intervals in coastal dunefields west of Port Elizabeth (Carrion *et al.* 2000; L. Rossouw field survey database). These fossils derive from older deflated and wind-eroded palaeosols, which also contain fossilized hyena coprolites rich in pollen and phytoliths. The clusters of fossil bone and hyena coprolites are interpreted as eroded hyena burrows. Vertebrate fossils formerly recovered from these deflated horizons include the remains of plains zebra, elephants, the extinct giant buffalo (*Pelorovis antiquus*) as well as a variety of other artiodactyls. Hyena burrows are intrusive features and may not be contemporaneous with their surrounding matrix. Their localized nature makes occurrences difficult to predict, but in this case highlights the potential for Quaternary palaeontological finds in the Nanaga and Schelm Hoek Formations. These accumulations, if they exist, are rare and are rated as of high palaeontological significance.

   Given the nature of fossil distribution in the Mesozoic and Late Cenozoic sedimentary rocks, it is not possible to exactly predict the buried fossil content of an area other than in general terms unless fresh exposures indicate otherwise and man-made excavations often provide the best opportunities to examine and sample fresh, potentially

fossiliferous bedrock. Also, in most cases, sampling of fossils for the purpose of palaeontological mitigation cannot usually be conducted prior to the commencement of construction/excavation activities.

Archaeology

1. Stone artefacts that may occur as individual finds within the river gravel deposits close to the Coega estuary are considered in secondary context and are rated as of low archaeological significance.
2. Shell middens, human burials and stone tool scatters may be found in primary (*in situ*) context under dense vegetation and coastal dune cover east of the Coega River Mouth, and are rated as of high archaeological significance and should not be destroyed.

12.5 APPLICABLE LEGISLATION AND PERMIT REQUIREMENTS

12.5.1 Applicable Legislation

The following Sections 35, 36 and 38 [and in particular s35(4), s36(3) and s38(1), (8)]of the National Heritage Resources Act 25 of 1999, apply to this assessment and are summarized below:

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;

c) 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 South African Heritage Resources Agency (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 5000m^2 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 000m^2 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.

12.5.2 Permit requirements

The discovery of archaeological or palaeontological remains will require a Phase 2 mitigation process which usually involves planning of the protection of significant sites or material (in terms of a permit) at sites that may be lost. For 2nd phase mitigation of archaeological and palaeontological sites and or material, SAHRA requires that, in terms of Section 38(4)(b and c) of the National Heritage Resources Act, the provisions of section 35 apply. The specialist will require a mitigation permit from the relevant Heritage Resources Authority for collection and/or excavation.

12.6 ASSESSMENT OF IMPACTS AND IDENTIFICATION OF MANAGEMENT ACTIONS

The impacts identified in this section are assessed according to the method provided in Chapter 4 of this Draft EIA Report.

12.6.1 Results of Field Survey

From the field assessment it would appear that the Coega River mouth area has generally been altered by large scale earth moving activities when the Port of Ngqura was built.

12.6.1.1 Liquid Bulk Berths (A100)

The onshore terminus of Liquid Bulk Berth A100 will impact on modern dune sands of the Schelm Hoek Formation (**Figure 12-7**) (GPS 345) while the opposite end is located offshore below the waterline (**Figure 12-8**).

12.6.1.2 Liquid Bulk Berths (A101)

The east side of the Coega River mouth, where Liquid Bulk Berth A101 will be constructed, is largely underlain by modern dune sands of the Schelm Hoek Formation (**Figure 12-9**). However, the Coega River mouth area has generally been altered by large scale earth moving activities, making stratigraphic relationships difficult to interpret. The inland terminus of A101 will not extend upstream of Klub Road, and as such does not cut across Sundays River Formation outcrop that is visible further upstream along the east bank of the river mouth (**Figure 12-10**) (GPS 347).

12.6.1.3 General Cargo Berth (B101)

The area allocated for the construction of Berth B101 is underlain by reworked spoil used to construct the existing quay (**Figure 12-11**) (GPS 351).

12.6.1.4 Revetment, Cerebos Pipeline Relocation and possible Klub Road Causeway Relocation

The western end of the revetment covers reworked spoil associated with the existing quay (**Figure 12-12**) (GPS 350) and then traverses the Coega River Mouth next to the Klub Road causeway. Here, the river mouth is underlain by terrestrial sediments of the upper Kirkwood Formation mantled by an admixture of Tertiary to recent river gravels and mud (**Figure 12-13**) (GPS 354). The revetment terminates on partially disturbed Schelm Hoek Formation dune sands flanking the Klub Road causeway on the east side of the river mouth (GPS 356). The Cerebos pipeline and Klub Road causeway are also constructed on Kirkwood Formation sediments covered by recent river gravels and mud.

12.6.2 Potential palaeontological impact

The potential palaeontological and archaeological impact significance is summarized in Table 12.2. Palaeontologically sensitive rock units include the Sundays River and Kirkwood Formation

outcrop that most likely extends at depth beneath a large part of the affected area. The palaeontological significance of both these formations is considered high.

Palaeontological impact as a result of construction of the navigation channel between the berths and provision of general services during the construction phase are considered low.

