Hawaiki Submarine Cable

Hawaiki Submarine Cable
Environmental Assessment

August 2016

This report: has been prepared by GHD for Hawaiki Submarine Cable and *may only be used and relied on by Hawaiki Submarine Cable for the purpose agreed between GHD and the Hawaiki Submarine Cable as set out QA010 executed 19 April 2016.*

GHD otherwise disclaims responsibility to any person other than Hawaiki Submarine Cable arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report throughout. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this report on the basis of information provided by Hawaiki Submarine Cable and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Glossary

Term	Definition
Beach Manhole (BMH)	Traditionally the point where the transition between the marine cable and terrestrial cable occurs. A chamber is constructed near the landing point and the beach joint is constructed inside.
Branching Unit (BU)	Branching units are underwater units which connect cables together, allowing the fibres in one cable or a portion of the capacity thereof to be routed individually to two separate cables (in a "Y" fashion).
Cable Landing Station (CLS)	A Telco-grade building, fit out properly with power, air-conditioning, security, monitoring systems, fire-suppression, etc, usually located relatively close to the beach, which most often is used to house all of the undersea cable related terminal equipment.
Desktop Study (DTS)	A report that provides information for use in the design, construction and maintenance of a cable system. The DTS is primarily used to select cable landing sites, a cable route for marine survey, assess risks for the proposed route, identify permitting requirements and identify information that will affect the schedule and ease of installation and maintenance.
Horizontal Directional Drilling (HDD)	A steerable trenchless method of installing underground pipes, conduits and cables in a shallow arc along a prescribed bore path by using a surface-launched drilling rig, with minimal impact on the surrounding area. HDD is used when seabed trenching or excavating is not practical
Pop-out point (POP)	The exit location of the HDD conduit
Cable Route Survey (CRS)	Marine survey of the cable route undertaken to understand bottom conditions to inform cable installation, methodology and types.
Route Position List (RPL)	A listing of geographic positions of the cable including any alterations to the course of the route. It defines the route of the cable and is a primary system record. It is usually accompanied with corresponding maps.

References: SubOptic 2013;

Abbreviations

AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AP	Articulated Pipe
CD	Chart Datum
EEZ	Exclusive Economic Zone
EPBC	Environment Protection and Biodiversity Conservation (Act)
HWM	High Water Mark
ICPC	International Cable Protection Committee
ITCZ	Inter Tropical Convergence Zone
kn	Knot (1 nm/hr)
LAT	Lowest Astronomical Tide
LGA	Local Government Area
LWM	Low Water Mark
MHW	Mean High Water
MHWS	Mean High Water Spring
MLW	Mean Low Water
MLWS	Mean Low Water Spring
MPA	Marine Protected Area
MSL	Mean Sea Level
nm	Nautical Mile
NRSMPA	National Representative System of Marine Protected Areas
OOS	Out-of-service
ROV	Remote Operative Vehicle
UXO	Un-exploded Ordnance
VAM	Variational analysis method
WD	Water depth

Table of contents

Table index

Figure index

Appendices

1. Introduction

1.1 Background

The Hawaiki Submarine Cable (the Cable) is a fibre optic, submarine, telecommunication repeatered cable system spanning across the Pacific Ocean directly connecting the USA and Australia with landings in Portland, USA, Sydney, Australia, Mangawhai Heads, New Zealand; and Tafuna, American Samoa Figure 1-1. The cable is proposed to land in Australia within the Southern Sydney Protection Zone (SSPZ). Whilst the cable passes within proximity of Lord Howe Island and Norfolk Island, landing parties have not been confirmed, and as such, the only Australian landing is in Sydney. Cable route through Australian waters is shown in Figure 1-2 and Figure 1-3

The proponent, Hawaiki Submarine Cable (Hawaiki), will need to obtain a number of approvals prior to commencement of the installation of the Cable. This report has been collated to provide information on expected Environmental Impacts and proposed mitigation and control measures in support of projects approvals for the portion of the cable that will be located within Australian waters.

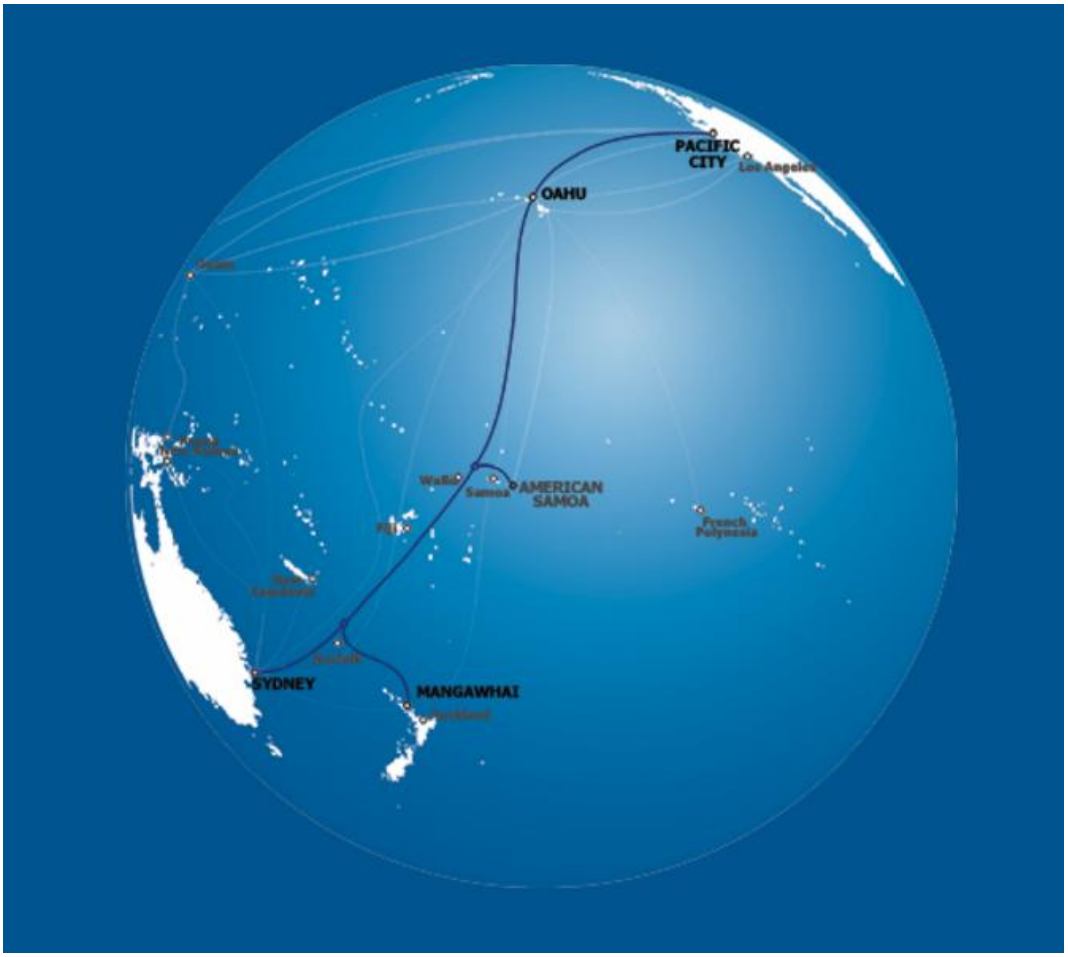
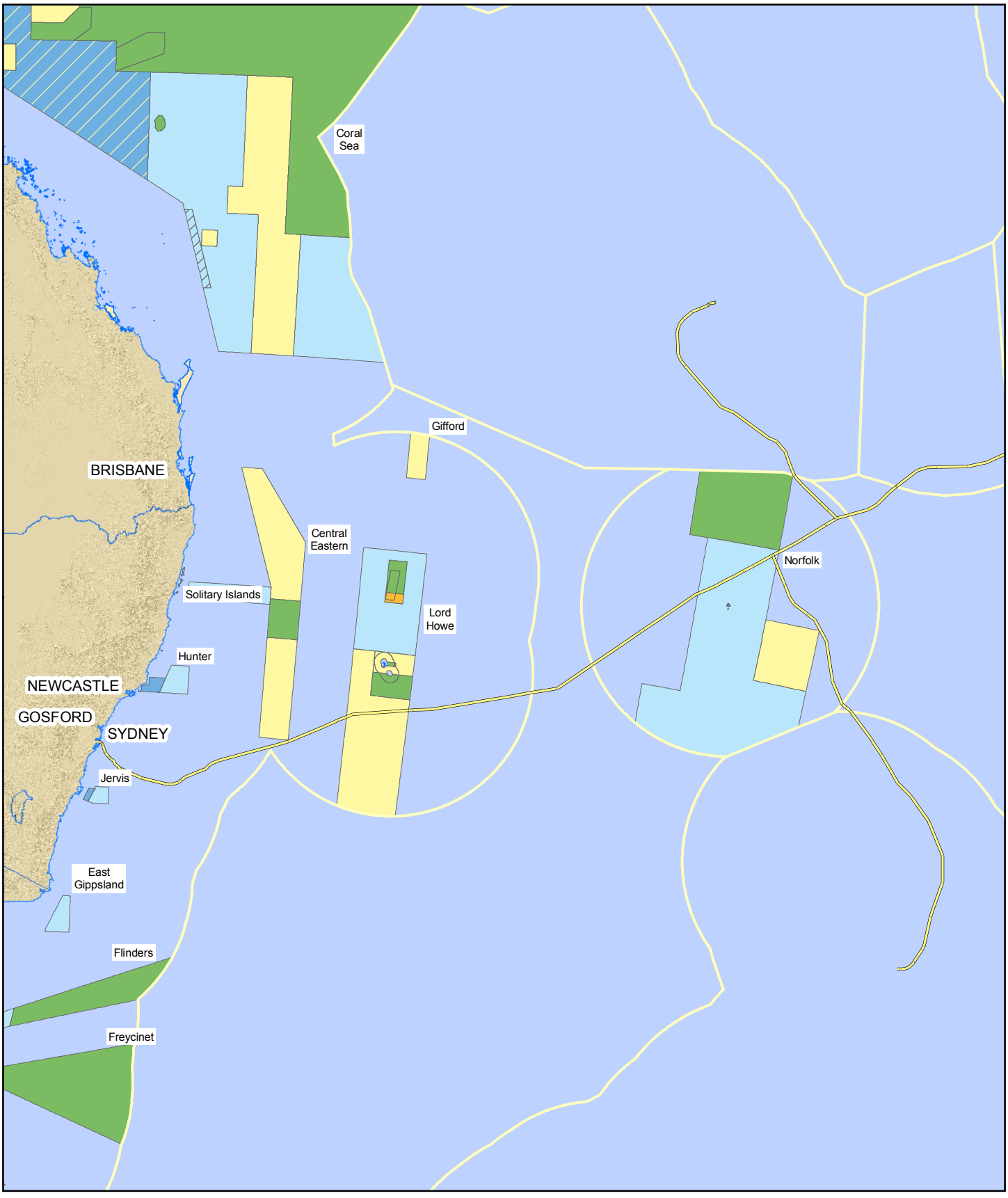


