Annex D

Specialist Studies

D1 – Fisheries Study
D2 - Heritage
D2.1 – Marine Heritage Study
D2.2 – Archaeological Assessment
D3 – Marine Ecology Assessment
D4 – Ecological Assessment

Annex D1

Fisheries Study

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED IOX SUBSEA CABLE SYSTEM OFF THE EAST COAST OF SOUTH AFRICA

FISHERIES STUDY

Date: September 2018

Prepared for: Environmental Resources Management South Africa (Pty) Ltd

ERM

On behalf of the applicant:

IOX
Links Across Islands...

Prepared by: Capricorn Marine Environmental (Pty) Ltd

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26 September 2018

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Mr Japp has worked in the field of Fisheries Science and resource assessment since 1987 and has considerable experience in undertaking specialist environmental impact assessments relating to fishing and fish stocks. His work has included environmental economic assessments and the evaluation of the environmental impacts on fishing. Sarah Wilkinson has worked on marine resource assessments, specializing in spatial and temporal analysis (GIS) as well as the economic impacts of fisheries exploitation in the southern African region.

This specialist report was compiled for Environmental Resources Management (ERM) for their use in compiling a Scoping Report and Environmental Impact Assessment (EIA) for the proposed IOX Submarine Cable System off the East Coast of South Africa. We do hereby declare that we are financially and otherwise independent of the Applicant and of ERM.

Dave Japp

Sarah Wilkinson

CONTENTS

ACRONYMS AND ABBREVIATIONS

AoI	Area of Influence
BMH	Beach Man Hole
CapMarine	Capricorn Marine Environmental (Pty) Ltd
CLS	Cable Landing Station
CPUE	Catch Per Unit Effort
DAFF	Department of Agriculture, Forestry and Fisheries
DEA	Department of Environmental Affairs
EAP	Environmental Assessment Process
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
ERM	Environmental Resources Management
EEZ	Exclusive Economic Zone
GRT	Gross Registered Tonnage
HDPE	High Density Polyethylene
HDD	Horizontal Directional Drilling
ICCAT	International Convention for the Conservation of Atlantic Tunas
ICT	Informations and Communications Technology
IDZ	Industrial Development Zone
IOTC	Indian Ocean Tuna Commission
kg	Kilogram
m	Metre
PLGR	Pre-Lay Grapnel Run
ROV	Remotely Operated Vehicle
SADSTIA	South African Deep-Sea Trawling Industry Association
SAFE (cable)	South Africa Far East
SANHO	South African Navy Hydrographic Office
t	Tonnes
TAC	Total Allowable Catch
TAE	Total Allowable Effort
ToR	Terms of Reference

EXECUTIVE SUMMARY

IOX is a Mauritius-based Informations and Communications Technology company that proposes installing a subsea telecommunication cable system extending from India to South Africa via Mauritius and Rodrigues Island. The proposed Project would enable improved communication capacity and internet services. As part of the EIA process, as assessment was undertaken of the impact of the proposed Project on the South African fishing industry.

The marine components of the Project would include the installation of approximately 24 km of fibre optic cable within the EEZ and territorial waters of South Africa, with a coastal landing in the East London Industrial Development Zone. The land-based components would comprise a Beach Man Hole (BMH) (4m x 2m x 3m), terrestrial fibre optic cable and cable landing station, all of which would be positioned within the Industrial Development Zone.

Prior to installation, a detailed survey would be undertaken (using side-scan sonar and sub-bottom profiling) to determine the optimal routing of the cable. Immediately prior to installation a clearance operation would be conducted to remove any obstacles from the path of the final cable route where burial is required (the pre-lay grapnel run). Following this, a specialised cable laying vessel would place the cable on the seabed along the predetermined route. In water depths shallower than 900 m, the cable would be buried by way of ploughing 0.9 to 1.5 m deep into the seabed. In nearshore areas, heavier armouring would used to provide additional protection to the cable. In water depths greater than 900 m, the cable would not be buried.

Activities proposed during the pre-installation, installation, and operational phases of the Project were identified as sources of a potential impact on the fishing industry. Fishing vessels would be required to maintain a safe operational distance from the Project vessels during the pre-grapnel run and installation of the cable. Once installed, the cable route would be charted by the South African Navy Hydrographic Office and would appear on navigational charts. Cable protection zones and corridors prohibit specified activities posing risks to submarine cables – including fishing, anchoring, and dredging – within fixed geographic areas. Although the cable would be considered protected from damage due to burial at depths shallower than 900 m, the entire cable route would be protected with an exclusion zone that would prohibit anchoring and trawling within a distance of 1 nm on either side of the cable. This would result in an impact of potential exclusion to any demersal fishery (ie those that direct fishing effort at the seabed). South African demersal fishery sectors include hake-directed trawl and longline and longline trap fisheries for rock lobster. The proposed cable route does not coincide with fishing grounds of the hake-directed trawl and longline sectors and there is no impact expected on these sectors during the pre-installation, installation or operational phases of the Project. There have historically been very low levels of fishing activity conducted by the trap fishery for south coast rock lobster in the vicinity of the inshore section of the proposed cable route;

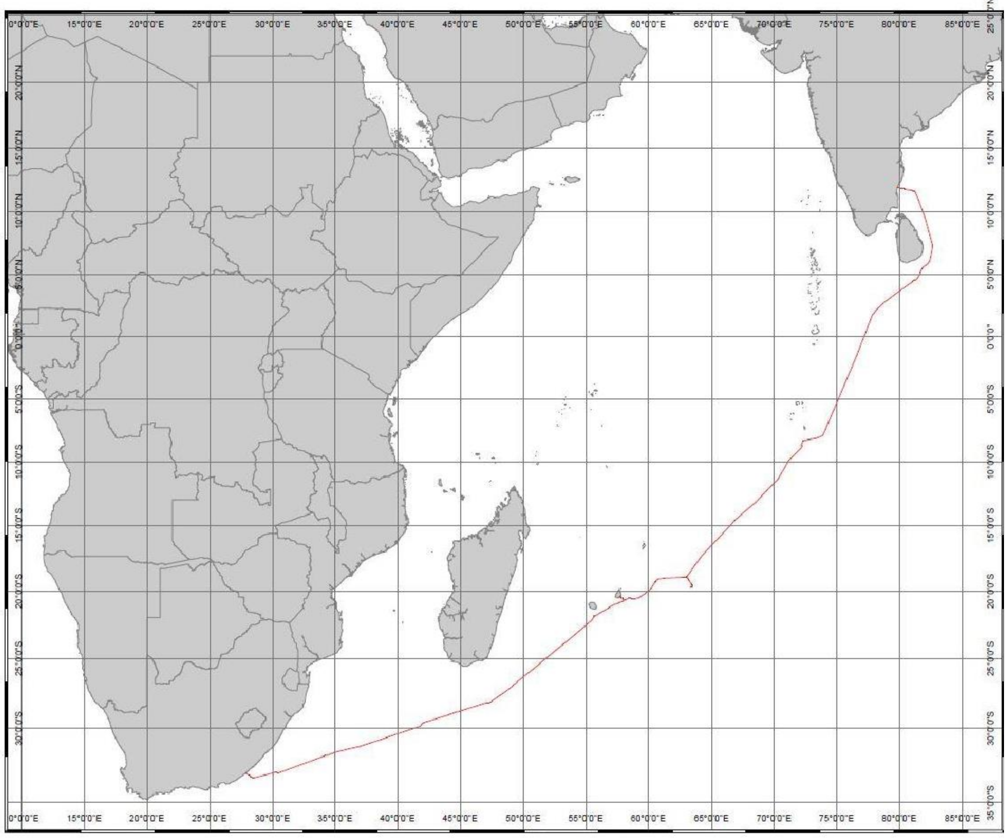
however, due to the negligible magnitude of the potential impact (there has been no catch reported since 2007) the overall significance of the impact on the sector is assessed to be negligible.

Sectors that could be affected during a temporary exclusion to fishing ground during the pre-installation and installation phase of the Project include the traditional linefish sector, which operates in the nearshore vicinity of the proposed area of influence, the large pelagic longline sector, which operates extensively from a distance of 12 nm from the coastline to the limit of the South African Exclusive Economic Zone, and the south coast rock lobster trap fishery, which has shown minimal expenditure of fishing effort in the area. The impact on the traditional linefish, large pelagic longline and south coast rock lobster trap sectors is considered to be of negligible significance.

1 INTRODUCTION

IOX is a Mauritius-based Information and Communications Technology (ICT) company formed to develop a new telecommunication cable system which will connect India and Africa and provide high speed and low latency network access to enhance businesses in these geographies and across industries. IOX proposes to build a submarine cable from India to South Africa via Mauritius and Rodrigues Island. The proposed installation completion date is May 2019 (see *Figure 1.1*). The project area of influence (AoI) includes the Republic of South African Exclusive Economic Zone (EEZ), territorial waters, beach and East London Industrial Development Zone (IDZ).

Figure 1.1 Location of the proposed routing of the IOX submarine cable system



Source: ERM, 2018

IOX has appointed Environmental Resources Management (ERM) as the independent Environmental Assessment Practitioner (EAP) for the Environmental Impact Assessment (EIA) process. The EIA will set out the anticipated impacts arising from the Project and propose measures on how these might be managed. The EIA report will inform an environmental authorisation decision to be taken by the Department of Environmental Affairs (DEA). As part of the EIA process, Capricorn Marine Environmental (Pty) Ltd ('CapMarine') has been appointed to undertake an assessment of the impact of the proposed project on commercial fishing operations.

1.1 *TERMS OF REFERENCE*

The Terms of Reference (ToR) for the current report are to provide an overview of fisheries spatial and temporal catch and effort data and to produce a baseline description of the current commercial fisheries operating within the vicinity of the proposed Project AoI. Following this, to provide an assessment of the potential impacts of the Project on the existing fisheries and to identify mitigation measures. The specific ToR for the Fisheries Specialist Study are as follows:

- Details of the person who prepared the report, and the expertise of that person to carry out the specialist study or specialised process.
- A declaration that the person is independent.
- An introduction that presents a brief background to the study and an appreciation of the requirements stated in the specific terms of reference for the study.
- A short literature review of existing fisheries spatial and temporal catch and effort data.
- A baseline description of the current commercial fisheries operating within the vicinity of the proposed Project (in territorial waters of South Africa).
- Details of the approach to the study where activities performed and methods used are presented.
- The specific identified sensitivity of fishing sectors related to the proposed Project.
- A map superimposing the proposed cable routing within South African territorial waters (with appropriate buffers), on the spatial distribution of catch and effort expended by each fishing sector.
- A description of the findings and potential implications of such findings on the impact of the proposed Project.
- Suggested mitigation measures and monitoring recommendations.
- A description of any assumptions made and any uncertainties or gaps in knowledge.

2 PROJECT DESCRIPTION

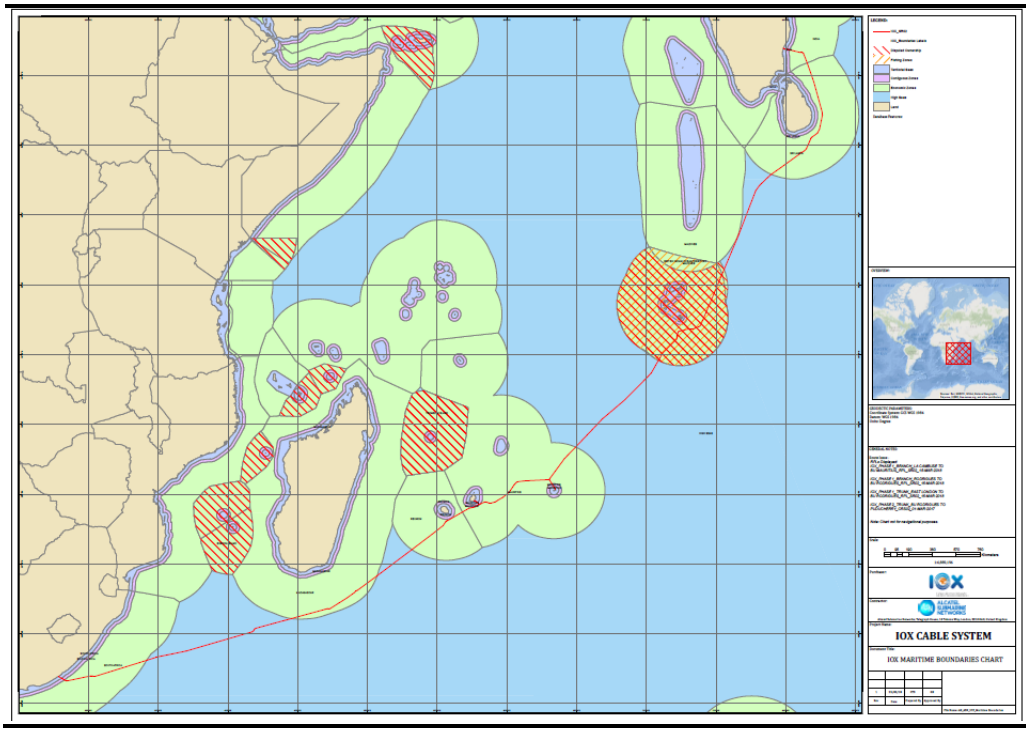
2.1 PROJECT LOCATION

In South Africa, the Project will involve the installation and operation of a subsea fibre optic cable system that will run inside the EEZ and territorial waters of South Africa to a coastal landing site near the East London IDZ in the Eastern Cape Province.

2.1.1 *Marine Route*

The main trunk of the cable is approximately 9 000 km in length and will run from India to South Africa. Branches of cable will split from Branching Units (BU) on the main trunk to landing sites in the other landing countries located along the route. The other landing countries include Mauritius and Rodrigues Island (see *Figure 2.1*).

Figure 2.1 Location of the proposed routing of the IOX submarine cable system



Source: ERM, 2018

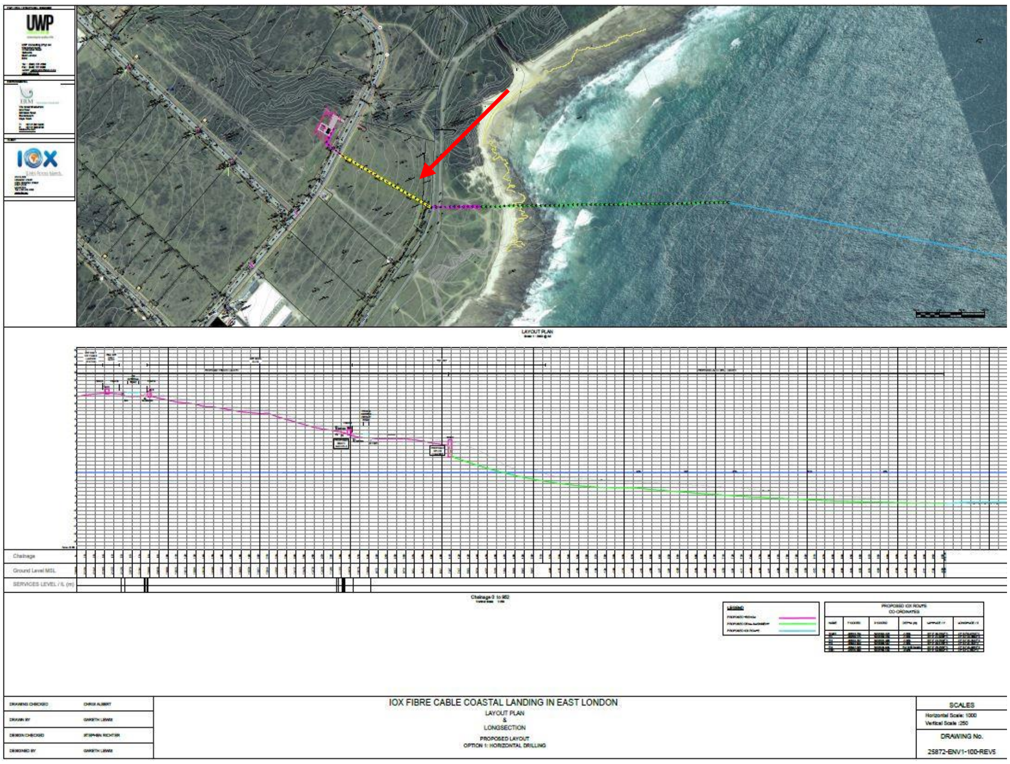
The main trunk of the marine cable will enter South African territorial waters at approximately 33°10'52.238"S 28°4'39.388"E and follow the route illustrated on *Figure 2.1*, to a landing site on the coast near the East London IDZ and across a short stretch of land to a Beach Manhole (BMH) that will be located within the boundary of the IDZ. The main trunk of the cable system terminates at South Africa, and as such there is no branching unit offshore of South Africa.

The determination of the subsea cable route is based on a desktop study followed by a detailed offshore and nearshore marine survey followed by a route engineering exercise. Should there be any hindering implementation criteria in the initial proposed route an alternative routing avoiding any hindering obstacle or feature is resurveyed and the cable is re-engineered until the complete route is satisfactorily mapped. The subsea route presented in this EIA Report is based on the final engineered cable route study which includes a small re-survey of the marine segment within the SA EEZ along the continental shelf ascent. The offshore route has not changed significantly from what is included in the Scoping Report.

2.1.2 Landing Site

The preferred landing site is located at approximately 33° 3'26.54"S 27°51'50.06"E on the beach near the East London IDZ (see *Figure 2.2*). The landing site is characterized by a sandy beach stretch with rocky outcrops and boulders as shown in *Figure 2.3*.

Figure 2.2 Preferred Cable Route and BMH Location



Source: UWP, 2018

Note: The location of the BMH is shown with the red arrow

Figure 2.3 Preferred Landing Site (outside the IDZ)

Source ERM, 2018

The preferred location for the BMH is within the boundary of the East London IDZ in the south-eastern quadrant. The IDZ has agreed to move the BMH in a straighter alignment with the Horizontal Directional Drilling (HDD) line close to location PI3, this is yet to be finalised.

Note that full details of the land-based Project components are included in the EIA Report compiled by ERM.

2.2 CABLE SYSTEM COMPONENTS

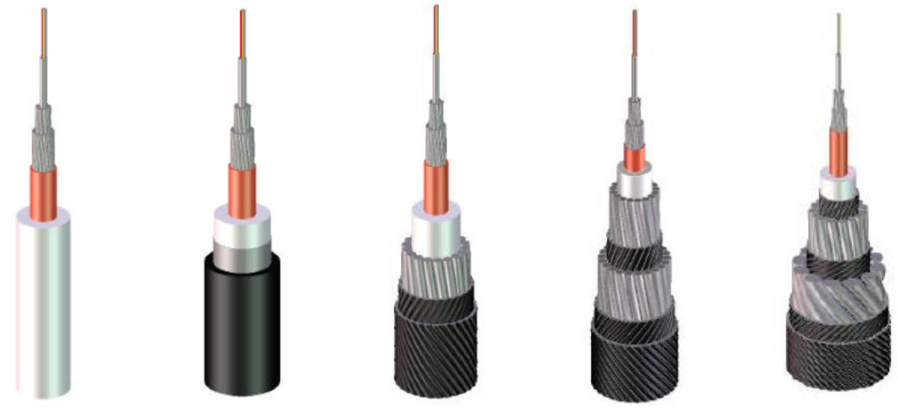
A description of the cable system components is provided below (refer to *Figure 2.4*).

2.2.1 *Subsea Fibre Optic Cable*

The fibre optic cable comprises of the following physical layers, ordered from innermost to outermost:

- Fibre – function: data transfer;
- Gel and neoprene – function: insulator;
- Steel core armour – function: strength and protection of fibres;
- Conductor ring (copper) – function: power supply to build in signal amplifiers and repeaters;
- Neoprene/HDPE protective layer – function: protection and insulation;
- Single/double/triple steel armouring interlaced with nylon yarn– function: protection and strength. The results of the marine survey will influence this design component.

Figure 2.4 Cable Armour Types



Lightweight	Lightweight Protected	Single Armour	Double Armour	Rock Armour
Used in 1 000 to 8 000 m water depth	Used in 1 000 to 3 500 m water depth	Used in water depths up to 2 000 m.	Used in water depths up to 200 m.	Used in water depths up to 200 m where added protection is needed (eg, rocky outcroppings).

Source: ASN, 2018

2.2.2 *Repeaters and Branching Units*

Repeaters are installed along the marine cable to boost the signal as it loses strength along the route. At approximately every 100 km along the cable there will be a built in repeater unit (typically about 1.5 m long and 0.4 m diameter) deployed as part of the cable. The copper ring in the cable structure conducts the required power from either shore end to operate the repeaters.

2.2.3 *Beach Manhole*

The BMH is the structure where the marine portion of the cable is connected to the terrestrial portion. The BMH will be located inside the boundary fence of the East London IDZ.

The BMH will be an underground, concrete vault with an access port along the side flush with ground level. It will have a tamper-proof cover to prevent intrusion. The approximate size of the BMH will be 4 m long x 2 m wide x 2 m high.

The cable will run from the sea to the BMH via a conduit which will be buried in a dedicated, sub-surface, trench of approximately 1.5 m deep and away from other utilities.

2.2.4 *System Earth*

The System Earth (also called an Ocean Ground Bed or earth array) is required to provide an earthen electrical ground for the cable. The System Earth will be either a sea earth plate located in saturated soil close to the water line or a rod type array located close to the BMH. The System Earth is entirely subsurface and will not be visible on completion of installation.

The terrestrial fibre optic cable will run from the BMH to other infrastructure, all located within the boundary of the IDZ. The terrestrial fibre optic cable is anchored on the inside wall of the BMH with a specifically built plate that joins the cable armouring elements to the BMH. The cable splits inside the BMH after the anchoring point into the following lines:

- A Power Feed (PF) cable providing power to the copper ring in the fibre optic cable;
- A grounding cable linked to grounding system usually located in the vicinity of the BMH; an
- A data line containing the optical fibres.

Connecting cables will run from the BMH inside the IDZ along existing roads and infrastructure to the Cable Landing Station (CLS) also located inside the IDZ. Further details are included in ERM's Project EIA Report.

Installation of the terrestrial cable is independent of installation of the submarine cable, but in some cases the terrestrial cable installation would be completed up to the BMH before the marine cable landing.

2.3 PROJECT ACTIVITIES

The project activities can be divided into four phases as follows:

- Pre-installation;
- Installation;
- Operations (including maintenance and repair); and
- Decommissioning.

A description of each phase and the associated activities is provided below.

2.3.1 Pre-Installation

Cable Route Study

Route determination for the cable is based initially on the findings of a desktop cable route study. This study uses analysis of charts and satellite imagery, taking a range of factors into account, including:

- Seafloor physiography and geography, such as avoidance of sandbanks and sandwaves;
- Seismicity and volcanism, such as avoidance of faults;
- Oceanography, such as waves and tides;
- Climate, such as winds and seasonal variations;
- Environmental and social sensitivities, such as avoidance of corals and fishing areas;

- Existing offshore oil and gas activities, such as existing pipelines;
- Existing offshore mining activities; such as diamond mining;
- Existing offshore submarine cable locations;
- Natural and man-made hazards, such as offshore dumping grounds;
- Marine traffic;
- General landing site features; and
- Accessibility.

The objectives of the study are to minimise potential risks to the cable (through avoiding hazards) and make preliminary recommendations on the routing, landing sites and cable type.

Marine Survey

Following the cable route study, the exact position of the cable is confirmed on the basis of sophisticated, offshore and nearshore surveying of the seabed. This provides the necessary information for detailed engineering, construction, installation and subsequent maintenance of the cable.

Two types of survey techniques are used:

- Sub-bottom profiling to identify the type of sediments and best route for burial of cable; and
- Sidescan sonar to identify obstacles such as deep gullies, rocks, and corals.

A detailed survey of the sea bottom bathymetry and geology was undertaken and this information wase used to finalize the cable route. A survey was also conducted at the landing sites to determine preferred alignment of the cable at the shore crossing and exact placement of the BMH and System Earth.

Pre-Lay Grapnel Run (PLGR)

Prior to installation a clearance operation would be conducted to remove any obstacles from the path of the final cable route (as discovered by the marine survey). Immediately in advance of installation, a Pre-Lay Grapnel Run (PLGR) will take place along the cable route where burial is required as a final check of the seabed for items that might interfere with installation or otherwise damage the marine cable. The PLGR is undertaken by the main cable laying vessel or another designated vessel. The operation involves the towing of one or an array of grapnels (*Figure 2.5*) along the route where burial is required. The vessel proceeds at a rate to ensure that the grapnel maintains continuous contact with the seabed. The grapnel is usually a sliding prong type which can penetrate up to 40 cm into the seabed.

As the vessel moves along the route, the towing tension is monitored and the grapnel is recovered if the tension increases indicating that an obstruction has been hooked. As a matter of routine, the grapnel is recovered and inspected at minimum intervals of 15 km along the route. Usually a single tow is made along the route but in areas where other marine activity or debris amounts are high, additional runs may be made. Any debris recovered during the PLGR is disposed of ashore upon completion of the operations.

Figure 2.5 Equipment Used for the Pre-lay Grapnel Run

Source: ASN, 2018b

2.3.2 *Installation*

Overview

The specialised cable laying vessel will place the cable on the seabed along the predetermined route. A typical cable laying ship is shown in *Figure 2.6.* The physical installation of the fibre optic cable is as such:

- In deep marine waters (deeper than 900 m) the bottom currents are such that the cable can be laid directly on the seabed without the need to be buried. The cable is also usually quite safe from human or other interactions at those depths and does not require much protection.

- At water depths shallower than 900 m, the cable is buried by way of ploughing 0.9 to 1.5 m deep into the seabed. The plough is one of the many tools deployed by the cable laying ship and is a standard operation tool in the industry. Detailed marine surveys and route planning experts determine the optimal cable laying route and avoid sensitive or damaging obstacles.

- As the cable approaches the shore, up from a water depth of 900 m heavier armouring is used to provide additional protection to the cable.

- At the shore end (very shallow depths from 0 to about 50 m) clamps may be used to protect and hold the cable in place at specific locations.

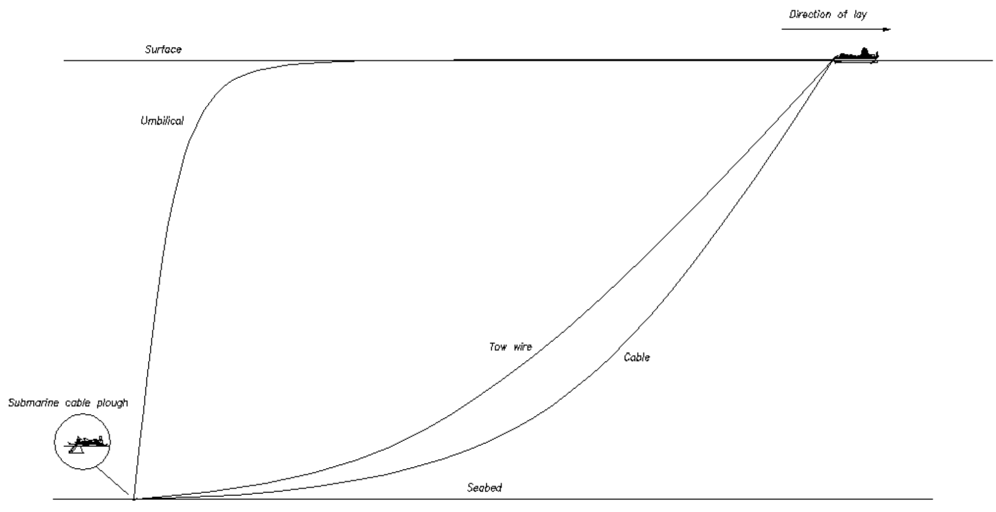
Figure 2.6 Typical Cable Laying Ship

Source: Alcatel-Lucent, 2009

Burial

The burial technique used is called ploughing and is undertaken by a specialised sea plough (*Figure 2.7*). The footprint of the submarine cable plough is limited to where the four plough skids are in contact with the seabed surface and the plough share, which is approximately 0.2 m wide. This results in very little or no long-term effect on the seabed, other than tracks and skid marks, following the passage of the plough. These will over time disappear due to the effect of seabed currents and wave action.

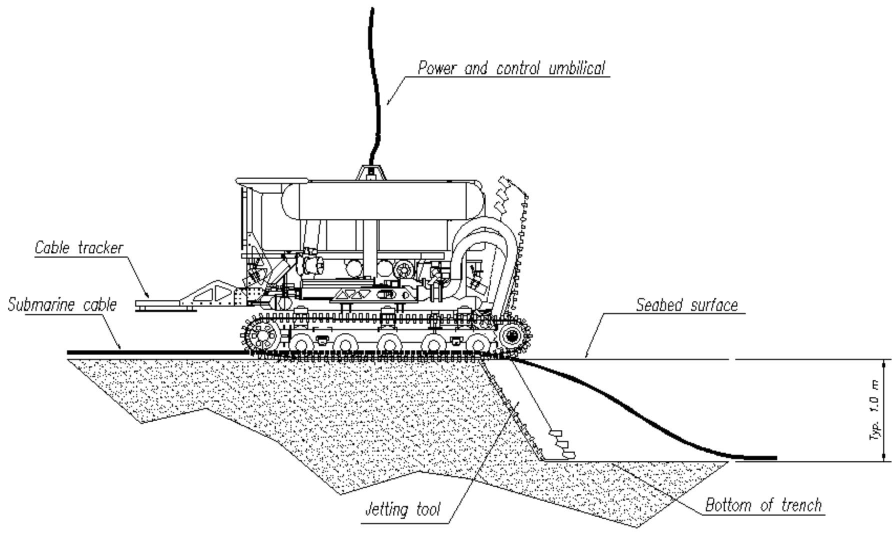
Figure 2.7 Illustration of Ploughing Operations



Source: ASN, 2018b

In the littoral zone closer to the shore, at depths less than 15 m, cable burial may be undertaken by the excavation of a trench from a remotely operated vehicle (ROV, *Figure 2.8*). Where burial cannot be achieved, additional protection on the cable in the form of an articulated split-pipe may be used to maximise cable security, particularly in rocky areas, areas with extensive fishing activities, or areas where other activities that may pose a threat to the cable.

Figure 2.8 Illustration of ROV Operations



Source: ASN, 2018b

2.3.3 *Shore Crossing*

A combination of HDD and trenching will be used for the installation of the subsea cable at the shoreline (from water depths of 10 – 15 m to the BMH). This technology alternative was selected as a result of a detailed cable route study.

The landing of the subsea cable will entail the following:

- HDD drilling approximately 541 m from a location above the beach (33° 3' 29.043" S 27° 51' 45.630" E) to a location within nearshore waters with water depths of 10 to 15 m (33° 3' 35.010" S 27° 52' 5.351" E);
- Trenching approximately 105 m from the beach location, crossing Prince George Circuit Road and a section of disturbed dune to a location within the IDZ (33° 3' 27.696" S 27° 51' 41.764" E); and
- Trenching approximately 130 m within the IDZ to the BMH (33° 3' 23.908" S 27° 51' 43.626" E).

See ***Error! Reference source not found.***2 for the proposed cable route, including differentiation between the HDD and trenching sections.

The cable will then follow a terrestrial route from the BMH to the CLS. However, this component is not being considered in this EIA, as development within the IDZ has been previously authorised. For the HDD component, the drilling and installation process is summarised as follows:

The drill unit of 150 tons with 4-1/2" drill rod has been proposed. This drill unit consists of a mud recycler; storage tanks; and mud pumps capable of pumping 2 000 liters of fluid per minute.

The location for the drill unit (ie, the drill pad) on the beach will be cleared and levelled. Bog mats will be laid on the flattened area to form a work surface. A pit will be excavated for temporary holding of the drilling fluid. The temporary pits will be roughly:

- Width: 2.5m
- Length: 2.5m
- Depth: 1.5m

The pits will be used to ensure that the drilling fluids, which will be pumped at roughly 1 500 liters/min for reaming (widening of the hole) and pilot hole drilling or when installing the terrestrial cable, are fully contained and ready to be transported to the receiving recycling unit. The pits will be barricaded using wooden poles, three-strand wire and safety netting.

The type of drilling fluid to be utilised will be sodium based drilling mud mixed with fresh water. This type of drilling fluid is preferred mainly because it is biodegradable and safe to the environment.

A pilot hole is drilled from the drill pad location toward the sea. The pilot hole direction is controlled by computer-aided control systems. A larger drill will be used to bore and enlarge the pilot hole to the desired size.

Special care is taken during the process when the drill exits the drill hole at the sea to avoid any release of drill fluids to the environment. This process will involve 'punching' through the end opening without the use of drill fluids and allowing seawater to flush the hole from the sea toward the drill pad location. Once the drill hole is prepared, the subsea cable is pulled through the hole from the sea to the land side.

The operation is expected to run for up to three consecutive months. Operations will be done from a prepared earthen platform which will be located in the IDZ.

As shown in ***Error! Reference source not found.****2* the remaining terrestrial cable route to the BMH will be trenched. A trench approximately 1 - 2 m wide and 1 m deep will be excavated from the upper beach/dune area where the HDD drilling terminates to the BMH located within the IDZ, a 3 m wide servitude will be required. The cable will be laid within the trench and covered over.

Table 2.1 *Summary of Cable Installation Activities*

Conditions/Environment	Installation Method
Water depth > 900 m	No burial, cable surface laid without armouring.
Water depth < 900 m	Ploughing from the cable lay vessel to a target depth of 1.5 m with Post Lay Burial (PLB) reserved for areas where ploughing is ineffective or impractical.
Littoral zone	Trench excavation using a ROV. The cable is protected by clamping additional pipe sections around it (articulated pipe). In areas of hard seabed and high wave energy, the split pipes may be pinned to the seabed to prevent movement.
Beach landing	Trenching /HDD
BMH construction	Excavation of a pit above the high water mark, followed by construction of a concrete bunker (typically up to 4 m x 2 m x 2 m) with ducts seaward for the cable entry.
System Earth construction	Excavation of a pit adjacent to the BMH to a depth of approximately 5 metres for burial of electrodes connected via an Earth Return Cable in the BMH.

The expected duration of the installation activities are noted in *Table 2.2* below:

Table 2.2 *Duration of Installation Activities*

Activities	Duration
Marine Installation (within 12 Nm)	4 days
Near shore Installation	7 to 10 days
Beach Installation – HDD	3 months
Beach Installation – Trenching	1 to 3 days
BMH and System Earth Construction	7 days
Terrestrial Cable Route	2 months

*All durations are approximate and subject to weather conditions.

2.3.4 *Operations*

Once installed and operational the cable will not require routine maintenance. Power is provided to the repeaters through electrical connection in the cable. The current is fully shielded by the polyethylene coating. During the operational phase, cable repair may be required as a result of physical damage or failure. Cables can be damaged or broken by human activity (fishing trawlers or other large ships dragging anchor), natural events (seismic activity), and animals (shark have been reported to bite cables). To effect repairs on deep sea cables, the damaged cable is cut at the seabed and each end separately brought to the surface, whereupon a new section is spliced in. Dedicated repair ships are on standby to respond to any emergency repairs.

2.3.5 *Decommissioning*

Options for decommissioning of the system at the end of the Project's lifetime include retirement in place, or removal and salvage. Decommissioning would involve demolition, recovery and removal of terrestrial components (unless re-used). The marine portion of the cable is likely to be retired in place, as per current global industry practice. This is done in accordance with a Decommissioning Plan, details of which will be provided in the EIR.

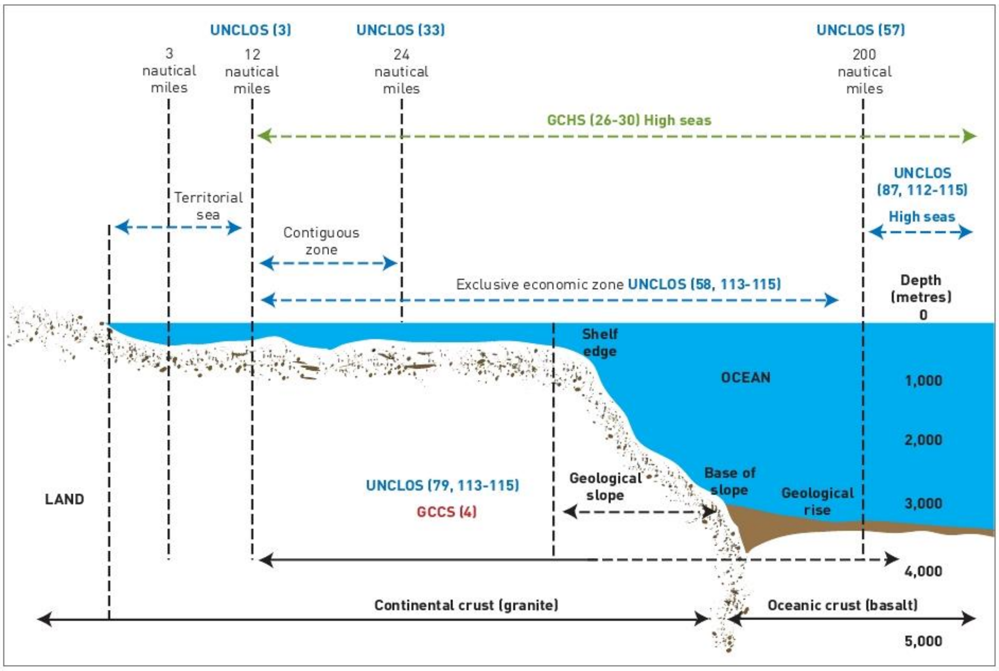
3 RELEVANT LEGISLATURE

The International Convention for the Protection of Submarine Cables (1884) is the foundation of modern international law for submarine cables as contained in the Geneva Conventions on the High Seas 1958 (Articles 26–30) and Continental Shelf 1958 (Article 4) and in the United Nations Convention on the Law of the Sea (1982) (UNCLOS).

Coastal states exercise sovereign rights and jurisdiction in the EEZ and on the continental shelf for the purpose of exploring and exploiting their natural resources, but other states enjoy the freedom to lay and maintain submarine cables in the EEZ and on the continental shelf. In the territorial sea, coastal states may establish conditions for cables or pipelines entering these zones (UNCLOS, Article 79(4)). At the same time, the laying and maintenance of submarine cables are considered reasonable uses of the sea and coastal states benefit from them. Outside of the territorial sea, the core legal principles applying to international cables can be summarized as follows (UNCLOS, Articles 21, 58, 71, 79, 87, 112-115 and 297(1)(a)):

- the freedoms to lay, maintain and repair cables outside of territorial seas, including cable route surveys incident to cable laying (the term laying refers to new cables while the term maintaining relates to both new and existing cables and includes repair) (Nordquist et al., 1993, p. 915);
- the requirement that parties apply domestic laws to prosecute persons who endanger or damage cables wilfully or through culpable negligence;
- the requirement that vessels, unless saving lives or ships, avoid actions likely to damage cables;
- the requirement that vessels must sacrifice their anchors or fishing gear to avoid injury to cables;
- the requirement that cable owners must indemnify vessel owners for lawful sacrifices of their anchors or fishing gear;
- the requirement that the owner of a cable or pipeline, who in laying or repairing that cable or pipeline causes injury to a prior laid cable or pipeline, indemnify the owner of the first laid cable or pipeline for the repair costs; and
- the requirement that coastal states along with pipeline and cable owners shall not take actions which prejudice the repair and maintenance of existing cables.

Figure 3.1 Legal boundaries of the ocean from territorial sea to exclusive economic zone and onto the high seas



Source: D. Burnett in UNEP-WCMC, 2009

Under UNCLOS and the earlier 1884 International Convention for the Protection of Submarine Cables, if a mariner damages a cable and the damage could be avoided by taking reasonable care as a prudent seaman, then the person causing the damage is liable. If a mariner damages a cable with fishing gear or an anchor, when he could have seen that cable on a chart and avoided it, he may be liable for the damage. In addition to civil liability for damages, the mariner may face criminal sanctions for culpable negligence or wilful injury to a cable.

International law also requires that a vessel that has gear or an anchor caught on a cable is required to sacrifice the gear or anchor to avoid injury to the cable. Provided the mariner was not negligent in contacting the cable in the first place, the mariner is entitled to indemnity for the cost of the sacrificed gear or anchor by the owners of the cable. To claim indemnity for the sacrifice, the mariner should file within 24 hours of arrival in port a declaration setting forth the circumstances of the sacrifice with the cable owner, if known, or the local government maritime authorities like the coast guard. In the case of a valid sacrifice, the cable owner may be required to pay the indemnity for the sacrificed gear or anchor.

A description of trawling gear and the risk posed by gear to the safety of a cable is included in Appendix 1.

4 APPROACH AND METHODOLOGY

4.1 DESCRIPTION OF POTENTIAL IMPACTS ON FISHERIES

Exclusion Zone

Under the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS, 1972, Part A, Rule 10), a vessel that is engaged in the laying of a cable is defined as a "vessel restricted in its ability to manoeuvre" which requires that power-driven and sailing vessels give way to a vessel restricted in her ability to manoeuvre. Vessels engaged in fishing shall, so far as possible, keep out of the way of the operation.

Once installed, a submarine cable is protected by a 500 m safety zone on either side of the cable and it is an offence for any anchoring or trawling within this zone. The proposed project therefore presents an impact on the fishing industry via exclusion to the demersal trawl or longline operations

4.2 ASSESSMENT METHODOLOGY

The proposed Project's potential significant impacts on commercial fishing are evaluated in this study. The assessment was focused on the marine portions of the Project and the effects caused by exclusion of fishing in the area during the cable laying operations and on the exclusion of anchoring and trawling within an area of 500 m to either side of the submarine cable. The shore-based activities of the Project were not considered to be applicable for assessing impacts to commercial fishing and were not included in this analysis.

The spatial distribution of catch was mapped at an appropriate resolution for each fishing sector (based on the fishing method and resulting area covered by fishing gear). The proposed routing of the cable was mapped and a spatial buffer of 500 m to either side of the cable route was applied to indicate 1) the temporary exclusion of fishing vessels during cable-laying operations and 2) the permanent area of exclusion to trawling and anchoring surrounding the installed cable (applicable to demersal fishing operations only). This area was mapped and the spatial overlap expressed as a percentage of fishing ground available to each sector. This measurement was used as an indication of the relative extent of the impact on each fishery where an overlap of less than 10% was considered to be local in extent and an overlap of greater than 10% was considered to be regional in extent. The average annual catch taken within the impacted area was used to calculate the amount of catch (also expressed as a percentage of overall total landings) that would potentially be lost.

For each impact, the TYPE (direct, indirect, induced or cumulative), DURATION (time scale), EXTENT (spatial scale), SCALE and FREQUENCY were described. These criteria were used to determine the MAGNITUDE (negligible, small, medium or large) of the impact. The overall

SIGNIFICANCE of the impact was a function of the consequence and the MAGNITUDE of the impact and the SENSITIVITY (low, medium or high) of the receptor. Practical mitigation and optimisation measures that can be implemented effectively to reduce or enhance the significance of impacts were identified. The impact significance was re-rated assuming the effective implementation of mitigation measures.

The methodology followed for this assessment was provided by ERM and is defined below.

4.2.1 Impact Identification and Characterisation

An 'impact' is any change to a resource or receptor caused by the presence of a project component or by a project-related activity.

Impacts can be negative or positive.

Impacts are described in terms of their characteristics, including the impact type and the impact spatial and temporal features (namely extent, duration, scale and frequency). Terms used in this EIA are described in *Table 4.1* below.

Table 4.1 Impact Characteristics (ERM, 2018)

Characteristic	Definition	Terms
Type	A descriptor indicating the relationship of the impact to the project (in terms of cause and effect).	**Direct** - Impacts that result from a direct interaction between the project and a resource/receptor (eg between occupation of the seabed and the habitats which are affected). **Indirect** - Impacts that follow on from the direct interactions between the project and its environment as a result of subsequent interactions within the environment (eg viability of a species population resulting from loss of part of a habitat as a result of the project occupying the seabed). **Induced** - Impacts that result from other activities (which are not part of the project) that happen as a consequence of the project. **Cumulative** - Impacts that arise as a result of an impact and effect from the project interacting with those from another activity to create an additional impact and effect.
Duration	The time period over which a resource / receptor is affected.	**Temporary** - impacts are predicted to be of short duration and intermittent/occasional. **Short term** - impacts that are predicted to last only for the duration of the project. **Medium term** - impacts that are predicted to extend not longer than three years. **Long term** - impacts that will continue beyond three years but within 10 years. **Permanent** - impacts that cause a permanent change in the affected receptor or resource or ecological process, and which endures beyond 10 years.
Extent	The reach of the impact (i.e. physical	**Local** - impacts that are limited to the project site **Regional** - impacts that affect regionally important environmental resources or are experienced at a

	distance an impact will extend to)	regional scale as determined by administrative boundaries, habitat type/ecosystems **National** - impacts that affect nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences. **Trans-boundary/International** - impacts that affect internationally important resources such as areas protected by international conventions or impact areas outside of South Africa.
Scale	Quantitative measure of the impact (eg the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.).	Quantitative measures as applicable for the feature or resources affects. No fixed designations as it is intended to be a numerical value.
Frequency	Measure of the constancy or periodicity of the impact.	No fixed designations; intended to be a numerical value or a qualitative description.

4.2.2 *Determining Impact Magnitude*

Once impacts are characterised they are assigned a 'magnitude'. Magnitude is typically a function of some combination (depending on the resource/receptor in question) of the extent, duration, scale and frequency.

Magnitude (from small to large) is a continuum. Evaluation along the continuum requires professional judgement and experience. Each impact is evaluated on a case-by-case basis and the rationale for each determination is noted. Magnitude designations for negative effects are: negligible, small, medium and large.

The magnitude designations themselves are universally consistent, but the definition for the designations varies by issue. In the case of a positive impact, no magnitude designation has been assigned as it is considered sufficient for the purpose of the impact assessment to indicate that the project is expected to result in a positive impact.

Some impacts will result in changes to the environment that may be immeasurable, undetectable or within the range of normal natural variation. Such changes are regarded as having no impact, and characterised as having a negligible magnitude.

In the case of impacts resulting from unplanned events, the same resource/receptor-specific approach to concluding a magnitude designation is used. The likelihood factor is also considered, together with the other impact characteristics, when assigning a magnitude designation.

Determining Magnitude for Biophysical Impacts

For biophysical impacts, the semi-quantitative definitions for the spatial and temporal dimension of the magnitude of impacts used in this assessment are provided below.

High Magnitude Impact affects an entire area, system (physical), aspect, population or species (biological) and at sufficient magnitude to cause a significant measureable numerical increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) or a decline in abundance and/ or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations (physical and biological). A high magnitude impact may also adversely affect the integrity of a site, habitat or ecosystem.

Moderate Magnitude Impact affects a portion of an area, system, aspect (physical), population or species (biological) and at sufficient magnitude to cause a measurable numerical increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) and may bring about a change in abundance and/or distribution over one or more plant/animal generations, but does not threaten the integrity of that population or any population dependent on it (physical and biological). A moderate magnitude impact may also affect the ecological functioning of a site, habitat or ecosystem but without adversely affecting its overall integrity. The area affected may be local or regional.

Low Magnitude Impact affects a specific area, system, aspect (physical), group of localised individuals within a population (biological) and at sufficient magnitude to result in a small increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) over a short time period (one plant/animal generation or less, but does not affect other trophic levels or the population itself), and localised area.

Determining Magnitude for Socio-economic Impacts

For socio-economic impacts, the magnitude considers the perspective of those affected by taking into account the likely perceived importance of the impact, the ability of people to manage and adapt to change and the extent to which a human receptor gains or loses access to, or control over socio-economic resources resulting in a positive or negative effect on their well-being. The quantitative elements are included into the assessment through the designation and consideration of scale and extent of the impact.

4.2.3 *Determining Receptor Sensitivity*

In addition to characterising the magnitude of impact, the other principal step necessary to assign significance for a given impact is to define the sensitivity of the receptor. There are a range of factors to be taken into account when defining the sensitivity of the receptor, which may be physical, biological, cultural or human. Where the receptor is physical (for example, a water body) its current quality, sensitivity to change, and importance (on a local, national and international scale) are considered. Where the receptor is biological or cultural (ie the marine environment or a coral reef), its importance (local, regional, national or international) and sensitivity to the specific type of impact are considered. Where the receptor is human, the vulnerability of the individual, community or wider societal group is considered. As in the case of magnitude, the sensitivity designations themselves are universally consistent, but the definitions for these designations will vary on a resource/receptor basis. The universal sensitivity of receptor is low, medium and high. (see *Table 4.2*).

Table 4.2 *Sensitivity Criteria (ERM, 2018)*

Sensitivity	Low	Medium	High
Criteria	Those affected are able to adapt with relative ease and maintain pre-impact status.	Able to adapt with some difficulty and maintain pre-impact status but only with a degree of support.	Those affected will not be able to adapt to changes and continue to maintain-pre impact status.

4.2.4 *Assessing Significance*

Once magnitude of impact and sensitivity of a receptor have been characterised, the significance can be determined for each impact. The impact significance rating will be determined, using the matrix provided in *Table 4.3*.

Table 4.3 *Impact Significance (ERM, 2018)*

		Sensitivity/Vulnerability/Importance of Resource/Receptor		
		Low	Medium	High
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/vulnerability/ importance designations that enter into the matrix. *Table 4.4* provides a context for what the various impact significance ratings signify.

Table 4.4 Context of Impact Significances (ERM, 2018)

An impact of **negligible** significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.
An impact of **minor** significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.
An impact of **moderate** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.
An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the project.

4.2.5 Mitigation Potential and Residual Impacts

A key objective of an EIA is to identify and define socially, environmentally and technically acceptable and cost effective measures to manage and mitigate potential impacts. Mitigation measures are developed to avoid, reduce, remedy or compensate for potential negative impacts, and to enhance potential environmental and social benefits.

The approach taken to defining mitigation measures is based on a typical hierarchy of decisions and measures, as described in *Table 4.5*.

The priority is to first apply mitigation measures to the source of the impact (ie to avoid or reduce the magnitude of the impact from the associated project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (ie to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

Once mitigation measures are declared, the next step in the impact assessment process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation measures.

Table 4.5 Mitigation Hierarchy (ERM, 2018)

Avoid at Source; Reduce at Source: avoiding or reducing at source through the design of the Project (eg avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity).
Abate/Minimize on Site: add something to the design to abate the impact (eg pollution control equipment).
Abate/Minimize at Receptor: if an impact cannot be abated on-site then control measures can be implemented off-site (eg traffic measures).
Repair or Remedy*:* some impacts involve unavoidable damage to a resource (eg material storage areas) and these impacts require repair, restoration and reinstatement measures.
Compensate in Kind; Compensate through Other Means: where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (eg financial compensation for degrading agricultural land and impacting crop yields).

As required by the South African EIA Regulations (as amended in 2017) the following additional items were considered in the assessment of impacts and risks identified:

- The degree to which the impact and risk can be reversed (this is rated on a scale of high, medium, or low);
- The degree to which the impact and risk may cause irreplaceable loss of resources (this is rated on a scale of high, medium, or low).

This will inform the residual impact significance.

4.2.6 *Residual Impact Assessment*

Once mitigation measures are declared, the next step in the impact assessment process is to assign residual impact significance.

This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation measures.

4.2.7 *Cumulative Impacts*

A cumulative impact is one that arises from a result of an impact from the Project interacting with an impact from another activity to create an additional impact. How the impacts and effects are assessed is strongly influenced by the status of the other activities (eg already in existence, approved or proposed) and how much data is available to characterise the magnitude of their impacts.

The approach to assessing cumulative impacts is to screen potential interactions with other projects on the basis of:

- projects that are already in existence and are operating;
- projects that are approved but not as yet operating; and

- projects that are a realistic proposition but are not yet built.

4.3 *DATA SOURCES*

Catch and effort data were sourced from the Department of Agriculture, Forestry and Fisheries (Branch: Fisheries) (DAFF) record for the years 2000 to 2016. All data were referenced to a latitude and longitude position and were redisplayed on a 10x10 minute grid. Additional information was obtained from the Marine Administration System from DAFF and from the *South Africa, Namibia and Mozambique Fishing Industry Handbook 2017 (45th Edition).*

4.4 *ASSUMPTIONS, UNCERTAINTIES & GAPS IN KNOWLEDGE*

The study is based on a number of assumptions and is subject to certain limitations, which should be acknowledged when considering information presented in this report. The validity of the findings is not expected to be affected by these assumptions and limitations:

- The fisheries dataset used in this report was derived from DAFF and is the official record of national commercial catch and effort. These data are derived from logbooks that are completed by skippers, and it is assumed that there will be a proportion of erroneous data due to mistakes in the capturing of these data into electronic format. The proportion of erroneous data is estimated to be up to 10% of the total dataset and would be primarily related to the accurate recording or transcription of the fishing position (latitude and longitude). Where obvious errors in the reporting of fishing positions were identified these were excluded from the analysis. There is also a possibility that catch and effort is under-reported, which presents a potential gap in knowledge in the current assessment.
- The magnitude and significance of the impact of a proposed subsea cable is difficult to ascertain. Based on the description provided for the current Project, the cable would be protected from damage by trawling (and other fishing operations) through burial to a depth of between 0.9 m and 1.5 m. This action is implemented to reduce the risk of damage to the cable rather than a mitigation of the impact of loss of ground to fishermen. The exclusion corridor would be charted and the cable routing would not be considered to be over-trawlable. Therefore, the current assessment is based on the assumption that demersal fishing activity would be excluded along the entire length of the proposed cable route whereas, in practice, fishing could take place in areas where the cable has been buried.

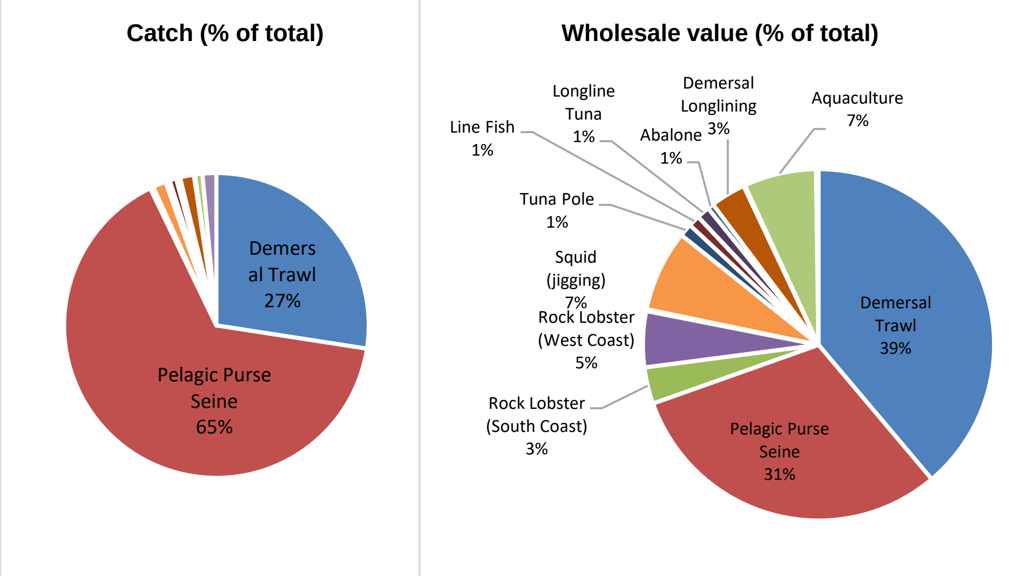
5 *DESCRIPTION OF THE BASELINE ENVIRONMENT*

5.1 *OVERVIEW OF SOUTH AFRICAN FISHERIES*

South Africa has a coastline that spans two ecosystems over a distance of 3,623 km, extending from the Orange River in the west on the border with Namibia, to Ponta do Ouro in the east on the Mozambique border. The western coastal shelf has highly productive commercial fisheries similar to other upwelling ecosystems around the world, while the East Coast is considerably less productive but has high species diversity, including both endemic and Indo-Pacific species. South Africa's fisheries are regulated and monitored by the Department of Agriculture, Forestry and Fisheries (DAFF). All fisheries in South Africa, as well as the processing, sale in and trade of almost all marine resources, are regulated under the Marine Living Resources Act, 1998 (No. 18 of 1998) (MLRA).

Approximately 14 different commercial fisheries sectors currently operate within South African waters. *Table 5.1* lists these along with ports and regions of operation, catch landings and number of active vessels and rights holders (2016). *Figure 5.1* indicates the proportional volume and value of catch landed by each of these sectors (2016). Primary fisheries in terms of economic value and overall tonnage of landings are the demersal (bottom) trawl and long-line fisheries targeting the Cape hakes (*Merluccius paradoxus* and *M. capensis*) and the pelagic-directed purse-seine fishery targeting pilchard (*Sardinops sagax)*, anchovy (*Engraulis encrasicolus*) and red-eye round herring (*Etrumeus whitheadii*). Highly migratory tuna and tuna-like species are caught on the high seas and seasonally within the South African waters by the pelagic long-line and pole fisheries. Targeted species include albacore (*Thunnus alalunga*), bigeye tuna (*T. obesus*), yellowfin tuna (*T. albacares*) and swordfish (*Xiphias gladius*). The traditional line fishery targets a large assemblage of species close to shore including snoek (*Thyrsites atun*), Cape bream (*Pachymetopon blochii)*, geelbek (*Atractoscion aequidens)*, kob (*Argyrosomus japonicus)*, yellowtail (*Seriola lalandi)* and other reef fish. Crustacean fisheries comprise a trap and hoop net fishery targeting West Coast rock lobster (*Jasus lalandii*), a line trap fishery targeting the South Coast rock lobster (*Palinurus gilchristi*) and a trawl fishery based solely on the East Coast targeting penaeid prawns, langoustines (*Metanephrops andamanicus* and *Nephropsis stewarti*), deep-water rock lobster (*Palinurus delagoae*) and red crab (*Chaceon macphersoni*). Other fisheries include a mid-water trawl fishery targeting horse mackerel (*Trachurus trachurus capensis*) predominantly on the Agulhas Bank, South Coast and a hand-jig fishery targeting chokka squid (*Loligo vulgaris reynaudii*) exclusively on the South Coast. In addition to commercial sectors, recreational fishing occurs along the coastline comprising shore angling and small, open boats generally less than 10 m in length. The commercial and recreational fisheries are reported to catch over 250 marine species, although fewer than 5% of these are actively targeted by commercial fisheries, which comprise 90% of the landed catch.

Figure 5.1 Pie chart showing percentage of landings by weight (left) and wholesale value (right) of each commercial fishery sector as a contribution to the total landings and value for all commercial fisheries sectors combined (2016).



Source: CapMarine 2018, modified from DAFF.

Most commercial fish landings must take place at designated fishing harbours. For the larger industrial vessels targeting hake, only the major ports of Saldanha Bay, Cape Town, Mossel Bay and Port Elizabeth are used. On the West Coast, St. Helena Bay and Saldanha Bay are the main landing sites for the small pelagic fleets. These ports also have significant infrastructure for the processing of anchovy into fishmeal as well as canning of sardine. Smaller fishing harbours on the West / South-West Coast include Port Nolloth, Hondeklip and Laaiplek, Hout Bay and Gansbaai harbours. On the East Coast, Durban and Richards Bay are deployment ports for the crustacean trawl and large pelagic longline sectors. There are more than 230 small-scale fishing communities on the South African coastline, ranging in size from small villages to towns (DAFF, 2016).

Table 5.1 South African offshore commercial fishing sectors, landings, number of rights holders, wholesale catch value and target species (DAFF, 2016)

Sector	Areas of Operation	Main Ports in Priority	No. of Rights Holders (Vessels)	Landed Catch (tons)	Wholesale Value (R'000)	Target Species
Small pelagic purse-seine	West, South Coast	St Helena Bay, Saldanha, Hout Bay, Gansbaai, Mossel Bay	111 (101)	399 612	3210924	Anchovy (*Engraulis encrasicolus*), sardine (*Sardinops sagax*), Redeye (*Etrumeus whiteheadi*)
Demersal trawl (offshore)	West, South Coast	Cape Town, Saldanha, Mossel Bay, Port Elizabeth	50 (45)	151 456	3927000	Deepwater hake (*Merluccius paradoxus*), shallow-water hake (*Merluccius capensis*)
Demersal trawl (inshore)	South Coast	Cape Town, Saldanha, Mossel Bay	18 (31)	6 956	131793	East coast sole (*Austroglossus pectoralis*), shallow-water hake (*Merluccius capensis*), juvenile horse mackerel (mackerel (*Trachurus capensis*)
Mid-water trawl	West, South Coast	Cape Town, Port Elizabeth	34 (6)	9 674		Adult horse mackerel (*Trachurus capensis*)
Demersal longline	West, South Coast	Cape Town, Saldanha, Mossel Bay, Port Elizabeth, Gansbaai	146 (64)	9 027	338600	Shallow-water hake (*Merluccius capensis*)
Large pelagic longline	West, South, East Coast	Cape Town, Durban, Richards Bay, Port Elizabeth	30 (31)	7 492	123367	Yellowfin tuna (*T. albacares*), big eye tuna (*T. obesus*), Swordfish (*Xiphius gladius),* southern bluefin tuna (*T. maccoyii*)
Tuna pole	West, South Coast	Cape Town, Saldanha	170 (128)	2 809	124009	Albacore tuna (*T. alalunga*)
Traditional line fish	West, South, East Coast	All ports, harbours and beaches around the coast	422 (450)	6 445	109763	Snoek (*Thyrsites atun*), Cape bream (*Pachymetopon blochii)*, geelbek (*Atractoscion aequidens)*, kob (*Argyrosomus japonicus)*, yellowtail (*Seriola lalandi),* Sparidae, Serranidae, Carangidae, Scombridae, Sciaenidae
South coast rock lobster	South Coast	Cape Town, Port Elizabeth	13 (12)	735	351196	*Palinurus gilchristi*
West coast rock lobster	West Coast	Hout Bay, Kalk Bay, St Helena	240 (105)	1 033	537516	*Jasus lalandii*
KwaZulu-Natal prawn trawl	East Coast	Durban, Richards Bay	6 (5)	181	17859	Tiger prawn (*Panaeus monodon*), white prawn (*Fenneropenaeus indicus*), brown prawn (*Metapenaeus monoceros*), pink prawn (*Haliporoides triarthrus*)
Squid jig	South Coast	Port Elizabeth, Port St Francis	92 (138)	8 500	781908	Squid/chokka (*Loligo vulgaris reynaudii)*
Gillnet	West Coast	False Bay to Port Nolloth	162 (N/a)	634	10433	Mullet / harders (*Liza richardsonii*)
Beach seine	West, South, East Coast	N/a	28 (N/a)	1 600		Mullet / harders (*Liza richardsonii*)
Oysters	South, East Coast	N/a	145 pickers	42	3300	Cape rock oyster (*Striostrea margaritaceae*)
Seaweeds	West, South, East	N/a	14 (N/a)	6 172	23566	Beach-cast seaweeds (kelp, *Gelidium* spp and *Gracilaria* spp
Abalone	West Coast	N/a	N/a (N/a)	86	59500	Abalone / "perlemoen" (*Haliotis midae*)

5.2 *SMALL PELAGIC PURSE-SEINE*

The pelagic-directed purse-seine fishery targeting pilchard (*Sardinops sagax)*, anchovy (*Engraulis encrasicolus*) and red-eye round herring (*Etrumeus whitheadii*) is the largest South African fishery by volume (tonnes landed) and the second most important in terms of economic value. The abundance and distribution of these small pelagic species fluctuates considerably in accordance with the upwelling ecosystem in which they exist. Fish are targeted in inshore waters, primarily along the West and South Coasts of the Western Cape and the Eastern Cape coast, up to a maximum offshore distance of about 100 km. The majority of the fleet of 101 vessels operate from St Helena Bay, Laaiplek, Saldanha Bay and Hout Bay with fewer vessels operating on the South Coast from the harbours of Gansbaai, Mossel Bay and Port Elizabeth. Ports of deployment correspond to the location of canning factories and fish reduction plants along the coast.

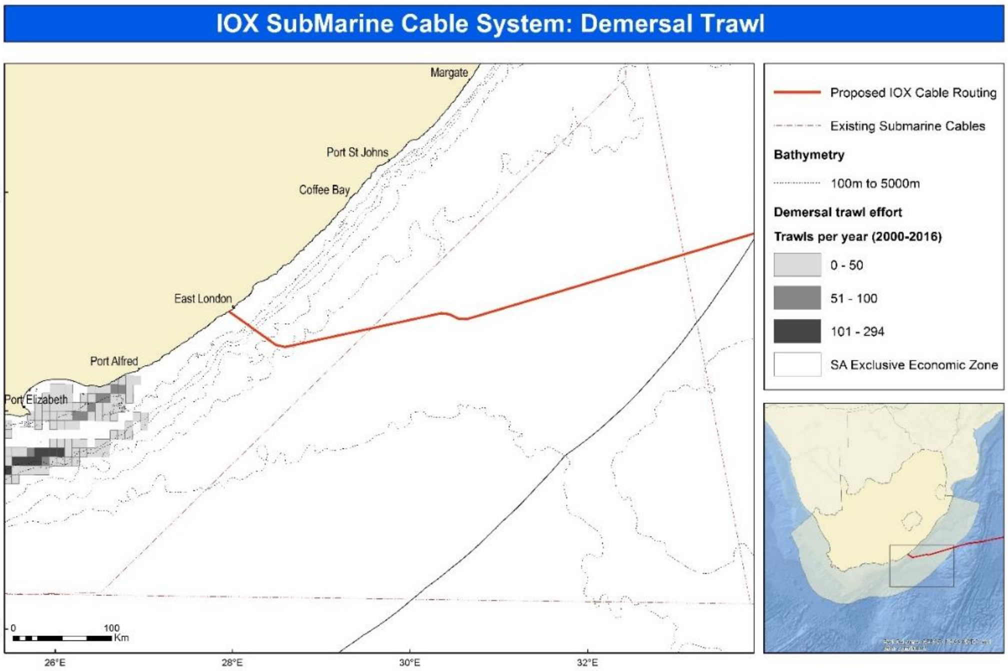
The eastern-most extent of fishing activity ranges to Algoa Bay and there is therefore no spatial overlap between the proposed cable route and grounds fished by the sector. There is no impact expected on the small pelagic purse seine fishery as a result of the proposed Project.

5.3 *DEMERSAL TRAWL*

The primary fisheries in terms of highest economic value are the demersal (bottom) trawl and longline fisheries targeting the Cape hakes (*Merluccius paradoxus* and *M. capensis*). Secondary species include a large assemblage of demersal fish of which monkfish (*Lophius vomerinus*), kingklip (*Genypterus capensis*) and snoek (*Thyrsites atun*) are the most commercially important. The demersal trawl fishery comprises an offshore and inshore fleet, which differ primarily in terms of vessel capacity and the areas in which they operate. Approximately 45 offshore vessels operate from most major harbours on both the West and South Coasts. Trawlers target fish at a water depth range of 300 m to 1 000 m and fishing grounds extend in an almost continuous band along the shelf edge from the Namibian maritime border in the north to Port Elizabeth in the East. The inshore fleet comprises approximately 30 vessels which operate off the South Coast from the harbours of Mossel Bay and Port Elizabeth. Inshore grounds are located on the Agulhas Bank and extend eastward towards the Great Kei River. Sole is targeted at a water depth range of between 50 m and 80 m, while hake is targeted at depths of between 100 m and 160 m.

Figure 5.2 shows the distribution of fishing activity in relation to the proposed cable route. As there is no spatial overlap with grounds fished by the sector there is no impact expected on the demersal trawl sector.

Figure 5.2 ***Spatial distribution of national fishing effort expended by the trawl sector targeting demersal species in relation to the proposed cable route.***



Source: CapMarine 2018.

5.4 *MID-WATER TRAWL*

Adult horse mackerel (*Trachurus trachurus capensis*) is targeted by mid-water trawl, which is defined in the Marine Living Resources Act (No. 18 of 1998) (MLRA) as any net which can be dragged by a fishing vessel along any depth between the sea bed and the surface of the sea without continuously touching the bottom. The fishery operates predominantly on the Agulhas Bank, where shoals are found in commercial abundance. The spatial extent of mid-water trawl activity is relatively limited when compared to that of demersal trawling. Until recently, fishing was restricted by permit condition to the area eastward of 20°E where fishing grounds are condensed into three areas. The first lies between 22 °E and 23 °E at a distance of approximately 70 nm offshore from Mossel Bay and the second extends from 24 °E to 27 °E at a distance of approximately 30 nm offshore. The third area lies to the south of the Agulhas Bank 21 °E and 22 °E. These grounds range in depth from 100 m to 400 m and isolated trawls are occasionally recorded up to 650 m. From 2017, DAFF has permitted experimental fishing to take place westward of 20°E in response to sustained low catch rates recorded off the South and East Coasts.

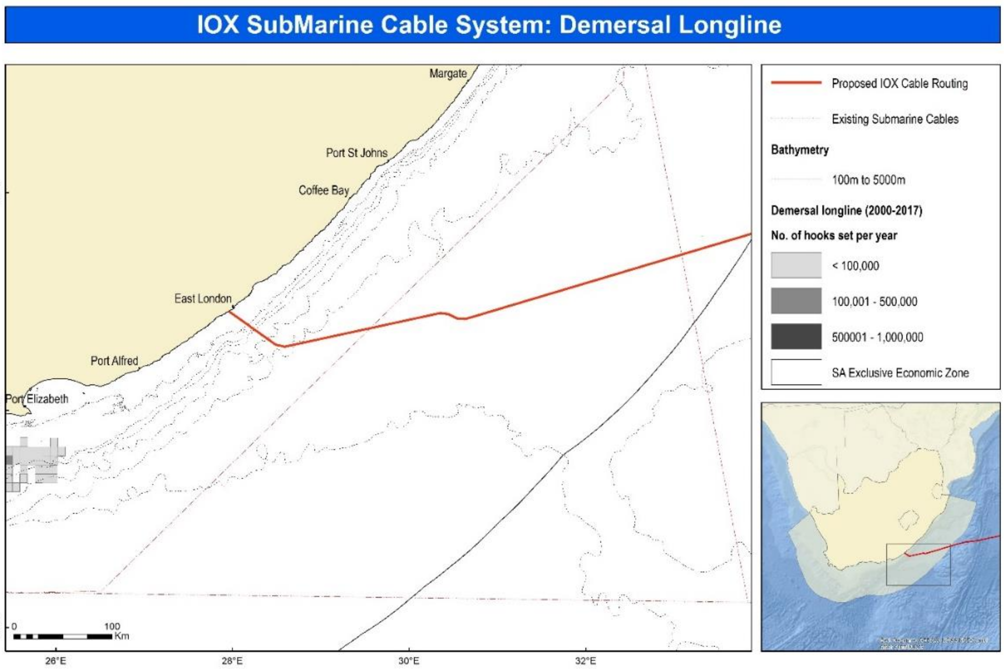
The eastern-most extent of fishing activity ranges to approximately 27°E and therefore does not coincide with the proposed cable route. There is no impact expected on the mid-water trawl fishery as a result of the proposed Project.

5.5 *DEMERSAL LONGLINE*

Like the demersal trawl fishery, the target species of the long-line fishery is the Cape hakes, with a small non-targeted commercial by-catch that includes kingklip. Currently 64 hake-directed vessels are active within the fishery, most of which operate from the harbours of Cape Town and Hout Bay. Fishing grounds are similar to those targeted by the hake-directed trawl fleet. Off the West Coast, vessels target fish along the shelf break from Port Nolloth (15°E, 29°S) to the Agulhas Bank (21°E, 37°S). Lines are set parallel to bathymetric contours and to a maximum depth of 1 000 m, in places.

Figure 5.3 shows the distribution of fishing activity in relation to the proposed cable route. As there is no spatial overlap with grounds fished by the sector there is no impact expected on the demersal longline sector.

Figure 5.3 Spatial distribution of national fishing effort expended by the longline sector targeting demersal species in relation to the proposed cable route.



Source: CapMarine 2018.

5.6 *LARGE PELAGIC LONGLINE*

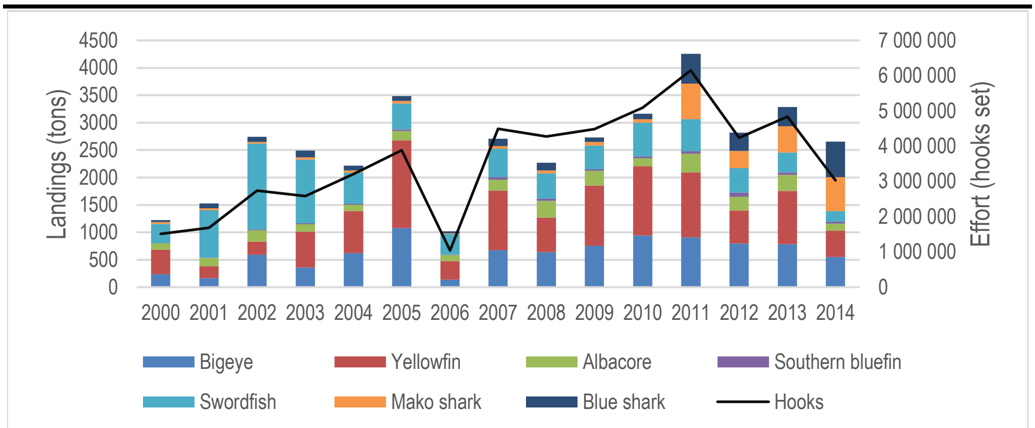
Highly migratory tuna and tuna-like species are caught on the high seas and seasonally within the South African Exclusive Economic Zone (EEZ) by the pelagic longline and pole fisheries. Targeted species include albacore (*Thunnus alalunga*), bigeye tuna (*T. obesus*), yellowfin tuna (*T. albacares*) and swordfish (*Xiphias gladius*). Tuna, tuna-like species and billfishes are migratory stocks and are therefore managed as a “shared resource” amongst various countries under the jurisdiction of the International Commission for the Conservation of

Atlantic Tunas (ICCAT) and the Indian Ocean Tuna Commission (IOTC). In the 1970s to mid-1990s the fishery was exclusively operated by Asian fleets (up to 130 vessels) under bilateral agreements with South Africa. From the early 1990s these vessels were banned from South African waters and South Africa went through a period of low fishing activity as fishing rights issues were resolved. Thereafter a domestic fishery developed and 50 fishing rights were allocated to South Africans only. These rights holders now include a small fleet of local longliners although the fishery is still undertaken primarily with Japanese vessels fishing in joint ventures with South African companies. There are currently 30 commercial large pelagic fishing rights issued and 21 vessels active in the fishery. During the period 2000 to 2014, the sector landed an average catch of 4 527 tons and set 3.55 million hooks per year. Catch by species and number of active vessels for each year from 2005 to 2014 are given in *Table 5.2*. Total catch and effort figures reported by the fishery for the years 2000 to 2014 are shown in *Figure 5.4*.

