

**MARITIME ARCHAEOLOGICAL IMPACT ASSESSMENT OF  
PROPOSED 2AFRICA (WEST) SUBMARINE FIBRE OPTIC CABLE SYSTEM,  
LANDING AT YZERFONTEIN, WESTERN CAPE PROVINCE**

Assessment conducted under Section 38 (8) of the National Heritage Resources Act (No. 25 of 1999)  
as part of an Environmental Impact Assessment

Prepared for  
**Acer (Africa) Environmental Consultants**

On behalf of  
**Alcatel Submarine Networks**

and

**Mobile Telephone Network (Pty) Ltd**

April 2021

Version 1.1



Prepared by

**John Gribble**

ACO Associates cc

Physical: Unit D17, Prime Park, 21 Mocke Rd, Diep River

Postal: 8 Jacobs Ladder St James, 7945

[john.gribble@aco-associates.com](mailto:john.gribble@aco-associates.com)

Tel: 021 7064104

Cell: 078 616 2961

Fax to e-mail: 086 603 7195

## CONTENTS OF THE SPECIALIST REPORT – CHECKLIST

<b>Regulation GNR 326 of 4 December 2014, as amended 7 April 2017, Appendix 6</b>	<b>Section of Report</b>
(a) details of the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a <i>curriculum vitae</i> ;	Page 4 and Appendix 3
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Page 4
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 3: Terms of Reference
(cA) an indication of the quality and age of base data used for the specialist report;	Section 5: Methodology
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 7: Impact Assessment
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 5: Methodology
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 5: Methodology
(f) details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Sections 6 and 7
(g) an identification of any areas to be avoided, including buffers;	Section 8: Conclusion and Recommendations
(h) a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Figures 9, 12 and 13
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 5,4: Limitations
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives on the environment, or activities;	Section 7: Impact Assessment
(k) any mitigation measures for inclusion in the EMPr;	Section 8: Conclusion and Recommendations

(l) any conditions for inclusion in the environmental authorisation;	Section 8: Conclusion and Recommendations
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 8: Conclusion and Recommendations
(n) a reasoned opinion— i. as to whether the proposed activity, activities or portions thereof should be authorised; iA. Regarding the acceptability of the proposed activity or activities; and ii. if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr or Environmental Authorization, and where applicable, the closure plan;	Section 8: Conclusion and Recommendations
(o) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Comments the South African Heritage Resources Agency and from Heritage Western Cape – see Sections 2 and 3 and Appendix 1
(p) any other information requested by the competent authority	N/A
Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	

## DETAILS OF THE SPECIALIST

This study has been undertaken by John Gribble BA Hons, MA (ASAPA) and Gail Euston-Brown BA of ACO Associates CC, archaeologists and heritage consultants.

Unit D17, Prime Park, Mocke Road, Diep River, Cape Town, 7800

Email: [john.gribble@aco-associates.com](mailto:john.gribble@aco-associates.com)

Phone: 021 706 4104 / 078 616 2961

Fax: 086 6037195

## CONSULTANT DECLARATION OF INDEPENDENCE

I, John Gribble, declare that:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, Regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- All the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

**Signature of the specialist:**

A handwritten signature in black ink, appearing to read 'J. Gribble', enclosed within a large, stylized circular flourish.

**Name of company (if applicable):** ACO Associates CC

**Date:** 28 January 2021

## EXECUTIVE SUMMARY

ACO Associates cc has been commissioned by ACER (Africa) Environmental Consultants on behalf of Mobile Telephone Network (Pty) Ltd to undertake a desktop maritime archaeological impact assessment of the route of the proposed 2AFRICA (West) submarine fibre optic cable system which makes landfall at Yzerfontein on the Cape West Coast.

This maritime heritage assessment report, supported by recommendations for implementable mitigation measures will form part of an Environmental Impact Assessment for the proposed cable system.

**Findings:** In respect of submerged prehistoric archaeological potential, this assessment indicates that although there have, to date, been no studies of submerged prehistory in the study area, the archaeological evidence for a Later Stone Age hominin presence on the West Coast is plentiful, while the important Earlier Stone Age sites of Duinefontein 1 and 2, approximately 5 km north of the cable landfall area have produced Acheulean stone tools in association with animal bone, deposited between 200,000 and 400,000 years ago, around palaeo-pans or lakes that developed in hollows within a large dune field, where hominins were hunting or scavenging animals.

During periods of lower sea level, similar palaeo-pans and palaeo-rvier channels are likely to have been present on the exposed continental shelf of the West Coast. Together with ancient rivers courses, these water sources, which are today buried under modern seabed sediment, would have been an important focus for hominin activity on the exposed continental shelf. As described above, the handaxes found within the seabed of Table Bay in the 1980s were the same age and type as those at Duinefontein 1 and 2 and there is thus a clear potential for the occurrence of ancient, submerged archaeological material in association with such seabed features within the area to be affected by the 2AFRICA (West) cable system.

In terms of palaeontological potential within the study area, extensive cemented crusts or “hardgrounds” formed on formations exposed at the seabed and eroded and reconsolidated during glacial sea level oscillations. These have produced a wide array of multiphase phosphorite nodules and phosphatic shell casts of various ages. The bones and teeth of sharks and other fishes, the skulls of extinct whale species and the occasional remains of land-living animals that roamed the ice age exposed shelf are also phosphatized and reworked into the latest, loose sediments on the seabed.

Regarding historical shipwrecks, this assessment found that there are no recorded wrecks within the study area or within approximately 8,5 km of the 2AFRICA (West) cable system.

One important world War II shipping casualty which is recorded in the EEZ in the vicinity of the cable route is the German U-boat U-1769, sunk on October 1942. Although outside the remit of the Act, this wreck must be treated as a war grave and if encountered must be avoided and the find reported to SAHRA.

The cable design and engineering surveys undertaken by Fugro Germany Marine identified a number of sidescan sonar and magnetic anomalies in and on the seabed of the cable corridor. The bulk of these were geological but a handful humanly-derived debris was noted although their nature was not possible to discern in the available data.

**Recommendations:** No mitigation is required or proposed in respect of submerged prehistoric archaeology or palaeontology in the Deep and Shallow Water portions of the cable route where installation will be burial by plough as it is extremely unlikely that sites or material will be affected by the installation of the cable and also impossible to mitigate any disturbance.

In the Inshore Waters and on the beach crossing, in respect of both submerged prehistoric archaeology and palaeontology, it is recommended that an alert for the occurrence of fossil bones and teeth, as well as potential submerged prehistoric archaeological material, be included in the EMP for the project, specifically for the divers working in the shoreface and the operators excavating the trench in the beach and dune.

With regard to historical shipwrecks, the proposed 2AFRICA (West) cable system has a very low potential for impacts arising out of the installation of the seabed cable. However, in view of the potential, albeit very small, for the presence of currently unknown wrecks close to the cable route, the following recommendations are made in respect of mitigation measures to be applied during the installation of the cable system:

- If any further geophysical data, particularly in the Inshore Waters portion of the cable route, is generated to support the installation of the cable system it be archaeologically reviewed for the presence of historical shipwrecks or related material. If possible, the project archaeologist should be consulted before data are collected to ensure that the survey specifications and data outputs are suitable for archaeological review;
- Should the data identify wreck material at or near the location of any portion of the cable, micro-siting of the cable and/or the possible implementation of an exclusion zone around the archaeological feature should be sufficient to mitigate the risks to the site;
- Should any archaeological material be accidentally encountered during the course of cable installation, work must cease in that area until the project archaeologist and SAHRA have been

notified, the find has been assessed by the archaeologist, and agreement has been reached on how to deal with it.

Based on the information and assessment above, it is our reasoned opinion that the proposed installation of the 2AFRICA (West) cable system raises no red flags, contains no fatal flaws and is unlikely to have any impact on known or unknown maritime and underwater cultural heritage resources. It is, therefore, considered acceptable.

## GLOSSARY

**Archaeology:** Remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.

**Early Stone Age:** The archaeology of the Stone Age between 700 000 and 2 500 000 years ago.

**Fossil:** Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

**Heritage:** That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act 25 of 1999).

**Holocene:** The most recent geological time period which commenced 10 000 years ago.

**Late Stone Age:** The archaeology of the last 20 000 years associated with fully modern people.

**Marine Isotope Stage:** Alternating warm and cool periods in the Earth's palaeoclimate, deduced from oxygen isotope data derived from data from deep sea core samples.

**Midden:** A pile of debris, normally shellfish and bone that have accumulated as a result of human activity.

**Middle Stone Age:** The archaeology of the Stone Age between 20 000-300 000 years ago associated with early modern humans.

**National Estate:** The collective heritage assets of the Nation.

**Palaeontology:** Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

**Pleistocene:** A geological time period (of 3 million – 10 000 years ago).

**Pliocene:** A geological time period (of 5 million – 3 million years ago).

**SAHRA:** South African Heritage Resources Agency – the compliance authority which protects national heritage.



## **ACRONYMS**

<b>BMH</b>	Beach Manhole
<b>CLS</b>	Cable Landing Station
<b>DEFF</b>	Department of Environment, Forestry and Fisheries
<b>EA</b>	Environmental Authorisation
<b>EEZ</b>	Exclusive Economic Zone
<b>EIA</b>	Environmental Impact Assessment
<b>ESA</b>	Early Stone Age
<b>HIA</b>	Heritage Impact Assessment
<b>HWC</b>	Heritage Western Cape
<b>LSA</b>	Late Stone Age
<b>MBES</b>	Multibeam Bathymetry
<b>MSA</b>	Middle Stone Age
<b>Mya</b>	Million years ago
<b>NHRA</b>	National Heritage Resources Act
<b>SAHRA</b>	South African Heritage Resources Agency
<b>SSS</b>	Sidescan Sonar
<b>UNCLOS</b>	United Nations Convention on the Law of the Sea

<b>CONTENTS OF THE SPECIALIST REPORT – CHECKLIST</b> .....	<b>2</b>
<b>DETAILS OF THE SPECIALIST</b> .....	<b>4</b>
<b>CONSULTANT DECLARATION OF INDEPENDENCE</b> .....	<b>4</b>
<b>EXECUTIVE SUMMARY</b> .....	<b>5</b>
<b>GLOSSARY</b> .....	<b>8</b>
<b>ACRONYMS</b> .....	<b>9</b>
<b>1. INTRODUCTION</b> .....	<b>13</b>
<b>2. PROJECT DESCRIPTION</b> .....	<b>13</b>
<b>3. TERMS OF REFERENCE</b> .....	<b>17</b>
<b>4. RELEVANT LEGISLATION</b> .....	<b>17</b>
4.1. National Heritage Resources Act (No 25 of 1999) .....	17
4.2. Maritime Zones Act (No 15 of 1994) .....	19
4.3. National Environmental Management Act (No 107 of 1998).....	20
<b>5. METHODOLOGY</b> .....	<b>22</b>
5.1. Palaeontological Comment .....	22
5.2. Geophysical Survey.....	22
5.3. Maritime Study Area.....	23
5.4. Limitations .....	23
<b>6. UNDERWATER CULTURAL HERITAGE</b> .....	<b>25</b>
6.1. Submerged Prehistory.....	26
6.1.1. Submerged Prehistory of Yzerfontein Area.....	29
6.2. Palaeontology.....	30
6.3. Maritime History of the South African Coast.....	33
6.3.1. Maritime History of the Yzerfontein Area .....	34
6.4. Review of Geophysical Survey Results .....	35
6.5. Maritime Heritage in the EEZ and Continental Shelf.....	42
<b>7. IMPACT ASSESSMENT</b> .....	<b>42</b>
7.1. Submerged Prehistory.....	43
7.2. Palaeontology.....	44
7.3. Maritime Archaeology .....	46
<b>8. CONCLUSIONS AND RECOMMENDATIONS</b> .....	<b>47</b>
8.1. Acceptability of the Proposed Activity with Respect to Heritage Resources .....	48

<b>9. REFERENCES .....</b>	<b>49</b>
<b>9.1. Online Sources.....</b>	<b>52</b>
<b>APPENDIX 1: CORRESPONDENCE WITH HWC RE NEED FOR TERRESTRIAL HERITAGE STUDIES .....</b>	<b>54</b>
<b>APPENDIX 2: RECORDED WRECKS AND SHIPPING CASUALTIES WITHIN &amp; PROXIMATE TO THE MARITIME ARCHAEOLOGICAL STUDY AREA (ALL ZONES).....</b>	<b>55</b>
<b>APPENDIX 3: SPECIALIST CV .....</b>	<b>56</b>
<b>APPENDIX 4: IMPACT ASSESSMENT METHODOLOGY.....</b>	<b>62</b>
Figure 1: General overview of the proposed 2AFRICA/GERA (West) and (East) Cable Systems (After ACER 2021).....	14
Figure 2: Proposed route of the 2AFRICA (West) cable system (red line) in South African waters (EEZ = orange; contiguous zone = red; territorial waters = purple). The continental shelf is coloured light blue (Source: Google Earth). .....	16
Figure 3: 2AFRICA (West) cable system and the maritime zones referred to in the text (Source: Google Earth).....	21
Figure 4: 2AFRICA (West) segment W1.12 between the Yzerfontein BMH and the offshore Swakopmund BU (After: Rackebrandt et al. 2020). .....	23
Figure 5: Maritime archaeological assessment study area for this report between the outer limit of the contiguous zone (24 NM from the baseline) to the mean high-water mark at the landfall at Yzerfontein. The study area comprises a 1 km buffer (orange) on either side of the proposed cable route (red line). (Source: Google Earth). .....	24
Figure 6: Possible extent of the South African continental shelf c.137,000 years ago (Source: Franklin et al, 2015).....	27
Figure 7: The south west coast continental shelf showing the water depths of 45, 75, 120 and 400 m. The 2AFRICA (West) cable system will be installed in the area highlighted in red on the left of the image (Source: Compton, 2011 from Cawthra, 2014). .....	28
Figure 8: Extent of the exposed continental shelf along the south west coast at the last glacial maximum c. 20,000 years ago (Source: <a href="https://select.timeslive.co.za/news/2020-05-21-decade-of-work-strips-90km-of-sea-for-a-glimpse-of-ice-age-sa/">https://select.timeslive.co.za/news/2020-05-21-decade-of-work-strips-90km-of-sea-for-a-glimpse-of-ice-age-sa/</a> ) .....	28
Figure 9: Chronostratigraphy of the continental shelf off Cape Town and locations of the subsea cable routes to both Yzerfontein and Duynefontein (After De Wet 2012). .....	31
Figure 10: Schematic cross-section depicting the formations which may be encountered beneath shoreface and beach sands in embayed bedrock settings. ....	32

Figure 11: Example of the strategic position of the South African coast in global trade. British trade routes as shown by ship logs – 1750 to 1800 (Source: <a href="http://www.theguardian.com/news/datablog/2012/apr/13/shipping-routes-history-map">http://www.theguardian.com/news/datablog/2012/apr/13/shipping-routes-history-map</a> ). .....	34
Figure 12: Proposed alignment of the 2AFRICA/GERA (West) cable system across the EEZ, contiguous zone, territorial waters and inland waters showing the recorded wrecks in the vicinity (Source: Google Earth). .....	36
Figure 13: Proposed alignment of the 2AFRICA (West) cable system showing the relative positions of the concentrations of wrecks around Saldanha Bay (top) and Dassen Island (bottom) (Source: Google Earth). .....	37
Figure 14: Beach crossing at BMH Yzerfontein. Note the confirmed position of the WACS Seg 1a cable (After: Rackebrandt et al. 2020). .....	38
Figure 15: MBES bathymetry (top) and SSS (bottom) images of the Inshore Survey area (After: Rackebrandt et al. 2020). .....	39
Figure 16: SSS image of rock outcrops surrounded by fine SAND between KP 5.899 and KP 7.528 (After: Rackebrandt et al. 2020). .....	40
Figure 17: MBES bathymetry (top) and gradient (bottom) images for the rock outcrop and sand-filled channels between KP 16.500 and 26.710 in water depths approaching the -120 m limit for prehistoric archaeological material (After: Rackebrandt et al. 2020). .....	41
Plate 1: Three Acheulian handaxes recovered from seabed sediments in Table Bay (Source: <a href="http://www.aimure.org/index.php/aimure-projects">http://www.aimure.org/index.php/aimure-projects</a> ) .....	30
Plate 2: Sub-bottom Profiler image of the profile with the thin layer of sand overlying rock between KP 7.240 and KP 7.900 (After: Rackebrandt et al. 2020). .....	40

## **1. INTRODUCTION**

ACO Associates cc (ACO) has been commissioned by ACER (Africa) Environmental Consultants (ACER) on behalf of Alcatel Submarine Networks (ASN) and Mobile Telephone Network (Pty) Ltd (MTN) to undertake a desktop maritime archaeological impact assessment of the route of the proposed 2AFRICA (West) submarine fibre optic cable system which makes landfall at Yzerfontein on the Cape West Coast.

ASN has been contracted to supply and install the proposed cable system which will be operated by MTN as the South African landing partner.

ACER is the appointed Environmental Assessment Practitioner (EAP) and is responsible for the Environmental Authorisation (EA) requirements, including identifying environmental aspects relevant to the proposed telecommunications infrastructure and construction of the cable system.