Figure 1-1: Hawaiki Cable Schematic (Hawaiki)



LEGEND

- Hawaiki Cable alignment
- Exclusive Economic Zones

Commonwealth Marine Reserves

- Marine National Park Zone (IUCN II)
- Recreational Use Zones (IUCN II and IV)
- Habitat Protection and Conservation Park Zones (IUCN IV)
- Habitat Protection Zone (Coral Sea) (IUCN IV)
- Special Purpose Zones (IUCN VI)
- Multiple Use Zone (IUCN VI)
- General Use Zone (IUCN VI)

Paper Size A4

0 50 100 200 300

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Hawaiki Submarine Cable
Hawaiki Cable - Australia

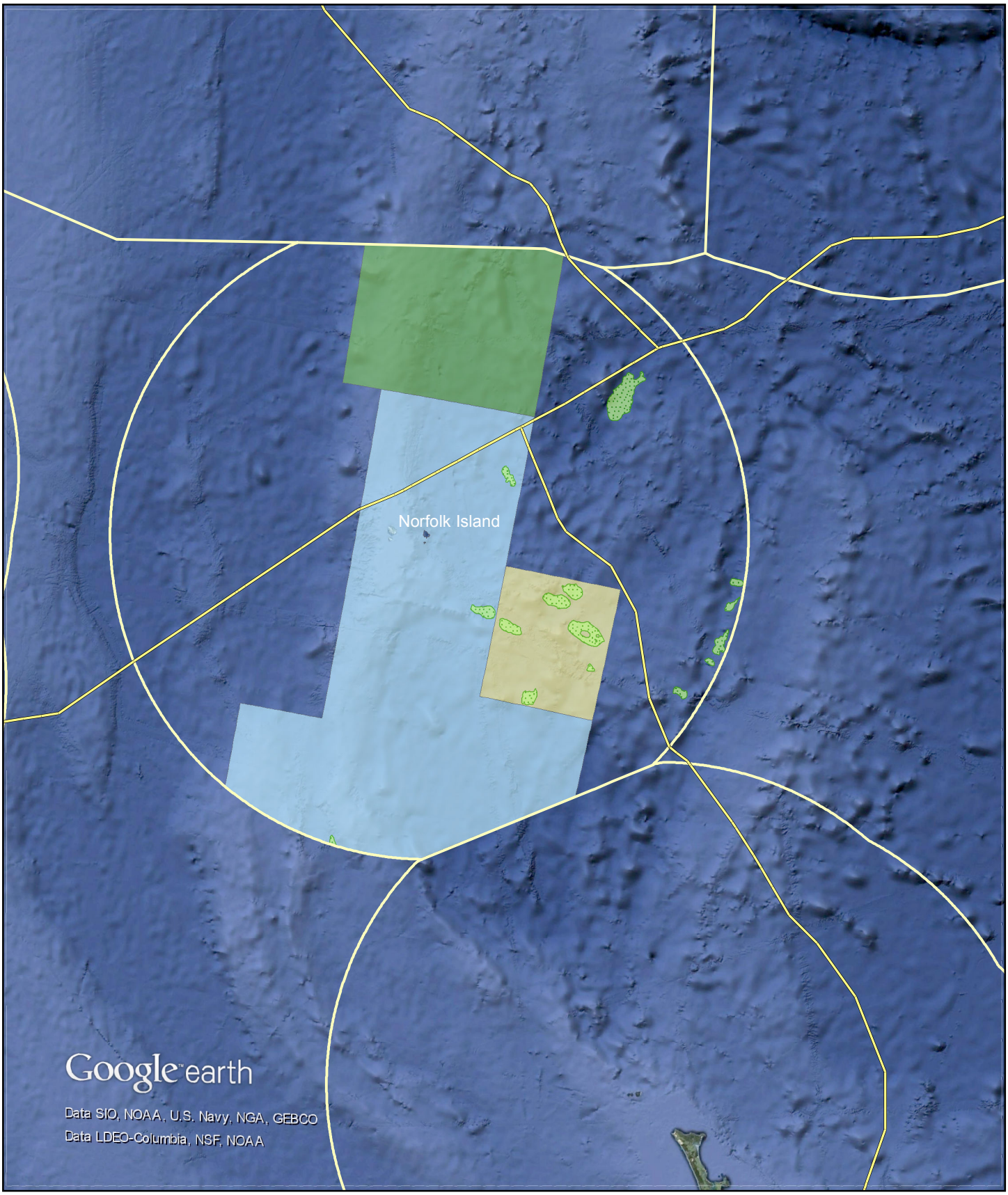
Job Number 21-25477
Revision A
Date 01 Jul 2016

Hawaiki Cable Alignment within Australian Exclusive Economic Zone Figure 1-2

145 Ann Street Brisbane QLD 4000 Australia T 61 7 3316 3000 F 61 7 3316 3333 E bnemail@ghd.com W www.ghd.com

G:\21\25477\GIS\Maps\MXD\21-25477_006_revA.mxd

Data source: Hawaiki: Cable Location (2016); GA: Mainland populated places (2007), EEZ (2014); ESRI: hillshade (2008). Created by: AJ



LEGEND

- Hawaiki Cable alignment
- Exclusive Economic Zones
- Seamount Chain

Commonwealth Marine Reserves

- Marine National Park Zone (IUCN II)
- Habitat Protection and Conservation Park Zones (IUCN IV)
- Multiple Use Zone (IUCN VI)

Paper Size A4

0 25 50 100 150

Kilometres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 55

N

GHD

Hawaiki Submarine Cable
Hawaiki Cable - Australia

Job Number	21-25477
Revision	0
Date	04 Aug 2016

Matters of National Environmental Significance - NPZ

Figure 1-3

145 Ann Street Brisbane QLD 4000 Australia **T** 61 7 3316 3000 **F** 61 7 3316 3333 **E** bnemail@ghd.com **W** www.ghd.com

G:\21\25477\GIS\Maps\MXD\21-25477_005_rev0.mxd

Data source: Hawaiki: Cable Location (2016); GA: Populated Places (2007); DE: Seamount Chain, Key Ecological Fatures, World Heritage Area, RAMSAR Wetlands (2005); GE: Imagery extracted 20/06/2016. Created by: AJ

1.2 Environmental Assessment Scope and Limitations

GHD has been commissioned to undertake an Environmental Assessment (EA), and seek relevant approvals for the portion of Hawaiki Cable proposed to be installed within Australian Waters including in the SSPZ and waters around Norfolk Island

The SSPZ extends from the coastline of Bondi and Coogee beaches to the 2000 m depth contour, located approximately 30 nm offshore.

The battery limits for scope of works for the approvals and EA cover the Cable corridor within Australian waters, 2.5 nm from the centreline of the RPL, and a 10 km square around the Branching Units (BU), and considers the cable activities - marine route survey and installation from:

- The Beach Man Hole (BMH) planned to be located in the proximity of Trenerry Reserve, South of Coogee Beach, NSW
- The subsea Cable route within Australian waters (as shown in Figure 1-2 and Figure 1-3); incorporating:

The Cable trunk line from:

- The BMH to the pop-out point at 20 m water depth, south of Wedding Cake Island, within the SSPZ
- The pop-out point to the limit of the SSPZ approx. 30 nm offshore of Sydney
- The limit of the SSPZ to the boundary of the Australian EEZ (approx. 200 nm east of Lord Howe Island)
- The re-entering and departure of Australian waters north of Norfolk Island

And, the branches (within Australian Waters), from a Branching Unit (BU) on the trunk line

- Beyond the SSPZ, connected to an approx. 10 km stub tail terminating in open water for possible service connection at a later date
- North-east of Norfolk Island, connecting south to New Zealand
- North-east of Norfolk Island, potentially connecting north to New Caledonia

1.3 Proponent

The proponent for the proposed works is Hawaiki Submarine Cable LP (Hawaiki) and are the company that hold the carrier licence under their Australian subsidiary Hawaiki Submarine Cable Australia Pty Ltd as per the requirements of the Commonwealth *Telecommunications Act 1997*.

Proponent:	Hawaiki Submarine Cable LP
Contact Name:	Mr Georges Krebs
Address:	2/A, 3 Ceres Court, Rosedale, Auckland New Zealand 0632
Phone:	0466 037 349
Email:	georges.krebs@hawaikicable.co.nz

1.4 Environmental Assessment Approach

An initial Desktop Study (DTS) for the Cable was prepared for Hawaiki by EGS (Asia) Ltd, on behalf of TE Subcom. These two companies, EGS and TE Subcom have been retained by Hawaiki to conduct the entirety of the marine route survey and the cable installation, respectively.

The DTS is a targeted study to ascertain the most technically feasible (initial) cable route and to generate a preliminary RPL. The peak submarine cable industry body, the International Cable Protection Committee (ICPC), assert that the DTS is an essential pre-requisite to a detailed submarine cable route survey, as it allows the RPL to be engineered in the first instance to avoid known hazards and environmentally sensitive areas. The DTS also offers a high level risk assessment and identification of environmental matters which is then expanded on further within the Environmental Assessment.

This Environmental Assessment was developed to align with policies surrounding economic development, social development, communications and the environment and as part of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) referral process for approval.

The Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) protects the environment, particularly matters of National Environmental Significance (Protected Matters) (NES). The concerns of NES include the Commonwealth marine area and Commonwealth listed threatened and migratory species (including matters within State jurisdictions).

This EA is structured to describe the proposed works (Section 2) and then aims to identify the existing environment (both ecological and social) and Protected Matters within the Cable footprint. The impact on these from the marine route survey, the installation of the Cable, and the installed Cable have then been considered, with appropriate mitigation or control measures proposed as appropriate. The issues identification, impacts and proposed controls are summarised in tables in Section 4 for ease of interpretation, while detailed supporting information is contained withinAppendix A. This EA also identifies the legislative and planning instruments that underpin the approval pathways for installation of the Cable in Section 3.

To inform and supplement the EA, various engagement activities have been undertaken with key stakeholders such as

1. Pre-referral meeting with Department of Environment
2. Early engagement meeting with the ACMA
3. Consult and formal notifications of project to State and Local Government

2. Description of the Proposed Works

2.1 Background

The Hawaiki Cable will extend across the Pacific Ocean from Australia to the US. The system will have repeaters and will link 6 landfalls. The system lies in water depths ranging from 20 m to greater than 5,000 m. The general cable engineering considerations have been extracted from the TE Subcom DTS (2016) and are presented in this section of the report.

It is noted that the proposed routes, cable types, burial and slack are subject to review during further working group meetings and will undergo final review when survey data becomes available; however, it is noted under the legislation that major modifications of the route are not allowed within Australian waters once the RPL is approved by the ACMA.

2.2 Submarine Cable Route

As mentioned, the cable route had been initially selected by EGS (Asia) Ltd and TE Subcom, together with Hawaiki, in the DTS and has been engineered in the first instance to avoid, where possible, any known sensitive areas including Marine Reserves, shipwrecks, and munitions dumps, etc.

During the consultation phase within this EA and approvals process, the RPL has been revised several times to ensure appropriate cable parallel distances and crossing angles to ICPC recommendations, minimal interaction with designated fishing zones, and to take advantage of the cable protection regulations within the SSPZ.

The final RPL, on which this assessment is based, is described within Appendix B with the Protected Matters Search.

2.3 Submarine Cable Types

The Hawaiki Cable system, within Australian waters, will utilise the TE Subcom SL17 family of undersea cables, including for the New Zealand branch but with the exception of the branch to New Caledonia which may also use the SL14 cable (narrower core cable). The proposed cables from the DTS phase are presented below in this section, with their likely uses shown in the straight line diagram in Figure 2-1; however the findings of the marine Cable Route Survey will confirm cable type selection.

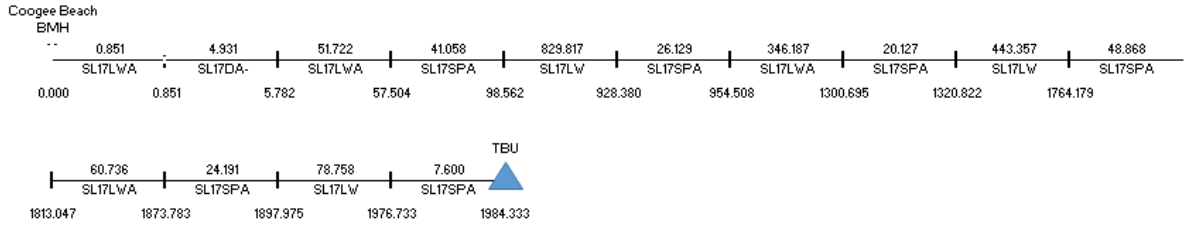


Figure 2-1: Straight Line Diagram of Trunk Line Cable Types in Australian Waters

2.3.1 SL17 Lightweight (LW) Cable

Generally used with benign, sandy bottom conditions and for deepwater deployment, and surface laid up to 8,000 m water depth. The SL17LW cable forms the core of the SL17 family.

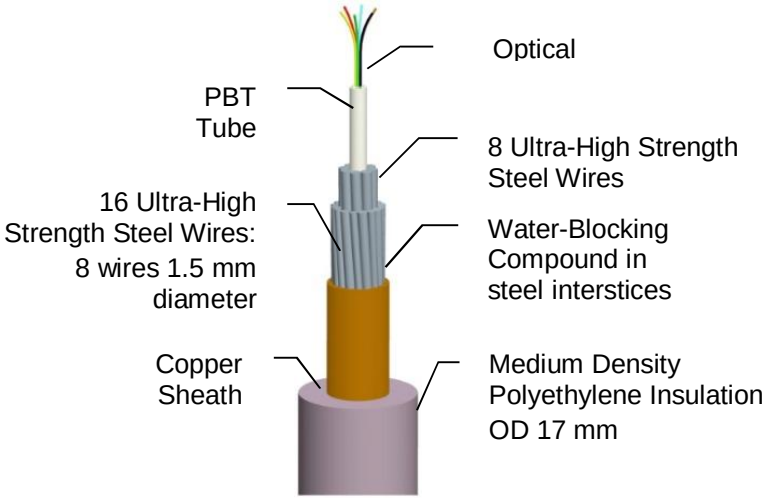


Figure 2-2: SL17LW (source TE-Subcom)

2.3.2 SL17 Light-wire Armour (LWA) Cable

This cable will be used for burial in areas of decreased risk of external aggression and is suitable for rocky terrain and shallow water deployment to 2,000 m water depth, such as within the SSPZ. It features a light-wire armor applied to the core layer for added protection.

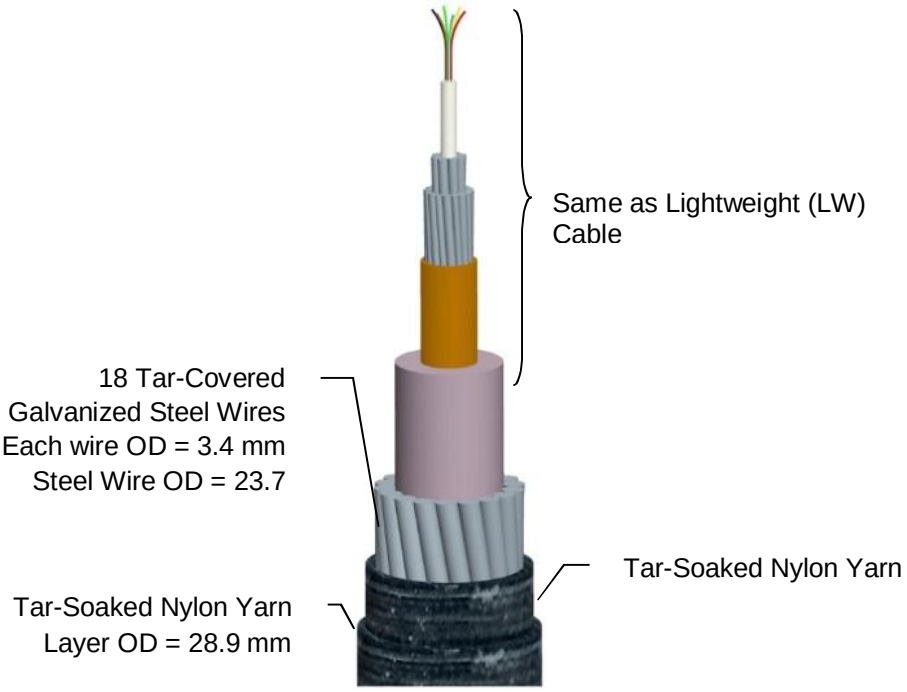


Figure 2-3: SL17 LWA Cable (TE Subcom)

2.3.3 SL17 Special Applications (SPA) Cable

This cable will be used where a rough seabed is expected and a risk of moderate abrasion and/or attack by marine life. This cable is commonly used as spare for SL17LW but is only suitable for deepwater deployment to 6,500 m water depth.

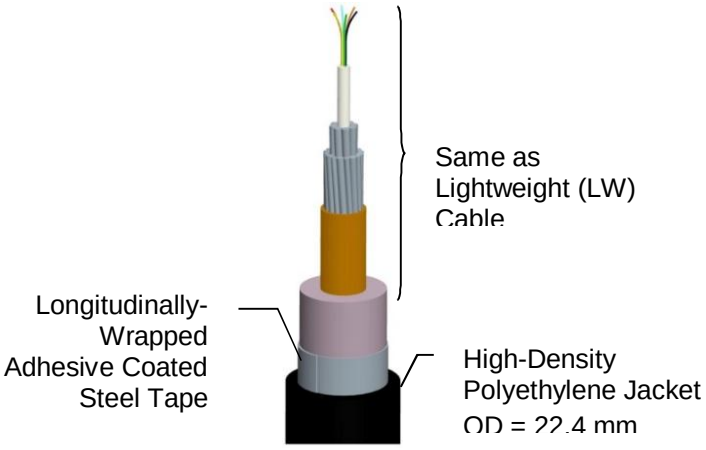


Figure 2-4: SL17LWA Cable (TE Subcom)

2.3.4 SL17 Double Armoured (DA) Cabe

This cable offers additional protection to the SL17LWA, and includes a second armour wire layer over the top. This cable is generally used in the nearshore, rocky terrain areas and where there is a high risk of fouling from human activities such as fishing. This cable is suitable at the pop-out point and through the Peak Fishing Zone.