Table 5.2 Total catch (t) and number of active domestic and foreign-flagged vessels targeting large pelagic species for the period 2005 to 2014 (Source: DAFF, 2016)

Year	Bigeye tuna	Yellowfin tuna	Albacore	Southern bluefin tuna	Swordfish	Shortfin mako shark	Blue shark	Number of active vessels	
								Domestic	Foreign-flagged
2005	1077.2	1603.0	188.6	27.1	408.1	700.1	224.6	13	12
2006	137.6	337.3	122.9	9.5	323.1	457.1	120.7	19	0
2007	676.7	1086.0	220.2	48.2	445.2	594.3	258.5	22	12
2008	640.3	630.3	340.0	43.4	397.5	471.0	282.9	15	13
2009	765.0	1096.0	309.1	30.0	377.5	511.3	285.9	19	9
2010	940.1	1262.4	164.6	34.2	527.7	590.5	311.6	19	9
2011	906.8	1181.7	338.7	48.6	584.4	645.2	541.6	16	15
2012	822.0	606.7	244.6	78.8	445.3	313.8	332.6	16	11
2013	881.8	1090.7	291.1	50.9	471.0	481.5	349.0	15	9
2014	543.8	485.8	113.8	31.2	223.1	609.6	573.4	16	4

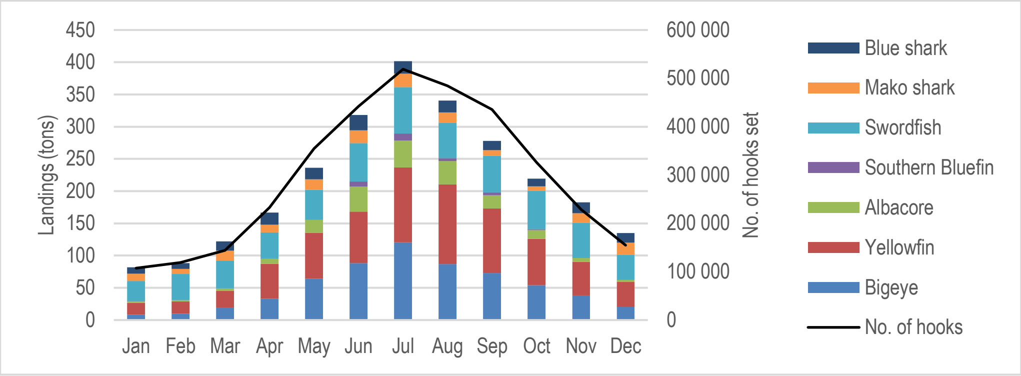
Figure 5.4 Inter-annual variation of catch landed and effort expended by the large pelagic longline sector over the period 2000 to 2014.



Source: CapMarine 2018.

The fishery operates year-round with a relative increase in effort during winter and spring (see *Figure 5.5*). Catch per unit effort (CPUE) variations are driven both by the spatial and temporal distribution of the target species. Variability in environmental factors such as oceanic thermal structure and dissolved oxygen can lead to behavioural changes in the target species, which may in turn influence CPUE (Punsly and Nakano, 1992).

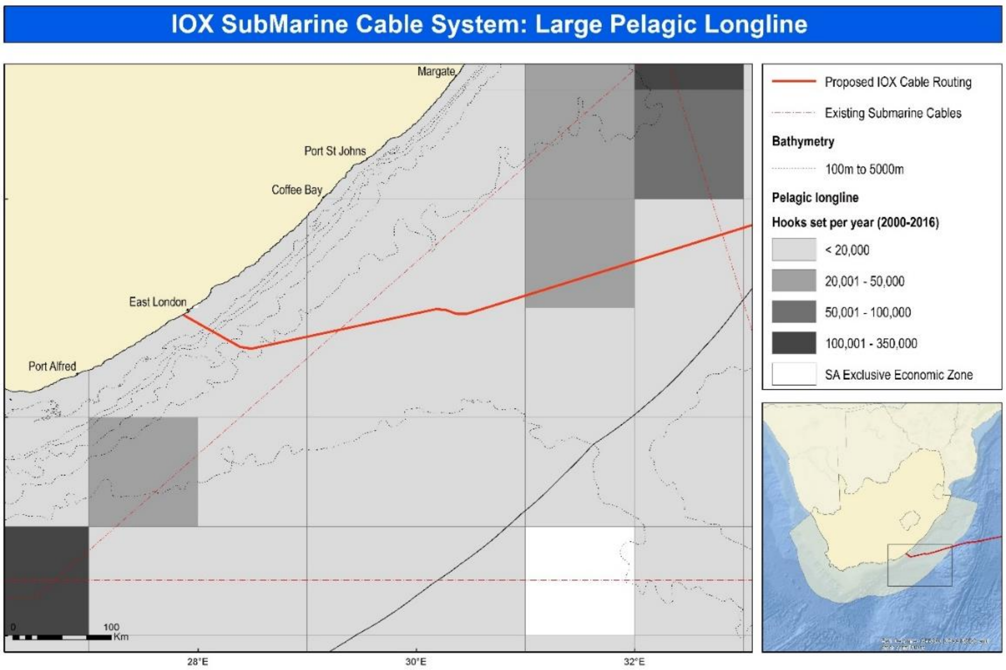
Figure 5.5 ***Monthly variation of catch and effort recorded by the large pelagic longline sector (average figures for the period 2000 to 2014).***



Source: CapMarine 2018.

The fishery operates extensively within the South African EEZ, primarily along the continental shelf break and further offshore. As indicated in *Figure 5.6*, the proposed cable route coincides with the spatial distribution of pelagic longline fishing effort. The impact of the proposed project activities on the sector will be assessed further in section 6.

Figure 5.6 ***Spatial distribution of national fishing effort expended by the longline sector targeting large pelagic species in relation to the proposed cable route.***



Source: CapMarine 2018.

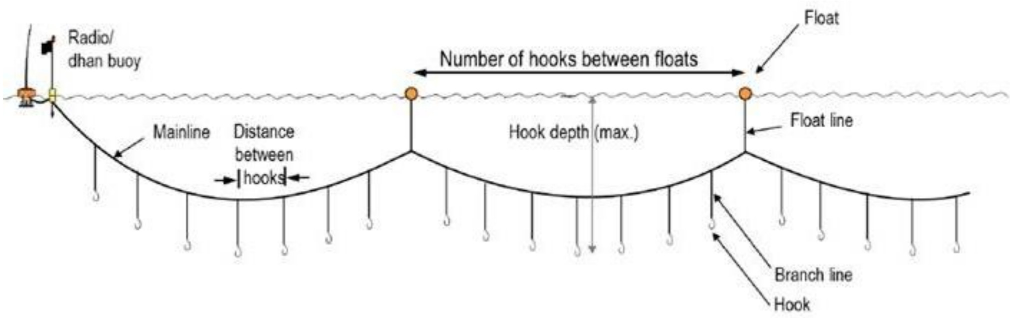
Tuna are targeted at thermocline fronts, predominantly along and offshore of the shelf break. Vessels set a drifting monofilament mainline of up to 100 km length which is suspended from surface buoys and marked at each end. Between radio buoys the mainline is kept near the surface or at a certain depth by means of ridged hard-plastic buoys, (connected via a "buoy-lines" of approximately 20 m to 30 m). The buoys are spaced approximately 500 m apart along the length of the mainline. Up to 3,500 hooks are attached to the mainline on branch lines, (droppers), which are clipped to the mainline at intervals of 20 m to 30 m between the ridged buoys. The main line can consist of twisted tarred rope (6mm to 8mm diameter), nylon monofilament (5mm to 7.5mm diameter) or braided monofilament (~6mm in diameter). A line may be left drifting for up to 18 hours before retrieval by means of a powered hauler at a speed of approximately 1 knot. During hauling, vessel manoeuvrability is severely restricted. In the event of an emergency, the line may be dropped and hauled in at a later stage.

See *Figure 5.7* for a photograph of a typical surface longline vessel, *Figure 4.8* for typical gear configuration and *Figure 4.9* for gear components used by the fishery.

Figure 5.7 Photograph of a typical large scale tuna longline vessel

Source: CapMarine 2017.

Figure 5.8 Typical configuration of surface longline gear targeting tuna, swordfish and shark species.



Source: IOTC Ross Observer Manual, 2015.

Figure 5.9 ***Photographs showing marker buoys (left), radio buoys (centre) and monofilament branch lines (right)***

Source: CapMarine 2015.

5.7 TRADITIONAL LINEFISH

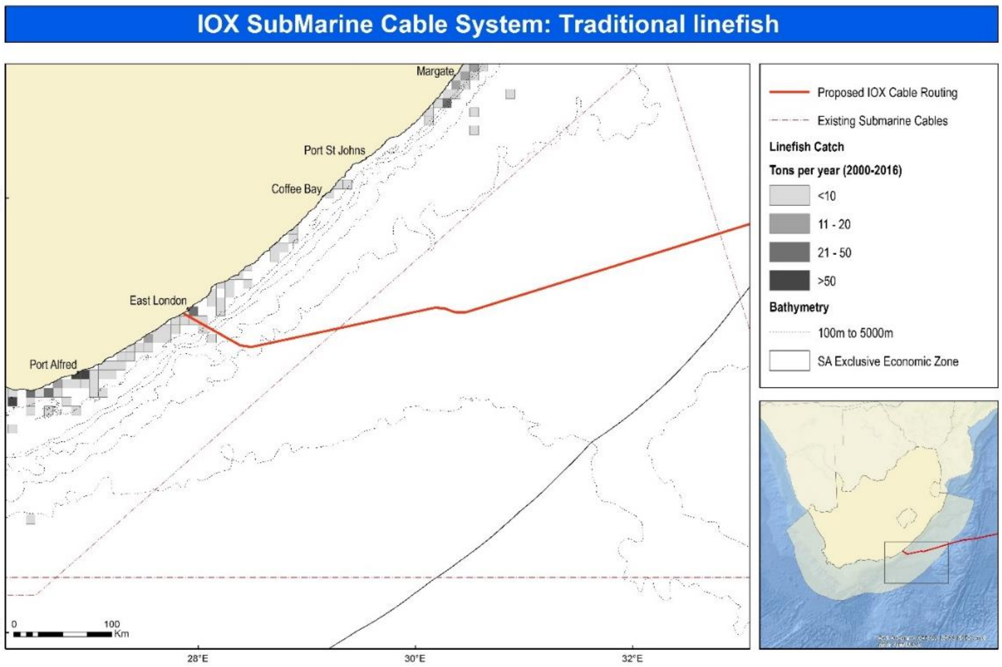
The traditional line fishery is the country's third most important fishery in terms of tonnage landed and economic value. It is a long-standing, nearshore fishery based on a large assemblage of different species using hook and line, but excludes the use of longlines. Within the Western Cape the predominant catch species is snoek (*Thyrsites atun*) while other species such as Cape bream (hottentot) (*Pachymetopon blochii)*, geelbek (*Atractoscion aequidens)*, kob (*Argyrosomus japonicus)* and yellowtail (*Seriola lalandi)* are also important. Towards the East Coast the number of catch species increases and includes resident reef fish (Sparidae and Serranidae), pelagic migrants (Carangidae and Scombridae) and demersal migrants (Sciaenidae and Sparidae). Table 4.3 lists the catch of important linefish species for the years 2002 to 2016.

Table 5.3 ***Annual catch of linefish species (t) from 2002 to 2016 (DAFF, 2018)***

	snoek	yellowtail	kob	carpenter	slinger	hottentot seabream	geelbek	santer	Total catch
2002	3837	242	392	231	101	79	315	48	
2003	4532	329	272	177	88	106	513	48	
2004	7278	883	360	228	184	254	672	87	
2005	4787	739	324	184	169	168	580	84	
2006	3529	310	400	159	192	87	419	79	
2007	2765	478	421	265	157	128	448	84	11841
2008	5223	313	358	226	194	120	403	82	
2009	6322	330	442	282	186	184	495	66	14109
2010	6360	171	419	263	180	144	408	69	13688
2011	6205	204	312	363	214	216	286	62	12530
2012	6809	382	221	300	240	160	337	82	11855
2013	6690	712	157	481	200	173	263	84	9142
2014	3863	986	144	522	201	192	212	74	6849
2015	2045	594	121	519	175	142	238	68	4421
2016	1643	474	133	690	211	209	246	65	4289

The traditional line fishery is a boat-based activity and has since December 2000 consisted of 3450 crew operating from about 450 commercial vessels. The number of rights holders in 2017 is 425 with 2550 allowable crew (rights are valid until 31 December 2020). The crew use hand line or rod-and-reel to target approximately 200 species of marine fish along the full 3000 km coastline, of which 50 species may be regarded as economically important. To distinguish between line fishing and longlining, line fishers are restricted to a maximum of 10 hooks per line. Target species include resident reef-fish, coastal migrants and nomadic species. Annual catches prior to the reduction of the commercial effort were estimated at 16000 tons for the traditional commercial line fishery. Almost all of the traditional line fish catch is consumed locally. The fishery is widespread along the country's shoreline from Port Nolloth on the West Coast to Cape Vidal on the East Coast (see *Figure 5.10*).

Figure 5.10 ***Spatial distribution of national fishing effort expended by the traditional linefish sector in relation to the proposed cable route.***



Source: CapMarine 2018.

Effort is managed geographically with the spatial effort of the fishery divided into three zones. Zone A extends from Port Nolloth to Cape Infanta, Zone B extends from Cape Infanta to Port St Johns and Zone C covers the KwaZulu-Natal region. *Table 4.3* lists the annual Total Allowable Effort (TAE) and activated effort per linefish management zone from 2006 to 2012.

Table 5.4 ***Annual Total Allowable Effort (TAE) and activated effort per linefish management zone from 2006 to 2012 (DAFF, 2016)***

Total TAE boats (fishers). Upper limit: 455 boats or 3450 crew			Zone A: Port Nolloth to Cape Infanta		Zone B: Cape Infanta to Port St Johns		Zone C: KwaZulu-Natal (Sikombe River to Ponto da Ouro)	
Allocation	455 (3182)		301 (2136)		103 (692)		51 (354)	
Year	Allocated	Activated	Allocated	Activated	Allocated	Activated	Allocated	Activated
2006	455	385	301	258	103	78	51	49
2007	455	353	301	231	103	85	51	37
2008	455	372	301	239	103	82	51	51
2009	455	344	300	222	104	78	51	44
2010	455	335	298	210	105	82	51	43
2011	455	328	298	207	105	75	51	46
2012	455	296	298	192	105	62	51	42

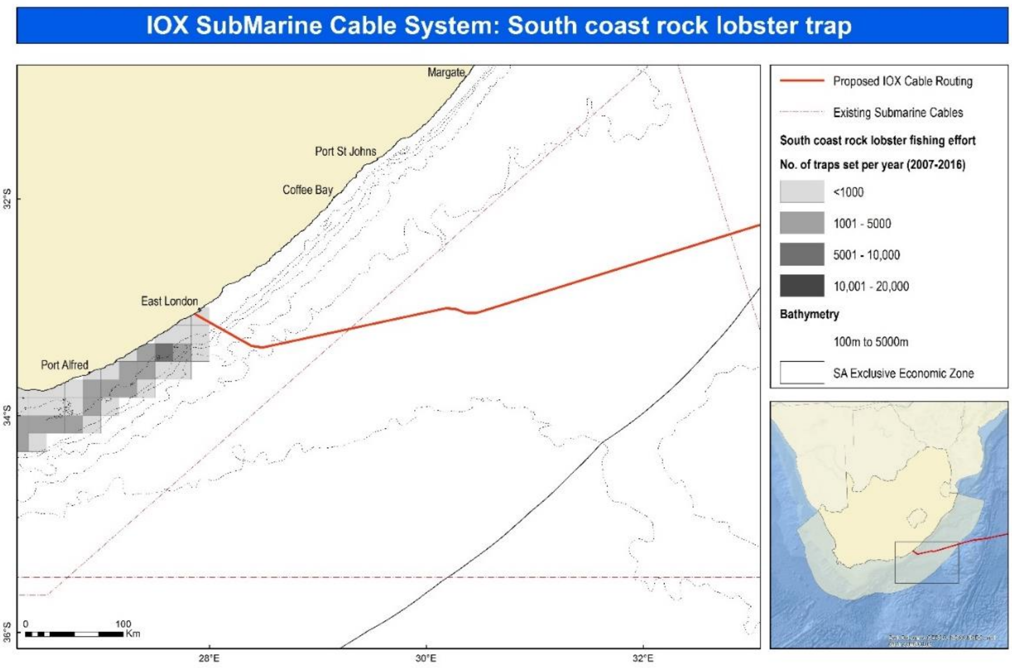
Most of the catch (up to 95%) is landed by the Cape commercial fishery, which operates on the continental shelf from the Namibian border on the West Coast to the Kei River in the Eastern Cape. Fishing vessels of between 4.5 m and 11 m in length generally range up to a maximum offshore distance of about 70 km, although fishing at this outer limit is sporadic. The spatial distribution of line-fishing effort coincides with inshore areas the proposed cable routing and the impact of the proposed project activities on the sector will be assessed further in section 6.

5.8 *SOUTH COAST ROCK LOBSTER*

The South Coast rock lobster fishery is a deep-water long-line trap fishery. Barrel-shaped plastic traps are set for periods ranging from 24 hours to several days. Each vessel typically hauls and resets approximately 2 000 traps per day in sets of 100 to 200 traps per line. They will set between ten lines and 16 lines per day, each of which may be up to 2 km in length. Each line is weighted to lie along the seafloor and will be connected at each end to a marker buoy at the sea surface. Vessels are large, ranging from 30 m to 60 m in length. Those that have on-board freezing capacity will remain at sea for up to 40 days per trip, while those retaining live catch will remain at sea between seven and 10 days before discharging at port. The fishery operates year-round with comparatively low activity during October. There are currently seven vessels operating within the fishery which landed a total lobster tail weight of 345 t in 2015/6.

South Coast Rock Lobster (*Palinurus gilchristi*) occurs on the continental shelf of the South Coast between depths of 50 m and 200 m. The stock is fished in commercially viable quantities in two areas off the South Coast, the first is on the Agulhas Bank approximately 200 km offshore and the second is within 50 km of the shoreline between Mossel Bay and East London. The fishery is restricted from operating far offshore by the Agulhas Current, but would be expected to operate west of East London and inshore of the 200 m bathymetric contour. *Figure 5.11* shows grounds fished in relation to the proposed cable routing. The spatial distribution of fishing effort coincides with inshore areas the proposed cable routing and the impact of the proposed project activities on the sector will be assessed further in section 6.

Figure 5.11 ***Spatial distribution of national fishing effort expended by the trap fishery for south coast rock lobster in relation to the proposed cable route.***



Source: CapMarine 2018.

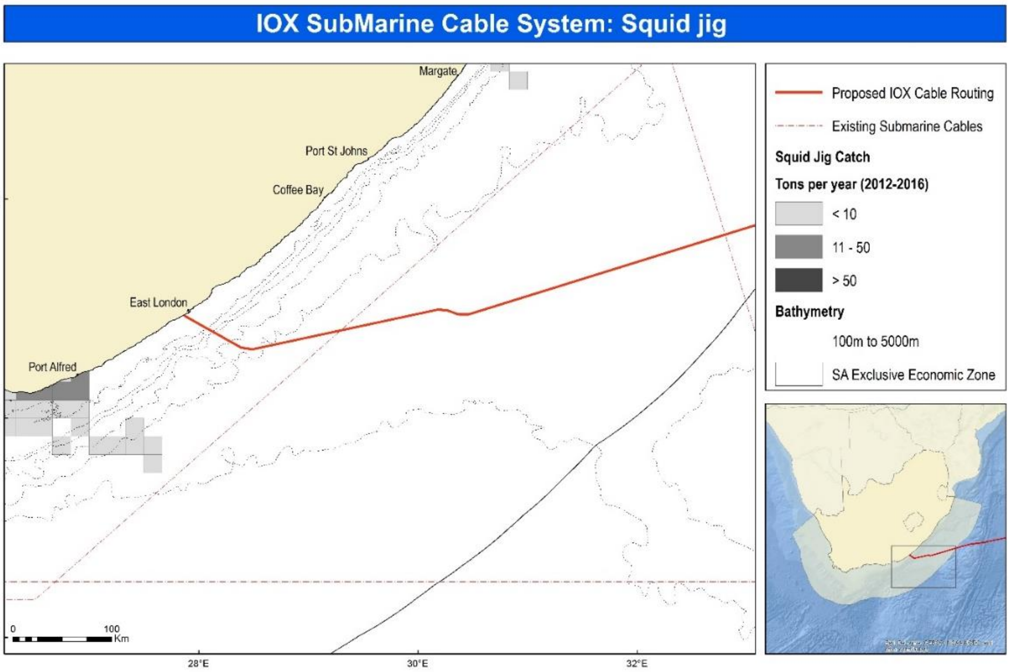
5.9 SQUID JIG

Chokka squid (*Loligo vulgaris reynaudii*) is distributed from the border of Namibia to the Wild Coast. It occurs extensively on the Agulhas Bank out to the shelf edge, increasing in abundance towards the eastern boundary of the South Coast, especially between Plettenberg Bay and Algoa Bay (Augustyn 1990; Sauer et al. 1992; Augustyn et al. 1994). Along the South Coast adult squid is targeted in spawning aggregations on shallow-water fishing grounds extending from Plettenberg Bay to Port Alfred between 20 m and 130 m depths (Augustyn 1990; Downey 2014). The most important spawning grounds are between Plettenberg Bay and Algoa Bay (Augustyn 1990), these having been linked to specific spawning habitat requirements (Roberts & Sauer 1994; Roberts 2005). Spawning aggregations are a seasonal occurrence reaching a peak between September and December (Augustyn et al. 1992).

The method of fishing involves hand-held jigs and bright lights which are used to attract squid at night. A squid jig is defined as a lure like object with a row or number of rows of barbless "hooks" at one end and an "eye" at the opposite end. Jigging operations involve the use of one or more jigs attached to a handline at the "eye" of the jig and moved up and down in a series of short movements in the water (Squid Permit Condition, DAFF).The catch is frozen at sea or at land-based facilities at harbours between Plettenberg Bay and Port Alfred. Vessels predominantly operate out of Cape St Francis and Port Elizabeth harbours.

Figure 5.12 shows the distribution of fishing effort in relation to the proposed cable route. As fishing grounds do not coincide with the route the sector is not expected to be impacted by the proposed Project.

Figure 5.12 ***Spatial distribution of national fishing effort expended by squid jig fishery in relation to the proposed cable route.***

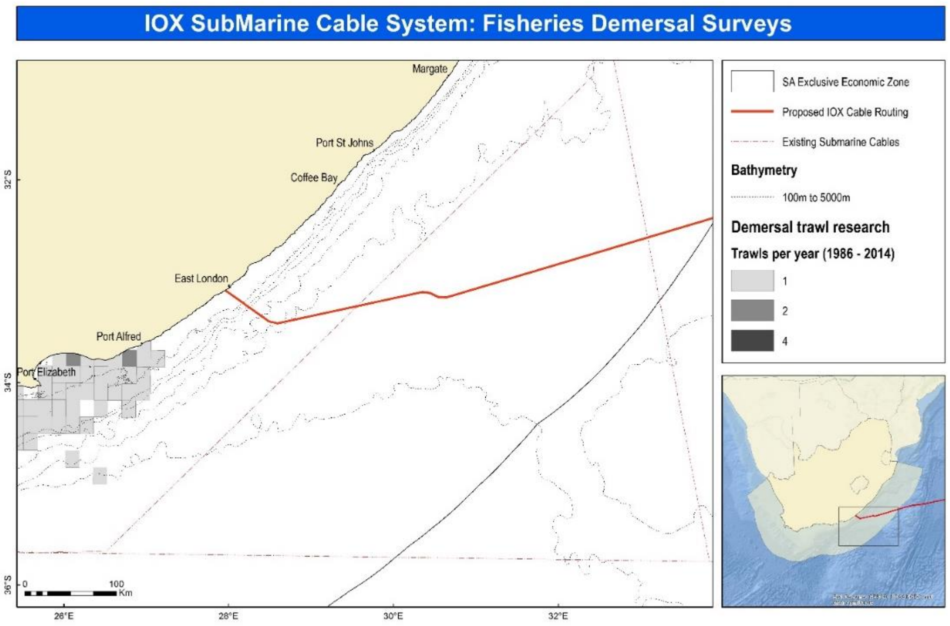


Source: CapMarine 2018.

5.10 *FISHERIES RESEARCH*

Swept-area trawl surveys of demersal fish resources are carried out twice a year by DAFF in order to assess stock abundance. Results from these surveys are used to set the annual TACs for demersal fisheries. First started in 1985, the West Coast survey extends from Cape Agulhas (20°E) to the Namibian maritime boarder and takes place over the duration of approximately one month during January. The survey of the Southeast coast (20°E – 27°E longitude) takes place in April/May. Following a stratified, random design, bottom trawls are conducted to assess the biomass, abundance and distribution of hake, horse mackerel, squid and other demersal trawl species on the shelf and upper slope of the South African coast. Trawl positions are randomly selected to cover specific depth strata that range from the coast to the 1 000 m isobath. *Figure 5.13* shows the distribution of research trawls undertaken in relation to proposed cable route. As fishing grounds do not coincide with the route research surveys are not expected to be impacted by the proposed Project.

Figure 5.13 ***Spatial distribution of trawling effort expended during research surveys undertaken by DAFF to ascertain biomass of demersal fish species. Effort is shown in relation to the proposed cable route.***

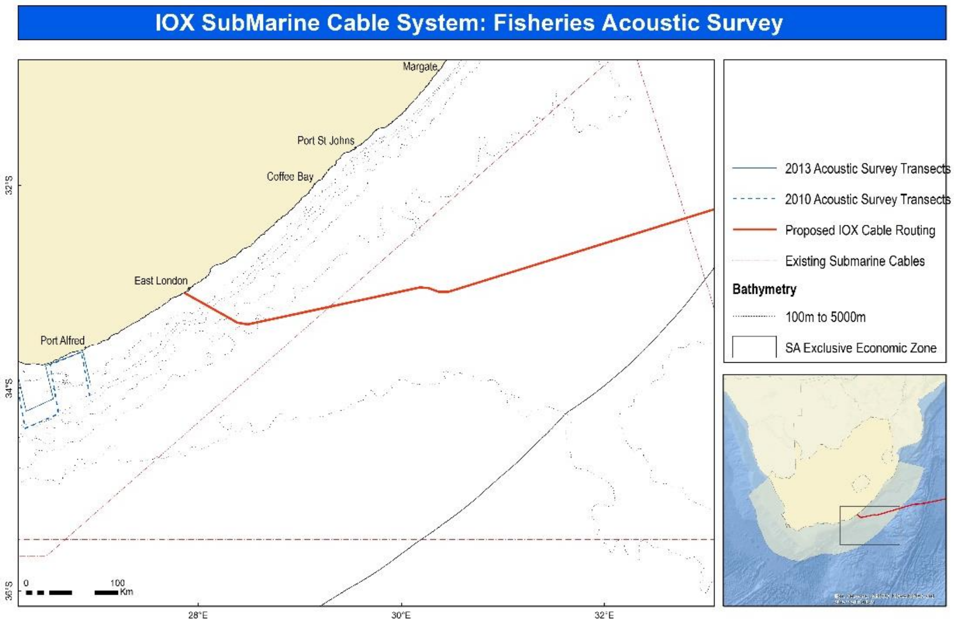


Source: CapMarine 2018.

The biomass of small pelagic species is assessed bi-annually by an acoustic survey. The first of these surveys is timed to commence in mid-May and runs until mid-June while the second starts in mid-October and runs until mid-December. The timing of the demersal and acoustic surveys is not flexible, due to restrictions with availability of the research vessel as well as scientific requirements. During these surveys the survey vessels travel pre-determined transects (perpendicular to bathymetric contours) running offshore from the coastline to approximately the 200 m isobath. The surveys are designed to cover an extensive area from the Orange River on the West Coast to Port Alfred on the East Coast and the DAFF survey vessel progresses systematically from the Northern border Southwards, around Cape Agulhas and on towards the east.

Figure 5.14 shows the location of sampling tracks undertaken in relation to proposed cable route. As these do not coincide with the route the sector is not expected to be impacted by the proposed Project

Figure 5.14 Spatial distribution of sampling tracks for acoustic surveys of the biomass of small pelagic species undertaken in 2010 and 2013 in relation to the proposed cable route.



Source: CapMarine 2018.

6 IMPACT DESCRIPTION AND ASSESSMENT

6.1 DESCRIPTION OF THE SOURCE OF IMPACT

Project activities proposed during pre-installation, installation, and operational phases were identified as sources of a potential impact on the fishing industry. Fishing vessels would be required to maintain a safe operational distance from the Project vessels during the pre-grapnel run and installation of the cable. Once installed, the cable route would be charted by the South African Navy Hydrographic Office. An exclusion zone would permanently be enforced around the cable routing. This would be marked into navigational charts and vessels would not be permitted to trawl or anchor within a distance of 1nm to either side of the cable.

6.2 DESCRIPTION OF THE ENVIRONMENTAL ASPECTS

Historically, commercial fishing has accounted for more than 40 percent of all submarine cable faults worldwide (CSRIC, 2014). Commercial fishing-related damage is most often caused by bottom-tending fishing gear such as trawl nets and dredges, but it is also cause by longlines anchored to the seabed and pot and trap fisheries using grapnels for gear retrieval. A description of gear used by selected South African demersal fishing sectors is included in Appendix 1, to illustrate the associated risks to submarine cables posed by each of these sectors.

Research indicates that when a trawl crosses a communications cable lying on the seabed, more than 90% of such crossings do not result in cable damage (Wilson, 2006) as trawls are designed to pass over seabed obstacles[1]. For the current Project, the cable will be buried to a depth of 0.9 m to 1.5 m in waters shallower than 900 m, thus protection will be provided against snagging by trawl gear (in particular trawl doors which dig into the top sediment layer of the seabed). Where burial is not possible, either due to seabed obstructions, hard ground or at depths greater than 900 m, the cable will laid directly on the seabed. If a piece of fishing gear or anchor hooks or snags a cable, there would be a likelihood of damage to the cable. Cable damage by bending, crushing and stretching can occur long before the cable breaks. Cables are at risk of damage, therefore, where anchors, grapnels or other equipment are used to drag for lost or unmarked gear. In nearshore areas, cable will be protected against potential damage by heavy armouring.

[1] This figure is averaged across different types of trawling gear, including "light" gear which may not necessarily make heavy contact with the seabed. Demersal trawl configurations used by the South African offshore trawl fleet do include trawl doors of up to 3 tons each which make 'heavy' contact with the sea bed.

6.3 *DESCRIPTION OF THE POTENTIAL IMPACT*

The following impacts on fisheries as a result of the laying and long-term establishment of the cable have been identified:

6.3.1 *Loss of catch*

Fishermen are required by law to take reasonable care to avoid damaging submarine cables. This means in practice not fishing near known cable locations, which are indicated on navigational charts. The requirement that fishermen avoid conduct likely to break cables is established in the United Nations Convention on the Law of the Sea (UNCLOS), as well as in South African legislation where subsea cables are marked by an exclusion zone of one nautical mile on either side of the cable routing within which trawling and anchoring is prohibited. A trawler would be required to "fly" its gear so as to avoid contact with the cable – this refers to shortening the trawl warps and hauling the gear up off the ground until clear of the obstruction. These days precision placement of the gear is possible even at depth due to the sensors attached to the gear. Therefore, the impact to fisheries would equate to exclusion from fishing ground and an associated loss in catch over the time that gear is lifted off the seabed. In the event that several cables are present in close proximity, there is the potential of a cumulative impact where the ground between the exclusion zones may become unfishable due to the distance required to raise and lower fishing gear.

6.3.2 *Safety of fishing vessels*

In the event that trawling gear snags a submarine cable, lifting the cable can be much more dangerous than pulling free from other seabed obstructions. When the winch is engaged the tension in the trawl warp increases as more cable is lifted from the seabed. The tension in the warps could build up rapidly to a point which would capsize the vessel. Most capsizes of this type are due to human error, and a well-designed vessel should have adequate resistance against capsizing. The combined winch and engine power of a modern trawler are capable of exerting considerable tension in the warp which in turn acts as a downward force on the towing block. This is frequently positioned above the vessel centre of gravity. If the load is also applied to one side then the vessel has the means of creating enough force to capsize itself (Drew and Hopper, 1996).

6.3.3 *Damage to fishing gear*

In areas where the cable is not buried (any areas of rocky ground, and at depths greater than 900 m) the cable would be exposed and vulnerable to snagging by demersal longline and trawling gear. If this were to occur, besides the potential for damage to the cable, snagging could result in the loss of fishing gear.

6.4 *SENSITIVE RECEPTORS*

All fishing vessels would be required to maintain a safe operational distance from the Project vessels during the pre-grapnel run and installation of the cable. Thus the sensitive receptors during the Pre-Installation and Installation Phases of the Project would potentially be any fishing sector.

The sensitive receptors during the Operational Phase of the Project would be those fishing sectors that would be excluded from anchoring or trawling within the protection corridor surrounding the cable i.e. those that direct fishing effort at the seabed. The relevant South African demersal fishery sectors include hake-directed trawl and longline and longline trap fisheries for rock lobster.

6.5 *PROJECT CONTROLS AND INDUSTRY OBJECTIVES*

Most of the larger companies operating in the submarine cable industry typically work to standards and quality management systems set by the International Organization for Standards under the ISO 9000 and ISO 9001 schemes. In addition, the International Cable Protection Committee (ICPC) publishes recommendations on key issues such as cable routing, cable protection and cable recovery that are available to anyone on request. Although their observance is not mandatory, these recommendations are designed to facilitate quality improvement and are often cited by third parties as examples of best practice in the industry (ICPC, 2009).

6.6 *IMPACT ASSESSMENT*

The spatial distribution of fishing effort of each sector in relation to the proposed cable route is provided in Section 5. The demersal fisheries (ie those that direct fishing effort at the seabed) that could be affected by exclusion to fishing during the Operational Phase of the Project include the hake-directed trawl and longline and longline trap fisheries for rock lobster. The proposed cable route does not; however, coincide with fishing grounds for the demersal trawl and longline sectors and therefore no impact is expected on these sectors either during the pre-installation, installation or operational phases of the Project. The proposed cable route coincides with commercial fishing block number 29 of the south coast rock lobster sector. Fishing block 29 lies on the outskirts of traditional fishing grounds, with catch taken within this area having historically been very low (<50kg per year or <0.01% of total landings). Since 2007 there has been no activity reported within the affected area. The magnitude of the impact on the sector is considered to be negligible as is the overall significance of the impact (see *Table 6.1*).

Sectors that could be affected during a temporary exclusion to fishing ground during the pre-installation and installation phases of the Project include the traditional linefish sector, which operates in the nearshore vicinity of the proposed area of influence, and the large pelagic longline sector, which operates extensively from a distance of 12 nm from the coastline to the limit of the South African Exclusive Economic Zone. The presence of Project vessels would present a direct but temporary impact which would be local in extent (vessels would transit along the survey or cable route). The scale of the impact on both sectors is considered to be small as the area of influence covers a very low proportion of fishing ground available to each of these sectors. The magnitude of the impact is considered to be small to negligible. The impact on the traditional linefish and large pelagic longline sectors is considered to be of overall negligible significance (see *Table 6.2*).

6.7 *MITIGATION MEASURES*

Standard measures would include a process of notification to affected parties prior to the commencement of installation of the cable. Selected fishing industry associations, the Department of Agriculture, Forestry and Fisheries and other affected parties should be informed of the pending activity and the safety clearance requirements of the cable-laying vessel.

The following actions are recommended:

- Distribute a Notice to Mariners prior to the commencement of the subsea cable installation. The Notice to Mariners should give notice of an indication of the proposed timeframes for subsea installation and an indication of the 500 m safety zone around the subsea cable lay. This Notice to Mariners should be distributed timeously to fishing companies and directly onto vessels where possible

- The subsea vessel contractors must adhere to the International Organization for Standards under the ISO 9000 and ISO 9001 and the International Cable Protection Committee (ICPC) recommendations.

- The subsea cable routing and exclusion corridor must be published in nautical charts, which are distributed by the navy hydrographic office.

- Undertaking all maritime operations in line with International Maritime Law and safe practice guidelines.

No additional mitigation measures are considered necessary. Refer to *Table 6.1* for the Impact Ratings on Fisheries resulting in the Operations Phase of the Project and *Table 6.2* for Impacts during the Pre-Installation and Installation Phases.

Table 6.1 Impact on fishing sectors during the operations phase of the proposed Project.

Exclusion to Fishing Ground during Operational Phase of the Project		
South Coast Rock Lobster Longline Trap		
Characteristic	**Impact**	**Residual Impact**
Type	Direct	Direct
Duration	Long-term	Long-term
Extent	Local	Local
Scale	Affected area yielded <0.01% of total catch prior to 2007 and no catch between 2007 and 2016	
Frequency	Rare	Rare
Magnitude	Negligible	Negligible
Sensitivity of the Receptor	Medium	Medium
Significance of Impact	**Negligible**	**Negligible**

Table 6.2 Impact on fishing sectors during the pre-installation and installation phases of the proposed Project.

Exclusion to Fishing Ground during Pre-Installation and Installation Phases of the Project		
Large Pelagic Longline		
Characteristic	**Impact**	**Residual Impact**
Type	Direct	Direct
Duration	Temporary	Temporary
Extent	Local	Local
Scale	Small	Small
Frequency	Occasional	Occasional
Magnitude	Small to Negligible	Small to Negligible
Sensitivity of the Receptor	Low	Low
Significance of Impact	**Negligible**	**Negligible**

Traditional Linefish		
Characteristic	**Impact**	**Residual Impact**
Type	Direct	Direct
Duration	Temporary	Temporary
Extent	Local	Local
Scale	Small	Small
Frequency	Occasional	Occasional
Magnitude	Small to Negligible	Small to Negligible
Sensitivity of the Receptor	Low	Low
Significance of Impact	**Negligible**	**Negligible**
South Coast Rock Lobster Longline Trap		
Characteristic	**Impact**	**Residual Impact**
Type	Direct	Direct
Duration	Temporary	Temporary
Extent	Local	Local
Scale	Small	Small
Frequency	Occasional	Occasional
Magnitude	Small to Negligible	Small to Negligible
Sensitivity of the Receptor	Low	Low
Significance of Impact	**Negligible**	**Negligible**

6.8 CUMULATIVE IMPACT

A cumulative impact is one that arises from a result of an impact from the Project interacting with an impact from another activity to create an additional impact. *Table 6.3* below lists the existing, approved and proposed projects, the impacts of which have previously been assessed with regards to the fishing industry. The negligible significance of the impact of the current Project proposal on affected sectors is not expected to increase the overall significance of cumulative impacts on any fisheries sectors.

Table 6.3 Identification of other proposed Projects that may contribute to a cumulative impact on fishing sectors.

Identified sources of potential cumulative impact on fisheries
Operational
Exclusion areas in place around wellheads and subsea pipelines within Licence Block 9
Exploration well drilling in Licence Block 11B/12B planned to take place in December 2018
Aproved but not operational
Seismic survey (2D) within Exploration Rights Areas held by Silverwave (Pty) Ltd
Exploration and well appraisal within Licence Block 9 by PetroSA (Pty) Ltd
Proposed and pending approval
Seismic survey (3D) proposed by Sungu Sungu Oil (Pty) Ltd within Pletmos Licence Area
Exploration well drilling within Exploration Right 236 by ENI South Africa B.V.

7 CONCLUSIONS

Fishermen are required by law to take reasonable care to avoid damaging submarine cables. Those sectors at risk of snagging cables include demersal fisheries, in particular, those that fish via trawl and longline. The demersal longline fishery deploys gear that anchors to the seabed. In the unlikely event of gear breaking, grapnel hooks may be used to retrieve lost lines and these could potentially snag and damage an exposed section of cable. With regards to demersal trawling operations, trawl doors pose a reasonably high risk of snagging.

As a means of protection against human activities, including fishing, the cable would be buried to a depth of 0.9 m to 1.5 m in waters shallower than 900 m; however, the cable may be exposed on the seabed in some areas unsuitable for burial, eg rock or highly mobile sand. Despite burial in some places, protection along the entire cable routing would be afforded by a legal cable protection zone of 1 nm to either side of the cable. National legislation prohibits trawling or anchoring within one nautical mile on either side of the cable and this would affect fishing sectors that trawl or set longline gear on the seabed. The cable routing and exclusion corridor would be published in official notices to mariners and nautical charts, which are distributed by the navy hydrographic office.

With regards to the South African fishing industry this would present an impact to demersal fisheries where the areas of operation of these sectors coincides with the proposed cable route. In practical terms, normal fishing operations would be disrupted and fishing activity would be displaced into adjacent grounds, or through the lifting ground gear (in the case of trawling) off the seabed whilst transiting over the cable. This could result in a loss of catch. In the event that gear were to foul a cable, the gear may be damaged or lost completely. Any catches contained in nets would likely be lost. At worst, there would be a risk to the vessel of capsizing if an attempt were made to lift the cable in order to free fishing gear.

The potential effects of the proposed Project activities on each of the sectors were evaluated. The demersal trawl and longline sectors are considered most vulnerable to the effects of an exclusion zone around an installed cable; however, the project area of influence does not coincide with trawl fishing grounds. Trawlers would not be expected to operate along the proposed cable route as fishing grounds are situated at least 130 km west of the proposed area of influence. Similarly, grounds used by the demersal longline fleet are situated at least 200 km west of the proposed area of influence and the sector is not expected to be affected by an exclusion zone around the proposed cable route. The impact expected to result during the Operational Phase of the Project (i.e. the exclusion corridor around the cable route) is expected only to affect the South Coast rock lobster trap fishery; however, due to the very low levels of fishing in the area, the overall significance of the impact is assessed to be negligible.

Sectors that could be affected during a temporary exclusion to fishing ground during the pre-installation and installation phase of the Project include the traditional linefish sector, which operates in the nearshore vicinity of the proposed area of influence, and the large pelagic longline sector, which operates extensively from a distance of 12 nm from the coastline to the limit of the South African Exclusive Economic Zone. Due to the temporary nature of the activity, and the very low level of overlap, the impact on the traditional linefish and large pelagic longline sectors is considered to be of negligible significance.

Apart from the proposed inherent project controls, no additional mitigation measures are considered necessary as the effects on the fishing industry associated with the proposed Project are considered to be within an acceptable level. Measures of monitoring that the extent of the effect on fisheries is maintained at an acceptable level is not considered necessary.

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9 APPENDIX 1: DESCRIPTION OF FISHING GEAR CONFIGURATIONS THAT POSE A RISK TO SUBMARINE CABLES

Historically, commercial fishing has accounted for more than 40 percent of all submarine cable faults worldwide (CSRIC, 2014). Commercial fishing-related damage is most often caused by bottom-tending fishing gear such as trawl nets and dredges, but it is also cause by longlines anchored to the seabed and pot and trap fisheries using grapnels for gear retrieval. A description of gear used by the South African hake-directed trawl and longline sectors is presented below to indicate the associated risks posed to submarine cables.

9.1 DEMERSAL TRAWL

The offshore trawl fleet is segregated into wetfish and freezer vessels which differ in terms of the capacity for the processing of fish at sea and in terms of vessel size and capacity. While freezer vessels may work in an area for up to a month at a time, wetfish vessels may only remain in an area for about a week before returning to port. Wetfish vessels range between 24 m and 56 m in length while freezer vessels are usually larger, ranging up to 80 m in length (see *Figure 9.1*). The configuration of trawling gear is similar for both freezer and wetfish vessels (see *Figure 9.2*).

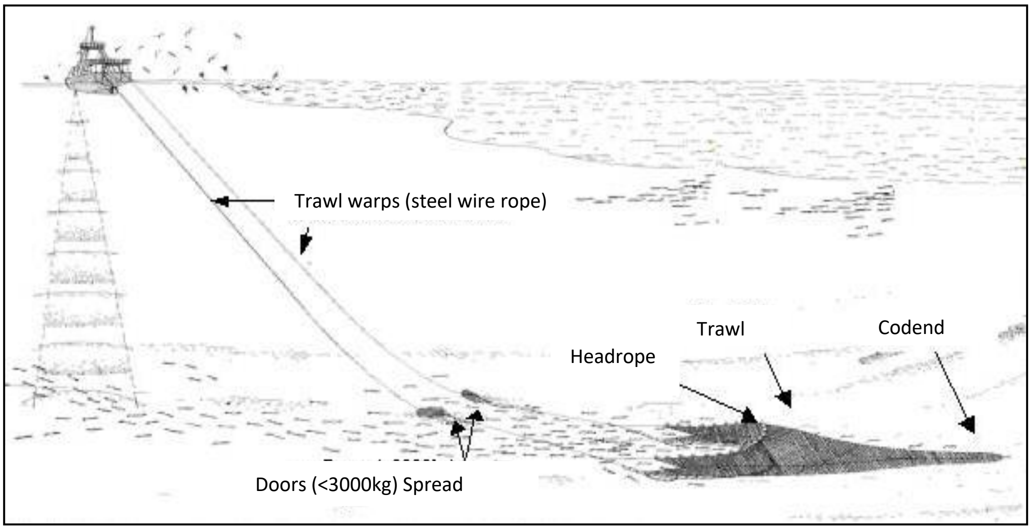
Figure 9.1 ***Photograph of a freezer (left) and wetfish (right) trawler vessel currently active in the offshore South African demersal trawl fleet.***

Trawl gear is deployed astern of the vessel and the main elements of the gear include:

- Steel trawl warps up to 32 mm diameter - in pairs up to 3 km long when towed;
- A pair of trawl doors (500 kg to 3 tons each);
- Net footropes which may have heavy steel bobbins attached (up to 24" diameter; maximum 200 kg) as well as large rubber rollers ("rock-hoppers"); and

- Net mesh (diamond or square shape) is normally wide at the net opening whereas the bottom end of the net (or cod-end) has a mesh size minimum limit of 110 mm (stretched).

Figure 9.2 Schematic diagram showing the typical gear configuration used by offshore trawlers to target demersal species.



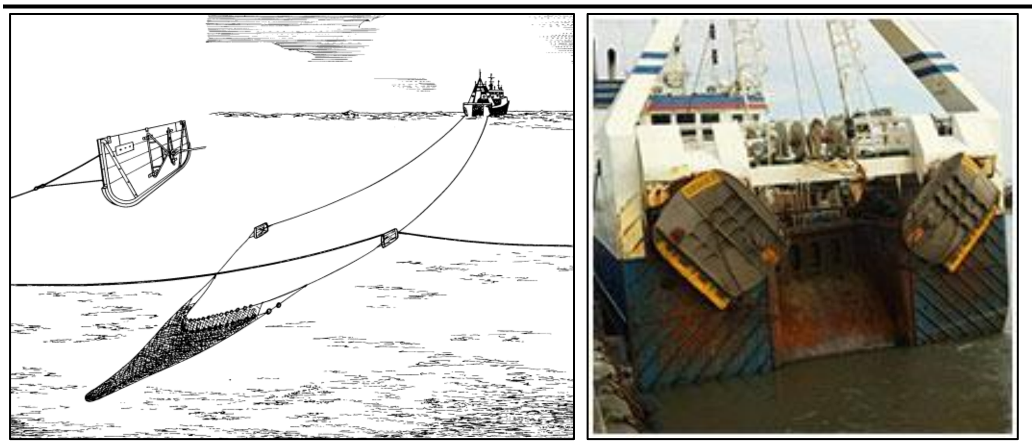
Otter trawling is the main trawling method used in the South African hake fishery. This method of trawling makes use of trawl doors (also known as otter boards) that are dragged along the seafloor ahead of the net, maintaining the horizontal net opening. Bottom contact is made by the footrope and by long cables and bridles between the doors and the footrope. Behind the trawl doors are bridles connecting the doors to the wings of the net (to the ends of the footrope and headrope). A headline, bearing floats and the weighted footrope (that may include rope, steel wire, chains, rubber discs, spacers, bobbins or weights) maintain the vertical net opening. The “belly”, “wings” and the “cod-end” (the part of the net that retains the catch) may contact the seabed.

There is a wide range of ground gear configurations used with different companies, vessels and skippers using different combinations that have varied over time, in different grounds and with different fishing strategies relating to market demands. The intention in demersal hake trawling is to have the ground gear in close contact with the seafloor surface and to skim over it rather than to dig into the ground although trawl doors often penetrate up to 150 mm into the seafloor on soft grounds. Footrope protection such as the use of wire in the footrope, bound ropes along the footrope, the addition of rubber disks or rollers (large rollers are considered rock hoper gear or rubber or steel bobbins at regular intervals along the footrope is required, particularly for fishing in hard or irregular ground.

Vessels towing on smooth bottom for species which live in contact with the seabed often use tickler chains ahead of the footrope which cause bottom dwellers to jump or swim up and be captured by the net. On smooth bottom, fishermen often keep their ground gear in close, continuous contact with the bottom. Some degree of seabed penetration is likely and this may increase the chances of fouling a cable. On rocky bottom, trawl gear is more often rigged to keep light bottom contact. Light contact in such areas might not decrease the chances of fouling a cable, since cables are more likely to be exposed on top of the seabed or spanning between rocks. There is also the risk of a door bouncing over a rock, landing hard and penetrating the seabed to strike a cable. Although some footropes have rollers, the rubber discs of rockhopper gear are not designed to roll. They may become cut or torn and this increases the risk of snagging on a cable.

Generally, trawlers tow their gear at 3.5 knots for two to four hours per drag. When towing gear, the distance of the trawl net from the vessel is usually between two and three times the depth of the water. The horizontal net opening may be up to 50 m in width and 10 m in height and the swept area on the seabed between the doors may be up to 150 m.

Figure 9.3 ***Schematic diagram showing otter trawl snagging cable (left) and photograph of trawl doors stowed astern of vessel.***



Source: ICPC Ltd (left) and CapMarine (right)

Trawl doors

Trawl doors keep the gear on or near the bottom and provide horizontal spread for the net. In most bottom fisheries the intention is to have the door and the footrope skim along in contact with the seabed without digging into it. When a door strikes a cable, damage to the cable is likely. The damage is more severe if the door snags the cable and exerts a pulling or lifting force. Doors with curved front edges and doors designed to ride with the front corner off the bottom are less likely to snag on cables and other seabed obstacles. In the 1970's the International Cable Protection Committee funded research to develop and spread the use of doors with curved forward edges. Some fishermen weld additional plates on the bottom of the door to increase its weight or protect against wear. Unless the front edge of the weight blends smoothly with the door, this can cause it to snag more on objects such as cables. See *Figure 9.4* for photographs of trawl doors.

Figure 9.4 ***Photographs of trawl doors typically used as part of ground gear in the South African demersal trawl fleet.***

Photo credit: Dr K. Sink, South African National Biodiversity Institute

Bobbins

In the context of trawling, bobbins refer to the spherical weights that are added to the footrope to protect the footrope, raise it off the ground and allow the net to roll along the seabed. In South Africa, round wooden bobbins were used in the 1950's with hollow banded steel and solid rubber bobbins used from the 1960s. Solid rubber bobbins may be heavier than steel bobbins (*Figure 9.5*) which are usually hollow although some skippers make holes in steel bobbins to increase the weight of their ground gear by allowing water to fill the hollow bobbins. Permit conditions stipulate an upper limit of 750 mm diameter and 200 kg for bobbins.

Figure 9.5 ***Photographs of solid rubber (left) and steel (right) bobbins typically used as part of ground gear in the South African demersal trawl fleet.***

Photo credit: Dr K. Sink, South African National Biodiversity Institute

Rubber discs

Rubber discs (also referred to as rollers or cookies) refer to the circular rubber disks, wheels, rollers or plates of varying sizes (usually 75 to 600 mm in diameter) that are used along the footrope. An entire footrope can be "wrapped" with small rubber disks but larger disks (rockhopper gear) are usually spaced at regular intervals along the footrope with rubber spacers or disks in between the larger disks or rollers.

Rockhopper gear

Rockhopper gear refers to moulded rubber disks larger than 250 mm in diameter which is designed to work on very hard seabed (see *Figure 9.6* for an example of a footrope with large diameter rubber discs). Rockhopper gear in South Africa is not designed to roll over the seabed but rather to raise the belly of the net slightly off rocky grounds. Early research showed that a fish trawl of 26 m headline length with ground gear consisting of 6 m of 350 mm diameter rubber wheels in the centre, and two 4.5 m wing sections of 90 mm diameter rubber discs, had the ability to traverse hard ground with boulders up to 2 m in height, and to physically displace boulders up to 1 m diameter when towed by a 22 m trawler with a 200 hp main engine (Main and Sangster, 1979 in Sink, 2012). Local skippers report that the main function of both bobbin and rockhopper gear is gear protection in rough ground. Many local skippers report that rockhopper gear is usually preferable to bobbin gear because it is less risky (less chance of snagging) and less dangerous on deck. Rockhopper gear is being increasingly used over bobbin gear, particularly in deep water.

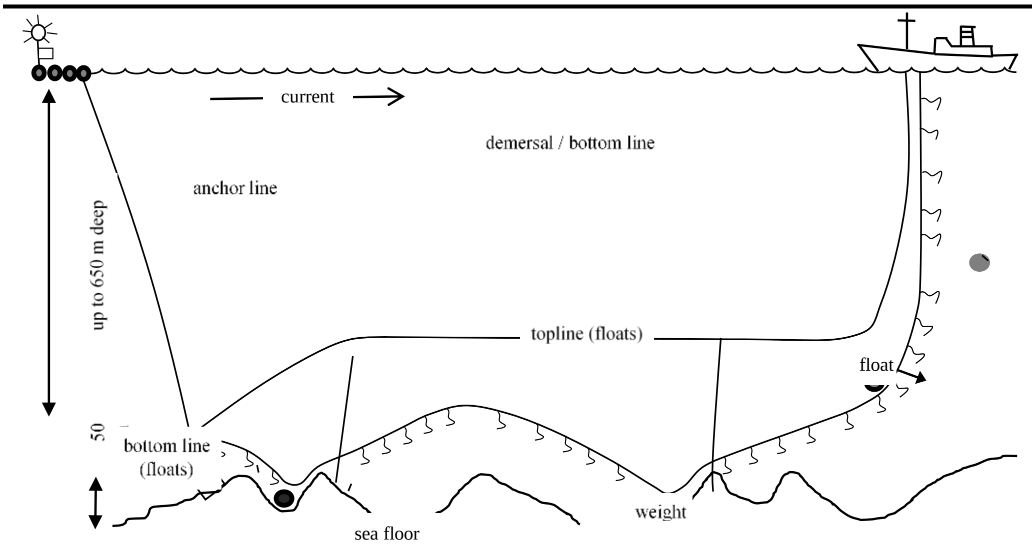
Figure 9.6 Photographs of a footrope with large diameter rubber discs comprising "rockhopper gear" typically used as part of ground gear in the South African demersal trawl fleet.

Photo credit: Dr K. Sink, South African National Biodiversity Institute

9.2 *DEMERSAL LONGLINE*

A demersal longline vessel may deploy either a double or single line which is weighted along its length to keep it close to the seafloor (see *Figure 9.7*). Steel anchors, of 40 kg to 60 kg, are placed at the ends of each line to anchor it, and are marked with an array of floats. If a double line system is used, top and bottom lines are connected by means of dropper lines. Since the top-line (polyethylene, 10 – 16 mm diameter) is more buoyant than the bottom line, it is raised off the seafloor and minimizes the risk of snagging or fouling. The purpose of the top-line is to aid in gear retrieval if the bottom line breaks at any point along the length of the line. Lines are typically between 10 km and 20 km in length, carrying between 6 900 and 15 600 hooks each. Baited hooks are attached to the bottom line at regular intervals (1 to 1.5 m) by means of a snood. Gear is usually set at night at a speed of between five and nine knots. Once deployed the line is left to soak for up to eight hours before it is retrieved. A line hauler is used to retrieve gear (at a speed of approximately one knot) and can take six to ten hours to complete.

Figure 9.7 ***Schematic diagram showing the typical configuration of demersal (bottom-set) gear used by longline vessels to target demersal species.***



Source: CapMarine

9.3 *SOUTH COAST ROCK LOBSTER TRAP (LONGLINE)*

The South Coast rock lobster fishery is a deep-water long-line trap fishery. Barrel-shaped plastic traps are set for periods ranging from 24 hours to several days. Each vessel typically hauls and resets approximately 2 000 traps per day in sets of 100 to 200 traps per line. They will set between ten lines and 16 lines per day, each of which may be up to 2 km in length. Each line is weighted to lie along the seafloor and will be connected at each end to a marker buoy at the sea surface. Vessels are large, ranging from 30 m to 60 m in length.

It is common practice for a vessel to tow a grapnel (a hook-like anchor or length of chain with several prongs) across the bottom to find and lift lost gear. Internationally, incident reports between cables and stationary fishing gear have occurred due to grapnels snagging cables and a number of cable faults caused by longlines have been reported. The force generated in trying to clear a snagged longline has been estimated at up to 4 tonnes.

Figure 9.8 Photograph of cable damaged by a grapnel intended to retrieve fish traps from 1800 m depth.

Source: Tyco Telecommunications) (US) Inc.

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED IOX SUBSEA CABLE SYSTEM OFF THE EAST COAST OF SOUTH AFRICA

Specialist:	Capricorn Marine Environmental (Pty) Ltd		
Contact person:	Sarah Wilkinson		
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Telephone:	0214256226	Fax:	0214251994
E-mail:	sarah@capfish.co.za		
Professional affiliation(s) (if any)	SA Council for Natural Scientific Professions (SACNASP) 115666		

Project Consultant:			
Contact person:			
Postal address:			
Postal code:		Cell:	
Telephone:		Fax:	
E-mail:			

4.2 The specialist appointed in terms of the Regulations_

I, Sarah Wilkinson, declare that --

General declaration:

I act as the independent specialist in this application;
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting 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:

Capricorn Marine Environmental (Pty) Ltd

Name of company (if applicable):

26 September 2018

Date:

Contents of this report in terms of Regulation GNR 982 of 2014	Cross-reference in this report
(a) details of— the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix 3
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	p. i
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 4.3
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 6.8
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 6
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 4.1 to 4.2
(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;	Section 6
(g) an identification of any areas to be avoided, including buffers;	N/a
(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;	Section 5
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4.4
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 6
(k) any mitigation measures for inclusion in the EMPr;	Section 6.7
(l) any conditions for inclusion in the environmental authorisation;	N/a
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	N/a
(n) a reasoned opinion— (i) 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, and where applicable, the closure plan;	Section 7
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/a
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/a
(q) any other information requested by the competent authority.	N/a

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

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Professional affiliation(s) (if any)	SA Council for Natural Scientific Professions (SACNASP) 115666		

Project Consultant:			
Contact person:			
Postal address:			
Postal code:		Cell:	
Telephone:		Fax:	
E-mail:			

4.2 The specialist appointed in terms of the Regulations_

I, Sarah Wilkinson , declare that --

General declaration:

- I act as the independent specialist in this application;
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting 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:

Capricorn Marine Environmental (Pty) Ltd

Name of company (if applicable):

26 September 2018

Date:

Annex D2.1

Marine Heritage Study

Maritime Heritage Impact Assessment: IOX Cable Route

Report prepared for

ERM Southern Africa

On behalf of

Indian Ocean Xchange SA (Pty) Ltd

September 2018

Version 2.0

ACO Associates cc
Archaeology and Heritage Specialists

Prepared by

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Executive Summary

ACO Associates was appointed to conduct a desk-based assessment of the maritime archaeological potential of the marine portion of the proposed cable route, to determine the likely impacts of the cable on maritime and underwater cultural heritage resources, and to the propose measures to mitigate such impacts.

In line with national legislation and policy regarding the marine environment, this maritime archaeological assessment is for the area below the high water. This report therefore excludes an archaeological assessment of the terrestrial portion of the cable route between the landfall and the beach manhole inside the East London Industrial Development Zone which has been done separately..

This proposed subsea cable system will comprise a main trunk, approximately 9000 km in length between India and South Africa. The cable will be laid on and in the seabed of South Africa’s exclusive economic zone, contiguous zone and territorial waters and will make landfall approximately 6 km south of the mouth of the Buffalo River at East London.

The cable will be laid by a specialised cable laying vessel. In water depths exceeding 900 m the cable can be safely laid directly on the seabed without the need to be buried. In water less than 900 m deep the cable will be buried in the seabed by ploughing. The seabed footprint of the cable plough is limited to the area approximately 0.2 m wide and between 900 and 1500 mm deep.

Findings: This assessment, which draws its information from readily available documentary sources, SAHRA’s Maritime and Underwater Cultural Heritage database, and a database of underwater heritage resources maintained by ACO Associates, the geophysical survey report and some geophysical data, reviewed the cable route, buffered by 10km on each side for maritime and underwater cultural heritage resources.

There are no known submerged prehistoric sites in the East London area or along the proposed cable route but hominin footprints found at Nahoon Point in 1964 which date approximately 124 000 years old ago are an indicator of the antiquity of a human presence in the area around East London.

There are records of 138 shipwrecks within the buffer zone, between the landfall and the outer limit of the contiguous zone. There are a further 13 wrecks recorded in the East London area for which it has been impossible to find any indication of position. These wrecks could, therefore, be present in the 10 km buffer zone around the cable route. A number of these wrecks are currently less than 60 years of age and are thus not protected by the NHRA as heritage resources. However, the risk they can pose to plant and the cable suggest that they cannot be discounted from the planning of the project.

There are no recorded wrecks in the bay within which the cable route will make its landfall: the nearest recorded sites being more than 2 km distant. An archaeological review of the multibeam bathymetry data found no evidence of shipwrecks within the survey corridor inside the contiguous zone and territorial waters..

Further offshore, within the EEZ and on the continental shelf, there are a number of shipping casualties related to German and Italian U-boat activity in the southern Indian Ocean during

World War II. None of these casualties are less than 20 km from the proposed route of the cable and it is extremely unlikely that they will be encountered during the laying of the cable. Their presence and their particular sensitivity as possible war graves must, however, be borne in mind should the alignment of the route be changed

This assessment has found that there is unlikely to be any impact on submerged prehistoric archaeological resources or historical shipwreck and no mitigation is required or proposed. In the event a previously unknown or unrecorded shipwreck is encountered during the installation of the cable, the project archaeologist and SAHRA must be notified immediately. If the wreck will be impacted by the cable laying all work must cease until the archaeologist and SAHRA have assessed the significance of the site and a decision has been taken as to how to deal with it.

The maritime elements of the proposed IOX fibre optic cable are highly unlikely to have any impact on known or unknown maritime and underwater cultural heritage resources and are considered archaeologically acceptable.

Details of the Heritage Practitioner

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

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1 Introduction

ACO Associates cc was appointed by ERM Southern Africa (ERM), on behalf of Indian Ocean Xchange SA (Pty) Ltd (IOX) to undertake a maritime archaeological assessment for the South African section of the proposed IOX cable route between India and South Africa.

This assessment forms part of the Environmental Impact Assessment being undertaken for IOX by ERM to obtain Environmental Authorization from the national Department of Environmental Affairs (DEA) for the project.

2 Terms of Reference

ACO Associates was appointed to conduct a desk-based assessment of the maritime archaeological potential of the marine portion of the proposed cable route, to determine the likely impacts of the cable on maritime and underwater cultural heritage resources, and to the propose measures to mitigate such impacts.

In line with national legislation and policy regarding the marine environment, this maritime archaeological assessment is for the area <u>below</u> the high water mark (see Section 4.2 below).

The archaeological assessment of the terrestrial portion of the cable route between the landfall and the beach manhole inside the East London Industrial Development Zone (IDZ) has been undertaken separately (ACO Associates 2018b).

3 Project Description

The following project description is a summary of the information presented in the draft Scoping Report (ERM 2018).

This proposed subsea cable system will comprise a main trunk, approximately 9000 km in length between India and South Africa. The cable will split from branching units on the main trunk to landing sites in other host countries including Mauritius and Rodrigues Island.

The cable will enter South African territorial waters at approximately -33.1811S, 28.0776E and will be laid on and in the seabed of South Africa's exclusive economic zone (EEZ), contiguous zone and territorial waters. It will make landfall at a site approximately 6 km south of the mouth of the Buffalo River at East London on the east coast. Landfall will be adjacent to the East London Industrial Development Zone (IDZ) at approximately -33.0573S, 27.8639E (**Figure 10**).

At the landfall the cable will run from the sea to a beach manhole inside the IDZ in a conduit that will be installed either by Horizontal Directional Drilling or trenching.

The fibre optic cable has a maximum diameter of approximately 45 mm.

3.1 Project Activities

The Project activities fall into four phases: pre-installation, installation, operations (including maintenance and repair), and decommissioning. Of these, the pre-installation and installation phases are most likely to have an impact on underwater cultural heritage resources.

3.1.1 Pre-installation

The proposed route of the subsea cable presented in the Scoping Report is based on a desktop study. The final route will be determined after the completion of the EIA, which includes a marine geophysical survey. The geophysical survey will comprise a sub-bottom profiler survey to identify the type of sediments and best route for burial of the subsea cable and a sidescan sonar survey to identify obstacles such as deep gullies, rocks, corals and wrecks.

Immediately ahead of installation a pre-lay grapnel run will be conducted along those portions of the subsea cable route where burial is required. This clearance survey involves the towing of one or an array of grapnels along the seabed to identify any items that might interfere with installation or otherwise damage the fibre optic cable.

3.1.2 Installation

The fibre optic cable will be laid by a specialised cable laying vessel. Based on the location and depth of water, the following methodologies will be applied:

In water depths exceeding 900 m the cable is usually quite safe from human or other interactions and can be safely laid directly on the seabed without the need to be buried.

In water less than 900 m deep the cable is buried in the seabed by ploughing to a depth of between 900 and 1500 mm. The footprint of the cable plough on the seabed is limited to the area of the four plough skids and the plough share, which is approximately 0.2 m wide.

Nearer the shore the cable is more heavily armoured to provide additional protection from potential damage and in very shallow water (from 0 to about 50 m) clamps can be used to protect and anchor the subsea cable in place.

3.1.3 Operations and Decommissioning

Once installed and operational the subsea cable system will not require routine maintenance. If the cable is damaged, repairs are effected by cutting out the damaged section using a Remotely Operated Vehicle (ROV), bringing the ends to surface and splicing in a new section of cable.

Options for decommissioning the system at the end of the project's life include retirement in place, or removal and salvage. It is likely that the subsea portion of the cable will be largely retired in place, according to current global industry practice. .

4 Relevant Legislation

4.1 National Heritage Resources Act (No 29 of 1999)

The National Heritage Resources Act (NHRA) came into force in 2000 with the establishment of the 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, a 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 laying of the proposed cable has the potential to impact the following:

- submerged pre-colonial archaeological sites and materials; and
- maritime and underwater cultural heritage sites and material, which are principally historical shipwrecks.

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.

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 (EEZ) and continental shelf which together comprises some 4.34 million square kilometres of seabed, 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 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 maritime cultural zone require the involvement of SAHRA, as a commenting body in respect of the NEMA EIA process and as permitting authority where impacts to sites or material cannot be avoided and damage or destruction will occur.

In terms of Section 9 of the Maritime Zones Act, activities undertaken from installations operating within South Africa's EEZ or on the continental shelf 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 IOX Cable Route is therefore, limited to area between the baseline and the outer edge of the contiguous/maritime cultural zone.

4.3 National Environmental Management Act (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 process have been promulgated in terms of NEMA and include the EIA Regulations (GNR R326/2017) and Listing Notices 1 – 3 (GNR 324, 325 and 327/2017). These regulations were amended in April 2017 by Government Notices 324, 325, 326 and 327.

The proposed IOX Cable triggers a number of activities in the Listing Notices and, in terms of GNR 325 therefore, the project will be subject to a full Scoping and Environmental Impact Assessment process and IOX will be required to obtain a positive Environmental Authorisation from the national Department of Environmental Affairs (DEA) prior to commencement of the proposed activities.

As a commenting body SAHRA was asked to comment on the draft Scoping Report (ERM Southern Africa (Pty) Ltd) for the proposed cable route and responded in a letter to IOX SA (Pty) Ltd, dated 11 July 2018. SAHRA supported the recommendation in the report that a specialist study of maritime heritage is to be undertaken as part of the EIA.

SAHRA noted that a marine survey is to be carried out to determine the most appropriate route for the subsea cable and requested that the data produced from this survey must be archaeologically reviewed as part of the specialist study. SAHRA further stipulated that the specialist study must identify and address all known wrecks that lie along the proposed pipeline route and at the proposed landing site, consider the potential for previously unknown sites to be revealed by the project and make recommendations for the mitigation of negative impacts to maritime and underwater cultural heritage resources.

5 Method

This desk-based report provides an assessment of the maritime and underwater cultural heritage potential of the study area defined in Section 5.1 below. It includes a description of what comprises South Africa's maritime and underwater cultural heritage, a brief maritime history of the East London area and a discussion of known maritime heritage resources within the study area.

The report draws its information from readily available documentary sources, SAHRA's Maritime and Underwater Cultural Heritage database, a database of underwater heritage resources maintained by ACO Associates, the geophysical survey report (ELETTRA/GeoTeam 2018) and some geophysical data.

The potential impacts arising from the proposed laying of the IOX cable on maritime and underwater cultural heritage resources are assessed and, where necessary, recommendations are made to mitigate such impacts.

5.1 Maritime Study Area

The study area for this maritime archaeological assessment has been defined as a corridor 10km wide centred on the proposed cable alignment between the outer limit of South Africa's contiguous zone (24 nautical miles from the baseline) and the high water mark at the cable landfall (see **Figure 8**).

The relative inaccuracy of shipwrecks records, particularly for areas further offshore, suggests that the larger study area described above is more appropriate than one that is narrowly defined around the proposed routing of the cable.

5.2 Geophysical Data

ELETTRA/GeoTeam were commissioned to carry out the seabed survey of the proposed cable route and the work was undertaken on the R/V OGS Explora of the Italian Research Institute of Oceanography and Geophysics. The survey acquired bathymetric, seabed feature and shallow geology data along the proposed route and a geotechnical sampling programme was also conducted.

Three lines of data were collected over most of the shallow water survey area (i.e. water less than 100 m deep) at a line spacing of 130 m. The survey corridor was approximately 700 m wide over most of the its length, except at the coast where it widened to 1.5 Km. A much wider area was surveyed off the break of the continental shelf within the EEZ (**Figure 1**)

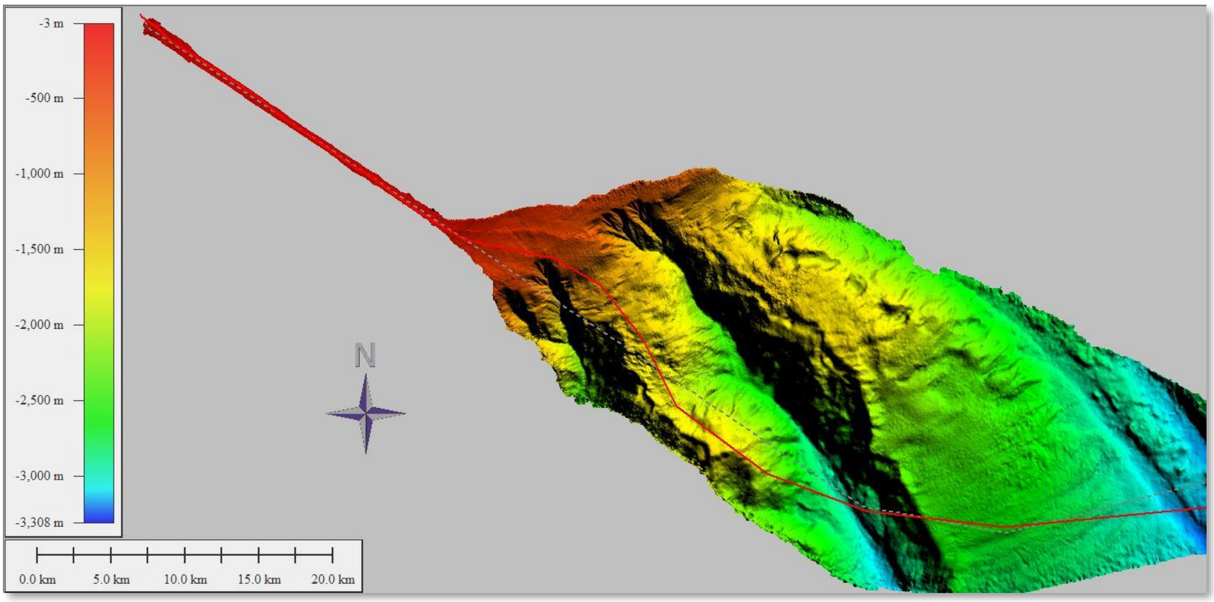

Figure 1:Extent of the multibeam bathymetric survey for the IOX cable route. Note the narrow survey corridor above the break of the continental shelf (Source: ELETTRA/GeoTeam)

Sidescan sonar data were collected in the narrow shallow water section of the cable route corridor. These data were used to characterize seabed feature (**Figure 2**) with areas of low to medium reflectivity ranging from fine clean sand to very coarse sand. Sand waves and mega ripples patches were identified in some areas. High reflectivity areas inferred as hardpan seafloor, rock outcrops and sub-cropping rock patches within were noted in numerous places.

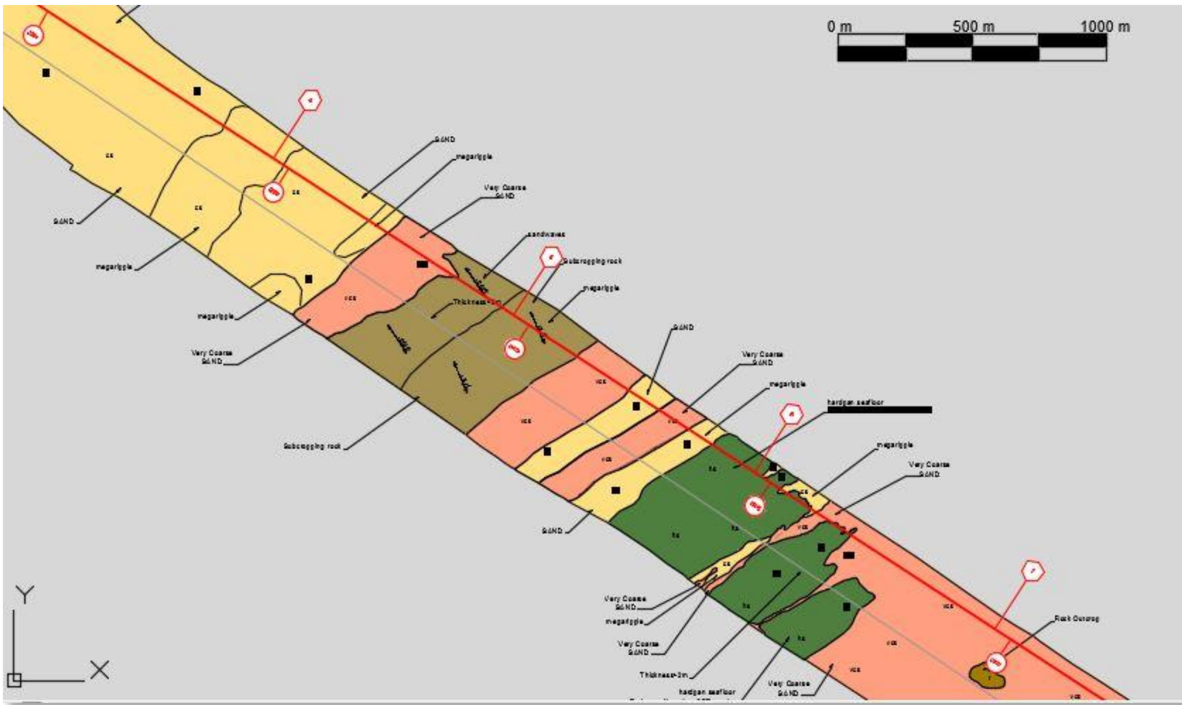

Figure 2: Example of the seabed feature characterisation developed from the sidescan sonar data (Source: ELETTRA/GeoTeam)

These sidescan sonar data were not available for archaeological review but the seabed characterisation created from the data was reviewed for features of possible heritage interest. An example of the sidescan sonar data is shown in **Figure 3**below.