## **2. PROJECT DESCRIPTION**

The following description of the project is summarised from information presented in the draft Scoping Report (ACER 2021).

The proposed submarine cable system known as 2AFRICA comprises two branches, west and east, which essentially circumnavigate Africa, connecting it to Europe and the United Kingdom (Figure 1). The 2AFRICA (West) component of the system, which terminates on the South African coast at Yzerfontein, will connect at least 11 countries on the west coast of Africa with Europe.

The cable system will enter South Africa's Exclusive Economic Zone (EEZ) from the continental shelf south of the maritime boundary between South Africa and Namibia (Figure 2). Thereafter the cable system follows a course south and east along the west coast before tracking north-east from a point approximately 64 km west of Grotto Bay to cross the contiguous zone, territorial waters and a portion of inland waters landward of the baseline. Landfall is at Yzerfontein where the preferred option is to link the cable into the existing WACS Cable System Beach Manhole (BMH). Except where it crosses the contiguous zone, territorial waters and inland waters, the cable system will be located well offshore within South Africa's EEZ. For a short, approximately 55 km stretch just to the south of the border with Namibia, the cable system will be routed across the continental shelf.

The proposed 2AFRICA (West) cable system to Yzerfontein comprises the following project components:

- Marine fibre optic cable (marine environment to the WACS BMH at Yzerfontein);



Figure 1: General overview of the proposed 2AFRICA/GERA (West) and (East) Cable Systems (After ACER 2021).

- An existing BMH located behind the coastal dune cordon at the northern end of Beach Road on Yzerfontein Main Beach; and
- Terrestrial fibre optic cable (from the BMH to the WACS Cable Landing Station (CLS) site adjacent to the R315, inland of Yzerfontein).

The installation and operation of the cable system will include the following activities:

- Pre-installation activities including cable route survey, route engineering, route clearance and pre-lay grapnel run;
- Laying of the cable in the offshore environment, preceded by route clearance and including cable burial to a water depth of 1,500 m;

- The laying of the cable within the shallow water environment is likely to involve a direct shore end operation where the shore end of the subsea cable is installed directly from the main subsea cable installation vessel and floated to the beach landing point using buoys, assisted by small boats and divers. It is then buried in the seabed using the diver jet burial technique. The cable will be buried in sediment wherever possible and the route will be adjusted to avoid obvious visible rock. The aim is to bury the cable to a depth of 1 m where possible;
- Excavations within the intertidal zone to bury the cable before it is anchored into the existing WACS anchor block and BMH (already constructed and located directly inland of the beach at the preferred landing point). The BMH is a concrete utility vault where the marine portion of the subsea cable is connected to the terrestrial portion;
- Installation of a sea earth system (System Earth) on Yzerfontein Beach; and
- Burial of the cable in the beach to a depth of 2 meters, substrate permitting.

This heritage impact assessment deals principally with the marine portion of the cable system located between the outer edge of the contiguous zone (a minimum of 24 nautical miles offshore) to the high water mark, which is the extent of the jurisdiction of the South African Heritage Resources Agency (SAHRA) (see Sections 4.1 and 4.2 and Figure 3 below). The potential for and impacts on heritage resources within the EEZ and on the continental shelf are addressed in Section 6.5 below.

The terrestrial portion of the cable route inland of the BMH falls under the jurisdiction of Heritage Western Cape (HWC) but because it will use the existing WACS cable landing infrastructure and cable sleeves does not trigger the relevant section of the National Heritage Resources Act (Section 38(1)). According to HWC, therefore, no heritage assessment for that portion of the route is required (see Appendix 1).

After geophysical survey of the route and clearance of possible debris (e.g. lost fishing gear) by grapnel dragging, the cable will be installed in a shallow trench in water depths shallower than ~1500 m below sea level.

In the deep water, this trench is created using a subsea plough, dragged through the surficial sediments, through which the cable is threaded and buried to a target depth of 2 m.

Close to the shore the cable is winched onshore to connect with the terrestrial cable route at the existing BMH infrastructure installed for the WACS Cable Landing Station. It is to be buried to ~1 m in the shoreface sediment wedge by diver-operated water jetting and buried in the beach to ~2 m depth in an excavated trench, substrate permitting

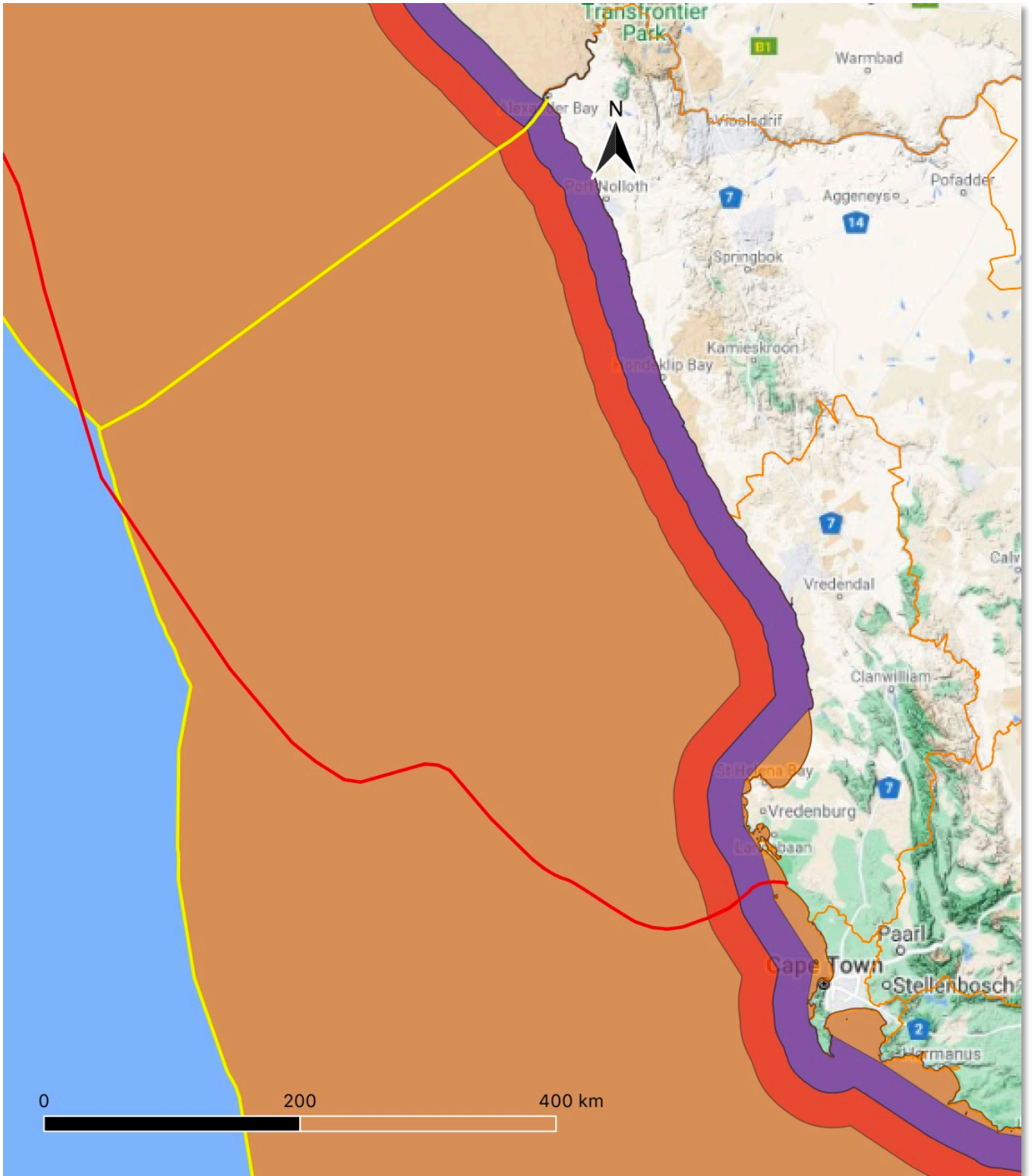


Figure 2: Proposed route of the 2AFRICA (West) cable system (red line) in South African waters (EEZ = orange; contiguous zone = red; territorial waters = purple). The continental shelf is coloured light blue (Source: Google Earth).



### **3. TERMS OF REFERENCE**

ACO Associates was commissioned to produce a Heritage Impact Assessment (HIA) of the proposed 2AFRICA (West) cable system as part of the Environmental Impact Assessment (EIA) process for the project, as required by the National Environmental Management Act (No. 107 of 1998), as amended.

The HIA aims to identify heritage resources which may be impacted during the construction, operation and decommissioning phases of the project, assess their significance and provide recommendations for mitigation.

This document therefore includes the following:

- A desk-top level literature review to assess the potential for maritime archaeological sites, and submerged pre-colonial sites along the route of the cable system;
- A comment from a palaeontologist regarding the potential for impacts to palaeontological features arising from the installation of the cable system; and
- A review of the geophysical survey reports for the cable system for seabed anomalies that may represent heritage resources.

The results of the studies listed above are integrated in this HIA report along with an assessment of the sensitivity and significance of any heritage resources, an evaluation of the potential impacts on them of the construction, operation and decommissioning of the project, and recommendations for measures to mitigate any negative impacts of the project on them.

### **4. RELEVANT LEGISLATION**

#### **4.1. National Heritage Resources Act (No 25 of 1999)**

The National Heritage Resources Act (NHRA) came into force in April 2000 with the establishment of SAHRA, replacing the National Monuments Act (No. 28 of 1969 as amended) and the National Monuments Council as the national agency responsible for the management of South Africa's cultural heritage resources.

The NHRA reflects the tripartite (national/provincial/local) nature of public administration under the South African Constitution and makes provision for the devolution of cultural heritage management to the appropriate, competent level of government.

Because national government is responsible for the management of the seabed below the high-water mark, however, the management of maritime and underwater cultural heritage resources under the

NHRA does not devolve to provincial or local heritage resources authorities but remains the responsibility of the national agency, SAHRA.

The NHRA gives legal definition to the range and extent of what are considered to be South Africa's heritage resources. According to Section 2(xvi) of the Act a heritage resource is "any place or object of cultural significance". This means that the object or place has aesthetic, architectural, historical, scientific, social, spiritual, linguistic or technological value or significance.

In terms of the definitions provided in Section 2 of the NHRA, maritime and underwater cultural heritage can include the following sites and/or material relevant to this assessment:

- Material remains of human activity which are in a state of disuse and are in or on land [which includes land under water] and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures (Section 2(ii));
- Wrecks, being any vessel or aircraft, or any part thereof, which was wrecked in South Africa, whether on land, in the internal waters, the territorial waters or in the maritime culture zone of the Republic, as defined respectively in sections 3, 4 and 6 of the Maritime Zones Act, 1994 (Act No. 15 of 1994), and any cargo, debris or artefacts found or associated therewith, which is older than 60 years or which SAHRA considers to be worthy of conservation (Section 2(ii)); and
- Any movable property of cultural significance which may be protected in terms of any provisions of the NHRA, including any archaeological artefact or palaeontological specimen (Section 2(xxix)).

Of the heritage resource types protected by the NHRA, the installation and operation of the 2AFRICA (West) cable system has the potential to impact the following:

- Submerged pre-colonial archaeological sites and materials;
- Maritime and underwater cultural heritage sites and material, which are principally historical shipwrecks; and
- Palaeontological features and material, which are defined by the NHRA as the fossilised remains or fossil trace of animals or plants which lived in the geological past.

As per the definitions provided above, these cultural heritage resources are protected by the NHRA and a permit from SAHRA is required to destroy, damage, excavate, alter, deface or otherwise disturb any such site or material.

It is also important to be aware that in terms of Section 35(2) of the NHRA, all archaeological objects and palaeontological material is the property of the State and must, where recovered from a site, be lodged with an appropriate museum or other public institution.

Section 38 (1) of the NHRA lists development activities that would require authorisation by the responsible heritage resources authority. Activities considered applicable to the proposed project include the following:

- (a) The construction of a road, wall, powerline, pipeline, canal or other similar form of linear development or barrier exceeding 300 m in length.
- (c) Any development or other activity which will change the character of a site.
- (i) exceeding 5 000 m<sup>2</sup> in extent.
- (d) The re-zoning of a site exceeding 10 000 m<sup>2</sup> in extent.

The NHRA requires that a person intending to undertake such an activity must notify the relevant national and provincial heritage authorities at the earliest stages of initiating such a development. The relevant heritage authority would then, in turn, notify the person whether a Heritage Impact Assessment Report should be submitted.

In response to the Background Information Document (BID) for the proposed cable route, SAHRA and responded in a letter to MTN (Pty) Ltd, dated 4 December 2020, noting that the “BID has already identified that a Heritage Assessment is to be undertaken as part of the process” and supporting this. SAHRA stipulated that the heritage impact assessment must include a specialist study of maritime and underwater cultural heritage to be undertaken by a suitably qualified Maritime Archaeologist.

As stated above, because the terrestrial portion of the cable system will use the existing WACS cable landing infrastructure and cable sleeves it does not trigger Section 38(1)(a) of the NHRA, and HWC has indicated that no heritage studies will be required for the terrestrial portion of the cable system, landward of the BMH (see Appendix 1).

#### **4.2. Maritime Zones Act (No 15 of 1994)**

South Africa’s Maritime Zones Act of 1994 is the national legislative embodiment of the international maritime zones set out in the United Nations Convention on the Law of the Sea (UNCLOS).

The Act defines the extent of the territorial waters, contiguous zone, exclusive economic zone and continental shelf, which together comprise some 4.34 million square kilometres of seabed around the South African coast and sets out South Africa’s rights and responsibilities in respect of these various maritime zones.

Under the terms of the maritime zones established by the Act, the application of the NHRA applies within South Africa’s territorial waters (12 nautical miles seaward of the baseline) and extends to the outer limit of the contiguous or maritime cultural zone (24 nautical miles seaward of the baseline). Any offshore activities that have the potential to disturb or damage cultural heritage resources located in or

on the seabed within the territorial waters and contiguous zone require the involvement of SAHRA, as a commenting body in respect of the National Environmental Management Act EIA process and as permitting authority where impacts to sites or material cannot be avoided and damage or destruction will occur.

The maritime portion of the proposed 2AFRICA (West) cable system crosses the continental shelf, the EEZ, the contiguous zone and the territorial waters, and comes ashore at Yzerfontein landward of the territorial water baseline (Figure 3), within what Section 3 of the Maritime Zones Act defines as South Africa's internal waters. In terms of Section 3(2) of the Act, "any law in force in the Republic, including the common law, shall also apply in its internal waters".

With respect to the portion of the cable system to be installed on the continental shelf and within the EEZ, Section 9 of the Maritime Zones Act states that activities undertaken from installations operating within these areas may be subject to the requirements of any law in force in the Republic. The definition of "installation" (which includes vessels) provided in the Act, however, appears to limit this to activities related to seabed mining and mineral exploitation.

The extent of the application of the NHRA and Maritime Zones Act in respect of the 2AFRICA (West) cable system is therefore, limited to the area between the high-water mark and the outer edge of the contiguous zone. The EEZ and continental shelf are excluded from this assessment, but Section 6.5 does address the a World War II wreck located near the cable route in the EEZ.

#### **4.3. National Environmental Management Act (No 107 of 1998)**

The National Environmental Management Act (No 107 of 1998) (NEMA) provides a framework for the integration of environmental issues into the planning, design, decision-making and implementation of plans and development proposals that are likely to have a negative effect on the environment.

Regulations governing the environmental authorisation (EA) process have been promulgated in terms of NEMA and include the EIA Regulations (GNR R326/2017) and Listing Notices (LN) 1-3 (R327, R325 and R324) that list activities requiring EA.

The proposed 2AFRICA (West) cable system triggers a number of activities in the Listing Notices and the project is thus be subject to a full Scoping and Environmental Impact Assessment process and must obtain a positive Environmental Authorisation from the national Department of Environment, Forestry and Fisheries (DEFF) (in close consultation with the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP)) prior to commencement of the proposed activities.