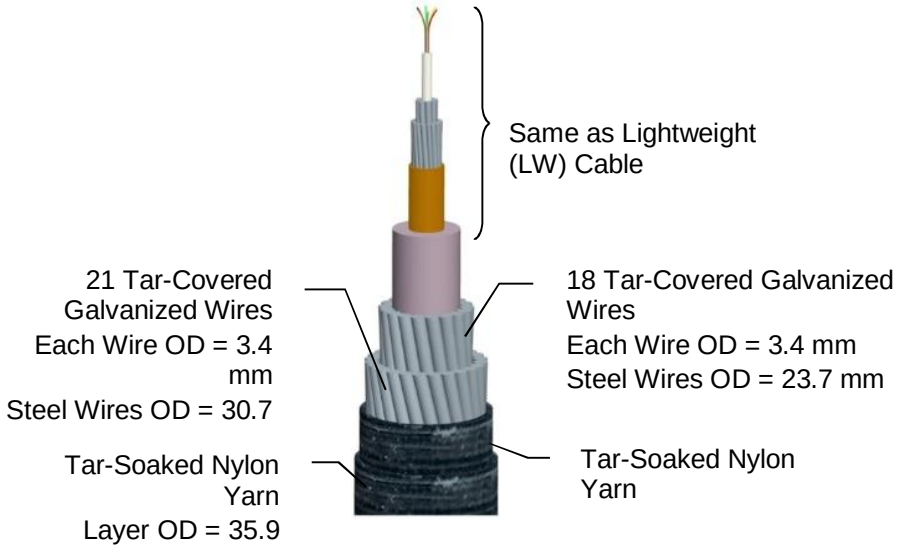
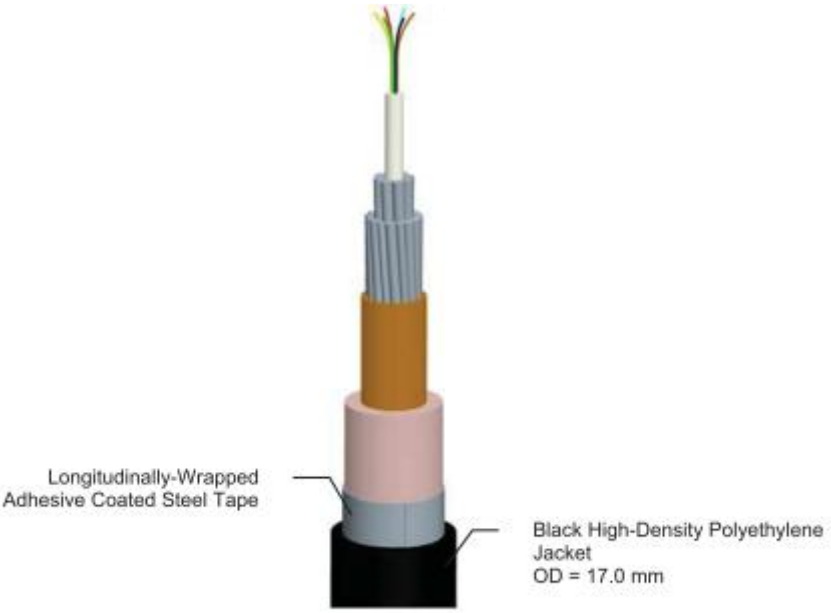


Figure 2-5: SL17 DA Cable (TE Subcom)

2.3.5 SL14 SPA Cable

This cable is narrower in diameter compared to the SL17SPA, and will be used for the New Caledonia branch within Australian waters only.



2.3.6 Cable Characteristics

The cable exteriors have varying finishes, either PE, HDPE or tar soaked nylon yarn, all of which have the following important functional characteristics:

- resisting to abrasion and rot,
- consisting of non-sticky, non-toxic, and non-flammable materials,
- inhibiting corrosion of the underlying metallic members,
- inhibiting biological fouling and attack,
- having sufficient flexibility to follow the sea-bed contours; and
- exposure of cable to sunlight during normal manufacture, storage, and ship loading produces no measurable change in cable jacket material properties, but is recommended by TE SUbcom to limit exposure to direct sunlight to 48 hours maximum.
- All cables are fabricated specifically for the Project

2.3.7 Cable Storage on vessel

All cables coil naturally in cable tanks to suit the minimum storage bending radii of the specific cables (ranging from 610 mm to 910 mm). The cable ship is capable of handling approx. 7,000 km of cable (dependent on cable type) within three tanks on the vessel.

2.4 Beach Man Hole

The BMH to the south of Coogee beach is required to receive the cable from offshore and aid haulage out to the CLS. It will be located at one of two Crown Reserve locations within the Randwick City Council local jurisdiction, which will be decided on advice from a drilling contractor. Given their proximity to each other as seen in Figure 2-6, the expected impacts at each potential BMH location are analogous such that this EA covers both sites.

Table 1: Approximate potential BMH location options (WGS84)

Crown Reserve	Long			Lat			Lot Number (DP)
Trenerry Reserve	33 °	55.672 ‘	S	151	15.54	E	1145957
West of Trenerry Reserve	33 °	55.583 ‘	S	151 °	15.53 ‘	E	758272

Figure 2-6: Potential Locations for BMH

The BMH is a fully below ground, low impact facility which will be fully buried with a minimum coverage of 1 m, as shown in Figure 2-7.

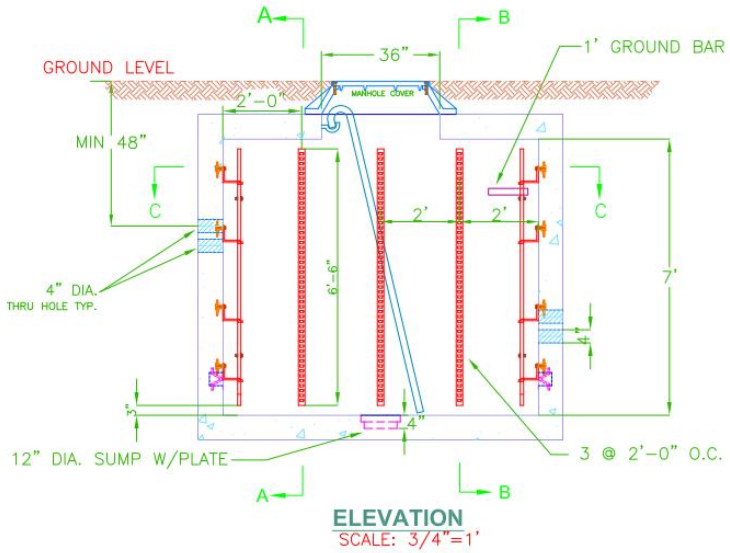


Figure 2-7: Generic BMH Schematic (TE Subcom)

2.5 Survey and Construction Works

This section provides a brief description of the marine Cable Route Survey that will be undertaken to determine the exact installation methodology. A description of the available installation methods is also contained thereafter.

2.5.1 Cable Route Survey

Prior to installation a survey of the proposed route will be carried out with the main objective to confirm or amend the proposed preliminary route to ensure it is suitable for cable system design, deployment, survivability and subsequent maintenance. The survey will also enable confirmation of the required marine installation procedures, and the extent of cable armouring through identification of seafloor characteristics.

In the event that additional data is required for the seafloor characteristics, such as places of intended cable burial, core samples will be taken approx. every 10 km in order to confirm substrate conditions.

Details of type of survey equipment to be used and associated acoustic outputs are found below in Table 2. Sound energy density levels are below threshold of disturbance to marine mammals of 160 dB re 1µPa2 which is explored further in Section 4.

Table 2: EGS Survey Specifications

Survey Equipment	Operating Frequency (kHz)	Source Level (dB re 1µPa-m)	Pulse Length (ms)	Pulses per Second (Hz)	Sound Levels Received at 500m from Source	
					Sound Pressure Level (dB re 1µPa)	Sound Energy Density Levels (dB re 10^{-6} μPa^2-s)
Single Beam Echosounder						
Kongsberg EA400 Dual Frequency	38	213	0.2	5	178.5	124.3
	200	213	0.1	5	141.6	91.8
Multi-Beam Echosounder						
Reson 7150-F	12	229	0.15	1	198.4	138.0
	24	230	0.15	2	198.0	140.5
Reson 8125	455	224	0.05	10	123.0	73.6
Side-Scan Sonar						
Edgetech FS4200 Dual Frequency (incl. in TVD combined system)	100	235	0.1	10	186.7	133.7
	450	235	0.05	10	134.7	85.2
Ultra-Short Baseline (USBL) Beacons						
Kongsberg HiPAP USBL	25	202	8	4	175.0	112.0
Pinger & Boomer Profilers						
GeoAcoustics 2x2 (incl. in TVD combined system)	2	205	1	4	176.9	116.9
4x4 Pinger array	2	214	1	3	183.9	123.9
C-Products LVB C-Boom	0.8	220	1	4	190.0	127.0

(EGS, 2015)

2.5.2 Cable Installation Method

The installation method will vary over the course of the cable route and is highly dependent on the nature of the seabed and the water depth. Burial from the shore to up to 1500 m water depth is normally recommended, and is the methodology planned by Hawaiki, to mitigate risk of fouling from human interactions. However, the SSPZ affords cable owners privileges and protections within this special zone, and the risk acceptance of surface laying a cable in (relatively) shallow waters may be acceptable in parts to the Proponent. Typical installation methodologies are detailed below.

Table 3: Description of installation methods

Installation Methods	
Surface laying on seabed:	This method simply consists of laying the cable directly onto the seabed and is suitable for a low risk, deep water (>1,500 m) region where constraints on the cable are expected to be minimal. The cable is laid on the ocean floor with sufficient slack to allow the cable to conform to the natural contours of the seabed. Selective placement in areas of relatively ambient ocean conditions together with the weight of the cable system ensures it remains in position.
Burial by Ploughing	Burial of the cable is a method commonly chosen in water depths up to 1500 m, in soft sandy sediments. This is a traditional cable laying technique as well as the most common and most efficient burial method. The plough is towed on the seabed behind the cable ship. The cable passes through the plough and is buried into the seabed. The ploughshare opens a furrow of approx. 0.3 m width such that the cable can be inserted inside, and allows sediment to return. The disturbed footprint of the dragged plough varies with type of plough used and has been conservatively assumed to not exceed 10 m width. Target burial depth is 1.5 m. A preliminary activity preceding the main laying and ploughing operations in areas of high human activity, is a seabed clearance operation called a Pre Lay Grapnel Run. A grapnel is towed behind the cable ship following the planned cable route to remove items of debris such as abandoned fishing nets, wires, hawsers etc. Due to the nature of some areas of seabed where mobile sediments are found, cables buried at the time of installation may become exposed over time; however, sufficient slack in the system should prevent any undermining and bridging of large sections.