12.6.2.1 Liquid Bulk Berths (A100)

Dredging depth of up to -21 m planned for the Liquid Bulk Berth A100 will severely impact on overlying Schelm Hoek Formation sands which are not regarded as palaeontologically sensitive along the shore. The lack of proper outcrop at the locality hampered investigation, but it is likely that remnants of older Mesozoic sediments as well as Palaeozoic Table Mountain Group bedrock sediments may also be affected.

The impact of dredging/excavations on fossils/fossil sites is rated with a high significance without the implementation of mitigation measures. However it is noted that most of the activities will take place close to and below the water line. The following mitigation measures are proposed:

- SAHRA or the Eastern Cape Provincial Heritage Resources Authority (ECPHRA) must be alerted of palaeontological material found during excavation activities by the Transnet Environmental Officer and/or the Contractor's Environmental Officer.

The significance of the impact is reduced to low with the implementation of the above-mentioned mitigation measures.

12.6.2.2 Liquid Bulk Berths (A101)

Construction of A101 will largely impact on intact and partially disturbed sand dunes of the Schelm Hoek Formation. It is evident that the possible dredging depths of up to - 21 m planned for the berths will most likely impact on fossiliferous sediments of the upper Kirkwood and Sundays River Formations. A moderate possibility exists that objects of palaeontological significance may be uncovered during the course of dredging activities into *in situ* Sundays River and Kirkwood Formation bedrock. The impact of dredging/excavations on fossils/fossil sites is rated with a high significance without the implementation of mitigation measures. However it is noted that most of the activities will take place below the water line. The following mitigation measures are proposed:

- SAHRA or the ECPHRA must be alerted of palaeontological material found during excavation activities by the Transnet Environmental Officer and/or the Contractor's Environmental Officer.

The significance of the impact is reduced to low with the implementation of the above-mentioned mitigation measures.

12.6.2.3 General Cargo Berth (B101)

It is unlikely that the proposed development will affect palaeontological heritage resources due to prior disturbance of the substrate in this region. Therefore, the destruction and disturbance of fossils/fossil sites on the ground or buried beneath the surface during excavations and other

construction work is rated as a low significance impact. No mitigation is proposed due to the disturbed substrate. The impact of excavations on potential fossils/fossil sites is rated with a low significance without the implementation of mitigation measures.

12.6.2.4 Revetment, Cerebos Pipeline Relocation and possible Klub Road Causeway Relocation

Extensive excavation activities related to the construction of the revetment as well as the possible diversion/relocation of the Klub Road causeway further upstream from the river mouth could impact on Sundays River and upper Kirkwood formation bedrock sediments while the eastern portion of the revetment will impact on a partially spoiled sand dune cover on the east side of the river mouth. However, the likelihood exists that the eastern portion of the revetment may potentially impact on Quaternary fossil remains not visible on the surface, but covered by intact Schelm Hoek Formation dune sands. The relocation of the Cerebos pipeline will not significantly impact on fossils or fossil sites.

The impact of the revetment construction as well as the possible diversion/relocation of the Klub Road causeway on fossils/fossil sites is rated with a high significance without the implementation of mitigation measures. The impact of the revetment construction at the east back of the river mouth may potentially impact on Quaternary fossil remains covered by intact Schelm Hoek Formation dune sands. The following mitigation measures are proposed:

- SAHRA or the ECPHRA must be alerted of any palaeontological material found during excavation activities by the Transnet Environmental Officer and/or the Contractor's Environmental Officer.

The significance of the impact is reduced to low with the implementation of the above-mentioned mitigation measures.

12.6.3 Potential archaeological impact

Except for a small portion of vegetated Schelm Hoek Formation dune cover at the inland terminus of Liquid Bulk Berth A101, it would appear that the affected area as a whole is of low archaeological sensitivity as a result of prior earth moving and construction activities. Archaeological impact as a result of construction of the navigation channel between the berths and provision of general services during the construction phase are considered low.

12.6.3.1 Liquid Bulk Berths A100 and A101

Intact Schelm Hoek Formation dune sands are generally considered to be of high archaeological significance, but the onshore area allocated for the construction of Liquid Bulk Berths A100 and A101 has been largely disturbed as a result of prior port construction activities. The impact of excavations on potential intact archaeological sites is rated with a low significance without the implementation of mitigation measures. No mitigation measures will be required.

12.6.3.2 General Cargo Berth (B101)

The area allocated for the construction of B101 is underlain by reworked bulk sediments used to construct the existing quay and is considered to be of low archaeological sensitivity. The

impact of excavations on potential intact archaeological sites is rated with a low significance without the implementation of mitigation measures. No mitigation measures will be required.

12.6.3.3 Revetment, Cerebos Pipeline Relocation and possible Klub Road Causeway Relocation

The western half of the proposed revetment as well as the area marked for the possible Klub Road Causeway diversion/relocation is of low archaeological sensitivity as a result of prior earth moving and construction activities. It is improbable that *in situ* material of archaeological significance will be uncovered during the course of excavation activities into the reworked sediments covering the site. The eastern portion of the revetment as well as the eastern portion of the area marked for the possible Klub Road Causeway diversion/relocation may potentially impact on subsurface archaeological remains covered by intact drifting dune sands (Schelm Hoek Formation) that are mantled against the coastal plateau east of the river mouth.