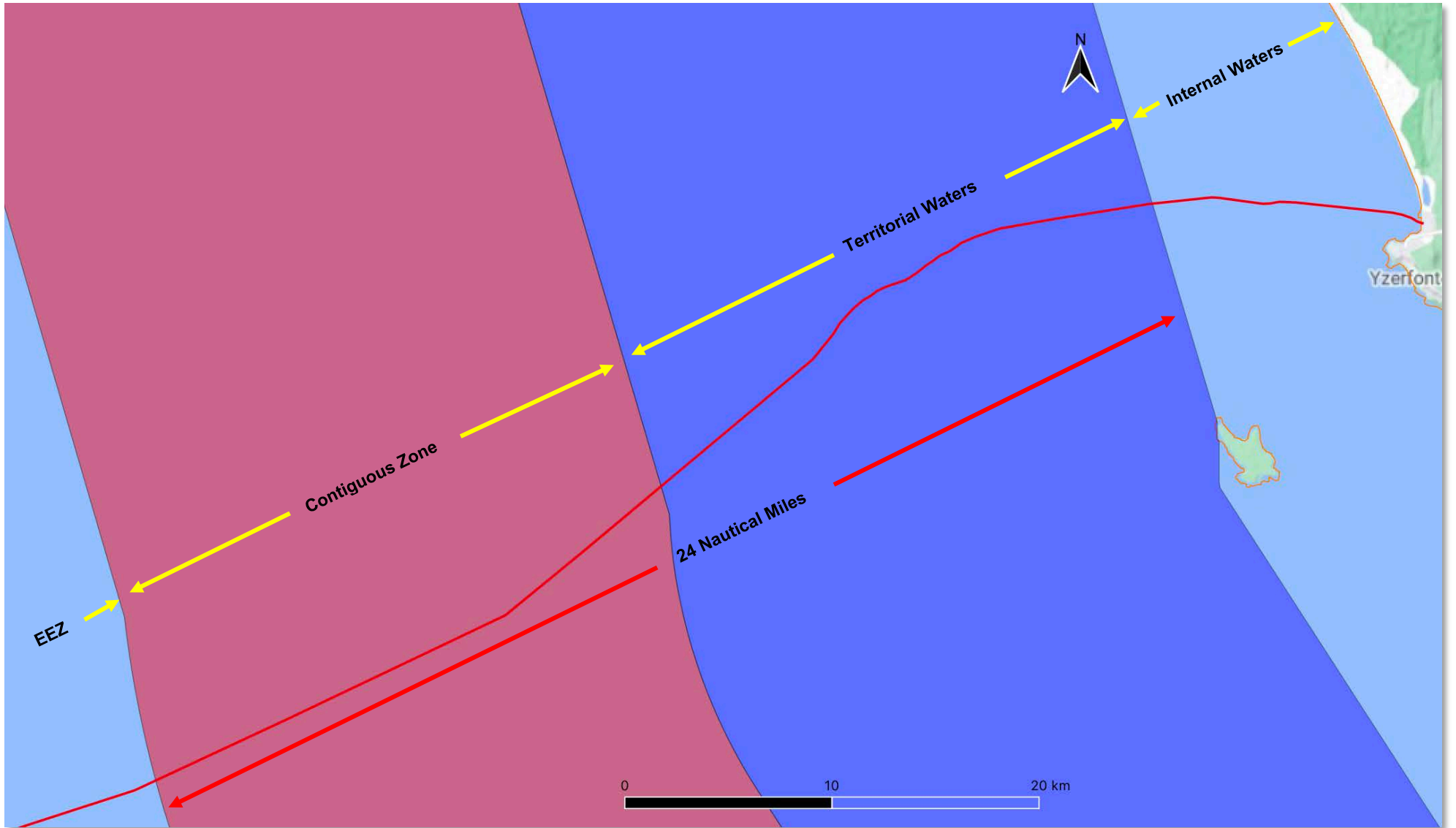


Figure 3: 2AFRICA (West) cable system and the maritime zones referred to in the text (Source: Google Earth).

## **5. METHODOLOGY**

This desktop report provides an assessment of the maritime and underwater cultural heritage potential of the offshore portion of the 2AFRICA (West) cable system within a study area defined in Section 5.3 below.

The report includes a short description of what comprises South Africa's maritime and underwater cultural heritage, with particular emphasis on the maritime history of the south west Cape coast in the vicinity of the cable landfall. This is followed by a discussion of potential maritime heritage resources along that portion of cable system within the contiguous zone, territorial waters and inland waters, framed within that wider context.

The report draws information from readily available documentary sources and databases, including SAHRA's Maritime and Underwater Cultural Heritage database, a database of underwater heritage resources maintained by ACO Associates, and from relevant primary and secondary sources, and current geophysical data collected along route (see Sections 5.2 and 6.4 below) to identify as accurately as possible any known and potential heritage resources along the proposed cable route alignment.

### **5.1. Palaeontological Comment**

Comment has also been obtained from the palaeontologist Dr John Pether regarding the potential for the installation of the cable system to impact on submerged palaeontological resources (see Section 6.2 below).

### **5.2. Geophysical Survey**

The geophysical survey report prepared by Fugro Germany Marine (Rackebrandt et al. 2020) for Segment W1.12 between the Yzerfontein BMH and the offshore Swakopmund Branching Unit (BU) (see Figure 4), was reviewed for this HIA to ascertain whether any shipwrecks or other potential heritage resources had been identified within the sidescan sonar (SSS), multibeam bathymetry (MBES) and magnetometer data collected during the survey of the cable route.

The geophysical survey, for cable route design and engineering, was conducted between June and November 2020 along the Deep, Shallow and Inshore Water sections of the 2AFRICA (West) cable system (Rackebrandt et al. 2020).

The route survey comprised an investigation of the bathymetry, seabed features and shallow geology of the proposed route. A geotechnical sampling programme was also undertaken to establish sediment types for correlation with geophysical data (Rackebrandt et al. 2020).

This archaeological review of the geophysical data relied on the survey report and the seabed feature characterisation it contained, processed seabed bathymetric maps attached to the report and other geophysical data within the contiguous zone and territorial waters.

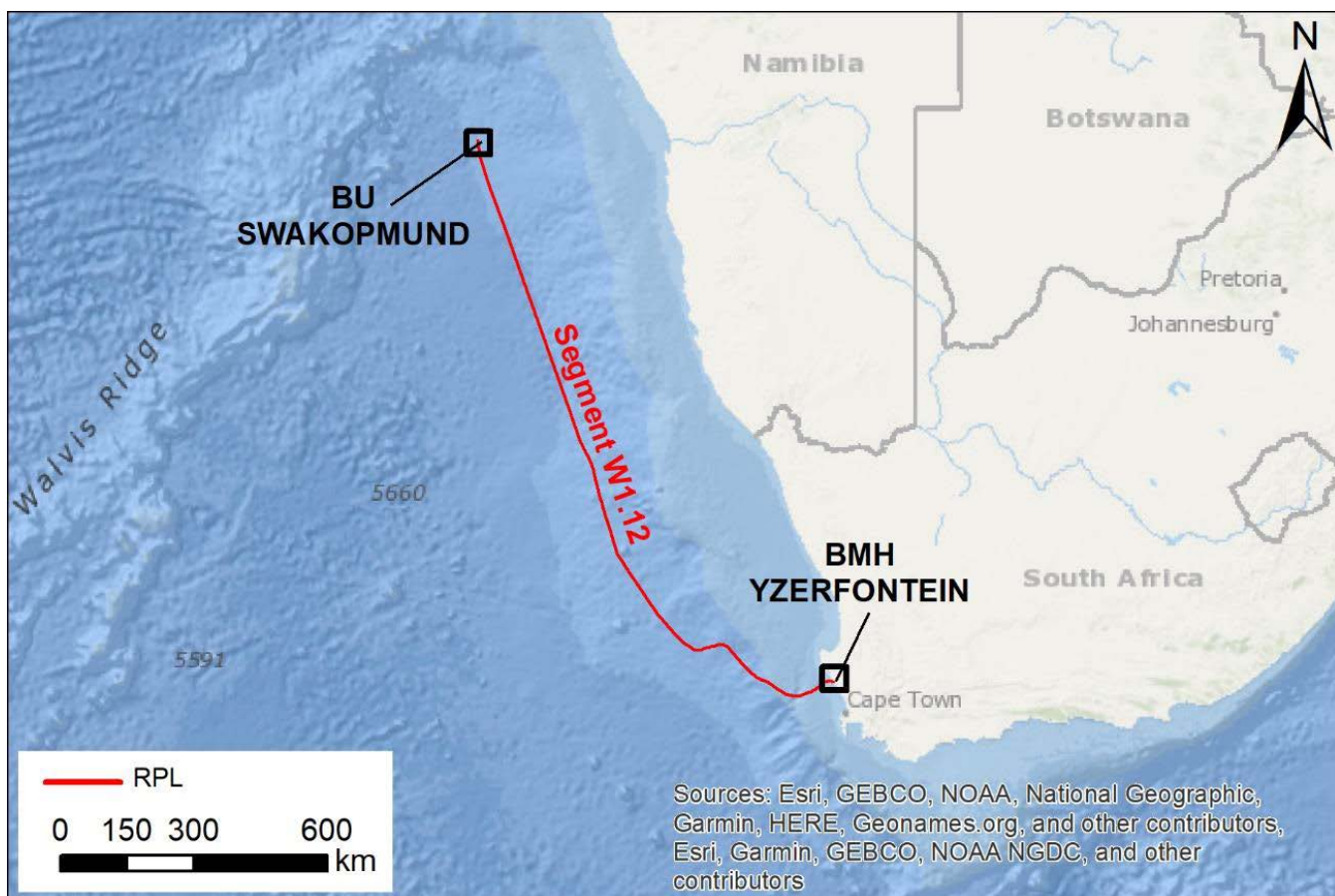


Figure 4: 2AFRICA (West) segment W1.12 between the Yzerfontein BMH and the offshore Swakopmund BU (After: Rackebrandt et al. 2020).

### 5.3. Maritime Study Area

The study area for this maritime archaeological assessment has been defined as a 1 km buffer on either side of the proposed route alignment between the Mean High Water Mark at Yzerfontein and the outer edge of the contiguous zone, 24 nautical miles from the baseline (Figure 5).

### 5.4. Limitations

South Africa's record of maritime and underwater cultural heritage resources is based on a mix of information derived from historical documents and other secondary sources. Where available this is supplemented by primary sources such as geophysical data and other field-based observations and site recordings. Thus, while every effort has been made to ensure the accuracy of the information



Figure 5: Maritime archaeological assessment study area for this report between the outer limit of the contiguous zone (24 NM from the baseline) to the mean high-water mark at the landfall at Yzerfontein. The study area comprises a 1 km buffer (orange) on either side of the proposed cable route (red line). (Source: Google Earth).



presented below, the reliance on secondary data sources does mean that there are considerable gaps and inaccuracies in this record.

For example, the positions given for most of the wrecks referred to in the following sections are estimated rather than known locations and are based on descriptions of their loss or positions taken at the time of loss (often by third parties).

The potential also exists for currently unknown and/or unrecorded maritime heritage sites to be encountered on the seabed in the course of the proposed project.

## **6. UNDERWATER CULTURAL HERITAGE**

South Africa has a rich and diverse underwater cultural heritage. South Africa's rugged and dangerous coastline is strategically located on the historical trade route between Europe and the East and has witnessed more than its fair share of shipwrecks and maritime dramas since the early 16<sup>th</sup> century.

At least 2400 vessels are known to have sunk, grounded, or been wrecked, abandoned or scuttled in South African waters since the early 1500s. This doesn't include the as yet unproven potential for shipwrecks and other sites that relate to pre-European, Indian Ocean maritime exploration, trade and interactions along the South African east coast.

In addition to historical shipwrecks, the record of South Africa's long association with the sea is much broader and extends far back into prehistory. This element of our maritime and underwater cultural heritage is represented around the South African coast by thousands of pre-colonial shell middens and large numbers of tidal fish traps, which reflect prehistoric human exploitation of marine resources since at least the Middle Stone Age (MSA), more than 150,000 years ago.

Another, until recently, largely unacknowledged and unexplored aspect of our maritime and underwater cultural heritage are pre-colonial terrestrial archaeological sites and palaeolandscapes which are now inundated by the sea.

This assessment considers maritime and underwater cultural heritage resources along the 2AFRICA (West) cable system landward of the EEZ/contiguous zone boundary, namely submerged prehistoric resources and historical shipwrecks, and also comments on the palaeontological potential of the seabed to be affected, and in broader terms on heritage resources potentially in the EEZ and on the continental shelf (see Section 6.5).

## 6.1. Submerged Prehistory

Since the start of the Quaternary, approximately 2.6 million years ago, the world has been subject to a series of cooling and warming climatic cycles in which sea level has generally been lower than it is today.

Within the last 900,000 years, global sea levels have fluctuated substantially on at least three occasions, with other lesser fluctuations in between. This has been the result of increased and decreased polar glaciation and falls in sea level were caused by the locking up in the polar ice caps of huge quantities of seawater as global temperatures cooled.

The most extreme recent sea level drop occurred between circa 20,000 and 17,000 years ago when at the height of the last glaciation (Marine Isotope Stage 2 (MIS)) global sea levels were more than 120 m lower than they are today (Waelbroeck *et al*, 2002; Rohling *et al*, 2009).

As with the MIS 2 low sea level stand, those which corresponded with MIS 4 (~70,000 years ago), MIS 6 (~190,000 years ago), MIS 8 (~301,000 years ago) and MIS 12 (~478,000 years ago) would have “added a large coastal plain to the South African land mass” (Van Andel 1989:133) where parts of the continental shelf were exposed as dry land (see Cawthra *et al*, 2016) (Figure 6).

The exposure of the South African continental shelf would have been most pronounced on the wide Agulhas Bank off the southern Cape coast, and it is estimated that a new area of land, as much as 80,000 km<sup>2</sup> in extent, was exposed during the successive glacial maxima (Fisher *et al*, 2010). Figure 7 and 8 below give more detail of the likely extent of the continental shelf exposure off the south western Cape coast during the last glaciation (MIS 2).

The exposed continental shelf was quickly populated by terrestrial flora and fauna, and also by our human ancestors who were dependant on these resources (Compton, 2011). As a result, for periods numbering in the tens of thousands of years on at least three occasions during the last 500,000 years our ancestors inhabited areas of what is now seabed around the South African coast.

This means that a large part of the archaeological record of the later Earlier, Middle and early Late Stone Age is located on the continental shelf and is now “inundated and for all practical purposes absent from [that] record” (Van Andel, 1989:133-134).

Until relatively recently there was little or no access to the submerged prehistoric landscapes and sites on the continental shelf, although evidence from various parts of the world of drowned, formerly

terrestrial landscapes hinted at the tantalising prospect of prehistoric archaeological sites on and within the current seabed.

Perhaps the best-known example of such evidence is archaeological material and late Pleistocene faunal remains recovered in the nets of fishing trawlers in the North Sea between the United Kingdom and the Netherlands throughout the 20th century (Peeters *et al*, 2009; Peeters, 2011) and the University of Birmingham's recent archaeological interpretation of 3D seismic data, collected in the same area by the oil and gas industry, which has revealed well-preserved prehistoric landscape features across the southern North Sea (Fitch *et al*, 2005, Gaffney *et al*, 2010).

Closer to home, there is archaeological evidence for a prehistoric human presence in what is now Table Bay. In 1995 and 1996 during the excavation of two Dutch East India Company shipwrecks, the *Oosterland* and *Waddinxveen*, divers recovered three Early Stone Age, Acheulian handaxes from the seabed under the wrecks (Plate 1). The stone tools, which are between 300,000 and 1.4 million years old, were found at a depth of 7-8 m below mean sea level and were associated with Pleistocene



Figure 6: Possible extent of the South African continental shelf c.137,000 years ago (Source: Franklin *et al*, 2015)



Figure 7: The south west coast continental shelf showing the water depths of 45, 75, 120 and 400 m. The 2AFRICA (West) cable system will be installed in the area highlighted in red on the left of the image (Source: Compton, 2011 from Cawthra, 2014).

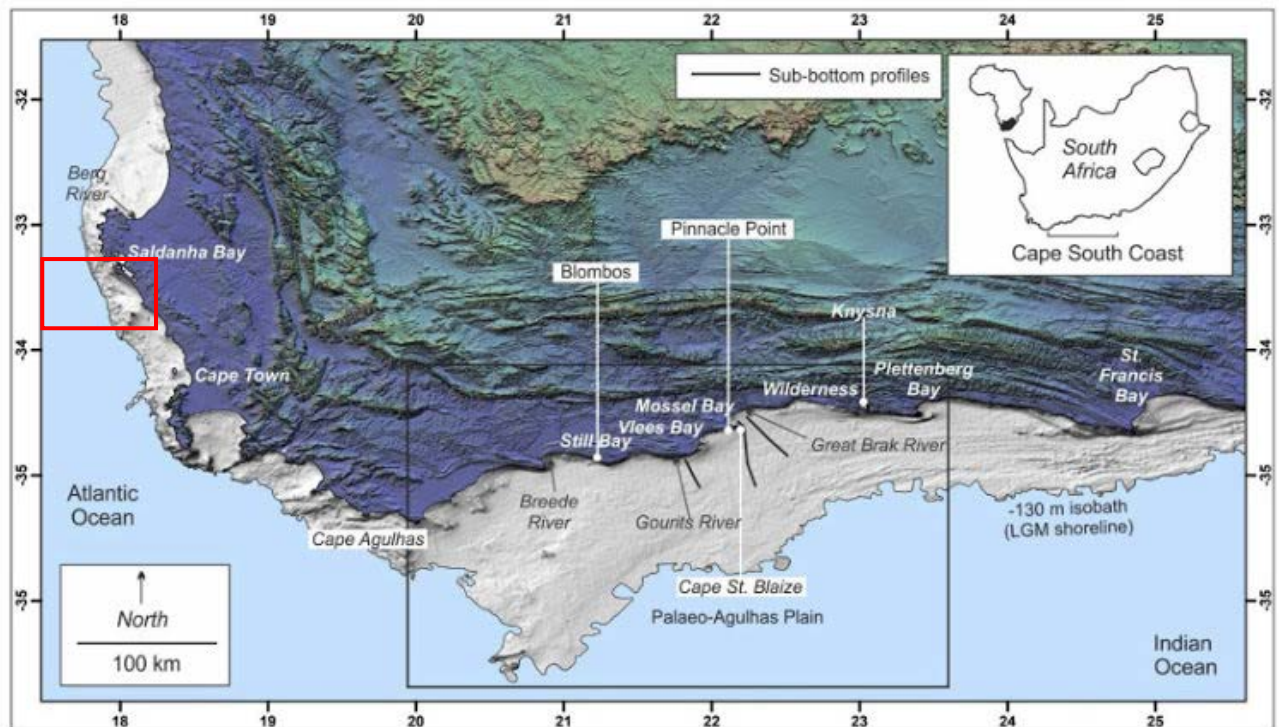


Figure 8: Extent of the exposed continental shelf along the south west coast at the last glacial maximum c. 20,000 years ago (Source: <https://select.timeslive.co.za/news/2020-05-21-decade-of-work-strips-90km-of-sea-for-a-glimpse-of-ice-age-sa/>)

sediments from an ancient submerged and infilled river channel. Their unrolled and unworn condition indicate that they had not been carried to their current position by the ancient river and suggests that

they were found more or less where they were dropped by Early Stone Age hominins more than 300,000 years ago, when the sea level was at least 10 m lower than it is today (Werz and Flemming, 2001; Werz *et al*, 2014).