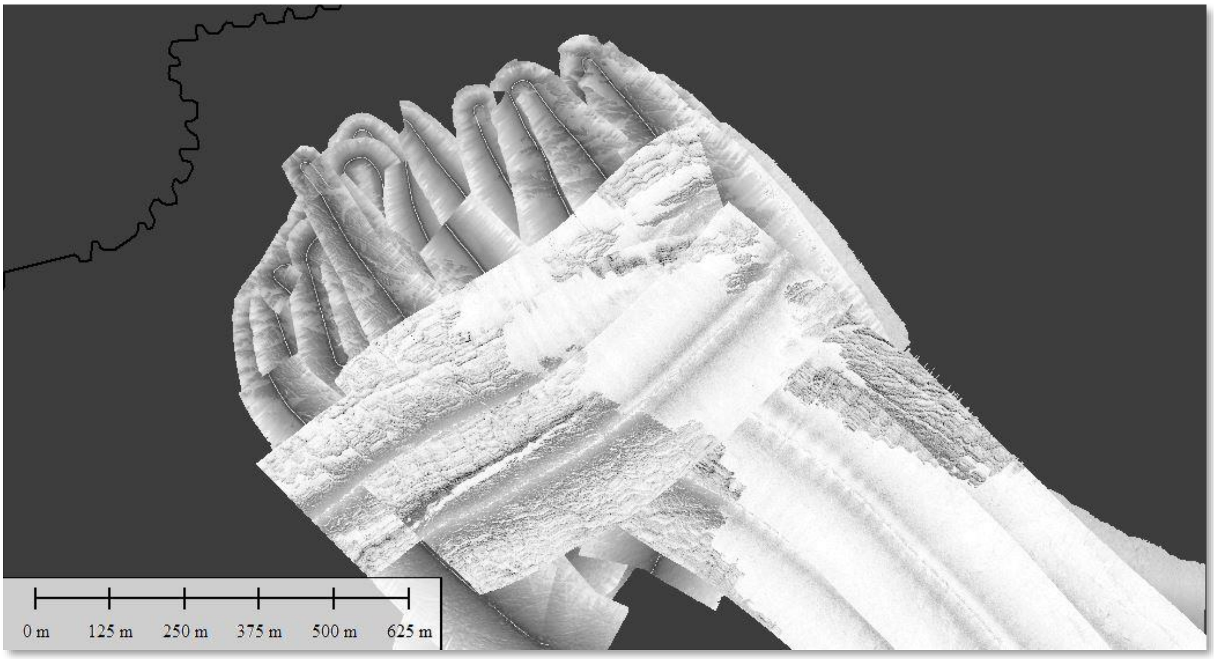

Figure 3:Sidescan sonar mosaic for the inshore section of the IOX cable corridor (Source: ELETTRA/GeoTeam)

This archaeological data review relied on the survey report, the seabed feature characterisation and geotiffs of the processed multibeam bathymetric data (**Figure 4**) within the contiguous zone and territorial waters, which were reviewed in QGIS.

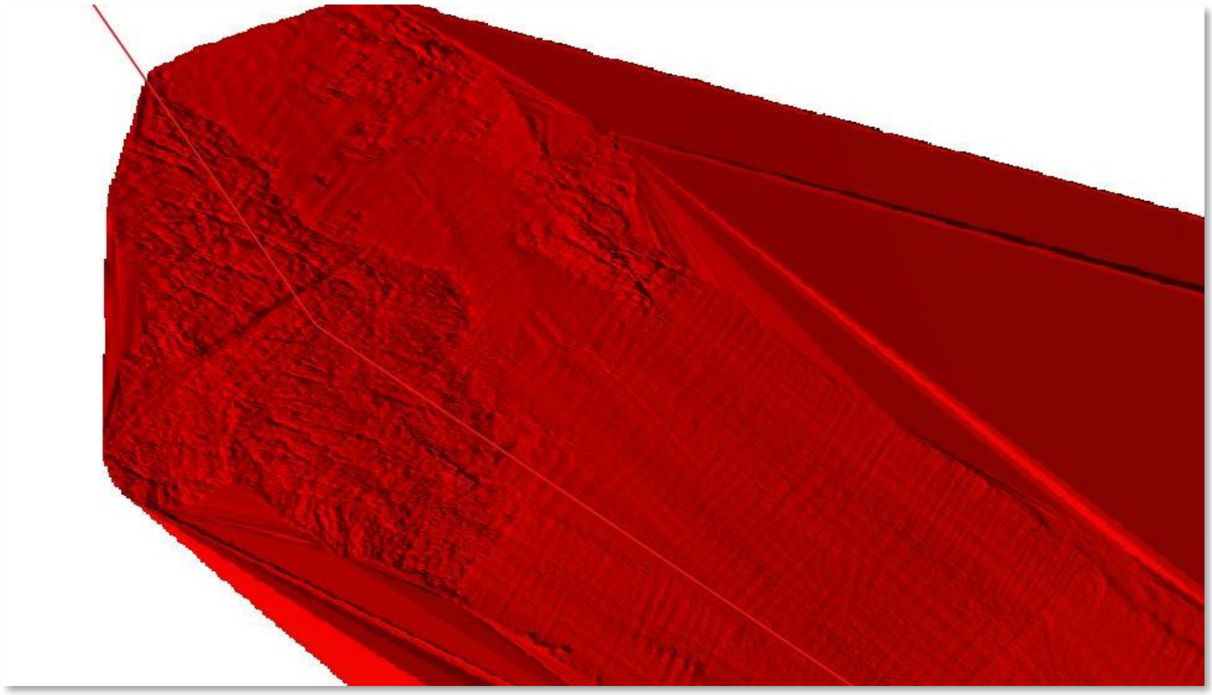

Figure 4: Inshore multibeam bathymetric data for IOX cable route

5.3 Limitations

The record of South Africa's maritime and underwater cultural heritage resources is based principally on 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.

The reliance on secondary data sources means that there are gaps and inaccuracies in this record, so while every effort has been made to ensure the accuracy of the information presented below, the potential exists for currently unknown and/or unrecorded maritime heritage sites to be encountered in the course of the proposed project.

It is important to note too that the geophysical data available for review for this assessment was of a resolution which didn't allow the identification of small, low profile seabed features. Thus, a buried wooden shipwreck, which can appear as a mound on the seabed, would have been very difficult to discern in the data.

6 Underwater Cultural Heritage

South Africa has a rich and diverse underwater cultural heritage. Strategically located on the historical trade route between Europe and the East, South Africa's rugged and dangerous coastline has witnessed more than its fair share of shipwrecks and maritime dramas in the last 500 years. At least 2500 vessels are recorded as having been wrecked, sunk, abandoned or scuttled in South African waters since the early 1500s.

More than 1900 of these wrecks are older than 60 years and are thus protected by the NHRA as archaeological resources. This list 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, thus 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.

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 coast by thousands of pre-colonial shell middens which reflect prehistoric human exploitation of marine resources since the Middle Stone Age, more than 150,000 years ago.

Stone-walled inter-tidal fish traps are another, potentially ancient feature of particularly the south-western and southern Cape coast (see Kemp 2006), although their age is contentious with some authors proposing that they are pre-colonial in origin (Goodwin 1946, Avery 1975, Gribble 2005) and others that they are much more recent (Hine 2008, Hine et al 2010).

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 those maritime and underwater cultural heritage resources in the vicinity of the proposed IOX Cable route which are located below the high water mark, namely submerged prehistoric resources and historical shipwrecks.

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 was mainly lower than it is today. During the last 900,000 years global sea levels have fluctuated substantially on at least three occasions, the result of increased and decreased polar glaciation. The dropping of sea levels was 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 (MIS) 2) the sea was more than 120m lower than it is today (Waelbroeck et al 2002; Rohling et al 2009).

The lower sea levels during glaciations which correspond 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), for example, 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). This would have been most pronounced on the wide Agulhas Bank off the southern Cape coast, but would also have occurred along the narrow continental shelves on South Africa's west and east coasts. It is estimated that this exposed continental shelf may have represented a new area of land as much as 80,000km^2 in extent during the successive glacial maxima (Fisher et al 2010). **Figure 5** below gives an indication of the extent of the continental shelf exposure during the second to last glaciation.

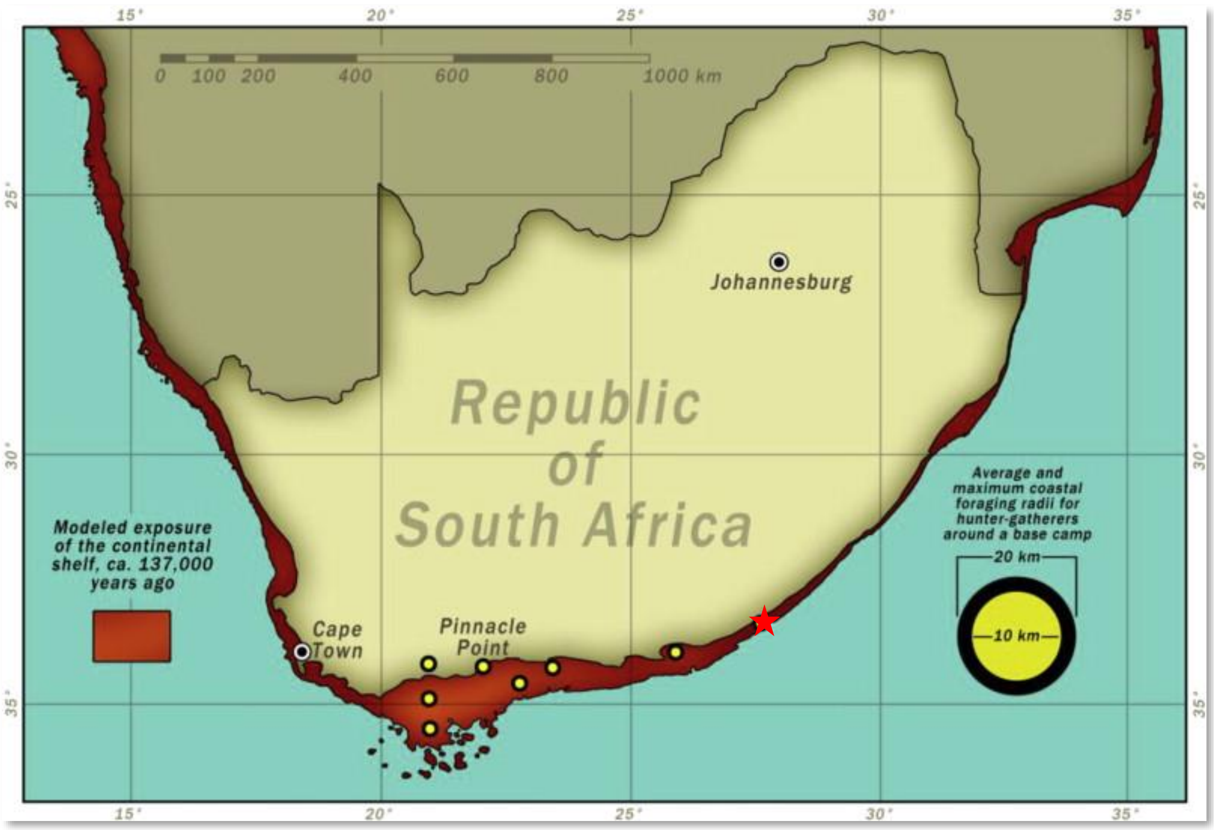

Figure 5: Possible extent of the South African continental shelf during MIS 6. The approximate location of East London marked by the red star (Source: Franklin et al, 2105)

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 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 fishing nets in the North Sea between the United Kingdom and the Netherlands throughout the 20th century (Peeters et al 2009; Peeters 2011) and the 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).

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 handaxes from the seabed under the wrecks. The stone tools, which are between 300,000 and 1.4 million years old, were found at a depth of 7-8m below mean sea level and were associated with Pleistocene sediments associated with an ancient submerged and infilled river channel. Their unrolled and unworn condition indicated 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 at least 300,000 years ago, when the sea level was at least 10m lower than it is today (Werz and Flemming 2001; Werz et al 2014) (**Plate 1**).

Plate 1: Acheulian hand axes found in Table Bay (Source: http://www.aimure.org/index.php/aimure-projects)

Ancient river courses, whose channels are today buried under modern seabed sediment, would have been an important focus for hominin activity in the past and as demonstrated in Table Bay there is the potential for the occurrence of ancient, submerged archaeological material in association with palaeo-river channels.

Where alluvial sediment within these channels has survived post-glacial marine transgressions there is also the potential to recover palaeoenvironmental data which can contribute contextual information to our understanding of the ancient human occupation of South Africa

6.1.1 Submerged Prehistory of the East London area

There are no known submerged prehistoric sites in the East London area or along the proposed cable route. However, in 1964 the footprints of a young human child and the tracks of a bird and two mammal species were discovered preserved in sandstone at Nahoon Point, north of the Buffalo River in East London. The tracks are estimated to be approximately 124 000 years old ago and their presence is an indicator of the antiquity of a human presence in the area around East London (http://www.thegreatkaroo.com/news/heritage_potential_of_the_nahoon_point_trace_fossil_footprints) (**Plate 2**).

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Plate 2: Cast of the Nahoon Point footprints on display at the Nahoon Point Nature Reserve. The original sandstone block containing the tracks is housed at the East London Museum (Source: http://www.bctourism.co.za/itemdetail.php?id=508&category=18)

6.2 Shipwrecks

In 1498 the Portuguese explorer Vasco da Gama finally pioneered the elusive 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; 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 South African 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).

For obvious historical reasons, 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 first the Dutch and then the British in European trade with the East and control at the Cape, the majority of wrecks along the South African coast are Dutch and British. However, at least 36 other nationalities are represented amongst the other 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 off the South African coast.

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. Archaeological evidence from Africa points to an ancient trade in African products – gold, skins, ivory and slaves – in exchange for beads, cloth, porcelain, iron and copper. The physical evidence for this trade includes Persian and Chinese ceramics excavated sites on African Iron Age like Khami, Mapungubwe and Great Zimbabwe (see Garlake 1968, Huffman 1972, Chirikure 2014), glass trade beads found in huge numbers on archaeological sites across eastern and southern Africa (Wood 2012).

There is shipwreck evidence on the East African coast for this pre-European Indian Ocean trade (see for example Pollard et al 2016) and clear archaeological and documentary evidence that this trade network extended at least as far south as Maputo in Mozambique. This 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 more than 2500 historical shipwrecks that make up the bulk of South Africa's underwater cultural heritage are a thus huge, cosmopolitan, repository of information about mainly 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.

6.3 Maritime History of East London

Like other river mouths and bays along South Africa's east coast, the Buffalo River was first used as a harbour during the frontier wars of the 19th century when there was a need for temporary harbours and anchorages at which to land troops and supplies close to the theatres of operation (Ingpen 1979). Although efforts had begun as early as 1825 to develop a harbour at the Kowie River mouth (Port Alfred) the river was found to be too shallow and liable to silting, and the attention of the military turned further east (Turpin 1983; https://www.sahistory.org.za/places/east-london).

The first investigation of the potential of the Buffalo River mouth as a port took place in 1834 when an expedition under Lieutenant-Colonel Harry Smith was despatched by the Governor of the Cape, Sir Benjamin D'Urban for that purpose. Smith reported that the "mouth formed a deep lagoon which would provide good shelter to small coasting vessels once they had crossed the shallow sand-bar". D'Urban appointed Captain John Bailie to survey the area properly in January 1836 and based on his report, the local coasting brig *Knysna* landed government supplies at the Buffalo River for the troops at Fort Peddie in November of that year (http://www.eastlondon-labyrinth.com/; https://www.sahistory.org.za/places/east-london).

Eight years later HMS *Thunderbolt* again surveyed the Buffalo River mouth and reported that "the discovery of this port in the immediate vicinity of the enemy is a circumstance of considerable moment in the operation of the present campaign … and we trust that no time will be lost in taking advantage of this opening". The landing "was described as 'easy', and the anchorage as 'excellent, free from rocks… with the further recommendation of affording every facility for putting to sea in the event of being caught on a lee shore'" (Ingpen 1979: 7).

In April 1847, at the height of the War of the Axe, Lieutenant-General George Berkeley and a contingent of troops arrived at the Buffalo River mouth with instructions to establish a port for the new colony of British Kaffraria. Within days they began to survey a site for a village on the west bank of the river. This settlement on the west bank, known at the time as Port Rex, was to form the nucleus of the town of East London (https://en.wikipedia.org/wiki/East_London,_Eastern_Cape) (**Figure 6**). The first recorded export of local goods from the Buffalo River took place in July 1847 when the coaster *Conch*, successfully negotiated the bar (http://www.eastlondon-labyrinth.com/).

Figure 6: Detail of a map of British Kaffraria dated 1848 showing the Buffalo river mouth and the nascent settlement on the west bank of the river (Source: http://www.digitalcollections.lib.uct.ac.za/collection/islandora-19528)

In January 1848, Sir Harry Smith, now governor of the Cape, annexed the Buffalo River mouth and territory in a radius of 3 km around it to the Cape Colony, proclaimed it a port and named it East London (https://www.sahistory.org.za/places/east-london). Trade soon developed between East London and other ports, including those elsewhere on the South African coast, and traffic increased after 1857 following the settlement of a large group of former soldiers of the British German Legion in a new village (Panmure) on the east bank of the river (Ingpen and Pabst 1985; Wynn Jones 2005) (**Plate 3**).

Plate 3: The arrival of the British German Legion at East London, February 1857. Painting by C C Henkel (Source: http://samilitaryhistory.org/vol133ej.html)

As with many ports at river mouths there was always an element of risk involved in entering and leaving the river and in the case of the Buffalo River, only vessels smaller than 80 tons could enter the river through a narrow gap in the bar. Larger vessels were forced to anchor in the roadstead offshore and any goods and people were transported to and fro in lighters. The first maritime casualty at of the Buffalo River was the coasting schooner, *Ghika* which was wrecked in 1847 (http://www.eastlondon-labyrinth.com/). Steam propelled vessels were at less risk of grounding when entering the river, but it wasn't until June 1872 that the German steamer *Bismarck* made the first successful entry into the river by a steamship (Ingpen 1979).

The construction of what was to become the formal harbour that now exists in the Buffalo River began in 1872 (Ingpen and Pabst 1985; https://www.sahistory.org.za/places/east-london). Despite these harbour works, which continued until well into the 20th century, the Buffalo River claimed a large number of shipping casualties and bears out Denfield's statement that "wrecks have always been a strong feature of the East London seascape" (Denfield 1965:56)

6.3.1 Shipwrecks of East London

The Cable Route Study for the IOX project (Alcatel Submarine Networks 2018) and draft Scoping Report (ERM Southern Africa 2018) refer to a search of the United Kingdom Hydrographic Office (UKHO) wreck database which flagged the presence of six recorded wrecks within 50 km of the proposed IOX route in South African waters and on its continental shelf (**Figure 7**). This list comprises two pilot tugs, a dredger, two yachts and one unidentified vessel, but no further detail about any these wrecks – name, date or position - is provided by either report.

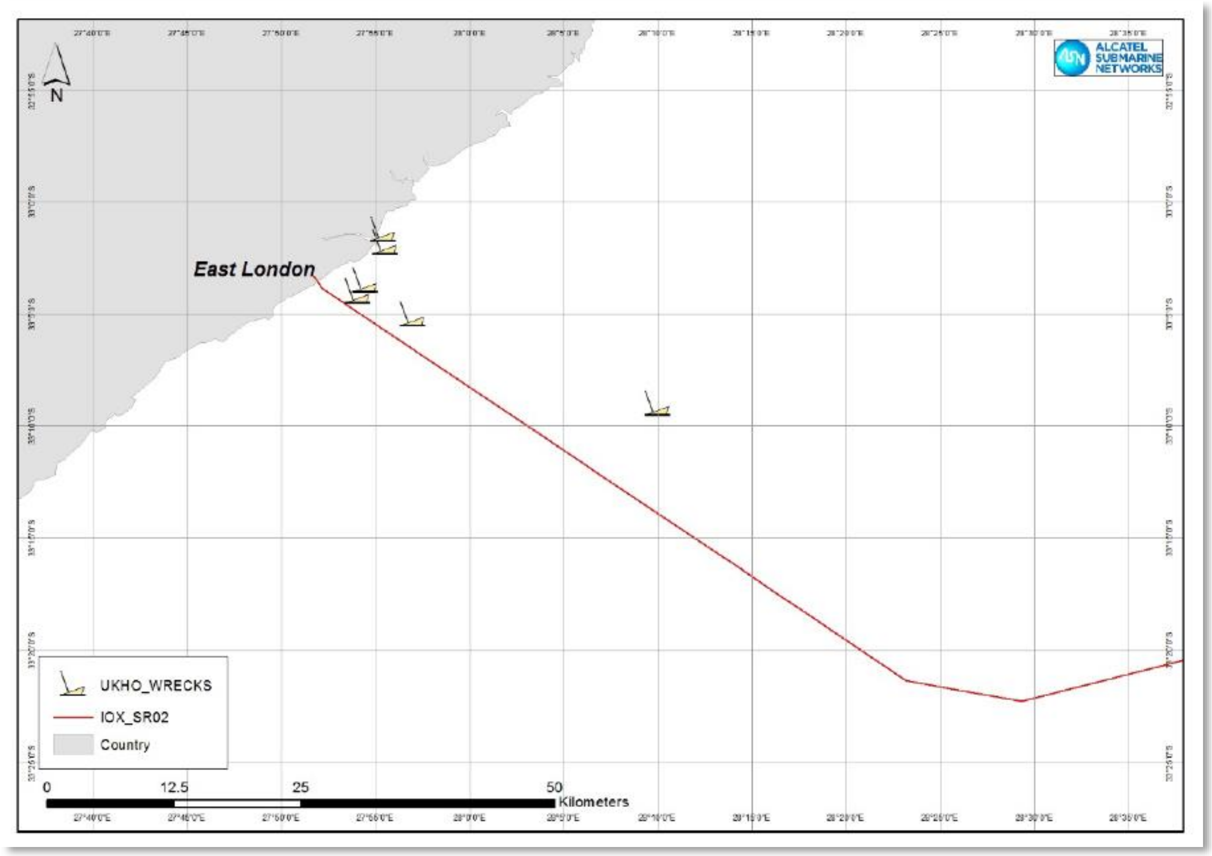

Figure 7: Wrecks on the South African shelf identified from UKHO records (source: Alcatel Submarine Networks (2018) IOX Cable Route Study)

Local records consulted for this study – the South African Heritage Resources Information System (SAHRIS) (http://www.sahra.org.za/sahris), a shipwreck database compiled by Fedde Van den Bosch (2014) and principally the shipwreck database maintained by ACO Associates – contain records of 138 wrecks within 10 km of the proposed cable route alignment inside the outer limit of the contiguous zone (**Figure 8**). There are a further 13 wrecks recorded in the East London area for which it has been impossible to find any indication of position. These wrecks could, therefore, be present in the 10 km buffer zone around the cable route. A gazetteer of these 151 wrecks is provided in **Appendix A**.

The bulk of these wrecks occurred within or close to the Buffalo River, or to the north of the mouth (**Figure 9**). Although the accurate positions of most of these wrecks is not known, based on the descriptions of these casualties in the historical record it is safe to assume that they are nevertheless sufficiently distant from the cable route and landfall to be discounted as potential risks to the project.

It is also important to be aware that there is possibly some confusion in the records with regard to wrecks close to East London's lighthouse: this because East London has had two lighthouses, both on the west bank, but roughly 2 km apart. The Hood Point lighthouse, which is still operational, is located between the river mouth and the cable route landfall (see **Plate 4**). It was constructed in 1895 to replace the earlier and original Buffalo River light at Castle Point on the western bank of the river. The Castle Point lighthouse (**Plate 5**) was erected in 1857, downgraded to a fixed red harbour light after the Hood Point light was commissioned in 1895 and finally demolished in 1929 (Denfield 1965). It is therefore likely that between 1857 and 1895 the eight references to vessels being wrecked near the lighthouse relate to Castle Point and that these sites fall into the category of wrecks near the river mouth described above that are a low potential risk to the cable route. These wrecks are the *Lunaria* (1861), *Theresa* (1861), *Antonie* (1864), *Sharp* (1872), *Compagne* (1874), *Countess of Dudley* (1877) *Clansman* (1882) and *Johan* (1882).

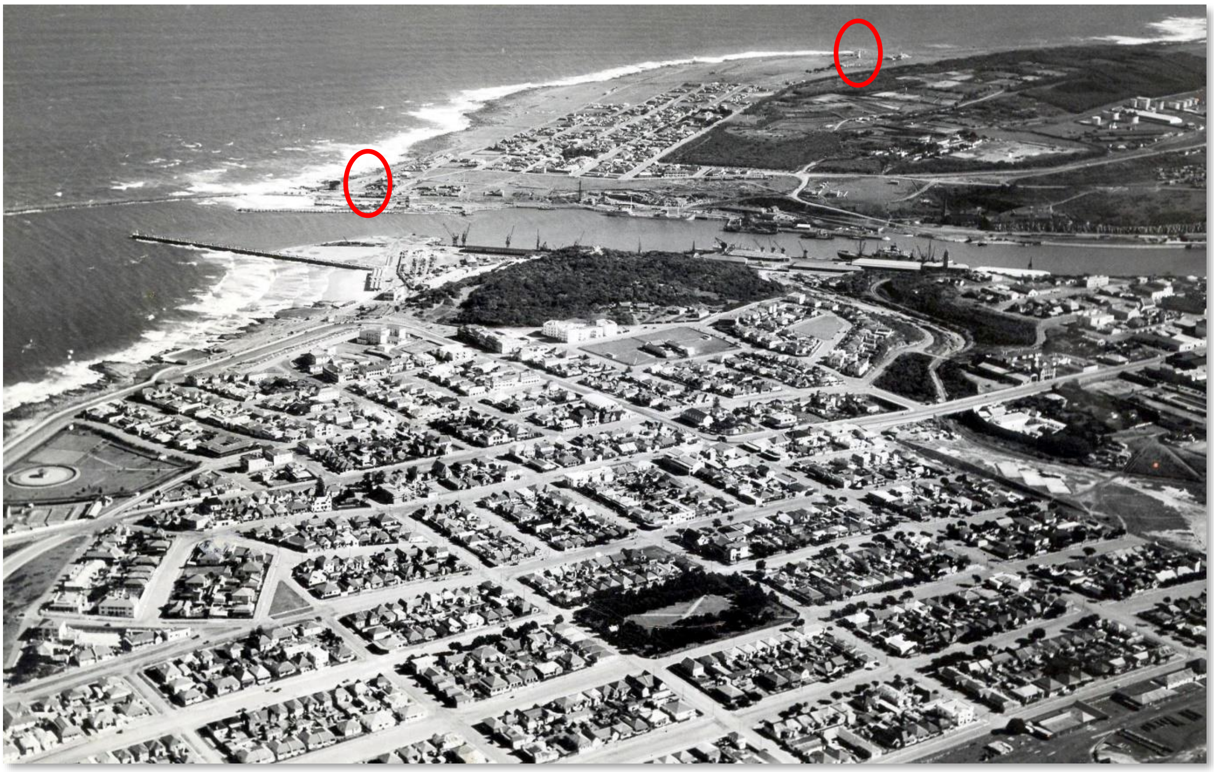

Plate 4: East London in 1935. The former position of the Castle Point lighthouse is shown circled on left and Hood Point lighthouse is circled on the top right. The cable landfall is beyond to top right corner of the photo.

The three wrecks described as being in the vicinity of a lighthouse after 1929 (Unknown 39 (no date), *Koodoo* (1960) and *Mary* (1960)) will be in the proximity of Hood Point and being that much closer to the cable route and landfall have a greater potential to be a risk. The *Cingalese* (1906) was grounded at Hood Point but refloated before being broken up in the harbour. This vessel was also the only casualty associated with a lighthouse during the period when both lights were operational, but the fact that she was refloated removes her from the equation.

The records indicate that 14 of the vessels listed as East London casualties grounded (see **Appendix A**). The recording of a vessel as having grounded usually implies that it was subsequently refloated and did not become a wreck. It is known that five of the grounded vessels in the gazetteer were refloated – the *Kaffir* (1890), *Cingalese* (1906), *Galway Castle* (1918), *Kanagawa Maru* (1924) and *Carlow Castle* (1926). It is not clear from the records,

Figure 8: Cable route, buffered by 10 km on either side, within South Africa's territorial waters (12 nautical miles) and contiguous zone (24 nautical miles) showing the clustering of wrecks north of the landfall at the Buffalo River mouth (Source: SAHRA and ACO databases)

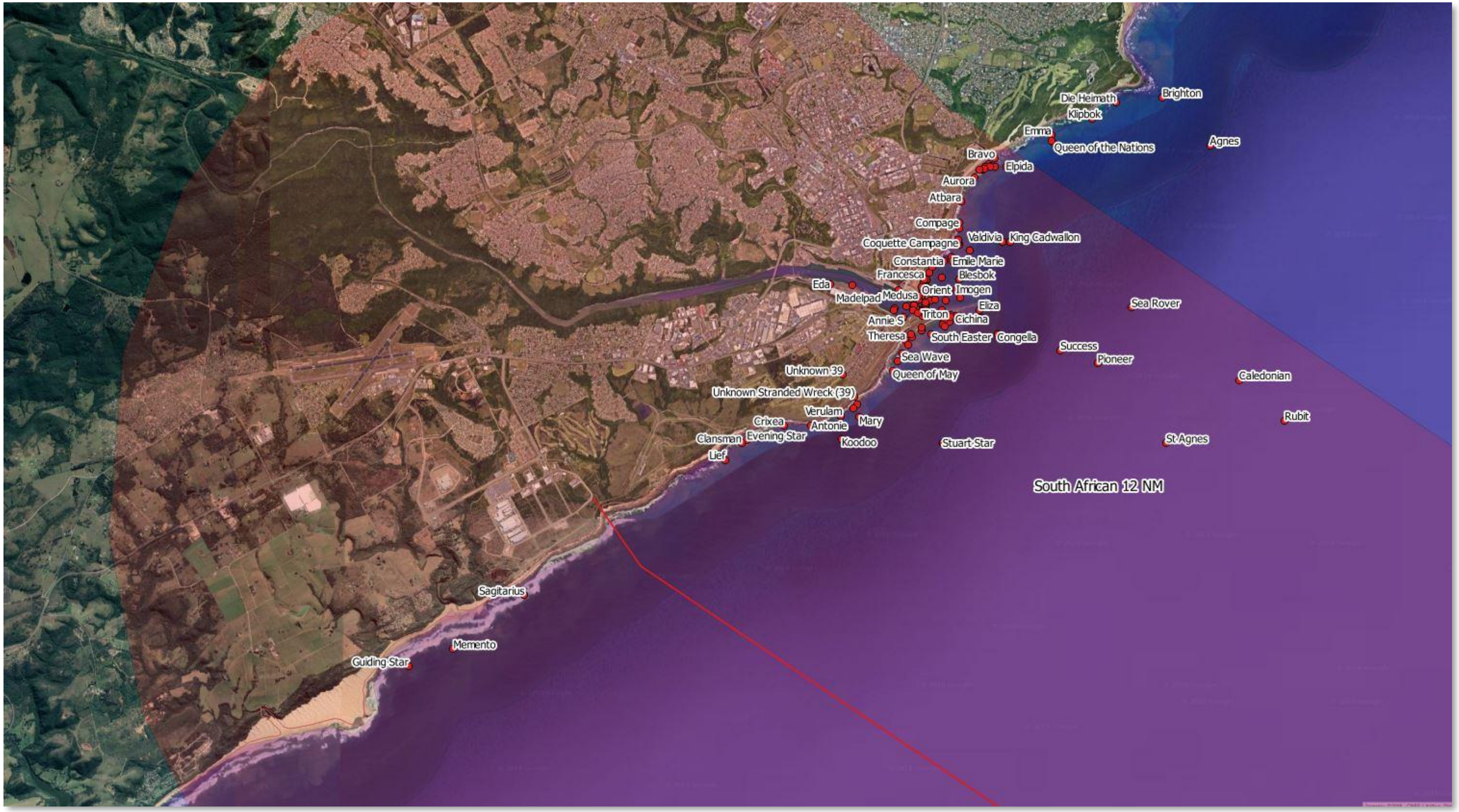

Figure 9: Cable route and landfall showing clustering of wrecks to the north-east around the Buffalo River mouth (Source: SAHRA and ACO databases)

however, what the fate of the remaining nine vessels was and, as a precaution, the remains of these vessels should be assumed to be present on the seabed within the buffer zone.

Plate 5: Entrance to the Buffalo River in 1882 from the west bank showing the Castle Point lighthouse between the breakwater (right) and the western training wall (centre left) (Source Denfield 1965: 16)

A last general point to make is that 13 wrecks in the buffer zone are currently less than 60 years of age and are thus not protected by the NHRA as heritage resources. That being said, these wrecks are nevertheless a potential risk to the project – to plant and to the cable – and for that reason have been retained in the overall count of sites that may lie within the buffer zone around the cable route.

6.3.2 Shipwrecks near the landfall

There are no recorded wrecks in the bay within which the cable route will make its landfall. The nearest recorded sites are the *Sagittarius* and the *Lief* both more than 2 km distant, to the south and north of the cable route and landfall respectively (**Figure 10**). The *Sagittarius* was a motor vessel wrecked in Leach Bay in 2002, and as such is not protected under the terms of the NHRA. The *Lief* was a Norwegian wooden sailing barque which ran aground at Shelly Beach in 1896 and is one of those vessels listed as grounded in the various sources consulted.

6.3.3 Geophysical Data

The resolution of the processed multibeam data was not ideal for archaeological review due to the grid cell sizes used to process the data, but it was possible to review it in the QGIS (**Figure 11**).

The ELETTRA/GeoTeam survey report (2018) indicates that no evidence of wrecks was observed on in the bathymetric and sidescan sonar data within the survey corridor. The archaeological review of the same data confirms that no upstanding, visible wreck was noted in the data (**Figure 12**).

6.3.4 Shipwrecks Offshore

Further offshore, within the EEZ and on South Africa's continental shelf, there are a number of shipping casualties related to German and Italian U-boat activity in the southern Indian Ocean during World War II (see **Figure 13**). Based on the co-ordinates for the sinking of these vessels recorded by the U-boats concerned which are available from https://uboat.net/, none of these casualties are less than 20 km from the proposed route of the cable. The nearest wrecks to the route are the *City of Joannesburg* (1942) which is approximately 23 km south of the route and the *John Drayton* (1943) which is roughly 50 km north of the cable route. It is extremely unlikely, therefore, that the cable route in its current alignment will encounter any of the recorded World War II casualties but their presence and their particular sensitivity as possible war graves must be borne in mind should the alignment of the route be changed.

Figure 10: Cable landfall showing the approximate positions of the closest wrecks (Source SAHRA and ACO databases).

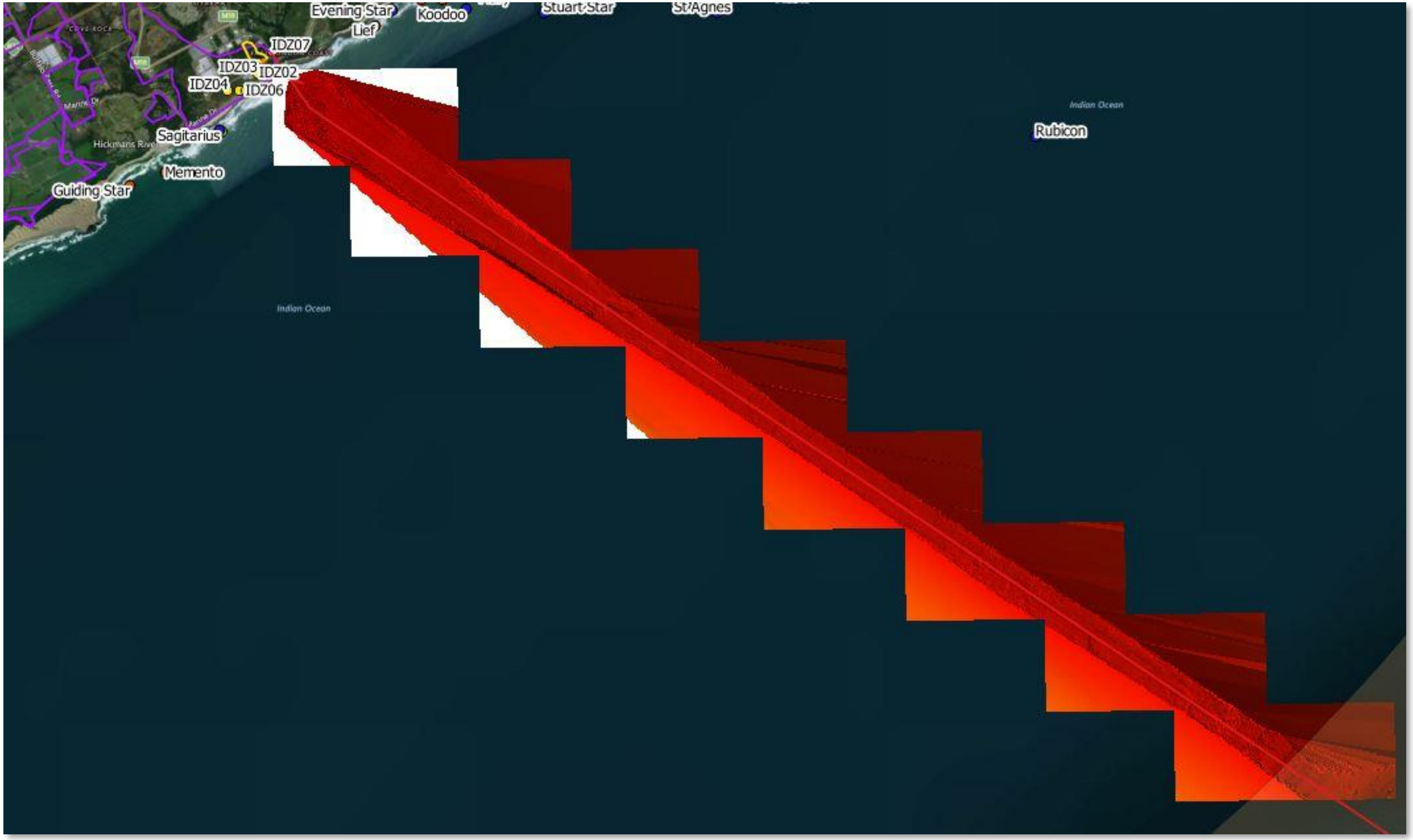

Figure 11: Multibeam bathymetric data for the IOX cable route collected in the contiguous zone and territorial waters.

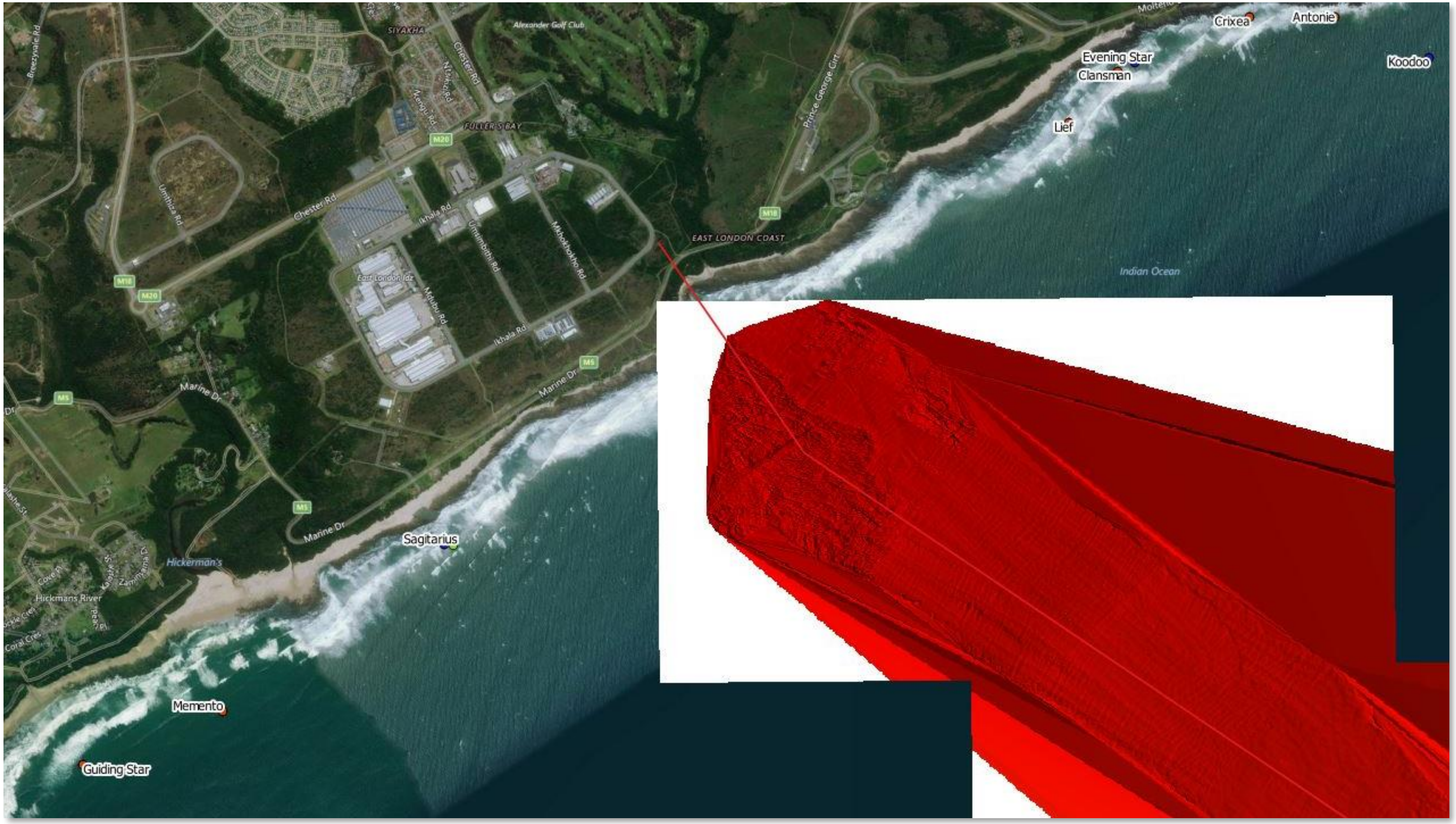

Figure 12: Overlay of inshore multibeam data with recorded shipwrecks in the vicinity of the landfall. None of the known wrecks are located within the survey corridor and no wreck was discernible in the data.

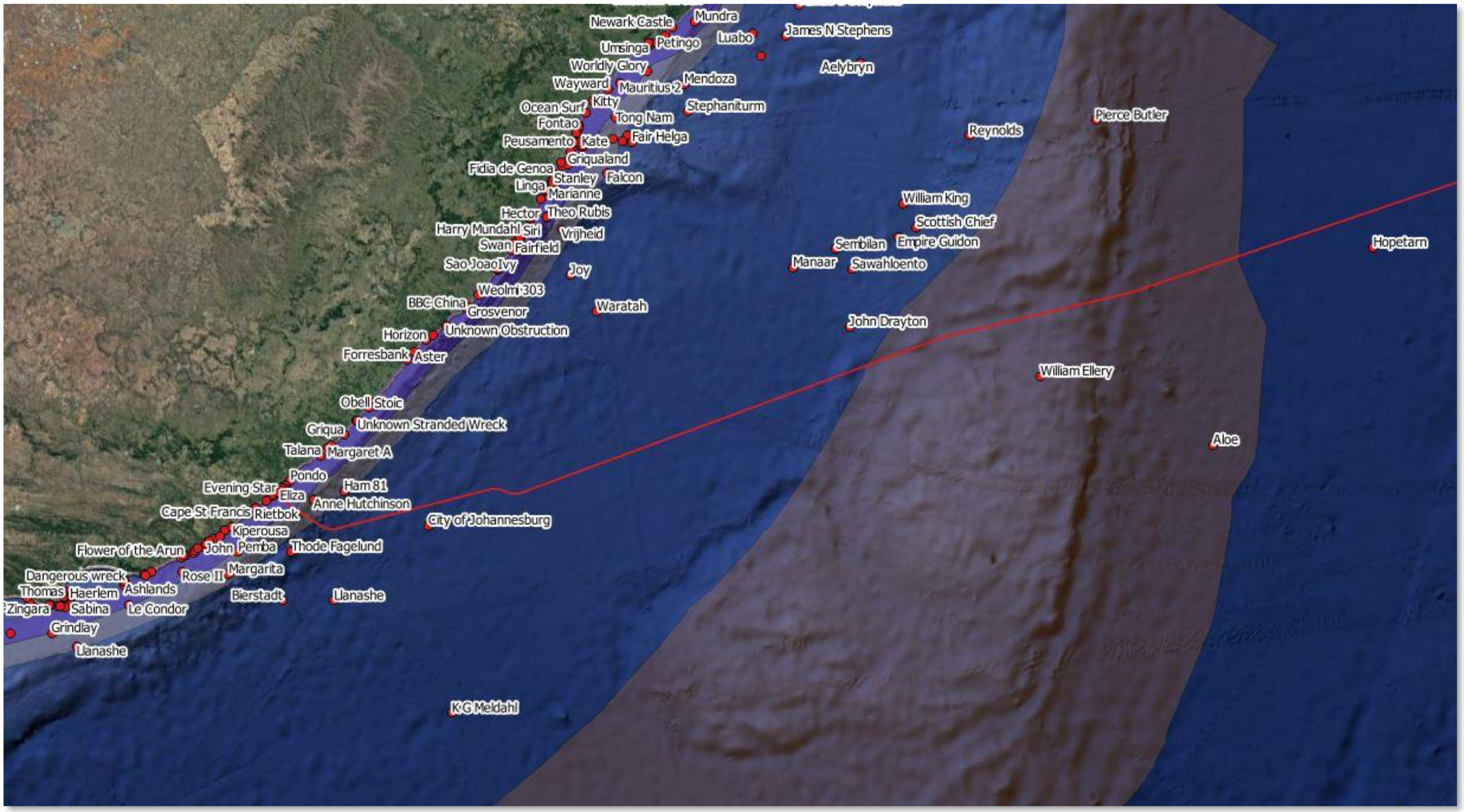

Figure 13: Map showing the location of deepwater wrecks of primarilly World War II vintage in relaton to the proposed cable route in the EEZ and on ther continental shelf. The continental shelf is the area coloured brown at centre left on the image (Source: ACO database)

7 Impact Assessment

The risks to heritage sites are a result of physical penetration of the surface during excavation on land or by trench ploughing and burial of the subsea cable offshore.

7.1 Submerged Prehistory

Although no geophysical data for the seabed adjacent to East London and within the buffer zone were available for this assessment, the major rivers along the East Coast are likely to have submerged palaeo-channels extending offshore. Where archaeological material and palaeoenvironmental evidence have survived post-glacial marine transgressions, there is the potential for this material to be within or associated with now submerged palaeo-channels.

The distance of the inshore cable route alignment from the Buffalo River mouth and any associated palaeo-channel and the small footprint of the seabed intervention that will result from the laying of the proposed cable make the potential for any interaction with or impact on submerged prehistoric archaeological material unlikely.

The potential impacts of the laying of the IOX fibre optic cable on submerged prehistoric archaeological resources can be summarised as follows:

Potential impact on submerged prehistoric archaeology	
Nature of impact	Damage to, or destruction of submerged prehistoric archaeological resources
Extent of impact	Localized
Duration of impact	Permanent
Intensity of impact	Potentially high if submerged prehistoric material is intersected by project activities, but the location and size of the footprint of the seabed interventions mean that impacts on submerged prehistoric archaeology are unlikely
Probability of occurrence	Low
Degree to which impact can be reversed	Irreversible
Irreplaceability of resources	High – submerged prehistoric archaeological resources are non-renewable and cannot be replaced if damaged or destroyed
Cumulative impact prior to mitigation	Low
Significance of impact pre-mitigation	Low
Degree of mitigation possible	Low
Proposed mitigation	None – the nature of the seabed interventions

	(ploughing by ROV) mean that is highly unlikely that any interaction with submerged prehistoric archaeology will be recognised and can be mitigated.
Cumulative impact post mitigation	Low
Significance after mitigation	N/A – no mitigation required

7.2 Shipwrecks

Although there are large numbers of historical wrecks near to the Buffalo River, the closest recorded wreck to the cable route is more than 2 km distant. The review of the multibeam data revealed no upstanding, visible wreck, which corresponds with the results of the desk-based work. Furthermore, for reasons of risk to plant and the cable, the route alignment will always be adjusted to avoid wrecks. Together this makes the potential for any interaction with or impact on historical wrecks <u>unlikely</u>.

Potential impact on historical shipwrecks	
Nature of impact	Damage to, or destruction of historical shipwrecks
Extent of impact	Localized
Duration of impact	Permanent
Intensity of impact	Low
Probability of occurrence	Improbable
Degree to which impact can be reversed	Irreversible
Irreplaceability of resources	High – historical shipwrecks are non-renewable and cannot be replaced if damaged or destroyed
Cumulative impact prior to mitigation	Low
Significance of impact pre-mitigation	Low
Degree of mitigation possible	High
Proposed mitigation	Known Wrecks – None, alignment of the cable route means that there will be no interaction with known historical shipwrecks in the vicinity
	Unknown/Unrecorded Wrecks – Should shipwreck material be encountered during cable laying, all work must cease until the archaeologist and SAHRA, the material has been assessed and a decision has been made about

	how to proceed.
Cumulative impact post mitigation	Low
Significance after mitigation	Known Wrecks – N/A Unknown/Unrecorded Wrecks – Low

8 Mitigation

No mitigation is required or proposed in respect of potential submerged prehistoric archaeology and known shipwrecks in the study area.

In the event a previously unknown or unrecorded shipwreck is encountered during the installation of the cable, the project archaeologist and SAHRA must be notified immediately. If the wreck will be impacted by the cable laying, all work must cease until the archaeologist and SAHRA have assessed the significance of the site and a decision has been taken as to how to deal with it.

9 Conclusion

The maritime elements of the proposed IOX fibre optic cable are highly unlikely to have any impact on known or unknown maritime and underwater cultural heritage resources and are considered archaeologically acceptable.

The impact of the project on any previously unknown shipwreck or other maritime archaeological material encountered during the work can be dealt with through the implementation of the mitigation measure proposed in this report.

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10.1 Online Resources

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Nahoon Foot Prints (Accessed online on 28 September 2018) http://www.bctourism.co.za/itemdetail.php?id=508&category=18

South African Heritage Resources Information System (Accessed online on 18 September 2018) http://www.sahra.org.za/sahris

The New Labyrinth of East London Lore (Accessed online on 21 September 2018) http://www.eastlondon-labyrinth.com/

U-boat.net (Accessed online on 1 October 2018) https://uboat.net/

What kind of projects does the AIMURE undertake? (Accessed online on 27 September 2018) http://www.aimure.org/index.php/aimure-projects

Appendix A: Gazetteer of Shipwreck within 10 km Buffer Zone

Ship Name	Area	Place	EventType	Ship Type	Nationality	Date	Notes
Albert Edward, Prince of Wales	East London	East London	Grounded			1882/01/23	Grounded according to van der Bosch
Albert Juhl	Orient Beach		Wrecked	3 Masted Schooner		1876/02/04	No lives lost
Alfred	Buffalo River	Buffalo River Mouth (near)	Wrecked			1866/06/15	No lives lost
Alma	Gonubie	Gonubie River Mouth (near?)	Wrecked	Schooner	German	1878/10/26	Cable parted in a (south) westerly gale. Went ashore and became a total wreck. No lives lost
Amatola	Buffalo River	Blinders Rock in river mouth	Wrecked	Schooner		1852/05/02	The Amatola was the first casualty at the Buffalo River, and was wrecked trying to enter the river No lives lost
Andes						1901	
Andries				Barque		1901/05/01	Towed into East London Harbour
Ann Staniland	Buffalo River	East Bank	Wrecked	Schooner	British	1876/11/28	The tug London tried to bring this vessel into the river when it was closed to shipping. She swerved over and became wrecked on the Eastern Wall. The vessel was under arrest for debt, and her loss cheated her creditors. She may have been a Brig according to one source.
Anna				Surf Boat		1868/08/27	
Annie			Broken up			1939	
Annie S	Buffalo River	West Bank (opposite old Customs House)	Wrecked	Brigantine	British	1875/12/11	Struck the bar opposite the Old Customs House while being towed into the river by the tug Buffalo. She drifted to the West Wall where she became a total wreck. Denfield (1965) refers to her as a coasting schooner, while another source refers to her as a coasting steamer (?).
Antonie	Lighthouse	100 metres west of	Wrecked	Brig	German	1864/10/18	Cables parted in a south-easterly gale. No lives lost. Other dates listed are: 10/21/1864 and 10/24/1864.
Aqua	Buffalo River	Buffalo River				1901/10/16	
Atbara	Marina Beach	Beach Hotel (below & 150m offshore)	Wrecked	Barque	Norwegian	1902/06/10	On the afternoon of 10 June 1902 a ferocious south-easterly gale descended on the East London roadstead and three sailing vessels were torn from their anchorage. They were the wooden barques Aurora, and Elise Linck, and the iron barque Atbara. The former two were beached on the bight opposite the Blind River, whilst the Atbara grounded on the rocks below the Beach Hotel. Although the rocket brigade arrived to help the Atbara who was in the most trouble, they were not able to get a line across and the ship was torn apart and 11 men lost. Ex Thomas Stowe. There is not much left of the wreck site as it was blasted in the past, but its cargo of cement barrels have made an interesting artificial reef.

Aurora	East Beach	Blind River Mouth	Wrecked	Barque	Swedish	1902/06/10	On the afternoon of 10 June 1902 a ferocious south-easterly gale descended on the East London roadstead and three sailing vessels were torn from their anchorage. They were the wooden barques Aurora, and Elise Linck, and the iron barque Atbara. The former two were beached on the bight opposite the Blind River, whilst the Atbara grounded on the rocks below the Beach Hotel. Although the rocket brigade arrived to help the Atbara who was in the most trouble, they were not able to get a line across and the ship was torn apart and 11 men lost. At about 1.30 am three men from the Elise Linck made it ashore with a rope and the rest of the crew were rescued without loss of life. At 6 am as the gale moderated somewhat a man from the Aurora managed to get a line ashore and the her crew was also rescued. No lives lost. The Aurora lies 50 m east of the Elise Linck.
Batavier	East London	East London				1876	
Bjorviken	Buffalo River	Mouth / Bar	Condemned	Barque	Norwegian	1893/07/30	Struck the Bar and subsequently condemned. No lives lost.
Blesbok	Buffalo River						
Blesbok	East London	East London	Wrecked	Dredger	South African	26/01/1971	Grounded and lost. Navypos describes the wreck as follows: (PA) BLESBOK Dredger Tonnage 3121 gross Length 316ft beam 54ft draught 19ft Aground and abandoned 26 1 1971 (Lloyds Weekly Volume 203 Pages 185 231 & 437) It is reported that this wreck will be left "as lying".
Bonanza	Orient Beach	South entrance of harbour ?	Wrecked	Barque	American	1894/12/22	Vessel lost steerage way while entering the river, and after becoming unmanageable took ground on the bar shoals.
Bravo	East Beach	East Beach	Wrecked			1912	
Caledonian	Buffalo River	Buffalo River	Lost	Steam Tug	British	1905/10/10	Heavy flood coming down the Buffalo River opened the bar and swept the Caledonian and its caretaker out to sea. Neither heard of again. Also swept a coal hulk from its moorings and wrecked it on the West Bank.
Campyne	East London	East London				1874	
Carl zu den Drei Greiffen	Buffalo River	West Bank (opposite Cemetery)	Wrecked	Brig	German	1875/10/16	Lost in a south easterly wind when her anchors dragged. No lives lost. Another source lists her location as Orient Beach.
Carlow Castle	Buffalo River	East London Harbour	Grounded *	Iron Steamship	British	1926/03/12	Vessel became unmanagable due to a strong easterly wind and flood tide. Struck a bank of soft mud in the river bed, and fouled a mooring buoy. No damage apparent.
Carrie Wyman	Buffalo River	East Bank (100 yards E of river)	Wrecked	Barque	Bahaman/B rit?	1886/08/14	Vessel bound for East London and Port Elizabeth, and lost when cables parted. Came ashore 100 yards east of the Eastern Training Wall at the mouth of the Buffalo River. No lives lost. Vessel may have been American or British. The salvaged cargo was sold for 1600 pounds.
Castor	Buffalo River	Buffalo River	Grounded?	Man-O-War	British	1851/04/03	This vessel was not wrecked is SA waters. Possibly grounded? Sold and broken up in 1902 in Woolwich - see http://www.pbenyon.plus.com/18-1900/C/00866.html and https://en.wikipedia.org/wiki/HMS_Castor_(1832)
Cichina	East London	East London	Unknown			1873	

Cingalese	Hood Point	Lighthouse (grounded at)	Broken up			1906/08/18	Grounded and damaged. Towed to East London and broken up.
City of Oxford	East London	East London	Unknown	Motor Vessel	British	1974	May have been the vessel built/acquired by the Ellerman Lines in 1948. Built by John Brown & Co. of Clydebank.
Clansman	Lighthouse	1.2 km west of	Wrecked	Brigantine / Barque	British	1882/05/31	Lost in a south-easterly gale when her cables parted. Went ashore on the rocks 3/4 mile west of the lighthouse / 1 mile west of the Buffalo River. Lies near the Dauntless (1833). According to the Gov. Gazette the vessel was registered in Banff, and had arrived in East London from Cardiff with a cargo of coal on 14 April.
Columba	East London	East London	Wrecked	Barque	Russian	1880/11/05	Cables parted during a south-easterly gale. No lives lost.
Compage	Esplanade	Esplanade Rocks (1ml east of lighthouse)	Wrecked	Schooner	British	1874/12/05	Lost in a south-easterly gale. South-westerly according to Van der Bosch. No lives lost. Lies 1 mile east of the lighthouse.
Concordia	Buffalo River	Buffalo River	Condemned	Barque	Swedish	1895/12/16	Struck the bar while being towed up the river. Later condemned.
Congella	Outer Anchorage	Outer Anchorage	Wrecked		British	1903/09/08	Steamship with an engine capacity of 180hp.
Constantia	Esplanade	Esplanade Rocks/800m off Buffalo R Mouth	Wrecked	Barque	British	1868/07/24	Lost in a south easterly gale after cables parted. Lies near the Crusader and Nundeeps (1868).
Coquette Campagne	Esplanade	Esplanade Rocks	Wrecked	Schooner		1874/12/05	Lies a little east of the steamship Quanza (1872), about 3/4 mile east of East London. Anchors dragged in a south easterly gale. No lives lost.
Countess of Dudley	Orient Beach	1/4 mile from lighthouse	Wrecked	Brig	Australian	1877/08/23	Collided with the Synriote when cables parted in a light breeze Wrecked ¼ mile from the lighthouse. No lives lost.
Crixea	Buffalo River	West Bank (west of lighthouse)	Wrecked	Barque	British	1872/11/27	Went ashore on the West Bank in a south easterly gale when her cables parted. No lives lost. Bell at EL Museum
Crusader	Esplanade	Esplanade Rocks	Wrecked	Barque		1868/08/29	Lies near the Constantia and Nundeeps (1868). Lost in a south easterly gale. No lives lost.
Dauntless	Buffalo River	West Bank (near / opposite Cemetery)	Wrecked	Ship	American	1883/09/28	Wrecked in south-easterly gale 1/2 mile west of the Buffalo River. After he cables parted. Crew of 22 landed by means of a rocket apparatus. No lives lost Lies close to the Clansman (1882)
Deutschland	East London	East London	Unknown			1876	
Early Morn	East London	East London	Unknown			1863/02/20	
Eda	East London	East London	Condemned			1904/06/22	Grounded and then condemned at East London. Date was 1906 according to Jobling.
Elaine	Buffalo River	East side of	Wrecked	Iron Brig / Barque	British	1872/05/26	Had partly discharged its cargo when its cables parted at 10 am on Sunday 26 May, and the vessel was driven ashore and wrecked in a osuth-easterly gale. Alternate sources suggest that it sprang a leak. Six other vessels wrecked at the same time.

Elise	Buffalo River	Buffalo River	Wrecked	Barque	German	1878/02/16	Lost in a southerly gale after cables parted. Went ashore at night. No lives lost
Elise Linck	East Beach	Blind River Mouth	Wrecked	Barque	German	1902/06/10	On the afternoon of 10 June 1902 a ferocious south-easterly gale descended on the East London roadstead and three sailing vessels were torn from their anchorage. They were the wooden barques Aurora, and Elise Linck, and the iron barque Atbara. The former two were beached on the bight opposite the Blind River, whilst the Atbara grounded on the rocks below the Beach Hotel. Although the rocket brigade arrived to help the atbara who was in the most trouble, they were not able to get a line across and the ship was torn apart and 11 men lost. At about 1.30 am three men from the Elise Linck made it ashore with a rope and the rest of the crew were rescued without loss of life. At 6 am as the gale moderated somewhat a man from the Aurora managed to get a line ashore and the her crew was also rescued. The Elise Linck lies 50 m west of the Aurora.
Eliza	Buffalo River	Roadstead	Wrecked	Brig		1880/08/04	Vessel arrived from Cardiff with a cargo of coals and was unloading them in the roadstead when she caught alight. No lives lost.
Elizabeth and Mary	Buffalo River	Buffalo River Mouth	Grounded?	Schooner		1861/10/17	Grounded
Ellen Browne	Orient Beach	Orient Beach	Wrecked	Barque	German	1877/10/27	Cables parted in a south-easterly gale. Lies near the Countess of Dudley (1877). No lives lost.
Elpida	Buffalo River	1/1.5 mile NE/E of Buffalo River ?	Wrecked	Barque	Norwegian	1893/09/29	Wrecked in a severe south-easterly gale. The crew were rescued by rocket apparatus. The entire cargo was still aboard, except for a single lighter load that had been landed. On 7 October there is an indication that the salvage of the cargo was proceeding. The vessel was carrying no passengers. No lives lost.
Elsie	East London	East London	Unknown	Barque		1878/02/16	
Elsie May	Buffalo River	1.5 miles east of	Wrecked	Anchor Boat	British	1883/10/28	According to Marsh was wrecked about 200 yards east of the mouth of the Buffalo River, on the same spot as the Schmayl was wrecked four days before. He also suggests her tonnage was 85 tons. Lost after her cables parted in a gale. No lives lost.
Emile Marie	East London	Just north-east of	Wrecked	Barque		1874/12/07	Wrecked in a south-westerly gale. No lives lost. Lies close to the Jane Davie (1872).
Emma	Buffalo River	Buffalo River Mouth (east bank)	Wrecked	Brig	American	1872/05/26	Wrecked after her cables parted at noon on Sunday 26 May, during a south easterly gale. Came ashore on the eastern shore of the river. Six other vessels also wrecked, and the roadstead cleared, but only 2 lives lost between them. Cargo was only partly discharged when vessel lost.
Euterpe	East Beach	East Beach / 2 miles east of EL ?	Wrecked	Brig	British	1876/11	Lost in a south-westerly gale after colliding with the Stirling. No lives lost.
Evening Star	Shelly Beach	2 miles west of	Grounded	Fishing Vessel	British / SA	1909/01/02	Left East London for a fishing trip and stranded about an hour later. No lives lost.
F Schermbrucker	East London	Quay in harbour	Broken Up	Tug	South African	1978	Broken up by Chicks Scrap Metal - http://www.clydeships.co.uk/view.php?ref=11373
Fingoe	East Beach	Blind River Mouth	Wrecked	Barque	South African	1874/07/19	Wrecked in a gale. No lives lost. Had previously run aground in the Great Gale of September 1869 in Algoa Bay.
Florie	East Beach	Blind River	Wrecked	Wooden Sailing	British	1874/12/06	Lost in a south westerly gale. One life lost. May be same vessel as Flora above - Marsh.

				Vessel			
Foam	Buffalo River	East Bank	Wrecked	Schooner	British	1851/09/13	Cables parted in a south easterly (westerly according to vd Bosch) swell, and strong easterly wind. No lives lost.
Francesca	Orient Beach	Orient Beach (off)	Wrecked	Barque	Italian	1882/05/12	Vessel Bound from Akyab to the English Channel via East London for orders. She was carrying 1000 tons (10 700 bags) of rice when she sprang a leak and began taking on water fast. She arrived in East London on 11 May in distress and looking for shelter, but the master found it impossible to keep her afloat and she was beached the next day, 1 mile east of the Buffalo River. Her crew were safe aboard other vessels in the bay, but the vessel became a total wreck Tonnage may have been 646 tons.
G M Tucker	Buffalo River	Old Harbour	Wrecked			1895/09/10	
Galway Castle	Orient Beach	Orient Beach	Grounded *	Mailship	British	1918/09/12	Grounded on Orient Beach after tow rope parted. About 100 men were rescued by means of the breeches buoy. The vessel remained upright, however and was successfully refloated. She had previously grounded and the entrance to the Buffalo River on 12 October 1917 when the tow cable parted. She was also refloated on that occasion. Catpained then by W B Dyer, with a crew of 225 , 66 passengers and a general cargo. She was later torpedoed and sunk by U.82 in September 1918 when only two days from Plymouth.
Gavrion	East London	East London		Motor Vessel		1974	
General Nott	East Beach	Blind River	Wrecked	Brig	British	1876/12/10	Lost in a north westerly gale. No lives lost.
Ghika	Esplanade	Esplanade Rocks	Wrecked	Schooner (Coasting)	British / SA	1847/10/17	First vessel wrecked at the Buffalo River. Anchored in the roadstead when her cables parted and driven ashore. 19 lives were lost - the Captain and 12 crew members, plus 6 lifeboatmen were killed. The same vessel was grounded but refloated after being driven ashore near the Hospital Lines in Table Bay in a north-westerly gale on 9 September 1842. There were no casualties. Four other vessels ran aground in the same storm. She was refloated on 2 October 1842. May have been owned by J Sedgwick.
Guiding Star	Cove Rock	Off	Wrecked	Barque		1879/10/08	Wrecked in a gale (Van der Bosch says grounded). No lives lost.
Hampton Court	160km west of	160km west of			British	1881/04/16	This vessel is listed in the Gov. Gazette dated 29 April - nearly two weeks after the date of her listing in the database. Could this mean she was not lost, but grounded instead? According to the Gov. Gazette (29/4) she was bound from Ibo to Marseilles via Cape Town with a cargo of sundries. She arrived in C.T. on 27/4. Registered in London.Van der Bosch suggests she was leaking, and presumably made port to be condemned.
Harriet	Buffalo River	Buffalo River Mouth	?	Schooner		1847/10/22	
Heathfield	Kayser's Beach	Three Sisters Rocks	Wrecked	Fishing Vessel		1964/01/09	Vessel grounded at the Three Sisters and broke up in heavy seas within 5 minutes. 12 crewmen managed to make it ashore, but the other 5 were drowned in the heavy surf on the rocks.
Helene	Orient Beach	East of	Grounded	Hulk (Coal)		1905/10/10	Lost at night during a storm.
Henry Douse	East London	East London	Wrecked	Brigantine	British	1867/08/13	Wrecked in a south-easterly gale. No lives lost.
Herma	East London	East London	?			1855	

Hohenzollern	East Beach	Blind River	Wrecked	Barque	German	1876/11	Lost during a south easterly gale and heavy rain squalls. One man drowned.
Hope	East London	East London	Grounded	Barque		1880/11/05	Cables parted in a south westerly gale and went ashore. No lives lost.
Huma	Orient Beach	Orient Beach	Wrecked	Schooner		1855/10/27	
Hung Mou Hao	East London	East London	Wrecked	Schooner		1855/10/27	Wrecked.
Imogen	East London	East London	Wrecked	Barque	British	1867/11/20	Lost in a south easterly gale. No lives lost. Date may be 18 November.
Itemaid of Arron	Buffalo River	West Bank	Wrecked	Sailing Vessel		1873	
Johan	West Bank	Castle Point Lighthouse	Wrecked	Barque	Swedish	1882/02/20	Cables parted in a south easterly gale and the vessel wrecked between the Training Wall and the Breakwater. About 100 tons of cargo still aboard. Date of loss may be 21 February - Marsh. Government Gazette # 1362 of 1882 (17/11/1882) - Details of vessel in years before she was wrecked. - May be the same vessel, but called the Johan Brolin. A Swedish sailing vessel of 797 tons. Captained by N F Forsberg, with a crew of 17. Registered in Soderhamn, Sewden, and owned by J Brolin & Son. No lives lost.
Kaffir	Buffalo River	Sandy spit near Western Training Wall	Grounded*	Iron Steamship	British	1890/12/07	The Captain of the Kaffir decided that he could pilot his own vessel up the navigable channel dredged in the Buffalo River whne he arrived in the roadstead on 7 December 1890. Unfortunately the vessel struck the South Breakwater and tore a hole in her side (Marsh suggests she sustained several holes in her bilge). Water rushed in and put out her fires, and the captain attempted to beach his vessel between the Breakwater and the West Wall. The vessel, however, took ground sooner than he expected and partly blocked the channel Divers were soon on the scene and succeeded in stopping the hole, but attempts to raise the ship by means of lighters and balks failed, even with the assistance of the dredger Lucy. Fortunately, the Harbour Master, Mr Tippett had just received a new set of Gwynn's pumps which he used with "miraculous effect". The vessel rose rapidly and was brought into the river. Temporary repairs were made on 12 December. Date of wrecking may be 2 December, although Marsh confirms that the date was in fact 7 December. The vessel was registered in Glasgow, and had an engine capacity of 50hp.
Kanagawa Maru	Buffalo River	Buffalo River Mouth	Grounded *	Iron Steamship	Japanese	1924/02/02	Stranded at the mouth of the Buffalo River through misinterpretation in the engine room of bridge orders when entering the port. Her port side propeller was slightly damaged, but she was later refloated. No lives lost.

King Cadwallon	Esplanade	Surf Zone	Wrecked	Freighter / Collier	British	1929/09/11	Caught fire at sea on 7 July 1929, eight days out from Durban. The crew fought the blaze for 5 days but At Lat 31.14S; Long 40.24E a fire caused by the spontaneous combustion of her cargo was discovered in No.2 hold. Although the crew fought the blaze for a number of days it was soon out of control, and the vessel was abandoned ablaze on 12 July 1929 when the ss Ardenhall arrived to take the crew off. Despite open sea cocks the vessel did not sink and floated for 41 days before she was sighted off East London. She was towed to East London by the tug Annie, but about three days after arriving, on 2 August 1929, she broke her cables during a south-easterly gale and ran aground. Was completely burned out, and by dawn the next day had broken in two. The wreck lies 300m from the Valdivia, about 250m offshore. Bell and steam whistle at EL Museum. Gross tonnage may be 5063 tons, and net tonnage was 3145. Dimensions: 400' 9" long; 52' 4" wide; 28' 3" deep. T.3 - cylinder engine (27"; 44", 73"-48") - 2500 ihp - Engine fitted to burn oil. Vessel had electric lights and a wireless. Launched by the Hong Kong and Whampoa Dock Co. Ltd., Hong Kong in 1920 as the War Piper, for the Shipping Controller of His Majesty's Government. Sold in 1920 to N E Ambatielos, Greece in July 1920, and completed as the Stathis. The owner failed to take delivery however, and reverted to the Controller (Glover Borthers, Managers). In June 1921, by order of the Admiralty Marshal the vessel was auctioned, and purchased by the King Line Ltd. Renamed King Cadwallon.
Koodoo	Hood Point	Near Lighthouse	Scuttled	Steam Pilot Tug	South African	1960/02/27	The Koodoo was built for the Union-Castle Mail S.S. Co. Ltd. as a steel twin screw steam tender for East London, official number 147697. Builders were JL Thornycroft & Co. Ltd. of southhampton (Yard No. 1029). The Koodoo's tonnage was 119 gross and 55 net, and her dimensions were 90.6 x 19.1 x 7.6 feet. She carried a 2 cylinder compound engine by her builders, which delivered 40hp (240 ihp) and 8 knots. She was launched on 3 June 1924, and completed in August that year. In 1938 she was sold by Union-Castle to the SA Railways and Harbours Administration and used as a pilot tug in East London. On 27 February 1960 she was scuttled, together with another East London tug, the Mary, near the Hood Point Lighthouse.
La Serena	Buffalo River	Buffalo River	Wrecked	Barque		1876	Struck the bar while being towed into the river by the tug Buffalo. Became a total wreck. No lives lost.
Lady Kennaway	Buffalo River	Buffalo River Mouth (below Protea Hotel)	Wrecked	Ship	British	1857/11/25	The vessel anchored in the East London roadstead on 20 November, and the work of unloading the 231 immigrants began. This took four days to complete, and the last person was brought ashore on the afternoon of the 23rd. On 25 November disaster struck the vessel when she was driven ashore in a south-easterly gale and wrecked on a sandy spit in the mouth of the Buffalo River. She had been anchored in what was considered a safe berth in 12.5 fathoms of water, but her anchor cables were worn. Moreover, they were too light and too short for a vessel of her mass, and she only had two anchors out. When her cables parted in the gale an atttempt was made to raise her sails, which resulted in her being driven onto the bar. She remained there for some months, an obstruction to vessels entering and leaving the harbour, until she was blown up to clear the passage.
Lief	Shelly Beach (1/4 mile W of Buffalo River	Shelly Beach	Grounded	Barque	Norwegian	1896/10/26	Vessel stranded after cables parted. One life lost. In 1875 (11 July) the same vessel had been abandoned as unmanagable by the same master, 20 miles west south-west of Cape St Francis. She was later found and towed to Algoa Bay by the tug Sit Frederick.