The relocation of the Cerebos pipeline will not impact on intact archaeological material or sites. The impact of excavations on potential intact archaeological sites during the relocation of the Cerebos pipeline is rated with a low significance without the implementation of mitigation measures. No mitigation measures will be required.

The potential archaeological impact of construction of the eastern portion of the revetment as well as the eastern portion of the area marked for the possible diversion/relocation of the Klub Road Causeway is rated with a medium significance without the implementation of mitigation measures. The following mitigation measures are proposed:

- SAHRA or the ECPHRA must be alerted by the Transnet Environmental Officer and/or the Contractor's Environmental Officer of any potential archaeological material found during excavation activities on the east side of the river mouth.

12.6.4 Cumulative Impacts

All future developments at the Port of Ngqura involving bedrock excavations or disturbance of intact dune systems are potentially negative and cumulative impacts will increase if further developments are not adequately assessed and properly mitigated beforehand.

Table 12.2 Palaeontological and Archaeological Impact assessment summary table for the Construction Phase

CONSTRUCTION PHASE										
DIRECT IMPACTS										
Impact Description	**Mitigation**	**Spatial Extent**	**Intensity**	**Duration**	**Reversibility**	**Irreplaceability**	**Probability**	**Significance & Status**		**Confidence**
								Without Mitigation	***With Mitigation***	
Berths A100 and A101: Destruction, disturbance of fossils/fossil sites on the ground or buried beneath the surface during excavations and other construction work.	The Contractor's Environmental Officer and/or the Transnet Environmental Officer to alert the South African Heritage Resources Agency or Eastern Cape Provincial Heritage Resources Authority of palaeontological finds found during construction.	Local, restricted to proposed development footprint	Medium Kirkwood and Sundays River Formation	Permanent	Non-reversible	Moderate to High, depending on rock unit	Probable	High Negative	Low Positive, Mitigation will enhance knowledge of local fossil heritage.	Medium, poor exposure of potentially fossil-bearing rock units.
Berths A100 and A101: Potential impact of development on archaeology above and below ground.	None, Spoiled, altered substrate	Local, restricted to proposed development footprint	Low, Schelm Hoek Formation	Permanent	Non-reversible	Moderate to Low	Improbable	Low Negative	Low Neutral	High
Berth B101: Destruction, disturbance of fossils/fossil sites on the ground or buried beneath the surface during excavations and other construction work.	None, Spoiled, altered substrate	Local, restricted to proposed development footprint	Low	Permanent	Non-reversible	Low	Improbable	Low Neutral	Low Neutral	High, Spoiled, altered substrate
Berths B101: Potential impact of development on archaeology above and below ground.	None, Spoiled, altered substrate	Local, restricted to proposed development footprint	Low	Permanent	Non-reversible	Low	Improbable	Low Neutral	Low Neutral	High, Spoiled, altered substrate
Revetment, Cerebos Pipeline and possible Klub Road Causeway Diversion/Relocation:	The Contractor's Environmental Officer and/or the Transnet Environmental Officer to alert the South African Heritage Resources	Local, restricted to proposed development	Moderate Kirkwood & Sundays River	Permanent	Non-reversible	Moderate to High, depending on rock unit	Probable	High Negative, Potential destruction of	Low Positive, Mitigation will enhance knowledge of	Medium, poor exposure of potentially

CONSTRUCTION PHASE										
DIRECT IMPACTS										
Impact Description	**Mitigation**	**Spatial Extent**	**Intensity**	**Duration**	**Reversibility**	**Irreplaceability**	**Probability**	**Significance & Status**		**Confidence**
								Without Mitigation	***With Mitigation***	
Destruction, disturbance of fossils/fossil sites on the ground or buried beneath the surface during excavations and other construction work.	Agency or Eastern Cape Provincial Heritage Resources Authority of palaeontological finds found during construction. Monitoring of excavations into Kirkwood and Sundays River Formation by the Contractor's Environmental Officer and/or the Transnet Environmental Officer.	footprint	Formation.					fossils	local fossil heritage.	fossil-bearing rock units.
Revetment, Cerebos Pipeline and possible Klub Road Causeway Diversion/Relocation: Potential impact of development on archaeology above and below ground.	The Contractor's Environmental Officer and/or the Transnet Environmental Officer to alert the South African Heritage Resources Agency or Eastern Cape Provincial Heritage Resources Authority of archaeological finds found during construction activities in Schelm Hoek Formation sands (dune sands) east of river mouth. Monitoring of excavations into Schelm Hoek Formation on east side of river mouth by the Contractor's Environmental Officer and/or the Transnet Environmental Officer.	Local, restricted to proposed development footprint	Moderate Schelm Hoek Formation.	Permanent	Non-reversible	Moderate to High, depending on rock unit	Probable	Medium, Negative, Potential destruction of archaeology	Low Positive, Mitigation will enhance knowledge of archaeological heritage.	Medium, poor exposure of potentially fossil-bearing rock units.

12.7 CONCLUSION

Any damage to, or loss of, palaeontological and archaeological heritage due to inadequate mitigation would result in a **highly negative heritage impact.** On the other hand, exposure as a result of excavation activities and subsequent reporting of fossils could be seen as a **positive palaeontological impact**. In such a case it is advised that SAHRA/ECPRHA should be notified immediately by the Contractor's Environmental Officer and/or the Transnet Environmental Officer.