#### 6.1.1. Submerged Prehistory of Yzerfontein Area

There have, to date, been no studies of submerged prehistory in the study area. However, archaeological evidence for a hominin presence along this portion of the West Coast, particularly during Later Stone Age, is plentiful (see Peringuey, 1911; Laidler, 1929; Rudner, 1968; Kaplan, 1998, 2000; Gray, 2000; Sealy *et al*, 2004; Orton, 2010; Hutten, 2014a & b).

Other very important archaeological evidence for the prehistoric use of the west coast comes from the Earlier Stone Age sites of Duinefontein 1 and 2, located approximately 40 km south of the cable landfall (see Deacon, 1975; Klein, 1976; Klein *et al*, 1999; Cruz-Uribe *et al*, 2003). These sites have produced Early Stone Age, Acheulean stone tools in association with animal bone, deposited between 200,000 and 400,000 years ago, around palaeo-pans or lakes that developed in hollows within a large dune field, where hominins were hunting or scavenging animals.

During periods of lower sea level, similar palaeo-pans and palaeo-river channels are likely to have been present on the exposed continental shelf of the West Coast. Together with ancient rivers courses, these water sources, which are today buried under modern seabed sediment, would have been an important focus for hominin activity on the exposed continental shelf. As described above, the handaxes found within the seabed of Table Bay in the 1980s were the same age and type as those at Duinefontein 1 and 2 and there is thus a clear potential for the occurrence of ancient, submerged archaeological material in association with such seabed features within the area to be affected by the 2AFRICA (West) cable system.

Where alluvial sediment within palaeochannels or other such features has survived post-glacial marine transgressions there is also the potential to recover palaeoenvironmental data (pollens, foraminifera and diatoms, for example) which can contribute contextual information to our understanding of the ancient human occupation of South Africa.

There is thus the potential for the preservation, within the thin Quaternary surficial sediments in water depths of less than approximately 120 m, of pre-colonial archaeological sites and material.



Plate 1: Three Acheulian handaxes recovered from seabed sediments in Table Bay (Source: <http://www.aimure.org/index.php/aimure-projects>)

## 6.2. Palaeontology

The following description of the geology of the affected formations on the continental shelf and their palaeontological potential has been provided by Dr John Pether.

**Continental Shelf:** The geometry and ages of the large-scale formations which outcrop on the continental shelf, beneath a thin, patchy cover of Quaternary surficial sediments, are depicted in Figure 9. These formations are for the most part fine-grained sediments, clays, muds and silts deposited in deeper shelf depths, with intercalations of shallower shelf sediments corresponding to periods of lower sea levels.

The Paleogene and Pliocene sediments are mainly terrigenous muds, whereas the Oligocene and Miocene sediments are more calcareous due to the marine biogenic content of microfossils, bryozoan debris, corals and macrofossil shells.



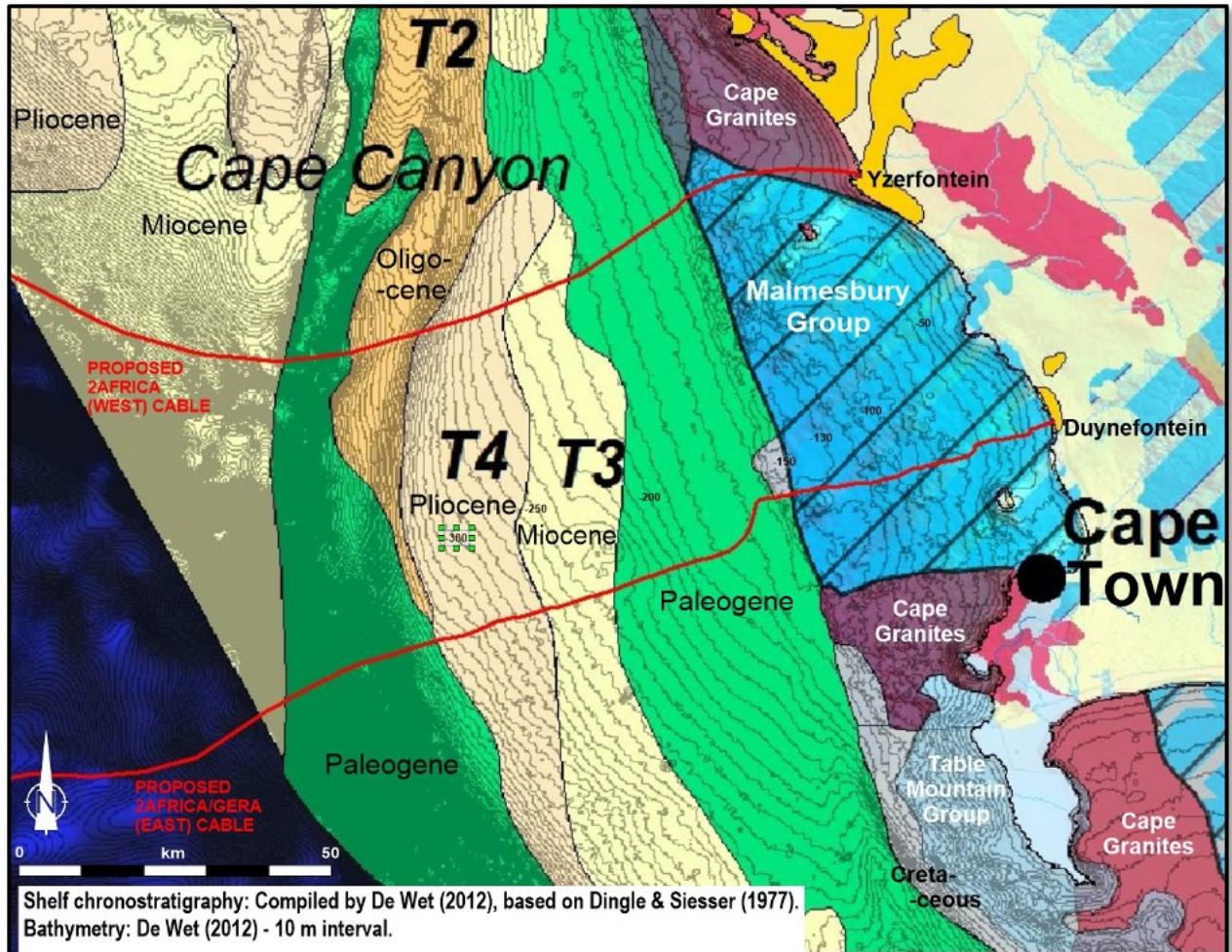


Figure 9: Chronostratigraphy of the continental shelf off Cape Town and locations of the subsea cable routes to both Yzerfontein and Duynfontein (After De Wet 2012).

During later Neogene and Quaternary times, the shelf was dominated by upwelling processes, with high organic productivity and authigenic mineralization of seabed rocks, clays and biogenic particles by phosphatization and glauconization. Extensive cemented crusts or “hardgrounds” formed on formations exposed at the seabed. Sea level oscillated repeatedly, dropping to ice-age palaeoshorelines as much as 140 m below present sea level. The hardgrounds were eroded during the ice-age/glacial shallowing episodes and re-cemented again during interglacial deepening.

This has produced a wide array of multiphase phosphorite nodules and phosphatic shell casts of various ages. The bones and teeth of sharks and other fishes, the skulls of extinct whale species and the occasional remains of land-living animals that roamed the ice age exposed shelf are also phosphatized and reworked into the latest, loose sediments on the seabed. A sample of this material turns up in bottom-trawl fishnets, scientific dredging and during diamond-mining operations.

Where the cable route proceeds across the inner shelf, it traverses bedrock of Precambrian Malmesbury shales and Cape Granites which are not of palaeontological concern. However, prospecting for diamonds on the western shelf reveals cemented patches and veneers of fossiliferous

Pliocene and earlier Quaternary deposits locally preserved as erosional remnants in bedrock depressions. Such remnants are local sources of fossil shells which are reworked into the surficial latest Quaternary deposits.

The youngest Quaternary deposits mantling the shelf are generally quite thin and typically comprise a shelly gravel of shallow-shelf origin, overlain by Holocene shelf muddy sands. The ice age palaeoshoreline gravels are dominated by a “venus shell” clam, *Tawera philomela*. This “cold-water” species, along with others, reached the Cape coast from the mid-Atlantic islands of Tristan da Cunha and Gough, apparently thrived here and then became extinct locally during the last deglaciation (Pether 1993). During the subsequent deglaciation/warming cycle, warm-water species from the south and east coasts temporarily “invaded” the western shelf and this shows a more marked influence of Agulhas water rounding the Cape and affecting the Benguela System during the global-warming steps of the last deglaciation (Pether 1994).

**Shoreface and Beach:** Based on near-coastal excavations (Koeberg, Ysterplaat), boreholes and beach wash-ups (Milnerton), the formations which may be encountered beneath the modern shoreface, beach and dune sands are shown in Figure 10.

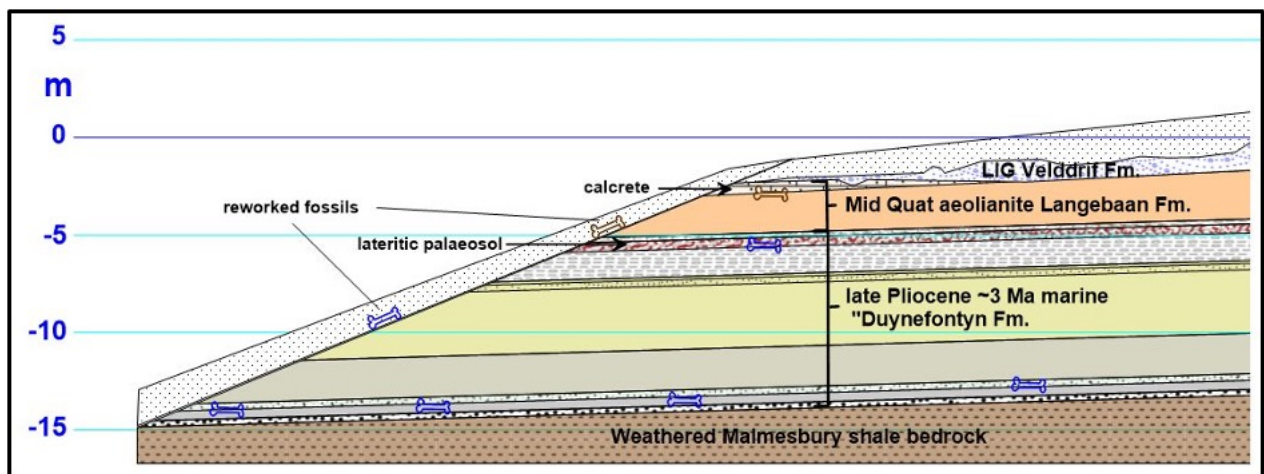


Figure 10: Schematic cross-section depicting the formations which may be encountered beneath shoreface and beach sands in embayed bedrock settings.

It may be that the shoreface and beach sands are sufficiently thick that the underlying older formations are not intersected in the relatively shallow trenches (1-2 m) required for the installation of the cable. The uppermost, Velddrif Formation shelly deposits are most likely to be encountered, and possibly the underlying calcrete of the Langebaan Formation.

The important fossils that may occur are those which have been reworked from the older formations into the modern shoreface and beach sands and include Pliocene cetaceans and seals and



Quaternary-age terrestrial bones and teeth from the Langebaan Formation. These may be uncovered in the shoreface and beach sands.

The older material is usually phosphatized and of readily visible brown to black hues. Fossil bones from the Langebaan Formation may be partly encased in calcrete cobbles and boulders.

### **6.3. Maritime History of the South African Coast**

In 1498 the Portuguese explorer Vasco da Gama finally pioneered the sea route around Africa from Europe to the East. Since then, the southern tip of the African continent has played a vital role in global economic and maritime affairs, and until the opening of the Suez Canal in 1869, represented the most viable route between Europe and the markets of the East (Axelson, 1973; Burman, 1976; Turner, 1988; Gribble, 2002; Gribble and Sharfman, 2013).

The South African coast is rugged and the long fetch and deep offshore waters mean that the force and size of seas around the coast are considerable; a situation exacerbated by prevailing seasonal winds.

The geographical position of the South African coast on the historical route to the East and the physical conditions mariners could expect to encounter in these waters have, in the last five centuries, been responsible for the large number of maritime casualties which today form the bulk of South Africa's maritime and underwater cultural heritage (Gribble, 2002).

At least 2400 vessels are known to have sunk, grounded, or been wrecked, abandoned or scuttled in South African waters since the early 1500s. More than 1900 of these wrecks are older than 60 years of age and are thus protected by the NHRA as archaeological resources.

The existing list of wrecks is by no means complete and does not include the as yet unproven potential for shipwrecks and other sites that relate to pre-European, Indian Ocean maritime exploration, trade and interactions along the South African east coast.

It is anticipated that further research in local and foreign archives, together with physical surveys to locate the remains of historical shipwrecks will produce a final tally of more than 3000.

The earliest known South African wrecks are Portuguese, dating to the sixteenth century when that country held sway over the route to the East. Due to the later, more prolonged ascendancy of the Dutch and British in European trade with the East and control at the Cape, the majority of wrecks along the South African coast belong to these two nations. However, at least 36 other nationalities are represented amongst the wrecks that litter the South African coast.

Da Gama's maritime incursion into the Indian Ocean laid the foundation for more than 500 years of subsequent European maritime activity in the waters around the South African coast (Figure 11). The Portuguese and other European nations who followed their lead around the Cape and into the Indian Ocean, however, joined a maritime trade network that was thousands of years old and in which east and south east Africa was an important partner. This trade spanned the Indian Ocean and linked the Far East, South East Asia, India, the Indian Ocean islands and Africa and suggests that there is the potential for shipwrecks and other sites that relate to pre-European, Indian Ocean maritime exploration, trade and interactions to exist along the South African east coast and offshore waters.

The historical shipwrecks that form part of South Africa's underwater cultural heritage are thus a unique and highly cosmopolitan repository of information about global maritime trade during the last five centuries and potentially much further back into the past. These sites contain a wealth of cultural material associated with that trade and clues to the political, economic, social and cultural changes that accompanied this trade and which contributed to the creation of the modern world.