Lizzie	Buffalo River Mouth	On Bar (near Breakwater)	Wrecked	Tender / Launch	British	1885/05/14	Vessel completed in 1879 as a single screw, iron steam tender for Union S.S. Co. Ltd., for service in South Africa. She was built by Day, Summers and Co. of Southampton, and her offical number was 51648. Her tonnage was 19 gross, 14 net, and her dimensions were 52 x 12.5 x 4.9 feet. The type of engines she carried are not known, but the could produce 16hp. She arrived in Algoa Bay on 1 March 1881, and was registered in Cape Town on 12 April that year. Wrecked close to the Breakwater on the Buffalo River Bar while inbound with mails from the Norham Castle.
Lockett	Buffalo River	West Bank (300 yards west of river)	Wrecked	Barque	British	1884/01/04	Wrecked in a south-easterly wind. No lives lost.
Lord of the Isles	Buffalo River	East Bank	Wrecked	Brig		1873/10/26	Captured by the French. Then wrecked by its English crew. No lives lost.
Louise	Buffalo River	Bar	Condemned	Barque	Norwegian	1891/05/27	In a heavy sea the vessel struck the bar while being towed into the river. She was later condemned and sold on 10 July 1891. No lives lost.
Lucy	Harbour	Eastern Training Wall (end of)	Wrecked	Dredger	South African	1895/11/11	The dredger Lucy arrived in the East London roadstead on 31 May 1886 to a huge welcome. The next day, Tuesday 1 June, two lighters went alongside to lighten her before she was taken in tow by the Buffalo. No sooner had she entered the river than she went aground inside the eastern wall and could not be got off. The next day however she floated off unharmed and was brought into the river by Captain Clifford and moored alongside the wharf. The Lucy was a steam pump hopper dredger of 290 tons register, and was built in Kinderkyk, Holland by Messrs. J & K Smit. She was named after the wife of the Commisioner of Public Works, Colonel Schermbrucker, who was instrumental in having her brought out to East London. She was offically inaugurated on 17 July 1886 with a demonstration watched by thousands from the shore. For her first few months she worked in the river, but on October 28th she crossed the bar to work in from the outside, literally digging her way over the bar. On 4 June 1887 she broke though the bar with a depth of 10-12 feet at low tide. Ships could now enter the river, and the first to make use of the opportunity was the barque Wolseley. The Lucy continued to prove her worth and dredged for nine years. She was wrecked at the end of the Eastern Training Wall on 11 November 1895 after touching the wall owing to a sudden swell. She became unmanagable, and foundered because anchored with insufficient cable. No lives lost.
Lunaria	Buffalo River	West Bank (near Castle Point (?) Lighthouse)	Wrecked	Barque	British	1861/09/11	Wrecked in a south-easterly gale No lives lost.
M M Jones	Buffalo River	West Bank (in present Turning Basin)	Wrecked	Barque		1876/09	Grounded on the West Bank. Her buried reminas were uncovered in 1929 during excavations for the present turning basin.
Madelpad	Harbour	In	Wrecked			1891/09/16	
Maid of Arron	Buffalo River	West Bank	Wrecked	Sealer		1873	
Marengo	East London	East London	Wrecked	Barque	British	1876/10/19	Lost in a south easterly gale.

Marion Neil	Orient Beach	100 yards east of Buffalo River	Wrecked	Barque	British	1885/09/05	Lost after cables parted. Crew landed safely and no lives lost.
Martha	Buffalo River Mouth	East Side	Wrecked	Brig		1872/05/26	Wrecked along with six other vessel lying in the roadstead in a south easterly gale. Cables parted on the morning of Sunday 26 May, and the vessel driven ashore. Only two lives lost between all seven vessels. The Martha was still fully loaded with an inward bound cargo.
Mary	Hood Point	Near Lighthouse	Scuttled	Pilot Tug	South African	1960/02/27	Scuttled near Hood Point Lighthouse along with the tug Koodoo.
Medusa	Buffalo River	Buffalo River Mouth (East Side)	Wrecked	Barque	British	1863/11/10	Marsh suggests this vessel was lost about 15 miles west of East London, near Buffelsfontein.
Memento	Shelly Beach (near)	Cove Rock	Wrecked	Barque	British	1876/02/05	Cables parted during a south easterly gale. Date may 1875.
Mendeep	East London	East London	?	Schooner		1868/08/27	
Nant-Y-Glo	Buffalo River	East Side	Wrecked	Snow / Brig (?)	British	1872/04/26	Lost in a south easterly gale. No lives lost.
Natal Star	Buffalo River	2.4km east of River	Wrecked	Barque	British	1874/07/19	Wrecked in a gale. No lives lost.
New Blessing	Buffalo River	Rowing Clubs	Grounded			1905/10/10	The New Blessing was grounded high on river bank by the flood of 10 October 1905. She came to rest near the old rowing club houses. By the time she came to grief she may already have been a hulk. It is not clear if she was refloated.
Nundeeps	Buffalo River	Buffalo River Mouth	Wrecked	Schooner	British	1868/08/28	Lost on the rocks close to the Crusader (1868) and the Constantia (1868) in a south easterly gale. No lives lost.
Olive	East London	East London	?	Barque		1900	
Olive	East Beach	East Beach	Wrecked	Barque	British	1878/02/16	Lost during a south-easterly gale. 6 lives lost.
Oranjeland	Orient Beach	Outside Harbour (near Bowling Club)	Wrecked	Freighter	South African	1974/08/13	Ship fetched up on the rocks immediately after leaving East London harbour in a north westerly gale. She had suffered a complete power failure. No lives lost Ex Oranjeland. Lies near the Valdivia (1908) 2800 tons of the granite was salvaged by Peter Sachs and co. in 1989.
Oranjeland	Esplanade	East Beach - West of Aquarium	Wrecked	Freighter	South African	1974	The Oranjeland was wrecked off East Londons Esplanade opposite today's Regent hotel on 13/8/1974 afther leaving the harbour during a gale. She had just dropped off the crew of the Produce which had been wrecked off Aliwal Shoal in 1974. For several months attempts were made to drag her off the rocks but in early 1975 she broke her back and was abandoned. She was eventually cut to pieces leaving only the hull that could be seen lying 1m below the water at spring tide.

Orient	Orient Beach	South side of Orient beach near the quay	Wrecked	Ship (Full-Rigged)	Russian	1907/07/29	The SS Orient was a Russian vessel which called in at East London on 29th July 1907 sailing from south Australia with a crew of 21 and carrying a cargo of wheat. She ran argound that same evening on Sandy Bay (now called Orient beach). As the crowds gathered the captain decided to jettison the cargo and nearly 400 tons of wheat was thrown overboard. Two tugs Annie and Buffalo tried to pull the Orient free and stop her being washed onto nearby rocks but this was not successful. She began to take on water and started listing and that is where she was to stay. Rigs and a temporary railway track were set up to recover the remainder of the cargo. An auction was held on the beach and she was sold to WJ Elllis for 130GBP. Her remains lie visible on the beach near the quay. The Orient was built by Messrs Connell & Co. in Glasgow in 1889 and was a fully rigged steel ship of 1647 gross tons (1664 tons according to Marsh). She was 258 feet in length and 37 feet 7 inches across the beam, with a loaded draft of 21 feet. Soon after the turn of the century she was sold to Russian owners. Early on the morning of 29 July 1907 the Orient was sighted under full sail making for East London. Later she was taken in tow by the tug Buffalo and headed toward the river. As the tug entered the mouth however, the towing hawser parted and the Orient quickly drifted to within 120 yards of the shore where she grounded at high tide. The local tugs made stenuous efforts to pull her off but to no avail. She had on board 2500/2600 (?) tons of wheat bound from Melbourne to the Kaffrarian Steam Milling Company. No immediate fears for her safety were felt, and it was thought that once she had been lightened by discharging some of her cargo she could be pulled off. The next day about 400 tons of wheat was jettisoned by gangs of labourers who threw it overboard, and the vessel moved about 100 feet before grounding again. The Rocket Brigade appeared on the scene and by mid-morning the first of the 21 Finnish crewmen was dragged ashore in the breeches buoy. Seven others followed, but the Captain and a dozen of the crew chose to remain on board. No lives were lost. Salvage operations by means of aerial tackle got underway. On 15 August the Orient, together with her boats, stores and remains of her cargo were sold for a mere 130 pounds to Mr W J Ellis, an East London Auctioneer. Much of the wheat was salvaged but a large amount remained in the holds where it fermented and gave off an offensive smell. The vessel was eventually broken up as far as possible, but the rudder post remained above the water for many years. The ship's bell is apparently in Cradock, where the Municipality uses it at the town market.
Osprey	Buffalo River	East Bank	Wrecked	Schooner	British	1865/09/23	No lives lost.
Ostkafir Chief	East London	East London	?	Barque		1876/01/14	
Palatinia	East Beach	Blind River Mouth	Beached	Freighter (Four-masted)	British	1911/03/07	Beached in a sinking condition at the Blind River Mouth, about 2 miles east of East London, after striking an object at sea. Net tonnage was 2332 tons - Marsh.
Pickle	East London	East London	Broken Up	Whaler	British / SA ?	1941	Marsh refers to an incident involving a vessel called the Pickle having taken place between Port St Johns and Port Shepstone in 1935. Probably the same vessel. On 10 March 1939 the vessel foundered in Port Elizabeth harbour while lying alongside the Dom Pedro Jetty after coaling. No one was aboard at the time, the crew having gone for lunch. Was refloated. The Pickle was built in Christiania, Norway as the Seeadler in 1913. On 17 November 1930 she was registered at Durban as owned by Hans Thorvald Bettum Hansen of Durban. In 1933 she was sold to Ocean Fisheries Pty Ltd of Durban, who in turn sold her to Coastal Fisheries of Port Elizabeth in 1939.
Pioneer	St John's River ?	St John's River ?	Foundered	Ketch (Coaster)		1902/06/10	Vessel blown out to sea in a storm and lost with all hands.

Plettenberg	Mbashe River	Mbashe River (off)	Foundered	Freighter	South African	1948/10/21	Bought from SAR&H she was employed on the Durban-Cape Town haul, but proved to be very uneconomical - at that stage she was already 44 years old. On a return voyage from Cape Town to Durban she struck a submerged objectoff the Bashee River Mouth and taking on water she turned and headed back for East London. When it became obvious that she was going to founder in the heavy seas, attempts being made to tow her were abandoned and the crew taken on board the EL tug, ES Steytler. Only 1 of the 33 crew members was lost.
Puntado	Buffalo River	West Bank	Wrecked			1857/11/14	
Quanza	Orient Beach	Quanza Pool	Wrecked	Four-Masted	British	1872/05/26	Partly laden with wool for England, the vessel parted her cables at 5am on Sunday 26 May and drove ashore on the eastern side of the Buffalo River mouth in a south-easterly gale. Although it had been blowing all night the vessel had neglected to raise steam, and was helpless when her cables parted. Six other vessel were driven ashore that night, and the roadstead was cleared of shipping. No lives lost were lost on the Quanza, but two died on the other vessels. The Quanza gave her name to the beach where she came ashore.
Queen of May	Buffalo River	Rocky shore west of	Wrecked	Barque	British	1872/05/26	Lost on the rocky shore to the west of the Buffalo River during the gale on Sunday 26 May. AShe was driven ashore at 8.30am and carried high up onto the shore to the west of the river. The vessel had only partly discharged her cargo when lost. One life - a boy - was lost.
Refuge	Buffalo River	East Bank	Wrecked	Barque	British	1872/05/26	Cables parted at 2.30 pm on Sunday 26 May in a south easterly gale, and the vessel was driven ashore and wrecked. Six other vessel wrecked on the same day.
Rose Hall	Buffalo River	Bar	Grounded	Brig		1876/04	Struck the bar while being towed into the river by the tug Buffalo. The vessel deviated from the course taken by the tug and lodged on a sand spit in the middle of the river.
Rubicon	East London	Near East London ??	Foundered	Yacht		1984/04/26	Lost during the Vasco da Gama race to East London.
Rubit	Off	Off	Foundered			1901	Broke up off East London.
Sagitarius		Leach Bay				2002	
Sandvik	Buffalo River	3/4 mile east of / Esplanade	Wrecked	Barque	Swedish	1888/03/26	No lives lost.
Sarah Philips	Buffalo River	East side of river		Brig	British	1871/10/15	No lives lost.
Schmayl	Orient Beach	Buffalo River Mouth (near)	Wrecked	Barque	American	1883/10/24	Wrecked 200 yards east of the Buffalo River mouth in a south-easterly gale after her cables parted. No lives lost. The Elsie May was lost on the same spot four days later.
Sea Rover	Buffalo River (near)	3.2km east of river mouth	Wrecked	Barque	British	1868/07/20	Cables parted during a south easterly gale. No lives lost.
Sea Wave	Buffalo River	West Bank (Rocks)	Wrecked	Barque	British	1879/10/08	Wrecked in a gale. No lives lost.
Shantung	Buffalo River	East of	Wrecked	Barque	British	1868/07/24	Lost in a south westerly gale when her cable parted.

Sharp	Buffalo River	233m/163deg t off light, Sth Breakwater	Wrecked	Brig	British	1872/05/26	Lost in a south easterly gale. Vessel driven ashore after her cables parted at 6am on Suinday 26 May. She struck the eastern side of the river. Was still loaded with her inward cargo, all or most of which is believed to have been lost. One man killed by falling block.
Shrimp	Buffalo River	Buffalo River (off)	Foundered	Schooner		1861/05/17	Date may be 17/10/1861
South Easter	East London	East London	Wrecked	Barque	British	1872/06/28	Five lives lost. Bell recovered in 1967. Marsh suggests wreck may have occurred in 1871.
St Agnes	East London	East London	Scuttled	Dredger		1955/11/01	Scuttled.
Starbeam	East London	East London	Wrecked	Barque		1880/11/04	Wrecked in a south-easterly gale when her cables parted. No lives lost. Date may be 06/11/1880 or 14/11/1880.
Stoic	Mbashe / Bashee Lighthouse	North of	Wrecked	Cutter	South African	1858/03/10	This vessel was one of the first, if not the first vessel to be built at East London. According to the Caspe Merchantile Advertiser of 3 June 1854 "A cutter was launched at East London on 18th ult. belonging to Messrs. Few and Garbutt. She is named Stoic and is intended for the coasting trade." According to Marsh, she was lost between the Kei and Bashee Rivers.
Stralenberg	East London	East London	Foundered	Fishing Vessel	South African	1970/08/01	Foundered and then blown up.
Stuart Star	Hood Point	Directly below light	Wrecked	Refrigerator Ship	British	1937/12/17	The vessel ran aground shortly before 10am on Hood Point, just outside the harbour entrance, in an unusually dense fog. The engines were put full astern, but she would not come off. The bumping she was receiving on the rocks soon opened up her bottom and she was considered unsalvagable. Much of her cargo (1900 tons) and ship's gear were salvaged by T Martin of Cape Town before she eventually broke up. The vessel was a twin screw turbine driven steamship. She was regarded as the largest refrigerated cargo vessel in the world at the time of her wrecking. Her master was found responsible for the loss because it was found that in the absence of electronic sounding equioment on board he had failed to take the necessary precautions to detect the current and sound the bottom.
Success	East London	East London	Scuttled	Dredger		1955	Scuttled
Taiyin 1	East of	East of	?			1993/07/01	27 rescued
Theresa	Buffalo River	West Bank near Lighthouse (Castle Point?)	Wrecked?	Schooner	South African	1861/09/12	Cables parted in a southerly gale. No lives lost.
Triton	Buffalo River	Buffalo River				1905/10/10	
Unknown 39	Hood Point area	590m/91 deg true off Hood Point Light					Unknown stranded wreck
Valdivia	Esplanade	East Beach - West of Aquarium	Beached	Steel Screw Steamship	British	1908/10/02	Struck Saltwart Point in good weather and holed her hull. Attempts to pump her out were unsuccessful. The vessel was visible for 7 weeks before she broke up. No lives lost Lies near the SA Oranjeland (1974) and 300m from the King Cadwallon (1929) Bell at EL Museum

Verulam	Buffalo River (West bank)	Cemetery (near)	Wrecked	Barque	British	1874/12/07	Wrecked in a south westerly gale No lives lost.
Vigilant	Buffalo River	Buffalo River Mouth	Wrecked	Snow / Brig (?)	British	1853/12/11	Cables parted in a south easterly gale.
Western Star	Orient Beach	Orient Beach	Wrecked	Brig	British	1874/12/05	Dragged anchors in a south westerly gale and ran ashore No lives lost. Lies close to the Coquette (1874).
Wild Rose	Orient Beach	Orient Beach	Wrecked	Barque	British	1872/09/23	Wrecked in a south-easterly gale. Lies between the Elaine (1872) and the Emma (1872). No lives lost.

Appendix B: Specialist's 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:	1
Years of experience:	28
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 Archaeologist's (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:

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Appendix C: 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;
- 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 24(F) of the Act.

Signature of the specialist

ACO Associates cc

Name of company (if applicable):

4 October 2018

Date

Annex D2.2

Archaeological Assessment

Archaeological Assessment of the Terrestrial Portion of the IOX Cable Route

Report prepared for

ERM Southern Africa

On behalf of

Indian Ocean Xchange SA (Pty) Ltd

October 2018

Version 2.0

ACO Associates cc
Archaeology and Heritage Specialists

Prepared by

John Gribble

ACO Associates CC

8 Jacobs Ladder

St James

7945

Phone 021 7064104

Executive Summary

ACO Associates was appointed to conduct a desk-based assessment of the archaeological potential of the terrestrial portion of the proposed IOX cable route, between the landfall on the southern edge of Fuller's Bay, about 6 km south of the mouth of the Buffalo River, and the beach manhole inside the East London Industrial Development Zone, to determine the likely impacts of the cable on archaeological sites and materials, and to propose measures to mitigate such impacts.

From the landfall the cable will run from the sea to a beach manhole inside the IDZ in a conduit that will be installed by Horizontal Directional Drilling below the beach and by trenching in the area between the beach and the beach manhole.

Due to security issues on site no archaeological site inspection or survey was carried out as part of this assessment. The results, therefore, are reflective of the archaeological <u>potential</u> of the cable route, based on information drawn from available archaeological literature sources.

The literature review, which draws its information from readily available documentary sources and information available on SAHRIS, found that a number of shell middens, mainly Later Stone Age in date, have been recorded along the coast to the north and south of the cable route in the past. Survey work by Derricourt (1977) identified midden material south of the cable route at Cove Rock, but more importantly behind Fuller's Bay, very close to the landfall and cable route. More recent, development-led surveys by Binneman and Webley (1996) and Anderson (2009; 2013) found a total of 15 shell middens within a radius of 2 km of the cable route alignment.

Findings: The density of recorded sites along the coast in the vicinity of the proposed cable route suggests that it is <u>highly likely</u> that pre-colonial shell midden material will be encountered on and/or below the surface along the cable route

The risk to such archaeological sites and material posed by the cable route arises from potential physical disturbance, damage and possible destruction of sites and materials during the excavation of the cable trench.

The following measures to mitigate potential damage to archaeological sites and materials arising out of the construction of the terrestrial portion of the IOX cable route are therefore proposed:

- At some point ahead of construction, an archaeological survey and testing of the route is commissioned to identify any sites that will be affected by the construction of the cable route. The results of this survey and testing programme can be used to inform decisions about the routing of the cable and whether further mitigation will be required;
- <u>Alternatively</u>, an archaeologist must be commissioned to monitor vegetation clearance and construction work. Should archaeological sites or material be encountered during construction, the archaeologist must have the authority to stop work until the find has been assessed and any sampling or excavation that is necessary to rescue the archaeological material in question has been carried out.

Of these two options, the former is preferred from both the archaeological and client risk perspectives.

Lastly, should any human remains be encountered at any stage during the construction of the cable route, work in the vicinity must cease, the remains must be left in situ but made secure and the project archaeologist and ECPHRA must be notified immediately.

Details of the Heritage Practitioner

This study has been undertaken by John Gribble BA Hons, MA (ASAPA) (CIfA) 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

Phone: 021 7064104

Fax: 086 6037195

Table of Contents

1 Introduction

ACO Associates cc was appointed by ERM Southern Africa (ERM), on behalf of Indian Ocean Xchange SA (Pty) Ltd (IOX) to undertake an archaeological assessment of the terrestrial portion of the proposed IOX cable route, between the landfall and the beach manhole inside the East London Industrial Development Zone (IDZ).

This assessment forms part of the Environmental Impact Assessment being undertaken for IOX by ERM to obtain Environmental Authorization from the national Department of Environmental Affairs (DEA) for the project.

2 Terms of Reference

ACO Associates was appointed to conduct a desk-based assessment of the archaeological potential of the terrestrial portion of the proposed cable route, to determine the likely impacts of the cable on archaeological resources and to the propose measures to mitigate such impacts.

2.1 Limitations

No archaeological site inspection or survey was carried out as part of this assessment. The results below, therefore, are reflective of the archaeological potential of the cable route, based on information drawn from available archaeological literature sources.

3 Project Description

The following project description is a summary of the information presented in the draft Scoping Report (ERM 2018).

This proposed subsea cable system will comprise a main trunk, approximately 9000 km in length between India and South Africa. The cable will split from branching units on the main trunk to landing sites in other host countries including Mauritius and Rodrigues Island.

The cable will enter South African territorial waters at approximately -33.1811S, 28.0776E and will make landfall at a site approximately 6 km south of the mouth of the Buffalo River at East London on the east coast. Landfall will be adjacent to the East London Industrial Development Zone (IDZ) on the southern edge of Fuller’s Bay.

From the landfall the cable will run from the sea to a beach manhole inside the IDZ in a conduit that will be installed by Horizontal Directional Drilling below the beach and by trenching in the area between the beach and the beach manhole (**Figure 1**).

Figure 1: The IOX cable landfall, re-aligned terrestrial cable route (red line), beach manhole (orange polygon) and surrounding area. The items marked as B&W and IDZ are archaeological sites found during previous surveys of the area which are discussed in Section 6 below

4 Relevant Legislation

4.1 National Heritage Resources Act (No 29 of 1999)

The National Heritage Resources Act (NHRA) came into force in 2000 with the establishment of the 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. In the Eastern Cape this is the Eastern Cape Provincial Heritage Resources Agency (ECPHRA).

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, heritage resources potentially relevant to this assessment are:

- 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
- 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));

As per the definitions provided above, these cultural heritage resources are protected by the NHRA and a permit from SAHRA or the ECPHRA 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.

4.2 National Environmental Management Act (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 process have been promulgated in terms of NEMA and include the EIA Regulations (GNR R326/2017) and Listing Notices 1 – 3 (GNR 324, 325 and 327/2017). These regulations were amended in April 2017 by Government Notices 324, 325, 326 and 327.

The proposed IOX Cable triggers a number of activities in the Listing Notices and, in terms of GNR 325 therefore, the project will be subject to a full Scoping and Environmental Impact Assessment process and IOX will be required to obtain a positive Environmental Authorisation from the national Department of Environmental Affairs (DEA) prior to commencement of the proposed activities.

5 Method

This desk-based report draws its information from readily available documentary sources and information available on SAHRA's SAHRIS (https://www.sahra.org.za/sahris) and provides an assessment of the archaeological potential of the proposed terrestrial cable route shown on **Figure 1** above, based on the known heritage resources in the vicinity.

The potential impacts on terrestrial archaeological sites and materials, arising from the proposed laying of the IOX cable, are assessed and recommendations are made to mitigate such impacts.

6 Archaeology in the Vicinity of the Cable Route

Two main sources were tapped for information about archaeological sites in the immediate vicinity of the proposed terrestrial cable route. These were formal, published archaeological books and papers, and unpublished archaeological reports and grey literature available on SAHRIS. The latter are generally reports generated for development applications as part of the environmental assessment process.

In respect of the published archaeological literature, between 1971 and 1973, Robin Derricourt directed the first systematic archaeological research programme in the former Transkei and Ciskei. The book that resulted from this work (Derricourt 1977) contains records of hundreds of sites recorded in these areas, including a number in the vicinity of the terrestrial cable route. Approximately 4.7 km south west of the cable route alignment Derricourt (1977) recorded three Later Stone Age (LSA) shell middens on the sandstone promontory adjacent to Cove Rock (**Figure 2**).

Figure 2: The location of Cove Rock (circled in red) in relation to the terrestrial cable route and other sites mentioned in the text below. The large purple polygon on the right of the image is the West Bank Precinct surveyed by Binneman and Webley (1996) and referred to below.

North east of the cable route on both the east and west banks of the Buffalo River, Derricourt refers to reports by Wells (1934) and Laidler (1935) of mounds found during historical quarrying activities which contained some archaeological material and numerous human skeletal remains. Together these remains, described by Wells (1934) and Laidler (1935), and their associated archaeological material suggest that these sites contain a mixture of LSA, Iron Age and possibly colonial era material and remains.

Most pertinent to this report, however, are “sealed and stratified midden lenses” reported by Derricourt (1977:113) in the dunes at Fuller’s Bay where the terrestrial cable route will make its landfall (**Figure 3**). Co-ordinates for these shell middens are not provided by Derricourt. The shell noted on these sites was principally *Perna perna* (brown mussel), but *Crassostrea margaritacea* (oyster) and *Haliotis midae* (abalone) were also present. A single damaged bone identified as sheep was recorded which suggests at least part of these middens is less than circa 2000 years old.

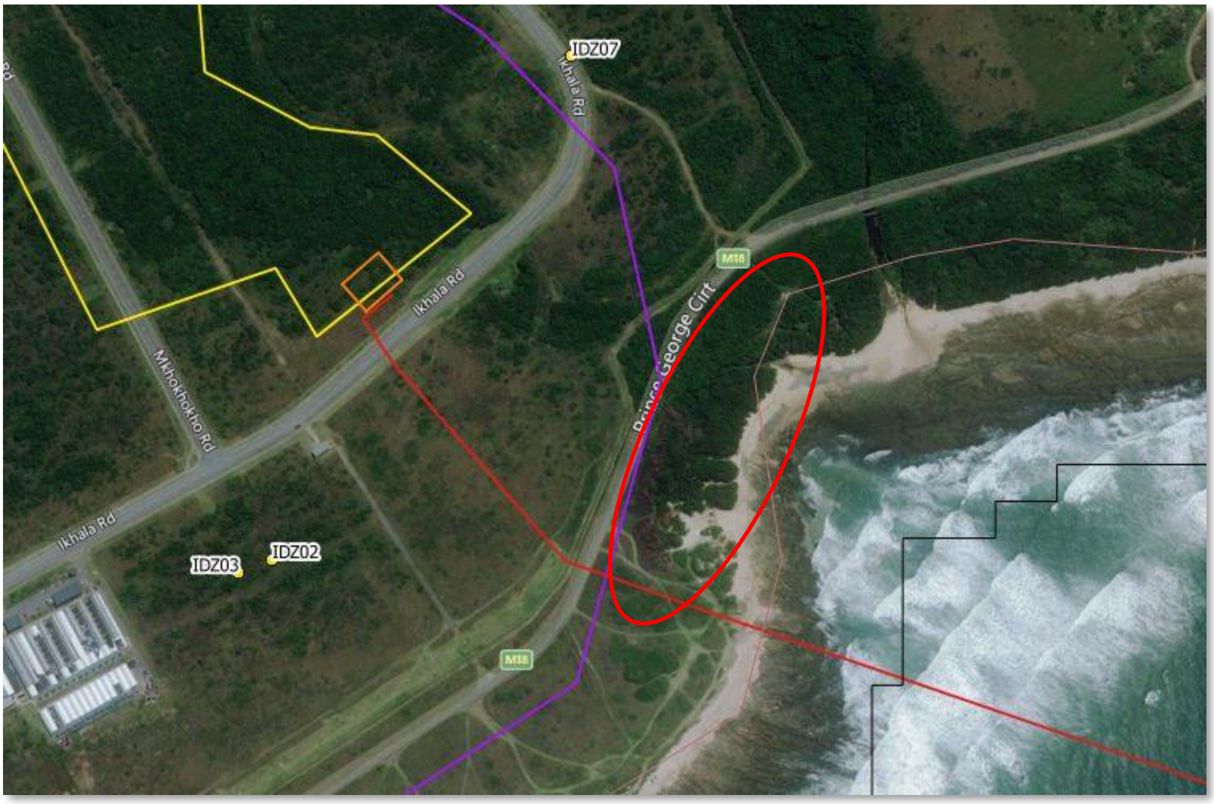

Figure 3: The dunes behind Fuller’s Bay (circled) within which Derricourt reported shell middens, shown in relation to the proposed cable landfall and terrestrial cable route. Co-ordinates for these shell middens are not provided by Derricourt.

There have been a number of archaeological field surveys associated with proposed development work carried out in the vicinity of the cable route. In 1996, Binneman and Webley surveyed what was known as the West Bank Precinct, the area now largely occupied by the East London IDZ (**Figure 2**). Dense vegetation meant that archaeological visibility on the landward side of Marine Drive was almost non-existent, but their fieldwork included a preliminary survey along the coast, during which they recorded a number of shell middens below Marine Drive. Above Marine Drive, marine shell was noted in mole hills and a shell lens was seen in the wall of an ant bear burrow (**Figure 4**). It is likely that this midden material is LSA in date.

Figure 4: The positions of the shell middens reported by Binneman and Webley (1996) (B&W1 – B&W8), on the coast to the south west of the proposed cable route.

Northwest of the West Bank Precinct, some 7km inland from the coast, Binneman and Webley (1996) reported a large collection of Early Iron Age pottery on the farm Canasta Place. This material relates to the first occupation of the area by black agri-pastoralists and based on similar finds elsewhere in the region (Binneman 1996) dates to between AD 700 and AD 1000. According to Nogwaza (1994) this is the most southerly occurrence of early black farming in Africa. There is thus the potential for Iron Age sites and material closer to the coast, and this must be borne in mind in relation to the cable route.

In 2009, Anderson conducted a heritage study for the Marine Aquaculture Zone within the East London IDZ in an area on the landward side of Marine Drive. This area overlaps with that surveyed by Binneman and Webley in 1996 but density of the coastal bush once again meant very poor to non-existent archaeological visibility. In a number of areas of newly cleared vegetation, however, Anderson recorded seven shell middens, which he suggested probably all predate the introduction of domestic stock into the area circa 1700 years ago (Anderson 2009). Three of the sites recorded by Anderson (IDZ02, IDZ03 and IDZ07) are located between 250 m and 350 m from, and on both sides of the proposed cable route alignment (**Figure 5**).

Figure 5: LSA shell middens reported by Anderson (2009) (IDZ01 – IDZ07) during the survey for the Marine Aquaculture Zone within the East London IDZ. The yellow polygon represents Site 1 for the proposed East London IDZ Photovoltaic Facility surveyed by Anderson (2013). The IOX cable route terminates at the beach manhole (orange polygon) adjacent to the bottom edge of Site 1.

More recently, Anderson (2013) carried out a heritage survey of the proposed East London IDZ Photovoltaic facility, one of whose proposed sites (Site 1) is adjacent to the end of the IOX cable route and beach manhole within the IDZ (**Figure 5**). According to Anderson (2013), the southern part of Site 1 was not as disturbed or densely vegetated as the northern and eastern parts. However, no shell middens or other archaeological sites were observed. The only archaeological material noted was two broken grindstones, but the report does not give the co-ordinates of these finds.

7 Impact Assessment

Based on the literature review above, it is highly likely that pre-colonial archaeological sites and material will be encountered during the construction of the terrestrial portion of the IOX cable route. The risk to such archaeological sites and material posed by the cable route arises from their physical disturbance, damage and possible destruction during the excavation of the cable trench and can be summarised as follows:

Potential impact on archaeological sites and materials	
Nature of impact	Disturbance, damage or destruction of

	archaeological sites and material
Extent of impact	Localized
Duration of impact	Permanent
Intensity of impact	Potentially high
Probability of occurrence	High
Degree to which impact can be reversed	Irreversible
Irreplaceability of resources	High – archaeological sites and material are non-renewable and cannot be replaced if damaged or destroyed
Cumulative impact prior to mitigation	Low
Significance of impact pre-mitigation	High
Degree of mitigation possible	High
Proposed mitigation	Option 1 – pre-construction archaeological survey and testing to identify any sites that will be affected by the construction of the cable route
	Option 2 – archaeological monitoring of vegetation clearance and construction work. Should sites or material be encountered work will be required to cease until the archaeologist has assessed the find and carried out any sampling or excavation that may be necessary to rescue the archaeological material in question.
Cumulative impact post mitigation	Low
Significance after mitigation	Low

8 Discussion, Recommendations and Proposed Mitigation

No archaeological survey of the proposed cable route has yet been undertaken but this desk-based assessment has highlighted the fact that numerous LSA shell middens have been recorded along the coast in the vicinity of the proposed cable route. The density of recorded sites suggests that it is highly likely that pre-colonial shell midden material will be encountered on and/or below the surface along the cable route.

Pre-colonial shell middens tend to accumulate within circa 300 m of the coast and are generally associated with rocky coastlines or points where shellfish can be exploited. These sites represent the physical record of pre-colonial foraging and other daily activities on the coast and contain a wealth of information about diet, technology and other aspects of the lives of our ancestors.

As with all archaeological material, these sites are extremely fragile and each is unique and must be viewed as a non-renewable resource which cannot be replaced if damaged or destroyed. Consequently, where they are proved to exist and will be affected by development activities, such sites will need to be assessed by a suitably qualified and experienced archaeologist and, where necessary, sampled to ensure the collection of a suitable record of the site before it is damaged or destroyed.

The following measures to mitigate potential damage to archaeological sites and materials arising out of the construction of the terrestrial portion of the IOX cable route are therefore proposed:

- At some point ahead of construction, an archaeological survey and testing of the route is commissioned to identify any sites that will be affected by the construction of the cable route. The results of this survey and testing programme can be used to inform decisions about routing of the cable and whether further mitigation will be required;
- Alternatively, an archaeologist must be commissioned to monitor vegetation clearance and construction work. Should archaeological sites or material be encountered during construction, the archaeologist must have the authority to stop work until the find has been assessed and any sampling or excavation that is necessary to rescue the archaeological material in question has been carried out.

Of these two options, the former is preferred from both the archaeological and client risk perspectives.

Lastly, should any human remains be encountered at any stage during the construction of the cable route, work in the vicinity must cease, the remains must be left in situ but made secure and the project archaeologist and ECPHRA must be notified immediately.

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9.1 Online Resources

South African Heritage Resources Information System (Accessed online on 26 October 2018) http://www.sahra.org.za/sahris

Appendix A: Specialist's 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:	1
Years of experience:	28
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 Archaeologist's (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

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Appendix B: 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;
- 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 24(F) of the Act.

Signature of the specialist

ACO Associates cc

Name of company (if applicable):

23 November 2018

Date

Appendix B: 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;
- 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 24(F) of the Act.

Signature of the specialist

ACO Associates cc

Name of company (if applicable):

23 November 2018

Date

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

PROPOSED IOX CABLE ROUTE: MARITIME ARCHAEOLOGICAL ASSESSMENT

Specialist:	Heritage Impact Assessment		
Contact person:	John Gribble		
Postal address:	ACO Associates, Unit D17, Prime Park, Mocke Road, Diep River		
Postal code:	7800	Cell:	0786162961
Telephone:	021 7064104	Fax:	
E-mail:	john.gribble@aco-associates.com		
Professional affiliation(s) (if any)	Member ASAPA (#043)		

Project Consultant:	ERM Southern Africa		
Contact person:	Reinett Mogotshi		
Postal address:	1st Floor, Great Westerford, 240 Main Road, Rondebosch		
Postal code:	7700	Cell:	073 511 6696
Telephone:	073 511 6696	Fax:	
E-mail:	Reinett.Mogotshi@erm.com		

4.2 The specialist appointed in terms of the Regulations_

I, John Gribble, declare that -- General declaration:

I act as the independent specialist in this application;
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting 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:

ACO Associates

Name of company (if applicable):

5 November 2018

Date:

Contents of this report in terms of Regulation GNR 982 of 2014	**Cross-reference in this report**
(a) details of— the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a curriculum vitae;	Appendix 3
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	p. i
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 4.3
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 6.8
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 6
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 4.1 to 4.2
(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;	Section 6
(g) an identification of any areas to be avoided, including buffers;	N/a
(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;	Section 5
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 4.4
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 6
(k) any mitigation measures for inclusion in the EMPr;	Section 6.7
(l) any conditions for inclusion in the environmental authorisation;	N/a
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	N/a
(n) a reasoned opinion— (i) 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, and where applicable, the closure plan;	Section 7
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/a
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/a
(q) any other information requested by the competent authority.	N/a

Annex D3

Marine Ecology Assessment

PROPOSED INSTALLATION OF THE IOX SUBMARINE CABLE SYSTEM, EAST LONDON, SOUTH AFRICA

Marine Ecology Assessment

Prepared for:

Environmental Resources Management Southern Africa Pty Ltd

On behalf of

July 2018

PISCES ENVIRONMENTAL SERVICES (PTY) LTD

PROPOSED INSTALLATION
OF THE IOX SUBMARINE CABLE SYSTEM,
EAST LONDON, SOUTH AFRICA

MARINE ECOLOGY ASSESSMENT

Prepared for

ERM Southern Africa (Pty) Ltd

Prepared by

Andrea Pulfrich
Pisces Environmental Services (Pty) Ltd

November 2018

PISCES ENVIRONMENTAL SERVICES (PTY) LTD

Contact Details:

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TABLE OF CONTENTS

ABBREVIATIONS and UNITS

CBD	Convention of Biological Diversity
CCA	CCA Environmental
CITES	Convention on International Trade in Endangered Species
cm	centimetres
cm/sec	centimetres per second
CMS	Centre for Marine Studies
CMS	Convention on Migratory Species
CSIR	Council for Scientific and Industrial Research
dB	decibell
DEA	Department of Environmental Affairs
E	East
EBSA	Ecologically or Biologically Significant marine Areas
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMPr	Environmental Management Programme
ENE	east-northeast
GIS	Global Information System
gC/m^2	grams Carbon per square metre
ha	hectares
HDD	Horizontal Directional Drilling
Hz	Herz
IDZ	Industrial Development Zone
IUCN	International Union for the Conservation of Nature
IWC	International Whaling Commission
km	kilometre
km^2	square kilometre
KZN	KwaZulu-Natal
MPA	Marine Protected Area
m	metres
m^2	square metres
mg/m^3	milligrams per cubic metre
ml	millilitre
mm	millimetre
m/sec	metres per second
m^3/sec	cubic metres per second
NE	northeast
NNE	north-northeast
ppt	parts per thousand
ROV	Remotely Operated Vehicle
S	south
SANBI	South African National Biodiversity Institute
S&EIR	Scoping and Environmental Impact Report

SSW	south-southwest
SW	southwest
WSW	west-southwest
µPa	micro Pascal
°C	degrees Centigrade
%	percent
~	approximately
<	less than
>	greater than

GLOSSARY

Benthic	Referring to organisms living in, or on, the sediments of aquatic habitats (lakes, rivers, ponds, etc.).
Benthos	The sum total of organisms living in, or on, the sediments of aquatic habitats.
Benthic organisms	Organisms living in, or on, sediments of aquatic habitats.
Biodiversity	The variety of life forms, including the plants, animals and micro-organisms, the genes they contain and the ecosystems and ecological processes of which they are a part.
Biomass	The living weight of a plant or animal population, usually expressed on a unit area basis.
Biota	The sum total of the living organisms of any designated area.
Bivalve	A mollusc with a hinged double shell.
Community structure	All the types of taxa present in a community and their relative abundance.
Community	An assemblage of organisms characterized by a distinctive combination of species occupying a common environment and interacting with one another.
Dilution	The reduction in concentration of a substance due to mixing with water.
Ecosystem	A community of plants, animals and organisms interacting with each other and with the non-living (physical and chemical) components of their environment
Environmental impact	A positive or negative environmental change (biophysical, social and/or economic) caused by human action.
Epifauna	Organisms, which live at or on the sediment surface being either attached (sessile) or capable of movement.
Habitat	The place where a population (*e.g.* animal, plant, micro-organism) lives and its surroundings, both living and non-living.
Infauna	Animals of any size living within the sediment. They move freely through interstitial spaces between sedimentary particles or they build burrows or tubes.
Macrofauna	Animals >1 mm.
Macrophyte	A member of the macroscopic plant life of an area, especially of a body of water; large aquatic plant.
Meiofauna	Animals <1 mm.
Marine environment	Marine environment includes estuaries, coastal marine and nearshore zones, and open-ocean-deep-sea regions.

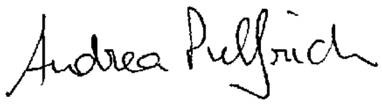
Pollution	The introduction of unwanted components into waters, air or soil, usually as result of human activity; *e.g.* hot water in rivers, sewage in the sea, oil on land.
Population	The total number of individuals of the species or taxon.
Pseudofaeces	Pseudofaeces production is a process of particle selection whereby less nutritious particles are rejected and the quality of the ingested material improved proportionately.
Recruitment	The replenishment or addition of individuals of an animal or plant population through reproduction, dispersion and migration.
Sediment	Unconsolidated mineral and organic particulate material that settles to the bottom of aquatic environment.
Species	A group of organisms that resemble each other to a greater degree than members of other groups and that form a reproductively isolated group that will not produce viable offspring if bred with members of another group.
Subtidal	The zone below the low-tide level, *i.e.* it is never exposed at low tide.
Surf-zone	Also referred to as the 'breaker zone' where water depths are less than half the wavelength of the incoming waves with the result that the orbital pattern of the waves collapses and breakers are formed.
Suspended material	Total mass of material suspended in a given volume of water, measured in mg/ℓ.
Suspended matter	Suspended material.
Suspended sediment	Unconsolidated mineral and organic particulate material that is suspended in a given volume of water, measured in mg/ℓ.
Taxon (Taxa)	Any group of organisms considered to be sufficiently distinct from other such groups to be treated as a separate unit (*e.g.* species, genera, families).
Toxicity	The inherent potential or capacity of a material to cause adverse effects in a living organism.
Turbidity	Measure of the light-scattering properties of a volume of water, usually measured in nephelometric turbidity units.
Vulnerable	A taxon is vulnerable when it is not Critically Endangered or Endangered but is facing a high risk of extinction in the wild in the medium-term future.

EXPERTISE AND DECLARATION OF INDEPENDENCE

This report was prepared by Dr Andrea Pulfrich of Pisces Environmental Services (Pty) Ltd. Andrea has a PhD in Fisheries Biology from the Institute for Marine Science at the Christian-Albrechts University, Kiel, Germany.

As Director of Pisces since 1998, Andrea has considerable experience in undertaking specialist environmental impact assessments, baseline and monitoring studies, and Environmental Management Programmes / Plans relating to marine diamond mining and dredging, hydrocarbon exploration and thermal/hypersaline effluents. She is a registered Environmental Assessment Practitioner and member of the South African Council for Natural Scientific Professions, South African Institute of Ecologists and Environmental Scientists, and International Association of Impact Assessment (South Africa).

This specialist report was compiled on behalf of ERM Southern Africa (Pty) Ltd (ERM) for their use in preparing a Scoping and Environmental Impact Report (S&EIR) for the proposed installation of the IOX Submarine Cable System, off the East Coast of South Africa. I do hereby declare that Pisces Environmental Services (Pty) Ltd is financially and otherwise independent of the Applicant and ERM.



Dr Andrea Pulfrich

1. GENERAL INTRODUCTION

The IOX Subsea Cable System will provide additional telecommunications capacity to South African users, as well as providing cross-connect opportunities from/to other networks within South Africa and the southern African region. By providing high speed connectivity to the global network, the project would benefit businesses and consumers through enhanced capacity and reliability for telecommunications services that support fixed and mobile communications networks and internet services. The demand for new and improved connectivity reflects an end-user and business environment in which high speed connectivity is needed for sustainable growth and development.

Figure 1: Nearshore cable route and preferred shore-crossing site near East London.

1.1. Scope of Work

This specialist report was compiled as a desktop study on behalf of ERM, for inclusion in the S&EIR and for developing an EMPr for the proposed installation of the submarine cable system off East London on the East Coast of South Africa.

The terms of reference for this study are:

- Provide a general description of the local marine fauna and benthic biodiversity along the proposed cable route within South Africa's Exclusive Economic Zone (EEZ) to the shore crossing south of East London based on current available literature and existing secondary data;
- Review the Comments and Responses Report to ensure that all issues and concerns relevant to the marine environment are addressed;
- Identify, describe and assess the significance of potential impacts of the proposed installation of the submarine cable, on the local marine fauna and benthic communities; and
- Identify practicable mitigation measures to reduce any negative impacts and indicate how these could be implemented in the construction and management of the proposed project.

1.2. Approach to the Study

As determined by the terms of reference, this study has adopted a 'desktop' approach. Consequently, the description of the natural baseline environment in the study area is based on a review and collation of existing information and data from the scientific literature, internal reports and the Generic Environmental Management Programme Report (EMPr) compiled for oil and gas exploration in South Africa (CCA & CMS 2001). The information for the identification of potential impacts on benthic communities was drawn from various scientific publications, and information sourced from the Internet. The sources consulted are listed in the Reference chapter.

All identified marine impacts are summarised, categorised and ranked in appropriate impact assessment tables, to be incorporated in EMPr Addendum and EIA report.

2. DESCRIPTION OF THE PROPOSED PROJECT

2.1. Project Location

The project involves the installation and operation of a subsea fibre optic cable system, the main trunk of which will run ~9 000 km from India to South Africa. Branches will split from the main trunk to landing sites located *en route*, including Mauritius and Rodrigues Island.

The main trunk of the marine cable will enter South African territorial waters at approximately 33°10'52.238"S, 28°4'39.388"E and follow a route[1] within the EEZ to a coastal landing site near the East London Industrial Development Zone (IDZ) in the Eastern Cape Province. The preferred landing site is located on the West Bank at approximately 33° 3'26.54"S, 27°51'50.06"E, and is characterized by a short stretch of sandy beach protected by rocky outcrops and boulders on either side (Figure 1). The site was identified from the analysis of a number of alternatives as described in Chapter 3 of the main EIA Report.

At the shore crossing, the buried subsea fibre optics cable will enter a beach manhole where it will connect to the terrestrial portion of the cable. The beach manhole would be located above the high water mark. Its exact location is dependent on finalising agreements with the IDZ and on the preferred shore-crossing technology alternative.

2.2. Installation Phase

The installation of the cable would involve two main phases, namely:

- A **pre-lay grapnel run**, which is conducted immediately in advance of cable installation to remove any obstacles from the path of the final cable route. The operation involves the towing of one or an array of grapnels by the main cable laying vessel along the route where burial is required. The grapnel is towed at a rate that ensures it maintains contact with the seabed and can penetrate up to 40 cm into unconsolidated sediments. As a matter of routine, the grapnel is recovered and inspected at intervals of ~15 km along the route. Usually a single tow is made along the route, although in areas where other marine activity or seabed debris are high, additional runs may be required.
- **Cable Installation**, which is undertaken by a specialised cable laying vessel that places the cable on the seabed along the predetermined route. At depths beyond 900 m, bottom currents are such that the cable can be placed directly on the seabed without the need for burial. At depths shallower than 900 m, a trench 0.9 – 1.5 m deep is excavated in the unconsolidated sediments by a specialised submarine cable plough to receive the cable. The foot print of the plough is limited to the area in which the four plough skids and the plough share, which is approximately 0.2 m wide, are in contact with the seabed. Heavier armouring around the cable is also used to provide additional protection, particularly in areas of uneaven or rocky seabed. In the littoral zone (<15 m), cable installation may be undertaken by a tracked remotely operated vehicle (ROV), which excavates a trench using powerful water jets and simultaneously buries the armoured cable. Where burial cannot be achieved[2], or where additional cable

[1]. The route would be determined during a pre-installation survey involving a desk-top Cable Route Study followed by detailed geophysical surveys of the seabed along the proposed cable route.

[2] in rocky areas, areas with extensive fishing activities, or areas where other activities may pose a threat to the cable.

protection is required, an articulated split-pipe may be used to maximise cable security. Within the wave-base (0 – 50 m), saddle clamps may be used to hold the cable and/or articulated split-pipes in place at specific locations.

2.3. Shore Crossing

Installation of the cable at the shore crossing will be undertaken using Horizontal Directional Drilling (HDD). This entails drilling a hole under the shoreline from approximately 541 m from a location above the beach (33° 3' 29.043" S 27° 51' 45.630" E) to a location within nearshore waters with water depths of 10 to 15 m (33° 3' 35.010" S 27° 52' 5.351" E) (Figure 2). Drilling would be performed by a drilling unit located on a prepared platform on land. A pilot hole is drilled from the drill pad location toward the exit point. A larger drill is then used to bore and enlarge the pilot hole to the desired size. During drilling a biodegradable, sodium-based drilling fluid mixed with fresh water would be used to cool and lubricate the drill bit, stabilise the bore hole during drilling, and carry cuttings out of the bore hole. To avoid the release of drill fluids to the marine environment, the exit is 'punched' open without the use of drill fluids, thereby allowing seawater to flush the hole from the sea toward the drill pad location. Once the drill hole is prepared, the cable is pulled through the hole from the sea to the land side.

The directional drilling method would require a lay-down area for the construction operation of approximately ~0.3 ha above the highwater mark.

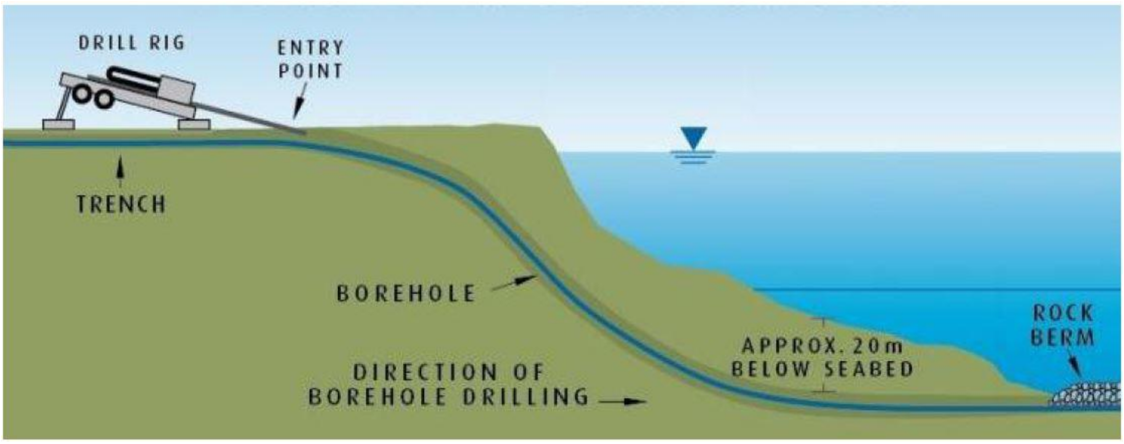


Figure 2: Schematic of horizontal directional drilling.

Table 1: Summary of Cable Installation Activities revalent to the marine environment.

Conditions/Environment	Installation Method
Water depth > 900 m	No burial, cable surface laid without armouring.
Water depth < 900 m	Ploughing from the cable lay vessel to a target water depth of 15 m with Post Lay Burial reserved for areas where ploughing is ineffective or impractical.
Littoral zone	Trench excavation using a ROV. The cable is generally protected by clamping additional pipe sections around it (articulated pipe or uraduct protection). In areas of hard seabed and high wave energy, the split pipes may be pinned to the seabed to prevent movement.
Beach landing	HDD and trenching above the High Water Mark (HWM).

The expected duration of the installation activities are provided in Table 2 below:

Table 2: Duration of Installation Activities

Activities	Duration
Marine Installation (within 12 Nm)	4 days
Near shore Installation	7 to 10 days
Beach Installation – HDD and trenching (above HWM)	3 months
BMH and System Earth Construction	7 days
Terrestrial Cable Route	2 months

*All durations are approximate and subject to weather conditions.

2.4. Operations

Once installed and operational the cable will not require routine maintenance, although cable repair may be required as a result of physical damage (either anthropogenic or natural) or failure. To effect repairs on deep sea cables, the damaged cable is cut at the seabed and each end separately bought to the surface, whereupon a new section is spliced in. Dedicated repair ships are on standby to respond to any emergency repairs.

2.5. Decommissioning

Options for decommissioning of the system at the end of the Project's lifetime include retirement in place, or removal and salvage. Decommissioning would involve demolition, recovery and removal of terrestrial components (if they are not re-used for another purpose).

The marine portion of the cable is likely to be left in place, as per current global industry practice.

3. DESCRIPTION OF THE BASELINE MARINE ENVIRONMENT

3.1. The Physical Environment

3.1.1 Bathymetry and Sediments

The East Coast is primarily linear with a narrow continental shelf and a steep continental slope. The bathymetry drops steeply at the coast to approximately 50 m within ~2,000 m of the shoreline. In the region of Algoa Bay, the narrow shelf widens, with depth increasing gradually to the shelf break at a depth of 140 m off Port Elizabeth. Outside the shelf break, depth increases rapidly to more than 1,000 m (Hutchings 1994).

The coastline around East London consists of alternating eroding wave-cut rocky platforms and depositional fine-grained sandy beaches. The most significant natural and constructed features of the West Bank shoreline are the Cove Rock headland and the breakwater of the East London harbour. Apart from these, the coastline is relatively uniform, with occasional small indentations and bays such as Fuller's Bay (preferred alternative for the shore crossing) and Leach's Bay. In the region around East London, sand dominates both the inshore and offshore surficial sediments, with the sand-cover thinning rapidly towards the coast. This was confirmed by the Reale *et al.* (2018) study as part of the current project, which confirmed that Fuller's Bay was dominated by a thin tongue of fine sand coming ashore between rocky outcrops and subcropping rocks, which extended to depths of ~30 m. Beyond 68 m depth the seabed becomes more diverse with alternating patches of very coarse sand, subcropping rock with sand waves and mega ripples, and hardpan seafloor at ~80 m depth, giving way to very coarse sand interspersed by rock outcrops to 84 m depth. A shore-parallel area of subcropping rock extends from ~11 km to 23 km (90 m depth) offshore. Alternating rocky outcrop and very coarse sand occur beyond 90 m depth.

Geophysical surveys undertaken off Hood Point (Machutchon *et al.* 2016) ~6.5 km northeast of the proposed shore crossing, similarly identified that the inshore zone (intertidal and shallow subtidal) is characterised by exposed dolerite rocky outcrops to ~7.5 m depth. Being controlled by the prevailing surf conditions, this rocky zone is typically devoid of notable sediment accumulations. If present, sediments occur as isolated, relatively thin accumulations or as a thin veneer, mantling the underlying bedrock. Offshore of 8 m depth the seabed deepens at a constant rate and is dominated by smooth, featureless unconsolidated sediments. There is a sharp bathymetric drop-off at 33.5 m, which appears to be a paleocoastline. Some surficial rock outcrops are present. Beyond this drop-off, the seabed is characterised by large sub-aqueous bedforms with a NNE-SSW orientation. Beyond ~ 50 m depth the seabed is smooth and featureless. Flemming and Hay (1988) note that in recent geological history and during the past 100 years of accelerated erosion, all fine sediments originating from floods have moved off the shelf into deep water. Accumulation of muds in the nearshore zone is thus not expected.

3.1.2 Water Masses and Circulation

The oceanography of this coast is almost totally dominated by the warm Agulhas Current. The current forms between 25° and 30° S, flowing southwards along the shelf edge of the East Coast (Schumann 1998) of southern Africa as part of the anticyclonic Indian Ocean gyre, before retroflecting between 16° and 20° E. It is a well-defined and intense jet some 100 km wide and 1,000 m deep (Schumann 1998), flowing in a south-west direction at a rapid rate, with current speeds of 2.5 m/sec or more, and water transport rates of over 60 × 10^6 m^3/sec have being recorded (Pearce *et al.* 1978; Gründlingh 1980). Following its divergence into deep water off the Tugela Bank, the Agulhas Current re-attaches itself to the coast, south of Durban where the continental shelf again narrows, until off Port Edward it is so close inshore that the inshore edge (signified by a temperature front) is rarely discernible (Pearce 1977). On the eastern half of the South Coast, the Agulhas Current flows along the shelf break at speeds of up to 3 m/sec, diverging inshore of the shelf break south of Still Bay (34° 28'S, 21° 26'E) before realigning to the shelf break off Cape Agulhas (Heydorn & Tinley 1980). The Agulhas Current may produce large meanders with cross shelf dimensions of approximately 130 km, which move downstream at approximately 20 km per day. It may also shed eddies, which travel at around 20 cm/sec and advect onto the Agulhas Bank (Swart & Largier 1987). After detaching from the shelf edge at 15° E, the Agulhas Current retroflects and flows eastwards (Schumann 1998)(Figure 3).

The average velocity of the Agulhas current off East London is 46 cm/sec in a south-westerly direction for 64% of the time (CSIR 1989). Current reversal occurs 24% of the time during periods of south-westerly winds. Over the inner and mid-shelf (to depths of 160 m) currents are weak and variable, with velocities ranging from 25 - 75 cm/sec midshelf and 10 - 40 cm/sec nearshore. Eastward flow may occur close inshore (Boyd *et al.* 1992; Boyd & Shillington 1994), being particularly strong off Port Elizabeth. Bottom water shows a persistent westward movement, although short-term current reversals may occur (Swart & Largier 1987; Boyd & Shillington 1994; CCA & CSIR 1998).

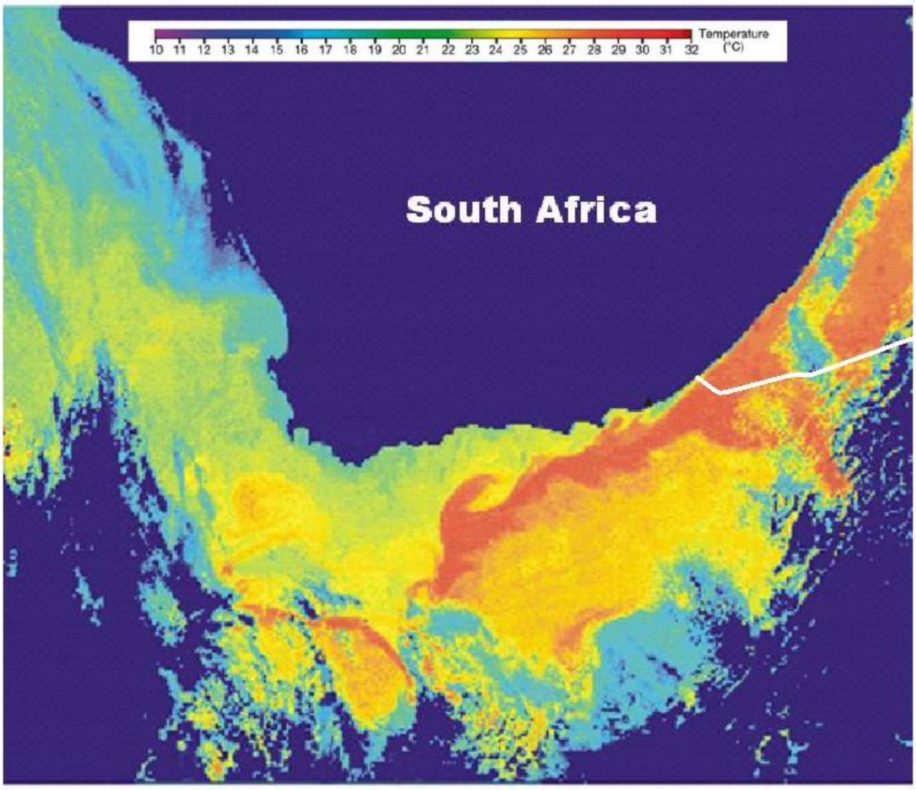


Figure 3: The predominance of the Agulhas current in the oceanography of the East Coast. The proposed cable route is indicated by the white line.

Current measurements made offshore of Nahoon Point and Hood Point (CSIR 1988) indicate a clear predominance of south-westerly to west-south-westerly currents and northeast to east-north-easterly in the project area (percentage occurrence of 65% to 80% and 15% and 25%, respectively, depending on the cross-shelf location of the current measurements). Offshore and onshore currents are minimal, with the onshore current component being greater near the seabed, particularly inshore. A percentage occurrence of south-westerly, north-easterly, onshore and offshore currents of 60%, 23%, 9% and 8%, respectively, have been reported (CSIR 1988). Current speeds generally increase upon moving in an offshore direction, with the increase being greatest for the dominant SW to WSW currents. However, the NE and ENE flows associated with current reversals can be equally strong in both the inshore and offshore regions and are essentially barotropic (*i.e.* the current reversals are of similar magnitude and take place simultaneously over the whole water column). There is a strong alongshore coherence in the currents measured in the inshore region.

As the Agulhas Current originates in the equatorial region of the western Indian Ocean its waters are typically blue and clear, with low nutrient levels. The surface waters are a mix of Tropical Surface Water (originating in the South Equatorial Current) and Subtropical Surface Water (originating from the mid-latitude Indian Ocean). The surface waters of the Agulhas Current may be over 25° C in summer and 21° C in winter and have lower salinities than the Equatorial Indian Ocean, South Indian Ocean Central water masses found below. Surface water characteristics, however, vary due to insolation and mixing (Schumann 1998). South Indian Ocean Central Water of 14° C and a salinity of 35.3 ppt occurs below the surface water layers at between 150 - 800 m depth. The deeper waters comprise, from shallowest to deepest, Antarctic Intermediate Water, North Indian Deep Water, North Atlantic Deep Water and Antarctic Bottom Water. Sub-tropical Surface Water of between 15 and 20° C often intrudes into the Agulhas Current at depths of 150 - 200 m from the east (Schumann 1998).

Seasonal variation in temperatures is limited to the upper 50 m of the water column (Gründlingh 1987), increasing offshore towards the core waters of the Agulhas Current. South of Mbashe and East London, a persistent wedge of cooler water is present over the continental shelf during summer (Beckley & Van Ballegooyen 1992), extending northwards to the southern KwaZulu-Natal coast in winter. This wedge is typically cooler than 19° C, but may be cooler than 16° C between East London and Port Alfred, and south of Mbashe. Inshore, waters are warmest during autumn, with warm water tongues found off Cape Recife (near Port Elizabeth) from January to March (Christensen 1980).

Strong and persistent thermoclines are common over the shelf beyond 30 m depth, extending inshore during the summer and autumn, but breaking down during the cooler and windier winter conditions (Schumann & Beekman 1984; Largier & Swart 1987; Boyd & Shillington 1994).

3.1.3 Winds and Swells

The main wind axis off the East Coast is parallel to the coastline, with north-north-easterly and south-south-westerly winds predominating for most of the year (Schumann & Martin 1991) and with average wind speeds around 2.5 m/sec (Schumann 1989).

Westerly winds predominate along the coast in winter, frequently reaching gale force strength. During summer, easterly wind directions increase markedly, resulting in roughly similar strength/frequency of east and west winds during that season (Jury 1994). Calm periods are most common in autumn (CCA & CSIR 1998).

On the South Coast, the majority of waves arrive from the south-west quadrant (Whitefield *et al.* 1983), dominating wave patterns during winter and spring (Carter & Brownlie 1990). Waves from this direction frequently exceed 6 m (Swart & Serdyn 1981, 1982) and can reach up to 10 m (Heydorn 1989). During summer, easterly wind-generated 'seas' occur (Heydorn & Tinley 1980; Heydorn 1989; Carter & Brownlie 1990).

3.2. The Biological Environment

The project area is located inshore of the 50 m depth contour and falls within the Agulhas Inshore bioregion (Lombard *et al.* 2004) (Figure 4). Communities within marine habitats are largely ubiquitous throughout the region, being particular only to substrate type or depth zone. The biological communities consist of many hundreds of species, often displaying considerable temporal and spatial variability (even at small scales). Beyond the surf-zone, marine ecosystems comprise a limited range of habitats, namely unconsolidated seabed sediments, rocky reefs and the water column. The biological communities 'typical' of these habitats are described briefly below, focussing both on dominant, commercially important and conspicuous species, as well as potentially threatened species.

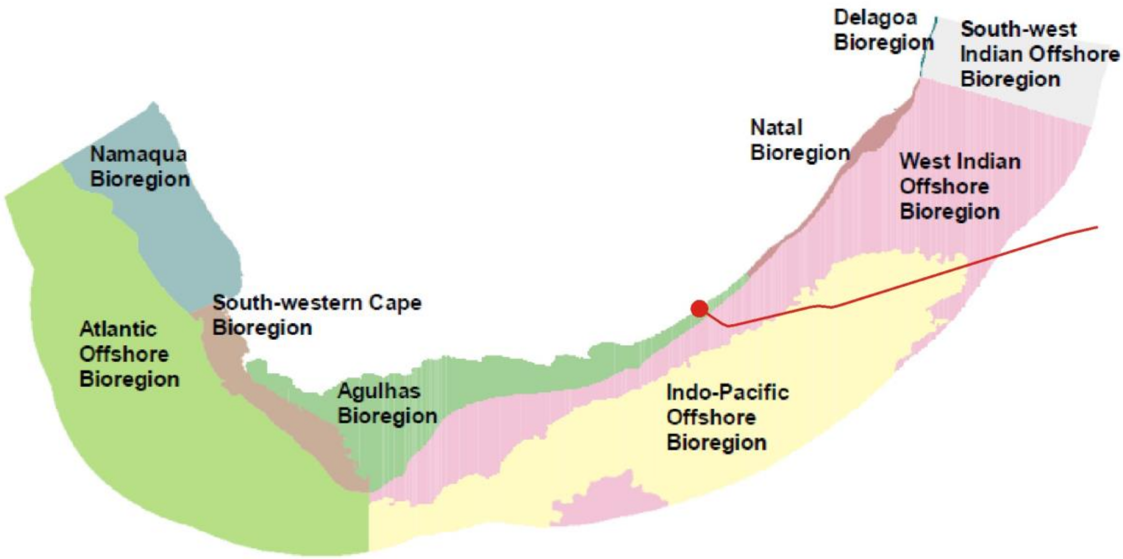


Figure 4: The inshore and offshore bioregions of South Africa indicating the location of the proposed marine outfall (red dot) within the Agulhas Inshore bioregion (adapted from Lombard *et al.* 2004).

3.2.1 Planktonic Communities

Phytoplankton

The nutrient-poor characteristics of the Agulhas Current water are reflected in comparatively low primary productivity, with mean *chlorophyll a* concentrations averaging between 1 - 2 mg/m^3 over the whole year in the top 30 m of the water column. *Chlorophyll a* concentrations vary seasonally, being minimal in winter and summer (<1 – 2 mg/m^3), and maximal (2 - 4 mg/m^3) in spring and autumn (Brown 1992). In the area off Port Elizabeth and East London, phytoplankton concentrations are usually higher than further west, comprising predominantly large cells (Hutchings 1994).

There is also a microflora component associated with beaches, namely microphytobenthos and phytoplankton, which are present both in the sand and the surf. The bays along the South Coast and the shoreline between Port Elizabeth and East London are reported to have a comparatively high diversity of microflora (Harris 2012).

A major ecological feature of the surf-zone along much of the Eastern Cape Coast is the regular occurrence of visible accumulations of the diatom, *Anaulus australi*s, which in some areas accounts for 95% of the primary production and is the basic food source in the surf-zone and adjacent beach (Campbell 1987; Wooldridge *et al.* 1997), fuelling three distinct food chains, one associated with the interstitial system (meiofauna), the microbial food chain and the macroscopic food chain (Brown & McLachlan 1990). Other diatom species such as *Aulacodiscus kittoni, Sroederella* sp., *Asterionella* sp., *Thalassiothrix* sp. and *Navicula* sp. also occur.

Zooplankton

Zooplankton communities in the study area have comparatively high species diversity (De Decker 1984), with standing stocks of mesozooplankton in the area off Port Elizabeth ranging from ~1.0-~2.0 gC/m^2), mirroring the eastward increase in *chlorophyll a* concentrations. Dense swarms of euphausiids dominate this zooplankton component, and form an important food source for pelagic fishes (Cornew *et al.* 1992; Verheye *et al.* 1994).

Continental shelf waters support greater and more variable concentrations of zooplankton biomass than offshore waters (Beckley & Van Ballegooyen 1992), with species composition varying seasonally (Carter & Schleyer 1988). Copepods represent the dominant species group (Carter & Schleyer 1988), but chaetognaths are also abundant (Schleyer 1985).

The surf-zone zooplankton is dominated by large motile crustaceans. The surf shrimp *Macropetasma africana* is associated with diatom accumulations inside the surf-zone (Romer 1986). The mysid *Mesopodopsis wooldridgei* forms dense swarms out to approximately 10–20 m depths and migrates inshore to just behind the breaker line at night to feed on phytoplankton (Wooldridge 1983; Webb 1986). This mysid is probably instrumental in transporting primary production from the surf-zone into the shallow and deeper subtidal regions. Swarming mysids are important in the surf-zone food web as they consitute a major prey species for various surf-zone fish. Other members of the surf-zone zooplankton community are siphonophores, chaetognaths, ostracods, copepods, isopods, amphipods and decapod larvae (Romer 1986).

Ichthyoplankton

A variety of pelagic species, including anchovy, pilchard, and horse mackerel, are reported to spawn east of Cape Agulhas, and to the west of the study area (Crawford 1980; Hutchings 1994; Roel & Armstrong 1991) (Figure 5). In the case of pilchards (*Sardinops sagax*), adults move eastwards and northwards after spawning. After the "sardine run" in June and July, pilchard eggs occur in inshore waters along the Eastern Cape and the southern KwaZulu-Natal coast (Anders 1975; Connell 1996). Anchovy (*Engraulis japonicus*) eggs were reported in the water column during December as far north as St Lucia (Anders 1975). There is thus overlap of egg and larval distributions of these species with the project area.

The inshore area of the Agulhas Bank, especially between the cool water ridge and the shore, serve as an important nursery area for numerous linefish species (e.g. elf *Pomatomus saltatrix*, leervis *Lichia amia*, geelbek *Atractoscion aequidens*) (Wallace *et al*. 1984; Smale *et al*. 1994). Adults undertake spawning migrations along the coast into KwaZulu-Natal waters (Van der Elst 1976, 1981; Griffiths 1987; Garret 1988; Beckley & van Ballegooyen 1992). The eggs and larvae are subsequently dispersed southwards by the Agulhas Current, with juveniles occurring on the inshore Agulhas Bank (Van der Elst 1976, 1981; Garret 1988). East of Cape Padrone, ichthyoplankton is confined primarily to inshore waters, with larval abundance varying between 0.005 and 4.576 larvae/m^3. Concentrations, however, decrease rapidly with distance offshore (Beckley & Van Ballegooyen 1992).

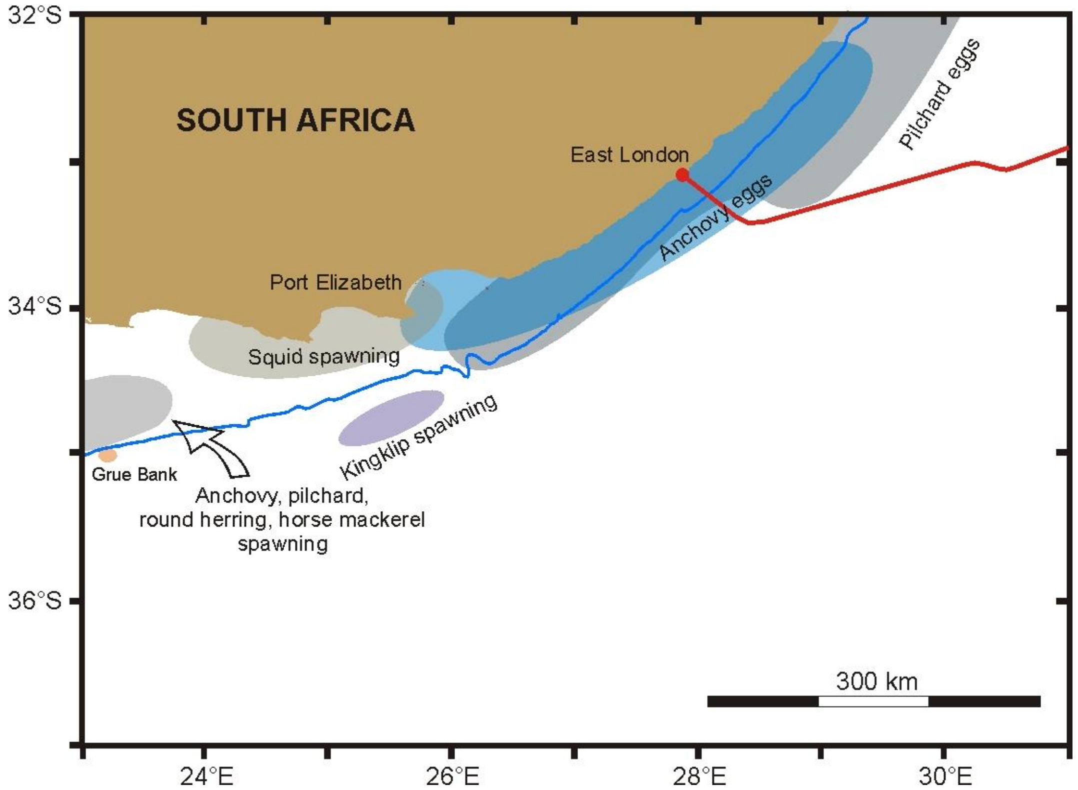


Figure 5: Important fishing banks, seamounts, and pelagic and demersal fish and squid spawning areas in relation to the proposed cable route (red line) and shore crossing (red dot) (after Anders 1975, Crawford *et al*. 1987, Hutchings 1994). The 200 m depth contour is also shown.

3.2.2 Benthic Communities

The proposed subsea cable route crosses a number of benthic habitats (Figure 6 and Figure 7). The seabed communities along the proposed cable route fall within the Agulhas photic and sub-photic biozones, which extend from the low water mark to the shelf edge. These biozones lie within the ‘minimal protected category’ (1 - 5%) and portions of the shelf area are defined as ‘Vulnerable’, ‘Endangered’ or ‘Critically Endangered’ as existing Marine Protected Areas (MPAs) are insufficient for conserving marine habitats and their associated biodiversity (Lombard *et al*.

2004; Sink *et al*. 2012). The benthic habitats on the shelf off East London have been identified as 'vulnerable', whereas the pelagic habitat has been rated as 'least threatened' (Figure 8).