Installation Methods	
Post-Lay Inspection and Burial	Following the plough burial, a post lay burial and inspection is normally carried out in areas where the plough could not bury the cable safely, such as at cable and pipeline crossings, steep slopes, and locations with unsatisfactory ground conditions etc. This burial is carried out by a Remotely Controlled Vehicle (ROV), which buries the cable to the same target depth as the main lay plough by use of water jetting. This operation also minimises seabed disturbance. Depending on the nature of the seabed, this method can normally achieve burial depths of up to 1.5m, with slopes the limiting factor. Specialised equipment can achieve burial depths of up to 3m.
Horizontal Directional Drilling	Horizontal Directional Drilling (HDD) will be used for the approx.1,000 m shore crossing from the BMH to the pop-out point within the SSPZ. Generally, HDD techniques are used for the steerable installation of new pipelines, ducts and cables, where other methods are unfeasible. The drill path will be gradually curved, and the direction of the drilling head can be adjusted at any stage during the initial pilot bore to steer around or under obstacles. Installation of the product pipe of duct is by either a drill and leave process or a drill, recover and install process. In the first scenario, when the drill “pops out" of the seabed, the drill head assembly is removed by divers and the drill pipe is left in situ. In the second scenario, once the "pop out" has been achieved, the drill pipe is recovered back through the HDD bore and the product pipe or duct is then installed into the HDD bore. Most guided horizontal boring machines use a drilling fluid, which lubricates and stabilises the bore, and also conveys the excavated material in suspension. The proposed drill fluid is non-toxic bentonite that will be recovered and disposed of in an EPA approved facility.

2.5.3 Schedule, Operations, Maintenance

Survey Schedule

A preliminary schedule for the marine Cable Route Survey (CRS) has been devised, with the survey vessel aiming to be within Australian waters in December 2016, approvals and permits notwithstanding. Although the survey instruments operate at an acceptable frequency, the schedule has still been considered to avoid, where possible, interaction with the expected migratory whales.

If unforeseen circumstances are encountered that delay the survey ship, there is a large four month contingency window before migratory whales are expected as can be seen in Table 4

The survey duration within Australian waters (including around Norfolk Island) is estimated as 27.5 days; however, for the purpose of this assessment we have conservatively used 50 days to allow for contingencies.

Installation Schedule

The cable installation is tentatively scheduled for Q3 2017; however, is dependent upon the weather, permits, and the following key factors resulting from the findings of the CRS

- Oceanographic factors;
- Bathymetry / Substrate;
- Water depth;
- Cable placement method and in turn rate of placement of the cable.

The timing in Australian waters has been proposed to align with whole-of-project scheduling, which happens to fall in the whale migration period. However, the average service speed of the cable ship is only approx. 0.5 knot for installing armoured cable (Southern Right Whales cruise at 1.6 kn (NSW OEH, 2014)), and marine mammal observers are expected on board. As such, the impact of this activity on migratory cetaceans is expected to be low, as interactions with whale pods can be avoided or minimised through available operational controls (discussed further in Section 4.2). Similarly, although the activities are scheduled to begin within the whale migration period, by commencing in the middle of the period there is a possibility of avoidance of the pods having travelled north and not yet returned south.

Key stages of the construction schedule including associated mobilisation and demobilisation are:

- BMH installation (low impact under legislation refer Section 3)
- HDD conduit from BMH (low impact under legislation refer Section 3)
- Cable installation through various techniques described in Table 3
- Commissioning of the network

Operations and Maintenance

The operational design life of a submarine cable is typically 25 years. During operation, maintenance activities are not expected to be required. However, in the event that maintenance is necessary (i.e. due to damage or failure) recovery would involve the use of a cable ship in order to locate and retrieve the cable, identify the fault and carry out the required repair. Depending on the location of the fault, cable recovery can either be undertaken using a grapnel or an ROV.

The most appropriate method in regards to surrounding environment, ground conditions and available plant and equipment, would be selected at the time; both techniques used in recovery are similar to those described in the installation and so are covered within that assessment.

2.5.4 Sensitive time windows

Windows of ecological sensitivity for environmental values identified within the cable corridor are summarised in Table 4 – note that the Cable Route Survey begins December 2016, and the Cable installation is scheduled to commence the following Q3/Q4 2017.

Table 4: Summary of sensitive time windows

Threatened species	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Survey & cable laying							(Earliest) Cable laying commence (2017)					Cable surveying (2016)
Blue whale, Sei whale, Fin whale					Migration to/from feeding areas to calving/wintering areas.							
Southern right whale					Annual migration from summer feeding grounds (in Antarctic waters) to tropical breeding grounds, returning by late spring. Migratory pathways of this species will be crossed by the cable corridor.							
Humpback whale					Annual migration from summer feeding grounds (in Antarctic waters) to tropical breeding grounds, returning by late spring. Calving may take place along the NSW coast. Migratory pathways of this species will be crossed by the cable corridor.							
Loggerhead turtle	Likely to be present as a transient visitor to the cable corridor - SSPZ. Breeding does not occur in the region.											
Green turtle	Likely to be present as a transient visitor to the cable corridor - SSPZ. Breeding does not occur in the region.											
Great white shark	Likely to be present throughout the year.											
Whale shark	May be present as a transient visitor to the area. May also breed in area, but biological data is limited for this species.											
Marine threatened birds	Marine threatened birds may be present and foraging throughout the year. No known breeding areas are within or near to the cable corridor.											
Migratory marine mammals	May be present as a transient visitor to the area.				A number of species undertake an annual migration from summer feeding grounds (in Antarctic waters) to tropical breeding grounds, returning by late spring.							May be present as a transient visitor to the area.
Migratory sharks	Majority of species may be present as a transient visitor to the area. However, lamnids (e.g. makos) likely to occur throughout the year.											
Migratory marine birds	May be present as a transient visitor to the area.				A number of species undertake an annual migration from southern waters to tropical/temperate wintering grounds, returning by late spring.							May be present as a transient visitor to the area.

	Survey activities and cable laying will occur throughout the year, and are conservatively assumed to run for a period of 50 and 150 days, respectively
	Peak period of activity – presence reliable and predictable – likelihood of occurrence within the cable corridor is high
	Lower level of abundance/activity/presence – may occur within cable corridor
	Activity not known to occur – unlikely to occur within cable corridor

3. Legislation and Associated Stakeholder Engagement

3.1 Legislation relevant to the Hawaiki Submarine Cable

The notification and approvals that are required for the installation of the Cable have been identified to fall under the following three jurisdictions:

1. Commonwealth agencies
2. NSW State Government; and
3. Local Government - Randwick City Council (RCC)

In particular, the four legislations outlined below are key for the approval process.

3.1.1 Telecommunications Act 1997– Schedule 3A

Installation of fibre optic submarine cables fall under the Commonwealth *Telecommunications Act 1997 (Cwth)*. This Act regulates the service provision to consumers by telecommunications carriers. Under Schedule 3A to the Act, and in accordance with the Australian Communications Media Authority (ACMA), deployment of a submarine cable requires an environmental assessment to be undertaken and that all required approvals/notifications for the project are obtained.

Schedule 3A to the Act regulates the installation of certain submarine cables that are connected to places in Australia. Carriers who intend to install certain submarine cables in certain Australian waters must apply for a permit to do so from the ACMA.

Under specific sub-clauses within Schedule 3A and the Telecommunications (Low-impact Facilities) Determination 1997, the BMH as an underground housing, and the HDD method of installation are both considered “low impact”. Declaration of these as “low impact facilities”, allows the installation of these with only notification required to stakeholders. Please refer to Appendix A for a full breakdown of the relevant subclauses.

3.1.2 Commonwealth Environment Protection and Biodiversity Act 1999

The Environmental Assessment falls under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) administered by the Commonwealth Department of Environment (DoE).

This legislation protects the environment, including matters of National Environmental Significance (Protected Matters) (NES) such as Commonwealth marine areas and Commonwealth listed threatened and migratory species (including matters within State jurisdictions). The EPBC Act also covers matters under the *Native Title Act 1993* and *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*.

This Environmental Assessment forms part of the EPBC Act Referral approval process.

3.1.3 Coastal Protection Act 1979

This Act makes provisions relating to the use and occupation of the coastal region of NSW (i.e. out to 3 nm) in order to preserve and protect these areas whilst encouraging sustainable use of the areas. This is a State Act administered by the OEH.

Under this Act, the Cable is deemed exempt development in coastal waters, which has been formally agreed with OEH, meaning no further approvals are required. Please refer to Appendix A for a full breakdown of the relevant subclauses.

3.1.4 State Environmental Planning Policy Infrastructure 2007

Telecommunication facilities are covered under this SEPP and are consistent with our understanding that no development applications are required by the State. SEPPs are administered by the NSW Department of Planning and Environment under the EP&A Act and are intended to facilitate streamlining of planning and permitting processes.

The SEPP defines all of the installations: Cable within coastal waters, the BMH and Cable from BMH to coastal zone as Exempt Development, i.e. no further State approvals are required. Please refer to Appendix A for a full breakdown of the relevant subclauses.

3.1.5 Other legislation considered

A complete list of legislation, State and Commonwealth, which has been considered for the installation of the telecommunications cable is presented in Table 5. A brief description of the relevance of the legislation is also provided, whilst a detailed assessment can be found for the relevant issues in the appendices.