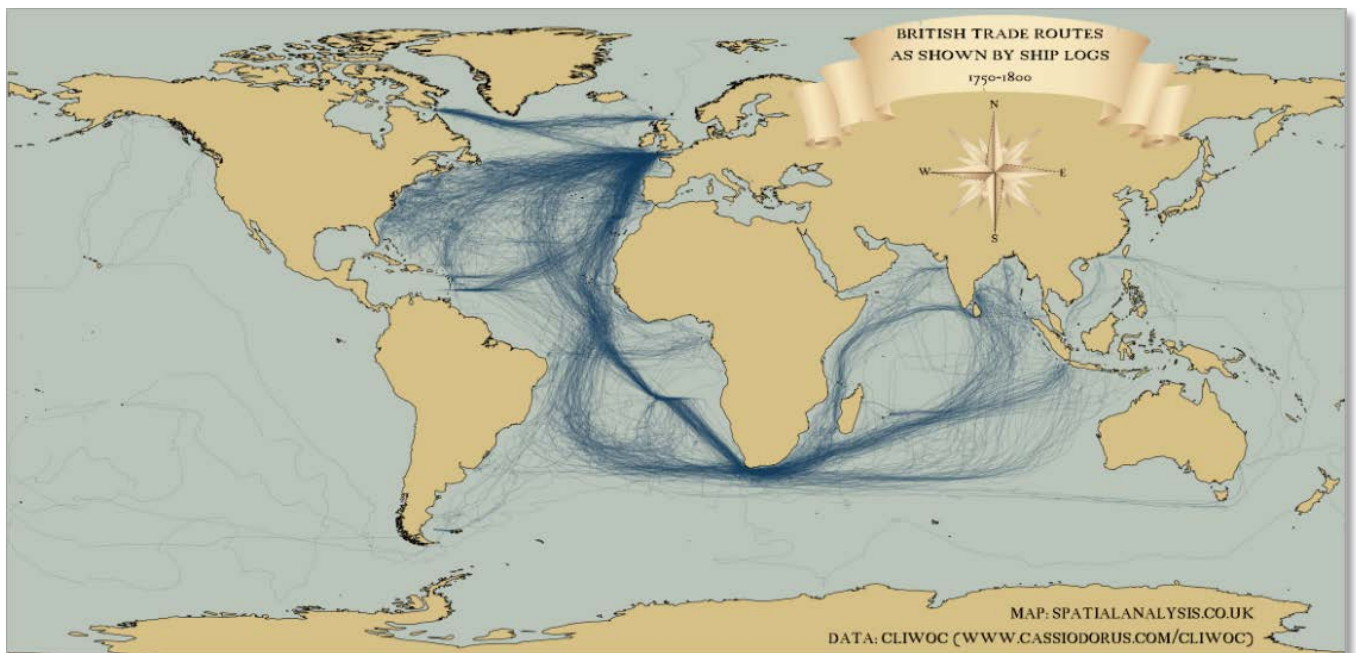


Figure 11: Example of the strategic position of the South African coast in global trade. British trade routes as shown by ship logs – 1750 to 1800 (Source: <http://www.theguardian.com/news/datablog/2012/apr/13/shipping-routes-history-map>).

### 6.3.1. Maritime History of the Yzerfontein Area

The 2AFRICA (West) cable system, in its crossing of the contiguous zone and territorial waters off the West Coast, will be routed well to the north of the historical anchorage in Table Bay, which has the largest concentration of historical wrecks in South African waters (more than 400), and south of the great natural harbour of Saldanha Bay and the dangerous coast of the Vredenburg Peninsula which

together have a large number of wrecks (Figure 12). A more immediate concentration of wrecks lies on and around Dassen Island which is located some 8,5 km south of the cable route where it crosses the inland waters before the landfall (Figure 13). Most of the wrecks around the island are located in close proximity to its shores.

With regard to wrecks along the cable route, available evidence is that there are no known or recorded shipwrecks within the study area for the 2AFRICA (West) cable system in the contiguous zone, territorial waters or internal waters.

The databases consulted indicate three wrecks potentially located more than 20 km north of the cable route within the contiguous zone, but a closer interrogation of the literature related to these casualties suggests that only one, a Taiwanese fishing vessel, the *Shin Tung Yong 18*, which foundered in 1978 (and is thus too young to be covered by the NHRA) may be in the area (Figure 13). Confidence in the position of the *Shin Tung Yong 18* is low but is sufficiently distant from the cable route for the likelihood that it will be encountered during the installation of the cable to be negligible.

The other two vessels, the harbour tug *Otto Siedle*, scuttled in 1982 and the Dutch merchant vessel *Mangkalihat*, a World War II U-boat casualty, appear to have been lost elsewhere. The *Otto Siedle* appears to have been scuttled west of Cape Point (<https://www.wrecksite.eu/wreck.aspx?216734>) and the *Mangkalihat*, although damaged by a mine laid by the German auxiliary minelayer *Doggerbank* north of Dassen Island on 4 May 1942, survived that encounter only to be torpedoed in August 1943 by U-170 off the Mozambican coast (<https://uboat.net/allies/merchants/ship/3032.html>).

The details of the *Shin Tung Yong 18* are provided in Appendix 1.

#### **6.4. Review of Geophysical Survey Results**

The purpose of the geophysical survey was to survey a safe and economical route for the proposed cable by determining water depth (Rackebrandt et al. 2020).

The results of the sidescan sonar, multibeam bathymetry and magnetometer surveys carried out by Fugro Germany Marine, providing as they do primary evidence of seabed hazards, seabed geomorphology and other oceanographic and anthropogenic data, are of interest from a maritime archaeological perspective as they can provide concrete evidence of wrecks and other heritage resources on or in the seabed.

The archaeological review of the geophysical survey report for Segment W1.12 of the 2AFRICA (West) cable system, between the Yzerfontein BMH and the offshore Swakopmund BU found the following:



Figure 12: Proposed alignment of the 2AFRICA/GERA (West) cable system across the EEZ, contiguous zone, territorial waters and inland waters showing the recorded wrecks in the vicinity (Source: Google Earth).





Figure 13: Proposed alignment of the 2AFRICA (West) cable system showing the relative positions of the concentrations of wrecks around Saldanha Bay (top) and Dassen Island (bottom)  
 (Source: Google Earth).

**Seabed Geology:** The BMH Yzerfontein is located just off the beach, approximately 110 m from the surf zone. Probing performed on the beach revealed predominantly sand with minor amount of gravel present. Ten cable detection probes were performed in order to identify the in-service WACS seg 1a cable (Figure 14).

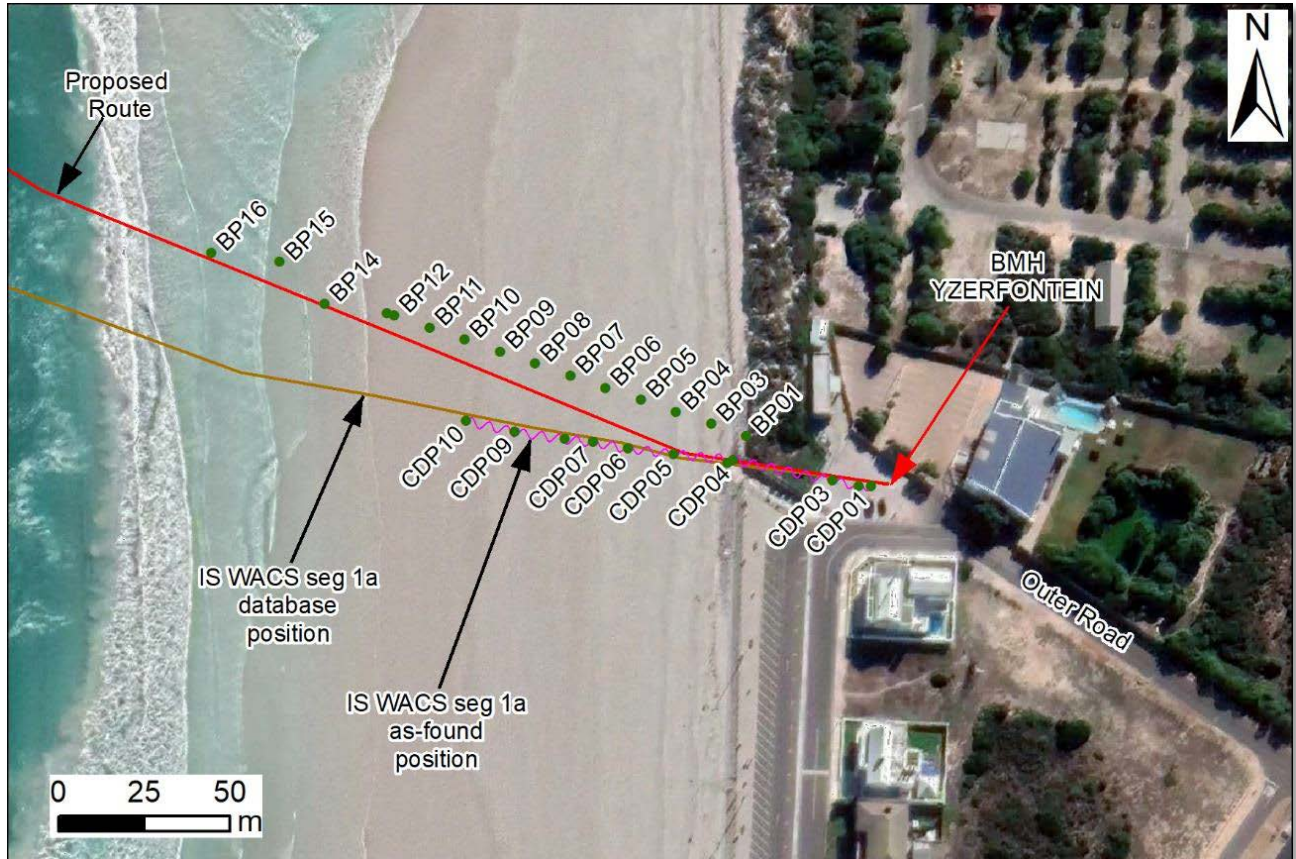


Figure 14: Beach crossing at BMH Yzerfontein. Note the confirmed position of the WACS Seg 1a cable (After: Rackebrandt et al. 2020).

The Inshore Survey starts at kilometre point (KP) 0.969 in approximately 6 m water depth (Figure 15). The seabed slope is very gentle towards the west and consists of subcropping hardground comprising very dense silty sand to sand) covered by a veneer of very loose to dense sand. An area with megaripples was noted between KP 1.972 and KP 2.192. The Inshore Survey area ends at KP 3.275 in approximately 23 m water depth (Rackebrandt et al. 2020).

The Shallow Water Survey starts at KP 2.330 in a water depth of approximately 14 m and overlaps for some distance with the Inshore Survey. The route extends in a westerly direction towards KP 5.899 where the water depth is approximately 43 m and seabed gradients are gentle. The sidescan sonar reflectivity is generally low, and the mapped fine surface sediments are confirmed with Cone Penetrometer Test (CPT) probing as very loose fine sand over dense sand overlying the same sort of subcropping hardground noted in the Inshore Survey. Between KP 5.899 and 6.376 crosses an area of



very soft to soft silt and clay overlying low relief subcropping rock (Figure 16 and Plate 2) (Rackebrandt et al. 2020).

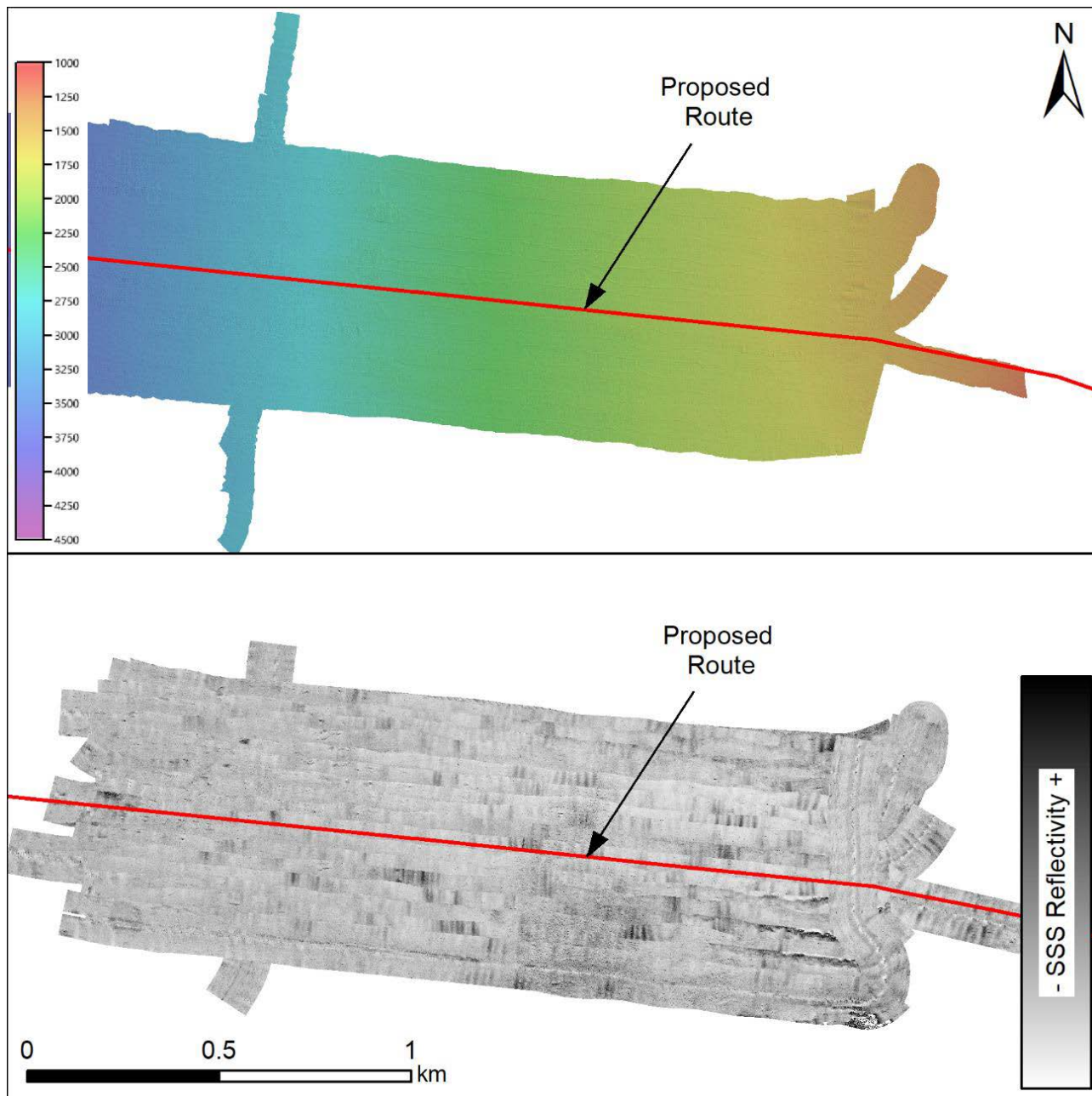


Figure 15: MBES bathymetry (top) and SSS (bottom) images of the Inshore Survey area (After: Rackebrandt et al. 2020).

Further away from the coast, between KP 17.575 and 25.752, where water depth approaches the -120 m maximum depth for the possible presence of prehistoric archaeological material, the seabed is characterised by areas of outcropping and subcropping rock with a cover of very soft silt to medium dense to dense sand ranging in thickness between 0.5 m and 2 m (see Figure 17) (Rackebrandt et al. 2020).

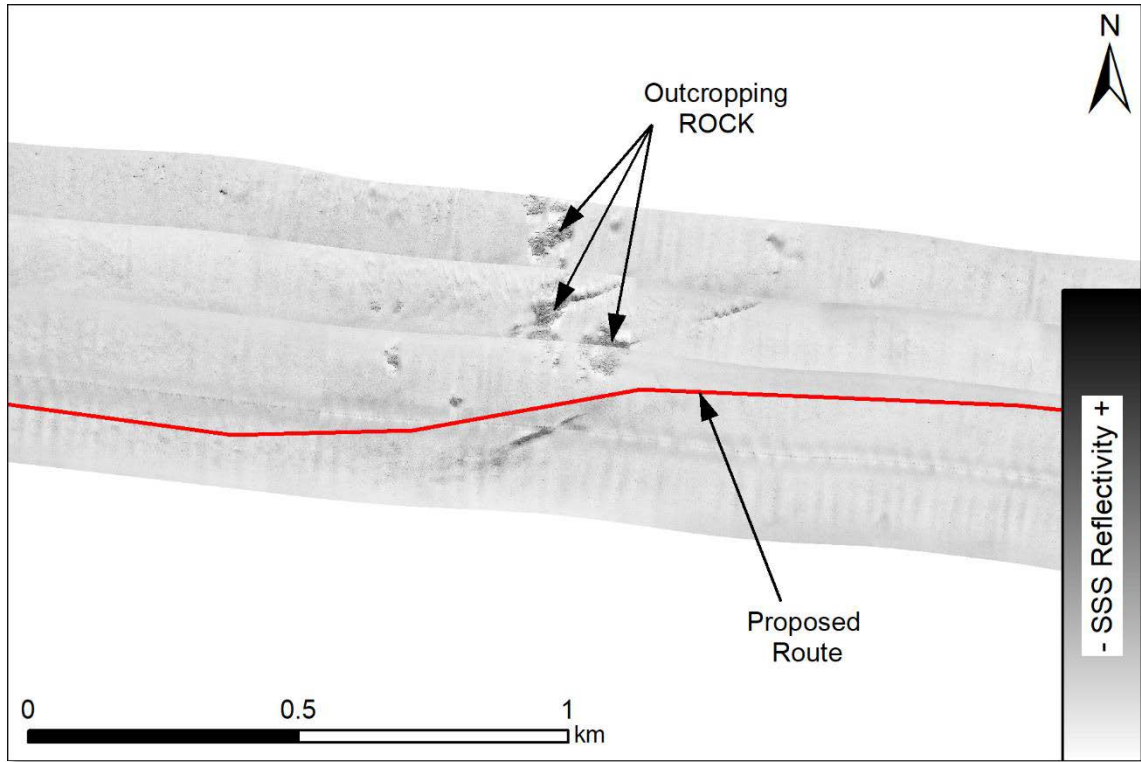


Figure 16: SSS image of rock outcrops surrounded by fine SAND between KP 5.899 and KP 7.528 (After: Rackebrandt et al. 2020).