In terms of possible palaeontological heritage, potentially sensitive rock units identified within the affected area include Sundays River and Kirkwood Formation outcrop that extends at depth beneath the affected area. The palaeontological significance of both these formations is considered high and excavations into these units should be monitored on a regular basis by the Contractor's Environmental Officer and/or Transnet Environmental Officer during the construction phase.

To summarize, the Liquid Bulk Berth A101 the revetment as well as the possible diversion/relocation of the Klub Road Causeway may impact on potentially sensitive palaeontological strata. Palaeontological impact as a result of construction of the navigation channel between the berths, General Cargo Berth B101 and the relocation of the Cerebos intake pipeline is considered low.

As for archaeological heritage, the proposed development overall is of low archaeological significance which can largely be attributed to prior construction activities in and around the affected area. However given the archaeological record of the region, there is always the possibility that archaeological remains such as shell middens or human remains may be uncovered from intact dune sands (Schelm Hoek Formation). All construction work must therefore be monitored, by the Contractor's Environmental Officer and/or the Transnet Environmental Officer during the construction phase.

To summarize, the relocation of the Cerebos water intake pipeline will not result in archaeological impacts. Archaeological impact as a result of construction of the navigation channel between the berths is considered negligible. The eastern portion of the revetment as well as the eastern portion of the area marked for the possible Klub Road Causeway diversion/relocation, may impact on potential subsurface archaeological remains covered by pockets of intact dune sands (Schelm Hoek Formation) east of the river mouth. Archaeological impact as a result of construction of the General Cargo Berth B101 will be negligible.

Palaeontological and archaeological impacts during the operational and decommissioning phase of the development are considered unlikely.

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APPENDICES

Appendix 12.A: Figures used in this chapter

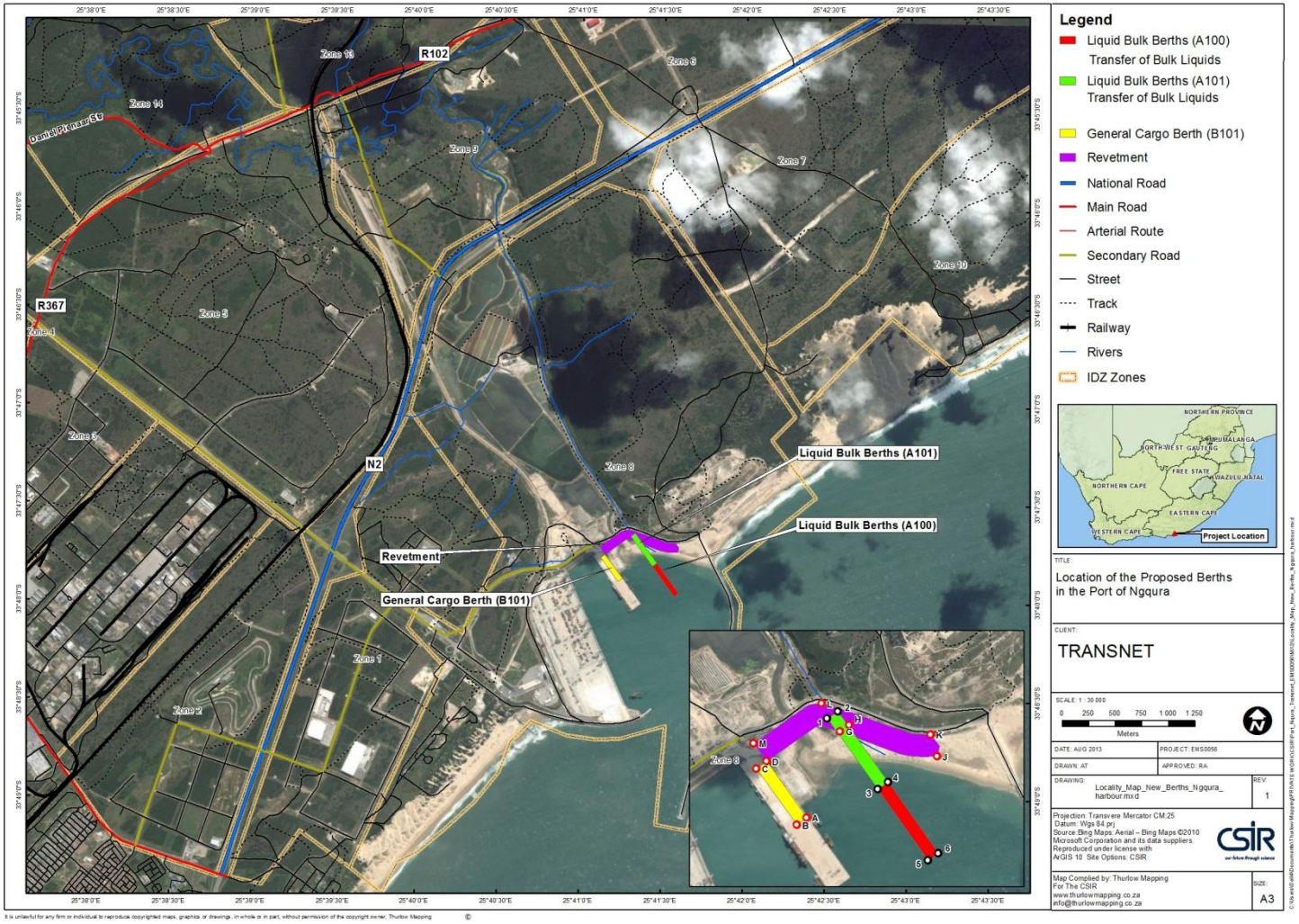

Figure 12.1. Locality Map of the proposed new Berths and Revetment at the Port of Ngqura