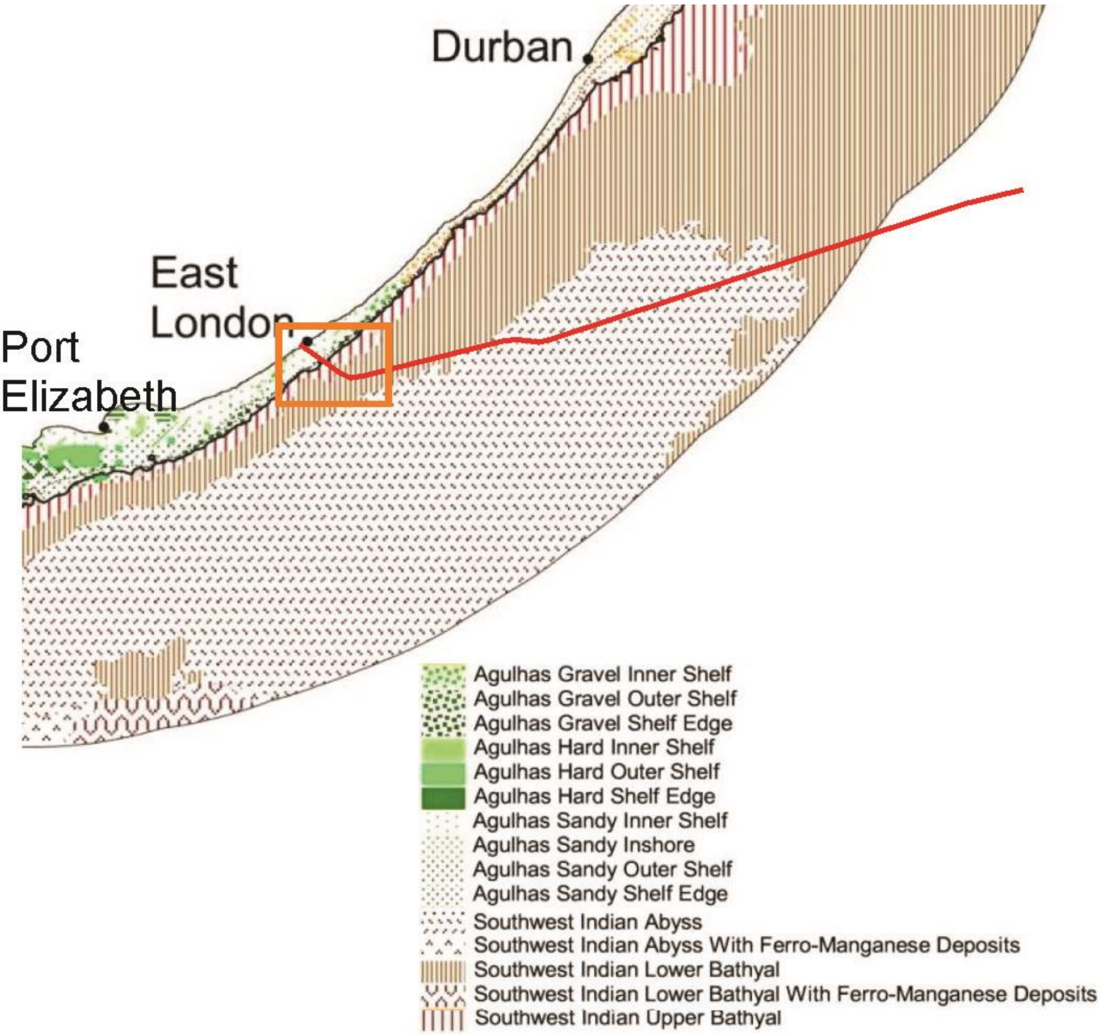


Figure 6: The proposed subsea cable route (red line) in relation to the benthic habitats off the South African East Coast (adapted from Sink *et al*. 2012). Coastal and shelf habitats within the orange rectangle are further detailed in Figure 8 overleaf.

Cumulative impacts and the lack of biodiversity protection has resulted in some of the coastal habitat types along the southeastern coast being assigned a threat status of 'critically endangered' and 'vulnerable' (Lombard *et al*. 2004; Sink *et al*. 2012) (Table 3). Using the SANBI benthic and coastal habitat type GIS database (**Error! Reference source not found.**), the threat status of the benthic habitats within the broader project area, and those potentially affected by proposed cable route, were identified (Table 3). Three benthic habitats rated as 'vulnerable' are affected by the proposed cable routing, namely Agulhas Mixed Shore, Agulhas Sandy Inshore and Agulhas Sandy Shelf Edge. All other habitats affected by the cable routing are considered 'least threatened'.

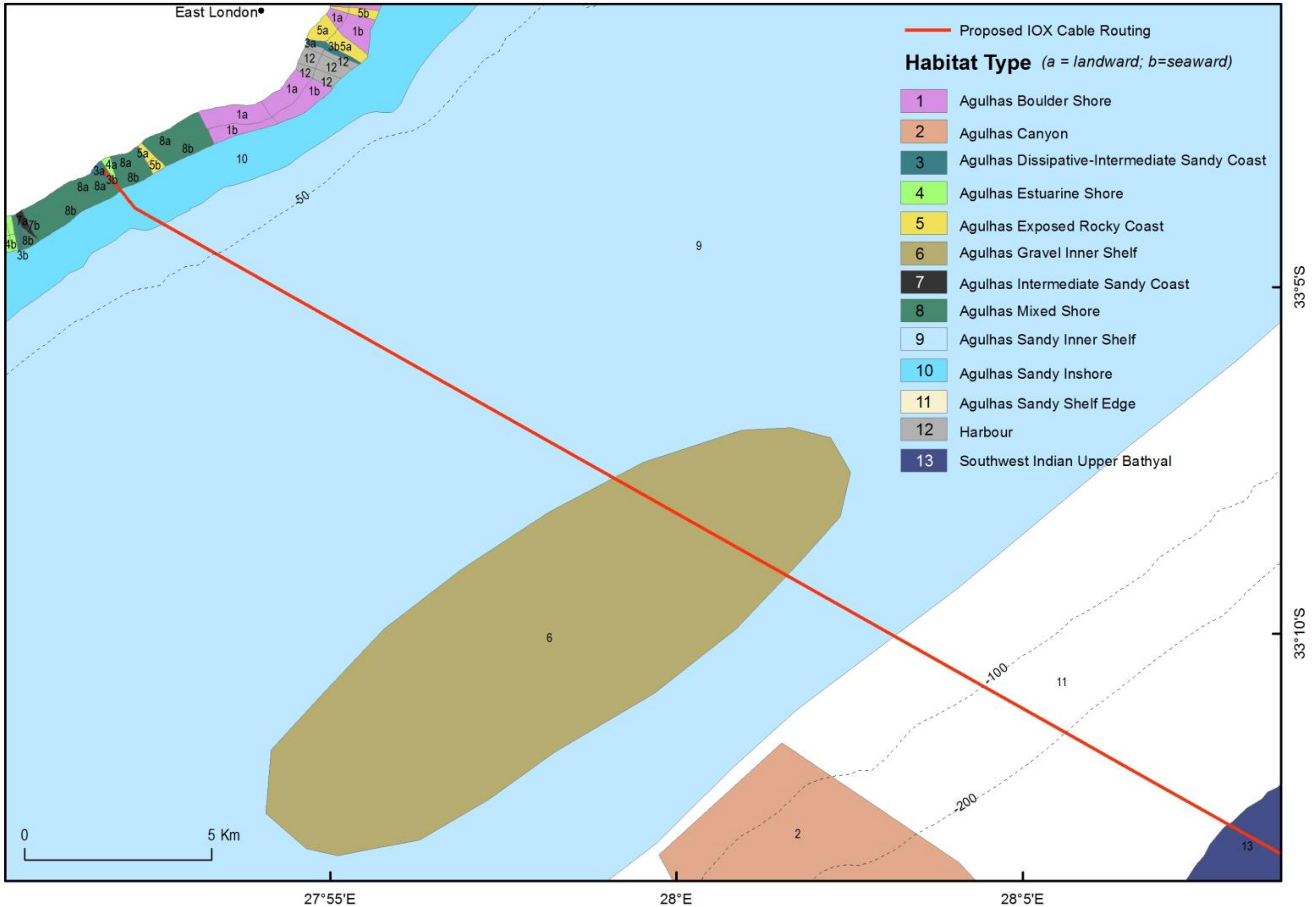


Figure 7: Benthic and coastal habitat types on the continental shelf of the general project area. The habitats affected by the proposed cable routing are identified in Table 3 (adapted from Sink *et al*. 2012).

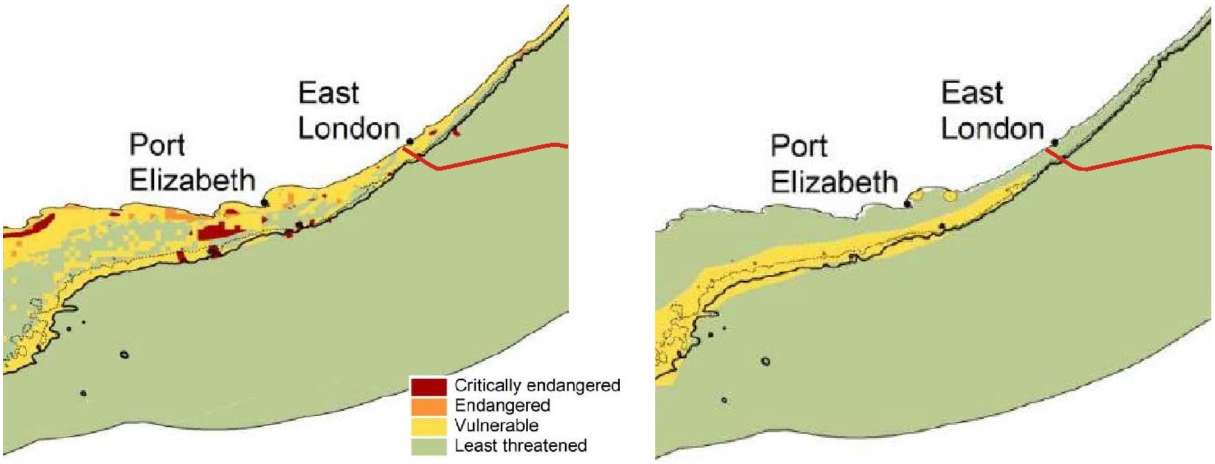


Figure 8: Ecosystem threat status for coastal and offshore benthic habitat types (left), and offshore pelagic habitat types (right) on the South African South Coast in relation to the proposed cable route (adapted from Sink *et al*. 2012).

Table 3: Ecosystem threat status for marine and coastal habitat types in the broader project area (adapted from Sink *et al*. 2012). Assuming HDD is implemented for the cable's shore crossing, those habitats potentially affected by the proposed cable route are shaded.

Habitat Type	Threat Status
Agulhas Boulder Shore	Least Threatened
Agulhas Canyon	Critically Endangered
Agulhas Dissipative-Intermediate Sandy Coast	Least Threatened
Agulhas Dissipative Sandy Coast	Vulnerable*
Agulhas Estuarine Shore	Least Threatened
Agulhas Exposed Rocky Coast	Vulnerable
Agulhas Gravel Inner Shelf	Least Threatened
Agulhas Gravel Outer Shelf	Vulnerable*
Agulhas Gravel Shelf Edge	Least Threatened*
Agulhas Inshore Reef	Critically Endangered*
Agulhas Intermediate Sandy Coast	Least Threatened
Agulhas Mixed Shore	Vulnerable
Agulhas Sandy Inner Shelf	Vulnerable
Agulhas Sandy Inshore	Vulnerable
Agulhas Sandy Outer Shelf	Least Threatened*
Agulhas Sandy Shelf Edge	Vulnerable
Agulhas Very Exposed Rocky Coast	Vulnerable*
Southwest Indian Upper Bathyal	Least Threatened
Southwest Indian Lower Bathyal	Least Threatened*

*Not represented in Figure 8 but present in the broader project area.

Sandy beaches and mixed shores occur along the coastline in the greater project area. The proposed shore-crossing site comprises a small isolated dissipative beach and adjacent estuarine shore, bordered by rocky shores. The rocky shores are characterised by platform reefs in the low and mid-shore giving way to sand-cover and cobbles above the high water mark extending inland to the vegetated fore-dunes.

Soft-sediment Benthic Macro and Meiofauna

The benthic biota of unconsolidated substrates constitutes invertebrates that live on (epifauna), or burrow within (infauna), the sediments, and are generally divided into megafauna (animals >10 mm), macrofauna (>1 mm) and meiofauna (<1 mm).

Although the coastline of the study area is highly dominated by rocky shores, there are some isolated beaches, typically associated with estuaries and river mouths, between the rocky outcrops. Longer beaches occur further to the southwest towards Port Alfred and Algoa Bay. Sandy beaches are one of the most dynamic coastal environments. The composition of their faunal communities is largely dependent on the interaction of wave energy, beach slope and sand particle size. The beaches in the study area are comprised of dune and medium-grained marine sands, and most are classified as being intermediate in the dissipative/reflective continuum, experiencing moderate to strong wave action. Considerable small-scale spatial and temporal variability in the physical state can, however, occur and beaches and their associated macrofaunal communities should therefore be viewed as extremely dynamic. Within a biogeographic province, the macrofaunal communities of sandy beaches are generally ubiquitous. As the study area falls within the transition zone between the South Coast and East Coast, invertebrate macrofauna representing both regions can occur.

The beach and surf-zones together are considered a functional ecosystem, which interacts with the terrestrial environment through the movement of sand, and with the nearshore through the activity of rip currents (McLachlan *et al*. 1981; McLachlan *et al*. 1984; Talbot 1986). In this semi-enclosed ecosystem, surf-zone phytoplankton are the producers, macrofauna the consumers and the interstitial meiofauna the decomposers.

Numerous methods of classifying beach zonation have been proposed, based either on physical or biological criteria. The general scheme proposed by Branch & Griffiths (1988) is used below (Figure 9), supplemented by data from publications on Eastern Cape sandy beach biota (e.g. Wooldridge *et al*. 1981; Bursey & Wooldridge 2002; Harris 2012).

The high shore between the base of the dunes and the high water mark is typically dominated by the ghost crabs *Ocypode ryderi* and *O. ceratophthalma* and the semi-terrestrial isopod *Tylos capensis*. Scavenging whelks such as *Bullia rhodostoma* are common in the midshore zone while *B. pura* and *B. digitalis* occur in the surf-zone (McLachlan 1977), feeding on almost any carion cast up on the shore. Several cirolanid isopod species occur across the intertidal moisture gradient (De Ruyck *et al*. 1992) with the genus *Eurydice* being the most common from the midshore and extending into the low shore. The isopods *Pontegeloides latipes* and *Excirolana natalensis* occur in lower numbers above mid-tidal level extending also into the lowshore. The nemertean worm *Cerebratulus* sp. and polychaete *Nephtys* sp. are typical of the mid- and lowshore, extending into the surf-zone.

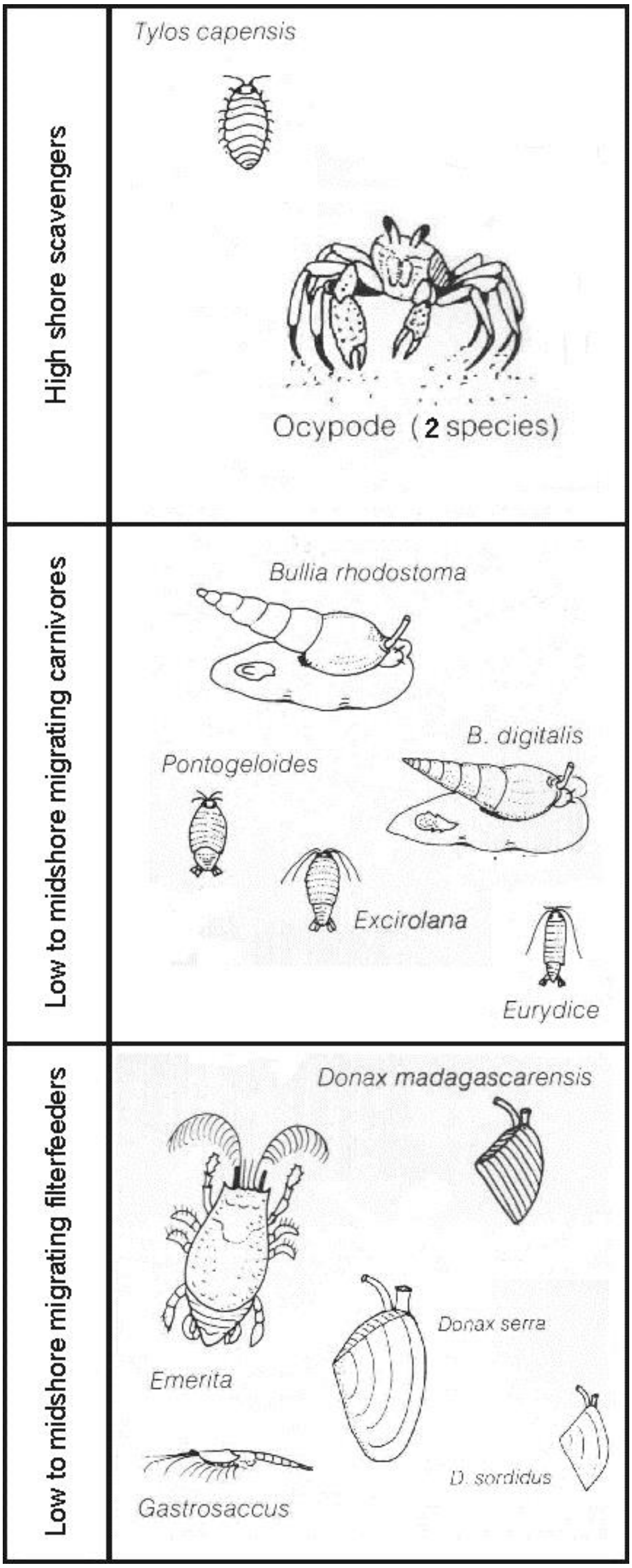


Figure 9: Schematic representation of the Southeast Coast intertidal zonation on sandy beaches (adapted from Branch & Branch 1981).

In the lowshore, the macrofauna is dominated by the filter feeding sand mussel *Donax serra*, with the smaller *D. sordidus* dominating the surf-zone (McLachlan & Bate 1984). The more subtropical *D. madagascariensis* may also occur in small numbers. Sand mussels in the region are thought to dependent largely on *Anaulus* and consequently reach their highest biomasses where *Anaulus* blooms are most frequent. Sand mussels are key organisms in the foodwebs and are preyed on by a variety of animals including gulls, oystercatchers, crabs, sandsharks, rays and fish. The mole crab *Emerita austroafricana* may also occur. The surf-zone swimming crab *Ovalipes punctatus*, is an important invertebrate predator on Eastern Cape beaches, feeding predominantly on *Donax* and *Bullia* (Du Preez 1984). Seawards of the breaker zone, the scavenging polychaete worm *Goniadopsis incerta* is abundant (McLachlan & Bate 1984). The bentho-pelagic mysid *Gastrosaccus psammodytes* is most abundant in the swash and surf-zone of sandy beaches and occurs in densities of up to 55 individuals/m^2, forming an important link between the primary food supply and higher levels of the macrofaunal foodweb (Wooldridge 1983; Wooldridge *et al.* 1997).

Meiofaunal organisms (<1 mm in size), which occur within the sediment, are dominated by nematodes (38%) and harpacticoid copepods (38%), with turbellarians (10%), mystacocarids (6%), archiannelids (3%), oligochaetes (2%) and other minor groups (3%) constituting the rest (McLachlan *et al.* 1981). Nematodes dominate where the sand is finer and the oxygen level lower, while harpacticoid copepods prefer coarser well-drained sands.

Further offshore, the structure and composition of benthic soft-bottom communities is primarily a function of abiotic factors such as water depth and sediment grain size, but others such as current velocity and organic content also play a role (Snelgrove & Butman 1994; Flach & Thomsen 1998; Ellingsen 2002). Further shaping is derived from biotic factors such as predation, food availability, larval recruitment and reproductive success. The high spatial and temporal variability for these factors results in seabed communities being both patchy and variable. In nearshore waters where sediment composition is naturally patchy, and significant sediment movement may be induced by the dynamic wave and current regimes (Fleming & Hay 1988), the benthic macrofauna are typically adapted to frequent disturbance. In contrast, further offshore where near-bottom conditions are more stable, the macrofaunal communities will primarily be determined by sediment characteristics and depth.

The benthic ecology study undertaken in 1999 as part of the EIA for the West Bank Waste Water Treatment Works (Bickerton & Blair 1999) and the subsequent monitoring study done in 2001 (Monteiro *et al.* 2001) identified that there was high species diversity (19 taxa and 39 taxa, respectively) and abundance of meiofauna, with abundance values for offshore sediments ranging from 924 to 4,530 individuals per 100 ml sample. The meiofauna was dominated by nematodes, with gastrotrichs, harpacticoid copepods and flatworms (turbellaria) also being major contributors. Some of the meiofauna are adept at burrowing while others live in the interstitial spaces between the sand grains. The high abundance of meiofauna is suggestive of well oxygenated seabed sediments in the offshore areas. The benthic macrofauna were represented by a total of 144 species. Communities were characterised by polychaetes, crustaceans (of which amphipods, cumaceans and isopods were the dominant types), echinoderms and molluscs. Macrofaunal community structure was influenced primarily by water depth, with sediment grain size playing less of a role. There was a general trend of increasing benthic macrofaunal abundance and species diversity with increase in water depth.

Rocky Shores and Subtidal Reefs

On the Southeast Coast, rocky intertidal shores can be divided into five zones on the basis of their characteristic biological communities: The Littorina, Upper Balanoid, Lower Balanoid, Cochlear and the Infratidal Zones. These biological zones correspond roughly to zones based on tidal heights (Figure 10) (Branch & Branch 1981). Tolerance to the physical stresses associated with life on the intertidal, as well as biological interactions such as herbivory, competition and predation interact to produce these five zones.

Supralittoral fringe or Littorina zone - The uppermost part of the shore is the supralittoral fringe, which is the part of the shore that is most exposed to air, perhaps having more in common with the terrestrial environment. The supralittoral is characterised by low species diversity, with the tiny periwinkle *Afrolittorina knysnaensis*, and the red alga *Porphyra capensis* constituting the most common macroscopic life. Sheltering under rocks on the high-shore is the common shore crab *Cyclograpsus punctatus*.

Upper Mid-littoral or Upper Balanoid zone - The upper mid-littoral is characterised by the limpets *Scutellastra granularis* and *S. oculus*. The gastropods *Oxystele variegata*, *Nucella dubia*, and *Helcion pectunculus* are variably present, as are low densities of the barnacles *Tetraclita serrata*, *Octomeris angulosa* and *Chthamalus dentatus*. Flora is best represented by the green algae *Ulva* spp. and the knobbly *Iyangaria stellate*.

Lower Mid-littoral or Lower Balanoid zone - Toward the lower shore, biological communities are determined by exposure to wave action. On sheltered and moderately exposed shores, a diversity of algae abounds with a variable representation of: green algae – *Ulva* spp, *Codium* spp.; brown algae – *Splachnidium rugosum*; and red algae – *Aeodes orbitosa*, *Mazzaella (=Iridaea) capensis*, *Gigartina polycarpa* (=*radula*), *Sarcothalia* (=*Gigartina*) *stiriata*, and *Gelidium pristoides*. The gastropods *Scutellastra longicosta, Oxystele sinensis* and *O. tigrina*, as well as scavenging whelks (*Burnupena* spp.) and anemones occur interspersed among the algae. Filter-feeders are represented primarily by the brown mussel *Perna perna*.

Cochlear zone – this zone, named after the limpet *S. cochlear* is characteristic of the South coast occurring as a dense band of limpets at the low tide mark. These limpets can reach densities up to 2,600 per m^2 thereby preventing algae from establishing and restricting juvenile limpets to the backs of adults.

Sublittoral fringe - The sublittoral fringe typically supports dense colonies of red bait Pyura stolonifera, and thick stands of algae including articulated corallines, species of *Hypnea*, *Plocamium* and *Laurencia*. In wave exposed areas *Bifurcaria brassicaeformis* and *Ecklonia biruncinata* abound, whereas on more sheltered shores the urchin *Parechinus angulosus* cover the rocks. In areas dominated by urchins, foliose algae are virtually absent, leaving only the grazer-resistant encrusting coralline *Lithothamnion*. Some of these species extend into the subtidal below.

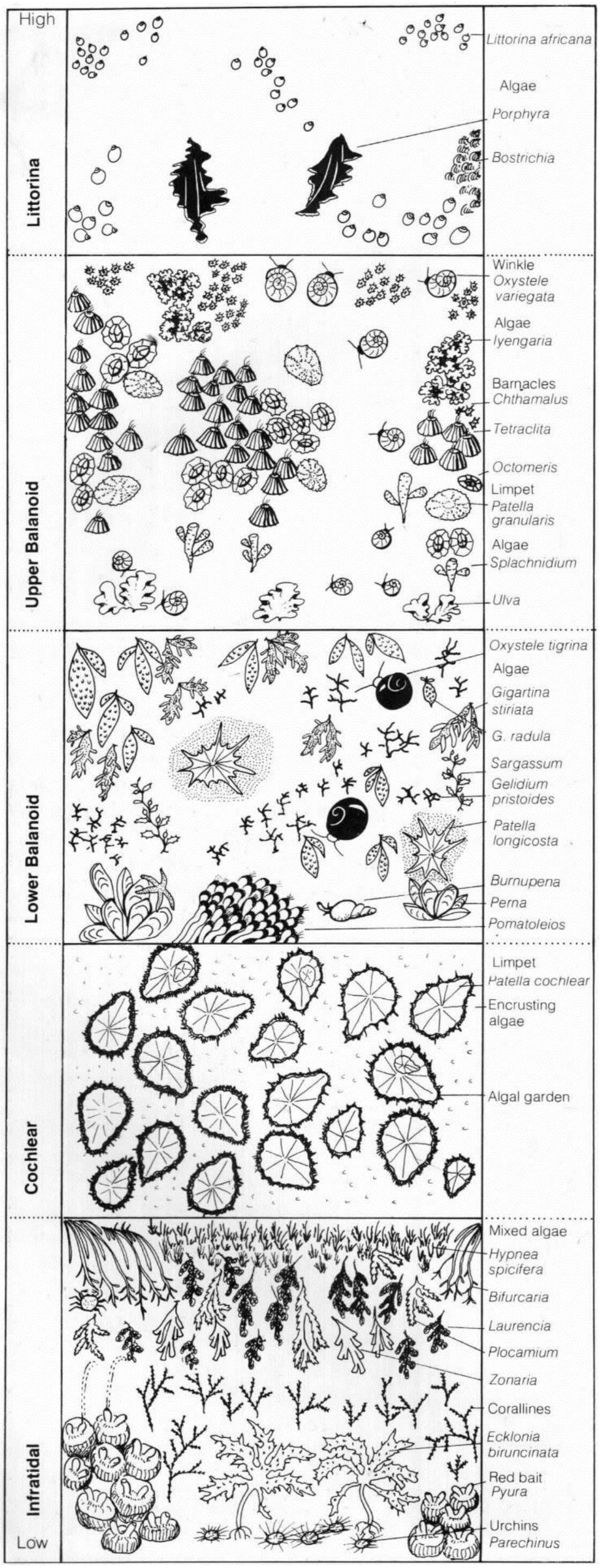


Figure 10: Schematic representation of the South Coast intertidal zonation on rocky shores (adapted from Branch & Branch 1981).

Inshore, at depths between 5 m and 30 m, lie the Agulhas Inshore Reef and Agulhas Inshore Hard Ground benthic habitats, identified by Sink *et al.* (2012) as 'Critically endangered - Moderately protected', and 'Vulnerable - Moderately protected', respectively. These reefs and hard grounds extend from the Mbashe River (east of East London) to Cape Point (Figure 11). The reefs are considered to be warm temperate reefs, which have a more heterogeneous community structure when compared with those in the Southwestern Cape and KwaZulu-Natal inshore regions.

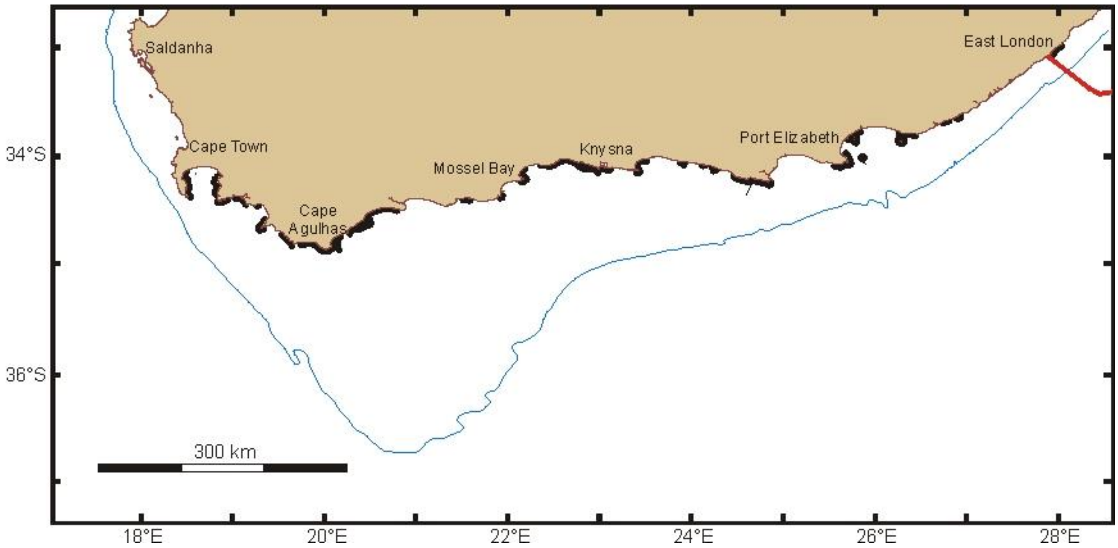


Figure 11: The extent of the Agulhas Inshore Reef and Hard Ground habitat types in relation to the proposed subsea cable route (red line) (adapted from Sink *et al.* 2012).

The intertidal and shallow subtidal reefs along the East Coast of South Africa support a wide diversity of marine flora and fauna and a relatively high percentage of endemic species (Turpie *et al.* 2000; Awad *et al.* 2002). However, information about benthic reef communities and hard grounds in the project area is limited to descriptions of reef ecosystems in the Pondoland area (Celliers *et al.* 2007). The following description is summarised from these studies and from descriptions of South Africa's reef types provided in SANBI's Reef Atlas Project.

The nearshore reefs of the Pondoland coast shelter a mix of subtropical and warm-temperate fauna that manifest both a latitudinal and longitudinal shift in benthic composition over a relatively short distance. There is a change from low-diversity macroalgae-dominated communities on the shallow high-profile reefs in the north to high-diversity (and comparatively high total cover and high biomass) communities dominated by sponges, ascidians and bryozoans, on low-profile deeper reefs and reefs to the south. The shallow-water algae-dominated habitats also harbour hard corals (*Stylophora pistillata*), with wave action strongly influencing the community structure. This shift is concomitant with a reduction in available light associated with increased water turbidity. The shift from a habitat defined primarily by phototropism to a benthic community dominated by suspension-feeders is probably driven by higher sediment loads and the greater availability of nutrients coming from the numerous rivers along this portion of the coast. The reduction in available light with depth similarly allows non-phototrophic species — such as sponges and ascidians — to compete with algae for space on the reef.

Further south in the Port Elizabeth area, inshore reefs to -30 m depth also show relatively distinct changes in community structure, being characterised by diverse reef assemblages dominated by cauliflower soft coral (Sink *et al*. 2011). In particular, the islands in Algoa Bay form ecological distinct subtidal habitats, containing many endemic species of invertebrates and seaweeds.

Information on offshore invertebrates occurring along the coast of the project area is sparse. The deep-water rock lobster (*Palinurus gilchristi*) occurs on rocky substrate in depths of 90 - 170 m between Cape Agulhas and southern KwaZulu-Natal. Larvae drift southwards in the Agulhas Current, settling in the south of the Agulhas Bank before migrating northwards again against the current to the adult grounds (Branch *et al*. 2010). The species is fished commercially along the southern Cape Coast between the Agulhas Bank and East London, with the main fishing grounds being in the 100 – 200 m depth range south of Cape Agulhas on the Agulhas Bank, and off Cape St Francis, Cape Recife and Bird Island.

Other deep-water crustaceans that may occur in the proposed survey area are the shovel-nosed crayfish (*Scyllarides elisabethae*), which occurs primarily on gravelly seabed at depths of around 150 m, although it is sometimes found in shallower water. Its distribution range extends from Cape Point to Maputo. Other rock lobster species occurring in shallower waters on the South and East Coasts include the West Coast rock lobster (*Jasus lalandii*), East Coast rock lobster (*Panulirus homarus*), Longlegged spiny lobster (*Panulirus longipes*), the ornate spiny lobster (*Panulirus ornatus*) and the painted spiny lobster (*Panulirus versicolor*), all of which are typically associated with shallow-water reefs, although the West Coast lobster has been recorded at depths of 120 m (Branch *et al*. 2010).

3.2.3 Pelagic and Demersal Fish

The East Coast ichthyofauna is diverse, comprising a mixture of temperate and tropical species. As a transition zone between the Agulhas and Benguela current systems, the ichthyofauna includes many species also occurring along the West and/or East Coasts.

Small pelagic shoaling species occurring along the South Coast include anchovy (*Engraulis encrasicolus*), pilchard (*Sardinops sagax*) (Figure 12, left), round herring (*Etrumeus japonicas*), chub mackerel (*Scomber japonicas*) and horse mackerel (*Trachurus trachurus capensis*) (Figure 12, right). Anchovies are usually located between the cool upwelling ridge and the Agulhas Current (Hutchings 1994), and are larger than those of the West Coast. Having spawned intensively in an area around the 200 m depth contour between Mossel Bay and Plettenberg Bay between October and January, most adults move inshore and eastwards ahead of the warm Agulhas Current water. Round herring juveniles similarly occur inshore along the South Coast, but move offshore with age (Roel *et al*. 1994; Hutchings 1994).

Pilchards are typically found in water between 14 °C and 20 °C. Spawning occurs on the Agulhas Bank during spring and summer (Crawford 1980), with recruits being found inshore along the South Coast (Hutchings 1994). It is thought that the Agulhas Bank may be a refuge for pilchard under low population levels, and therefore vital for the persistence of the species (CCA & CSIR 1998). During the winter months of June to August, the penetration of northerly-flowing cooler water along the Eastern Cape coast and up to southern KwaZulu-Natal effectively expands the suitable habitat available for this species, resulting in a 'leakage' of large shoals northwards along the coast in what has traditionally been known as the 'sardine run'. The cool band of inshore water is critical to the 'run' as the sardines will either remain in the south or only move northwards further offshore if the inshore waters are above 20 °C. The shoals can attain lengths of 20-30 km and are typically pursued by Great White Sharks, Copper Sharks, Common Dolphins, Cape Gannets and various other large pelagic predators (www.sardinerun.co.za). Catch rates of several important species in the recreational shoreline fishery of KwaZulu-Natal have been shown to be associated with the timing of the sardine run (Fennessey *et al*. 2010). Other pelagic species that migrate along the coast include elf (*Pomatomus saltatrix*), geelbek (*Atractoscion aequidens*), yellowtail (*Seriola lalandi*), kob (*Argyrosomus* sp), seventy-four (*Cymatoceps nasutus*), strepie (*Sarpa salpa*), Cape stumpnose (*Rhabdosargus holubi*) and mackerel (*Scomber japonicus*), which are all regular spawners within KwaZulu-Natal waters (Van der Elst 1988).

Figure 12: Cape fur seal preying on a shoal of pilchards (left). School of horse mackerel (right) (photos: www.underwatervideo.co.za; www.delivery.superstock.com).

There is a high diversity of Teleosts (bony fish) and Chondrichthyans (cartilaginous fish) associated with the inshore and shelf waters of the South and East Coasts, many of which are endemic to the Southern African coastline and form an important component of the demersal trawl and long-line fisheries.

The shallower inshore areas (<100 m) along the South and East Coasts comprise a varied habitat of rocky reefs and soft-bottom substrates, which support a high diversity of endemic sparid and other teleost species (Smale *et al*. 1994), some of which move into inshore protected bays to spawn (Buxton 1990) or undertake spawning migrations up the coast to KwaZulu-Natal. Those species that undertake migrations along the South and East Coasts include Red Steenbras, White Steenbras (summer), Kob, Geelbek and Elf (winter). Spawning of the majority of species endemic to the area occurs in spring and summer. Many of these species form an important component of the commercial and recreational linefishery (Table 4). Furthermore, there are numerous pelagic species that frequent nearshore waters and are targeted by line-fishermen (Table 4).

A wide variety of chondrichthyans occur in nearshore waters of the South Coast (Table 5), some of which, such as St Joseph shark (*Callorhincus capensis*), Soupfin shark (*Galeorhinus galeus*) and Biscuit skate (*Raja straeleni*), are also landed by the trawl and line fishery.

A species likely to be encountered in the project area is singled out for further discussion, namely the great white shark *Carcharodon carcharias*. The great white shark has a cosmopolitan distribution and although not necessarily threatened with extinction, is described as ‘vulnerable’ in the IUCN Red listing, and is listed in Appendix II (species in which trade must be controlled in order to avoid utilization incompatible with their survival) of CITES (Convention on International Trade in Endangered Species) and Appendix I and/or II of the Bonn Convention for the Conservation of Migratory Species (CMS).

The great white shark is a significant apex predator along the South African south and east coasts, and was legislatively protected in South Africa in 1991 in response to global declines in abundance. Long-term catch-per-unit-effort data from protective gillnets in KwaZulu-Natal, however, suggest a 1.6% annual increase in capture rate of this species following protection, although high interannual variation in these data lessen the robustness of the trend (Dudley & Simpfendorfer 2006).

White sharks migrate along the entire South African coast, typically being present at seal colonies during the winter months, but moving nearshore during summer (Johnson *et al.* 2009). Recent research at Mossel Bay into the residency patterns of white sharks revealed that male sharks display low site fidelity, often rapidly moving in an out of the area. Females, in contrast, display high site fidelity and may remain resident in the area for up to two months (Koch & Johnson 2006). Great white sharks are, however, capable of transoceanic migrations (Pardini *et al.* 2001; Bonfil *et al.* 2005; Koch & Johnson 2006), with recent electronic tag data suggesting links between widely separated populations in South Africa and Australia and possible natal homing behaviour in the species. Although during transoceanic migrations they appear to spend most of the time just below the sea surface, frequent deep dives to a much as 980 m are made whilst *en route*. Long-distance return migrations along the South African coast are also frequently undertaken (Figure 13), particularly by immature individuals (Bonfil *et al.* 2005). These coastal migrations, which are thought to represent feeding-related events, potentially traverse the project area.

Table 4: Some of the more important demersal and pelagic linefish species landed by commercial and recreational boat fishers and shore anglers along the South and East Coasts (adapted from CCA & CMS 2001).

Name	Species Name
Demersal teleosts	
Bank steenbras	Chirodactylus grandis
Belman	*Umbrina canariensis*
Blacktail	*Diplodus sargus*
Blue hottentot	*Pachymetopon aeneum*
Bronze bream	*Pachymetopon grande*
Cape bank steenbras	*Chirodactylus grandis*
Cape stumpnose	*Rhabdosargus holubi*
Carpenter	*Argyrozona argyrozona*
Dageraad	*Chrysoblephus christiceps*
Englishman	*Chrysoblephus anglicus*
Fransmadam	*Boopsoidea inornata*
Galjoen	*Dichistius capensis*
Grey chub	*Kyphosus biggibus*
Kob	*Argyrosomus hololepidotus*
Mini kob	*Johnius dussumieri*
Musselcracker	*Sparodon durbanensis*
Natal stumpnose	*Rhabdosargus sarba*
Poenskop	*Cymatoceps nasutus*
Pompano	*Trachinotus africanus*
Red roman	*Chrysoblephus laticeps*
Red steenbras	*Petrus rupestris*
Red stumpnose	*Chrysoblephus gibbiceps*
River bream	*Acanthopagrus berda*
Rockcod	*Epinephalus* spp.
Sand steenbras	*Lithognathus mormyrus*
Santer	*Cheimerius nufar*
Scotsman	*Polysteganus praeorbitalis*
Seventyfour	*Polysteganus undulosus*
Slinger	*Chrysoblephus puniceus*
Snapper salmon	*Otolithes ruber*
Spotted grunter	*Pomadasys commersonnii*
Squaretail kob	*Argyrosomus thorpei*
Steentjie	*Spondyliosoma emarginatum*
Strepie	*Sarpa salpa*
White steenbras	*Lithognathus lithognathus*
White stumpnose	*Rhabdosargus globiceps*
Wreckfish	*Polyprion americanus*
Zebra	*Diplodus cervinus*
Pelagic teleosts	
Elf	*Pomatomus saltatrix*
Garrick/leerfish	*Lichia amia*
Geelbek	*Atractoscion aequidens*
Green jobfish	*Aprion virescens*
King mackerel	*Scomberomorus commerson*
Kingfish species	*Caranx* spp.
Queenfish	*Scomberoides commersonianus*
Queen mackerel	*Scomberomorus plurilineatus*
Tenpounder	*Elops machnata*
Wahoo	*Acanthocybium solandri*
Yellowtail	*Seriola lalandi*

Table 5: Some of the chondrichthyan species occurring along the South and East Coasts (adapted from CCA & CMS 2001).

Name	Species Name
Great white shark	*Carcharodon carcharias*
Ragged-tooth shark	*Odontaspis taurus*
Bronze whaler shark	*Carcharhinus brachyurus*
Dusky shark	*Carcharhinus obscures*
Blacktip shark	*Carcharhinus limbatus*
Hammerhead shark	*Sphyrna* spp.
Lesser Sandshark	*Rhinobatus annulatus*
Milkshark	*Rhizoprionodon acutus*
Gully shark	*Triakis megalopterus*
Skates	Rajiformes
Stingrays	Dasyatidae
St Joseph shark	*Callorhincus capensis*
Soupfin shark	*Galeorhinus galeus*
Diamond ray	*Gymnura natalensis*
Tiger catshark	*Halaelurus natalensis*
Izak	*Halohalaelurus regani*
Puffadder shyshark	*Haploblepharus edwardsii*
Houndsharks	*Mustelus* spp.
Bullray	*Myliobatis aquilla*
Yellowspotted catshark	*Scyliorhinus capensis*
Spiny dogfish	*Squalus* spp.
Electric ray	*Torpedo fuscomaculata*

Figure 13: Long-distance return migrations of two tracked great white sharks along the South African coast in relation to the proposed subsea cable route (red line). The black trace shows a migration from 24 May – 2 November 2003; the white trace shows a migration from 31 May – 1 October 2004 (adapted from Bonfil *et al.* 2005)

3.2.4 Turtles

Three species of turtle occur along the South Coast, namely the leatherback (*Dermochelys coriacea*) (Figure 14, left), and occasionally the loggerhead (*Caretta caretta*) (Figure 14, right) and the green (*Chelonia mydas*) turtle. In the IUCN Red listing, the green turtle is listed as 'Endangered' and the leatherback and loggerhead turtles as 'Vulnerable' on a global scale. These species are thus in the categories in terms of need for conservation in CITES, and CMS (Convention on Migratory Species). As a signatory of CMS, South Africa has endorsed and signed a CMS International Memorandum of Understanding specific to the conservation of marine turtles. South Africa is thus committed to conserve these species at an international level.

Figure 14: Leatherback (left) and loggerhead turtles (right) occur along the East Coast of South Africa (Photos: Ketos Ecology 2009; www.aquaworld-crete.com).

Leatherback turtles inhabit the deeper waters of the Atlantic Ocean and are considered a pelagic species. They travel the ocean currents in search of their prey (primarily jellyfish) and may dive to over 600 m and remain submerged for up to 54 minutes (Hays *et al.* 2004; Lambardi *et al.* 2008). They come into coastal bays and estuaries to mate, and lay their eggs on the adjacent beaches. Leatherback turtles from the east South African population have been satellite tracked swimming around the west coast of South Africa and remaining in the warmer waters west of the Benguela ecosystem (Lambardi *et al.* 2008) (Figure 16).

Loggerheads tend to keep more inshore, hunting around reefs, bays and rocky estuaries along the African East Coast, where they feed on a variety of benthic fauna including crabs, shrimp, sponges, and fish. In the open sea their diet includes jellyfish, flying fish, and squid (www.oceansafrica.com/turtles.htm) (Figure 15).

The green turtle is a non-breeding resident along the east coast of South Africa, and together with loggerhead turtles are expected to occur only as occasional visitors along the East Coast.

Both the leatherback and the loggerhead turtle nest on the beaches of the northern KwaZulu-Natal coastline between October and February, extending into March.

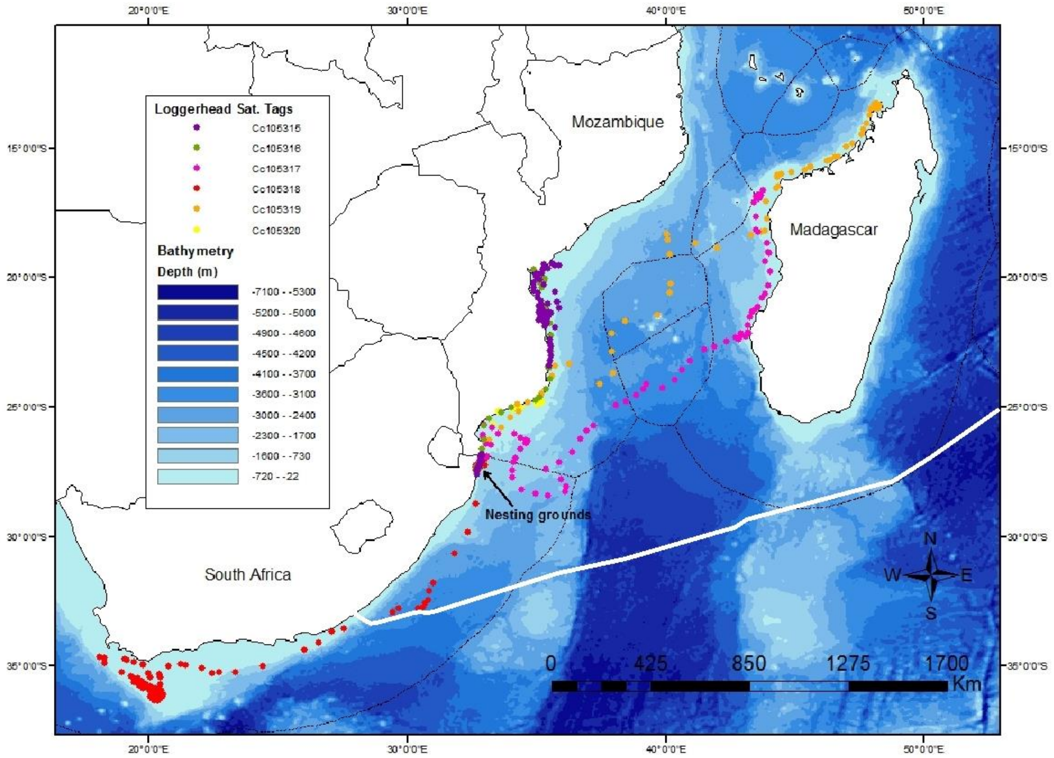


Figure 15: Spatial distribution of satellite tagged loggerhead females (2011/2012; Oceans and Coast, DEA unpublished data) in relation to the proposed subsea cable route (white line).

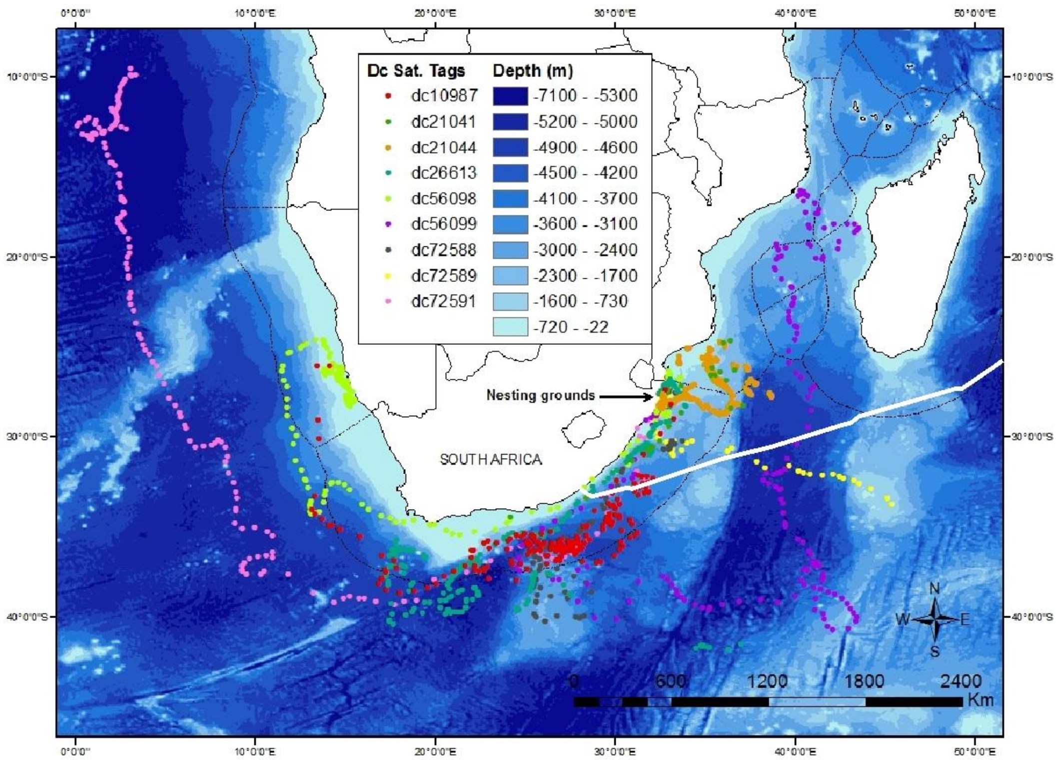


Figure 16: The post-nesting distribution of nine satellite tagged leatherback females (1996 – 2006; Oceans and Coast, DEA unpublished data) in relation to the proposed subsea cable route (white line).

3.2.5 Seabirds

Thirteen of the 60 species of seabirds known to, or thought likely to occur, along the South Coast, breed within the region (Table 6), including Cape Gannets (Algoa Bay islands), African Penguins (Algoa Bay islands), Cape Cormorants (a small population at Algoa Bay islands and mainland sites), Whitebreasted Cormorant, Roseate Tern (Bird and St Croix Islands), Swift Term (Stag Island) and Kelp Gulls. Although the Algoa Bay Islands fall to the south of the proposed outfall, they are in close enough proximity for the seabird species to be encountered in the project area.

Table 6: Breeding resident seabirds present along the South Coast (adapted from CCA & CMS 2001).

Species name	Common name	Global IUCN Status
Spheniscus demersus	African Penguin	Endangered
Phalacrocorax carbo	Great Cormorant	Least Concern
Phalacrocorax capensis	Cape Cormorant	Near Threatened
Phalacrocorax neglectus	Bank Cormorant	Endangered
Phalacrocorax coronatus	Crowned Cormorant	Least Concern
Morus capensis	Cape Gannet	Vulnerable
Larus dominicanus	Kelp Gull	Least Concern
Larus cirrocephalus	Greyheaded Gull	Least Concern
Larus hartlaubii	Hartlaub's Gull	Least Concern
Hydroprogne caspia	Caspian Tern	Vulnerable
Sterna bergii	Swift Tern	Least Concern
Sterna dougallii	Roseate Tern	Least Concern
Sterna balaenarum	Damara Tern	Near Threatened

Sea-birds along the South and East coasts at times intensively target shoals of pelagic fish, particularly during the 'sardine run'. Small pelagic species such as anchovy and pilchard form important prey items for seabirds, particularly the Cape Gannet (Figure 17, left), the African Penguin (Figure 17, right) and the various cormorant species. Most of the breeding resident seabird species feed on pelagic shoaling fish species (with the exception of the gulls, which scavenge, and feed on molluscs and crustaceans). Feeding strategies include surface plunging (gannets and terns), pursuit diving (cormorants and penguins), and scavenging and surface seizing (gulls). All these species feed relatively close inshore, although gannets may feed further offshore.

All the species forage at sea either inshore or further offshore. When breeding, African Penguins forage within 20 km of the coast and to the south of Cape Recife, but some birds do follow the sardine migration eastwards in autumn/winter.

Forty-six seabird species occur commonly along the East coast (Table 7). As the East Coast provides few suitable breeding sites for coastal and seabirds, only three species (Grey-headed gull, Caspian tern and Swift tern breed regularly along the coast (CSIR 1998). Many of the river mouths and estuaries along the East Coast, however, serve as important roosting and foraging sites for coastal and seabirds birds (Underhill & Cooper 1982; Turpie 1995).

Figure 17: Typical diving seabirds on the South Coast are the Cape Gannets (left) (Photo: NACOMA) and the flightless African Penguin (right) (Photo: Klaus Jost).

Table 7: Resident and fairly-common to common visiting seabirds present along the KwaZulu-Natal coast (from CSIR 1998).

Species name	Common name	Status
Diomedea exulans	Wandering albatross	Non-breeding winter visitor
Diomedea cauta	Shy albatross	Non-breeding winter visitor
Diomedea melanophris	Blackbrowed albatros	Non-breeding winter visitor
Diomedea chlororhynchos	Yellownosed albatross	Non-breeding winter visitor
Macronectes giganteus	Southern giant petrel	Non-breeding winter visitor
Macronectes halli	Northern giant petrel	Non-breeding winter visitor
Daption capense	Pintado petrel	Non-breeding visitor, mainly in winter
Pterodroma macroptera	Greatwinged petrel	Non-breeding winter visitor
Pterodroma mollis	Softplumaged petrel	Non-breeding visitor, mainly in winter
Pachyptila vittata	Broadbilled prion	Non-breeding visitor, mainly in winter
Procellaria aequinoctialis	Whitechinned petrel	Non-breeding visitor, mainly in winter
Calonectris diomedea	Cory's shearwater	Summer visitor
Puffinus gravis	Great shearwater	Summer vagrant
Puffinus griseus	Sooty shearwater	Non-breeding visitor, mainly in winter
Hydrobates pelagicus	European storm petrel	Non-breeding visitor, mainly in summer
Oceanodroma leucorhoa	Leach's storm petrel	Summer vagrant
Oceanites oceanicus	Wilson's storm petrel	Non-breeding visitor, common year round
Morus capensis	Cape gannet	Common, follows 'sardine run'
Stercorarius parasiticus	Arctic skua	Summer visitor from Palaearctic
Catharacta skua	Antarctic skua	Present all year, more abundant in winter
Larus dominicanus	Kelp gull	Year-round visitor from South & West Coast
Larus cirrocephalus	Greyheaded gull	
Hydroprogne caspia	Caspian tern	Coastal breeding resident
Sterna bergii	Swift tern	Coastal breeding resident
Sterna paradisaea	Arctic tern	Coastal breeding resident
Sterna sandvicensis	Sandwich tern	Summer visitor from Palaearctic
Sterna bengalensis	Lesser crested tern	Summer visitor from Palaearctic
Sterna albifrons	Little tern	Visitor to the coast, mainly in summer
Sterna hirundo	Common tern	Palaearctic migrant, common in summer

3.2.6 Marine Mammals

The marine mammal fauna of the South and East Coasts comprises between 28 and 38 species of cetaceans (whales and dolphins) known (historic sightings or strandings) or likely (habitat projections based on known species parameters) to occur here (Table 8) and one seal species, the Cape fur seal (*Arctocephalus pusillus*) (Findlay 1989; Findlay *et al*. 1992; Ross 1984; Peddemors 1999). The offshore areas have been particularly poorly studied with almost all available information from deeper waters (>200 m) arising from historic whaling records. Information on smaller cetaceans in deeper waters is particularly poor. Of the migratory cetaceans listed in Table 5, the blue whale is listed as 'Critically Endangered', sei and fin whales are listed as 'Endangered' and the Humpback and Southern Right whales as 'Least Concern' in the SA Red List Assessment (2014) (Child *et al*. 2016). The Marine Living Resources Act, 1998 (No. 18 of 1998) states that no whales or dolphins may be harassed, killed or fished. The act prohibits aircraft to approach within 300 m of a whale. Therefore, except for when the aircraft lands on or takes off from the drillship and logistics base, the flight altitude would be >300 m.

The distribution of whales and dolphins on the South and East Coasts can largely be split into those associated with the continental shelf and those that occur in deep, oceanic waters. Cetaceans comprised two basic taxonomic groups: the mysticetes (filter-feeding baleen whales) and the odontocetes (toothed predatory whales and dolphins). Due to large differences in their size, sociality, communication abilities, ranging behaviour and acoustic behaviour, these two groups are considered separately.

The majority of baleen whales fall into the family Balaenidae. Those occurring in the broader study area include the blue, fin, sei, minke, dwarf minke and two populations of Bryde's whale. Most of these species occur in pelagic waters, with only occasional visits into shelf waters. All of these species show some degree of migration offshore of the project area when *en route* between higher-latitude feeding grounds (Antarctic or Subantarctic) and lower-latitude breeding grounds. Depending on the ultimate location of these feeding and breeding grounds, seasonality off South Africa can be either unimodal (usually in June-August, e.g. minke and blue whales) or bimodal (usually May-July and October-November, e.g. fin whales), reflecting a northward and southward migration through the area. As whales follow geographic or oceanographic features, the northward and southward migrations may take place at difference distances from the coast, thereby influencing the seasonality of occurrence at different locations. Due to the complexities of the migration patterns, each species is discussed in further detail below.

Two types of Bryde's whales are recorded from South African waters - a smaller neritic form and a larger pelagic form described as *Balaenoptera brydei*. The migration patterns of Bryde's whales differ from those of all other baleen whales in the region as they are not linked to seasonal feeding patterns. The inshore population is unique in that it is resident year round on the Agulhas Bank, only undertaking occasional small seasonal excursions up the East Coast during winter. Sightings over the last two decades suggest that the distribution of this population has shifted eastwards, with sightings on the West Coast very rare compared to pre-1980s whaling records (Best 2001, 2007; Best *et al*. 1984). Although this is a very small population, which is possibly decreasing in size (Penry 2010), its current distribution implies that it is likely to be encountered in the project area.

Table 8: Cetaceans occurrence off the South and East Coasts of South Africa, their seasonality and IUCN conservation status (adapted from S. Elwen, Mammal Research Institute, pers. comm., Best 2007).

Common Name	Species	Shelf	Offshore	Seasonality	IUCN Conservation Status
Delphinids					
Common bottlenose dolphin	*Tursiops truncatus*	Yes	Yes	Year round	Least Concern
Indo-Pacific bottlenose dolphin	*Tursiops aduncus*-Ifafa-False Bay subpopulation	Yes		Year round	
	Tursiops aduncus-Seasonal subpopulation	Yes		Year round	Near threatened
Common (short beaked) dolphin	*Delphinus delphis*	Yes	Yes	Year round	Data Deficient
Common (long beaked) dolphin	*Delphinus capensis*	Yes		Year round	Least Concern
Fraser's dolphin	*Lagenodelphis hosei*		Yes	Year round	Least Concern
Spotted dolphin	*Stenella attenuata*	Yes	Yes	Year round	Least Concern
Striped dolphin	*Stenella coeruleoalba*		Yes	Year round	Least Concern
Indo-Pacific humpback dolphin	*Sousa chinensis*	Yes		Year round	Endangered
Long-finned pilot whale	*Globicephala melas*		Yes	Year round	Least Concern
Short-finned pilot whale	*Globicephala macrorhynchus*		Yes	Year round	Least Concern
Killer whale	*Orcinus orca*	Occasional	Yes	Year round	Least Concern
False killer whale	*Pseudorca crassidens*	Occasional	Yes	Year round	Least Concern
Risso's dolphin	*Grampus griseus*	Yes (edge)	Yes	Year round	Least Concern
Pygmy killer whale	*Feresa attenuata*		Yes	Year round	Least Concern
Sperm whales					
Pygmy sperm whale	*Kogia breviceps*		Yes	Year round	Data Deficient
Dwarf sperm whale	*Kogia sima*		Yes	Year round	Data Deficient
Sperm whale	*Physeter macrocephalus*		Yes	Year round	Vulnerable

Common Name	Species	Shelf	Offshore	Seasonality	IUCN Conservation Status
Beaked whales					
Cuvier's	*Ziphius cavirostris*		Yes	Year round	Least Concern
Arnoux's	*Beradius arnouxii*		Yes	Year round	Data Deficient
Southern bottlenose	*Hyperoodon planifrons*		Yes	Year round	Least Concern
Hector's	*Mesoplodon hectori*		Yes	Year round	Data Deficient
Strap-toothed whale	*Mesoplodon layardii*		Yes	Year round	Data Deficient
Longman's	*Mesoplodon pacificus*		Yes	Year round	Data Deficient
True's	*Mesoplodon mirus*		Yes	Year round	Data Deficient
Gray's	*Mesoplodon grayi*		Yes	Year round	Data Deficient
Blainville's	*Mesoplodon densirostris*		Yes	Year round	Data Deficient
Baleen whales					
Antarctic Minke	*Balaenoptera bonaerensis*	Yes	Yes	>Winter	Least Concern
Dwarf minke	*B. acutorostrata*	Yes		Year round	Least Concern
Fin whale	*B. physalus*		Yes	MJJ & ON, rarely in summer	Endangered
Antarctic Blue whale	*B. musculus intermedia*		Yes	MJJ	Critically Endangered
Sei whale	*B. borealis*		Yes	MJ & ASO	Endangered
Bryde's (inshore)	*B brydei (subspp)*		Yes	Year round	Vulnerable
Pygmy right	*Caperea marginata*	Yes		Year round	Least Concern
Humpback	*Megaptera novaeangliae*	Yes	Yes	AMJJASOND	Least Concern
Southern right	*Eubalaena australis*	Yes		JJASON	Least Concern

The offshore population of Bryde's whale lives off the continental shelf (>200 m depth), and migrates between wintering grounds off equatorial West Africa (Gabon) and summering grounds off the South African West Coast (Best 2001). Its seasonality within South African waters is thus opposite to the majority of the balaenopterids, with abundance on the West Coast highest in January-February. This population of Bryde's whales is unlikely to be encountered in the project area.

Sei whales migrate through South African waters, where they were historically hunted in relatively high numbers, to unknown breeding grounds further north. Their migration pattern thus shows a bimodal peak with numbers on the East Coast highest in June (on the northward migration), and with a second larger peak in September. All whales were caught in waters deeper than 200 m with most deeper than 1,000 m (Best & Lockyer 2002). Almost all information is based on whaling records 1958-1963 and there is no current information on abundance or distribution patterns in the region.

Fin whales were historically caught off the South African East Coast, with a unimodal winter (June-July) peak in catches off Durban. However, as northward moving whales were still observed as late as August/September, the return migration may occur further offshore. Some juvenile animals may feed year round in deeper waters off the shelf (Best 2007). There are no recent data on abundance or distribution of fin whales off Southern Africa.

Blue whales were historically caught in high numbers off Durban, showing a single peak in catches in June/July. Sightings of the species in the area between 1968-1975 were rare and concentrated in March to May (Branch *et al.* 2007). However, scientific search effort (and thus information) in pelagic waters is very low. The chance of encountering the species in the project area is extremely low.

Minke whales are present year-round with a large portion of this population consisting of small, sexually immature animals that primarily occur beyond 30 nautical miles from the coast during summer and autumn. Off Durban Minke whales are reported to increase in numbers in April and May, remaining at high levels through June to August and peaking in September (Best 2007).

The most abundant baleen whales off the coast of South Africa are southern right and humpback whales (Figure 18). Southern rights migrate to the southern Africa subcontinent to breed and calve, where they tend to have an extremely coastal distribution mainly in sheltered bays (90% <2 km from shore; Best 1990, Elwen & Best 2004). Winter concentrations have been recorded all along the southern and eastern coasts of South Africa as far north as Maputo Bay, with the most significant concentration currently on the South Coast between Cape Town and Port Elizabeth. They typically arrive in coastal waters off the South Coast between June and November each year, although animals may be sighted as early as April and as late as January. They migrate to the southern African sub-region to breed and calve, inhabiting shallow coastal waters in sheltered bays (90% were found <2 km from shore; Best 1990; Elwen & Best 2004). While in local waters, southern rights are found in groups of 1-10 individuals, with cow-calf pairs predominating in inshore nursery areas. From July to October, animals aggregate and become involved in surface-active groups, which can persist for several hours.

The most recent abundance estimate for this population (2017), estimated the population at ~6,116 individuals including all age and sex classes, which is thought to be at least 30% of the original population size with the population growing at ~6.5% per year since monitoring began

(Brandaõ *et al.* 2018). Although the population is likely to have continued growing at this rate overall, there have been observations of major changes in the numbers of different classes of right whales seen; notably there has been a significant decrease in the number of adults without calves seen in near-shore waters since 2009 (Roux *et al.* 2015, Vinding *et al.* 2015). A large resurgence in numbers of right whales along the South African coast in 2018 and analysis of calving intervals suggests that these 'missing whales' are largely a result of many animals shifting from a 3 year to 4 year calving intervals (Brandao *et al.* 2018). The reasons for this are not yet clear but may be related to broadscale shifts in prey availability in the Southern Ocean, as there has been a large El Niño during some of this period.

Figure 18: The humpback whale (left) and the southern right whale (right) migrate along the South and East Coasts during winter (Photos: www.divephotoguide.com; www.aad.gov.au).

The majority of humpback whales on the south and east coasts of South Africa are migrating past the southern African continent. The main winter concentration areas for Humpback whales on the east coast include Mozambique, Madagascar, Kenya and Tanzania. Three principal migration routes for Humpbacks in the south-west Indian Ocean have been proposed. On the first route up the East Coast, the northern migration reaches the coast in the vicinity of Knysna continuing as far north as central Mozambique. The second route approaches the coast of Madagascar directly from the south, possibly *via* the Mozambique Ridge. The third, less well established route, is thought to travel up the centre of the Mozambique Channel to Aldabra and the Comore Islands (Findlay *et al.* 1994; Best *et al.* 1998). Humpbacks have a bimodal distribution off the East Coast, most reaching southern African waters around April, continuing through to September/October when the southern migration begins and continues through to December. The calving season for Humpbacks extends from July to October, peaking in early August (Best 2007). Cow-calf pairs are typically the last to leave southern African waters on the return southward migration, although considerable variation in the departure time from breeding areas has been recorded (Barendse *et al.* 2010). The population of humpback whales that migrate through the project area likely belong to breeding stock C, one of two populations that occur off southern Africa (IWC 1998). Their migration stream along the East Coast of South Africa has been shown to begin at, or near, Knysna in the west (23° E) from where they travel inshore of the Agulhas current to the breeding grounds off Mozambique (Best *et al.* 1998; Banks 2013). A study conducted in Plettenberg Bay and Knysna, well to the south of the project area, calculated the width of the migration stream to extend a minimum of 16.5 km offshore of the Robberg peninsula (Banks 2013), with anecdotal reports from sailing and fishing vessels operating in the area reporting humpback whales at least 40 km from the coast. Off Cape Vidal whale abundances peak around June/July on their northward migration, although some have been observed still moving north as late as October. Southward moving animals on their return migration were first seen in July, peaking in August and continuing to late October (Findlay & Best 1996a, b).

All information about sperm whales in the southern African subregion results from data collected during commercial whaling activities prior to 1985 (Best 2007). Sperm whales are the largest of the toothed whales and have a complex, well-structured social system with adult males behaving differently from younger males and female groups. They live in deep ocean waters, occasionally coming into depths of 500-200 m on the shelf (Best 2007). Seasonality of catches off the East Coast suggest that medium- and large-sized males are more abundant during winter, while female groups are more abundant in summer, although animals occur year round (Best 2007). Although considered relatively abundant worldwide (Whitehead 2002), no current data are available on density or abundance of sperm whales in African waters. Sperm whales feed at great depth, during dives in excess of 30 minutes, making them difficult to detect visually. This species is unlikely to occur in the inshore regions of the project area.

There are almost no data available on the abundance, distribution or seasonality of the smaller odontocetes (including the beaked whales and dolphins) known to occur in oceanic waters off the South and East Coasts. Beaked whales are all considered to be true deep water species usually being seen in waters in excess of 1,000 - 2,000 m depth (see various species accounts in Best 2007). Their presence in the area may fluctuate seasonally, but insufficient data exist to define this clearly. Of the smaller odontocetes, the common bottlenose dolphin (Figure 19, left) and humpback dolphins (Figure 19, right) are known to be resident on the shelf and offshore and are likely to be frequently encountered in the project area.

Figure 19: Toothed whales that occur on the South and East Coasts include the Bottlenose dolphin (left) and the Indo-pacific humpback dolphin (right) (Photos: www.fish-wallpapers.com; www.shutterstock.com).

Humpback dolphins occur along the South African South and East Coasts, from Danger Point in the Western Cape to Mozambique, Tanzania, Kenya, the Comoros Islands and the western coast of Madagascar. Due to the recent recognition of the Western Indian Ocean population as a separate species, their conservation status is internationally regarded as 'vulnerable' and within South Africa as 'endangered', and the species is accepted to be South Africa's most endangered marine mammal. Overall, it is expected that the distribution of the species in the

Indian Ocean is not continuous, but rather consists of many subpopulations that should be regarded as separate management units (Durham 1994; Karczmarski 1996; Keith 1999; Karczmarski *et al.* 2000).

Humpback dolphins are coastal animals, preferring water depths less than 20 m and are usually observed within 500 m from shore, predominantly within 10 km of river mouths (Melly 2011; Koper *et al.* 2016). This is similar to findings from the early 1990s, where 87% of sightings were observed within 400 m of land, and almost all the sightings were in waters less than 15 m deep (Karczmarski 1996; Karczmarski *et al.* 2000). Localised populations on the South Coast are concentrated around shallow reefs, whereas those off Richard's Bay appear to prefer large estuarine systems. It appears that the species is more closely associated with estuaries and rivers than other inshore cetaceans. The species is caught accidentally in the shark nets, with 3 animals being killed on average annually, most of which are caught in Richard's Bay (S. Plön, pers com.).

Seasonal movements and migrations are not characteristic of the species, but sightings rate and group size appear to increase between January and April, and again in September. The population off KZN is estimated at 160 individuals, with that for South Africa numbering no more than 1,000. Recent studies on the South Coast have indicated a decrease in sightings by approximately 50% and a reduction in mean group sizes from 7 to 4 individuals in the last decade (Greenwood 2013; Koper *et al.* 2016). Several hypotheses have been suggested as likely reasons for the decline: a decrease in prey availability, prolonged disturbance from whale and dolphin watching tourism and other marine recreation, coastal development and sustained pollution that contaminates the prey on which this species depends.

Due to their limited spatial distribution (restricted to shallow, coastal areas) this species is likely to occur in the project area. Sightings close inshore off Hood Point have been reported (P. Whittington, East London Museum, pers. comm.)

The Indo-Pacific bottlenose dolphin occurs throughout coastal and shallow offshore waters of the temperate and tropical regions of the Indian Ocean and South-West Pacific. The species inhabits waters less than 50 m deep between the Mozambique border in the east and False Bay in west (Ross 1984; Ross *et al.* 1987). It is found year-round in the coastal inshore habitats of the South and East coast, with peak sightings being recorded in April/May (autumn) and October/November (spring) in Algoa Bay (Melly *et al.* in press).

Although their distribution is essentially continuous from Cape Agulhas eastwards to southern Mozambique, the Indo-Pacific bottlenose dolphin seems to have 'preferred areas' along the coast (Ross *et al.* 1987; Ross *et al.* 1989; Cockcroft *et al.* 1990, 1991). Areas in which it is more frequently encountered are about 30 km apart, and are thought to correspond to discrete home ranges. Genetic assessments have identified a resident population North of Ifafa (KZN coast, listed as 'vulnerable'), a resident population south of Ifafa (listed as 'near threatened'), as well as a migratory population South of Ifafa ('data deficient'), which appears to undertake seasonal migrations into KZN waters in association with the 'sardine run' (Natoli *et al.* 2008; Cockcroft *et al.* 2016). On average, 15 animals die annually as bycatch in the shark nets set along the KZN coast to protect bathers.

Indo-Pacific bottlenose dolphins are often seen in large groups of 10s to 100s of animals (Saayman *et al.* 1972; Ross 1984; Melly 2011) with calves seen year-round along the South-East Coast (Cockcroft & Peddemors 1990; Best 2007).

Two species of common dolphin are currently recognised, the short-beaked common dolphin (*Delphinus delphis*) and the long-beaked common dolphin (*Delphinus capensis*). The long-beaked common dolphin (*D. capensis*) is resident to the temperate Agulhas Bank with sightings extending as far up the West Coast as St Helena Bay and up the East Coast to Richards Bay, in waters less than 500 m deep. Individuals of this species are wide ranging within this area and may move hundreds of kilometers in short periods of time. They are not known to show any degree of residency to coastal areas. Group sizes in this species tend to be large: 100s to even 1000s of animals. No population estimate is available for the two species, but they are thought to be large (15,000 – 20,000; Cockcroft & Peddemors 1990; Peddemors 1999).

The short-beaked common dolphin prefers offshore habitats and is unlikely to be encountered in the project area. Estimates of the population size and seasonality for the subregion are lacking. A few studies have suggested that common dolphins inhabit the Eastern Cape coastline during summer, with movements towards the KwaZulu-Natal coastline during winter (Ross 1984; Cockcroft & Peddemors 1990; O'Donoghue *et al*. 2010a, 2010b, 2010c), although sightings off KZN have also been made during summer. These movements are associated with the annual sardine migration up the East Coast in winter (Best 2007). Patterns in their spatial and temporal distribution along the coast are unclear, but long-beaked common dolphins may be observed off the East Coast year round.

As with the common bottlenose dolphins, an average of 39 animals die annually through entanglement in the shark nets (Best 2007).

The Cape fur seal (*Arctocephalus pusillus pusillus*) is the only seal species that has breeding colonies along the South Coast, namely at Seal Island in Mossel Bay, on the northern shore of the Robberg Peninsula in Plettenberg Bay and at Black Rocks (Bird Island group) in Algoa Bay. The timing of the annual breeding cycle is very regular occurring between November and January, after which the breeding colonies break up and disperse. Breeding success is highly dependent on the local abundance of food, territorial bulls and lactating females being most vulnerable to local fluctuations as they feed in the vicinity of the colonies prior to and after the pupping season (Oosthuizen 1991).

Seals are highly mobile animals with a general foraging area covering the continental shelf up to 120 nautical miles offshore (Shaughnessy 1979), with bulls ranging further out to sea than females. The movement of seals from the three South Coast colonies are poorly known, however, although limited tracking of Algoa Bay animals has suggested these seals to be feeding in the inshore region south of Cape Recife. The diet varies with season and availability and includes pelagic species such as horse mackerel, pilchard, and hake, as well as squid and cuttlefish.