Table 5: Other Relevant Legislation investigated

Legislation	Administrator	Relevance to Project
Commonwealth *Historic Shipwrecks Act 1976*	Department of Environment	*Historic Shipwrecks Act 1976* protects historic wrecks and relics in Commonwealth waters, extending from below the low water mark. For the purposes of this study, any shipwrecks within the Australian EEZ would be under the jurisdiction of this Act. The study has found numerous archaeological sites within 500 m either side of the cable route which is detailed further.
Commonwealth *Native Title Act 1993*	Federal Court of Australia, National Native Title Tribunal	The Native Title Act 1993 has been enacted to recognise the rights of indigenous inhabitants of Australia. The study has found there are no Native Title Applications or Determinations within the BMH site
NSW Heritage Act 1977 (amended 1999)	Office of Environment and Heritage (NSW)	State legislation affording protection to all items of environmental heritage (natural and cultural) in New South Wales. "Items of environmental heritage" include *places, buildings, works, relics, moveable objects* and *precincts* identified as significant based on *historical, scientific, cultural, social, archaeological, architectural, natural* or *aesthetic* values. The study has identified numerous archaeological sites 500 m either side of the cable route detailed further in Section 4.3; however, none directly in the cable route.
Crown Lands Act 1989	Department of Industries - Lands	This act sets out processes and principles for using and managing Crown land. The Act enables covenants to be placed over Crown land to protect environmental and cultural and heritage values before the land is sold or transferred As the cable is proposed to be installed on Crown Reserves (managed by RCC) an easement may be applied for to protect the cable. Given the cable's national significance, compulsory acquisition is likely an option.
Environmental Planning and Assessment Act 1979	Department of Planning and Environment	The objective of the *EP&A Act* is to protect the environment of the State. The SEPP 2007 provided under this Act expects that no significant environmental impacts will be encountered from the installation of this cable. As such, no approvals are required under this act.
Lord Howe Island Act 1953	Lord Howe Island Board / OEH	An Act to make provision for the care, control and management of Lord Howe Island. Cable does not land in Lord Howe, or encroach on coastal waters. No approvals required.
Norfolk Island Act 1979	Department of Infrastructure and Regional Development (Cwth)	An Act to make provision for the care, control and management of Norfolk Island – defaults to Cwth and NSW laws. Cable does not land in Norfolk Island, or encroach on coastal waters. No approvals required.

Legislation	Administrator	Relevance to Project
Offshore Petroleum and Greenhouse Gas Storage Act 2006 *(Cwth)*	National Offshore Petroleum Titles Administrator	Legislation setting out regulations for Offshore Petroleum permits. The Cable initially crossed an Exploration concession block; however this has since been revised
Aboriginal Land Rights Act 1983	Aboriginal Land Council/ Department of Industries - Lands	This Act is a compensatory regime which recognises that land is of spiritual, social, cultural and economic importance to Aboriginal people, and allows Local Aboriginal Land Councils to make claims on Crown Land – Lands are the determining authority. Both BMH locations have current undetermined Aboriginal Land Claims; however, Lands are still able to permit the proposed works under their existing authority
Defence Force Regulations 1952	Department of Defence	This Act sets out regulations relating to Australia's military interest. The Cable passes through Defence training areas, as such, vessel operators must notify DoD of intent to enter these areas.

3.2 Stakeholder Engagement

Engaging with relevant stakeholders is a key component of any large scale infrastructure project.

As this Cable is landing within the SSPZ and protected under the Telecommunications Act 1997, and the SEPP 2007 defines this type of project as Exempt Development, the list of relevant stakeholders becomes streamlined, with the level of detail in the consultation mostly limited to notifications as to align with the recommendations in the *Telecommunications Code of Practice 1997*.

A Stakeholder Engagement program was still undertaken where any perceived conflicts (on water use) with the Cable arose through duration of this Environmental Assessment study. It is understood that the proponent will continue with the relevant engagement through the project life cycle – this is particular important in regard to Fisheries during the marine Cable Route Survey as well as the Cable Installation. A summary of the consultations undertaken to date can be found below in Table 6.

Table 6: Stakeholder Engagement Summary

Stakeholder	Responsibility	Nature of Contact
Randwick City Council	Manager of potential BMH locations - Crown Reserves in Coogee	Letter/email/phone
Department of Industries - Lands	Responsible for Crown Lands and Reserves Determining authority for Aboriginal Lands Claims on Crown Reserves	Email/phone
NSW Department of Primary Industries - Fisheries	Administer of fisheries laws governing the fisheries resources of the State	Letter/email/phone
Various State Fisheries	Recreational and commercial fisheries	Public Consultation Flyer
Australian Fisheries Management Authority (Cwth)	Australian Government agency responsible for the efficient management and sustainable use of Commonwealth fish resources	Email/phone - Various Fisheries managers
South East Trawl Fisheries Association	A not-for-profit industry association representing quota owners fishermen and sellers in the south east trawl fishery	Email/phone
Office of Environment and Heritage NSW	Administrator of the Coastal Protection Act 1979	Letter/email/phone
Australian Communication and Media Authority (Cwth)	Administrator of the *Telecommunications Act 1997 (Cwth)*	Meeting
Department of Environment (Cwth)	Administrator of the *EPBC Act*	Meeting

4. Environmental Impact Assessment and Recommendations

An environmental impact assessment has been undertaken to investigate the effects of the marine route survey, the installation of the cable and any potential maintenance works. The following sections provide a summary of this assessment, recommended mitigation measures, and subsequent outcomes. Full descriptions of the existing environment, which have been used to inform the following sections, are provided in Appendix A .

4.1 Physical Environment

The following tables (Table 7 to Table 15) consider the potential impacts that the laying, securing and maintenance of the cable may have on the existing physical environment, management controls to minimise these potential impacts, and the predicted outcomes. As the cable is predominatly in deep water around Lord Howe Island and Norfolk Island, the impacts of the Cable on the physical environment are expected to be negligible, except where noted below.

Table 7: Bathymetry

Physical Environment Element	Available Management Controls	Predicted Environmental Outcome
Water depth variations can lead to constraints during the placement and maintenance of a cable. Thus work methods need to be adapted to the local depth.	Near Coogee, the cable shoreline crossing would be undertaken using a HDD machine from the beach manhole to an offshore location in approximately 20 m water depth.	The bathymetry along the cable route is not expected to be affected by the placement and maintenance of the cable.
See above.	Offshore of the pop-out point, the cable would be laid and buried using a range of techniques (surface lay, plough, jetting). In water depths too shallow for the cable ship to access safely and/or too close to coastal features (e.g. reef), divers will need to carry out the works including at the pop-out point.	The bathymetry along the cable route is not expected to be affected by the placement and maintenance of the cable.

Table 8: Seabed Conditions

Physical Environment Element	Available Management Controls	Predicted Environmental Outcome
The cable route offshore of Coogee and across the continental shelf will encounter a range of sediment types and features which may lead to some rerouting or alternate installation techniques.	The proposed cable route will aim to avoid hard ground as best as possible however if hard substrate is encountered, extra cable armouring (SL17DA) can be used to limit issues of possible movement and abrasion of the cable against the rock as well as minimising any potential impact on rock reef/algae habitat.	Should significant sediment transport occur during a storm or cyclone (swell) event, localised erosion and sedimentation may occur. Sedimentation is not anticipated to be an issue as it will simply provide additional cover for the cable. Should erosion next to hard ground occur it is expected that the additional slack will allow for the cable not to be undermined (and placed in tension) and to remain at rest on the seabed.
See above.	If hard ground is encountered, the armour of the cable will be increased and additional slack will be deployed to minimise risks of cable strum (vibration). The depth of the soft seabed material over firmer strata will be confirmed with further geotechnical samples taken during the survey and this will assist with refining the cable route and confirming the feasibility of the proposed construction methodology.	At this stage a slack allocation of 0.25% to 0.90% is suggested for burial areas and an allocation of greater than 3% for all other areas. The slack requirements will be adjusted based on seabed gradients and anticipated seabed roughness once the survey is complete. Although strong currents during storm events may have the potential to affect the seabed morphology, this is generally expected to only be minimal in water depths greater than 20 metres.

Table 9: Water Level Variation

Physical Environment Element	Available Management Controls	Predicted Environmental Outcome
Water level variation and storms have the potential to affect placement of cables.	The cable laying campaign will monitor weather patterns and storm events in order to minimise the potential impact on the cable installation.	The proposed cable installation is not expected to affect this element of the physical environment.
Near Coogee, tidal variations are small in particular compared to the nearshore water depth.	The proposed construction methodology will include HDD in the shallow area beneath the seabed. The water level variation is expected to have little impact on the cable or cable operations.	The proposed cable installation is not expected to affect this element of the physical environment.
The topography of Coogee residential area and surrounding land is generally on elevated ground and not subject to flooding during peak tides and/or storm surge. The proposed BMH is to be located on elevated ground at Trennery Reserve.	It is understood that all equipment and connection within the BMH will be waterproof and consequently flooding arising from rain run-off of the BMH is not considered an issue.	The proposed cable installation is not expected to affect this element of the physical environment.

Table 10: Wave Climate

Physical Environment Element	Available Management Controls	Predicted Environmental Outcome
The NSW coast is subject to a moderate wave climate predominantly from the south to south-east with an average offshore significant wave height of about 1.5 m.	Nearshore waves should not affect the cable as the cable would only emerge near the seabed at about 20 m water depth (via HDD). At this depth, the effect of wave driven currents under ambient conditions is minimal. Generally, wave heights and periods should not pose a problem during survey or installation; the dominant risk to the inshore area is large swells during storm events. It is preferable that the cable work be undertaken during summer or spring with careful planning based on available weather forecast in order to avoid potential storm events.	The placement and maintenance of the cable is not expected to affect the wave climate offshore and along Coogee Beach. This is because the cable footprint beyond the pop out point is not significant enough to affect wave processes and wave propagation.

Physical Environment Element	Available Management Controls	Predicted Environmental Outcome
Under extreme storm wave events, large waves will create strong currents near the seabed, especially in the nearshore area, which have the potential to mobilise sediment.	It is understood that the construction measures proposed (i.e. HDD to 20 m contour) will prevent any potential movement of the cable under extreme wave conditions in the nearshore.	See above.
Waves may affect cable placement and maintenance activities	Whilst there would be times during storms when wave conditions would be too rough for placement or maintenance of the cable, significant periods of calm would exist for the work to be safely carried out. It is preferable that the cable work be undertaken during summer or spring with careful planning based on available weather forecast in order to avoid potential storm events.	See above.

Table 11: Winds

Physical Environment Element	Available Management Controls	Predicted Environmental Outcome
Strong winds may occur during storm events. Such winds can affect cable placement and maintenance activities and it is expected that there will be periods when gale force wind conditions will prevent the placement or maintenance of the cable	This would be an infrequent occurrence and one that could be managed with good planning based on the available weather forecast.	The placement and maintenance of the cable is not expected to affect local wind patterns.

Table 12: Currents

Physical Environment Element	Available Management Controls	Predicted Environmental Outcome
Wind-induced and tidal currents in the study area are relatively small and mitigation construction measures will be considered in order to limit potential cable movement and cable suspension in areas of irregular terrains	Nearshore currents should not affect the cable as the cable would only emerge near the seabed at about 20 m water depth (via HDD) which is offshore of any significant effect by wave driven currents under ambient conditions	The placement and maintenance of the cable is not expected to affect the current patterns offshore and along the beaches as the cable footprint beyond the pop out point is not anticipated to be significant enough to affect current processes.