Figure 12.2. Looking southwest. Panoramic view of the Port of Ngqura from a low-relief coastal plateau on the east side of the Coega River mouth

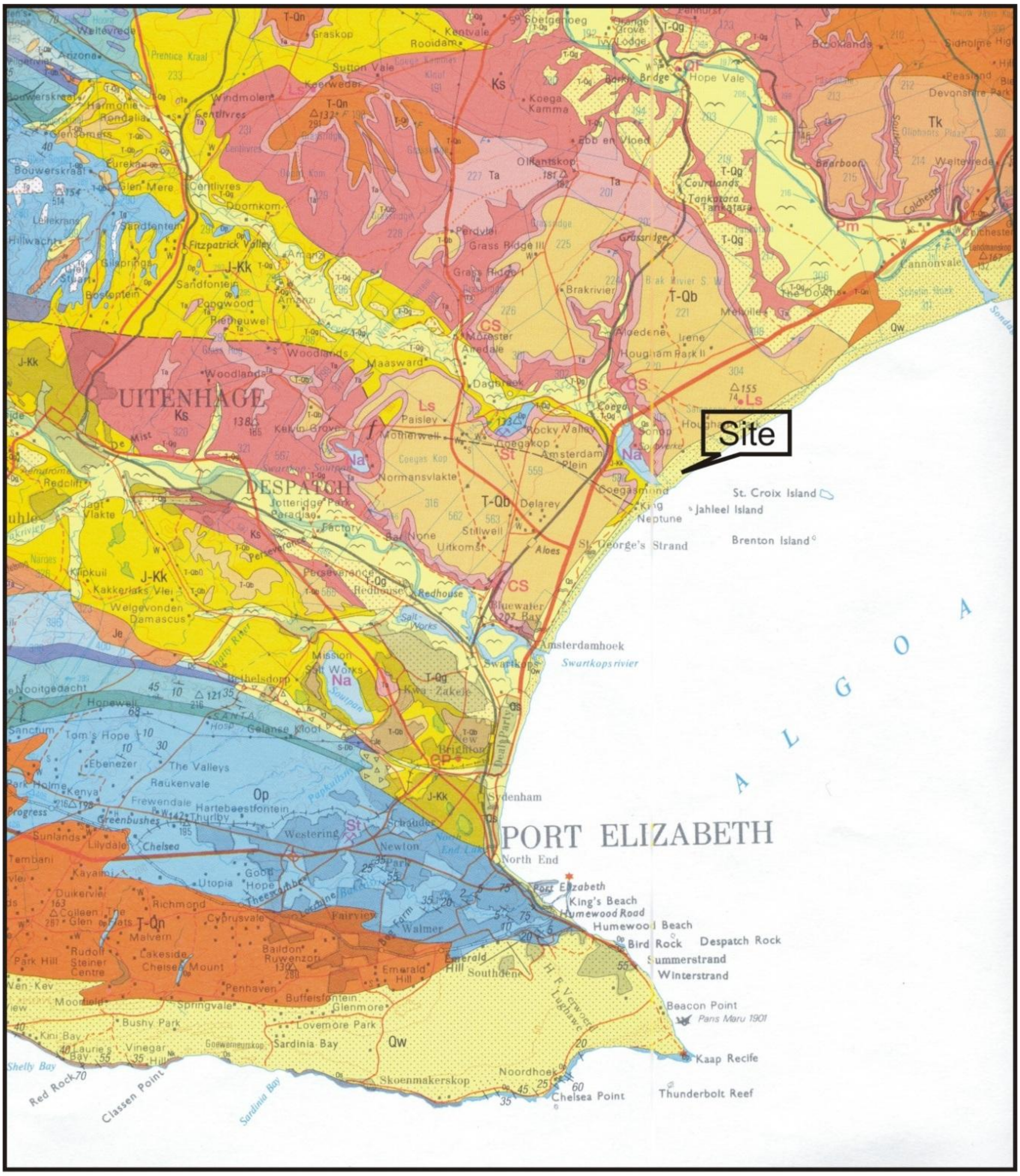

Figure 12.3. Portion of the 1: 250 000 scale geological map 3324 Port Elizabeth showing bedrock geology in and around the study area.

From the oldest to youngest: Palaeozoic strata consist of the Table Mountain Group including the Peninsula Formation Op, the Nardouw Subgroup (Goudini Formation Sg, Skurweberg Formation Ss, Baviaanskloof Formation Db), as well as undifferentiated Ceres Subgroup sediments (Bokkeveld Group, Dc). Mesozoic sediments are represented by fluvial and shallow marine deposits of the Kirkwood Formation J-Kk and the Sundays River Formation Ks (Uitenhage Group). Cenozoic sediments are represented by the late Neogene Alexandria Formation Ta, the Plio-Pleistocene Nanaga T-Qn and Bluewater Bay T-Qb Formations and the Late Pleistocene Salnova Formation T-Qg. Superficial alluvial deposits blanket river valleys as flood plain soils or merge into sheet wash in the upper reaches of tributaries. Shifting sand dunes are common along the coastline (Qw).