Historically the Cape fur seal was heavily exploited for its luxurious pelt. Sealing restrictions were first introduced to southern Africa in 1893, and harvesting was controlled until 1990 when it was finally prohibited. The protection of the species has resulted in the recovery of the populations, and numbers continue to increase. Consequently, their conservation status is not regarded as threatened.

3.2.7 Marine Protected Areas

Numerous marine protected areas (MPAs) exist along the South and East Coasts (Figure 20). MPAs of the Eastern Cape include Sardinia Bay and the Bird Island Group, the Amathole MPA in the vicinity of East London, and the Dwesa-Cwebe, Hluleka and Pondoland MPAs located on the Wild Coast. The Amathole MPA comprised the three former closed areas, namely from Christmas Rock to the Gxulu River mouth, from Nahoon Point to Gonubie Point, and from the Nyara River mouth to the Kei River mouth. The proposed shore crossing for the subsea cable is located ~16 km southwest of the western boundary of the Gonubie MPA.

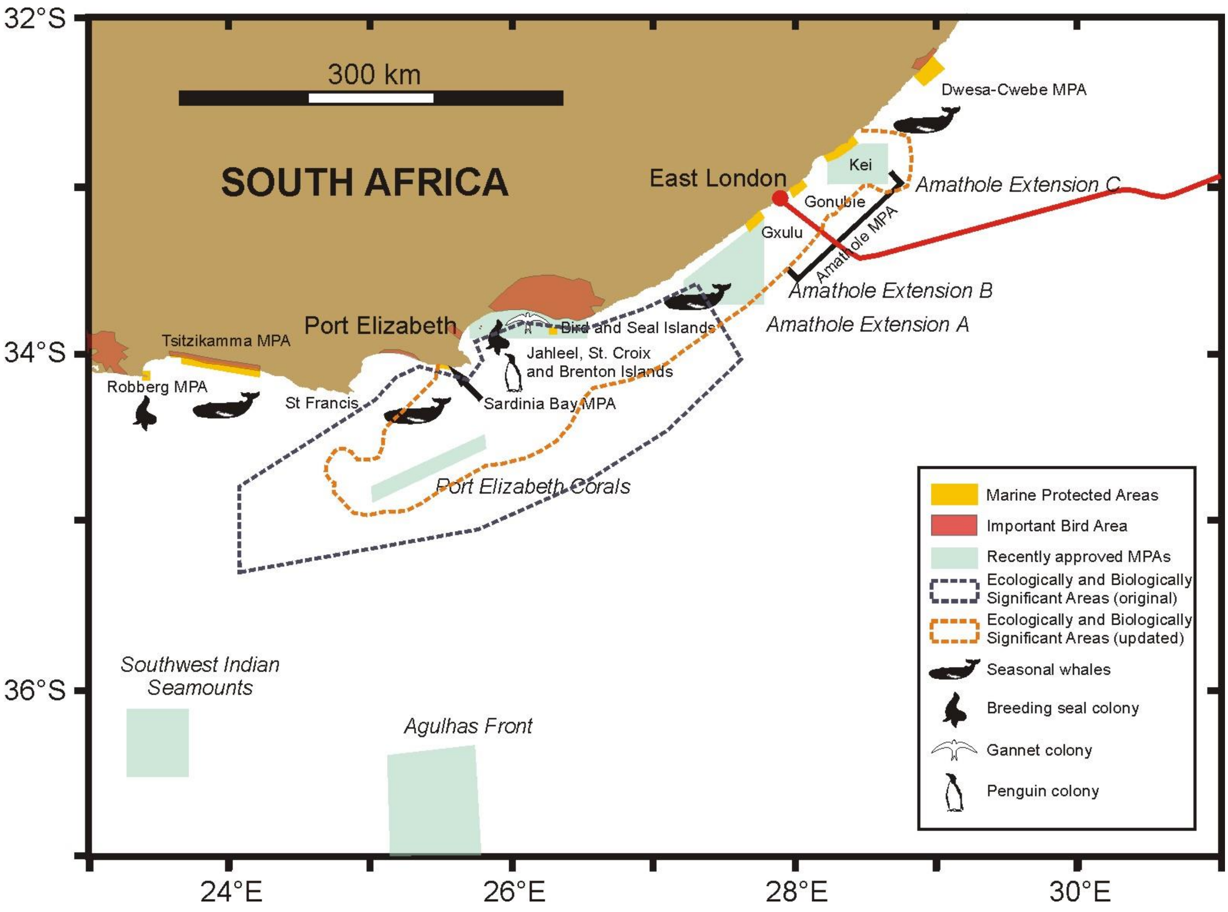


Figure 20: Project - environment interaction points on the southeast coast, illustrating the location of seabird and seal colonies, seasonal whale populations, and marine protected areas in relation to the proposed subsea cable route (red line).

Offshore Marine Biodiversity Protection Areas

Using biodiversity data mapped for the 2004 and 2011 National Biodiversity Assessments a systematic biodiversity plan was developed for the South African coast with the objective of identifying both coastal and offshore priority areas for MPA expansion. To this end, numerous offshore focus areas were identified for protection between 23°E and 30°E, and these carried forward through Operation Phakisa for the proposed development of offshore MPAs. This network of 20 MPAs was approved by Cabinet on 24 October 2018, thereby increasing the ocean protection within the South African Exclusive Economic Zone (EEZ) to 5%. The existing and recently approved MPAs within the broader project area are shown in Figure 20.

Hope Spots are defined by Mission Blue of the Sylvia Earle Alliance as special conservation areas that are critical to the health of the ocean. The first six Hope Spots were launched in South Africa in 2014 and include Aliwal Shoal in KwaZulu-Natal, Algoa Bay, Plettenberg Bay, Knysna, the Cape Whale Coast (Hermanus area) and False Bay in the Western Cape. None of these are located within the proposed subsea cable route.

Ecologically and Biologically Significant Areas (EBSAs)

Following application of the Convention of Biological Diversity's (CBD) Ecologically or Biologically Significant marine Areas (EBSA) criteria[3], a number of areas around the South African coast were identified as potentially requiring enhanced conservation and management. The outcome was presented at the CBD regional workshop for the description of ecologically or biologically significant marine areas in the Southern Indian Ocean (July/August 2012) (CBD 2013).

One Ecologically or Biologically Significant Area (EBSA) was proposed for the Southeast Coast under the Convention of Biological Diversity (CBD) (CBD 2013), namely the "Offshore of Port Elizabeth". Following new research conducted in the area since the original description of this EBSA, the boundary, name, description and criteria ranks have all been recently updated. The EBSA, now known as "Algoa to Amathole", encompasses the likely biggest single collection of significant and special marine features in all of South Africa that also jointly support key ecological processes, including important land-sea connections. Complex ocean circulation occurs here, where the Agulhas Current leaves the coast, following the shelf break. This results in the formation of cold-water eddies, intrusions of Agulhas water onto the shelf and large offshore meanders of the Agulhas Current. The area includes several small islands in Algoa Bay that are breeding habitat for seabirds (notably, the Endangered African penguin); spawning areas, nursery areas, and key transport pathways for demersal and pelagic fish, thereby also supporting foraging areas for seabirds, marine mammals and sharks. Several species including threatened turtles (adults, juveniles, and hatchlings) and marine mammals also migrate through the EBSA. Habitats present include some rare habitat types with limited spatial representation, as well as submarine canyons, steep shelf edge, deep reefs, outer shelf and shelf edge gravels, and vulnerable species such as reef-building cold-water corals in depth between 100 and 1,000 m. It also contains several key biodiversity features, including: a newly

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[3] In 2008, the Conference of the Parties to the Convention on Biological Diversity (COP 9) adopted the following scientific criteria for identifying ecologically or biologically significant marine areas in need of protection in open-ocean waters and deep-sea habitats (further details available at http://www. cbd.int/marine/doc/azores-brochure-en.pdf):

1. Uniqueness or Rarity
2. Special importance for life history stages of species
3. Importance for threatened, endangered or declining species and/or habitats
4. Vulnerability, Fragility, Sensitivity, or Slow recovery
5. Biological Productivity
6. Biological Diversity
7. Naturalness

In 2010, COP 10 noted that the application of the EBSA criteria was a scientific and technical exercise, and that areas found to meet the criteria may require enhanced conservation and management measures, and that this could be achieved through means such as marine protected areas and impact assessments. It was emphasised that the identification of EBSAs and the selection of conservation and management measures was a matter for States and competent intergovernmental organisations, in accordance with international law , including the UN Convention on the Law of the Sea.

discovered unique rocky ridge that supports fragile corals and is covered by dense clouds of plankton and hake; sites where coelocanths are present; a critically endangered localised endemic estuarine pipefish; several priority estuaries; rare habitat types of limited spatial extent; and a few existing coastal MPAs.

No specific management actions have as yet been formulated for these EBSAs, although the uniqueness of the areas contributed to the development of the recently approved offshore MPAs.

4. ASSESSMENT OF IMPACTS ON MARINE FAUNA

4.1. Impact Assessment Methodology

An EIA methodology should minimise subjectivity as far as possible and accurately assess the project impacts. In order to achieve this ERM has followed the methodology defined below.

4.1.1 Impact Identification and Characterisation

An 'impact' is any change to a resource or receptor caused by the presence of a project component or by a project-related activity. Impacts can be negative or positive.

Impacts are described in terms of their characteristics, including the impact type and the impact spatial and temporal features (namely extent, duration, scale and frequency). Table 9 describes the terms used in this EIA.

Table 9: Impact Characteristics

Characteristic	Definition	Terms
Type	A descriptor indicating the relationship of the impact to the project (in terms of cause and effect).	**Direct** - Impacts that result from a direct interaction between the project and a resource/receptor (eg between occupation of the seabed and the habitats which are affected). **Indirect** - Impacts that follow on from the direct interactions between the project and its environment as a result of subsequent interactions within the environment (eg viability of a species population resulting from loss of part of a habitat as a result of the project occupying the seabed). **Induced** - Impacts that result from other activities (which are not part of the project) that happen as a consequence of the project. **Cumulative** - Impacts that arise as a result of an impact and effect from the project interacting with those from another activity to create an additional impact and effect.
Duration	The time period over which a resource / receptor is affected.	**Temporary** - impacts are predicted to be of short duration and intermittent/occasional. **Short term** - impacts that are predicted to last only for the duration of the drilling and well testing phase, i.e. 6 months or less. **Medium term** - impacts that are predicted to extend beyond the drilling phase but not longer than three years. **Long term** - impacts that will continue beyond three years but within 10 years. **Permanent** - impacts that cause a permanent change in the affected receptor or resource or ecological process, and which endures beyond 10 years.

Characteristic	Definition	Terms
Extent	The reach of the impact (i.e. physical distance an impact will extend to)	**On-site** - impacts that are limited to the site area only, i.e. within 500 m of drilling well (exclusion zone). **Local** - impacts that are limited to the project site and within the block. **Regional** - impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries, habitat type/ecosystems, ie extend to areas outside the block. **National** - impacts that affect nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences. **Trans-boundary/International** - impacts that affect internationally important resources such as areas protected by international conventions or impact areas outside of South Africa.
Scale	Quantitative measure of the impact (eg the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.).	Quantitative measures as applicable for the feature or resources affects. No fixed designations as it is intended to be a numerical value.
Frequency	Measure of the constancy or periodicity of the impact.	No fixed designations; intended to be a numerical value or a qualitative description.

Once a rating is determined for likelihood and consequence, the risk matrix in Table 10 is used to determine the risk significance for accidental events. The prediction takes into account the mitigation and/or risk control measures that are already an integral part of the project design, and the management plans to be implemented by the project.

Table 10: Accidental Events Risk Significance

Risk Significance Rating				
Likelihood		Low	Medium	High
Consequence	**Minor**	Minor	Minor	Moderate
	Moderate	Minor	Moderate	Major
	Major	Moderate	Major	Major

4.1.2 Determining Impact Magnitude

Once impacts are characteristed they are assigned a 'magnitude'. Magnitude is typically a function of some combination (depending on the resource/receptor in question) of the following impact characteristics:

- Extent;
- Duration;
- Scale; and
- Frequency.

Magnitude (from small to large) is a continuum. Evaluation along the continum requires professional judgement and experience. Each impact is evaluated on a case-by-case basis and the rationale for each determination is noted. Magnitude designations for negative effects are: negligible, small, medium and large.

The magnitude designations themselves are universally consistent, but the definition for the designations varies by issue. In the case of a positive impact, no magnitude designation has been assigned as it is considered sufficient for the purpose of the impact assessment to indicate that the project is expected to result in a positive impact.

Some impacts will result in changes to the environment that may be immeasurable, undetectable or within the range of normal natural variation. Such changes are regarded as having no impact, and characterised as having a negligible magnitude.

In the case of impacts resulting from unplanned events, the same resource/ receptor-specific approach to concluding a magnitude designation is used. The likelihood factor is also considered, together with the other impact characteristics, when assigning a magnitude designation.

4.1.3 Determining Magnitude for Biophysical Impacts

For biophysical impacts, the semi-quantitative definitions for the spatial and temporal dimension of the magnitude of impacts used in this assessment are provided below.

High Magnitude Impact affects an entire area, system (physical), aspect, population or species (biological) and at sufficient magnitude to cause a significant measureable numerical increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) or a decline in abundance and/ or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations (physical and biological). A high magnitude impact may also adversely affect the integrity of a site, habitat or ecosystem.

Moderate Magnitude Impact affects a portion of an area, system, aspect (physical), population or species (biological) and at sufficient magnitude to cause a measurable numerical increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) and may bring about a change in abundance and/or distribution over one or more plant/animal generations, but does not threaten the integrity of that population or any population dependent on it (physical and biological). A moderate magnitude impact may also affect the ecological functioning of a site, habitat or ecosystem but without adversely affecting its overall integrity. The area affected may be local or regional.

Low Magnitude Impact affects a specific area, system, aspect (physical), group of localised individuals within a population (biological) and at sufficient magnitude to result in a small increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) over a short time period (one plant/animal generation or less, but does not affect other trophic levels or the population itself), and localised area.

4.1.4 Determining Receptor Sensitivity

In addition to characterising the magnitude of impact, the other principal step necessary to assign significance for a given impact is to define the sensitivity of the receptor. There are a range of factors to be taken into account when defining the sensitivity of the receptor, which may be physical, biological, cultural or human. Where the receptor is physical (for example, a water body) its current quality, sensitivity to change, and importance (on a local, national and international scale) are considered. Where the receptor is biological or cultural (i.e. the marine environment or a coral reef), its importance (local, regional, national or international) and sensitivity to the specific type of impact are considered. As in the case of magnitude, the sensitivity designations themselves are universally consistent, but the definitions for these designations will vary on a resource/receptor basis. The universal sensitivity of a receptor is rated as low, medium or high.

For ecological impacts, sensitivity is assigned as low, medium or high based on the conservation importance of habitats and species. For the sensitivity of individual species, Table 11 presents the criteria for deciding on the value or sensitivity of individual species.

Table 11: Biological and Species Value / Sensitivity Criteria

Value / Sensitivity	Low	Medium	High
Criteria	Not protected or listed as common / abundant; or not critical to other ecosystem functions (eg key prey species to other species).	Not protected or listed but may be a species common globally but rare in South Africa with little resilience to ecosystem changes, important to ecosystem functions, or one under threat or population decline.	Specifically protected under South African legislation and/or international conventions e.g. CITES Listed as rare, threatened or endangered e.g. IUCN

Note: The above criteria should be applied with a degree of caution. Seasonal variations and species lifecycle stage should be taken into account when considering species sensitivity. For example, a population might be deemed as more sensitive during the breeding/spawning and nursery periods. This table uses listing of species (e.g. IUCN) or protection as an indication of the level of threat that this species experiences within the broader ecosystem (global, regional, local). This is used to provide a judgement of the importance of affecting this species in the context of project-level changes.

4.1.5 Assessing Significance

Once magnitude of impact and sensitivity of a receptor have been characterised, the significance can be determined for each impact. The impact significance rating will be determined, using the matrix provided in Table 12.

Table 12: Impact Significance

		Sensitivity/Vulnerability/Importance of Resource/Receptor		
		Low	**Medium**	**High**
Magnitude of Impact	**Negligible**	Negligible	Negligible	Negligible
	Low	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	High	Moderate	Major	Major

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/vulnerability/ importance designations that enter into the matrix. A context for what the various impact significance ratings signify is provided below.

An impact of **negligible** significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.
An impact of **minor** significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.
An impact of **moderate** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.
An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the project.

4.1.6 Mitigation Potential and Residual Impacts

A key objective of an EIA is to identify and define socially, environmentally and technically acceptable and cost effective measures to manage and mitigate potential impacts. Mitigation measures are developed to avoid, reduce, remedy or compensate for potential negative impacts, and to enhance potential environmental and social benefits.

The approach taken to defining mitigation measures is based on a typical hierarchy of decisions and measures, as described in Table 13

The priority is to first apply mitigation measures to the source of the impact (i.e. to avoid or reduce the magnitude of the impact from the associated project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e. to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

Once mitigation measures are declared, the next step in the impact assessment process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation measures. The approach taken to defining mitigation measures is based on a typical hierarchy of decisions and measures, as described in Table 13.

Table 13: Mitigation Hierarchy

Avoid at Source; Reduce at Source:
avoiding or reducing at source through the design of the Project (eg avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity).
Abate/Minimize on Site:
add something to the design to abate the impact (eg pollution control equipment).
Abate/Minimize at Receptor:
if an impact cannot be abated on-site then control measures can be implemented off-site (eg traffic measures).
Repair or Remedy:
some impacts involve unavoidable damage to a resource (eg material storage areas) and these impacts require repair, restoration and reinstatement measures.
Compensate in Kind; Compensate through Other Means:
where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate (eg financial compensation for degrading agricultural land and impacting crop yields).

As required by the South African EIA Regulations (as amended in 2017) the following additional items will be considered in the assessment of impacts and risks identified:

- The degree to which the impact and risk can be reversed (this will be rated on a scale of high, medium, or low);
- The degree to which the impact and risk may cause irreplaceable loss of resources (this will be rated on a scale of high, medium, or low).

This will inform the residual impact significance.

4.2. Identification of Impacts

Potential impacts to the marine environment as a result of the installation and operation of the subsea cable are briefly summarised below, and discussed in more detail in Sections 4.3 and 4.4.

4.2.1 Subsea Cable Installation

The installation of the subsea cable would result in:

- Disturbance of sediments and associated fauna during the pre-lay grapnel run;
- Disturbance of sediments and associated fauna during cable installation;
- Elimination of biota in the cable's structural footprint;
- Reduced area of unconsolidated seabed available for colonisation by infaunal communities; and
- Physical presence of the cable providing an alternative substratum for colonising benthic communities, or resulting in faunal attraction to fish and mobile invertebrates.

4.2.2 Shore crossing of the Cable

As HDD will be used for the cable's shore crossing, intertidal habitats will not be affected in any way. The shore-entry hole for the cable, cable burial and stabilisation of the cable on the seabed will, however, impact on shallow subtidal biota during the construction phase in the following ways:

- Temporary loss of benthic habitat and associated sessile communities due to preparation of seabed for buried cable laying;
- Possible temporary impacts on adjacent habitat health due to turbidity generated during trenching and installation;
- Temporary disturbance of marine biota, particularly marine mammals and coastal birds, due to construction activities;
- Possible impacts to marine water quality and sediments through hydrocarbon pollution by marine construction infrastructure and plant, inappropriate disposal of used lubricating oils from marine machinery maintenance and spillage of drilling fluids at the offshore exit point in the case of HDD; and
- Potential contamination of marine waters and sediments by inappropriate disposal of human wastes, which could in turn lead to impacts upon marine flora, fauna and habitat.

4.2.3 Operation of the Cable

As no routine maintenance of the cable is required, impacts associated with the operational phase would consitute temporary disturbance of the seabed if cable sections require replacing. Impacts would be highly localised and sporadic.

4.2.4 Decommissioning

As the cable will most likely be left in place at decommissioning, the potential impacts during the decommissioning phase are expected to be minimal and no key issues related to the marine environment are identified at this stage. As full decommissioning will require a separate EIA, potential issues related to this phase will not be dealt with further in this report.

4.3. Installation of the Subsea Cable

Construction phase impacts associated with the installation of the beach manhole and subsea cable are discussed below.

4.3.1 Disturbance of the Coastal Zone[4]

As HDD has been adopted as the preferred shore crossing option, the undersea tunnel would be bored from the land to the sea and all material would be removed on the landward side for disposal. Following drilling of the pilot borehole to a predetermined offshore location, the borehole would be enlarged with a reamer and the cable pulled back through the borehole (i.e. from the offshore location onto land). Intertidal and shallow subtidal habitats would thus not be affected at all as the borehole would pass well below the seabed before surfacing out of the seabed at an offshore location in 10-15 m water depth. At the seaward end of the borehole, emergence of the drill bit and reamer would result in localised increased suspended sediment concentrations in the water column, and potential smothering of seabed communities by re-depositing sediments (see Section 4.3.4). A rock berm may be constructed where the cable enters the seabed to aid in stabilisation. Placement of rocks on the seabed would crush any biota in the footprint of the berm, but the berm itself would provide an alternative substrate for colonisation by benthic organisms (see Section 4.3.5).

As the cable exit point is located above the highwater mark~540 m inland of the beach, it falls outside the marine scope of this assessment and is thus not discussed further here.

With implementation of the HDD option, the impact area would be confined to the offshore site where the cable enters the seabed. Impacts on benthic communities would primarily be direct, once-off and of low magnitude due to the site-specific extent of the disturbance. Although the entry point of the cable would likely be located in a habitat of medium sensitivity, the highly localised extent and short-term duration of the disturbance and would result in a low sensitivity rating, and the overall significance can thus be considered **NEGLIGIBLE**.

4 The coastal zone is defined as the coastal strip from 500 m inland of the high water mark to the 30 m depth contour (Sink *et al*. 2012).

Disturbance and destruction of sandy substrate biota through horizontal directional drilling		
Characteristic	Impact	Residual Impact
Extent	Site-specific: limited to the immediate vicinity of the cable entry point	Site-specific
Duration	Temporary; recovery is expected rapidly from adjacent areas	Temporary
Scale	Small	Small
Reversibility	Fully reversible	
Loss of resource	Low	
Magnitude	Low	
Sensitivity/Vulnerability/Importance of the Resource/Receptor	Low	Low
Significance of Impact	**NEGLIGIBLE**	**NEGLIGIBLE**
Mitigation Potential	Low	

Trenching of the cable in the littoral zone beyond 10-15 m depth would result in the mobilisation and redistribution of sediments in tidal currents and the littoral drift. This would result in localised increased suspended sediment concentrations in the water column. Where burial cannot be achieved and additional cable protection is required, an articulated split-pipe may be used to maximise cable security. Within the wave-base (0 – 50 m), the cable and/or articulated split-pipes may be held in place with saddle clamps at specific locations. This would require drilling into the bedrock to secure the clamps. The cable burial and/or securing process would result in disturbance of subtidal unconsolidated sediments and their associated macrobenthic communities through displacement, injury or crushing. Potential impacts associated with this construction area will not be further assessed here as it will be located well above the highwater mark.

Although the activities in the subtidal regions would be localised and confined to within a few metres of the cable route, the benthic biota would be disturbed, damaged or destroyed through displacement of sediments during trenching and cable burial. Mobile organisms such as fish and marine mammals, on the other hand, would be capable of avoiding the construction area. Any shorebirds feeding and/or roosting in the area would also be disturbed and displaced for the duration of construction activities.

The invertebrate macrofauna inhabiting unconsolidated sediments in the coastal zone are all important components of the detritus / beach-cast seaweed-based food chains, being mostly scavengers, particulate organic matter and filter-feeders (Brown & McLachlan 1994). As such, they assimilate food sources available from the detritus accumulations typical of this coast and, in turn, become prey for surf-zone fishes and migratory shorebirds that feed on the beach slope and in the swash zone. By providing energy input to higher trophic levels, they are all important in nearshore nutrient cycling, and significant reduction or loss of these macrofaunal assemblages may therefore have cascade effects through the coastal ecosystem (Dugan *et al*. 2003).

Once the cable has been buried, the affected seabed areas would, with time, be recolonised by benthic macrofauna. The ecological recovery of the disturbed sea floor is generally defined as the establishment of a successional community of species, which progresses towards a community that is similar in species composition, population density and biomass to that previously present (Ellis 1996). In general, communities of short-lived species and/or species with a high reproduction rate (opportunists) may recover more rapidly than communities of slow growing, long-lived species. Opportunists are usually small, mobile, highly reproductive and fast growing species and are the early colonisers. Sediments in the nearshore wave-base regime, which are subjected to frequent disturbances, are typically inhabited by these opportunistic species (Newell *et al*. 1998). Recolonisation will start rapidly after cessation of trenching, and species diversity and abundance may recover within short periods (weeks) whereas biomass often remains reduced for several years (Kenny & Rees 1994, 1996). Provided the construction activities are all conducted concurrently, the duration of the disturbance impacts should be limited to 8 - 10 months. Disturbed subtidal communities within the wave base (<40 m water depth) might recover even faster (Newell *et al*. 1998). However, while recovery of the intertidal and subtidal communities is rapid, physical alteration of the shoreline in ways that cannot be remediated by swell action, such as deposition of large piles of pebbles and boulders, can be more or less permanent. Whilst the construction activities associated specifically with the cable installation are unlikely to have a significant effect at the ecosystem level, the cumulative effects of increasing development along this stretch of coast must be kept in mind.

The impacts on benthic communities as a result of the cable installation beyond the cable entry point would be of low magnitude. Impacts would, however, be once-off and highly localised, being restricted to within a few metres of the cable entry point and cable route. Impacts would be expected to endure over the short-term only as communities within the wave-influenced zone are adapted to frequent natural disturbances and recover relatively rapidly. As the cable routing passes through inshore benthic habitats identified as 'vulnerable' the impact can be considered of medium sensitivity. The potential impacts on benthic organisms of installation of the shoreline crossing is consequently deemed to be of **MODERATE** significance without mitigation.

Mitigation Measures

The following mitigation measures are recommended:

- Plan routing of proposed cable to as far as practicably possible avoid sensitive benthic habitats in the coastal and nearshore zone.

Disturbance and destruction of biota in unconsolidated sediments during trench excavation and cable installation		
Characteristic	**Impact**	**Residual Impact**
Extent	Site-specific: limited to within a few metres of the cable route and shore-crossing entry point	Site-specific
Duration	Short-term	Short-term
Scale	Small	Small
Reversibility	Fully reversible	
Loss of resource	Low	
Magnitude	Low	
Sensitivity/Vulnerability/Importance of the Resource/Receptor	Medium	Medium
Significance of Impact	**MINOR**	**MINOR**
Mitigation Potential	Low	

4.3.2 Increase in Noise

Noise propagation represents energy travelling either as a wave or a pressure pulse through a gas or a liquid. Due to the physical differences between air and water (density and the speed at which sound travels), the decibel units used to describe noise underwater are different from those describing noise in air. Furthermore, hearing sensitivities vary between species and taxonomic groups. Underwater noise generated by drilling activities is therefore treated separately from noise generated in the air.

During installation of the cable shore-crossing, noise and vibrations from excavation machinery may have an impact on surf-zone biota, marine mammals and shore birds in the area. Noise levels during construction are generally at a frequency much lower than that used by marine mammals for communication (Findlay 1996), and these are therefore unlikely to be significantly affected. Additionally, the maximum radius over which the noise may influence is very small compared to the population distribution ranges of surf-zone fish species, resident cetacean species and shore birds. Both fish and marine mammals are highly mobile and should move out of the noise-affected area (Findlay 1996). Similarly, shorebirds and terrestrial biota are typically highly mobile and would be able to move out of the noise-affected area.

Further offshore, underwater noise generated during cable installation could affect a wide range of fauna; from benthic invertebrates and demersal species residing on the seabed along the cable route, to those invertebrates and vertebrates occurring throughout the water column and in the pelagic habitat near the surface. The taxa most vulnerable to noise disturbance are turtles, pelagic seabirds, large migratory pelagic fish, and both migratory and resident cetaceans.

The ocean is a naturally noisy place and marine animals are continually subjected to both physically produced sounds from sources such as wind, rainfall, breaking waves and natural seismic noise, or biologically produced sounds generated during reproductive displays, territorial defence, feeding, or in echolocation (see references in McCauley 1994). Such acoustic cues are thought to be important to many marine animals in the perception of their environment as well as for navigation purposes, predator avoidance, and in mediating social and reproductive behaviour. Anthropogenic sound sources in the ocean can thus be expected to interfere directly or indirectly with such activities thereby affecting the physiology and behaviour of marine organisms (NRC 2003). Natural ambient noise will vary considerably with weather and sea state, ranging from about 80 to 120 dB re 1 μPa (Croft & Li 2017). Of all human-generated sound sources, the most persistent in the ocean is the noise of shipping. Depending on size and speed, the sound levels radiating from vessels range from 160 to 220 dB re 1 μPa at 1 m (NRC 2003). Especially at low frequencies between 5 to 100 Hz, vessel traffic is a major contributor to noise in the world's oceans, and under the right conditions, these sounds can propagate 100s of kilometres thereby affecting very large geographic areas (Coley 1994, 1995; NRC 2003; Pidcock *et al*. 2003). Other forms of anthropogenic noise include 1) multi-beam sonar systems, 2) seismic acquisition, 3) hydrocarbon and mineral exploration and recovery, and 4) noise associated with underwater blasting, pile driving, and construction (Figure 21).

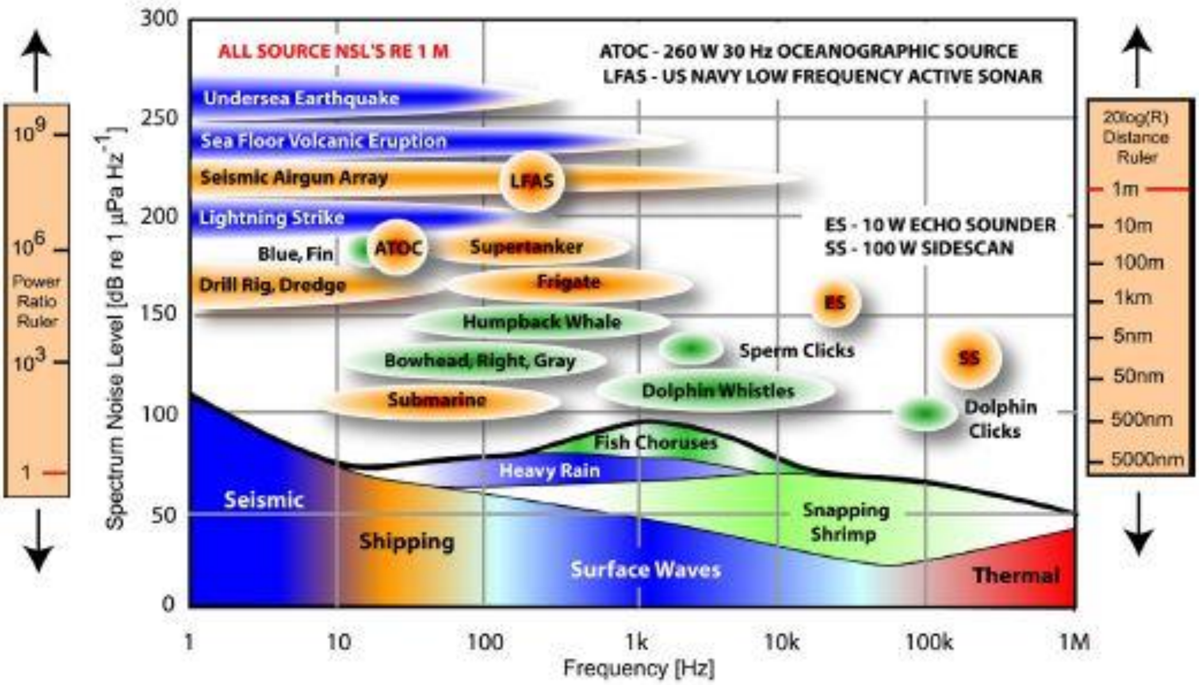

Figure 21: Comparison of noise sources in the ocean (Goold & Coates 2001).

The cumulative impact of increased background anthropogenic noise levels in the marine environment is an ongoing and widespread issue of concern (Koper & Plön 2012). The sound level generated by the cable laying vessel and subsea apparatus would fall within the hearing range of most fish and marine mammals, and would be audible for considerable ranges (in the order of tens of kms) before attenuating to below threshold levels. However, the noise is not considered to be of sufficient amplitude to cause direct physical injury or mortality to marine life, even at close range. The underwater noise may, however, induce localised behavioural changes or masking of biologically relevant sounds in some marine fauna, but there is no evidence of significant behavioural changes that may impact on the wider ecosystem (Perry 2005).

Disturbance and injury to marine biota due to construction noise or noise generated by the vessel and cable plough is thus deemed of low magnitude within the immediate vicinity of the construction site/cable route, with impacts persisting over the short-term only. In both cases impacts are fully reversible once construction and cable installation operations are complete. Without mitigation, the direct impacts of construction and vessel noise are therefore assessed to be of **MINOR** significance, respectively. As the noise associated with construction and cable installation is unavoidable, no direct mitigation measures, other than the no-project alternative, are possible. Impacts of construction noise can however be kept to a minimum through responsible construction practices.

Disturbance and avoidance behaviour of surf-zone fish communities, shore birds and marine mammals through coastal construction noise and offshore cable installation noise

Characteristic	Impact	Residual Impact
Extent	Local: limited to the construction site	Local
Duration	Short-term: for duration of shore-crossing installation and construction	Short-term
Scale	Small	Small
Reversibility	Fully reversible	
Loss of resource	Negligible	
Magnitude	Low	
Sensitivity/Vulnerability/Importance of the Resource/Receptor	Medium	Medium
Significance of Impact	**MINOR**	**MINOR**
Mitigation Potential	Very Low	

Behavioural changes and masking of biologically significant sounds in Marine Fauna due to noise from cable installation operations

Characteristic	Impact	Residual Impact
Extent	Local: limited to vicinity of the vessel and subsea equipment	Local
Duration	Short-term: for duration of installation	Short-term
Scale	Small	Small
Reversibility	Fully reversible	
Loss of resource	Low	
Magnitude	Low	
Sensitivity/Vulnerability/Importance of the Resource/Receptor	Medium	Medium
Significance of Impact	**MINOR**	**MINOR**
Mitigation Potential	None	

4.3.3 Pollution and Accidental Spills

Construction of the beach manhole will involve construction activities. There would thus be potential for or accidental spillage or leakage of fuel, chemicals or lubricants, litter, inappropriate disposal of human wastes and general degradation of ecosystem health. Any release of liquid hydrocarbons has the potential for direct, indirect and cumulative effects on the marine environment through contamination of the water and/or sediments. These effects include physical oiling and toxicity impacts to marine fauna and flora, localised mortality of plankton, pelagic eggs and fish larvae, and habitat loss or contamination (CSIR 1998; Perry 2005). Many of the compounds in petroleum products have been known to smother organisms, lower fertility and cause disease in aquatic organisms. Hydrocarbons are incorporated into sediments through attachment to fine-grained particles, sinking and deposition in low turbulence areas. Due to differential uptake and elimination rates, filter-feeders, particularly mussels, can bioaccumulate organic (hydrocarbons) contaminants (Birkeland *et al.* 1976).

During construction, litter can enter the marine environment. Inputs can be either direct by discarding garbage into the sea, or indirectly from the land when litter is blown into the water by wind. Marine litter is a cosmopolitan problem, with significant implications for the environment and human activity all over the world. Marine litter travels over long distances with ocean currents and winds. It originates from many sources and has a wide spectrum of environmental, economic, safety, health and cultural impacts. It is not only unsightly, but can cause serious harm to marine organisms, such as turtles, birds, fish and marine mammals. Considering the very slow rate of decomposition of most marine litter, a continuous input of large quantities will result in a gradual increase in litter in coastal and marine environment. Suitable waste management practices should thus be in place to ensure that littering is avoided.

During HDD, a loss of drilling fluid into the sea at the point where the drill string punches out of the bedrock could occur due to the elevation difference between the pipeline’s entry and exit points. A biodegradable, non-toxicity sodium-based drilling fluid would be used, and should any spillages occur, these would have a low impact on environment. Spillage at the exit point is likely to result in a temporary increase in turbidity, but dilution in the receiving seawater would be rapid.

Potential hydrocarbon spills and pollution in the intertidal and shallow subtidal zone during installation of the cable, and spills of HDD drilling fluid near the seabed are deemed of medium magnitude within the immediate vicinity of the construction site, with impacts persisting over the medium- to long-term. Impacts of pollution and accidental spills would be direct, indirect and cumulative. As the coastal habitats at the shore-crossing have been identified as ‘vulnerable’, the impact can be considered of medium sensitivity. The impact of pollution and accidental spills on the shoreline during the construction phase is therefore assessed to be of **MODERATE** significance without mitigation. With the implementation of mitigation measures, impacts would reduce to **MINOR** significance.

Mitigation Measures

The recommended mitigation measures for the construction phase of the proposed IOX cable installation are:

- Keep heavy vehicle traffic associated with construction in the coastal zone to a minimum.
- Restrict vehicles to clearly demarcated access routes and construction areas only. These should be selected under guidance of the local municipality.
- Conduct a comprehensive environmental awareness programme amongst contracted construction personnel, emphasising compliance with relevant provincial and national legislation and the EMPr, pollution control and minimising construction impacts to the intertidal habitat and associated communities.
- For equipment maintained in the field, oils and lubricants must be contained and correctly disposed of off-site.
- Maintain vehicles and equipment to ensure that no oils, diesel, fuel or hydraulic fluids are spilled.
- There is to be no vehicle maintenance or refuelling on beach.
- Vehicles should have a spill kit (peatsorb/ drip trays) onboard in the event of a spill to ensure that all accidental diesel and hydrocarbon spills are cleaned up accordingly.
- No mixing of concrete in the intertidal zone.
- Regularly clean up concrete spilled during construction.
- No dumping of construction materials, excess concrete or mortar in the intertidal and subtidal zones or on the sea bed.
- Ensure regular collection and removal of refuse and litter from intertidal areas.
- Good housekeeping must form an integral part of any construction operations on the beach from start-up.
- All construction activities in the coastal zone must be managed according to a strictly enforced EMPr.
- After completion of construction activities remove all artificial constructions or created shore modifications from above and within the intertidal zone. No accumulations of excavated intertidal sediments should be left above the high water mark, and any substantial sediment accumulations below the high water mark should be levelled.

If these mitigation measures are implemented, all residual impacts are expected to be of low significance.

Accidental spillage or leakage of fuel, chemicals or lubricants, HDD drilling fluid, cement and disposal of litter may cause water or sediment contamination and/or disturbance to intertidal and subtidal biota		
Characteristic	Impact	Residual Impact
Extent	Local: limited to the shore-crossing and construction area	Local
Duration	Medium- to Long-term; some litter can persist for many years	Short-term
Scale	Medium	Medium
Reversibility	Partially reversible	
Loss of resource	Low	
Magnitude	Medium	
Sensitivity/Vulnerability/Importance of the Resource/Receptor	Medium	Low
Significance of Impact	**MODERATE**	**MINOR**
Mitigation Potential	High	

4.3.4 Disturbance of Offshore Habitats

The grapnel used during the pre-lay grapnel run, and the submarine cable plough and tracked trenching/burial ROV implemented during cable laying would result in the disturbance and turnover of unconsolidated sediments in an ~0.5 m wide strip along the length of the cable route. Any epifauna or infauna associated with the disturbed sediments are likely to be displaced, damaged or destroyed. Similarly, the plough skids or ROV tracks would injure or crush benthic invertebrates in their path. Mobilisation and redistribution of sediments in near-bottom currents during trenching would result in localised increased suspended sediment concentrations near the seabed and in the water column (see Section 4.3.5). Although the cable is typically only 25 mm[5] – 200 mm[6] in diameter the presence of the cable effectively reduces the area of seabed available for colonisation by macrobenthic infauna. The loss of substratum would, however, be temporary, as the cable itself would provide an alternative substratum for colonising benthic communities or provide shelter for mobile invertebrates (see Section 4.3.6).

The potential direct impacts on benthic organisms of crushing and sediment disturbance would be of medium magnitude and once off (unless cable repair is necessary). Although the cable will extend along some 9,000 km of seabed, benthic impacts will be highly localised along the length of the cable route. Impacts would be limited to the medium-term only as recolonisation of disturbed sediments will occur from adjacent areas within a year. The change in habitat from unconsolidated sediments to the hard sustratum of the cable itself would, however, be permenent. Although the cable routing passes through shelf edge benthic habitats identified as 'vulnerable' the impact can be considered of low sensitivity due to the negligible proportion of the available habitat that would be affected by the cable installation. Consequently, the potential impacts on benthic organisms of cable installation across the continental shelf and abyss is deemed to be of **MINOR** significance without mitigation.

[5]un-armoured cable at depths >900 m.

[6]armoured cable in the littoral zone, articulated plit-pipes.

The elimination of marine benthic communities in the structural footprint of the cable is an unavoidable consequence of the installation of subsea cables, and no direct mitigation measures, other than the no-project option, are possible.

Disturbance and destruction of subtidal sandy biota during cable laying		
Characteristic	Impact	Residual Impact
Extent	Local: limited to the cable route	Local
Duration	Medium-term; recovery is expected within 2-5 years	Medium-term
Scale	Small	Small
Reversibility	Partially reversible	
Loss of resource	Low	
Magnitude	Medium	
Sensitivity/Vulnerability/Importance of the Resource/Receptor	Low	Low
Significance of Impact	**MINOR**	**MINOR**
Mitigation Potential	Very Low	

4.3.5 Increased Turbidity

The disturbance and turnover of sediments during the pre-lay grapnel run and during trenching will result in increased suspended sediments in the water column and physical smothering of biota by the re-depositing sediments. The effects of elevated levels of particulate inorganic matter and depositions of sediment have been well studied, and are known to have marked, but relatively predictable effects in determining the composition and ecology of intertidal and subtidal benthic communities (e.g. Zoutendyk & Duvenage 1989, Engledow & Bolton 1994, Iglesias *et al*. 1996, Slattery & Bockus 1997). Increased suspended sediments in the surf-zone and nearshore can potentially affect light penetration and thus phytoplankton productivity and algal growth, whereas further offshore it can load the water with inorganic suspended particles, which may affect the feeding and absorption efficiency of filter-feeders.

The impact of the sediment plume, however, is expected to be relatively localised and temporary (only for the duration of pre-lay, construction and trenching activities below the low water mark). As the biota of sandy and rocky intertidal and subtidal habitats in the wave-dominated nearshore areas of southern Africa are well adapted to high suspended sediment concentrations, periodic sand deposition and resuspension, impacts are expected to occur at a sublethal level only.

Rapid deposition of material from the water column and direct deposition of excavated sands on adjacent areas of seabed may result in the physical smothering of resident biota by the depositing sediments. Some mobile benthic animals inhabiting soft-sediments are capable of migrating vertically through more than 30 cm of deposited sediment (Maurer *et al*. 1979; Newell *et al*. 1998; Ellis 2000; Schratzberger *et al*. 2000a, 2000b). Sand inundation of shallow-water reef habitats was found to directly affect species diversity, whereby community structure and species richness appears to be controlled by the frequency, nature and scale of disturbance of the system by sedimentation (Seapy & Littler 1982; Littler *et al*. 1983; Schiel &

Foster 1986, McQuaid & Dower 1990, Santos 1993, Airoldi & Cinelli 1997 amongst others). For example, frequent sand inundation may lead to the removal of grazers, thereby resulting in the proliferation of algae (Hawkins & Hartnoll 1983; Littler *et al*. 1983; Marshall & McQuaid 1989; Pulfrich *et al*. 2003a, 2003b; Pulfrich & Branch 2014).

Elevated suspended sediment concentrations due to trenching and burial activities associated with the cable installation is deemed of low magnitude and would extend locally around the cable route and down-current of the shore-crossing, with impacts persisting only temporarily. Within the wave-base at least, marine biota are typically adapted to periods of elevated turbidity and as suspended sediment concentrations would remain at sub-lethal levels, this indirect impact can be considered of low sensitivity. The impact is therefore assessed to be of **NEGLIGIBLE** significance without mitigation. As elevated suspended sediment concentrations are an unavoidable consequence of trenching activities, no direct mitigation measures, other than the no-project alternative, are possible. In the intertidal and shallow subtidal zone, impacts can however be kept to a minimum through responsible construction practices.

Reduced physiological functioning of marine organisms due to increased turbidity in surf-zone as a result of excavations and mobilising of sediments

Characteristic	Impact	Residual Impact
Extent	Local: limited to the immediate vicinity of the excavations and construction site	Local
Duration	Temporary	Temporary
Scale	Small	Small
Reversibility	Fully reversible	
Loss of resource	Negligible	
Magnitude	Low	
Sensitivity/Vulnerability/Importance of the Resource/Receptor	Low	Low
Significance of Impact	**NEGLIGIBLE**	**NEGLIGIBLE**
Mitigation Potential	Very Low	

4.3.6 Physical Presence of Subsea Cable

Although the cable is typically only 25 mm – 200 mm in diameter the presence of the cable effectively reduces the area of seabed available for colonisation by macrobenthic infauna in seabed sediments. The cable itself, however, would serve as an alternative substratum for colonising benthic communities or provide shelter for mobile invertebrates and demersal fish (Figure 22). Assuming that the hydrographical conditions around the subsea cable and repeaters would not be significantly different to those on the seabed, a similar community to that typically found on hard substrata in the area can be expected to develop over time. As offshore portions of the cable will be located on unconsolidated sediments, biota developing on the structures would be significantly different from the original soft sediment macrobenthic communities. The presence of subsea infrastructure (namely cable and repeaters) can therefore alter the community structure in an area, and effectively increase the availability of hard substrate for colonisation by sessile benthic organisms, thereby locally altering and increasing biodiversity and biomass.

Figure 22: Submarine cables can provide alternative substratum for colonising benthic biota (left) and shelter for mobile invertebrates (right) (Source: www.digit.in/telecom/reliance-jio-launches-longest-100gbps-submarine-cable-system-aae-1-35827; www.farinia.com).

The composition of the fouling community on artificial structures depends on the age (length of time immersed in water) and the composition of the substratum, and usually differs somewhat from the communities of nearby natural rocky reefs (Connell & Glasby 1999; Connell 2001). In the intertidal and shallow subtidal habitats, colonisation of hard substratum goes through successional stages (Connell & Slayter 1977). Early successional communities are characterized by opportunistic algae (e.g. *Ulva* sp., *Enteromorpha* sp.). These are eventually displaced by slower growing, long-lived species such as mussels, sponges and/or coralline algae, and mobile organisms, such as urchins and lobsters, which feed on the fouling community. With time, a consistent increase in biomass, cover and number of species can usually be observed (Bombace *et al*. 1994; Relini *et al*. 1994; Connell & Glasby 1999). Depending on the supply of larvae and the success of recruitment, the colonization process can take up to several years. For example, a community colonising concrete blocks in the Mediterranean was found to still be changing after five years with large algae and sponges in particular increasing in abundance (Relini *et al*. 1994). Other artificial reef communities, on the other hand, were reported to reach similar numbers of species (but not densities and biomass) to those at nearby natural reefs within eight months (Hueckel *et al*. 1989).

Ellis *et al*. (1996), who compared the abundance and size class structure of macroepifaunal invertebrates (shrimp, crabs, scallops, and starfish) at various distances from three oil platforms, concluded that differences in community structure of associated fauna were attributable to the physical presence of the subsea infrastructure, and the unique physical environment around each piece of infrastructure. Differences in abundance and size of epifaunal invertebrates near the platforms compared to far away were attributed to differences in food availability and predation. Mobile fish and invertebrates would be attracted by the shelter and food (biofouling organisms) provided by the underwater structures (Bull & Kendall 1994; Fechhelm *et al*. 2001).

The impacts on marine biodiversity through the physical presence of the cable would be of medium magnitude and highly localised. As the cable would likely be left in place on the seabed beyond decommissioning of the project, its impacts would thus be permanent. No direct mitigation measures, other than the no-project alternative, are possible. The potential impacts on marine biota is consequently deemed to be of **MINOR** significance without mitigation.

Physical presence of the subsea cable		
Characteristic	Impact	Residual Impact
Extent	Site-specific: limited to the cable and repeaters	Site-specific
Duration	Permanent	Permanent
Scale	Small	Small
Reversibility	Partially reversible	
Loss of resource	Low	
Magnitude	Medium	
Sensitivity/Vulnerability/Importance of the Resource/Receptor	Low	Low
Significance of Impact	MINOR	MINOR
Mitigation Potential	Very Low	

4.3.7 Collisions with and entanglement by Marine Fauna

Depending on the onboard equipment and types of ploughs used, prevailing sea conditions as well as the nature of the seabed, cable ships can lay 100-150 km of cable per day, with modern ships and ploughs achieving up to 200 km of cable laying per day (www.independent.co.uk>science). This equates to a vessel speed of between 2.3 – 4.5 knots. The pre-laying grapnel run is typically consudted at 0.5 knots. Given the slow speed of the vessel during the pre-lay grapnel run and the cable installation, ship strikes with marine mammals and turtles or entanglement of marine fauna in the cable are unlikely, and should the impact occur it would be very infrequent.

In the event of a collision or entaglement, the impact is deemed of low magnitude and would be site specific to the vessel location. Injury through collision and/or entanglement would persist over the medium term and considering the slow vessel speed would likely remain at sub-lethal levels. Although this direct impact can be considered of high sensitivity, the risk significance is assessed to be **MINOR**.

Mitigation Measures

The recommended mitigation measures for the installation phase of the proposed IOX cable are:

- Give consideration for the cable-laying vessels to accommodate dedicated independent MMOs with experience in seabird, turtle and marine mammal identification and observation techniques, to carry out daylight observations of the cable route and record incidence of marine mammals, and their responses to vessel activities. Data collected should include position, distance from the vessel, swimming speed and direction, and obvious changes in behaviour (e.g. startle responses or changes in surfacing/diving frequencies, breathing patterns). Both the identification and the behaviour of the animals must be recorded accurately.

- Alternatively, relevant vessel staff trained in seabird, turtle and marine mammal identification and observation techniques should be assigned for observation, distance estimation and reporting, to perform marine mammal observations and notifications.

Collions with and Entanglement by Marine Fauna		
Characteristic	Impact	Residual Impact
Extent	Site-specific: limited to the vessel position	Site-specific
Duration	Medium	Medium
Scale	Small	Small
Likelihood	Low	
Reversibility	Fully reversible	
Loss of resource	Low	
Consequence	Moderate	Minor
Sensitivity/Vulnerability/Importance of the Resource/Receptor	High	High
Significance of Impact	**MINOR**	**MINOR**
Mitigation Potential	Low	

4.4. Decommissioning Phase

No decommissioning procedures have been developed at this stage. In the case of decommissioning the cable will most likely be left in place. The potential impacts during the decommissioning phase are thus expected to be minimal in comparison to those occurring during the installation phase.

5. ENVIRONMENTAL STATEMENT AND CONCLUSIONS

5.1. Environmental Statement

Construction of the beach manhole and installation of the cable will potentially result in localised disturbance of the rocky intertidal and shallow subtidal habitats, as well as unconsolidated seabed beyond the surf-zone and across the shelf. Most potentially negative impacts were rated as being of negligible to minor significance, with only disturbance of coastal communities at the shore crossing and pollution and accidental spills during construction rated as medium significance. As recovery of marine communities over the medium-term can be expected, residual impacts were all considered minor or negligible.

5.2. Management Recommendations

From the marine ecology assessment in Chapter 4, certain recommendations can be put forward as how best to manage potential impacts to the marine environment of the proposed installation of the subsea cable. These include:

- Plan routing of proposed cable to as far as practicably possible avoid sensitive benthic habitats in the coastal and nearshore zone.
- Keep heavy vehicle traffic associated with construction and cable installation in the coastal zone to a minimum.
- Restrict vehicles to clearly demarcated access routes and construction areas only. These should be selected under guidance of the local municipality.
- Conduct a comprehensive environmental awareness programme amongst contracted construction personnel, emphasising compliance with relevant provincial and national legislation and the EMPr, pollution control and minimising construction impacts to the intertidal habitat and associated communities.
- For equipment maintained in the field, oils and lubricants must be contained and correctly disposed of off-site.
- Maintain vehicles and equipment to ensure that no oils, diesel, fuel or hydraulic fluids are spilled.
- There is to be no vehicle maintenance or refuelling on beach.
- Vehicles should have a spill kit (peatsorb/ drip trays) onboard in the event of a spill to ensure that all accidental diesel and hydrocarbon spills are cleaned up accordingly.
- No mixing of concrete in the intertidal zone.
- Regularly clean up concrete spilled during construction.
- No dumping of construction materials, excess concrete or mortar in the intertidal and subtidal zones or on the sea bed.
- Ensure regular collection and removal of refuse and litter from intertidal areas.
- Good housekeeping must form an integral part of any construction operations on the beach from start-up.

- All construction activities in the coastal zone must be managed according to a strictly enforced EMPr.
- After completion of construction activities remove all artificial constructions or created shore modifications from above and within the intertidal zone. No accumulations of excavated intertidal sediments should be left above the high water mark, and any substantial sediment accumulations below the high water mark should be levelled.
- Give consideration for the cable-laying vessels to accommodate dedicated independent MMOs with experience in seabird, turtle and marine mammal identification and observation techniques, to carry out daylight observations of the cable route and record incidence of marine mammals, and their responses to vessel activities. Data collected should include position, distance from the vessel, swimming speed and direction, and obvious changes in behaviour (e.g. startle responses or changes in surfacing/diving frequencies, breathing patterns). Both the identification and the behaviour of the animals must be recorded accurately.
- Alternatively, relevant vessel staff trained in seabird, turtle and marine mammal identification and observation techniques should be assigned for observation, distance estimation and reporting, to perform marine mammal observations and notifications.

5.3. Conclusions

If all environmental guidelines and appropriate management and monitoring recommendations advanced in this report are implemented, there is no reason why the proposed installation of the IOX fibre optics cable should not proceed.

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Curriculum Vitae

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Personal Details

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Nationality and Citizenship:	South African and German
Languages:	English, German, Afrikaans
ID No:	610811 0179 087

Address:	23 Cockburn Close, Glencairn Heights 7975, South Africa PO Box 31228, Tokai, 7966, South Africa
Tel:	+27 21 782 9553
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E-mail:	apulfrich@pisces.co.za

Academic Qualifications

- BSc (Zoology and Botany), University of Natal, Pietermaritzburg, 1982
- BSc (Hons) (Zoology), University of Cape Town, 1983
- MSc (Zoology), University of Cape Town, 1987
- PhD, Department of Fisheries Biology of the Institute for Marine Science at the Christian-Albrechts University, Kiel, Germany, 1995

Membership in Professional Societies

- South African Council for Natural Scientific Professions (Pr.Sci.Nat. No: 400327/06)
- South African Institute of Ecologists and Environmental Scientists
- International Association of Impact Assessment (South Africa)
- Registered Environmental Assessment Practitioner (Certification Board for Environmental Assessment Practitioners of South Africa).

Employment History and Professional Experience

1998-present: Director: Pisces Environmental Services (Pty) Ltd. Specifically responsible for environmental impact assessments, baseline and monitoring studies, marine specialist studies, and environmental management programme reports.

1999: Senior researcher at the University of Cape Town on contract to Namdeb Diamond Corporation and De Beers Marine South Africa; investigating and monitoring the impact of diamond mining on the marine environment and fisheries resources; experimental design and implementation of dive surveys; collaboration with fishermen and diamond divers; deep water benthic sampling, sample analysis and macrobenthos identification.

1996-1999: Senior researcher at the University of Cape Town, on contract to the Chief Director: Marine and Coastal Management (South African Department of Environment Affairs and Tourism); investigating and monitoring the experimental fishery for periwinkles on the Cape south coast; experimental design and implementation of dive surveys for stock assessments; collaboration with fishermen; supervision of Honours and Masters students.

1989-1994: Institute for Marine Science at the Christian-Albrechts University of Kiel, Germany; research assistant in a 5 year project to investigate the population dynamics of mussels and cockles in the Schleswig-Holstein Wadden Sea National Park (employment for Doctoral degree); extensive and intensive dredge sampling for stock assessments, collaboration with and mediation between, commercial fishermen and National Park authorities, co-operative interaction with colleagues working in the Dutch and Danish Wadden Sea, supervision of Honours and Masters projects and student assistants, diving and underwater scientific photography. Scope of doctoral study: experimental design and implementation of a regular sampling program including: (i) plankton sampling and identification of lamellibranch larvae, (ii) reproductive biology and condition indices of mussel populations, (iii) collection of mussel spat on artificial collectors and natural substrates, (iv) sampling of recruits to the established populations, (v) determination of small-scale recruitment patterns, and (vi) data analysis and modelling. Courses and practicals attended as partial fulfilment of the degree: Aquaculture, Stock Assessment and Fisheries Biology, Marine Chemistry, and Physical and Regional Oceanography.

1988-1989: Australian Institute of Marine Science; volunteer research assistant and diver; implementation and maintenance of field experiments, underwater scientific photography, digitizing and analysis of stereo-photoquadrats, larval culture, analysis of gut contents of fishes and invertebrates, carbon analysis.

1985-1987: Sea Fisheries Research Institute of the South African Department of Environment Affairs and Tourism: scientific diver on deep diving surveys off Cape Agulhas; censusing fish populations, collection of benthic species for reef characterization.

South African National Research Institute of Oceanography and Port Elizabeth Museum: technical assistant and research diver; quantitative sampling of benthos in Mossel Bay, and census of fish populations in the Tsitsikamma National Park.

University of Cape Town, Department of Zoology and Percy Fitzpatrick Institute of African Ornithology; research assistant; supervisor of diving survey and collection of marine invertebrates, Prince Edward Islands.

1984-1986: University of Cape Town, Department of Zoology; research assistant (employment for MSc Degree) and demonstrator of first year Biological Science courses. Scope of MSc study: the biology, ecology and fishery of the western Cape linefish species *Pachymetopon blochii*, including (i) socio-economic survey of the fishery and relevant fishing communities, (ii) collection and analysis of data on stomach contents, reproductive biology, age and growth, (iii) analysis of size-frequency and catch statistics, (iv) underwater census, (v) determination of hook size selectivity, (vi) review of historical literature and (vii) recommendations to the Sea Fisheries Research Institute of the South African Department of Environment Affairs and Tourism for the modification of existing management policies for the hottentot fishery.

Curriculum Vitae

Dr Andrea Pulfrich

Dr Andrea Pulfrich is the founder, director, sole employee and share holder of Pisces Environmental Services (Pty) Ltd. The company was established in January 1998 to help fill the growing need for an expert interface between users of the coastal and marine environment and the various national and provincial management authorities. Since then, PISCES has been providing a wide range of information, analyses, environmental assessments, advice and management recommendations to these user groups, particularly the South African and Namibian marine diamond mining and hydrocarbon industries.

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environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

ENVIRONMENTAL IMPACT ASSESSMENT (EIA) FOR THE PROPOSED IOX SUBSEA CABLE SYSTEM OFF THE EAST COAST OF SOUTH AFRICA

Specialist:	Dr Andrea Pulfrich		
Contact person:	Dr Andrea Pulfrich		
Postal address:	PO Box 302 McGregor		
Postal code:	6708	Cell:	082 7818152
Telephone:	021 7829553	Fax:	
E-mail:	apulfrich@pisces.co.za		
Professional affiliation(s) (if any)	South African Council for Natural Scientific Professions (Pr.Sci.Nat. No: 400327/06) South African Institute of Ecologists and Environmental Scientists International Association of Impact Assessment (South Africa) Registered Environmental Assessment Practitioner (Certification Board for Environmental Assessment Practitioners of South Africa).		

Project Consultant:			
Contact person:			
Postal address:			
Postal code:		Cell:	
Telephone:		Fax:	
E-mail:			

4.2 The specialist appointed in terms of the Regulations_

I, Andrea Pulfrich, declare that -- General declaration:

I act as the independent specialist in this application;
I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;
I declare that there are no circumstances that may compromise my objectivity in performing such work;
I have expertise in conducting 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.

Andrea Pulfrich

Signature of the specialist:

Pisces Environmental Services (Pty) Ltd

Name of company (if applicable):

3 November 2018

Date:

1.1 *CONTENT OF THE SPECIALIST REPORT CHECKLIST*

The content of this report has been prepared in terms of Regulation GNR 326 of 2014, as amended, Appendix 6, as shown in *Table Error*! **No text of specified style in document.**.1.

Table** Error! No text of specified style in document.**.1 Specialist Report Checklist

Contents of this report in terms of Regulation GNR 982 of 2014, Appendix 6	**Cross-reference in this report**
(a) details of— the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a curriculum vitae;	Pg vii CV pg 83
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Pg vii
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.1
(cA) an indication of the quality and age of base data used for the specialist report;	Section 1.2
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 3
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	n/a
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 4
(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 2 and 3
(g) an identification of any areas to be avoided, including buffers;	Section 3.2.7
(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;	Figure 21
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	n/a
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities.	Sections 4.3 and 4.4
(k) any mitigation measures for inclusion in the EMPr;	Section 5.2
(l) any conditions for inclusion in the environmental authorisation;	n/a
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	n/a
(n) a reasoned opinion— (i) 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, and where applicable, the closure plan;	Section 5.1
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	n/a
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	n/a responses to comments incorporated into Section 3
(q) any other information requested by the competent authority.	n/a

Annex D4

Ecological Assessment

IOX Fibre Optic Cable: Ecological Assessment Report

Report Prepared by:
Engineering Advice & Services (Pty) Ltd

EAS Project Number: 1587

16 November 2018

IOX Fibre Optic Cable: Ecological Assessment Report

For:

ERM

1st Floor, Great Westerford, 240 Main Road,
Rondebosch, Cape Town, South Africa

By: Engineering Advice & Services (Pty) Ltd

73 Heugh Road, Walmer, Port Elizabeth, 6013
Tel: +27 (0) 41 581 2421, Fax: +27 (0) 86 683 9899

EAS Project Number: 1587

16 November 2018

Compiled by:

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Ms Lea Steyn	Engineering Advice & Services (Reports and Databases)	lea@easpe.co.za

EAS Ref: F:\1500-1599\1587\Environmental\Reports\Biophysical Reports\1587 IOX Cable - Ecological assessment report -amended - 16112018.docx

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Abbreviations

CARA	Conservation of Agricultural Resources Act 43 of 1983
CBA	Critical Biodiversity Area
DEDEAT	Department of Economic Development, Environmental Affairs and Tourism
DEMC	Desired Ecological Management Class
DWS	Department of Water Affairs and Sanitation
DWAF	Department of Water Affairs and Forestry (former department name)
EA	Environmental Authorisation
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EMC	Ecological Management Class
EMP	Environmental Management Plan
EMPr	Environmental Management Programme report
ER	Environmental Representative
ESS	Ecosystem Services
IAP's	Interested and Affected Parties
IEM	Integrated Environmental Management
LM	Local Municipality
masl	meters above sea level
NBA	National Biodiversity Assessment
NEMA	National Environmental Management Act 107 of 1998
NFA	National Forests Act
NEMBA	National Environmental Management: Biodiversity Act 10 of 2004
NFA	National Forest Act 84 of 1998
PEMC	Present Ecological Management Class
PES	Present Ecological State
PNCO	Provincial Nature and Environment Conservation Ordinance (No. 19 of 1974).
RDL	Red Data List
RHS	Right Hand Side
RoD	Record of Decision
SANBI	South African National Biodiversity Institute
SDF	Spatial Development Framework
SoER	State of the Environment Report
SSC	Species of Special Concern
TOPS	Threatened of Protected Species
ToR	Terms of Reference
+ve	Positive
-ve	Negative

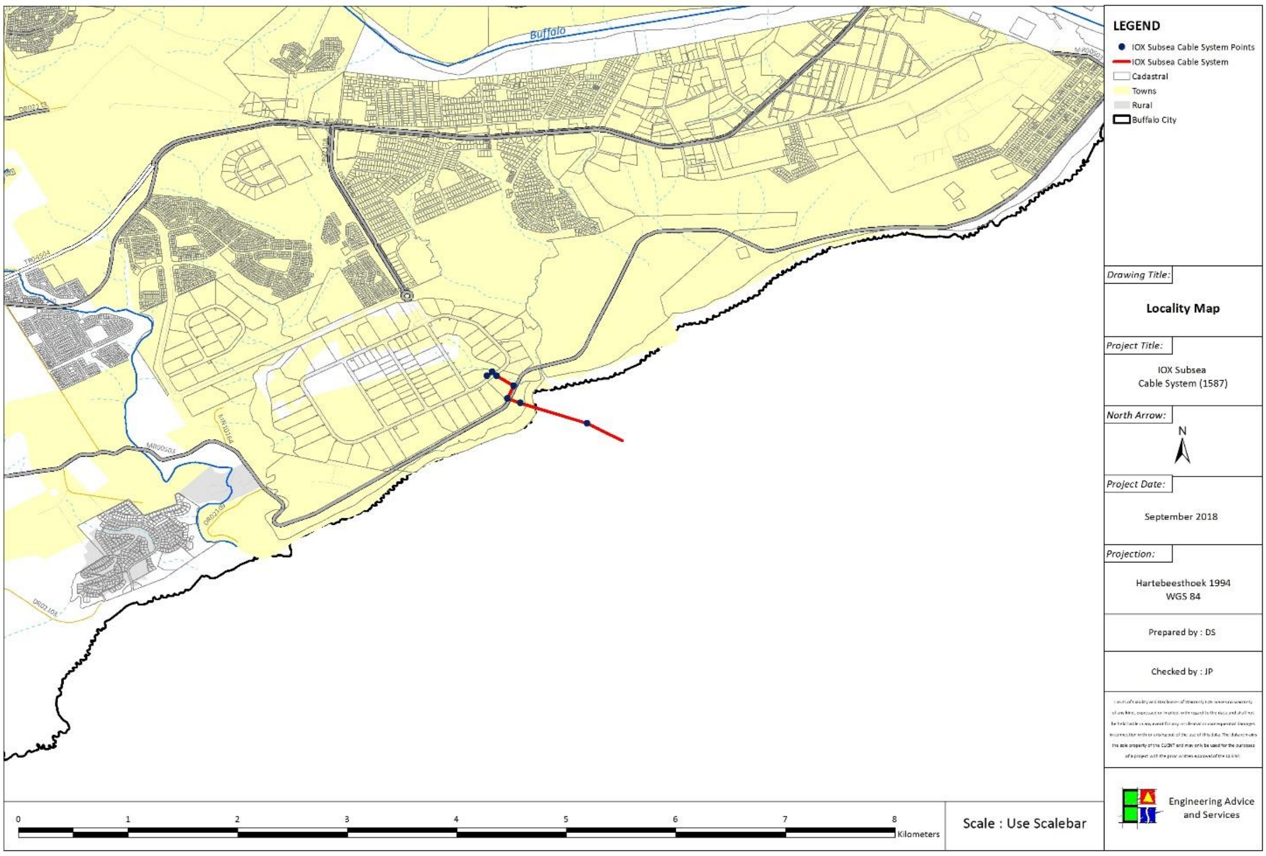
Glossary

Corridors:	Have important functions as strips of a particular type of landscape differing from adjacent land on both sides. Habitat, ecosystems or undeveloped areas that physically connect habitat patches. Smaller, intervening patches of surviving habitat can also serve as "stepping stones" that link fragmented ecosystems by ensuring that certain ecological processes are maintained within and between groups of habitat fragments.
Degraded habitat/land:	Land that has been impacted upon by human activities (including introduction of invasive alien plants, light to moderate overgrazing, accelerated soil erosion, dumping of waste), but still retains a degree of its original structure and species composition (although some species loss would have occurred) and where ecological processes still occur (albeit in an altered way). Degraded land is capable of being restored to a near-natural state with appropriate ecological management.
Ecological Processes:	Ecological processes typically only function well where natural vegetation remains, and in particular where the remaining vegetation is well-connected with other nearby patches of natural vegetation. Loss and fragmentation of natural habitat severely threatens the integrity of ecological processes. Where basic processes are intact, ecosystems are likely to recover more easily from disturbances or inappropriate actions if the actions themselves are not permanent. Conversely, the more interference there has been with basic processes, the greater the severity (and longevity) of effects. Natural processes are complex and interdependent, and it is not possible to predict all the consequences of loss of biodiversity or ecosystem integrity. When a region's natural or historic level of diversity and integrity is maintained, higher levels of system productivity are supported in the long run and the overall effects of disturbances may be dampened.
Ecosystem status:	Ecosystem status of terrestrial ecosystems is based on the degree of habitat loss that has occurred in each ecosystem, relative to two thresholds: one for maintaining healthy ecosystem functioning, and one for conserving the majority of species associated with the ecosystem. As natural habitat is lost in an ecosystem, its functioning is increasingly compromised, leading eventually to the collapse of the ecosystem and to loss of species associated with that ecosystem.
Ecosystem:	All of the organisms of a particular habitat, such as a lake or forest, together with the physical environment in which they live.
Endangered:	Endangered terrestrial ecosystems have lost significant amounts (more than **60 % lost**) of their original natural habitat, so their functioning is compromised.
Endemic:	A plant or animal species, or a vegetation type, which is naturally restricted to a particular defined region. It is often confused with indigenous, which means 'native, occurring naturally in a defined area'.
Environment:	The external circumstances, conditions and objects that affect the existence and development of an individual, organism or group. These circumstances include biophysical, social, economic, historical and cultural aspects.
Exotic:	Non-indigenous; introduced from elsewhere, may also be a *weed* or alien *invasive* species. Exotic species may be invasive or non-invasive.
Fragmentation (habitat):	Causes land transformation, an important current process in landscapes as more and more development occurs.
Habitat:	The home of a plant or animal species. Generally those features of an area inhabited by animal or plant which are essential to its survival.
Indigenous:	Native; occurring naturally in a defined area.

Least threatened terrestrial ecosystems:	These ecosystems have lost only a small proportion (more than 80 % remains) of their original natural habitat, and are largely intact (although they may be degraded to varying degrees, for example by invasive alien species, overgrazing, or overharvesting from the wild).
Riparian:	Pertaining to, situated on or associated with a river bank.
River corridors:	River corridors perform a number of ecological functions such as modulating stream flow, storing water, removing harmful materials from water, and providing habitat for aquatic and terrestrial plants and animals. These corridors also have vegetation and soil characteristics distinctly different from surrounding uplands and support higher levels of species diversity, species densities, and rates of biological productivity than most other landscape elements. Rivers provide for migration and exchange between inland and coastal biotas.
Transformation:	In ecology, transformation refers to adverse changes to biodiversity, typically habitats or ecosystems, through processes such as cultivation, forestry, drainage of wetlands, urban development or invasion by alien plants or animals. Transformation results in habitat fragmentation – the breaking up of a continuous habitat, ecosystem, or land-use type into smaller fragments.
Transformed Habitat/Land:	Land that has been significantly impacted upon as a result of human interferences/disturbances (such as cultivation, urban development, mining, landscaping, severe overgrazing), and where the original structure, species composition and functioning of ecological processes have been irreversibly altered. Transformed habitats are not capable of being restored to their original states.
Tributary/ Drainage line:	A small stream or river flowing into a larger one.
Untransformed habitat/land:	Land that has not been significantly impacted upon by man's activities. These are ecosystems that are in a near-pristine condition in terms of structure, species composition and functioning of ecological processes.
Vulnerable:	Vulnerable terrestrial ecosystems have lost some (more than 60 % remains) of their original natural habitat and their functioning will be compromised if they continue to lose natural habitat.
Weed:	An indigenous or non-indigenous plant that grows and reproduces aggressively, usually a ruderal pioneer of disturbed areas. Weeds may be unwanted because they are unsightly, or they limit the growth of other plants by blocking light or using up nutrients from the soil. They can also harbour and spread plant pathogens.
Wetlands:	A collective term used to describe lands that are sometimes or always covered by shallow water or have saturated soils, and where plants adapted for life in wet conditions usually grow.

1 Introduction & Background

Engineering Advice and Services has been appointed by ERM to undertake an ecological assessment for the proposed IOX Subsea Cable System landing site in East London. The Ecological assessment and report has been undertaken by Mr Jamie Pote.



1.1 Project Description

The IOX Subsea Cable System will provide additional telecommunications capacity to South African users as well as providing cross-connect opportunities from/to other networks within SA and the region. The Project will provide high speed connectivity to the global network.

In South Africa, the Project will involve installation and operation of a subsea fibre optic cable inside the Exclusive Economic Zone (EEZ) (approximately 372 km) and territorial waters (approximately 22 km) to a coastal landing site in East London next to the East London Industrial Development Zone (IDZ).

1.2 Methodology and Approach

The proposed methodology and approach is outlined below:

1) Conduct a comprehensive desktop study and identify potential risks for a Scoping Phase Report relating to vegetation and flora of the site and surrounding area. This will include the relevant Regional Planning frameworks,
2) Conduct a detailed site visit to assess the following:
   a) Detailed field survey of vegetation, flora and habitats present:
   b) Comprehensive species list, highlighting species that are of special concern, threatened, Red Data species and species requiring permits for destruction/relocation in terms of NEMBA and the Provincial Nature Conservation Ordinance No. 19 of 1974

c) Detailed mapping of the various habitat units and assessment of habitat integrity, ecological sensitivity, levels of degradation and transformation, alien invasion and species of special concern, the outcome being a detailed sensitivity map ranked into high, medium or low classes.

3) Reporting will be comprised of a preliminary summary, with identification of anticipated impacts and risks, a draft detailed Assessment Report (for public review and comment) and should any comments be raised these will be addressed in a Final Assessment Report. This report is for the Draft EIR which will go for public consultation following which Final EIR will be issued. The draft and final detailed reports will address the following:
   a) Indicate any assumptions made and gaps in available information. Assessment of all the vegetation types and habitat units within the relevant Regional Planning Frameworks;
   b) A detailed species list highlighting the various species of special concern categories (endemic, threatened, Red Data species and other protected species requiring permits for destruction/relocation and invasive/exotic weeds);
   c) Description and assessment of the habitat units and site sensitivities ranked into high, medium or low classes based on sensitivity and conservation importance. A standard methodology has been developed based on other projects in the specific area;
   d) A habitat sensitivity map will be compiled, indicting the sensitivities as described above;
   e) A map indicating buffers (if required) in order to accommodate Regional Planning and OSMP requirements;
   f) Assessment of Impacts and Mitigation Measure, as well as specific measure that may be required for alternative development plans;
   g) A comprehensive EMPr for inclusion in the reports and EMP with specific management actions for construction and Operation.