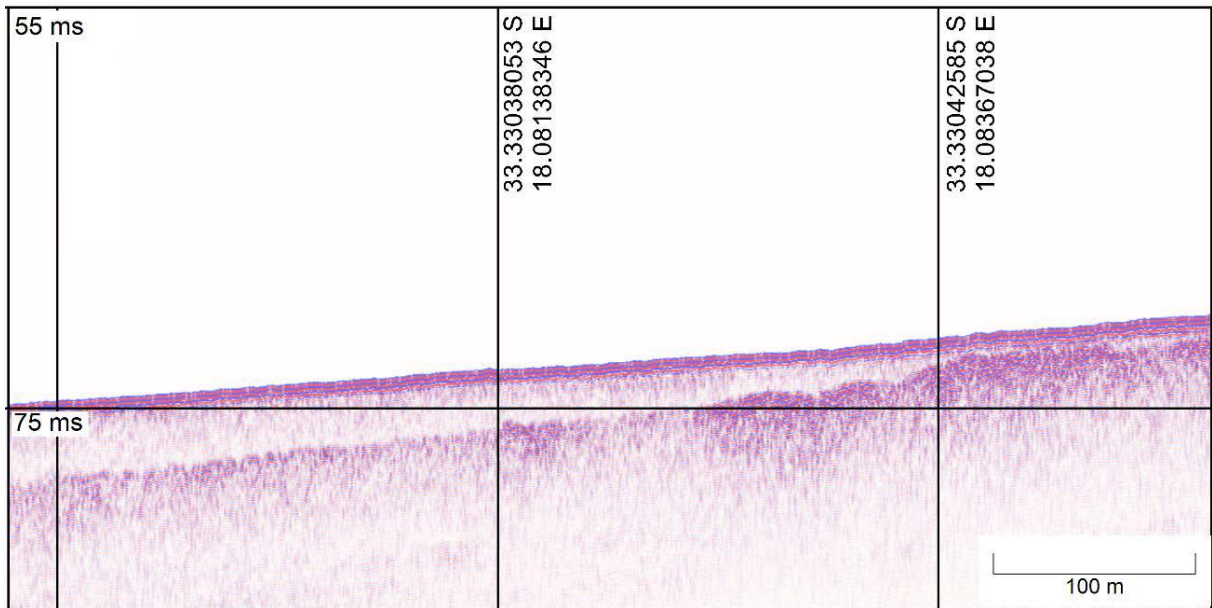


Plate 2: Sub-bottom Profiler image of the profile with the thin layer of sand overlying rock between KP 7.240 and KP 7.900 (After: Rackebrandt et al. 2020).



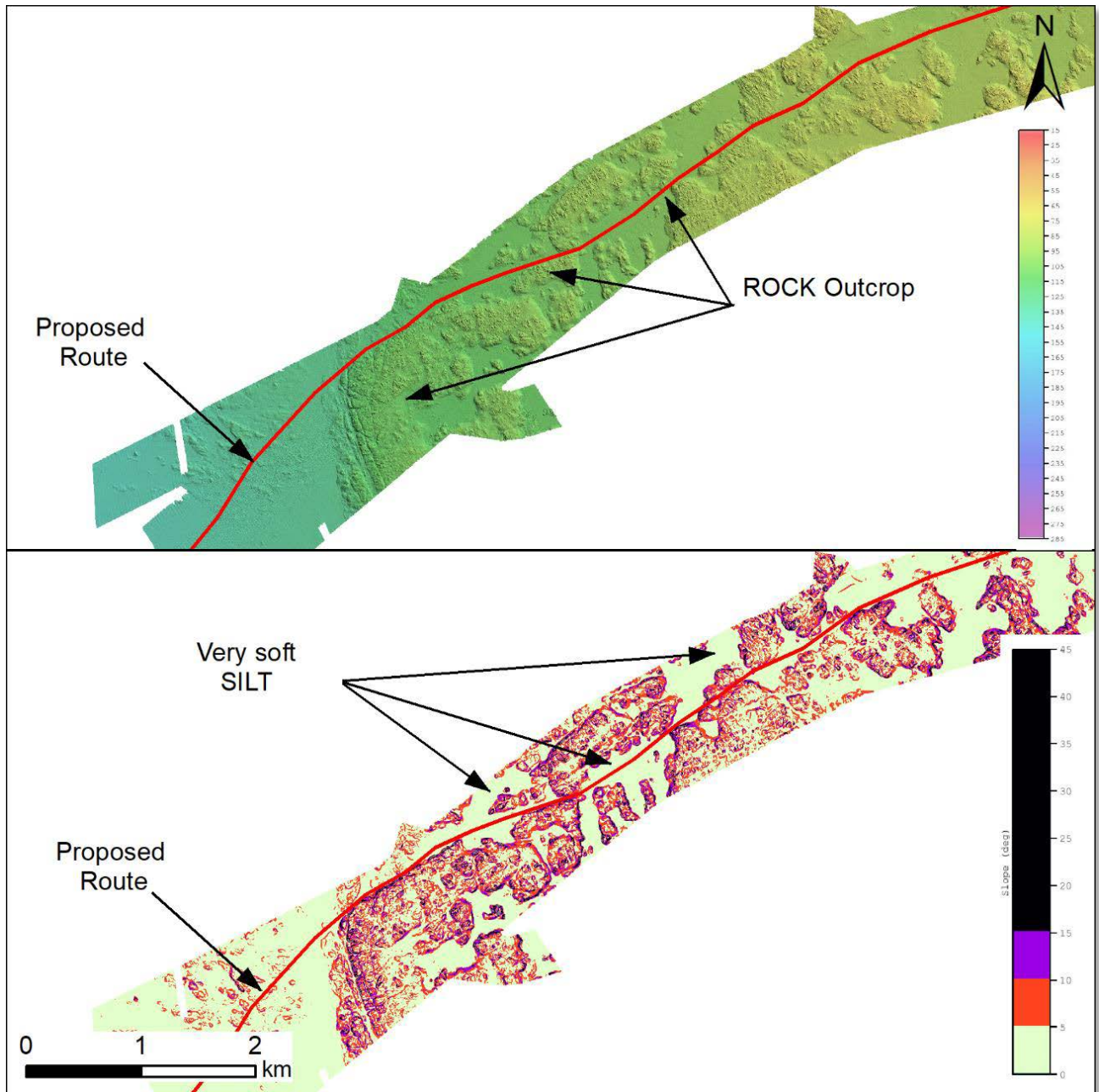


Figure 17: MBES bathymetry (top) and gradient (bottom) images for the rock outcrop and sand-filled channels between KP 16.500 and 26.710 in water depths approaching the -120 m limit for prehistoric archaeological material (After: Rackebrandt et al. 2020).

**Sonar Contacts:** One hundred and twenty-four (124) sonar contacts were detected in the Shallow Water portion of the proposed route. The majority, 110, are interpreted as boulders, seven as debris and seven as depressions (Rackebrandt et al. 2020).

**Magnetometer Contacts:** Sixty-nine (69) magnetometer contacts were recorded in the Shallow Water survey, of which, three are spatially coincident with sonar contact W1.12-G-S110 cable and twenty-four (24) are interpreted as related to surficial and/or subsurface geology. The remaining forty-two (42) magnetic anomalies are unclassified and may either be geologic or marine debris (Rackebrandt et al. 2020).

In summary, while a handful of the sidescan and magnetometer anomalies identified in or on the sea bed may be humanly-derived debris they could not be identified any further in the available data and no wrecks were observed in any of the geophysical datasets.

## 6.5. Maritime Heritage in the EEZ and Continental Shelf

Although outside the remit of the NHRA and therefore this assessment, it is worth noting the presence, within the EEZ one important wreck in proximity to the proposed cable route, namely the World War II German submarine U-179.

One of 30 IXD U-boats commissioned and built between 1940-44 in the yard of AG Weser in Bremen in Germany, U-179 was laid down on 15 January 1941 and launched in November of that year. She was over 87 m long with a displacement of 2150 tons, and a crew of 61. She carried 24 torpedoes, fired from four bow and two stern torpedo tubes (<https://uboat.net/boats/u179.htm>).

U-179 was commissioned on 7 March 1942 under the command of Fregattenkapitän Ernst Sobe and after training departed Kiel on the Baltic coast on 15 August on her first and only patrol (<https://uboat.net/boats/u179.htm>).

Fifty-five days later on 8 October 1942 off Dassen Island she made her only kill when she torpedoed and sank the unescorted Ellerman Lines steamship *City of Athens*. Some hours after the loss of the *City of Athens*, the destroyer HMS *Active* rescued the survivors and then shortly after 22h00 picked up a radar contact and opened fire at the surfaced U-179 after illuminating her with star shells and a searchlight. The U-boat crash dived and was then apparently sunk by a depth charge attack by the *Active* as a large amount of oil came to the surface. The destroyer remained in the vicinity until daylight without gaining contact again or finding further proof for the destruction of the U-boat before leaving to land the survivors of the *City of Athens* at Cape Town (see <https://uboat.net/allies/merchants/ship/2247.html>).

While not protected by the NHRA because it is located in the EEZ, the circumstances of the loss of U-179 during wartime nevertheless makes this wreck a sensitive site. The loss of naval personnel that accompanied its sinking means that the wreck must be considered a war grave and in the extremely unlikely event of it being encountered during the installation of the cable system, it must be avoided and SAHRA notified of its discovery.

## 7. IMPACT ASSESSMENT

Among the potential impacts associated with the proposed 2AFRICA (West) cable system are impacts on submerged prehistoric and maritime archaeological heritage resources and on palaeontological

features and fossil material. In all cases impacts can arise where interventions on and in the seabed intersect with heritage resources – either directly where sites or material are damaged or disturbed, or indirectly where particularly the downstream effects of seabed activities can affect sites or material.

Direct impacts to buried heritage resources are caused by the cable burial process itself, where trenching or jetting cut into the seabed. Where cables are laid on the seabed rather than buried, their placement can also have a direct impact on heritage sites and materials in their footprint. Interactions between cables, seabed ploughs and other equipment and historical wrecks can also have a direct impact in the form of damage to the former and it is thus desirable to ensure that direct interactions between project infrastructure and heritage resources are avoided.

Indirect impacts on heritage resources in seabed development contexts usually arise from the downstream effects of interventions on or in the seabed on nearby heritage resources. For example, the placement of cables on the seabed may affect local current patterns, causing seabed scour, which can in turn affect nearby heritage sites, both on or within the sea bed.

That said, the small footprint and low profile of the cable is unlikely to cause downstream effects on the surrounding seabed.

On the basis of the heritage resources review in the preceding sections, the heritage receptors defined for this impact assessment are:

- Submerged prehistoric archaeological resources;
- Palaeontological features and fossil material; and
- Maritime archaeological resources, mostly historical shipwrecks.

The assessment of impacts on these receptor classes is based on the methodology set out in Appendix 4 below.

### **7.1. Submerged Prehistory**

Available evidence from South Africa and elsewhere in the world indicates that there is the potential for the survival in submerged, seabed contexts of archaeological material and palaeoenvironmental evidence deposited on the continental shelf, to approximately the -120 m contour, during periods of lower sea level within the last 900 000 years.

Where such material has survived post-glacial marine transgression, it will form part of the sedimentary make-up of the seabed and may be impacted by interventions on and in the seabed.

The small footprint of the seabed intervention that will result from the installation of the cable system, however, makes the potential for **direct** impacts on submerged prehistoric archaeological material in the study area unlikely.

The nature of the proposed seabed intervention, namely the burial of the cable in the seabed within the area covered by this assessment suggests that **indirect** impacts, which manifest themselves after and/or downstream of the activity are also unlikely.

Based on the likely direct and indirect of the installation of seabed cables off the Cape west coast, the **cumulative impacts** of this cable system on submerged prehistorical archaeological material, in combination with other systems already installed on the seabed, are likely to be low.

The **nature** of impacts, were they to occur, will be negative because the finite and non-renewable nature of heritage resources means that they cannot recover if disturbed, damaged or destroyed.

The potential impacts of the installation of the 2AFRICA (West) cable system on submerged prehistoric archaeological resources can be summarised as follows:

	Spatial Extent	Duration	Intensity	Frequency	Probability	Irreplaceability & Reversibility	Significance	Confidence
Without mitigation	Site specific	Short-term	Low	Once off	Improbable	- High irreplaceability - Non-reversible	Medium	Low
	Essential mitigation measures: <ul style="list-style-type: none"> <li>No mitigation proposed in Deep and Shallow Water</li> <li>Inshore Waters and on the beach crossing, it is recommended that an alert for the occurrence of submerged prehistoric archaeological material, be included in the EMPr for the project, specifically for the divers working in the shoreface and the operators excavating the trench in the beach and dune.</li> </ul>							
With mitigation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

## 7.2. Palaeontology

As described above, extensive cemented crusts or “hardgrounds” formed on formations exposed at the seabed and eroded and reconsolidated during glacial sea level oscillations have produced a wide array of multiphase phosphorite nodules and phosphatic shell casts of various ages. The bones and teeth of sharks and other fishes, the skulls of extinct whale species and the occasional remains of land-living

animals that roamed the ice age exposed shelf are also phosphatized and reworked into the latest, loose sediments on the seabed.

Although the seabed plough method of cable burial on the shelf means that it is not possible to perform palaeontological mitigation as seabed materials are not brought up to the vessel for inspection and sampling, the limited subsurface seabed disturbance entailed in burying the cable by seabed plough, means that **direct** palaeontological impacts are considered to be negligible.

Where the cable crosses the shoreface and beach sands, the water jetting and trench digging may encounter reworked marine and terrestrial fossil bones and teeth, but the probability is unlikely given the widely scattered occurrence and the small, narrow volume of the excavation. This impact is therefore considered to be low to negligible.

The Velddrif Formation shelly deposits which may be encountered comprise a predominantly extant shell fauna which is of **low** palaeontological sensitivity. Given the small volume which will be affected, and the availability of Velddrif Formation exposures at many places along the coast, the impact may be considered negligible.

The nature of the proposed seabed intervention also suggests that **indirect** impacts, which manifest themselves after and/or downstream of the activity are likely to be negligible.

Based on the likely direct and indirect of the installation of seabed cables off the Cape west coast, the **cumulative impacts** of this cable system on palaeontological material, in combination with other systems already installed on the seabed, are likely to be low.

The **nature** of impacts, were they to occur, will be negative because the finite and non-renewable nature of palaeontological material means that they cannot recover if disturbed, damaged or destroyed.

The potential impacts of the installation of the 2AFRICA (West) cable system on palaeontological resources can be summarised as follows:

	Spatial Extent	Duration	Intensity	Frequency	Probability	Irreplaceability & Reversibility	Significance	Confidence
Without mitigation	Site specific	Short-term	Low	Once off	Improbable	- High irreplaceability - Non-reversible	Medium	Low
Essential mitigation measures:								

	<ul style="list-style-type: none"> <li>• No mitigation proposed in Deep and Shallow Water</li> <li>• Inshore Waters and on the beach crossing, it is recommended that an alert for the occurrence of palaeontological material, be included in the EMPr for the project, specifically for the divers working in the shoreface and the operators excavating the trench in the beach and dune.</li> </ul>							
With mitigation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

### 7.3. Maritime Archaeology

Based on the discussion of maritime heritage resources and the results of the seabed surveys above, no wrecks have been identified within the 1 km study area buffer around the proposed cable alignment or within less than 8 km of the route..

The seabed surveys recorded no wrecks but did note the presence along the route of a possibly humanly-derived debris. None of these contacts could be more accurately described on the basis of available data. It is therefore not known whether any of these anomalies represent historical shipwrecks or related material.

The small footprint of the seabed intervention and the potential for seabed debris to damage the cable plough, which means that these contacts are likely to be carefully avoided during cable installation, suggests that the potential for **direct** impacts on maritime archaeological sites or material in the study area is negligible.

The nature of the proposed seabed intervention suggests that **indirect** impacts, which manifest themselves after and/or downstream of the activity and can take the form of, for example, seabed scour, are unlikely to affect any of the handful of known wrecks in vicinity of the cable system.

Based on the likely direct and indirect of the installation of seabed cables off the Cape west coast, the **cumulative impacts** of this cable system on maritime heritage resources, in combination with other systems already installed on the seabed, are likely to be low.

The **nature** of impacts, should they to occur, will be negative because the finite and non-renewable nature of heritage resources means that they cannot recover if disturbed, damaged or destroyed.

The potential impacts of the installation of the 2AFRICA (West) cable system on maritime heritage resources can be summarised as follows:

	Spatial Extent	Duration	Intensity	Frequency	Probability	Irreplaceability & Reversibility	Significance	Confidence
Without mitigation	Site specific	Short-term	Low	Once off	Improbable	- High irreplaceability - Non-reversible	Medium	Low
Essential mitigation measures: <ul style="list-style-type: none"> <li>Any further geophysical data generated to support to installation of the cable system must be archaeologically reviewed for the presence of historical shipwrecks or related material;</li> <li>Should the data identify wreck material at or near the location of any portion of the cable, micro-siting of the cable and/or the possible implementation of an exclusion zone around the archaeological feature should be sufficient to mitigate the risks to the site;</li> <li>Should any maritime archaeological sites or material be accidentally encountered during the course of laying the cable, work must cease in that area until the project archaeologist and SAHRA have been notified, the find has been assessed by the archaeologist, and agreement has been reached on how to deal with it.</li> </ul>								
With mitigation	Site specific	Short-term	Low	Once off	Improbable	- High irreplaceability - Non-reversible	Low	Low

## 8. CONCLUSIONS AND RECOMMENDATIONS

This assessment of the heritage resources within the study area established around the 2AFRICA (West) cable system suggests that although there is the potential for the presence of submerged prehistoric archaeological and palaeontological material on or in the seabed, particularly above the - 120 m contour, the patchiness in the distribution of these heritage resource and the minor seabed interventions associated with the installation of the cable system mean that impacts to such material are very unlikely.