There is potential for the cable to become suspended on features above the seabed during placement under strong currents.	To minimise this risk, a marine route survey along the proposed route would be undertaken to establish the existence of any features that could possibly lead to suspension of the cable above the seabed. In these areas, armouring of the cable could be specified.	See above.

Table 13: Sediment Mobility during Storms and Shoreline Stability

Physical Environment Element	Available Management Controls	Predicted Environmental Outcome
Storm erosion of beach profile	Based on the existing data and prediction at the site it is understood that the HDD pop-out will be located beyond the depth where storm erosion is significant. It is understood that the HDD will be at least 3 m below the existing bed in order for the cable not to be exposed under an extreme storm erosion event. With a predicted beach erosion of about 2-3 m in the vertical for an extreme event, it is anticipated that the HDD cable duct will not be exposed. Should the HDD duct to be exposed, site inspection and maintenance measures would then be put in place.	Low probability of short term exposure of the HDD duct.
Erosion in the vicinity of the BMH.	BMH is to be located at the top of a rocky cliff and inland of the predicted setback.	No impact expected.

Table 14: Noise

Physical Environment Element	Available Management Controls	Predicted Environmental Outcome
Noise pollution due to cable installation activities.	The activities associated with the placement of the cable offshore should not cause an unacceptable noise impact on the nearest residents given the pop out point is approx. one kilometre offshore.	Temporary localised mechanical noise within the proximity of the installation is expected to be heard in particular close to the HDD machine. It is good practice to notify local residents of construction works as part of the general notification procedures to stakeholders and should be undertaken by Drilling contractor when works dates are known.

Table 15: Natural Hazards

Physical Environment Element	Available Management Controls	Predicted Environmental Outcome
There is a very small likelihood of a significant tsunami occurring on the NSW coast.	The BMH will be above the predicted run up level.	Marine activities would be stopped and standard tsunami evacuation and marine safety guidelines would be adhered to.
Geological features: Earthquakes and faults.	The DTS has Identified and avoided any known significant hazards. Further details of geological features/processes will be reviewed during the marine route survey. The outcomes of this survey may influence the cable placement method.	Marine activities would be stopped and standard marine safety guidelines would be adhered to.

4.2 Marine Ecology

The following tables summarise the detailed assessments of the known and likely environment where the cable is proposed to be installed (Appendix A and Appendix B) and an ecological risk assessment (Appendix C) of the hazards relating to the cable installation.

Summaries include descriptions of the natural and physical resources, the qualities and characteristics of locations, places and areas, and the heritage value of places that may be affected by the proposed cable corridor through NSW State and Commonwealth waters. The assessment considers the onshore, nearshore and offshore habitats traversed by the cable corridor within both the Southern Sydney Protection Zone (SSPZ) and the Non-Protection Zone (NPZ). The NPZ description is inclusive of all Australian Waters that are not designated cable protection zones, not to be confused with habitat protection zones.

Activities associated with the cable-related installation have been assessed to identify potential impacts on the biological environment, and the level of risk associated with that potential impact. The assessment was used to determine the type of available management controls that may be implemented.

Table 16: Onshore habitat

Biological Element	Existing Environment Summary	Biological Risk Assessment Summary	Available Management Controls	Predicted Environmental Outcome with Controls
Onshore habitat at Coogee	Rocky headland with urban recreational park	Potential impacts to the onshore habitat at Coogee: • Localised, physical disturbance to the urban environment within Trenerry Reserve associated with horizontal direct drilling (HDD) such as soil removal (as the sites are cleared, no vegetation should be removed) • Noise generation from use of HDD and impact on sensitive receptors • Physical and chemical disturbance of ecology from the HDD fluids	• Good practice guidelines in HDD and experienced contractor EMPs for management of fluid and waste releases and noise generation. These could include bunding, recycling of HDD fluids, and full recovery and disposal of drilling waste at an EPA approved facility. • Appropriate maintenance of HDD machinery • Use of a non-toxic HDD lubricant • Rehabilitation of any disturbed land	Impacts to the shoreline habitat at Coogee are expected to be localised, restricted to the HDD period and minor with the prescribed management measures in place.
Onshore habitat in the region	Sandy beaches Rocky shoreline	Potential impacts to the shorelines in the region include: • Chemical and physical impacts to shoreline habitats through unplanned release of hydrocarbons, environmentally hazardous chemicals, waste and other pollutants	• Appropriate maintenance to machinery • Appropriate waste disposal strategies for HDD cuttings and waste in alignment with the provision of relevant legislation • Appropriate on vessel waste management systems for survey and cable ships • Valid and current Shipboard Oil Pollution Emergency Plan (SOPEP) and Shipboard Marine Pollution Emergency Plan (SMPEP) • Adherence to MARPOL, Marine Orders and Protection of the Sea (Prevention of Pollution from Ships) Act 1983, International Convention of the Safety of Life at Sea (SOLAS) 1974 and the Navigation Act 2012. • Notification to Australian Government agencies (AHO and Australian Maritime Safety Authority (AMSA))	Cable installation activities are not expected to impact on shorelines in the region with the prescribed management measures in place.

Table 17: Nearshore shallow water benthic habitat (SSPZ)

Biological Element	Existing Environment Summary	Biological Risk Assessment Summary	Available Management Controls	Predicted Environmental Outcome with Controls
Shallow water benthic habitat along cable corridor within the SSPZ (zone with water depth < 20 m)	• Rocky reef • Macroalgal beds	Potential impacts to shallow benthic habitats include: • Physical disturbance of benthos from the HDD punch out point • Physical and chemical disturbance of benthos from the HDD fluids • Disturbance from an unplanned translocation of an invasive pest species	• Ecologically sensitive areas will be bypassed as the HDD will be undertaken beneath such habitat • Use of a non-toxic HDD lubricant • Minimise the discharge of bentonite to the sea, by ceasing pumping operations prior to the drill head penetrating through the seabed. • Reduce rate of pumping as the drill head approaches the punch out point • If vessel anchoring is required, it will be avoided in any ecologically sensitive areas such as rocky reefs and macroalgal beds • Adherence to Australian Quarantine and Inspection Service (AQIS) guidelines on quarantine and ballast water exchange • Adherence to International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001 (IMO, 2001; ratified on 17 September 2008) and follow the "*National Biofouling Management Guidance for Non-Trading Vessels*"	Any potential disturbance to nearshore benthic habitat is expected to be localised, restricted to the HDD period and minor with the prescribed management measures in place.
Nearshore water benthic habitat along cable corridor within the SSPZ (water depth 20 m – 1,500)	• Rocky reef • Macroalgal beds • Largely soft sandy sediments and associated infauna and epibenthos	• Physical disturbance from ploughing activities for cable burial • Physical disturbance from water jetting activities for cable burial • Physical disturbance from vessel anchoring • Physical disturbance from an unplanned dropped object to the sea floor • Disturbance from an unplanned translocation of an invasive pest species	• Cable burial activities to be restricted to the cable alignment • Sea-fastening of vessel objects • Appropriate on-board lifting techniques • Appropriate maintenance to vessel and machinery • Adherence to MARPOL, Marine Orders and Protection of the Sea (Prevention of Pollution from Ships) Act 1983, International Convention of the SOLAS 1974 and the Navigation Act 2012 • Adherence to AQIS guidelines on quarantine and ballast water exchange	Any potential disturbance to nearshore benthic habitat is expected to be localised, restricted to the ploughing or water jetting period and minor with the prescribed management measures in place. Recovery of disturbed habitat will be over time.

Biological Element	Existing Environment Summary	Biological Risk Assessment Summary	Available Management Controls	Predicted Environmental Outcome with Controls
			• Adherence to International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001 (IMO, 2001; ratified on 17 September 2008)	
Shallow water benthic habitats in the region	• Rocky reefs • Macroalgal communities • Soft sediments and associated infauna and epibenthos • Coral reefs • Seagrass beds	Potential impacts from the activities to shallow water benthic habitats in the region include: • Chemical and physical impacts to shallow water benthic habitats through unplanned release of hydrocarbons, environmentally hazardous chemicals and dropped objects to the marine environment	• Sea-fastening of vessel objects • Appropriate on-board lifting techniques • Appropriate maintenance to vessel and machinery • Valid and current SOPEP and SMPEP • Adherence to MARPOL, Marine Orders and *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, International Convention of the SOLAS 1974 and the *Navigation Act 2012*. • Notification to Australian Government agencies (AHO, AMSA)	Cable installation activities are not expected to permanently impact on nearshore habitats in the region with the prescribed management measures in place.

Table 18: Offshore deep water benthic habitat (SSPZ and NPZ)

Biological Element	Existing Environment Summary	Biological Risk Assessment Summary	Available Management Controls	Predicted Environmental Outcome with Controls
Deep water benthic habitat along cable corridor within SSPZ and NPZ (water depths > 1,500 m)	• Largely soft sandy sediments and associated infauna and epibenthos • Key Ecological Features (Tasman front and eddy field and Norfolk Ridge) • Cable passes through Commonwealth Marine Reserves (Lord Howe Habitat Protection Zone (IV) and Norfolk Multiple Use Zone (VI))	Potential impacts to deep water benthic habitats include: • Physical disturbance from ploughing and water jet burial • Physical disturbance from direct cable placement on seabed • Physical disturbance from vessel anchoring (if shallow enough) • Physical disturbance from an unplanned dropped object to the sea floor	• Ecologically sensitive areas will be identified through the site survey and avoided if possible • Sea-fastening of vessel objects • Appropriate on-board lifting techniques • Appropriate maintenance to vessel and machinery • Adherence to MARPOL, Marine Orders and Protection of the Sea (Prevention of Pollution from Ships) Act 1983, International Convention of the SOLAS 1974 and the Navigation Act 2012 • Adherence AQIS guidelines on quarantine and ballast water exchange • Adherence to International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001 (IMO, 2001; ratified on 17 September 2008) and	Any potential disturbance to offshore deep water benthic habitat is expected to be localised, with recovery of disturbed habitat occurring over time.