1.3 Specialist Information

Mr Jamie Pote has 15 years extensive professional experience in a wide range of Ecological Specialist Assessments in South Africa (Eastern, Western & Northern Cape, Gauteng and Limpopo), Namibia, Mozambique, Democratic Republic of Congo, Republic of Congo and Ghana in the Infrastructure, Mining and Development Sectors. He also has experience in conducting Basic Assessments, EIA's, Section 24 G applications and Mining Permit EMP's as well as developing GIS and other tools for Environmental related work. He has broad ecological experience in a wide range of habitats and ecosystems in Southern, West and Central Africa and has been involved in all stages of project development from inception, through planning and environmental application and authorization (BAR and EMP) to implementation (Flora relocation) and compliance monitoring (ECO auditing). The specialist has a BSc degree in Botany and Environmental Science and a BSc (Hons) degree in Botany and is a SACNASP registered Ecological Scientist

1.3.1 Content of the Specialist Report Checklist

The content of this report has been prepared in terms of Regulation GNR 326 of 2014, as amended, Appendix 6, as shown in *Table 1.*

Table 1 Specialist Report Checklist

Contents of this report in terms of Regulation GNR 982 of 2014, Appendix 6	**Cross-reference in this report**
(a) details of— the specialist who prepared the report; and the expertise of that specialist to compile a specialist report including a curriculum vitae;	Section 1.3 & Appendix D.
(b) a declaration that the specialist is independent in a form as may be specified by the competent authority;	Appendix D

Contents of this report in terms of Regulation GNR 982 of 2014, Appendix 6	**Cross-reference in this report**
(c) an indication of the scope of, and the purpose for which, the report was prepared;	Section 1.2
(cA) an indication of the quality and age of base data used for the specialist report;	Appendix A
(cB) a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 2
(d) the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Section 2
(e) a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 1.2
(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;;	Section 1.8
(g) an identification of any areas to be avoided, including buffers;	Section 2
(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;	Section 1.8
(i) a description of any assumptions made and any uncertainties or gaps in knowledge;	Section 2.3.4
(j) a description of the findings and potential implications of such findings on the impact of the proposed activity or activities.	Section 3
(k) any mitigation measures for inclusion in the EMPr;	Section 3
(l) any conditions for inclusion in the environmental authorisation;	Section 3
(m) any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 3
(n) a reasoned opinion— (i) 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, and where applicable, the closure plan;	Section 4
(o) a description of any consultation process that was undertaken during the course of preparing the specialist report;	N/A
(p) a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	N/A
(q) any other information requested by the competent authority.	N/A

1.4 Legislation Framework

In terms of NEMA EIA Regulations (07 April 2017), the following Listing notices have bearing on this report:

Listing Notice 1 (GN R 327): Activity 15: The development of *structures in the coastal public property* where the development footprint is *bigger than 50 square metres*.

Implications
This activity will be triggered.

Listing Notice 1 (GN R 327): Activity 17: The development- (i) in the sea; ie in respect of infrastructure with a development footprint of 50 square metres or more

Implications
The subsea cable will enter South African territorial waters and land on the beach near East London IDZ (at approximately 33° 3'26.54"S 27°51'50.06"E). The cable length in the sea is approximately 22 km and the anticipated diameter is a maximum of 45 mm (with 1.5 m disturbance for seabed protection per metre run) the footprint within the sea is therefore greater than 33 000 square meters.

Listing Notice 2 (GN R 327): Activity 6: The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.

Implications
The Horizontal Directional Drilling be utilised for the shore crossing installation. The Project require a Coastal Water Discharge Permit for, thus triggering this activity.

Listing Notice 2 (GN R 327): Activity 14: The development of facilities or infrastructure for any process or activity which requires a permit or licence or an amended permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.

Implications
The proposed Project involves the installation of the subsea cable below and/or along the seabed

Listing Notice 3 (GN R 324): Activity 12: The clearance of an area of *300 square metres or more* of indigenous vegetation except where such clearance of indigenous vegetation is required for maintenance purposes undertaken in accordance with a maintenance management plan.
a) In Eastern Cape,
iii. *Within the littoral active zone or 100 metres inland from high water mark of the sea* or an estuarine functional zone, whichever distance is the greater, excluding where such removal will occur behind the development setback line on erven in urban areas; or
v. On land, where, at the time of the coming into effect of this Notice or thereafter *such land was zoned open space, conservation or had an equivalent zoning"*

Implications
The proposed installation of the subsea cable will require the removal of indigenous primary dune vegetation from the Landing Site to the BMH. It is anticipated that a maximum area of 105 m long x 3 m wide (= 315 square metres) will be cleared between the edge of the beach and within the IDZ. Although some disturbances are present, it can be concluded that the majority of the site is having indigenous vegetation, therefore this activity is likely to be triggered. From experience, the disturbances as a result of trenching can be higher than the indicative 3 m wide, so it is likely that at least 300 square meters of 'indigenous vegetation' will be disturbed during construction.

Other relevant legislation includes the following:

- NEMA: Environmental management principles set out in NEMA, and other Specific Environmental Management Acts (SEMA's) should guide decision making throughout the project life cycle to reflect the objective of sustainable development. One of the most important and relevant principles is that disturbance of ecosystems, loss of biodiversity, pollution and degradation of environment and sites that constitute the nation's cultural heritage should be avoided, minimised or as a last option remedied. This is supported by the Biodiversity Act as it relates to loss of biodiversity.

- Liability for any environmental damage, pollution, or ecological degradation: Arising from any and all -related activities occurring inside or outside the area to which the permission/right/permit relates is the responsibility of the rights holder. The National Water Act and NEMA both oblige any person to take all reasonable measures to prevent pollution or degradation from occurring, continuing or reoccurring (polluter pays principle). Where a person/company fails to take such measures, a relevant authority may direct specific measures to be taken and, failing that, may carry out such measures and recover costs from the person responsible.
- Constitution of Republic of South Africa (1996): Section 24(a) of the Constitution states that everyone has the right *'to an environment that is not harmful to their health or well-being'*. Construction activities must comply with South African constitutional law by conducting their activities with due diligence and care for the rights of others.
- National Forests Act 84 of 1998 with Amendments: Lists Protected trees, requiring permits for removal Department of Agriculture, Forestry and Fisheries).
- Conservation of Agricultural Resources Act 43 of 1993: Lists Alien invasive species requiring removal.
- Eastern Cape Nature and Environmental Conservation Ordinance 19 of 1974: Lists Protected species, requiring permits for removal (Department of Economic Development, Environmental Affairs and Tourism).
- Water Use Authorisations: the National Water Act (No. 36 of 1998): Requires that provision is made both in terms of water quantity and quality for 'the reserve', namely to meet the ecological requirements of freshwater systems and basic human needs of downstream communities. It is essential in preparing an EMP that any impacts on water resources be they surface water or groundwater resources, and/ or impacts on water quality or flow, are carefully assessed and evaluated against both the reserve requirement and information on biodiversity priorities. This information will be required in applications for water use licenses or permits and/or in relation to waste disposal authorisations.

1.5 Systematic Planning Frameworks

A screening of Systematic Planning Framework for the region was undertaken (summarised in Table 1), that included the following features:

- Critically Endangered and Endangered Ecosystems
- Critical Biodiversity Areas
- Ecological Support Areas
- Vulnerable Ecosystems
- River and Wetland Freshwater Ecosystem Priority Areas (FEPAs)
- 100 m buffer of Rivers and Wetlands
- Protected Areas
- Protected Area buffers

Table 1: Summary of -Biodiversity features.

Feature	Description	Implications/Comment
Affected Vegetation Types (VEGMAP)	Albany Coastal Belt	Least threatened
	Cape Seashore Vegetation	Least threatened
	Albany Dune Strandveld	Least threatened

Feature	Description	Implications/Comment
Vegetation Types (Other)	Eastern Cape Dune Forest patches	High Sensitivity
Critically Endangered and Endangered Ecosystems	None	N/A
Vulnerable Ecosystems	None	N/A
Critical Biodiversity Areas (ECBCP)	CBA 2: Whilst the current ECBCP plan is not a gazetted Bioregional plan, it is regarded as the applicable guideline.	The proposed activity has a limited impact/disturbance footprint and will be of minimal concern within a CBA 2 area. The coastal zone wherein the cable will be sited is already in a significantly disturbed state as is currently serves as an informal parking area with some clumps of semi-intact vegetation.
Protected Areas in vicinity	Potters Pass Nature Reserve directly to the north	Construction of fibre cable will not result in any activities taking place within the nature reserve.
Marine/Coastal areas	Will pass through the surf zone as well as the ocean floor. Rocky shore vegetation is present rather than mobile dune sands at the preferred site.	Not located within a marine protected area.
Within 100 m of River, watercourse or Wetland	Alternative 2 river outfall may require activity in proximity to a watercourse.	WULA may be required if this option is implemented
Surrounding Land Uses	Natural, degraded land	Natural, degraded land
Ecological Support Areas	No designated Ecological support areas are relevant at the planning scale.	Generally, ESA's are associated with rivers and drainage line.

NOTE**: Refer to Figure 1 to Figure 6.* ***Error! Reference source not found.

1.5.1 Vegetation of Southern Africa

With reference to Mucina and Rutherford (2006) two vegetation units (Figure 2) are primarily affected by the proposed IOX Subsea cable. The site is located within the ***Albany Dune Strandveld*** with elements of ***Albany Coastal Belt*** and ***Cape Seashore Vegetation*** (all Least Threatened). A general description of the three vegetation units is provided below (as per Mucina & Rutherford, 2006):

(AZs 2) Albany Dune Strandveld

Distribution Eastern Cape Province: A narrow coastal strip of the Indian Ocean extending from the Sundays River to south of Kei Mouth.

Vegetation & Landscape Features: Very dense shrubby thicket composed of 2–4 m high, mostly sclerophyllous shrubs accompanied by several woody and herbaceous vines, and with a sparse grassy understorey. This unit also includes low (wind-sheared and salt-sprayed), dense thickets found on seaward slopes of the coastal dune cordons and rocky headlands (coastal cliffs). The occurrence of bulbous geophytes and succulent herbs is an important feature of this vegetation unit.

Geology, Soils & Hydrology Dune systems of the Schelm Hoek Formation, which also consists of dune sands in which shell material and calcrete lenses occasionally occur, as well as older Algoa Group calcareous sandstones and shallow marine deposits.

Climate Rainfall can occur any time of the year (but with most in summer), but the probability of rain is the highest in March and October (slight bimodality). Mean Annual Precipitation (MAP) slightly higher than 700 mm. The temperature regime is ameliorated, with the mean daily maximum and minimum temperatures being 26.4 °C and 8.8 °C for February and July, respectively. The unit lies in a broad transition including warm-temperate and subtropical regions. Local salt-laden sea winds constitute a serious stress factor.

Important Taxa (Stunted shrubby forms of trees) Succulent Tree: *Aloe africana*. Succulent Shrubs: *Cotyledon orbiculata, Crassula nudicaulis, Delosperma ecklonis, D. litorale.* Tall Shrubs: *Brachylaena discolor* (d), *Chrysanthemoides monilifera* (d), *Euclea undulata* (d), *Metalasia muricata* (d), *Pterocelastrus tricuspidatus* (d), *Sideroxylon inerme* (d), *Azima tetracantha, Cassine peragua, Clausena anisata, Cordia caffra, Cussonia thyrsiflora, Diospyros dichrophylla, Euclea natalensis, E. racemosa subsp. macrophylla, Eugenia capensis, Grewia occidentalis, Gymnosporia buxifolia, Hippobromus pauciflorus, Maytenus procumbens, Mystroxylon aethiopicum, Plumbago auriculata, Putterlickia pyracantha, Rhus crenata, R. glauca, R. longispina, R. lucida, R. pterota, Robsonodendron eucleiforme, Schotia afra var. afra, Scutia myrtina, Tarchonanthus littoralis, Zanthoxylum capense*. Low Shrubs: *Passerina rigida (d), Anthospermum littoreum, Asparagus capensis var. litoralis, Carissa bispinosa subsp. bispinosa, Helichrysum teretifolium, Lauridia tetragona, Pavetta revoluta, Psoralea repens, Rhoiacarpos capensis, Robsonodendron maritimum, Salvia africana-lutea, Senecio burchellii*. Semiparasitic Shrub: *Osyris compressa.* Succulent Woody Climber: *Sarcostemma viminale*. Woody Climbers: *Asparagus asparagoides, A. racemosus, Capparis sepiaria, Rhoicissus digitata.* Herbaceous Succulent Climber: *Senecio angulatus.* Herbaceous Climbers: *Astephanus marginatus, Cynanchum ellipticum, C. natalitium, C. obtusifolium, Kedrostis nana, Senecio deltoideus.* Herbaceous Parasitic Climber: *Cassytha filiformis*. Herb: *Felicia erigeroides*. Geophytic Herbs: *Haemanthus albiflos (d), Veltheimia bracteata (d), Androcymbium longipes, Bonatea speciosa, Bulbine frutescens, Chasmanthe aethiopica, Dietes iridioides, Gladiolus floribundus, Massonia echinata, Sansevieria hyacinthoides, Trachyandra revoluta*. Succulent Herbs: *Carpobrotus deliciosus, C. edulis, Crassula cotyledonis, Gasteria acinacifolia, G. croucheri. Graminoids: Stenotaphrum secundatum (d), Brachiaria chusqueoides, Panicum deustum.*

Conservation *Least threatened*. Target 20%. Some 25% statutorily conserved in the Greater Addo Elephant National Park, Gulu, Christmas Vale, Cape Morgan, Cintsa, Cove Rock, Bluebend and Sunshine Coast Nature Reserves as well as in private conservation areas such as the Glendour and Kasouga Farm Natural Heritage Sites and Waterloo Bay Forest Reserve. Alien Australian acacias (Acacia cyclops, A. saligna, A. longifolia) have invaded large stretches of the coastal thicket and are dominant in places. Lagurus ovatus and species of Lolium occur in disturbed patches of this coastal thicket. At present these plants are targeted for eradication by the Working for Water Programme of DWAF. Some 8% transformed for urban development and cultivation. Erosion very low (26%), moderate (22%), high (14%) and low (11%).

Remarks Most of the woody species present in the Algoa Dune Strandveld vegetation also occur in Albany Dune Strandveld, but here the species richness is enhanced by several subtropical elements such as *Pavetta revoluta* and *Phoenix reclinata*—taxa that reach their southernmost distribution here. The presence of species such as *Euphorbia triangularis*, *Plumbago auriculata* and *Scutia myrtina* in this unit indicates a direct relationship with the neighbouring Albany Thicket. This relationship may well indicate that the thickets of the Albany Dune Strandveld have long been a precursor of climax forest vegetation, probably not dissimilar to those of the present Alexandria Forest.

(AZd 3) Cape Seashore Vegetation

Distribution Western Cape and Eastern Cape Provinces: Temperate coasts of the Atlantic Ocean (Olifants River mouth to Cape Agulhas) and Indian Ocean (Cape Agulhas to East London). According to Tinley (1985; see also Lubke et al. 1997), this stretch of coast comprises the South West and South Coasts.

Vegetation & Landscape Features: Beaches, coastal dunes, dune slacks and coastal cliffs of open grassy, herbaceous and to some extent also dwarf-shrubby (sometimes succulent) vegetation, often dominated by a single pioneer species. Various plant communities reflect the age of the substrate and natural disturbance regime (moving dunes), distance from the upper tidal mark and the exposure of dune slopes (leeward versus seaward).

Geology, Soils & Hydrology Young coastal sandy sediments forming beaches and dunes (Strandveld Formation), exposed to reworking by relentless winds and frequent sea storms. Some stretches of the West Coast are covered by extensive shell beds.

Climate Largely uniform, all-year precipitation pattern, but this pattern must be interpreted with care since the unit encompasses regions of very diverse precipitation regimes. The precipitation becomes transitional, with a considerable increase of summer rainfall eastwards. MAP in Lambert's Bay, Cape Town, Plettenberg Bay and Port Elizabeth is 128 mm, 517 mm, 661 mm and 604 mm, respectively. The temperature varies less than precipitation (17–18 °C for both Lambert's Bay and Port Elizabeth).

Important Taxa Dunes & beaches: Succulent Shrubs: *Drosanthemum candens* (d), *Pelargonium capitatum* (d), *Tetragonia decumbens* (d), *Didelta carnosa* var. *tomentosa, Exomis microphylla* var. *axyrioides, Lycium tetrandrum, Scaevola plumieri.* Low Shrubs: *Hebenstretia cordata* (d), *Frankenia repens, Oncosiphon sabulosum.* Semiparasitic Shrub: *Thesidium fragile*. Herbaceous Climbers: *Cynanchum ellipticum, C. obtusifolium.* Herbs: *Gazania rigens* (d), *Senecio littoreus* (d), *Amellus asteroides*, *Dasispermum suffruticosum, Manulea tomentosa, Polygonum maritimum, Senecio elegans*. Geophytic Herb: *Trachyandra divaricata.* Succulent Herbs: *Arctotheca populifolia* (d), *Carpobrotus acinaciformis, C. edulis*. Graminoids: *Cladoraphis cyperoides* (d), *Ehrharta villosa* var. *maxima* (d), *Sporobolus virginicus* (d), *Stipagrostis zeyheri* subsp. *barbata*. Cliffs: Succulent Shrubs: *Disphyma crassifolium* (d), *Sarcocornia littorea* (d). Herb: *Gazania rigens* (d).

Endemic Taxa Dunes & beaches: Low Shrub: *Psoralea repens* (d). Succulent Shrub: *Amphibolia laevis* (d). Herbs: *Amellus capensis, Gazania maritima, G. rigens* var. *leucolaena, Silene crassifolia*. Succulent Herbs: *Senecio litorosus*, *S. maritimus*. Graminoids: *Thinopyrum distichum* (d), *Eragrostis sabulosa*. Dune slacks: Herb: *Vellereophyton vellereum*. Cliffs: Succulent Shrubs: *Drosanthemum marinum* (d), *D. stokoei, Erepsia steytlerae, Prenia vanrensburgii*. Low Shrub: *Syncarpha sordescens*. Herbs: *Limonium* sp. nov. (Mucina 6942/1 STEU), *Lobelia boivinii*.

Conservation *Least threatened*. Target 20%. Almost half of the area statutorily conserved in the West Coast, Cape Peninsula, Agulhas, proposed Garden Route and Greater Addo Elephant National Parks as well as the Rocher Pan, Cape Columbine, Dassen Island, Wolvengat, Kleinmond, Walker Bay, De Mond (Ramsar site), De Hoop, Kleinjongensfontein, Geelkrans, Robberg, (all Western Cape), and Cape St Francis, Cape Recife, Joan Muir, Gxulu, Cape Henderson, Kwelera and Bosbokstrand Nature Reserves (all Eastern Cape). A number of private conservation areas such as Donkin Bay, Robben Island, Rein's Coastal Reserve and Tharfield Nature Reserve protect other considerable portions of the Cape Seashore Vegetation. Only about 1.7% has been transformed, mainly by urban development.

Remark Extensive dunefields are found at De Hoop, Cape St Francis, Gamtoos, Alexandria and Boknes along this coastal stretch (Tinley 1985, Young 1987, Talbot & Bate 1991).

(AT 9) Albany Coastal Belt

Distribution Eastern Cape Province: Within 15 km (sometimes up to 30 km) of the Indian Ocean coastline, from Kei Mouth to the Sundays River, interrupted by many valleys. Altitude 10–400 m.

Vegetation & Landscape Features: On the gently to moderately undulating landscapes and dissected hilltop slopes close to the coast, dominated by short grasslands punctuated by scattered bush clumps or solitary Acacia natalitia trees.

Geology & Soils The area covered by this unit is geologically complex and includes Beaufort Group mudstone and sandstone in the northeast, Nanaga Formation arenite and sand in the west and Bokkeveld, Witteberg and Ecca sandstone and shale in between, and a thin strip of Quaternary sand along the coast. The pure grasslands are limited to the Nanaga and Quaternary sands, whereas thornveld is prominent on the more finely textured soils derived from the Beaufort and Bokkeveld mudstone, arenite and shale. The most important land types include Db, Fa and Ae.

Climate In general the climate is ameliorated by the proximity to the coast. MAP ranges from 450 mm inland in the southwest to 900 mm in the northeast, and decreases slightly from the coast inland. The rainfall is nonseasonal with optima in March and October/November, but summer rainfall increases with distance northeastwards. There is a strong rainfall gradient across this unit, with higher rainfall further northeast, which influences species composition, with more subtropical elements up the coast and more drought-tolerant elements farther west. There is little variation in temperature from season to season and frost occurs on average for only 3 days a year in the inland sites and never at the coast. Mean monthly maximum and minimum temperatures for East London are 32.3 °C and 5.3 °C for March and July, respectively.

Important Taxa Tall Tree: *Erythrina caffra*. Succulent Tree: *Euphorbia triangularis*. Small Trees: *Acacia natalitia* (d), *Brachylaena elliptica*, *Canthium spinosum*, *Cussonia spicata*, *Ficus sur*, *Ochna arborea*, *Sideroxylon inerme*, *Zanthoxylum capense*. Tall Shrubs: *Clausena anisata, Clerodendrum glabrum, Coddia rudis, Croton rivularis, Diospyros villosa var. parvifolia, Grewia occidentalis, Gymnosporia heterophylla, Hippobromus pauciflorus, Mystroxylon aethiopicum, Pavetta lanceolata, Psydrax obovata, Pterocelastrus tricuspidatus, Rhus lucida, Scutia myrtina, Tarchonanthus camphoratus, Turraea obtusifolia*. Low Shrubs: *Rhynchosia ciliata* (d), *Carissa bispinosa subsp. bispinosa*, *Chaetacanthus setiger, Helichrysum asperum var. albidulum, Pelargonium alchemilloides, Phyllanthus maderaspatensis, Selago corymbosa, Senecio pterophorus, Tephrosia capensis* var. *acutifolia*. Semiparasitic Epiphytic Shrub: *Viscum obscurum*. Woody Succulent Climbers: *Crassula pellucida* subsp. marginalis, *Sarcostemma viminale*. Woody Climbers: *Asparagus aethiopicus, A. racemosus, Capparis sepiaria var. citrifolia, Clematis brachiata, Rhoiacarpos capensis, Rhoicissus digitata, R. tridentata, Secamone alpini, Tecoma capensis*. Herbaceous Climbers: *Rhynchosia caribaea, R. totta, Thunbergia capensis, Zehneria scabra*. Graminoids: *Brachiaria serrata* (d), *Cynodon dactylon* (d), *Dactyloctenium australe* (d), *Digitaria natalensis* (d), *Ehrharta calycina* (d), *Eragrostis capensis* (d), *E. curvula* (d), *E. plana* (d), *Heteropogon contortus* (d), *Panicum deustum* (d), *P. maximum* (d), *Setaria sphacelata* (d), *Sporobolus africanus* (d), *Themeda triandra* (d), *Tristachya leucothrix* (d), *Cymbopogon marginatus, Ehrharta erecta, Elionurus muticus, Melica racemosa, Setaria megaphylla, Trachypogon spicatus. Succulent Herb: Plectranthus verticillatus* (d). Geophytic Herbs: *Cheilanthes hirta, Moraea pallida, Oxalis smithiana, Sansevieria hyacinthoides, Strelitzia reginae*. Herbs: *Chamaecrista mimosoides* (d), *Abutilon sonneratianum, Acalypha ecklonii, Centella asiatica, Commelina africana, C. benghalensis, Cynoglossum hispidum, Eriosema squarrosum, Lactuca inermis, Lobelia erinus, Monsonia emarginata, Phyllopodium cuneifolium, Senecio burchellii, Sonchus dregeanus*.

Endemic Taxa Succulent Shrub: *Bergeranthus concavus*. Succulent Herbs: *Brachystelma franksiae* var. *grandiflorum, Bulbine frutescens* var. nov. ('chalumnensis' Baijnath ined.), *Faucaria subintegra, Haworthia coarctata* var. *tenuis*, *H. cooperi* var. *venusta, H. reinwardtii* var. *reinwardtii f. chalumnensis, Stapelia praetermissa* var. *luteola, S. praetermissa* var. *praetermissa*. Geophytic Herbs: *Bobartia gracilis, Apodolirion*

amyanum, Aspidoglossum flanaganii, Drimia chalumnensis. Low Shrub: *Acmadenia kiwanensis*. Herb: *Monsonia galpinii*.

Conservation Least threatened. Target 19%. Only 1% of this vegetation unit is protected in 20 local-authority and provincial nature reserves as well as in the Greater Addo Elephant National Park (including Alexandria Coast Reserve West) as well as in number of private conservation areas. About 12% of the Albany Coastal Belt has recently been altered by cultivation, 1% by plantation forestry and 4% by urbanisation. According to land-cover data, at least 7% consists of degraded vegetation. It is difficult,

however, to determine the proportion of the vegetation that is in a secondary state, since land-cover data do not distinguish between primary and secondary vegetation. Erosion is very low to moderate.
Remarks: The seaboard region that contains this unit is a mosaic of a wide variety of structural vegetation types, ranging from grassland to forest. This variation reflects post-disturbance succession gradients as well as natural variation in geology, soil patterns and distribution of water in the landscape. The forests of the region have been mapped as different vegetation units (see Chapter on Forests in this book). Admittedly, this vegetation unit exemplifies a deviation from our mapping philosophy by featuring current-state rather than potential vegetation. We assume that the current vegetation mosaic so typical of the Albany Coastal Belt is a creation of man and the original (pre-settlement) vegetation was dominated by nonseasonal, dense thicket. The area of this unit was prime agricultural land which attracted early settlers who, presumably, cleared the dense thicket cloak for pastures.

1.6 Vegetation and Ecological Processes

The Eastern Cape Province has highly diverse vegetation since it occupies an area where the biomes of South Africa converge (Rutherford and Westfall, 1994). As a result, the Eastern Cape vegetation is a mosaic of vegetation types, many of which have become severely threatened by development (Lubke *et al.*, 1988, Low and Rebelo, 1996). The vegetation of the region falls in the Tongoland-Pondoland phytochorion (White, 1983) that is considered to have originated in Natal and migrated south-westward where it merged with Cape and arid flora, hence the vegetation is generally highly diverse.

The dune thickets around East London are also referred to as the <u>Transfish Dune Thickets</u> (STEP, 2002) and have some fundamental characteristics. *Mimusops caffra* is abundant, seemingly largely replacing *Sideroxylon inerme*, while *Brachylaena discolor* is largely replaced by *Tarchonanthus camphoratus*. Distinctive elements present, such as *Aloe thraskii, Phoenix reclinata* and *Strelitzia nicolai*, renders it easy to recognise. Forest tree species are often present in the Transfish Dune Thicket, sometimes to the extent that it is difficult to distinguish it from a coastal forest. The relative abundance of species typical of other Dune Thicket units, e.g. *Azima tetracantha, Brachylaena discolor, Carissa bispinosa, Mystroxylon aethiopicum, Robsonodendron maritimum, Euclea racemosa, Grewia occidentalis, Maytenus procumbens, Putterlickia verrucosa*, coerce us to recognise it as a Thicket unit. Many species typical of the Tongoland-Pondoland flora are present, while Fynbos elements are largely restricted to its mosaic units. It is interesting to note that all the localised endemic species that occur in the Transfish Dune Thicket are related to taxa that occur more abundantly in the western areas. These may be relics of a once more well-developed winter rainfall flora, which became displaced by sub-tropical eastern species when the summer rainfall increased. This is further exemplified by the occurrence of taxa in the associated coastal grassland that are more typical of the Drakensberg flora, e.g. *Aloe pratensis*. Even more remarkable is the still continuous distribution of taxa from the Cape Flora to the Drakensberg escarpment, via these Grasslands, with the myrmecochorous *Agathosma ovata* serving as a prime example.

The Transfish Dune Thicket is less exposed to periodic summer drought conditions. Probably the main reason why the sub-tropical elements are so prominent in the Transfish Dune Thicket located around East London. One should keep in mind that both these areas receive adequate winter rain (± 300 mm from April to September) to sustain many Fynbos and even Afromontane elements. The general paucity of the winter rainfall elements from the Transfish Dune Thicket environment is thus not due to a lack of winter rain, but rather because they are displaced by sub-tropical elements typical of the Tongoland-Pondoland area. One would predict that the majority of these sub-tropical elements are fast growing C4 plants that are able to utilise the reliable summer rain better than the winter rainfall taxa, most of which are typically C3 plants. It is interesting to note that the winter rainfall elements (e.g. *Bobartia gracilis*, *Erica cerinthoides*, *Gnidia anthylloides*, *Leucospermum cuneiforme, Watsonia pillansii*, etc.) are able to persist in nutrient stressed sites in this area, such as outcrops of sandstone and quartzite, where the C4 plants are less likely to perform very well.

Even regular fires, one factor that seems to be able to restrain the rapid establishment of the sub-tropical woody elements, have not been able to ensure the persistence of the winter rainfall elements in much of the Transfish Dune Thicket area. The fire-prone areas that have nutrient rich soils are dominated by C4 grass species that are equally strong competitors to their woody counterparts to displace the C3 winter rainfall elements. These winter rainfall elements are thus only prominent in sites where nutrient poor soils occur and where regular fires can curb the onslaught of the sub-tropical elements. These rigidly selecting abiotic features only allow taxa that are able to resprout after fire to persist and they are exactly the only ones that are still prevalent in these areas. Even the local genotype of, the otherwise strictly reseeding, *Agathosma ovata* is a resprouter here.

There can be little doubt that the area, which at present consists of the Grasslands associated with the local Dune and Valley Thicket units in the Transfish area, was once an important link between the flora of the Drakensberg Escarpment and those of the Cape flora. The rapid increase in fire frequency, largely due to the now favoured presence of C4 grasses in the area, probably annihilated much of the evidence to support this opinion. The associated grazing by herbivores in these Grasslands and Savanna areas probably further exemplified the impacts fire, as seedlings of certain winter rainfall taxa that may have persisted in this environment (e.g. large seeded myrmecochorous species such as Leucospermum cuneiforme) are targeted by browsers after a fire. This may well explain the apparent absence of a link between the Leucospermum cuneiforme populations that occurred until recently in the Kentani area and those of Leucospermum saxosum, a closely related species that now only occur in the northern section of the Drakensberg escarpment. It is most tempting to speculate about this seemingly “missing-link”, but we firmly believe that it was the original route followed by many of the taxa now prominent in the Cape flora. Ever since the flow of genetic between populations of these taxa has been cut by an increase in summer rainfall and the advent of frequent fires in the area, the original species of this connecting zone became fragmented. This resulted in a proliferation of species towards the southern region, where summer drought (and other factors, such as the general lack of nutrients in the substrate) prevented the establishment of the sub-tropical elements. The abundance of highly localised Leucospermum species in the matrix vegetation associated with the Dune Thicket in the southern and south-western Cape serves as a fine example. This pattern is, however, repeated many times over in small-seeded myrmecochorous shrubs such as Muraltia and geophytes, such as the genera Aristea, Trachyandra, etc. This pattern is also repeated at a higher taxonomic order where genera such as *Calpurnia*, at present associated with the Thicket- Forest interface, probably gave rise to species rich genera in the Fynbos environment such as the genus Aspalathus – the second largest genus in the Cape flora

It should also be noted that birds are the main dispersal agents of may pioneer woody species (e.g. *Azima, Gymnosporia, Lycium, Rhus,* etc.) for all the mainland Thicket units, but some of the pioneer Dune Thicket species (e.g. *Brachylaena, Tarchonanthus,* etc.) also utilize wind as a dispersal agent.

1.6.1 Eastern Cape Biodiversity Conservation Plan (ECBCP)

Critical Biodiversity Areas (CBAs) are terrestrial and aquatic features in the landscape that are critical for conserving biodiversity and maintaining ecosystem functioning (SANBI 2007). These form the key output of the conservation plan. They are used to guide protected area selection and should remain in their natural state as far as possible. Whilst the current ECBCP plan is *not a gazetted Bioregional plan*, it is regarded as the applicable guideline. The ECBCP is currently under revision, but was not yet available at the time of this assessment.

As indicated in Figure 3, the Eastern Cape Biodiversity Conservation Plan (ECBCP, 2007), the proposed site falls within an area designated a CBA 2 status. Due to the limited impact of the development of the preferred site at a local and regional scale, the effect on Critical Biodiversity Areas and ecological processes, will most likely be insignificant or of low significance.

The proposed activity has a very limited impact/disturbance footprint and will be of minimal concern within a CBA 2 area. The coastal zone wherein the cable will be sited is already in a significantly disturbed state as it currently serves as an informal parking area with some clumps of semi-intact vegetation.

Any specific areas identified as being sensitive will be addressed in the *Impact and Mitigation* sections of the report as necessary. The construction of a linear feature of this limited footprint is unlikely to have any significant impact for the portions of the route that are located within CBA 2 areas.

1.6.2 Protected areas

The Potters Pass Nature Reserve is located to the east of the site. The proposed activity will have no impact on the protected area.

1.7 Implications of Systematic Planning frameworks

The development of the site is unlikely to compromise the vegetation units significantly due to:

- The limited development footprint.
- The generally degraded state of most of the immediate surrounding area.
- The general proximity to transformed, disturbed and degraded areas and low conservation priority vegetation types.
- The implementation of an Environmental Management Plan to include the following:
  - A flora relocation plan, which will include a search and rescue of protected flora.
  - A rehabilitation plan, which will be driven primarily by the appropriate removal and replacement of topsoil during construction.

1.8 Regional Planning Maps

The maps below elucidate the Regional Planning context discussed above.

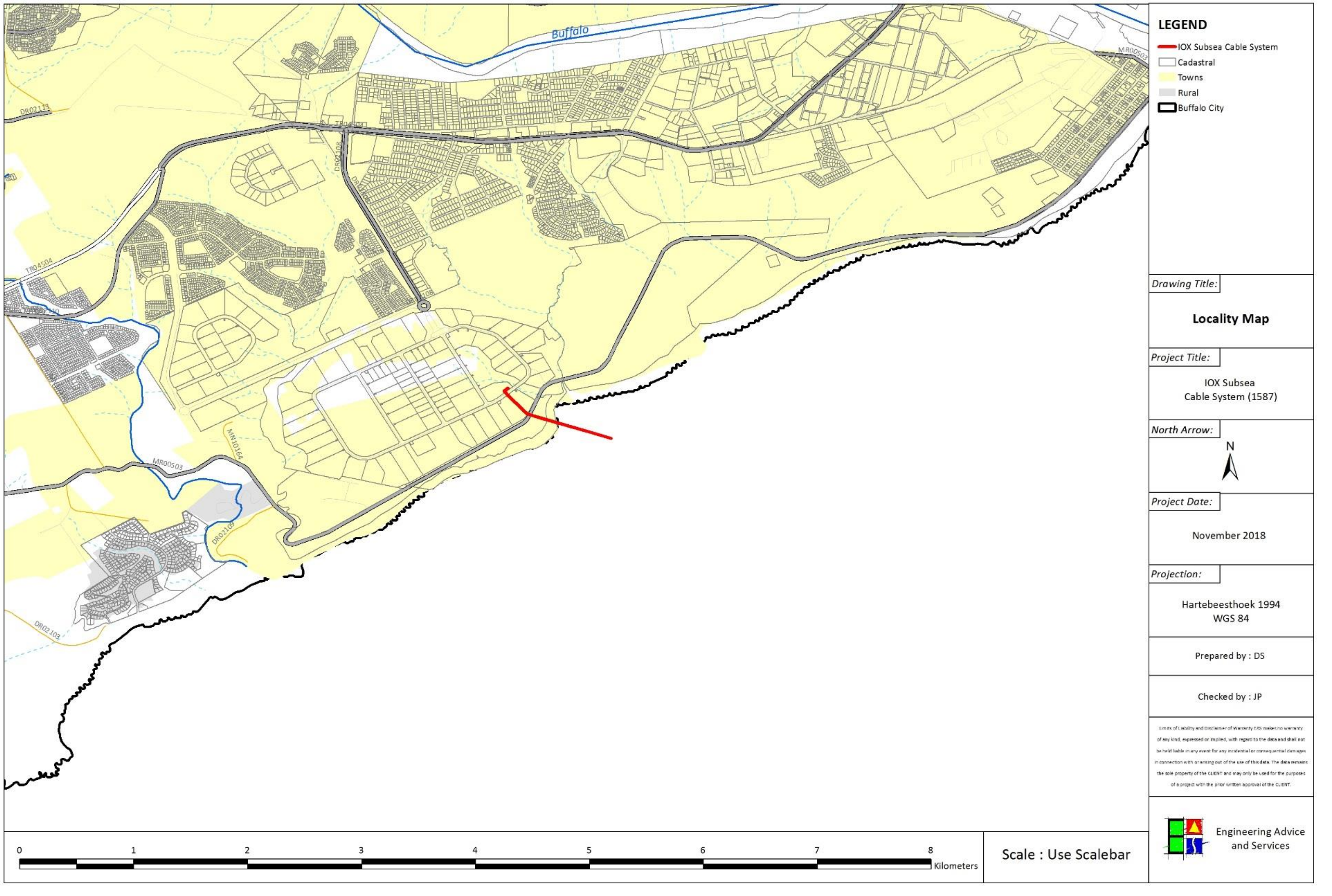


Figure 1: Locality Map.

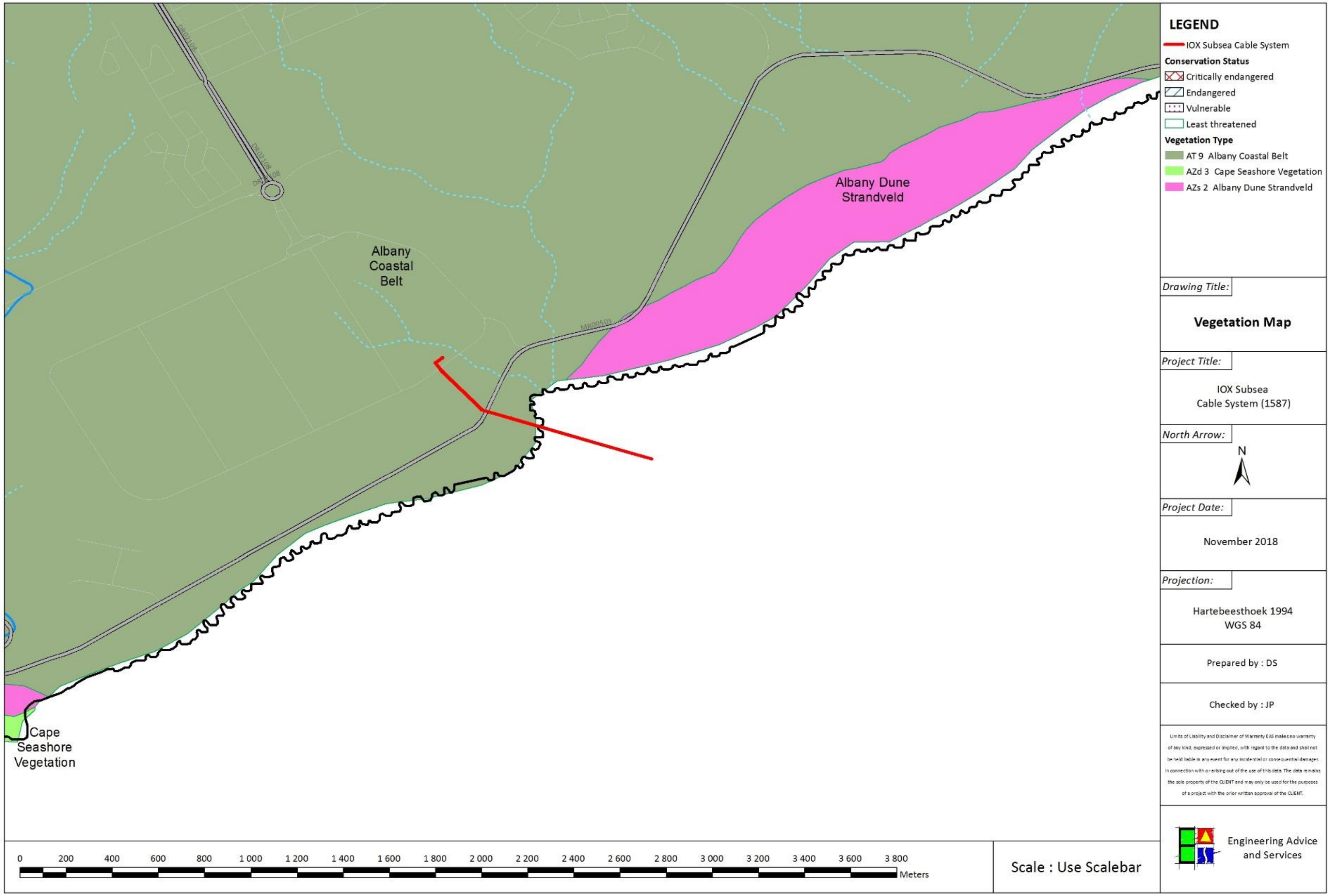


Figure 2: Vegetation and Status

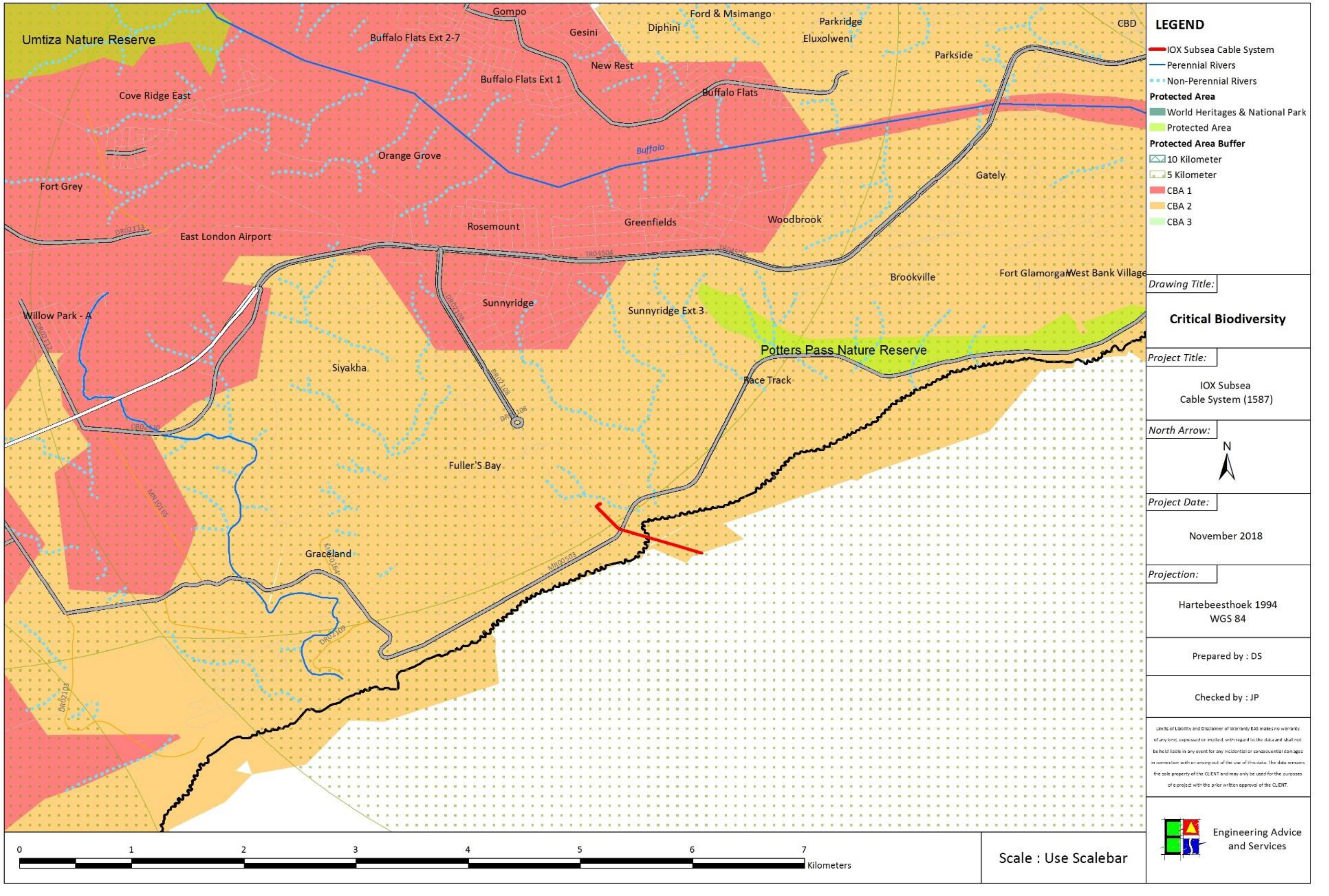


Figure 3: Critical Biodiversity Areas, as per Eastern Cape Biodiversity Conservation Plan (ECBCP, 2007).

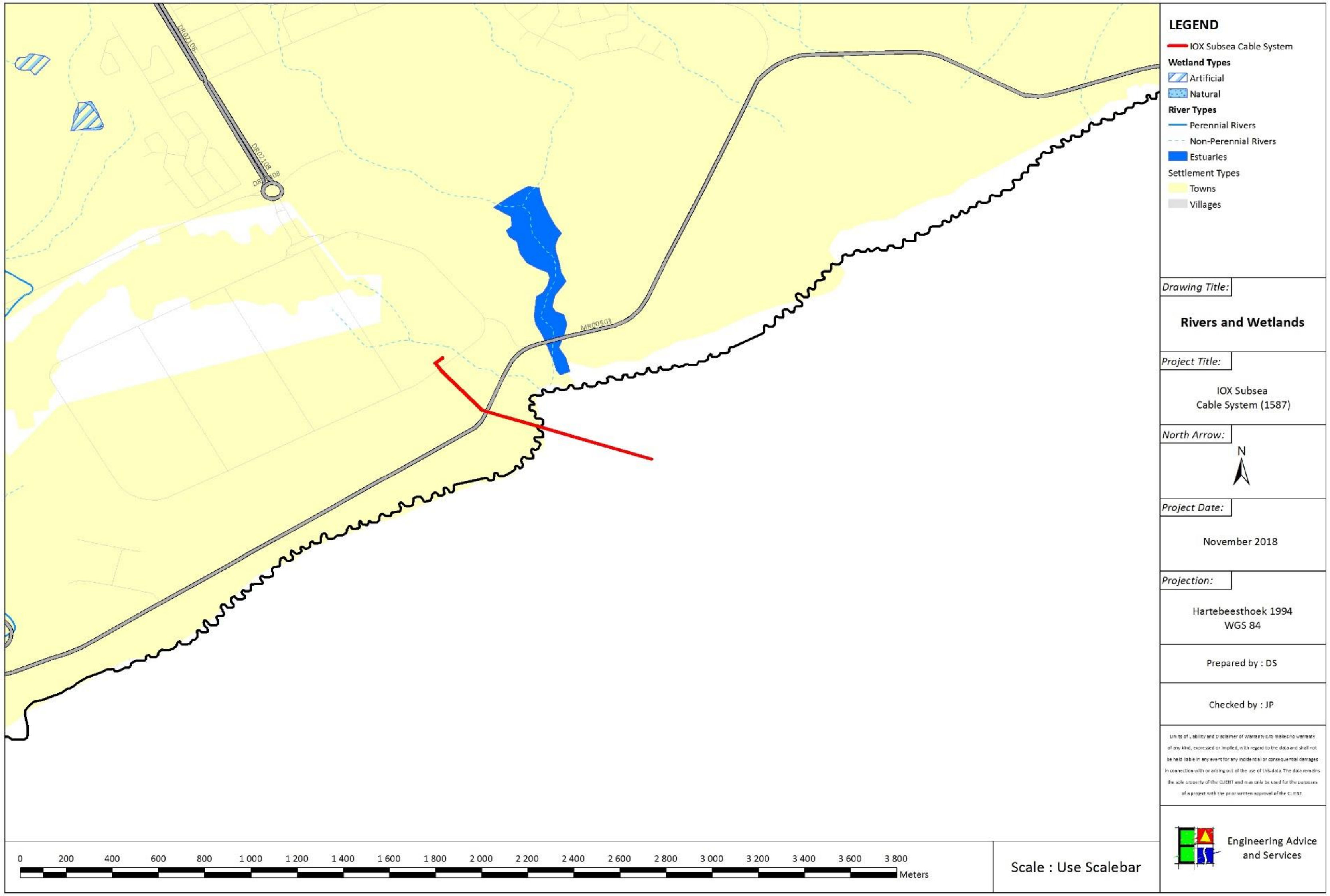


Figure 4: Rivers and Wetlands

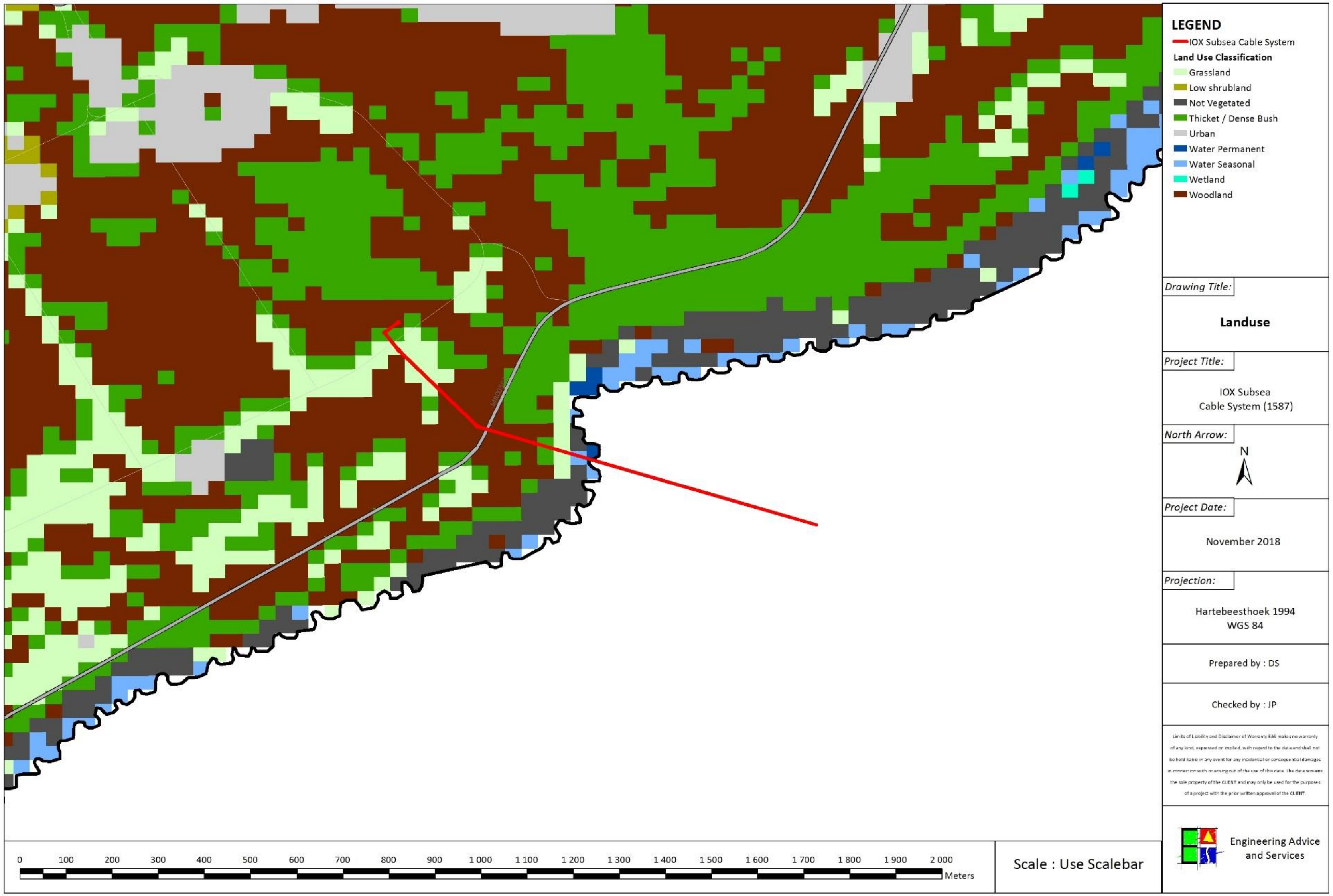


Figure 5: Land Cover

Figure 6: Aerial Photo (Preferred option)

2 Description of the Terrestrial Environment

A site visit was conducted on 26 September 2018 (early spring).

2.1 Site Locality

The site is situated in the West Bank area on the eastern side of the Buffalo River and will run from a point within the IDZ to the sea in the south.

2.2 Topography and Drainage

The affected area can generally be described as gentle undulating sea-facing vegetated dunes.

2.3 Vegetation and Flora

Three vegetation units are indicated to be represented within the general area that will be affected by the proposed development, namely **Albany Coastal Belt,** with elements of **Albany Dune Strandveld** and **Cape Seashore Vegetation**. Whilst they are distinct units, there is some overlap regarding species composition. **Albany Coastal Belt** is present on the gently to moderately undulating landscapes and dissected hilltop slopes close to the coast, dominated by short grasslands punctuated by scattered bush clumps to dense thicket and coastal forest. The seaboard region that contains this unit is a mosaic of a wide variety of structural vegetation types, ranging from grassland to forest. South defacing slopes tend towards Coastal Forest and drier north facing slopes often have more arid features (such as *Euphorbia triangularis*). This variation reflects post-disturbance succession gradients as well as natural variation in geology, soil patterns and distribution of water in the landscape. The **Albany Dune Strandveld** occurs along a narrow costal belt and is characterised by short dense with a distinctive wind-sheared and salt-sprayed appearance. It is generally a very dense shrubby thicket composed of 2–4 m high, mostly sclerophyllous shrubs accompanied by several woody and herbaceous vines, and with a sparse grassy understorey. Elements of **Cape Seashore Vegetation** are present along the beaches, coastal dunes, dune slacks and coastal cliffs, consisting of open grassy, herbaceous and to some extent also dwarf-shrubby (sometimes succulent) vegetation, often dominated by a single pioneer species.

2.3.1 Albany Coastal Belt

As described in the general description above, **Albany Coastal Belt** is present on the gently to moderately undulating landscapes and dissected hilltop slopes close to the coast, dominated by short grasslands punctuated by scattered bush clumps to dense thicket and coastal forest. The seaboard region that contains this unit is a mosaic of a wide variety of structural vegetation types, ranging from grassland to forest. This variation reflects post-disturbance succession gradients as well as natural variation in geology, soil patterns and distribution of water in the landscape.

Species within the grassland / disturbed areas predominantly include *Acacia natalitia*, *Brachylaena elliptica*, *Diospyros villosa var. parvifolia, Grewia occidentalis, Scutia myrtina, Tarchonanthus camphoratus, Carissa bispinosa, Helichrysum asperum, Pelargonium alchemilloides, Phyllanthus maderaspatensis, Selago corymbosa, Senecio pterophorus, Tephrosia capensis* var. *acutifolia*. Various grasses include *Brachiaria serrata*, *Cynodon dactylon*, *Dactyloctenium australe*, *Digitaria natalensis, Eragrostis capensis*, *Eragrostis curvula, Panicum deustum, Setaria sphacelata, Sporobolus africanus* and *Cymbopogon marginatus.* **This vegetation is present along the northern portion of the route within the IDZ.**

The wetter south facing slopes generally have Thicket and Coastal Dune Forest where conditions allow. Species predominantly include *Mimusops caffra, Brachylaena elliptica*, *Ficus sur, Erythrina caffra,* *Sideroxylon inerme, Ochna arborea, Zanthoxylum capense, Clausena anisata, Clerodendrum glabrum, Hippobromus pauciflorus, Mystroxylon aethiopicum, Pavetta lanceolata, Pterocelastrus tricuspidatus, Scutia myrtina, Tarchonanthus camphoratus, Viscum obscurum, Sarcostemma viminale, Capparis sepiaria, Clematis brachiata, Rhoiacarpos capensis, Rhoicissus digitata, R. tridentata, Cynodon dactylon, Dactyloctenium australe, Digitaria natalensis, Ehrharta calycina, Panicum deustum, P. maximum, Cheilanthes hirta, Moraea pallida, Sansevieria hyacinthoides, Strelitzia reginae, Abutilon sonneratianum, Acalypha ecklonii, Centella asiatica* and *Commelina africana*. **This vegetation is present along the drainage line to the east and is not affected by the route.**

Image: 1

Image: 2

Image:3

Image:4

Image:5

Image:6

The **Albany Coastal Belt** within the proposed site is comprised of transformed and degraded grassland vegetation and open thicket, becoming a denser thicket along the drainage line to the east. The south-facing coastal slopes as well as slopes adjacent to the drainage line to the east have some Coastal Dune Forest elements, especially within protected lower lying valleys. These forest elements will not be impacted by the proposed development. The vegetation along the route south of the road is Albany Dune Strandveld along the coastline before becoming unvegetated dunes and rocky shore.

2.3.2 Albany Dune Strandveld and Cape Seashore vegetation

This unit is described as having a distinctive wind-sheared and salt-sprayed, hedge like appearance, with a very dense shrubby thicket up to approximately 1 – 2 composed predominantly of *Chrysanthemoides monilifera*, with *Brachylaena discolor*, *Euclea undulata*, *Metalasia muricata*, *Azima tetracantha*, *Plumbago auriculata*, *Rhus spp. Scutia myrtina*, *Tarchonanthus littoralis*, *Passerina rigida* with occasional succulents such as *Aloe africana*, *Cotyledon orbiculata* and *Delosperma litorale* also present. **This vegetation is present south of the road, outside of the IDZ, towards the coastline.**

Image: 7

Image: 8

Image: 9

Image: 10

Image: 11

Image: 12

The **Albany Dune Strandveld** is present south of the road and tends to be fragment, disturbed and invaded to some extent. It can be concluded that the vegetation has most likely been exposed to various historical disturbances and may be of a secondary nature. The **Albany Dune Strandveld** at the specific site has negligible ecological value and is unlikely to be affected by the limited and temporary construction footprint of the proposed development.

2.3.3 Flora

A flora species list is provided in Appendix D. Due to limited sampling time and inaccessibility of some portions, presence or absence of all species cannot be confirmed without detailed seasonal site visits during different seasons. For the purposes of this proposed project, having a limited extent, the level of detail is considered to be adequate.

2.3.4 Species of Special Concern occurring in the region

Based on a desktop Assessment of existing online databases, the potential list of flora species that may occur in the vicinity of the site, is indicated as being potentially moderately high. However, field verification indicated that these species are not common to the site and those species that are present are generally widely distributed flora species.

Table 2 provides a detailed list of species protected in term of the PNCO and NFA, for which permits will be required should they occur and require removal.

Table 2: Flora Species of Special Concern known to occur in the vicinity of the site.

Botanical Name	Family	Status**	Comment
Aloe africana	ASPHODELACEAE	PNCO	Present, scattered individuals
Amphibolia laevis	MESEMBRYANTHEMACEAE	End, PNCO	
Apodolirion amyanum	AMARYLLIDACEAE	End, PNCO	
Bergeranthus concavus	MESEMBRYANTHEMACEAE	End, PNCO	
Bobartia gracilis	IRIDACEAE	End, PNCO	
Bonatea speciosa	ORCHIDACEAE	PNCO	Present, scattered individuals
Bulbine frutescens	ASPHODELACEAE	PNCO	Present, scattered individuals
Carpobrotus acinaciformis	MESEMBRYANTHEMACEAE	PNCO	
Carpobrotus deliciosus	MESEMBRYANTHEMACEAE	PNCO	Present, scattered clumps
Carpobrotus edulis	MESEMBRYANTHEMACEAE	PNCO	Present, scattered clumps
Chasmanthe aethiopica	IRIDACEAE	PNCO	Present, scattered individuals
Delosperma ecklonis	MESEMBRYANTHEMACEAE	PNCO	Present, scattered individuals
Delosperma litorale	MESEMBRYANTHEMACEAE	PNCO	*Present, scattered individuals*
Dietes iridioides	IRIDACEAE	PNCO	Present, scattered individuals

Botanical Name	Family	Status**	Comment
Disphyma crassifolium	MESEMBRYANTHEMACEAE	PNCO	
Drimia chalumnensis	HYACINTHACEAE	End, PNCO	
Drosanthemum candens	MESEMBRYANTHEMACEAE	PNCO	
Drosanthemum marinum	MESEMBRYANTHEMACEAE	End, PNCO	Present, scattered individuals
Drosanthemum stokoei	MESEMBRYANTHEMACEAE	End, PNCO	
Erepsia steytlerae	MESEMBRYANTHEMACEAE	End, PNCO	
Faucaria subintegra	MESEMBRYANTHEMACEAE	End, PNCO	
Gasteria acinacifolia	ASPHODELACEAE	PNCO	
Gasteria croucheri	ASPHODELACEAE	PNCO	
Gladiolus floribundus	IRIDACEAE	PNCO	Present, scattered individuals
Haemanthus albiflos	AMARYLLIDACEAE	PNCO	Present, scattered individuals
Haworthia coarctata	ASPHODELACEAE	End, PNCO	
Haworthia cooperi	ASPHODELACEAE	End, PNCO	
Haworthia reinwardtii	ASPHODELACEAE	End, PNCO	
Massonia echinata	HYACINTHACEAE	PNCO	
Mimusops caffra	SAPOTACEAE	NFA	Present, large scattered trees
Moraea pallida	IRIDACEAE	PNCO	Present, scattered individuals
Prenia vanrensburgii	MESEMBRYANTHEMACEAE	End, PNCO	
Sideroxylon inerme	SAPOTACEAE	NFA	Present, scattered individuals
Trachyandra divaricata	ASPHODELACEAE	PNCO	
Trachyandra revoluta	ASPHODELACEAE	PNCO	
Veltheimia bracteata	HYACINTHACEAE	PNCO	

**PNCO – Provincial Nature Conservation Ordinance (19 of 1974); NFA – National Forests Act

Due to limited sampling time, presence or absence of all species cannot be confirmed without detailed seasonal site visits. Furthermore, due to the limited footprint of the site, located in predominantly disturbed areas, the risk of any Critically Endangered or Endangered species being present is very Low.

The plant Species of Special Concern listed above require permits if any individuals are to be removed, translocated or pruned according to the relevant legislation including the National Forests Act and the Provincial Nature Conservation Ordinance (PNCO):

- Permits from the relevant authority (Department of Economic Development, Environmental Affairs and Tourism) are required for the removal, translocation or destruction of all plants listed as protected; and all faunal species, in terms of the Provincial Nature and Conservation Ordinance (No. 19 of 1974). ***No species listed under Threatened and Protected Species (T.o.P.S.) were noted to be present during the site assessment. Permits from the Department of Economic Development, Environmental Affairs and Tourism would be required before construction commences and a Flora search and rescue may be required.***
- Permits from the relevant authority (The Department of Agriculture, Forestry and Fisheries (DAFF)) are required for the damage, destruction or removal of all trees listed as protected in terms of the National Forests Act (1998). ***No protected trees were noted to be present within the proposed footprint.***
- The patches of Coastal Dune Forest will likely be protected in terms of the National Forests Act (1998). ***These will not be impacted by the proposed route.***

2.3.5 Alien Invasive species

Invasive alien plants have a significant negative impact on the environment by causing direct habitat destruction, increasing the risk and intensity of wildfires, and reducing surface and sub-surface water. Landowners are under legal obligation to control alien plants occurring on their properties. Alien Invasive Plants require removal according to the Conservation of Agricultural Resources Act 43 of 1983 (CARA) and the National Environmental Management: Biodiversity Act (10 of 2004; NEMBA): Alien and Invasive Species Lists (GN R598 and GN R599 of 2014). Alien control programs are long-term management projects and a clearing plan, which includes follow up actions for rehabilitation of the cleared area, is essential. This will save time, money and significant effort. Collective management and planning with neighbours allows for more cost effective clearing and maintenance considering aliens seeds as easily dispersed across boundaries by wind or water courses. All clearing actions should be monitored and documented to keep track of which areas are due for follow-up clearing. A general rule of thumb is to first target lightly infested areas before tackling densely invaded areas, and prioritize sensitive areas such as river banks and wetlands.

A list of species and their respective NEMBA status occurring within the vicinity of the site is provided in Table 3. No serious or problematic invasives were noted to be present in close proximity of the construction footprint.

Table 3: Alien Invasive plants and common weeds present and respective NEMBA classifications.

Botanical Name	Common name	Family	Status*	Extent
Acacia mearnsii	Black Wattle	Fabaceae	NEMBA, Cat 2	Scattered
Solanum mauritianum	Bugweed	Solanaceae	NEMBA, Cat 1b	Scattered
Lantana camara	Lantana	Verbenaceae	NEMBA, Cat 1b	Scattered
Cestrum laevigatum	Inkberry	Solanaceae	NEMBA, Cat 1b	Scattered
Ricinus communis	Castor Oil plant	Euphorbiaceae	NEMBA, Cat 2	Scattered

*** NEMBA:** Alien and Invasive Species as per National Environmental Management: Biodiversity Act (10 of 2004; NEMBA): Draft Alien and Invasive Species Lists (GN R598 and GN R599 of 2014 (category 1, 2 or 3)

It is likely that ruderal weeds will be introduced during the construction phase. Appropriate measures to be implemented to control these weeds and a suitable aftercare period to be implemented.

Eradication protocol

Standard eradication and management procedures must be stipulated in the EMP as to the methods to be implemented to remove and control any alien invasive species or weeds. The EMP to provide for measures to mitigate this during construction and to be monitored by the ECO.

2.4 Fauna

The West Bank region is of phytogeographical interest, being on both the eastern end of the Albany hotspot and the south-western end of the Pondoland-Tongoland phytochorion. The coastal grassland is of high conservation importance, containing 17 species of special concern. The other vegetation types (*Acacia* savannah and Riverine and Valley Thicket) are widespread.

The area has a high diversity of reptiles, but none are endemic to the area. Although 13 species of amphibians are known to occur in the East London region, it is unlikely that any of these occur in significant numbers. None are listed as Endangered or Vulnerable, and no endemic or sensitive species occur in the region. A diverse avifauna of approximately 200 species have been observed in the area, and seven have some status of special concern. Eleven of these species rely on the three vegetation types present within the proposed IDZ for their habitat requirements (CES, 1997).

2.4.1 Invertebrates

Lepidoptera

Whilst a large number of butterflies are known to occur within the Eastern Cape, according to the databases available, no known Red listed Lepidoptera of concern are recorded as being present within the study area.

2.4.2 Amphibians

Thirteen species of amphibians are known to occur in the East London region, but because of the restricted diversity of habitats available in the study area, it is unlikely that any of these occur in significant numbers. None are listed as Endangered or Vulnerable in the Red Data Book, and no endemic or sensitive species occur in the region. The majority of the amphibian species utilise the wetlands, forest and grassland/savannah habitats. The majority of amphibians in the West Bank area furthermore require standing water for breeding during summer.

2.4.3 Reptiles

The Eastern Cape supports a high diversity of reptiles (snakes, lizards & tortoises) and these form an important component of the overall diversity of vertebrates within the region. Despite this diversity, relatively few reptiles are endemic to the Eastern Cape and none are locally endemic to the study area (CES, 1997). The Giant legless skink (*Acontias cf. plumbeus)* which is associated with forest habitats may be a regionally endemic species. It is possible that the isolated East London population of this species is taxonomically distinct, and if future taxonomic studies confirm this the species would become a regional endemic. No other reptile species occurring on the West Bank are listed as being of special significance. Most of the reptile species are associated with the Thicket vegetation, Forest, Coastal Grassland and Savannah habitats.

2.4.4 Birds

A diverse avifauna of approximately 200 species currently utilise habitats in the West Bank. Owing to their high mobility, birds are capable of moving to a suitable habitat, within and beyond the study area, provided a suitable habitat is available. Seven species which have been observed in the area have some status of special concern. These include: the Longcrested Eagle (*Lophaetus occipitalis*), Black Sparrowhawk (*Accipiter melanoleucus*), Cape Parrot (*Poicephalus robustus*), Black Stork (*Ciconia nigra*), Cuckoo Hawk (Falcon) (*Aviceda cuculoides*), Knysna Warbler (*Bradypterus sylvaticus*) and the African Black Oyster Catcher (*Haematopus monquini*). These species are associated with the forest, thicket or dune communities found within the West Bank area. Only the Knysna Warble and the African Black Oyster Catcher are endemic to southern Africa.

2.4.5 Mammals

Of the 338 mammal species recorded for South Africa about 90 may be expected to occur in the general study system. The dominant small mammal species associated with Coastal Grasslands and *Acacia* Savannah are two *Rhabodomys* and *Otomys* species (rodents). Other relatively common animals include various mole species, mole rats, Aardvark and Yellow Mongoose. There is evidence that the areas of Valley Thicket provide habitat to at least one small feline carnivore (either *Felis libyca* or *Felis caracal*). The Woodland Dormouse and the Woodland Mouse are the main rodent species that utilise this environment.

There are 14 mammal species of special concern which may occur in the West Bank area. Eleven of these species rely on the three vegetation types present within the proposed IDZ for their habitat requirements, and may therefore be present in the IDZ site (Table 4.11; CES, 1997). It must be noted that the list presented in Table 4.11 is for the greater West Bank area, and that the occurrence of the listed mammals within the IDZ is unlikely.

Species	Common Name	Rdb Status	Habitat
Suncus infinitesimus	Least dwarf shrew	Indeterminate	Coastal Grasslands /Savannah
Kerivoula lanosa	Lesser wooly bat	Indeterminate	Thicket and Forest
Mystromys albicaudatus	White-tailed mouse	Vulnerable	Coastal Grasslands

Species	Common Name	Rdb Status	Habitat
Mellivora capensis	Honey badger	Vulnerable	Widespread
Poecilogale albinucha	Striped weasel	Rare	Savannah & Coastal Grasslands
Proteles cristatus	Aardwolf	Rare	Widespread
Felis lybica	African wild cat	Vulnerable	Widespread
Orycteropus afer	Aardvark	Vulnerable	Coastal Grasslands & Savannah
Dendrohyrax arboreus	Tree dassie	Rare	Thickets
Cephalophus monticola	Blue duiker	Rare	Thickets
Aleterix frontalis	Hedgehog	Rare	Wide Variety

It is not likely that the proposed development will have any significant impact on faunal species. Most of the mobile larger fauna are expected to vacate the area that is to be developed once vegetation clearing and other site preparation activities commence and will seek refuge in intact natural or near-natural surrounding areas. Smaller mammals, reptiles, amphibians and invertebrates will however be more susceptible and the following precautionary measures are advisable:

- Measures should be implemented to ensure that fauna on site are not harmed during site preparation or operational phase activities associated with the development, e.g. environmental induction process for construction personnel.
- Removal of animals from the affected areas before the start of site clearing and relocating these to safe areas would only be a valid mitigation option in the case of tortoises.
- All other reptile and small mammal species are extremely difficult to catch and it would be a futile attempt to try and relocate them. Before doing site clearing, affected areas should be thoroughly searched for tortoises. Tortoises found must be released in the no-go areas.
- A professional reptile handler (with the necessary permits) needs to be contacted to remove dangerous reptiles when in conflict with the workers.
- Search and rescue operations before and during the site preparation phase will decrease the impacts considerably.

2.4.6 <u>Permit Requirements</u>

The faunal species of special concern listed require permits if any individuals are to be removed or translocated according to the relevant legislation including the Provincial Nature Conservation Ordinance as well as Threatened and Protected Species (T.o.P.S.). A fauna search and rescue may be undertaken before clearing commences. Permits from the relevant authority (Department of Economic Development, Environmental Affairs and Tourism) are required for the removal, translocation or destruction of protected faunal species, in terms of the Provincial Nature and Environment Conservation Ordinance (No. 19 of 1974).

3 Impact Assessment

3.1 Impact Assessment Methodology

An ‘impact’ is any change to a resource or receptor caused by the presence of a Project component or by a Project-related activity. Impacts can be negative or positive. Impacts are described in terms of their characteristics, including the impact’s type and the impact’s spatial and temporal features (namely extent, duration, scale and frequency). Terms used in this EIA process are described in Table 4

Table 4: Impact Characteristics

Characteristic	Definition	Terms
Type	A descriptor indicating the relationship of the impact to the Project (in terms of cause and effect).	**Direct** - Impacts that result from a direct interaction between a planned Project activity and the receiving environment/receptors (ie, between occupation of a site and the pre-existing habitats or between an effluent discharge and receiving water quality). **Indirect** - Impacts that result from other activities that are encouraged to happen as a consequence of the Project (ie, in-migration for employment placing a demand on resources). **Induced** - Impacts that result from other activities (which are not part of the Project) that happen as a consequence of the Project. **Cumulative** - Impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the Project.
Duration	The time period over which a resource / receptor is affected.	**Temporary** - (period of less than 3 years -negligible/ pre-construction/ other). **Short term** - (period of less than 5 years ie, production ramp up period). **Long term** -impacts that will continue for the life of the Project, but ceases when the Project stops operating. **Permanent** - (a period that exceeds the life of plant – ie, irreversible.).
Extent	The reach of the impact (ie, physical distance an impact will extend to)	**On-site** - impacts that are limited to the Project site. **Local** - impacts that are limited to the Project site and adjacent properties. **Regional** - impacts that are experienced at a regional scale. **National** - impacts that are experienced at a national scale. **Trans-boundary/International** - impacts that are experienced outside of South Africa.
Scale	Quantitative measure of the impact ie, the size of the area damaged or impacted, the fraction of a resource that is lost or affected, etc.).	Quantitative measures as applicable for the feature or resources affects. No fixed designations as it is intended to be a numerical value.
Frequency	Measure of the constancy or periodicity of the impact.	No fixed designations; intended to be a numerical value or a qualitative description.

3.2 Determining Impact Magnitude

Once impacts are characterised they are assigned a ‘magnitude’. Magnitude is typically a function of some combination (depending on the resource/receptor in question) of the following impact characteristics:

- Extent
- Duration
- Scale
- Frequency

Magnitude (from small to large) is a continuum. Evaluation along the continuum requires professional judgement and experience. Each impact is evaluated on a case-by-case basis and the rationale for each determination is noted. Magnitude designations for negative effects are: Negligible, Small, Medium and Large.

The magnitude designations themselves are universally consistent, but the definition for the designations varies by issue. In the case of a positive impact, no magnitude designation has been assigned as it is considered sufficient for the purpose of the impact assessment to indicate that the Project is expected to result in a Positive impact.

Some impacts will result in changes to the environment that may be immeasurable, undetectable or within the range of normal natural variation. Such changes are regarded as having no impact, and characterised as having a Negligible Magnitude.

Determining Magnitude for Biophysical Impacts

For biophysical impacts, the semi-quantitative definitions for the spatial and temporal dimension of the magnitude of impacts used in this assessment are provided below.

Large Magnitude Impact affects an entire area, system (physical), aspect, population or species (biological) and at sufficient magnitude to cause a significant measureable numerical increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) or a decline in abundance and/ or change in distribution beyond which natural recruitment (reproduction, immigration from unaffected areas) would not return that population or species, or any population or species dependent upon it, to its former level within several generations (physical and biological). A High Magnitude impact may also adversely affect the integrity of a site, habitat or ecosystem.