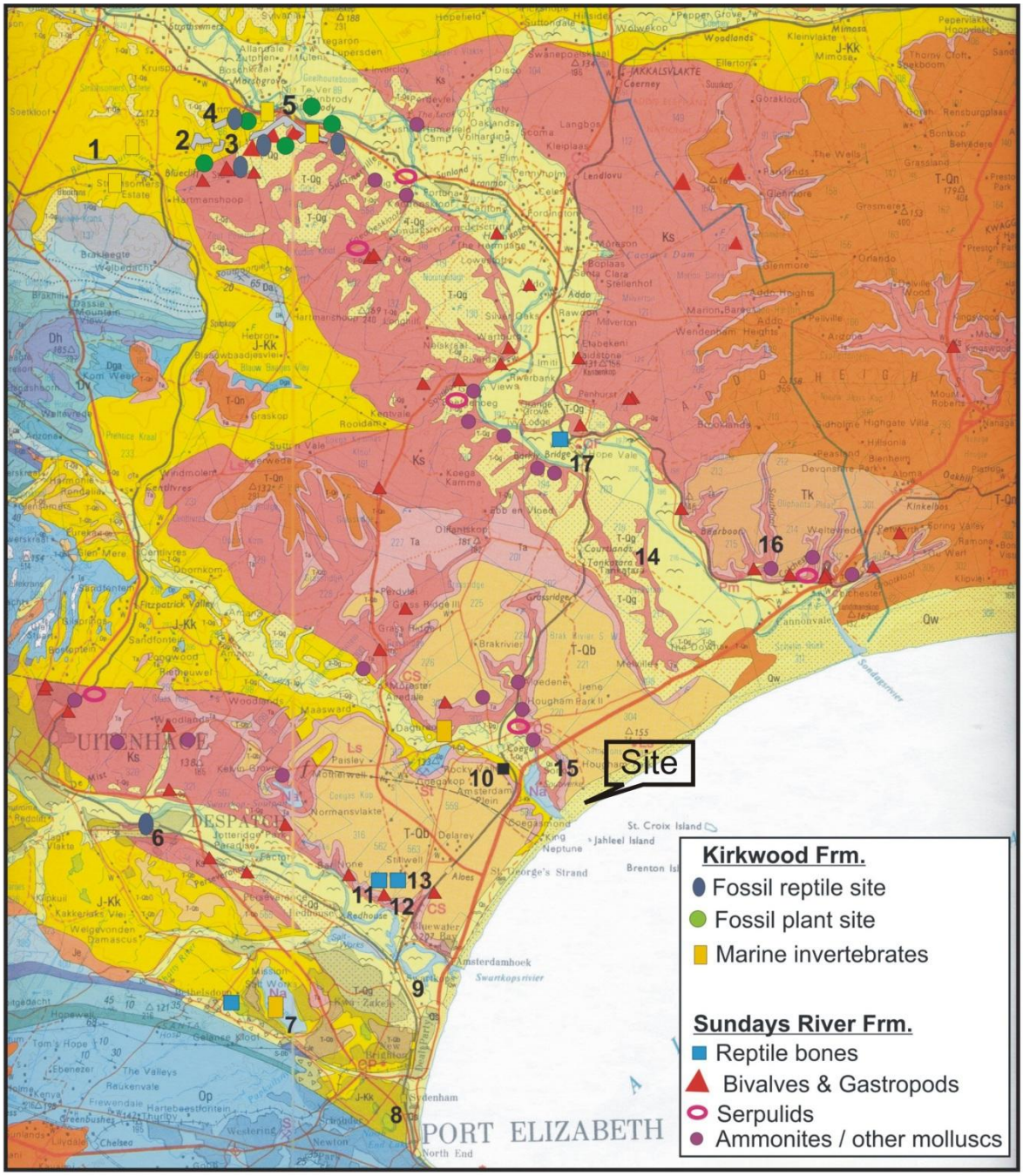

Figure 12.4. Palaeontological sites recorded within Uitenhage Group sediments in the vicinity of Port Elizabeth.