The nature of buried prehistoric archaeological sites and palaeontological material means that it will be virtually impossible to detect such sites during ploughed offshore cable burial. No mitigation is thus proposed in respect of submerged prehistoric archaeological or palaeontological resources in the Shallow or Deep Water areas of the cable route..

In the Inshore Waters and on the beach crossing, in respect of both submerged prehistoric archaeology and palaeontology, it is recommended that an alert for the occurrence of fossil bones and teeth, as well as potential submerged prehistoric archaeological material, be included in the EMP for the project, specifically for the divers working in the shoreface and the operators excavating the trench in the beach and dune.

Due to the dynamic nature of the environment, any possible archaeological or palaeontological material encountered in these activities must be immediately collected by the diver or operator before it is lost. The ECO and/or the monitoring archaeologist must be informed and take custody of the find and obtain its context. All such finds must be recorded and their contextual information (a report) must be deposited at an SAHRA-approved institution.

With regard to historical shipwrecks, the proposed 2AFRICA (West) cable system has a very low potential for impacts arising out of the installation of the seabed cable. However, in view of the potential, albeit very small, for the presence of currently unknown wrecks close to the cable route, the following recommendations are made in respect of mitigation measures to be applied during the installation of the cable system:

- If any further geophysical data, particularly in the Inshore Waters portion of the cable route, is generated to support the installation of the cable system it be archaeologically reviewed for the presence of historical shipwrecks or related material. If possible, the project archaeologist should be consulted before data are collected to ensure that the survey specifications and data outputs are suitable for archaeological review;
- Should the data identify wreck material at or near the location of any portion of the cable, micro-siting of the cable and/or the possible implementation of an exclusion zone around the archaeological feature should be sufficient to mitigate the risks to the site;
- Should any archaeological material be accidentally encountered during the course of cable installation, work must cease in that area until the project archaeologist and SAHRA have been notified, the find has been assessed by the archaeologist, and agreement has been reached on how to deal with it.

### **8.1. Acceptability of the Proposed Activity with Respect to Heritage Resources**

Based on the information and assessment above, it is our reasoned opinion that the proposed installation of the 2AFRICA (West) cable system raises no red flags, contains no fatal flaws and is unlikely to have any impact on known or unknown maritime and underwater cultural heritage resources. It is, therefore, considered acceptable.



## 9. REFERENCES

- ACER. 2021. *Alcatel Submarine Networks (ASA) 2AFRICA (West) Submarine Fibre Optic Cable System to be Landed at Yzerfontein, West Coast District, Western Cape, South Africa*. Draft Scoping Report prepared for Mobile Telephone Network (Pty) Ltd. ACER (Africa) Environmental Consultants.
- Axelson, E. 1973. *The Portuguese in South-East Africa, 1488-1600*. Wits University Press. Johannesburg.
- Burman, J. 1976. *The Bay of Storms: Table Bay 1503-1860*. Cape Town. Human & Rousseau.
- Cawthra, H.C. 2014. *The marine geology of Mossel Bay, South Africa*. Unpublished PhD dissertation. Faculty of Science. University of Cape Town.
- Cawthra, H.C., Compton, J.S., Fisher, E.C., Machutchon, M.R. and Marean, C.W. 2016. Submerged shorelines and landscape features offshore of Mossel Bay, South Africa. In Harff, J., Bailey, G. and Luth, F. (eds). *Geology and Archaeology: Submerged Landscapes of the Continental Shelf*. Geological Society, London, Special Publications, 411, 219– 233.
- Compton, J.S. 2011. Pleistocene sea-level fluctuations and human evolution on the southern coastal plain of South Africa. *Quaternary Science Reviews* 30: 506-527.
- Cruz-Uribe, K., Klein, R.G., Avery, G., Avery, M., Halkett, D., Hart, T., Milo, R.G., Garth Sampson, C. & Volman, T.P. 2003. Excavation of buried Late Acheulean (Mid-Quaternary) land surfaces at Duinefontein 2, Western Cape Province, South Africa. *Journal of Archaeological Science*, 30: 5, 559-575.
- Deacon, J. 1975. Report on stone artefacts from Duinefontein 2, Melkbosstrand. *South African Archaeological Bulletin* 31:21-25.
- De Wet, W. M. 2012. *Bathymetry of the South African continental shelf*. M.Sc thesis, Department of Geological Sciences, University of Cape Town. 255 pp.
- Dingle, R.V. & Siesser, W.G. 1977. *Geology of the continental margin between Walvis Bay and Ponto do Ouro*. Map - Geological Survey of South Africa Marine Geoscience Series.
- Fisher, E.C., Bar-Matthews, M., Jerardino, A. and Marean, C.W. 2010. Middle and Late Pleistocene paleoscape modeling along the southern coast of South Africa. in *Quaternary Science Reviews*, 29, pp 1382-1398.

Fitch, S., Thomson, K. and Gaffney, V. 2005. Late Pleistocene and Holocene depositional systems and the palaeogeography of the Dogger Bank, North Sea. *Quaternary Research*, 64, 185-196.

Franklin, J., Potts, A.J., Fisher, E.C., Cowling, R.M., and Marean, C.W. 2015. Paleodistribution modelling in archaeology and paleoanthropology. *Quaternary Science Reviews* 110, 1-14.

Gaffney, V., Fitch, S., and Smith, D. 2010. *Europe's Lost World: The Rediscovery of Doggerland*. Research Report 160. London. Council for British Archaeology.

Gray, J. 2000. *Report for SAHRA on the excavation at Melkbosstrand (Erf 609) Site CBD 14 (2)*. Unpublished report. Cape Town.

Gribble, J. 2002. The Past, Present and Future of Maritime Archaeology in South Africa. *International Handbook of Underwater Archaeology* (eds Ruppe and Barstad). New York. Plenum Press.

Gribble, J. and Sharfman, J. 2013. Maritime Legal Management in South Africa. *Online Encyclopaedia of Global Archaeology*, pp 6802-6810.

Hutten, L. 2014a. *Preliminary report on the rescue excavation of exposed human skeletal remains at 75 Mostert Road, Melkbosstrand, Western Cape*. Unpublished report prepared for Riaan de Villiers. Cape Town: Department of Archaeology, University of Cape Town.

Hutten, L. 2014b. *Supplementary report on the rescue excavation of exposed human skeletal remains at 75 Mostert Road, Melkbosstrand, Western Cape*. Unpublished report prepared for Riaan de Villiers. Cape Town: Department of Archaeology, University of Cape Town.

Kaplan, J. 1998. *Archaeological rescue excavations at CA1 (Cape Atlantic 1), Melkbosstrand*. Unpublished report prepared for Johnnie Property Developments (Pty) Ltd. Riebeeck West: Agency for Cultural Resource Management.

Kaplan, J. 2000. *Archaeological excavations, Melkbos Shopping Centre, Melkbosstrand*. Unpublished report prepared for Wilmos CC. Cape Town: ACO Associates.

Klein, R.G. 1976. A Preliminary Report on the 'Middle Stone Age' Open-Air Site of Duinefontein 2, Melkbosstrand, South-Western Cape Province, South Africa. *The South African Archaeological Bulletin*, 31:121/122, 12-20.

Klein, R.G., Avery, G., Cruz-Uribe, K., Halkett, D., Hart, T., Milo, R. & Volman, T.P. 1999. Duinefontein 2: an Acheulean site in the western Cape province of South Africa. *Journal of Human Evolution* 37:2, 153-190.

Laidler, P.W. 1929. Hottentot and Bushman pottery of South Africa. *South African Journal of Science* 26: 758-786.

Orton, J. 2010. *Archaeological Excavations at Erf 164, Melkbosstrand, Malmesbury Magisterial District, Western Cape*. Unpublished report prepared for Colliers RMS. Riebeeck West: Agency for Cultural Resource Management

Peeters, H., Murphy, P., Flemming, N. (eds), 2009, *North Sea Prehistory Research and Management Framework*. Amersfoort.

Peeters, H. 2011. How Wet Can It Get? – Approaches to submerged prehistoric sites and landscapes on the Dutch continental shelf, in Benjamin, J., Bonsall, C., Pickard, C., and Fischer, A. (eds). *Submerged Prehistory*. Oxbow Books. Oxford and Oakville.

Peringuey, L. 1911. The Stone Ages of South Africa as represented in the collection of the South African Museum. *Annals of the South African Museum* 8: 1-218.

Pether, J. 1993. Relict shells of Subantarctic Mollusca from the Orange Shelf, Benguela Region, off southwestern Africa. *The Veliger* 36 (3): 276-284.

Pether, J. 1994. Molluscan evidence for enhanced deglacial advection of Agulhas water in the Benguela Current, off southwestern Africa. *Palaeogeography, Palaeoclimatology, Palaeoecology* 111: 99-117.

Rackebandt, N., Bielefeld, J. and Arndt, L. 2020. *2AFRICA Subsea Cable Network: Volume – Segment W1.12 BMH YZERFONTEIN – BU SWAKOPMUND Book 1 Survey Report*. Unpublished reports produced for Alcatel Submarine Networks Limited. Fugro Germany Marine.

Rohling, E.J., Grant, K., Bolshaw, M., Roberts, A. P., Siddall, M., Hemleben, Ch., and Kucera, M. 2009. Antarctic temperature and global sea level closely coupled over the past five glacial cycles. *Nature Geoscience*, 2 July 2009.

Rudner, J. 1968. Strandloper pottery from South and South West Africa. *Annals of the South African Museum*, 49:2.

Sealy, J., Maggs, T., Jerardino, A and Kaplan, J. 2004. Excavations at Melkbosstrand: Variability among Herder Sites on Table Bay, South Africa. *The South African Archaeological Bulletin*, 59:179, 17-28.

Turner, M. 1988. Shipwrecks and Salvage in South Africa: 1505 to the Present. C Struik. Cape Town.

Van Andel, T.H.1989. Late Pleistocene Sea Levels and the Human Exploitation of the Shore and Shelf of the Southern South Africa. *Journal of Field Archaeology* 16:2, 133-155.

Waelbroeck, C., Labeyrie, L., Michela, B.E., Duplessy, J.C., McManus, J.F., Lambeck, K., Balbon, E., and Labracherie, M. 2002. Sea-level and deep water temperature changes derived from benthic foraminifera isotopic records. *Quaternary Science Reviews*, 21: 295–305.

Weinerlein, V. 2006. HMSAS *Gamtoos*,1942-1945: A South African salvage vessel in the Second World War, *Military History Journal*, Vol 13, No 5.

Werz, B.E.J.S and Flemming, N.C. 2001. Discovery in Table Bay of the oldest handaxes yet found underwater demonstrates preservation of hominid artefacts on the continental shelf. *South African Journal of Science* 97: 183-185.

Werz, B.E.J.S., Cawthra, H.C. and Compton, J.S. 2014. Recent Developments in African Offshore Prehistoric Archaeological Research, with an Emphasis on South Africa, In Evans, A.M., Flatman, J.C. and Flemming, N.C. (Eds) *Prehistoric Archaeology on the Continental Shelf: A Global Review*. Springer Science and Business Media. New York. 233-253.

### 9.1. Online Sources

18th Century shipping mapped using 21st Century technology.  
<http://www.theguardian.com/news/datablog/2012/apr/13/shipping-routes-history-map>. Accessed on 15 January 2021.

Decade of work strips 90km of sea for a glimpse of Ice Age SA.  
<https://select.timeslive.co.za/news/2020-05-21-decade-of-work-strips-90km-of-sea-for-a-glimpse-of-ice-age-sa/>. Accessed online 19 January 2021.

SAHRIS. <http://www.sahra.org.za/sahris>. Accessed online 14 January 2021.

U-boat.net. <https://uboat.net/allies/merchants.html>. Accessed on 15 January 2021.

What Kind Of Projects Does The Aimure Undertake? <http://www.aimure.org/index.php/aimure-projects>. Accessed online 14 January 2021.

SS Otto Siedle (+1981). <https://www.wrecksite.eu/wreck.aspx?216734>. Accessed online 21 January 2021

*Mangkalihat* - Dutch Steam merchant. <https://uboat.net/allies/merchants/ship/3032.html>. Accessed online 21 January 2021

## APPENDIX 1: CORRESPONDENCE WITH HWC RE NEED FOR TERRESTRIAL HERITAGE STUDIES

**From:** Waseefa Dhansay Waseefa.Dhansay@westerncape.gov.za   
**Subject:** RE: 2AFRICA Submarine Cable landfills at Duynefontein and Yzerfontein: Requirement for NIDs?  
**Date:** 22 December 2020 at 13:26  
**To:** john.gribble john.gribble@aco-associates.com, Stephanie Barnardt Stephanie.Barnardt@westerncape.gov.za  
**Cc:** Giles Churchill giles.churchill@acerafrica.co.za, Carina Boonzaaier carina.boonzaaier@acerafrica.co.za

Dear John

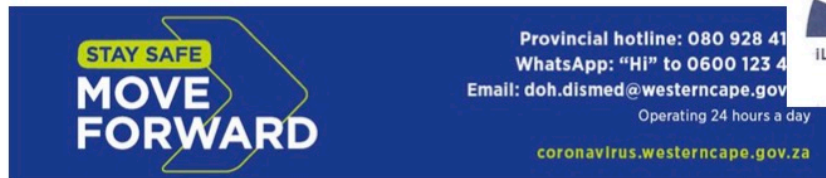
There will be no S38(1) trigger and no NID required as the cables affecting HWC's jurisdiction would be less than 100m. The standard archeological approach will apply nonetheless – if any heritage resources are uncovered work is to stop and HWC to be informed.

[HWC December 2020 and January 2021 Operations](#)

Kind regards,

Waseefa Dhansay  
Assistant Director: Professional Services  
Heritage Resource Management Services  
Heritage Western Cape

Email: [waseefa.dhansay@westerncape.gov.za](mailto:waseefa.dhansay@westerncape.gov.za)  
Website: <https://www.hwc.org.za>



**STAY SAFE**  
**MOVE FORWARD**

Provincial hotline: 080 928 41  
WhatsApp: "HI" to 0600 123 4  
Email: [doh.dismed@westerncape.gov.za](mailto:doh.dismed@westerncape.gov.za)  
Operating 24 hours a day  
[coronavirus.westerncape.gov.za](https://coronavirus.westerncape.gov.za)



---

**From:** John Gribble <[john.gribble@aco-associates.com](mailto:john.gribble@aco-associates.com)>  
**Sent:** Tuesday, December 22, 2020 12:28 PM  
**To:** Stephanie Barnardt <[Stephanie.Barnardt@westerncape.gov.za](mailto:Stephanie.Barnardt@westerncape.gov.za)>; Waseefa Dhansay <[Waseefa.Dhansay@westerncape.gov.za](mailto:Waseefa.Dhansay@westerncape.gov.za)>  
**Cc:** Giles Churchill <[giles.churchill@acerafrica.co.za](mailto:giles.churchill@acerafrica.co.za)>; Carina Boonzaaier <[carina.boonzaaier@acerafrica.co.za](mailto:carina.boonzaaier@acerafrica.co.za)>  
**Subject:** 2AFRICA Submarine Cable landfills at Duynefontein and Yzerfontein: Requirement for NIDs?  
**Importance:** High

Dear Stephanie and Waseefa

I'm doing impact assessments for two submarine telecoms (fibre) cables that will be landed on the west coast - one at Duynefontein and the other at Yzerfontein.

SAHRA has requested HIA's for the offshore component (i.e. below the high water mark) of each cable route and these are underway.

I need to check with you both about the whether NIDs for the terrestrial portions of both cables will be required.

At Duynefontein the cable will land at the existing ACE Cable landing point where a number of other cable systems already come ashore (SAT2, SAT3, ACE and the future Equiano cable system), and at Yzerfontein landfall will be at the existing submarine cable WACS landing point, where again a number of existing cable make landfall.

In both instances once they have crossed the beach and high/low water boundary the cables will be routed to existing Beach Manholes (BMH) and from there each will routed in an existing buried cable sleeves to their respective Cable Landing Stations (CLS) which are the control centres for the cable systems and where they connect to the domestic telecoms network. No disturbance to the terrestrial environment will thus occur between the BMH and CLS in either case.

Where there will be disturbance to the ground between the high water mark and the BMHs, the documentation I have for both projects indicates that the total length of new terrestrial cabling will be approximately 100 m in the case of Yzerfontein and approximately 250 m or 200 m (depending on which BMH option is used) at Duynefontein. In both cases, therefore, less than the 300 m required to trigger a NID.

Could you please confirm for me that a NID application is thus not required for either of these two projects?