Medium Magnitude Impact affects a portion of an area, system, aspect (physical), population or species (biological) and at sufficient magnitude to cause a measurable numerical increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) and may bring about a change in abundance and/or distribution over one or more plant/animal generations, but does not threaten the integrity of that population or any population dependent on it (physical and biological). A moderate magnitude impact may also affect the ecological functioning of a site, habitat or ecosystem but without adversely affecting its overall integrity. The area affected may be local or regional.

Small Magnitude Impact affects a specific area, system, aspect (physical), group of localised individuals within a population (biological) and at sufficient magnitude to result in a small increase in measured concentrations or levels (to be compared with legislated or international limits and standards specific to the receptors) (physical) over a short time period (one plant/animal generation or less, but does not affect other trophic levels or the population itself), and localised area.

3.2.1 Determining Receptor Sensitivity

In addition to characterising the magnitude of impact, the other principal step necessary to assign significance for a given impact is to define the sensitivity of the receptor. There are a range of factors to be taken into account when defining the sensitivity of the receptor, which may be physical, biological, cultural or human. Where the receptor is physical (for example, a water body) its current quality, sensitivity to change, and importance (on a local, national and international scale) are considered.

Where the receptor is biological or cultural (ie, the marine environment or a coral reef), its importance (local, regional, national or international) and sensitivity to the specific type of impact are considered. Where the receptor is human, the vulnerability of the individual, community or wider societal group is considered. As in the case of magnitude, the sensitivity designations themselves are universally consistent, but the definitions for these designations will vary on a resource/receptor basis. The universal sensitivity of receptor is Low, Medium and High.

For ecological impacts, sensitivity is assigned as Low, Medium or High based on the conservation importance of habitats and species. For the sensitivity of individual species,
Table 5 presents the criteria for deciding on the value or sensitivity of individual species.

For socio-economic impacts, the degree of sensitivity of a receptor is defined as the level of resilience (or capacity to cope) with sudden social and economic changes.
Table 5 and Table 6 present the criteria for deciding on the value or sensitivity of biological and socioeconomic receptors.

Table 5: Biological and Species Value / Sensitivity Criteria

Value / Sensitivity	**Low**	**Medium**	**High**
Criteria	Not protected or listed as common / abundant; or not critical to other ecosystem functions ie, key prey species to other species).	Not protected or listed but may be a species common globally but rare in South Africa with little resilience to ecosystem changes, important to ecosystem functions, or one under threat or population decline.	Specifically protected under South African legislation and/or international conventions e.g. CITIES Listed as rare, threatened or endangered e.g. IUCN

Note: The above criteria are applied with a degree of caution. Seasonal variations and species lifecycle stage will be taken into account when considering species sensitivity. For example, a population might be deemed as more sensitive during the breeding/spawning and nursery periods. This table uses listing of species ie, IUCN) or protection as an indication of the level of threat that this species experiences within the broader ecosystem (global, regional, local). This is used to provide a judgement of the importance of affecting this species in the context of Project-level changes.
T8.4 Socio-Economic Sensitivity Criteria

Table 6: Socio-Economic Sensitivity Criteria

Sensitivity	**Low**	**Medium**	**High**
Criteria	Those affected are able to adapt with relative ease and maintain pre-impact status.	Able to adapt with some difficulty and maintain pre-impact status but only with a degree of support.	Those affected will not be able to adapt to changes and continue to maintain-pre impact status.

3.3 Assessing Significance

Once magnitude of impact and sensitivity of a receptor have been characterised, the significance can be determined for each impact. The impact significance rating will be determined, using the matrix provided in Table 7.

Table 7 Impact Significance

		Sensitivity/Vulnerability/Importance of Resource/Receptor		
		Low	**Medium**	**High**
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/vulnerability/ importance designations that enter into the matrix. Box 1 provides a context for what the various impact significance ratings signify.

Box 1: Context of Impact Significances

An impact of **Negligible** significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.
An impact of **Minor** significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.
An impact of **Moderate** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.
An impact of **Major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (ie, ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

3.3.1 Mitigation Potential and Residual Impacts

A key objective of an EIA process is to identify and define socially, environmentally and technically acceptable and cost effective measures to manage and mitigate potential impacts. Mitigation measures are developed to avoid, reduce, remedy or compensate for potential negative impacts, and to enhance potential environmental and social benefits.

The approach taken to defining mitigation measures is based on a typical hierarchy of decisions and measures, as described in Box 2.

The priority is to first apply mitigation measures to the source of the impact (ie, to avoid or reduce the magnitude of the impact from the associated Project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (ie, to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

Once mitigation measures are declared, the next step in the impact assessment process is to assign residual impact significance.

This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation measures. The approach taken to defining mitigation measures is based on a typical hierarchy of decisions and measures, as described in Box 2

Box 2: Mitigation Hierarchy

Avoid at Source; Reduce at Source: avoiding or reducing at source through the design of the Project ie, avoiding by siting or re-routing activity away from sensitive areas or reducing by restricting the working area or changing the time of the activity).
Abate on Site: add something to the design to abate the impact ie, pollution control equipment).

Abate at Receptor: if an impact cannot be abated on-site then control measures can be implemented off-site ie, traffic measures).
Repair or Remedy: some impacts involve unavoidable damage to a resource ie, material storage areas) and these impacts require repair, restoration and reinstatement measures. **Compensate in Kind; Compensate Through** Other Means where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate ie, financial compensation for degrading agricultural land and impacting crop yields).

3.3.2 Residual Impact Assessment

Once mitigation measures are declared, the next step in the impact assessment process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional declared mitigation measures.

3.3.3 Cumulative Impacts

A cumulative impact is one that arises from a result of an impact from the Project interacting with an impact from another activity to create an additional impact. How the impacts and effects are assessed is strongly influenced by the status of the other activities (i.e., already in existence, approved or proposed) and how much data is available to characterise the magnitude of their impacts.

The approach to assessing cumulative impacts is to screen potential interactions with other projects on the basis of:

- Projects that are already in existence and are operating;
- Projects that are approved but not as yet built or operating; and
- Projects that are a realistic proposition but are not yet built.

3.4 Impact Assessment

3.4.1 Vegetation Clearance

Impact Description

As indicated in the baseline assessment, the local vegetation composition of the Project's Direct Area of Influence (AoI) consists of the Albany Coastal Belt and Albany Dune Strandveld. This is a distinct vegetation occurring over extensive areas in the Indian Ocean coastal belt of the African sub-continent (Coastal and Environmental Services, 2001). There are several vegetation types and associated faunal habitats, which may be affected by the terrestrial cable burial and the construction of the cable station, including Albany Coastal Belt and Albany Dune Strandveld.

The potential for loss of vegetation and habitat is limited to the construction of the terrestrial cable route. The clearance of vegetation for the installation of the terrestrial cable will result in removal of vegetation cover, loss of species of special concern and susceptibility of some areas to erosion.

Impact Assessment

The clearing of vegetation from the site will result in the localised permanent loss of natural vegetation cover within the affected footprint. The impacts will be confined to the construction footprint (540 square meters), for the duration of construction ie, seven days. The sensitivity of the impact is medium as there is potential for species protected under the provincial ordinance to occur within the development footprint, however, the magnitude is small as any species of special concern that are present generally have widespread distributions and any losses are unlikely to result in any significant impacts to populations. The overall significance of the impact is assessed to be **Minor** the residual impact is **Negligible** (Table 8**)**

Mitigation Measures

The following mitigation measures have been identified in order to ensure that the impact of the cable route on the vegetation and habitat of the affected area is minimised:

- Blanket clearing of vegetation must be limited to the required footprint and the area to be cleared must be demarcated before any clearing commences. No clearing outside of maximum required footprint must take place.
- Topsoil must be stripped and stockpiled separately during site preparation and replaced over disturbed areas on completion.
- Applicable permits must be obtained for protected species timeously (1 – 2 months) before vegetation clearing commences and a flora search and rescue plan must be implemented before commencement.
- Permits must be kept on site and in the possession of the flora and fauna search and rescue team at all times.
- Once flora search and rescue is complete, a clearance certificate must be issued to the contractor and copies of a post audit report supplied to Department of Economic Development, Environmental Affairs & Tourism of the Eastern Cape.
- Suitable measures must be implemented in areas that are susceptible to erosion (i.e. on dunes with mobile sands and near watercourse), including but not limited to gabions and temporary runoff diversion berms (if necessary). Areas must be rehabilitated and a suitable cover crop planted once construction is completed.
- Disturbances to any watercourses must be kept to a minimum and measures implemented to mitigate any erosion risk.
- A suitable indigenous grass crop must be applied on completion of construction.

Table 8: Significance of Impacts to Vegetation and Habitat

Characteristic	**Impact**	**Residual Impact**
Extent	Local	Local
Duration	Short- term	Short-term
Scale	Small	Small
Reversibility	Medium (Partially reversible)	
Loss of resource	High	
Magnitude	Small	Negligible
Sensitivity/Vulnerability/Importance of the Resource/Receptor	Medium	Medium
Significance of Impact	**Minor**	**Negligible**

3.4.2 Alien Invasive

Impact Description

Invasive alien plants have a significant negative impact on the environment by causing direct habitat disturbance, increasing the risk of wildfires, and reducing surface and sub-surface water. Landowners are under legal obligation to control alien plants occurring on their properties. Alien Invasive Plants require removal according to the Conservation of Agricultural Resources Act 43 of 1983 (CARA) and the National Environmental Management: Biodiversity Act (10 of 2004; NEMBA): Alien and Invasive Species Lists (GN R598 and GN R599 of 2014). Alien control programs are long-term management projects and a clearing plan, which includes follow up actions for rehabilitation of the cleared area, is essential. This will save time, money and significant effort. Collective management and planning with neighbours allows for more cost effective clearing and maintenance considering aliens seeds as easily dispersed across boundaries by wind or watercourses. A general rule of thumb is to first target lightly infested areas before tackling densely invaded areas and prioritize sensitive areas such as river banks and wetlands.

Impact Assessment

The proliferation of invasive alien plants in the terrestrial cable route may be supported by the soil disturbance during construction activities. Alien invasive plants can be successfully mitigated, by means of ongoing alien invasive plant management around the terrestrial cable route and the servitude.

The magnitude of the impact is small, and the sensitivity is medium. The significance of this impact is assessed as **Minor** and the residual impact is **Negligible** *(*Table 9)

Mitigation Measures

The following mitigation measures have been identified in order to ensure that the introduction and spread of alien invasive vegetation is minimised:

- Alien species must be removed from the site as per the National Environmental Management: Biodiversity Act (No. 10 of 2004) requirements.
- A suitable weed management strategy must be implemented in the construction phase and carried through the operational phase.
- After clearing is completed, an appropriate cover crop may be required, should natural re-establishment of grasses not take place in a timely manner.

Table 9: Significance of Impact of the Introduction of Alien Invasive Vegetation

Characteristic	Impact	Residual Impact
Extent	Local	Local
Duration	Long-term	Long-term
Scale	Small	Small
Reversibility	Medium (Partially reversible)	
Loss of resource	Low	
Magnitude	Small	Small
Sensitivity/Vulnerability/Importance of the Resource/Receptor	Medium	Low
Significance of Impact	**Minor**	**Negligible**

3.4.3 Ecological Processes

Impact Description

Disruption of ecological processes and fragmentation of habitat as a result of construction activities and clearing of servitudes can have a significant negative impact on the environment and habitat for faunal species, which may include pollinators (such as bees and butterflies), seed dispersal agents (such as small mammals and birds). Wide servitudes and extensive construction footprints, especially when disputing ecological corridors can have a significant negative influence of the movement of these pollinator and dispersal agents, which could in turn result in loss of species and general degradation of the habitat over time. This is also dependant to some extent on the nature of the disturbance and also the mobility of the affected faunal agents.

Impact Assessment

The disruption of ecological processes and fragmentation of habitat as a result of construction of the terrestrial cable route will be negligible, as the disturbance will be limited to the cable trench (most likely less than 3 m in total, including disturbance from machinery). Furthermore, the disturbance will only be temporary (1 week) and once completed and the trench has been covered (i.e. topsoil replaced), the residual impact/disturbance will be negligible as vegetation cover will most likely recover.

The magnitude of the impact is small, and the sensitivity is medium. The significance of this impact is assessed as **Minor** and the residual impact is **Negligible** *(*Table 10**).**

Mitigation Measures

The following mitigation measures have been identified in order to ensure that the disruption of ecological process and fragmentation of habitat is minimised:

- Blanket clearing of vegetation must be limited to the development footprint, and the area to be cleared must be demarcated before any clearing commences.
- The open trench must be monitored for any trapped fauna on an ongoing basis.
- After clearing is completed, an appropriate cover crop may be required, should natural re-establishment of grasses not take place in a timely manner.

Table 10: Significance of Impact to Ecological Processes

Characteristic	Impact	Residual Impact
Extent	Local	Local
Duration	Long-term	Long-term
Scale	Small	Small
Reversibility	Medium (Partially reversible)	
Loss of resource	Low	
Magnitude	Small	Small
Sensitivity/Vulnerability/Importance of the Resource/Receptor	Medium	Low
Significance of Impact	**Minor**	**Negligible**

3.5 Residual Impacts

Due to the limited footprint and construction time for the terrestrial component of the subsea cable and likelihood of complete recovery of the trench scar on completion, residual impacts are likely to be negligible with implementation of all the recommended mitigation measures and responsible housekeeping by the respective contractors.

3.6 Cumulative Impacts

Due to the limited footprint and construction time for the terrestrial component of the subsea cable, cumulative impacts are likely to be negligible with implementation of all the recommended mitigation measures.

4 Recommendations and Conclusions

The proposed installation of the subsea cable will require the removal of indigenous primary dune vegetation from the Landing Site to the BMH. It is anticipated that a maximum area of 105 m long x 3 m wide (= 315 square metres) will be cleared between the edge of the beach and within the IDZ. Although some disturbances are present, it can be concluded that the majority of the site is having indigenous vegetation, therefore this activity is likely to be triggered. From experience, the disturbances as a result of trenching can be higher than the indicative 3 m wide, so it is likely that at least 300 square meters of 'indigenous vegetation' will be disturbed during construction.

The clearing of vegetation from the site will result in the localised permanent loss of vegetation cover within the affected footprint. The impacts will be confined to the construction footprint, having a limited area. In addition, any species of special concern that are present generally have widespread distributions, and any losses are unlikely to result in any significant impacts to populations. A flora search and rescue will ensure that protected species are relocated before construction.

The clearing of vegetation may result in a temporary increase in erosion and erosion risk in some areas of the site during construction, especially due to mobile dune sands. Adequate measures must be implemented to stabilise areas having an erosion risk using appropriate means as necessary, including temporary cut-off berms. Should any problematic areas be identified after completion, additional measures may be necessary in order to establishing adequate plant cover. Measures should be implemented to eradicate any weeds and invasive species that may regenerate after disturbance for a suitable aftercare period (3 months).

The transient fauna that are present are likely to migrate away during construction. A faunal search and rescue is however advisable beforehand. Any open trenches must be inspected regularly for trapped fauna.

Minimising the clearing footprint, rehabilitation of the disturbance footprint, in conjunction with alien vegetation removal to enhance ecological functioning and integrity will result in the overall impacts being localised and of low significance. During construction, topsoil should be stripped separately to overburden and replaced once the trench has been backfilled. This will minimise overall disturbance and maximise recovery of the affected area.

The impacts of the proposed activity to terrestrial vegetation, flora and fauna are likely to be of *low to negligible significance* with the implementation of the recommended mitigation measures. Impacts noted in this assessment report are likely to have negligible residual impacts if mitigation measures are implemented.

5 Appendix A: References

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6 Appendix B: Site Photographic Record

Photo 1:

Photo 2:

Photo 3:

Photo 4:

Photo 5:

Photo 6:

Photo 7:

Photo 8:

Photo 9:

Photo 10:

Photo 11:

Photo 12:

Photo 13:

Photo 14:

Photo 15:

Photo 16:

Photo 17:

Photo 18:

Photo 2:

Photo 3:

Photo 4:

Photo 5:

Photo 6:

Photo 7:

Photo 8:

Photo 9:

Photo 10:

Photo 11:

Photo 12:

Photo 13:

Photo 14:

Photo 15:

Photo 16:

Photo 17:

Photo 35:

Photo 36:

Photo 37:

Photo 38:

Photo 39:

Photo 40:

Photo 41:

Photo 42:

Photo 43:

Photo 44:

Photo 45:

7 Appendix C: Flora typical of the vegetation unit and Fauna

FLORA

Scientific Name	Family	Status	Present/ Dominant	Growth Form
Abutilon sonneratianum	MALVACEAE			Herbs
Acacia natalitia	FABACEAE		D	Tall Trees
Acalypha ecklonii	EUPHORBIACEAE		P	Herbs
Acmadenia kiwanensis	RUTACEAE	End		Low Shrub
Aloe africana	ASPHODELACEAE	PNCO	P	Succulent Tree
Amellus asteroides	ASTERACEAE			Herbs
Amellus capensis	ASTERACEAE	End		Herbs
Amphibolia laevis	MESEMBRYANTHEMACEAE	End, PNCO		Succulent Shrub
Androcymbium longipes	COLCHICACEAE		P	Geophytic Herbs
Anthospermum littoreum	RUBIACEAE		P	Low Shrubs
Apodolirion amyanum	AMARYLLIDACEAE	End, PNCO		Geophytic Herbs
Arctotheca populifolia	ASTERACEAE		P	Succulent Herbs
Asparagus aethiopicus	ASPARAGACEAE		P	Woody Climbers
Asparagus asparagoides	ASPARAGACEAE		P	Woody Climbers
Asparagus capensis var. litoralis	ASPARAGACEAE		P	Low Shrubs
Asparagus racemosus	ASPARAGACEAE		P	Woody Climbers
Aspidoglossum flanaganii	APOCYNACEAE	End		Geophytic Herbs
Astephanus marginatus	APOCYNACEAE			Climbers
Azima tetracantha	SALVADORACEAE		P	Tall Shrubs
Bergeranthus concavus	MESEMBRYANTHEMACEAE	End, PNCO		Succulent Shrub
Bobartia gracilis	IRIDACEAE	End, PNCO		Geophytic Herbs
Bonatea speciosa	ORCHIDACEAE	PNCO	P	Geophytic Herbs
Brachiaria chusqueoides	POACEAE			Graminoids
Brachiaria serrata	POACEAE		D	Graminoids
Brachylaena discolor	ASTERACEAE		D	Tall Trees
Brachylaena elliptica	ASTERACEAE			Tall Trees
Brachystelma franksiae	APOCYNACEAE	End		Succulent Herbs
Bulbine frutescens	ASPHODELACEAE	PNCO	P	Geophytic Herbs
Canthium spinosum	RUBIACEAE		P	Small Trees
Capparis sepiaria	CAPPARACEAE		P	Woody Climbers
Carissa bispinosa	APOCYNACEAE		P	Low Shrubs
Carpobrotus acinaciformis	MESEMBRYANTHEMACEAE	PNCO	P	Succulent Herbs
Carpobrotus deliciosus	MESEMBRYANTHEMACEAE	PNCO	P	Succulent Herbs
Carpobrotus edulis	MESEMBRYANTHEMACEAE	PNCO	P	Succulent Herbs
Cassine peragua	CELASTRACEAE			Tall Shrubs
Cassytha filiformis	LAURACEAE			Climber
Centella asiatica	APIACEAE		P	Herbs
Chaetacanthus setiger	ACANTHACEAE			Low Shrubs
Chamaecrista mimosoides	FABACEAE		D	Herbs
Chasmanthe aethiopica	IRIDACEAE	PNCO		Geophytic Herbs
Cheilanthes hirta	PTERIDACEAE		P	Geophytic Herbs
Chrysanthemoides monilifera	ASTERACEAE		D	Tall Shrubs
Cladoraphis cyperoides	POACEAE			Graminoids
Clausena anisata	RUTACEAE			Tall Shrubs

Scientific Name	Family	Status	Present/ Dominant	Growth Form
Clematis brachiata	RANUNCULACEAE		P	Woody Climbers
Clerodendrum glabrum	LAMIACEAE			Tall Shrubs
Coddia rudis	RUBIACEAE			Tall Shrubs
Commelina africana	COMMELINACEAE		P	Herbs
Commelina benghalensis	COMMELINACEAE			Herbs
Cordia caffra	BORAGINACEAE			Tall Shrubs
Cotyledon orbiculata	CRASSULACEAE			Succulent Shrubs
Crassula cotyledonis	CRASSULACEAE			Succulent Herbs
Crassula nudicaulis	CRASSULACEAE			Succulent Shrubs
Crassula pellucida	CRASSULACEAE			Climber
Croton rivularis	EUPHORBIACEAE			Tall Shrubs
Cussonia spicata	ARALIACEAE		P	Small Trees
Cussonia thyrsiflora	ARALIACEAE			Tall Shrubs
Cymbopogon marginatus	POACEAE			Graminoids
Cynanchum ellipticum	APOCYNACEAE			Climber
Cynanchum natalitium	APOCYNACEAE		P	Climber
Cynanchum obtusifolium	APOCYNACEAE			Climber
Cynodon dactylon	POACEAE		D	Graminoids
Cynoglossum hispidum	BORAGINACEAE			Herbs
Dactyloctenium australe	POACEAE		D	Graminoids
Dasispermum suffruticosum	APIACEAE			Herbs
Delosperma ecklonis	MESEMBRYANTHEMACEAE	PNCO	P	Succulent Shrubs
Delosperma litorale	MESEMBRYANTHEMACEAE	PNCO	P	Succulent Shrubs
Didelta carnosa var. tomentosa	ASTERACEAE			Succulent Shrubs
Dietes iridioides	IRIDACEAE	PNCO	P	Geophytic Herbs
Digitaria natalensis	POACEAE			Graminoids
Diospyros dichrophylla	EBENACEAE		P	Tall Shrubs
Diospyros villosa var. parvifolia	EBENACEAE			Tall Shrubs
Disphyma crassifolium	MESEMBRYANTHEMACEAE	PNCO	P	Succulent Shrubs
Drimia chalumnensis	HYACINTHACEAE	End, PNCO		Geophytic Herbs
Drosanthemum candens	MESEMBRYANTHEMACEAE	PNCO		Succulent Shrubs
Drosanthemum marinum	MESEMBRYANTHEMACEAE	End, PNCO	P	Succulent Shrubs
Drosanthemum stokoei	MESEMBRYANTHEMACEAE	End, PNCO		Succulent Shrubs
Ehrharta calycina	POACEAE			Graminoids
Ehrharta erecta	POACEAE			Graminoids
Ehrharta villosa var. maxima	POACEAE			Graminoids
Elionurus muticus	POACEAE			Graminoids
Eragrostis capensis	POACEAE			Graminoids
Eragrostis curvula	POACEAE		D	Graminoids
Eragrostis plana	POACEAE			Graminoids
Eragrostis sabulosa	POACEAE	End		Graminoids
Erepsia steytlerae	MESEMBRYANTHEMACEAE	End, PNCO		Succulent Shrubs
Eriosema squarrosum	FABACEAE			Herbs
Erythrina caffra	FABACEAE		P	Tall Trees
Euclea natalensis	EBENACEAE		P	Small Trees
Euclea racemosa	EBENACEAE		P	Tall Shrubs

Scientific Name	Family	Status	Present/ Dominant	Growth Form
Euclea undulata	EBENACEAE		P	Small Trees
Eugenia capensis	MYRTACEAE			Tall Shrubs
Euphorbia triangularis	EUPHORBIACEAE		P	Succulent Tree
Exomis microphylla	CHENOPODIACEAE			Succulent Shrubs
Faucaria subintegra	MESEMBRYANTHEMACEAE	End, PNCO		Succulent Herbs
Felicia erigeroides	ASTERACEAE			Herb
Ficus sur	MORACEAE		P	Tall Trees
Frankenia repens	FRANKENIACEAE			Low Shrubs
Gasteria acinacifolia	ASPHODELACEAE	PNCO		Succulent Herbs
Gasteria croucheri	ASPHODELACEAE	PNCO		Succulent Herbs
Gazania maritima	ASTERACEAE	End	P	Herbs
Gazania rigens	ASTERACEAE		P	Herbs
Gazania rigens	ASTERACEAE	End	P	Herbs
Gladiolus floribundus	IRIDACEAE	PNCO	P	Geophytic Herbs
Grewia occidentalis	MALVACEAE		P	Small Trees
Gymnosporia buxifolia	CELASTRACEAE			Small Trees
Gymnosporia heterophylla	CELASTRACEAE		P	Small Trees
Haemanthus albiflos	AMARYLLIDACEAE	PNCO	P	Geophytic Herbs
Haworthia coarctata	ASPHODELACEAE	End, PNCO		Succulent Herbs
Haworthia cooperi	ASPHODELACEAE	End, PNCO		Succulent Herbs
Haworthia reinwardtii	ASPHODELACEAE	End, PNCO		Succulent Herbs
Hebenstretia cordata	SCROPHULARIACEAE			Low Shrubs
Helichrysum asperum	ASTERACEAE		P	Low Shrubs
Helichrysum teretifolium	ASTERACEAE		P	Low Shrubs
Heteropogon contortus	POACEAE			Graminoids
Hippobromus pauciflorus	SAPINDACEAE		P	Tall Trees
Kedrostis nana	CUCURBITACEAE			Climber
Lactuca inermis	ASTERACEAE			Herbs
Lauridia tetragona	CELASTRACEAE		P	Low Shrubs
Limonium sp.	PLUMBAGINACEAE	End	P	Herbs
Lobelia boivinii	LOBELIACEAE	End		Herbs
Lobelia erinus	LOBELIACEAE			Herbs
Lycium tetrandrum	SOLANACEAE		P	Succulent Shrubs
Manulea tomentosa	SCROPHULARIACEAE			Herbs
Massonia echinata	HYACINTHACEAE	PNCO	P	Geophytic Herbs
Maytenus procumbens	CELASTRACEAE		P	Tall Shrubs
Melica racemosa	POACEAE			Graminoids
Metalasia muricata	ASTERACEAE		D	Tall Shrubs
Mimusops caffra	SAPOTACEAE	NFA	D	Tall Trees
Monsonia emarginata	GERANIACEAE			Herbs
Monsonia galpinii	GERANIACEAE	End		Herb
Moraea pallida	IRIDACEAE	PNCO	P	Geophytic Herbs
Mystroxylon aethiopicum	CELASTRACEAE		P	Small Trees
Ochna arborea	OCHNACEAE			Small Trees
Oncosiphon sabulosum	ASTERACEAE			Low Shrubs
Osyris compressa	SANTALACEAE			Semiparasitic Shrub
Oxalis smithiana	OXALIDACEAE			Geophytic Herbs

Scientific Name	Family	Status	Present/ Dominant	Growth Form
Panicum deustum	POACEAE		D	Graminoids
Panicum maximum	POACEAE		D	Graminoids
Passerina rigida	THYMELAEACEAE		D	Low Shrubs
Pavetta lanceolata	RUBIACEAE			Tall Shrubs
Pavetta revoluta	RUBIACEAE			Low Shrubs
Pelargonium alchemilloides	GERANIACEAE		P	Low Shrubs
Pelargonium capitatum	GERANIACEAE			Succulent Shrubs
Phyllanthus maderaspatensis	PHYLLANTHACEAE			Low Shrubs
Phyllopodium cuneifolium	SCROPHULARIACEAE			Herbs
Plectranthus verticillatus	LAMIACEAE		P	Succulent Herb
Plumbago auriculata	PLUMBAGINACEAE		P	Tall Shrubs
Polygonum maritimum	POLYGONACEAE			Herbs
Prenia vanrensburgii	MESEMBRYANTHEMACEAE	End, PNCO		Succulent Shrubs
Psoralea repens	FABACEAE			Low Shrubs
Psydrax obovata	RUBIACEAE			Tall Shrubs
Pterocelastrus tricuspidatus	CELASTRACEAE		P	Tall Shrubs
Putterlickia pyracantha	CELASTRACEAE		P	Tall Shrubs
Rhoiacarpos capensis	SANTALACEAE		P	Climber
Rhoicissus digitata	VITACEAE		P	Climber
Rhoicissus tridentata	VITACEAE			Climber
Rhus crenata	ANACARDIACEAE		P	Small Trees
Rhus glauca	ANACARDIACEAE		P	Small Trees
Rhus longispina	ANACARDIACEAE			Small Trees
Rhus lucida	ANACARDIACEAE			Small Trees
Rhus pterota	ANACARDIACEAE			Small Trees
Rhynchosia caribaea	FABACEAE			Climber
Rhynchosia ciliata	FABACEAE		P	Low Shrubs
Rhynchosia totta	FABACEAE			Climber
Robsonodendron eucleiforme	CELASTRACEAE			Tall Shrubs
Robsonodendron maritimum	CELASTRACEAE			Low Shrubs
Salvia africana-lutea	LAMIACEAE		P	Low Shrubs
Sansevieria hyacinthoides	DRACAENACEAE			Geophytic Herbs
Sarcocornia littorea	CHENOPODIACEAE		P	Succulent Shrubs
Sarcostemma viminale	APOCYNACEAE			Climber
Scaevola plumieri	GOODENIACEAE		P	Succulent Shrubs
Schotia afra var. afra	FABACEAE		P	Tall Shrubs
Scutia myrtina	RHAMNACEAE		P	Tall Shrubs
Secamone alpini	APOCYNACEAE			Woody Climbers
Selago corymbosa	SCROPHULARIACEAE		P	Low Shrubs
Senecio angulatus	ASTERACEAE			Climber
Senecio burchellii	ASTERACEAE			Herbs
Senecio deltoideus	ASTERACEAE		P	Climber
Senecio elegans	ASTERACEAE		P	Herbs
Senecio litorosus	ASTERACEAE	End	P	Succulent Herbs
Senecio littoreus	ASTERACEAE		P	Herbs
Senecio maritimus	ASTERACEAE	End	P	Succulent Herbs
Senecio pterophorus	ASTERACEAE			Low Shrubs

Scientific Name	Family	Status	Present/ Dominant	Growth Form
Setaria megaphylla	POACEAE			Graminoids
Setaria sphacelata	POACEAE		D	Graminoids
Sideroxylon inerme	SAPOTACEAE	NFA	P	Tall Trees
Silene crassifolia	CARYOPHYLLACEAE	End		Herbs
Sonchus dregeanus	ASTERACEAE			Herbs
Sporobolus africanus	POACEAE		D	Graminoids
Sporobolus virginicus	POACEAE			Graminoids
Stapelia praetermissa	APOCYNACEAE	End		Succulent Herbs
Stenotaphrum secundatum	POACEAE		D	Graminoids
Stipagrostis zeyheri	POACEAE			Graminoids
Strelitzia reginae	STRELITZIACEAE		P	Geophytic Herbs
Syncarpha sordescens	ASTERACEAE	End		Low Shrub
Tarchonanthus camphoratus	ASTERACEAE		P	Tall Trees
Tarchonanthus littoralis	ASTERACEAE		P	Tall Shrubs
Tecoma capensis	BIGNONIACEAE			Woody Climbers
Tephrosia capensis	FABACEAE			Low Shrubs
Tetragonia decumbens	AIZOACEAE		P	Succulent Shrubs
Themeda triandra	POACEAE			Graminoids
Thesidium fragile	SANTALACEAE			Semiparasitic Shrub
Thinopyrum distichum	POACEAE	End		Graminoids
Thunbergia capensis	ACANTHACEAE			Climbers
Trachyandra divaricata	ASPHODELACEAE	PNCO		Geophytic Herb
Trachyandra revoluta	ASPHODELACEAE	PNCO		Geophytic Herbs
Trachypogon spicatus	POACEAE			Graminoids
Tristachya leucothrix	POACEAE			Graminoids
Turraea obtusifolia	MELIACEAE			Tall Shrubs
Vellereophyton vellereum	ASTERACEAE	End		Herb
Veltheimia bracteata	HYACINTHACEAE	PNCO	P	Geophytic Herbs
Viscum obscurum	VISCACEAE			Epiphytic Shrub
Zanthoxylum capense	RUTACEAE		P	Small Trees
Zehneria scabra	CUCURBITACEAE			Climber

FAUNA

Scientific Name	Family	Common Name	Status
Invertebrates - Lepidoptera			
Callioratis abraxas	GEOMETRIDAE	Dimorphic tiger	Least Concern (LC)
Acleros mackenii mackenii	HESPERIIDAE	Macken's dart	Least Concern (SABCA 2013)
Apallaga mokeezi mokeezi	HESPERIIDAE	Christmas forester	Least Concern (SABCA 2013)
Borbo fatuellus fatuellus	HESPERIIDAE	Long-horned swift	Least Concern (SABCA 2013)
Eretis umbra umbra	HESPERIIDAE	Small marbled elf	Least Concern (SABCA 2013)
Kedestes mohozutza	HESPERIIDAE	Fulvous ranger	Least Concern (SABCA 2013)
Sarangesa motozi	HESPERIIDAE	Elfin skipper	Least Concern (SABCA 2013)
Spialia spio	HESPERIIDAE	Mountain sandman	Least Concern (SABCA 2013)
Zophopetes dysmephila	HESPERIIDAE	Palm-tree night-fighter	Least Concern (SABCA 2013)
Aloeides caffrariae	LYCAENIDAE	Border copper	Least Concern (SABCA 2013)
Anthene amarah amarah	LYCAENIDAE	Black striped hairtail	Least Concern (SABCA 2013)
Cupidopsis cissus cissus	LYCAENIDAE	Common meadow blue	Least Concern (SABCA 2013)
Deloneura millari millari	LYCAENIDAE	Millar's buff	
Deudorix antalus	LYCAENIDAE	Brown playboy	Least Concern (SABCA 2013)
Durbania amakosa amakosa	LYCAENIDAE	Amakoza rocksitter	Least Concern (SABCA 2013)
Iolaus aemulus	LYCAENIDAE	Short line sapphire	Least Concern (SABCA 2013)
Iolaus aphnaeoides	LYCAENIDAE	Yellow banded sapphire	Least Concern (SABCA 2013)
Iolaus sidus	LYCAENIDAE	Red-line sapphire	Least Concern (SABCA 2013)
Iolaus silas	LYCAENIDAE	Southern sapphire	Least Concern (SABCA 2013)
Stugeta bowkeri bowkeri	LYCAENIDAE	Bowker's marbled sapphire	Least Concern (SABCA 2013)
Dysgonia properans	NOCTUIDAE		Not listed
Acraea aganice aganice	NYMPHALIDAE	Wanderer	Least Concern (SABCA 2013)
Bicyclus safitza safitza	NYMPHALIDAE	Common bush brown	Least Concern (SABCA 2013)
Byblia anvatara acheloia	NYMPHALIDAE	Joker	Least Concern (SABCA 2013)
Cassionympha cassius	NYMPHALIDAE	Rainforest brown	Least Concern (SABCA 2013)
Charaxes brutus natalensis	NYMPHALIDAE	White-barred charaxes	Least Concern (SABCA 2013)
Charaxes varanes varanes	NYMPHALIDAE	Pearl charaxes	Least Concern (SABCA 2013)
Dira clytus eurina	NYMPHALIDAE	Cape autumn widow	Least Concern (SABCA 2013)
Eurytela hiarbas angustata	NYMPHALIDAE	Pied piper	Least Concern (SABCA 2013)
Hypolimnas misippus	NYMPHALIDAE	Common diadem	Least Concern (SABCA 2013)
Neptis saclava marpessa	NYMPHALIDAE	Spotted sailer	Least Concern (SABCA 2013)
Paralethe dendrophilus dendrophilus	NYMPHALIDAE	Forest beauty	Least Concern (SABCA 2013)
Pardopsis punctatissima	NYMPHALIDAE	Polka dot	Least Concern (SABCA 2013)
Precis octavia sesamus	NYMPHALIDAE	Gaudy Commodore	Least Concern (SABCA 2013)
Telchinia esebria	NYMPHALIDAE	Dusky acraea	Least Concern (SABCA 2013)
Vanessa cardui	NYMPHALIDAE	Painted lady	Least Concern (SABCA 2013)
Vanessa hippomene hippomene	NYMPHALIDAE	Southern short-tailed admiral	Least Concern (SABCA 2013)
Papilio dardanus cenea	PAPILIONIDAE	Mocker swallowtail, Flying Handkerchief	Least Concern (SABCA 2013)
Papilio nireus lyaeus	PAPILIONIDAE	Green-banded swallowtail	Least Concern (SABCA 2013)
Belenois creona severina	PIERIDAE	African common white	Least Concern (SABCA 2013)
Belenois gidica abyssinica	PIERIDAE	African veined white	Least Concern (SABCA 2013)

Scientific Name	Family	Common Name	Status
Belenois zochalia zochalia	PIERIDAE	Forest white	Least Concern (SABCA 2013)
Catopsilia florella	PIERIDAE	African migrant	Least Concern (SABCA 2013)
Colias electo electo	PIERIDAE	African clouded yellow	Least Concern (SABCA 2013)
Colotis euippe omphale	PIERIDAE	Smoky orange tip	Least Concern (LC)
Dixeia charina charina	PIERIDAE	African small white	Least Concern (SABCA 2013)
Eronia cleodora	PIERIDAE	Vine-leaf vagrant	Least Concern (SABCA 2013)
Eurema brigitta brigitta	PIERIDAE	Broad-bordered grass yellow	Least Concern (SABCA 2013)
Mylothris rueppellii haemus	PIERIDAE	Twin dotted border	Least Concern (SABCA 2013)
Mylothris trimenia	PIERIDAE	Trimen's dotted border	Least Concern (SABCA 2013)
Pontia helice helice	PIERIDAE	Common meadow white	Least Concern (SABCA 2013)
Urota sinope	SATURNIIDAE		Not listed
Temnora pseudopylas	SPHINGIDAE		Not listed
Amphibians			
Sclerophrys capensis	Bufonidae	Raucous Toad	Least Concern
Hyperolius marmoratus	Hyperoliidae	Painted Reed Frog	Least Concern (IUCN ver 3.1, 2013)
Kassina senegalensis	Hyperoliidae	Bubbling Kassina	Least Concern
Xenopus laevis	Pipidae	Common Platanna	Least Concern
Ptychadena oxyrhynchus	Ptychadenidae	Sharpnosed Grass Frog	Least Concern
Amietia delalandii	Pyxicephalidae	Delalande's River Frog	Least Concern
Tomopterna natalensis	Pyxicephalidae	Natal Sand Frog	Least Concern
Reptiles			
Bradypodion ventrale	Chamaeleonidae	Eastern Cape Dwarf Chameleon	Least Concern (SARCA 2014)
Dispholidus typus typus	Colubridae	Boomslang	Least Concern (SARCA 2014)
Philothamnus hoplogaster	Colubridae	South Eastern Green Snake	Least Concern (SARCA 2014)
Hemidactylus mabouia	Gekkonidae	Common Tropical House Gecko	Least Concern (SARCA 2014)
Pachydactylus maculatus	Gekkonidae	Spotted Gecko	Least Concern (SARCA 2014)
Aparallactus capensis	Lamprophiidae	Black-headed Centipede-eater	Least Concern (SARCA 2014)
Duberria lutrix lutrix	Lamprophiidae	South African Slug-eater	Least Concern (SARCA 2014)
Homoroselaps lacteus	Lamprophiidae	Spotted Harlequin Snake	Least Concern (SARCA 2014)
Lamprophis aurora	Lamprophiidae	Aurora House Snake	Least Concern (SARCA 2014)
Lycodonomorphus inornatus	Lamprophiidae	Olive House Snake	Least Concern (SARCA 2014)
Lycodonomorphus laevissimus	Lamprophiidae	Dusky-bellied Water Snake	Least Concern (SARCA 2014)
Lycodonomorphus rufulus	Lamprophiidae	Brown Water Snake	Least Concern (SARCA 2014)
Macrelaps microlepidotus	Lamprophiidae	Natal Black Snake	Near Threatened (SARCA 2014)
Psammophylax rhombeatus rhombeatus	Lamprophiidae	Spotted Grass Snake	Least Concern (SARCA 2014)
Trachylepis homalocephala	Scincidae	Red-sided Skink	Least Concern (SARCA 2014)
Trachylepis varia sensu lato	Scincidae	Common Variable Skink Complex	Least Concern (SARCA 2014)
Afrotyphlops bibronii	Typhlopidae	Bibron's Blind Snake	Least Concern (SARCA 2014)
Varanus niloticus	Varanidae	Water Monitor	Least Concern (SARCA 2014)
Bitis arietans arietans	Viperidae	Puff Adder	Least Concern (SARCA 2014)

Scientific Name	Family	Common Name	Status
Causus rhombeatus	Viperidae	Rhombic Night Adder	Least Concern (SARCA 2014)
Mammals			
Cercopithecus albogularis	Cercopithecidae	Samango Monkey	
Chlorocebus pygerythrus	Cercopithecidae	Vervet Monkey	Least Concern (2016)
Atilax paludinosus	Herpestidae	Marsh Mongoose	Least Concern (2016)
Hystrix africaeaustralis	Hystricidae	Cape Porcupine	Least Concern
Aethomys namaquensis	Muridae	Namaqua Rock Mouse	Least Concern
Rattus rattus	Muridae	Roof Rat	Least Concern
Rhabdomys pumilio	Muridae	Xeric Four-striped Grass Rat	Least Concern (2016)
Poecilogale albinucha	**Mustelidae**	**African Striped Weasel**	**Near Threatened (2016)**

8 Appendix D: Specialist Declaration, CV and Professional Registration

environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

DETAILS OF SPECIALIST AND DECLARATION OF INTEREST

	(For official use only)
File Reference Number:	12/12/20/ or 12/9/11/L
NEAS Reference Number:	DEA/EIA
Date Received:	

Application for integrated environmental authorisation and waste management licence in terms of the-

(1) National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2014; and

(2) National Environmental Management Act: Waste Act, 2008 (Act No. 59 of 2008) and Government Notice 921, 2013

PROJECT TITLE

IOX Fibre Optic Cable: Ecological Assessment Report

Specialist:	Engineering Advice and Services (Pty) Ltd		
Contact person:	Mr Jamie Pote		
Postal address:	PO BOX 13867, Humewood, Port Elizabeth		
Postal code:	6013	Cell:	076 888 9890
Telephone:	041 581 2421	Fax:	086 683 9899
E-mail:	jamiep@easpe.co.za		
Professional affiliation(s) (if any)	SACNASP, IAIASA		

Project Consultant:	ERM Southern Africa		
Contact person:	Reinett Mogotshi		
Postal address:	2nd Floor, The Great Westerford Building, 240 Main Road, Rondebosch, Cape		
Postal code:	7725	Cell:	
Telephone:	+27 21 681 5400	Fax:	
E-mail:	Reinett.Mogotshi@erm.com		

4.2 The specialist appointed in terms of the Regulations_

I, Mr Jamie Pote declare that –

General declaration:

I act as the independent specialist in this application;

I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant;

I declare that there are no circumstances that may compromise my objectivity in performing such work;

I have expertise in conducting 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:

Engineering Advice and Services

Name of company (if applicable):

05 November 2018

Date:

Name of firm	Engineering Advice & Services (Pty) Ltd
Name of staff	JAMIE ROBERT CLAUDE POTE
ID Number	740515 5152 089
Profession	Registered Ecological Scientist and Environmental Scientist
Years with firm	3 Years
Nationality	South African
Membership to Professional Societies	The South African Council for Natural Scientific Professions (SACNASP): Pr. Sci. Nat.: 115233 International Association for Impact Assessment South Africa (IAIAsa) Member Number 5045

KEY QUALIFICATIONS

Mr Jamie Pote has 15 years extensive professional experience in a wide range of Ecological Specialist Assessments in South Africa (Eastern, Western & Northern Cape, Gauteng and Limpopo), Namibia, Mozambique, Democratic Republic of Congo, Republic of Congo and Ghana in the Infrastructure, Mining and Development Sectors. He also has experience in conducting Basic Assessments, EIA's, Section 24 G applications and Mining Permit EMP's as well as developing GIS and other tools for Environmental related work.

He has broad ecological experience in a wide range of habitats and ecosystems in Southern, West and Central Africa and has been involved in all stages of project development from inception, through planning and environmental application and authorization (BAR and EMP) to implementation (Flora relocation) and compliance monitoring (ECO auditing). Jamie has a well-deserved reputation for providing quality professional services. His strategy incorporates using proven methodologies with a highly responsive approach to sound environmental management, including developing adaptive methodologies and approaches with available technologies. He is highly capable of working within a team of qualified professionals or in an individual capacity.

EDUCATION

•BSc	Rhodes University (Botany and Environmental Science)	2001
•BSc (Hons)	Rhodes University (Botany)	2002

EMPLOYMENT RECORD

2003 – 2014	Self Employed Consultant	Specialist Environmental Consultant (Ecology)
2014 (Aug) – present	Engineering Advice & Services	Environmental Unit Manager, EAP and Ecologist

LANGUAGES

	Speak	**Read**	**Write**
English	Excellent	Excellent	Excellent
Afrikaans	Good	Excellent	Excellent

PROJECT EXPERIENCE

SPECIALISED ECOLOGICAL REPORTS

- Botanical & Riparian Assessment for Orange River Weirs-Boegoeberg, Douglas Dam and Sendelingsdrif in Northern Cape 2006
- Botanical Assessment for State of the Environment Report for Chris Hani District Municipality SoER in Eastern Cape 2003
- Forestry Rehabilitation Assessment Report for Amahlathi Forest Rehabilitation in Eastern Cape 2007
- Botanical Sensitivity Analysis for LSDP, Greenbushes-Hunters Retreat in NMB 2008
- Representative for landowner group for Seaview burial Park in NMB 2010
- Mapping of bridge for Kenton Water Board in Eastern Cape 2010
- Rehabilitation Plan for N2 Upgrade - Coega to Colchester in NMB 2010
- Rehabilitation Plan for Nieu Bethesda in Eastern Cape 2011
- Mapping and Ecological services for Congo Agriculture in Republic of Congo 2013
- Section 24G Assessment and Rehabilitation Plan for Bingo Farm in Eastern Cape 2014
- Green Star Rating Ecological Assessment for SANRAL office, Bay West City, NMBM 2015
- Rehabilitation Plan for Hitgeheim Farm (Farm 960), Sunland, Eastern Cape 2017

FLORA AND FAUNA RELOCATION PLANS, PERMITS AND IMPLEMENTATION

- Flora Relocation for Disco Poultry Farm in NMB 2010
- Flora Relocation for Mainstream Windfarm in Eastern Cape 2010
- Flora Search and Rescue Plan for Red Cap Wind Farm in Eastern Cape 2012
- Flora and Fauna Search and Rescue for Mainstream Windfarm in Eastern Cape 2013
- Flora Search and Rescue for Steytlerville Bulk Water Supply in Eastern Cape (Phase 1, 2 & 3) 2013
- Flora and Fauna Search and Rescue for OTGC Tank Farm, Coega IDZ in NMB 2013
- Flora and Fauna Search and Rescue for Jeffreys Bay School in Eastern Cape 2013
- Flora and Fauna Search and Rescue for Riversbend Citrus Farm in NMB 2014
- Flora Search and Rescue for Steytlerville Bulk Water Supply & WTW in Eastern Cape (Phase 4) 2015
- Flora Search and Rescue for Steytlerville Bulk Water Supply in Eastern Cape (Phase 5) 2016
- Flora Search and Rescue for Citrus expansion on Farm 960, Patensie (AIN du Preez Boerdery) 2016
- Flora Search and Rescue for Citrus expansion on Hitgeheim Farm (Farm 960), Sunland, Eastern Cape 2017

INFRASTRUCTURE DEVELOPMENT PROJECTS

- Botanical Assessment for PE Airport Extention in NMB 2006
- Botanical Assessment and GIS mapping for golf course realignment for East London Golf Course in BCM, Eastern Cape 2007
- Botanical Assessment for Radar Mast construction for South African Weather Service - BCM and NMB 2008
- Ecological Assessment for Jansenville Cemetery in Eastern Cape 2009
- Ecological Assessment for Kouga Dam wall upgrade in Eastern Cape 2012
- Botanical Assessment for Kidd's Beach Desalination Plant in BCM, Eastern Cape 2006

POWERLINE INFRASTRUCTURE PROJECTS

- Botanical Assessment for Steynsburg - Teebus 132 kV powerline in Eastern Cape 2004
- Botanical Assessment for Eskom132kV Dedisa Grassridge Power line-Coega in NMB 2006
- Botanical Assessment for Eskom Power line – Tyalara-Wilo in Eastern Cape 2006
- Species of Special Concern Mapping Transmission Line for San Souci to Nivens Drift 132kV powerline in NMB 2009
- Botanical Assessment for Eskom Powerline - Albany-Kowie in Eastern Cape 2009
- Botanical Assessment for Dedisa-Grassridge Powerline in Eastern Cape 2010
- Ecological Assessment for Grahamstown-Kowie Powerline in Eastern Cape 2010
- Ecological Assessment for Dieprivier Karreedouw 132kV Powerline in Eastern Cape 2012
- Flora and Fauna search and Rescue plan for Van Stadens Windfarm Powerline in NMB 2012
- Rehabilitation Plan and Auditing for Grassridge-Poseidon Powerline Rehab in Eastern Cape 2013
- Eskom Solar one Ecological Walkdown: Nieuwehoop 400 kV powerline 2015
- Ecological Assessment: Dieprivier-Karreedouw 132kV Powerline realignment in Kouga LM 2016
- Eskom Ecological Walkdown: Dieprivier-Karreedouw 132 kV Powerline in Kouga LM 2016

BRIDGE INFRASTRUCTURE PROJECTS

- Detailed Botanical Assessment for Port Alfred water bridge in Eastern Cape 2004
- Botanical & Floristic Report for Hankey bridge in Eastern Cape 2006
- Environmental Risk Assessment for Elands River bridge in Eastern Cape 2007
- Detailed Botanical Assessment for Motherwell Bridge in NMB 2007
- Detailed Botanical Assessment, GIS maps for Erasmuskloof Bridge in Eastern Cape 2007
- Map Production for Russell Rd Stormwater in NMB 2008
- Basic Botanical Assessment for Albany Bridge in Eastern Cape 2008
- Species of Special Concern Mapping for Seaview Bridge in NMB 2009
- Species of Special Concern Mapping for Chelsea Bulk Water Bridge in NMB 2009
- Basic Botanical Assessment for Wanhoop farm bridge in Eastern Cape 2010
- Basic Botanical Assessment for Chatty Sewer in NMB 2010
- Detailed Ecological Assessment for Suikerbos Bridge in Gauteng 2012
- Ecological Assessment for Steytlerville Bulk Water Supply in Eastern Cape (Phase 4) 2013
- Ecological Assessment for Steytlerville Bulk Water Supply in Eastern Cape (Phase 5) 2013
- Vegetation Assessment for Wanhoop-Willowmore Bulk Water Supply in Eastern Cape 2016
- Vegetation Assessment for Butterworth Emergency Water Supply Scheme 2017

ROAD AND RAILWAY INFRASTRUCTURE PROJECTS

- Ecological Assessment for Road Layout for Whiskey Creek- Kenton in Eastern Cape 2006
- Botanical Assessment for Mn Conveyor Screening Report in NMB 2008
- Botanical Basic Assessment for Bholani Village Rd, Port St Johns in Eastern Cape 2009
- Botanical Report, EMP and Rehab Plan for Coega-Colchester N2 Upgrade in NMB 2009
- Botanical Assessment for Chelsea RD - Walker Drive Ext. in NMB 2010
- Botanical Assessment for Motherwell - Blue Water Bay Road in NMB 2010
- Ecological Assessment for Port St John Road in Eastern Cape 2010
- Ecological Assessment Review for Penhoek Road widening in Eastern Cape 2012
- Ecological Assessment for R61 road widening in Eastern Cape 2012
- Botanical Assessment for CDC IDZ Mn Terminal, conveyor and railway line in NMB 2013

MINING PROJECTS

- Biophysical Assessment for Humansdorp Quarry in Eastern Cape 2006
- Botanical Assessment, Rehab Plan & Maps for Quarry-Cathcart & Somerset East in Eastern Cape 2006
- Botanical Assessment, Rehab Plan & Maps for Quarry - Despatch Quarry in NMB 2006
- GIS Mapping & Botanical Assessment and Rehab Plan for Quarry - JBay Crushers in Eastern Cape 2006
- Botanical Assessment, EMP and Rehabilitation Plan for Polokwane Silicon Smelter in Limpopo 2006
- Application for Mining Permit for Bruce Howarth Quarry in Eastern Cape 2006
- Botanical Assessment for Scoping Report and Detailed Botanical Assessment and Rehab Plan for Elitheni Coal Mine in Eastern Cape 2007
- Botanical Assessment, Rehab Plan & Maps for Borrow Pit - Oyster Bay in Eastern Cape 2007
- Botanical Assessment, Rehab Plan & Maps for Borrow Pit - Bathurst/GHT in Eastern Cape 2007
- Botanical Assessment, Rehab Plan & Maps for Borrow Pit – Jeffreys Bay in Eastern Cape 2007
- Botanical Assessment, Rehab Plan & Maps for Borrow Pit - Storms river/Kareedouw in Eastern Cape 2007
- Botanical Assessment for Zwartenbosch Quarry in Eastern Cape 2008
- Botanical description & map production for Quarry - Rudman Quarry in Eastern Cape 2008
- Botanical Basic Assessment, Rehab Plan & Maps for Borrow Pit - Rocklands/Patensie in Eastern Cape 2008
- Botanical Assessment & Maps for Sandman Sand Gravel Mine in Eastern Cape 2008
- Botanical Assessment & GIS maps for Shamwari Borrow Pit in Eastern Cape 2008
- Detailed Botanical Assessment, EMP and Rehab Plan for Kalakundi Copper/Cobalt Mine in Democratic Republic of Congo 2008
- Botanical Assessment, Rehab Plan & Maps for Borrow Pit Humansdorp/Oyster Bay in Eastern Cape 2008
- Botanical Assessment, Rehab Plan & Maps for AWRM - Cala in Eastern Cape 2008
- Botanical Assessment, Rehab Plan & Maps for AWRM - Camdeboo in Eastern Cape 2008
- Botanical Assessment, Rehab Plan & Maps for AWRM - Somerset East in Eastern Cape 2008
- Botanical Assessment, Rehab Plan & Maps for AWRM - Nkonkobe in Eastern Cape 2008
- Botanical Assessment, Rehab Plan & Maps for AWRM - Ndlambe in Eastern Cape 2008
- Botanical Assessment, Rehab Plan & Maps for AWRM - Blue Crane Route in Eastern Cape 2008
- Botanical Assessment, EMP and Rehabilitation Plan for AWRM - Cathcart in Eastern Cape 2008
- Botanical Assessment, GIS maps and Rehab Plan for Mthatha Prospecting in Eastern Cape 2008
- Regional Botanical Map for mining prospecting permit for Welkom Regional mapping in 2008
- Ecological Assessment and Mining and Rehabilitation Plan for Baghana Mining in Ghana 2010
- Ecological Assessment for Bochum Borrow Pits in Limpopo 2013
- Ecological Assessment and Mining and Rehabilitation Plan for Greater Soutpansberg Mining Project in Limpopo (3 proposed Mines) 2013
- Ecological Assessment for Thulwe Road Borrow Pits in Limpopo 2013

WIND FARM AND PHOTOVOLTAIC INFRASTRUCTURE PROJECTS

- Botanical Assessment for Electrawinds Windfarm Coega in NMB 2010
- Botanical Assessment and Open Space Management Plan for Mainstream Windfarm Phase 2 in Eastern Cape 2010
- Ecological Assessment for Inca Energy Windfarm in Northern Cape 2011
- Ecological Assessment for Universal Windfarm in NMB 2011
- Ecological Assessment for Broadlands Photovoltaic Farm in the Eastern Cape 2011
- Ecological Assessment for Windcurrent Wind Farm in Eastern Cape 2012

BUSINESS AND INDUSTRIAL DEVELOPMENT PROJECTS

- Botanical Assessment for Kenton Petrol Station in Eastern Cape 2005
- Botanical Assessment and RoD amendments for Colchester - Petrol Station in NMB 2005
- Botanical Assessment for Bluewater Bay Erf 805 in NMB 2009
- Botanical Assessment and Open Space Management Plan for Petro SA Refinery, Coega IDZ in NMB 2010
- Ecological Assessment for OTGC Tank Farm in NMB 2012
- Ecological Assessment for Green Star grading for SANRAL in NMB 2014
- Ecological Assessment for Bay West City ENGEN Service Station 2015

HOUSING DEVELOPMENT PROJECTS

- Botanical Assessment for Bridgemead – Malabar PE in NMB 2004
- Botanical Basic Assessment for Trailees Wetland Assessment in Eastern Cape 2005
- Botanical Assessment and Rehab Plan for Arlington Racecourse - PE in NMB 2005
- Botanical Assessment for Smart Stone in NMB 2005
- Botanical Assessment for Peninsular Farm (Port Alfred) in Eastern Cape 2005
- Botanical Assessment for Mount Pleasant - Bathurst in Eastern Cape 2005
- Botanical Assessment and RoD amendments for Colchester Erven 1617 & 1618 (Riverside) in NMB 2005
- Basic Botanical Assessment for Parsonsvlei 3/4 in Eastern Cape 2005
- Botanical Assessment for Gonubie Portion 809/9 in BCM, Eastern Cape 2006
- Botanical Assessment for Glengariff Farm 723 in BCM, Eastern Cape 2006
- Botanical Assessment for Gonubie Portion 809/10 in BCM, Eastern Cape 2006
- Botanical Assessment for Gonubie Portion 809/4 & 5 in BCM, Eastern Cape 2006
- Botanical Assessment for Plettenberg bay - Ladywood 438/1&3 in Western Cape 2006
- Botanical Assessment and Rehab Plan for Winterstrand Desalination Plant in BCM 2006
- Botanical Assessment for Bosch Hoogte in NMB 2006
- Botanical Assessment for Plettenberg bay Farm 444/38 in Western Cape 2006
- Botanical Assessment for Plettenberg Bay - 444/27 in Western Cape 2006
- Botanical Assessment for Leisure Homes in BCM, Eastern Cape 2006
- Botanical Assessment for Plettenberg Bay - 438/24 in Western Cape 2007
- Botanical Assessment for Plettenberg Bay - Olive Hills 438/7 in Western Cape 2007
- Vegetation Assessment for Kwanokuthula RDP housing project in Western Cape 2008
- Site screening assessment for Greenbushes Site screening in NMB 2008
- Botanical Assessment for Fairfax development in Eastern Cape 2008
- Botanical Assessment for Plettenberg Bay Brakkloof 50&51 in Western Cape 2008
- Botanical Assessment, GIS mapping for Theescombe Erf 325 in NMB 2008
- Site Screening for Mount Road in NMB 2008
- Botanical Assessment for Greenbushes Farm 40 Swinburne 404 in NMB 2008
- Botanical Assessment for Greenbushes 130 in NMB 2008
- Botanical Assessment for Greenbushes Kuyga no. 10 in NMB 2008
- Botanical Assessment for Kouga RDP Housing in Eastern Cape 2009
- Botanical Assessment for Fairview Erf 1226 (Wonderwonings) in NMB 2009
- Species List Compilation for Zeeloeirivier Humansdorp in Eastern Cape 2009
- Botanical Assessment for Woodlands Golf Estate (Farm 858) in BCM, Eastern Cape 2009
- Botanical Assessment for Plettenberg Bay - 438/4 in Western Cape 2009
- Botanical Assessment for The Crags 288/03 in Western Cape 2010
- Revision of Ecological Assessment for Fairview Housing – NMB (EC) 2010
- Botanical Assessment, EMP and Open Space Management Plan for Hornlee Housing Development in WC 2010
- Botanical Assessment for Little Ladywood in Western Cape 2010
- Botanical Assessment and Open Space Management Plan for Motherwell NU31 in NMB 2010
- Botanical Assessment and Open Space Management Plan for Plett 443/07 in Western Cape 2010
- Botanical Assessment for Willow Tree Farm in NMB 2010
- Flora Search and Rescue Plan for Kwanobuhle Housing in Western Cape 2011
- Ecological Assessment for Ethembeni Housing in NMB 2012
- Ecological Assessment for Pelana Housing in Limpopo 2012
- Ecological Assessment for Lebowakgoma Housing in Limpopo 2013
- Ecological Assessment for Giyani Development in Limpopo 2013
- Ecological Assessment for Palmietfontein Development in Limpopo 2013
- Ecological Assessment for Seshego Development in Limpopo 2013
- Botanical Assessment for Sheerness Road in BCM, Eastern Cape 2013
- Ecological Assessment for Hankey Housing, Kouga District Municipality 2015
- Ecological Assessment for erf 15, Kabega, Port Elizabeth 2017

GOLF ESTATE AND RESORT DEVELOPMENT PROJECTS

- Botanical Assessment, EMP and Rehabilitation Plan for Tiffendel Ski Resort in Eastern Cape 2006
- Botanical Assessment for Rockcliff Resort Development in BCM, Eastern Cape 2007
- Botanical Assessment for Rockcliff Golf Course in BCM, Eastern Cape 2008
- Species List& Comments Report for Kidds Beach Golf Course in BCM, Eastern Cape 2009
- Botanical Assessment for Plettenberg Bay -Farm 288/03 in Western Cape 2009

MIXED USE DEVELOPMENT PROJECTS

- Botanical Assessment and GIS mapping for Madiba Bay Leisure Park in NMB 2007
- Botanical Assessment and GIS mapping for Madiba Bay Leisure Park in NMB 2007
- Botanical Basic Assessment for Cuyler Manor (Farm 320), Uitenhage in NMB 2007
- Botanical Assessment and GIS maps for Utopia Estate PE in NMB 2008
- Botanical Assessment, GIS maps, Open Space and Rehab Plans for Fairview Erf 1082 in NMB 2009
- Botanical Assessment, EMP and Open Space Management Plan for Bay West City in NMB 2010

ECO-ESTATE DEVELOPMENT PROJECTS

- Botanical Assessment for Rosehill Farm in Eastern Cape 2005
- Botanical Assessment for Resolution Game Farm in Eastern Cape 2005
- Botanical Assessment for Gonubie Portion 809/11 in BCM, Eastern Cape 2005
- Botanical Assessment for Kidd’s Beach portion 1075 in BCM, Eastern Cape 2005
- Botanical Assessment, EMP and Rehabilitation Plan for Seaview Eco-estate in NMB 2006
- Botanical Assessment for Kidd’s Beach portion 1076 in BCM, Eastern Cape 2006
- Botanical Assessment for Palm Springs, Kidds Beach East London in BCM, Eastern Cape 2006
- Botanical Assessment for Nahoon Farm 29082 in BCM, Eastern Cape 2006
- Botanical Assessment for Roydon Game farm, Queenstown in Eastern Cape 2007
- Botanical Assessment for Winterstrand Estate (Farm 1008) in BCM, Eastern Cape 2007
- Botanical Assessment for Homeleigh Farm 820 in BCM, Eastern Cape 2007
- Botanical Basic Assessment, Rehab Plan & Maps for Candlewood, Tsitsikamma in Western Cape 2007
- Botanical Assessment, EMP and Rehab Plan for Carpe Diem Eco development in Eastern Cape 2007
- Botanical Assessment - Poultry Farm for Coega Kammaskloof Farm 191 in NMB 2008
- Botanical Assessment - Housing development for Coega Ridge in NMB 2008
- Botanical Assessment, Rehabilitation Plan, EMP and GIS maps for Amanzi Estate in NMB, 2008
- Detailed Botanical Assessment and Open Space Management Plan for Olive Hills in Western Cape 2010
- Botanical Assessment and EMP for Zwartenbosch Road in Eastern Cape 2010

AGRICULTURAL PROJECTS

- Botanical Assessment and Flora Relocation Plan for Wildemans Plaas, in NMB 2006
- Botanical Assessment and Open Space Management Plan for Kudukloof in NMB 2010
- Botanical Assessment and Open Space Management Plan for Landros Veeplaats in NMB 2010
- Ecological Assessment for Tzaneen Chicken Farm in Limpopo 2013
- Ecological Assessment for Doornkraal Pivot (Hankey) in Eastern Cape 2014
- Ecological Assessment for Citrus expansion on farm 960, Patensie 2014
- Ecological Assessment for Citrus expansion on Hitgeheim Farm, Sunland, Eastern Cape 2015

ENVIRONMENTAL MANAGEMENT PLANS

- Floral Survey for Mbotyi Conservation Assessment in Eastern Cape 2005
- Identifying and Assessment on Aquatic Weeds for Pumba Private Game Reserve in Eastern Cape 2005
- Biodiversity & Ecological Processes for Bathurst-Commonage in Eastern Cape 2006
- EMP for Kromensee EMP (Jeffries Bay) in Eastern Cape 2006
- Baseline Botanical Study, Vegetation mapping and EMP for Local Nature Reserve for Plettenberg Bay Lookout LNA in Western Cape 2009
- Basic Botanical Assessment for Kromensee EMP (Jeffries Bay) in Eastern Cape 2010
- Wetland Management Plan for NMB Portnet in NMB 2010

ENVIRONMENTAL MANAGEMENT, ENVIRONMENTAL CONTROL OFFICER, AUDITING AND MONITORING PROJECTS

- Flora Relocation Plan and Permit application for Wildemans Plaas, in NMB 2006
- EMP submission and ECO for Seaview Garden Estate in NMB 2010
- EMP and ECO for Sinati Golf Estate EMP in BCM, Eastern Cape 2009
- ECO audits for NMB Road surfacing in NMB (multiple contacts) 2011
- ECO for Mainstream Windfarm wind monitoring mast installation in Eastern Cape 2010
- Final EMP submission for Seaview Garden Estate in NMB 2012
- EMP and ECO for Utopia Estate in NMB 2013
- ECO for Riversbend Citrus Farm in NMB 2014
- ECO for Alfred Nzo DM Road resurfacing - DR08071, DR08649, DR08092, DR08418, DR08452, DR08015, DR08085, DR08639 & DR08073 in Eastern Cape - MSBA 2014
- ECO Audits for Koukamma Flood Damage Road Repairs – Hatch Goba 2014
- ECO for DRPW IRM Road Maintenance projects in Amahlathi Municipality 2015
- ECO for DRPW IRM Road Maintenance projects in Makana/Ndlambe Municipality 2015
- ECO for DRPW IRM Road Maintenance projects in Mbashe/Mqume Municipality 2015
- ECO for DRPW IRM Road Maintenance projects in Port St Johns, Mbizana, Ingquza Hill Municipalities 2015
- ECO and Botanical Specialist for the special maintenance of national route R61 Section 2 from Elinus Farm (km 42.2) to N10 (km 85.0) (SANRAL) 2016
- Environmental Control Officer (ECO): Construction of NSRI Slipway - Port Elizabeth Harbour 2016
- ECO for SANRAL RRP Road Maintenance projects in Mbashe LM 2016
- ECO for SANRAL RRP Road Maintenance projects in Nkonkobe LM 2016
- ECO for SANRAL RRP Road Maintenance projects in Mbizana LM 2016
- ECO for SANRAL RRP Road Maintenance projects in Senqu LM 2016
- ECO for SANRAL RRP Road Maintenance projects in Elundini LM 2016
- ECO and Environmental Management for closure of Bushmans River Landfill site 2016
- ECO for Citrus expansion on Farm 960, Patensie (AIN du Preez Boerdery) 2017
- ECO for Citrus expansion on Hitgeheim Farm (Farm 960), Sunland, Eastern Cape 2017
- DEO for improvement of national route R67 section 5 from Whittlesea (km 0.00) to Swart Kei river (km 15.40) – Murray & Roberts 2017

BASIC ASSESSMENT REPORT PROJECTS (DEDEAT)

- Basic Assessment Application for Citrus expansion on farm 960, Patensie (AIN du Preez Boerdery) 2014
- Basic Assessment Application for Citrus expansion on Hitgeheim Farm, Sunland, Eastern Cape 2015
- Basic Assessment Application for Hankey Housing, Kouga District Municipality 2015

MINING PERMIT/ENVIRONMENTAL MANAGEMENT PROGRAMME APPLICATIONS (DMR)

- Mining BAR/EMP's for Chris Hani DM Borrow Pits - MR00716 (DRPW) 2014
- Mining BAR/EMP's for Chris Hani DM Borrow Pits - DR02581 (DRPW) 2014
- Mining BAR/EMP's for Chris Hani DM Borrow Pits - DR08041, DR08247, DR08248 & DR08504 (DRPW) 2014
- Mining BAR/EMP's for Chris Hani DM Borrow Pits - DR08599, DR08601 & DR08570 (DRPW) 2014
- Mining BAR/EMP's for Chris Hani DM Borrow Pits - DR08235, DR08551 & DR08038 (DRPW) 2014
- Mining BAR/EMP's for Alfred Nzo DM Borrow Pits - DR08092, DR08093 & DR08649 (DRPW) 2014
- Mining BAR/EMP's for Alfred Nzo DM Borrow Pits - DR08090, DR08412, DR08425, DR08129, DR08109, DR08106, DR08104 & DR08099 – Matatiele (DRPW)
- Mining BAR/EMP's for Chris Hani DM Borrow Pits - MR00716 (Tarkastad) (DRPW) 2015
- Mining BAR/EMP's for Chris Hani DM Borrow Pits – Intsika Yethu and Emalahleni (DRPW) 2015
- Mining BAR/EMP's for Joe Gqabi DM Borrow Pits – Senqu (DRPW) 2015
- Mining BAR/EMP's for Makana/Ndlambe LM Borrow Pits – Sarah Baartman (DRPW) 2015
- Mining BAR/EMP's for Amahlathi LM Borrow Pits – Amatole (DRPW) 2015
- Mining BAR/EMP's for Mbashe/Mqume LM Borrow Pits – Amatole (DRPW) 2015
- Mining BAR/EMP's for Sundays River Valley LM Borrow Pits – Sarah Baartman (DRPW) 2015
- Mining BAR/EMP's for Kouga LM Borrow Pits – Sarah Baartman (DRPW) 2015
- Mining BAR/EMP's for Nkonkobe LM Borrow Pits – (SANRAL) 2016
- Mining BAR/EMP's for Mbhashe LM Borrow Pits – (SANRAL) 2016
- Mining BAR/EMP's for Mbizana LM Borrow Pits – (SANRAL) 2016
- Mining BAR/EMP's for Senqu LM Borrow Pits – (SANRAL) 2016
- Mining BAR/EMP's for Elundini LM Borrow Pits – (SANRAL) 2016
- Mining BAR/EMP's for Emalahleni LM Borrow Pits – (SANRAL) 2016
- Mining BAR/EMP's for Emalahleni LM Borrow Pits – (DRPW) 2016
- Mining BAR/EMP's for Ikwezi/Baviaans LM Borrow Pits – (DRPW) 2016
- Mining BAR/EMP's for Ingquza Hill LM Borrow Pits – (SANRAL) 2017

SECTION 24G APPLICATIONS

- 12 000 ML Dam constructed on farm 960, Patensie (MGM Trust) 2015
- Illegal clearing of 20 Ha of lands on Hitgeheim Farm, Sunland, Eastern Cape 2015

ENVIRONMENTAL SCREENING PROJECTS

- Terrestrial Vegetation Risk Assessment for proposed Skietnek Citrus Farm development (Kirkwood) 2015
- Preliminary Environmental Risk Assessment: NSRI Slipway, NMB 2015
- Environmental Screening Report for Proposed Development of a Dwelling on Erf 899, Theescombe, NMB 2015
- Environmental Screening Report for Proposed Development on Erf 559, Walmer, NMB 2015
- Environmental Screening Report for Proposed Housing Scheme Development of Erf 8709, Wells Estate, NMB 2015

GIS AND IT DEVELOPMENT

- Development of GIS databases and mapping tools for Manifold GIS software 2008
- Landsat Image classification and analysis (Congo Agriculture) 2010
- Development of *iAuditor* Environmental Audit templates (DRPW audits) 2014
- Environmental Risk model for Borrow Pit screening in Eastern Cape 2016
- Development of audit templates for DRPW and SANRAL projects 2017

CONFERENCES AND PUBLICATIONS

- Pote, J., Shackleton, C.M., Cocks, M. & Lubke, R. 2006. Fuelwood harvesting and selection in Valley Thicket, South Africa. Journal of Arid Environments, 67: 270-287.
- Pote, J., Cocks, M., Dold, T., Lubke, R.A. and Shackleton, C. 2004. The homegarden cultivation of indigenous medicinal plants in the Eastern Cape. Indigenous Plant Use Forum, 5 - 8 July 2004, Augsburg Agricultural School, Clanwilliam, Western Cape.
- Pote, J. & Lubke, R.A. 2003. The selection of indigenous species suitable for use as fuelwood and building materials as a replacement of invasive species that are currently used by the under-privileged in the Grahamstown commonage. Working for Water Inaugural Research Symposium 19 - 21 August 2003, Kirstenbosch. Poster presentation.
- Pote, J. & Lubke, R.A. 2003. The screening of indigenous pioneer species for use as a substitute cover crop for rehabilitation after removal of woody alien species by WfW in the grassy fynbos biome in the Eastern Cape. Working for Water Inaugural Research Symposium 19 - 21 August 2003, Kirstenbosch, South Africa.

RESEARCH EXPERIENCE

- Resource assessment of bark stripped trees in indigenous forests in Weza/Kokstad area (June 2000; Dr. C. Geldenhuis & Mr. M. Kaplin).
- Working for Water research project for indigenous trees for woodlots (December 2000/January 2001; Prof R.A. Lubke, Rhodes University).
- Project coordinator and leader of the REFYN project – A BP conservation gold award: Conservation and Restoration of Grassy-Fynbos. A multidisciplinary project focusing on management, restoration and public awareness/education (2001 – 2002).
- Conservation Project Management Training Workshops: Royal Geographical Society, London 2001 – Fieldwork Techniques, Habitat Assessment, Biological Surveys, Project Planning, Public Relations and Communications, Risk Assessment, Conservation Education
- Selection and availability of wood in Crossroads village, Eastern Cape, South Africa. Honours Research Project 2002. Supervisors: Prof. R.A. Lubke & Prof. C. Shackleton.
- Floral Morphology, Pollination and Reproduction in *Cyphia* (LOBELIACEAE). Honours Research Project 2002. Supervisor: Mr. P. Phillipson.
- Forestry resource assessment of bark-stripped species in Amatola District (December 2002; Prof R.A. Lubke).
- Homegarden Cultivation of Medicinal Plants in the Amathole area. Postgraduate Research Project (2003-2005; Prof R.A. Lubke, Prof C.M. Shackleton and Ms C.M., Cocks).

SACNASP

South African Council for Natural Scientific Professions

herewith certifies that

Jamie Robert Claude Pote

Registration number: 115233

is registered as a

Professional Natural Scientist

in terms of section 20(3) of the Natural Scientific Professions Act, 2003
(Act 27 of 2003)
in the following fields(s) of practice (Schedule 1 of the Act)

Ecological Science

Effective **20 July 2016** Expires **31 March 2019**

President

Executive Director