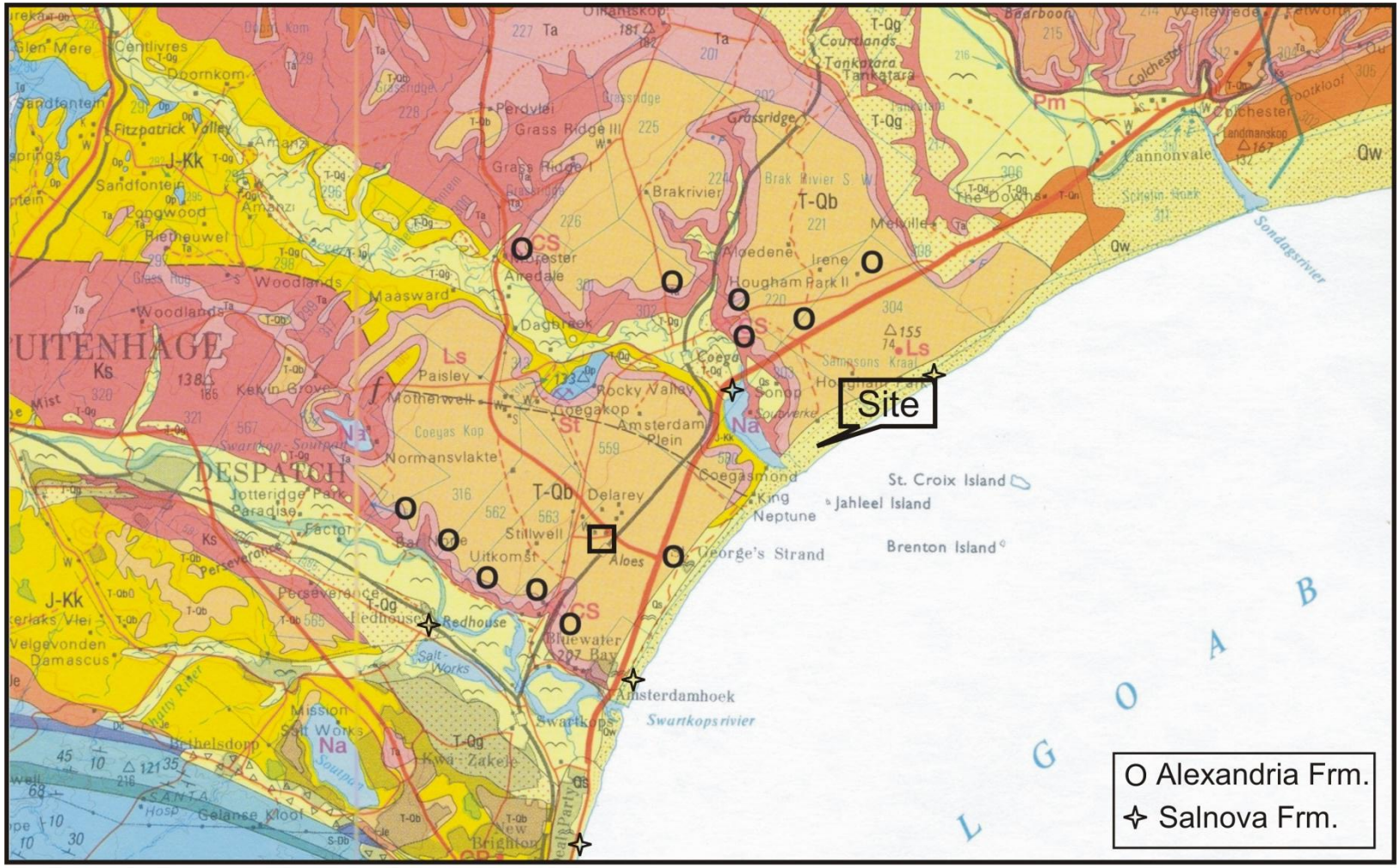

Figure 12.5. Palaeontological sites recorded within Algoa Group sediments in the vicinity of the footprint.