I have attached a copy of the BIDs for both projects for your information.

All the best

John

\*All views or opinions expressed in this electronic message and its attachments are the view of the sender and do not necessarily reflect the views and opinions of the Western Cape Government (the WCG). No employee of the WCG is entitled to conclude a binding contract on behalf of the WCG unless he/she is an accounting officer of the WCG, or his or her authorised representative. The information contained in this message and its attachments may be confidential or privileged and is for the use of the named recipient only, except where the sender specifically states otherwise. If you are not the intended recipient you may not copy or deliver this message to anyone.\*

**APPENDIX 2: RECORDED WRECKS AND SHIPPING CASUALTIES WITHIN & PROXIMATE TO THE MARITIME ARCHAEOLOGICAL STUDY AREA (ALL ZONES)**

Ship Name	Area	Place	Latitude (estimated)*	Longitude (estimated)*	Event Type	Vessel Category	Type	Date Wreck
<i>Shin Tung Yong 18</i>	West Coast	40.2km south west of Saldanha Bay	-33,295502	17,651128	Foundered	Motor Vessel	Fishing vessel	1978/10/01
<i>U-179</i>	Dassen Island	West of	-33,41307	17,035671	Sunk	U-boat	U-boat	1942/10/08

\* **PLEASE NOTE:** The shipwreck positions provided above are estimated positions based on descriptions of loss in the historical record. Confidence in the accuracy of these positions is thus very low and it is unlikely that the vessels concerned will be found at the given co-ordinates

## APPENDIX 3: SPECIALIST CV

**Name:** John Gribble  
**Profession:** Archaeologist  
**Date of Birth:** 15 November 1965  
**Parent Firm:** ACO Associates cc  
**Position in Firm:** Senior Archaeologist  
Years with Firm: 2+  
Years of experience: 27  
**Nationality:** South African  
HDI Status: n/a

### Education:

1979-1983 Wynberg Boys' High School (1979-1983)  
1986 BA (Archaeology), University of Cape Town  
1987 BA (Hons) (Archaeology), University of Cape Town  
1990 Master of Arts, (Archaeology) University of Cape Town

### Employment:

- ACO Associates, Senior Archaeologist and Consultant, September 2017 – present
- South African Heritage Resources Agency, Manager: Maritime and Underwater Cultural Heritage Unit, 2014 – 2017 / Acting Manager: Archaeology, Palaeontology and Meteorites Unit, 2016-2017
- Sea Change Heritage Consultants Limited, Director, 2012 – present
- TUV SUD PMSS (Romsey, United Kingdom), Principal Consultant: Maritime Archaeology, 2011-2012
- EMU Limited (Southampton, United Kingdom), Principal Consultant: Maritime Archaeology, 2009-2011
- Wessex Archaeology (Salisbury, United Kingdom), Project Manager: Coastal and Marine, 2005-2009
- National Monuments Council / South African Heritage Resources Agency, Maritime Archaeologist, 1996-2005
- National Monuments Council, Professional Officer: Boland and West Coast, Western Cape Office, 1994-1996

### Professional Qualifications and Accreditation:

- Member: Association of Southern African Professional Archaeologists (No. 043)



- Principal Investigator: Maritime and Colonial Archaeology, ASAPA CRM Section
- Field Director: Stone Age Archaeology, ASAPA CRM Section
- Member: Chartered Institute for Archaeologists (CIfA), United Kingdom
- Class III Diver (Surface Supply), Department of Labour (South Africa) / UK (HSE III)

#### Experience:

I have nearly 30 years of combined archaeological and heritage management experience. After completing my postgraduate studies, which were focussed on the vernacular architecture of the West Coast, and a period of freelance archaeological work in South Africa and aboard, I joined the National Monuments Council (NMC) (now the South African Heritage Resources Agency (SAHRA)) in 1994. As the Heritage Officer: the Boland I was involved in day to day historical building control and heritage resources management across the region. In 1996 I become the NMC's first full-time maritime archaeologist in which role was responsible for the management and protection of underwater cultural heritage in South Africa under the National Monuments Act, and subsequently under the National Heritage Resources Act.

In 2005 I moved to the UK to join Wessex Archaeology, one of the UK's biggest archaeological consultancies, as a project manager in its Coastal and Marine Section. In 2009 I joined Fugro EMU Limited, a marine geosurvey company based in Southampton to set up their maritime archaeological section. I then spent a year at TUV SUD PMSS, an international renewable energy consultancy based in Romsey, where I again provided maritime archaeological consultancy services to principally the offshore renewable and marine aggregate industries.

In August 2012 I set up Sea Change Heritage Consultants Limited, a maritime archaeological consultancy. Sea Change provides archaeological services to a range of UK maritime sectors, including marine aggregates and offshore renewable energy. It also actively pursues opportunities to raise public awareness and understanding of underwater cultural heritage through educational and research projects and programmes, including some projects being developed in South Africa.

Projects include specialist archaeological consultancy for more than 15 offshore renewable energy projects and more than a dozen offshore aggregate extraction licence areas.

In addition to managing numerous UK development-driven archaeological projects, I have also been involved in important strategic work which developed guidance and best practice for the offshore industry with respect to the marine historic environment. This has included the principal authorship of two historic environment guidance documents for COWRIE and the UK renewable energy sector, and the development of the archaeological elements of the first Regional Environmental Assessments for the UK marine aggregates industry. In 2013-14 I was lead author and project co-ordinator on the

Impact Review for the United Kingdom of the 2001 UNESCO Convention on the Protection of the Underwater Cultural Heritage. In 2016 I was co-author of a Historic England / Crown Estate / British Marine Aggregate Producers Association funded review of marine historic environment best practice guidance for the UK offshore aggregate industry.

I returned to South African in mid-2014 where I was re-appointed to my earlier post at SAHRA: Manager of the Maritime and Underwater Cultural Heritage Unit. In July 2016 I was also appointed Acting Manager of SAHRA's Archaeology, Palaeontology and Meteorites Unit.

I left SAHRA in September 2017 to join ACO Associates as Senior Archaeologist and Consultant. I have been a member of the ICOMOS International Committee for Underwater Cultural Heritage since 2000 and have served as a member of its Bureau since 2009. I am currently the secretary of the Committee.

I have been a member of the Association of Southern African Professional Archaeologists for more than twenty years and am accredited by ASAPA's CRM section. I have been a member of the UK's Chartered Institute for Archaeologists (CIfA) since 2005, and served on the committee of its Maritime Affairs Group between 2008 and 2010. Since 2010 I have been a member of the UK's Joint Nautical Archaeology Policy Committee.

I am currently a member of the Advisory Board of the George Washington University / Iziko Museums of South Africa / South African Heritage Resources Agency / Smithsonian Institution 'Southern African Slave Wrecks Project' and serve on the Heritage Western Cape Archaeology, Palaeontology and Meteorites Committee.

#### Books and Publications:

Gribble, J. and Scott, G., 2017, *We Die Like Brothers: The sinking of the SS Mendi*, Historic England, Swindon

Lloyd Jones, D., Langman, R., Reach, I., Gribble, J., and Griffiths, N., 2016, Using Multibeam and Sidescan Sonar to Monitor Aggregate Dredging, in C.W. Finkl and C. Makowski (eds) *Seafloor Mapping along Continental Shelves: Research and Techniques for Visualizing Benthic Environments*, Coastal Research Library 13, Springer International Publishing, Switzerland, pp 245-259.

Athiros, G. and Gribble, J., 2015, *Wrecked at the Cape Part 2*, The Cape Odyssey 105, Historical Media, Cape Town.

Gribble, J. and Sharfman, J., 2015, The wreck of SS Mendi (1917) as an example of the potential trans-national significance of World War I underwater cultural heritage, *Proceedings of the UNESCO Scientific Conference on the Underwater Cultural Heritage from World War I*, Bruges, 26-28 June 2014.

Gribble, J., 2015, Underwater Cultural Heritage and International Law. Cambridge by Sarah Dromgoole, in *South African Archaeological Bulletin*, 70, 202, pp 226-227.

Athiros, G. and Gribble, J., 2014, *Wrecked at the Cape Part 1*, The Cape Odyssey 104, Historical Media, Cape Town.

Gribble, J., 2014, Learning the Hard Way: Two South African Examples of Issues Related to Port Construction and Archaeology, in *Dredging and Port Construction: Interactions with Features of Archaeological or Heritage Interest*, *PIANC Guidance Document 124*, pp 97-107.

UK UNESCO 2001 Convention Review Group, 2014, The UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001: An Impact Review for the United Kingdom, ISBN 978-0-904608-03-8.

Sadr, K., Gribble, J. and Euston-Brown, G, 2013, Archaeological survey on the Vredenburg Peninsula, in Jerardino et al. (eds), *The Archaeology of the West Coast of South Africa*, BAR International Series 2526, pp 50-67

Gribble, J. and Sharfman, J, 2013, Maritime Legal Management in South Africa, *Online Encyclopaedia of Global Archaeology*, pp 6802-6810.

Gribble, J., 2011, The UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001, *Journal of Maritime Archaeology* 6:1 77-86.

Gribble, J., 2011, The SS Mendi, the Foreign Labour Corps and the trans-national significance of shipwrecks, in J. Henderson (ed.): *Beyond Boundaries, Proceedings of IKUWA 3, The 3rd International Congress on Underwater Archaeology*, Römisch-Germanische Kommission (RGK), Frankfurt.

Gribble, J., 2011, Competence and Qualifications, in Guèrin, U., Egger, B. and Maarleveld, T. (eds) *UNESCO Manual for Activities directed at Underwater Cultural Heritage*, UNESCO - Secretariat of the 2001 Convention, Paris.

Gribble, J. and Leather, S. for EMU Ltd., 2010, Offshore Geotechnical Investigations and Historic Environment Analysis: Guidance for the Renewable Energy Sector. Commissioned by COWRIE Ltd (project reference GEOARCH-09).

- Sadr, K and Gribble, J., 2010, The stone artefacts from the Vredenburg Peninsula archaeological survey, west coast of South Africa, *Southern African Humanities* 22: 19–88.
- Gribble, J., 2009, HMS Birkenhead and the British warship wrecks in South African waters in *Proceedings of the Shared Heritage Seminar*, University of Wolverhampton, 8 July 2008
- Gribble, J., Parham, D. and Scott-Ireton, D., 2009, Historic Wrecks: Risks or Resources? In *Conservation and Management of Archaeological Sites*, Vol. 11 No. 1, March, 2009, 16–28.
- Gribble, J. and Athiros, G., 2008, *Tales of Shipwrecks at the Cape of Storms*, Historical Media, Cape Town.
- Gribble, J., 2008, The shocking story of the ss Mendi, in *British Archaeology*, March/April 2008.
- Gribble, J., 2007, The Protection of the Underwater Cultural Heritage: National Perspectives in light of the UNESCO Convention 2001 by Sarah Dromgoole, in *The International Journal of Nautical Archaeology*, 36, 1, pp 195-6.
- Gribble, J., 2006, The Sad Case of the ss Maori, in Grenier, R., D. Nutley and I. Cochran (eds) *Underwater Cultural Heritage at Risk: Managing Natural and Human Impacts*, pp 41-43, ICOMOS, Paris
- Gribble, J., 2006, Pre-Colonial Fish Traps on the South Western Cape Coast, South Africa, in Grenier, R., D. Nutley and I. Cochran (eds) *Underwater Cultural Heritage at Risk: Managing Natural and Human Impacts*, pp 29-31, ICOMOS, Paris.
- Forrest, C.S.J., and Gribble, J., 2006, The illicit movement of underwater cultural heritage: The case of the Dodington coins, in *Art and Cultural Heritage: Law, Policy and Practice*, (ed B.T. Hoffman), New York, Cambridge University Press.
- Forrest, C.S.J., and Gribble, J., 2006, Perspectives from the Southern Hemisphere: Australia and South Africa, in *The UNESCO Convention for the Protection of the Underwater Heritage: Proceedings of the Burlington House Seminar*, October 2005, JNAPC / NAS.
- Gribble, J., 2003, “Building with Mud” – Developing historical building skills in the Karoo, in ICOMOS South Africa, in *The Proceedings of Symposium on Understanding and using urban heritage in the Karoo*, Victoria West, South Africa, 3-5 March 2002.

Forrest, C.S.J., and Gribble, J., 2002, The illicit movement of underwater cultural heritage: The case of the Dodington coins, *International Journal of Cultural Property*, Vol II (2002) No 2, pp 267-293.

Gribble, J. 2002, The Past, Present and Future of Maritime Archaeology in South Africa, *International Handbook of Underwater Archaeology* (eds Ruppe and Barstad), New York, Plenum Press.

Thackeray, F. and Gribble, J., 2001, Historical Note on an Attempt to Salvage Iron from a Shipwreck, *Looking Back*, Vol 40, November 2001, pp 5-7.

Gribble, J., 1998, Keeping Our Heads Above Water – the development of shipwreck management strategies in South Africa, *AIMA Bulletin*, Vol 22, pp 119-124.

Gribble, J. 1996, Conservation Practice for Historical Shipwrecks, Monuments and Sites of South Africa, Colombo, Sri Lanka, ICOMOS 11th General Assembly.

Gribble, J. 1996, National Databases on Monuments and Sites, Monuments and Sites of South Africa, Colombo, Sri Lanka, ICOMOS 11th General Assembly.

Sadr, K, Gribble, J, & Euston-Brown, G L, 1992 The Vredenburg Peninsula survey, 1991/1992 season, Guide to Archaeological Sites in the South-western Cape, Papers compiled for the South African Association of Archaeologists Conference, July 1992, by A.B. Smith & B. Mutti, pp 41-42.

Smith, AB, Sadr, K, Gribble, J, & Yates, R., 1992 Witklip and Posberg Reserve, *Guide to Archaeological Sites in the South-western Cape*, Papers compiled for the South African Association of Archaeologists Conference, July 1992, by A.B. Smith & B. Mutti, pp 31-40.

Smith, AB, Sadr, K, Gribble, J & Yates, R., 1991, Excavations in the south-western Cape, South Africa, and the archaeological identity of prehistoric hunter-gatherers within the last 2000 years, *The South African Archaeological Bulletin* 46: 71-91.

## APPENDIX 4: IMPACT ASSESSMENT METHODOLOGY

The following conventions have been adopted and applied to this impact assessment:

- Direct impacts are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
- Indirect impacts of an activity are indirect or induced changes that may occur because of the activity. These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken, or which occur at a different place because of the activity.
- Cumulative impacts are those that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over time and can include both direct and indirect impacts.
- Nature – the evaluation of the nature is impact specific. Most negative impacts will remain negative, however, after mitigation, significance should reduce:
  - Positive.
  - Negative.
- Spatial extent – the size of the area that will be affected by the impact:
  - Site specific.
  - Local (limited to the immediate areas around the site; < 2 km from site).
  - Regional (would include a major portion of an area; within 30 km of site).
  - National or International.
- Duration – the timeframe during which the impact will be experienced:
  - Short-term (0-3 years or confined to the period of construction).
  - Medium-term (3-10 years).
  - Long-term (the impact will only cease after the operational life of the activity).
  - Permanent (beyond the anticipated lifetime of the project).
- Intensity – this provides an order of magnitude of whether the intensity (magnitude/size/frequency) of the impact would be negligible, low, medium or high):
  - Negligible (inconsequential or no impact).
  - Low (small alteration of natural systems, patterns or processes).



- Medium (noticeable alteration of natural systems, patterns or processes).
- High (severe alteration of natural systems, patterns or processes).
- Frequency – this provides a description of any repetitive, continuous or time-linked characteristics of the impact:
  - Once off (occurring any time during construction).
  - Intermittent (occurring from time to time, without specific periodicity).
  - Periodic (occurring at more or less regular intervals).
  - Continuous (without interruption).
- Probability – the likelihood of the impact occurring:
  - Improbable (very low likelihood that the impact will occur).
  - Probable (distinct possibility that the impact will occur).
  - Highly probable (most likely that the impact will occur).
  - Definite (the impact will occur).
- Irreplaceability – of resource loss caused by impacts:
  - High irreplaceability of resources (the project will destroy unique resources that cannot be replaced).
  - Moderate irreplaceability of resources (the project will destroy resources, which can be replaced with effort).
  - Low irreplaceability of resources (the project will destroy resources, which are easily replaceable).
- Reversibility – this describes the ability of the impacted environment to return/be returned to its pre-impacted state (in the same or different location):
  - Impacts are non-reversible (impact is permanent).
  - Low reversibility.
  - Moderate reversibility of impacts.
  - High reversibility of impacts (impact is highly reversible at end of project life).
- Significance – the significance of the impact on components of the affected environment (and, where relevant, with respect to potential legal infringement) is described as:
  - Low (the impact will not have a significant influence on the environment and, thus, will not be required to be significantly accommodated in the project design).
  - Medium (the impact will have an adverse effect or influence on the environment, which will require modification of the project design, the implementation of mitigation measures or both).

- High (the impact will have a serious effect on the environment to the extent that, regardless of mitigation measures, it could block the project from proceeding).
- Confidence – the degree of confidence in predictions based on available information and specialist knowledge:
  - Low.
  - Medium.
  - High.