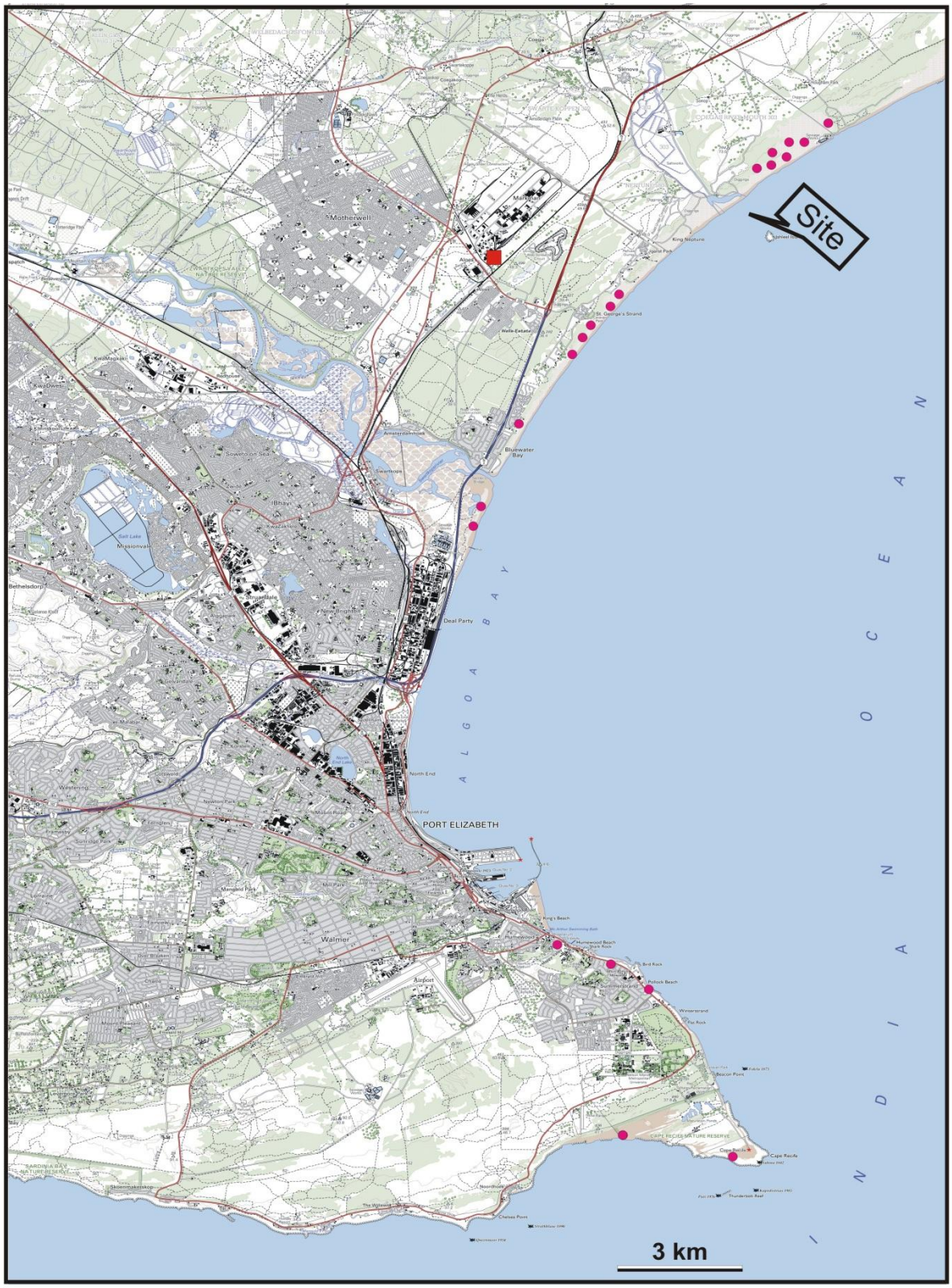

Figure 12.6. Map of Later Stone Age shell midden localities (approximate positions) recorded near the coastline at Port Elizabeth. The approximate position of the Aloes bone deposit (Gess 1969; Wells 1970) is indicated by the red square.

Figure 12.7. Looking northwest towards the Coega River mouth. The direction of the onshore section of the Liquid Bulk Berth A100 is indicated by the large arrow.

Figure 12.8. Looking southeast. Offshore direction of Liquid Bulk Berth A100, underlain by modern Schelm Hoek Formation dune sands.

Figure 12.9. Part of the heavily vegetated dune sands (Schelm Hoek Formation) overlying Mesozoic Sundays River Formation sediments on the east side of the river mouth.

Figure 12.10. Weathered outcrop of potentially fossil-bearing Sundays River Formation (Walking stick = 80 cm).

Figure 12.11. The harbour, looking southwest. The area allocated for the construction of the proposed General Cargo Berth (B101) is underlain by reworked bulk sediments used to construct the existing harbour quay (arrows).

Figure 12.12. Looking northeast from the west side of the river mouth. The substrate on the west side are largely made up of reworked spoil.

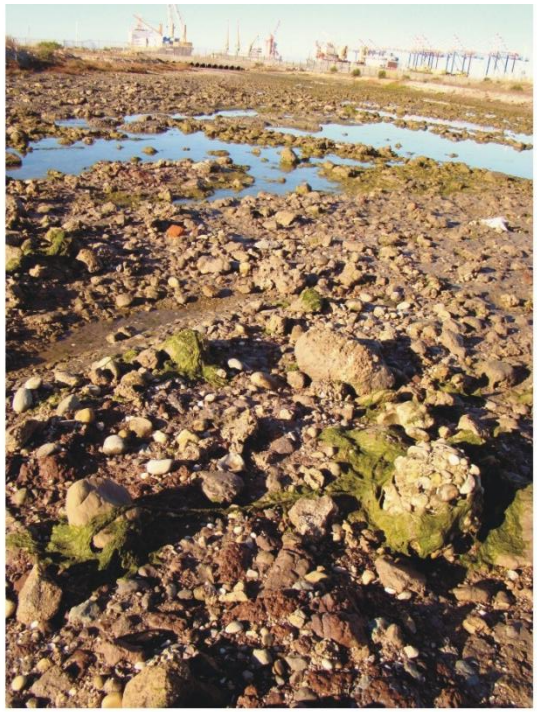

Figure 12.13. The river mouth is underlain by terrestrial sediments of the upper Kirkwood Formation covered by an admixture of Tertiary to recent river gravels, sand and mud.

Appendix 12.B: Field Assessment GPS Readings

GPS readings taken during the field assessment carried out on 5, 6, and 7 June 2013 (Garmin Etrex, datum WGS 84)

GPS #	Coordinates	
345	33°47'43.62"S	25°41'21.23"E
346	33°47'38.39"S	25°41'21.38"E
347	33°47'34.27"S	25°41'16.01"E
348	33°47'39.75"S	25°41'14.23"E
449	33°47'38.64"S	25°41'17.06"E
350	33°47'43.56"S	25°41'6.02"E
351	33°47'46.18"S	25°41'8.27"E
352	33°47'34.67"S	25°41'17.33"E
353	33°47'32.88"S	25°41'14.46"E
354	33°47'38.77"S	25°41'11.34"E
355	33°47'40.68"S	25°41'19.59"E
356	33°47'41.76"S	25°41'35.38"E
357	33°47'43.72"S	25°41'30.89"E