Biological Element	Existing Environment Summary	Biological Risk Assessment Summary	Available Management Controls	Predicted Environmental Outcome with Controls
		• Physical disturbance from pinning the cable to hard substrate (not expected) • Unplanned translocation of an invasive pest species	follow the "*National Biofouling Management Guidance for Non-Trading Vessels*"	
Deep water benthic habitats in the region	• Largely soft sandy sediments and associated infauna and epibenthos • Seamount chains • Coral reefs associated with Lord Howe and Norfolk Islands • Other KEFs (canyons of the eastern continental slope) • Other Commonwealth Marine Reserves (Lord Howe Habitat Protection Zone IV and Norfolk Marine National Park Zone II)	Potential impacts to deep water benthic habitats in the region include: • Chemical and physical impacts to deep water habitats through unplanned release of hydrocarbons, environmentally hazardous chemicals and dropped objects to the marine environment • Unplanned translocation of an invasive pest species	• Appropriate maintenance to vessel and machinery • Valid and current SOPEP and SMPEP • Adherence to MARPOL, Marine Orders and *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*, International Convention of the SOLAS 1974 and the *Navigation Act 2012.* • Notification to Australian Government agencies (AHO, AMSA) • Adherence to MARPOL, Marine Orders and Protection of the Sea (Prevention of Pollution from Ships) Act 1983, International Convention of the SOLAS 1974 and the Navigation Act 2012 • Adherence AQIS guidelines on quarantine and ballast water exchange • Adherence to International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001 (IMO, 2001; ratified on 17 September 2008) and follow the "*National Biofouling Management Guidance for Non-Trading Vessels*"	Cable installation activities are not expected to impact any other regional deep water habitats with the prescribed management measures in place.

Table 19: Terrestrial and marine fauna

Biological Element	Existing Environment Summary	Biological Risk Assessment Summary	Available Management Controls	Predicted Environmental Outcome with Controls
Terrestrial fauna	• Mammals • Birds	Potential impacts from the activities to terrestrial fauna include:	• Drilling equipment and other plants are maintained in accordance with manufacturer specifications	Impacts to terrestrial fauna are expected to be minimal with the

Biological Element	Existing Environment Summary	Biological Risk Assessment Summary	Available Management Controls	Predicted Environmental Outcome with Controls
		• Behavioural impacts to terrestrial fauna from cable-related activities, e.g. light, noise or vibrations		prescribed management measures in place.
Marine fauna	• Marine mammals • Marine reptiles • Marine birds • Fish	Potential impacts from the activities to marine fauna include: • Physiological and or behavioural impacts to marine fauna from cable-related emissions, e.g. light, noise/acoustic or vibrations • Physical and chemical disturbance from the HDD punch out point. • Chemical and physical impacts to fauna through an unplanned release of hydrocarbons, environmentally hazardous chemicals to the marine environment • Physiological and or behavioural impacts from vessel interaction including vessel traffic and vessel collision • Physiological impacts from entanglement of marine fauna with cables associated with seismic survey and/or cable laying equipment	• Ecologically sensitive areas will be identified through the site survey and avoided if possible • If vessel anchoring is required, it will be avoided in any ecologically sensitive areas • Use of a non-toxic HDD lubricant • Use of survey equipment with Sound energy density levels below threshold of disturbance to marine mammals of 160 dB re 1µPa2 • Slow vessel operation speeds • Sea-fastening of vessel objects • Appropriate on-board lifting techniques • Appropriate maintenance to vessel and machinery • Adherence to MARPOL, Marine Orders and Protection of the Sea (Prevention of Pollution from Ships) Act 1983, International Convention of the SOLAS 1974 and the Navigation Act 2012 • Adherence to AQIS guidelines on quarantine and ballast water exchange • Adherence to International Convention on the Control of Harmful Antifouling Systems on Ships, 2001 (IMO, 2001; ratified on 17 September 2008) and follow the “National Biofouling Management Guidance for Non-Trading Vessels” • Use of directional lighting and light shields • Vessel deck lighting switched off unless required under navigation or safety standards (AMSA Marine Orders) • Activities that generate underwater noise (ploughing, jetting) could be timed to pose the least threat to migratory mammals	Impacts to marine fauna are expected to be minimal with the prescribed management measures in place.

Biological Element	Existing Environment Summary	Biological Risk Assessment Summary	Available Management Controls	Predicted Environmental Outcome with Controls
			• Operations of vessels will be commensurate with Part 8 of the EPBC Regulations (Interacting with Cetaceans and Whale Watching) • The interaction of all vessels with cetaceans, pinnipeds and whale sharks will be consistent with Part 8 of the EPBC Regulations (2000) • Acoustic surveys will be undertaken in accordance with EPBC Act Policy Statement 2.1: Interaction between offshore seismic exploration and whales (DEWHA, 2008) • The Australian Guidelines for Whale and Dolphin Watching (DEH, 2006) for sea-faring activities will be implemented across the entire project. This includes the implementation of the following guidelines: – Caution zone (300 m either side of whales and 150 m either side of dolphins) – vessels must operate at no wake speed in this zone. – No approach zone (100 m either side of whales and 50 m either side of dolphins) – vessels should not enter this zone and should not wait in front of the direction of travel or an animal or pod. – Do not encourage bow riding. – If animals are bow riding, do not change course or speed suddenly. – If there is a need to stop, reduce speed gradually.	

Table 20: Biological/natural impacts on marine cables

Biological Element	Existing Environment Summary	Biological Risk Assessment Summary	Available Management Controls	Predicted Environmental Outcome with Controls
Marine fauna	Not applicable	• Biological induced corrosion (biofouling) has a possibility of occurring. • Marine fauna have been recorded, in rare	• Any exposed area of the cable is susceptible to marine organisms biofouling the cable, as such burying of the cable in shallower water to minimise risk of epiphytic growth and armouring of the cable in deeper waters are recommended.	Localised impact to established habitat on and adjacent to cable retrieved for repair, in the event of cable maintenance.

Biological Element	Existing Environment Summary	Biological Risk Assessment Summary	Available Management Controls	Predicted Environmental Outcome with Controls
		instances, damaging submarine cables and other oceanographic equipment through biting (Edbert, 2003). • In the event that cable repair activities are to be undertaken, such activities would directly impact on the existing habitat established on and adjacent to the cable.	• Occurrences of cable damage from marine fauna in deeper waters has been recorded in the slopes of continental shelves, as such, avoiding areas of steep elevation changes, as well burying and armouring the cable are recommended. • Unplanned cable recovery activities to be undertaken with minimum impact. Selection of grapnel sizes is to be based on smallest available to achieve required outcome.	

4.3 Other Impact Assessment and Recommendations

Full descriptions of the existing constraints are provided in Appendix A, the following section details the potential regulatory, commercial and heritage constraints associated with installing the proposed cable. Unless noted otherwise, the offshore sections of the cable around Lord Howe Island and Norfolk Island are not impacted under these headings.

Table 21: Regulatory Impact

Stakeholder	Issues Identified	Outcome
Department of Environment	Various;	A pre-referral meeting was held on 5 August 2016 to present the project and discuss the relevant issues, which have been addressed throughout this document and are highlighted in EPBC Act referral document
Parks (Department of Environment)	Cable to interact with proposed Commonwealth Marine Reserves (CMR) in the Temperate East Network • Cable passes by, but does not pass through proposed Central Eastern CMR • Lord Howe Habitat Protection Zone (IV) –Cable avoids Former Lord Howe Marine Reserve • Cable passes through Norfolk Island Multiple Use Zone (VI)	A Parks representative attended the pre-referral meeting and a Parks representative will be involved in review of this EA. All proposed CMRs are currently under Transitional Management Arrangements. For the CMRs listed, Director of National Parks has issued a list of approved actions which includes carrying out works and Commercial vessel transit (without any other activity being carried on. The proposed cable activities fit within this broad description of approved actions. If the proposed CMRs are gazetted between cable activities, Parks will refer to the standing EPBC Act decision
Department of Primary Industries - Fisheries	As the Telco Act 1997 (Cwth) excludes Coastal waters, State Fisheries, whose responsibility lies within coastal waters, must be consulted. In addition to the ecological issues surrounding biodiversity and biosecurity above, the social impact issues have also been considered with Fisheries: • Effects on Commercial fishing; and • Effects on Recreational fishing	A public consultation was undertaken for two week in June 2016, which was distributed by Fisheries to known users of the Peak Fishing zone (within the SSPZ). Responses revealed that existing users have no issues with the currently imposed fishing regulations. As Hawaiki are not intending to request to change the regulations, there will be no sustained impact on recreation and commercial fisheries in State managed waters.

Stakeholder	Issues Identified	Outcome
		The Ocean Trap & Line Fishery did not respond to the consultation flyer; however, it should be noted that demersal droplining and trap fishing are permitted within the SSPZ up to 100 m water depth, providing the line breaking strain is 850 kg or less. The Cable will either be buried or surface laid with SL17LWA. The breaking load of the cable is roughly 31,000 kg (306 kN), so the line should certainly break before the cable. Cable fouling from fishing is not expected to be a significant impact. Notification in advance of cable installation activities should be provided, so traps and pots can be removed from cable RPL.
Department of Defence	It was identified that: • The cable route passes through a number of military training areas • There may be ammunition dumps in proximity of the cable route	The military training areas are both flight zones and non flight zones. Notice must be given to Defence by vessel operators prior to entering these areas under Cwth law. An ammunition dump has been identified within 2.5 nm of the Cable RPL, however with a position accuracy of 2 nm. The CRS prior to installation will identify any large munitions, which can then be further identified in a detailed survey and/or removed by a suitable subcontractor -or avoided before installation. For the purpose of personnel safety, these dumps should be treated as live until shown otherwise. Defence generally advise that The Australian Hydrographic Office (AHO) requests a minimum of three weeks for the required notice prior to commencement of cable activities, with subsequent provision of bathymetric data in digital format.
Department of Industries – Lands/ NSW Aboriginal Land Council	The Cable may require a lease/licence or easement to exist in a Crown Reserve (BMH locations) Both potential BMH locations have existing Aboriginal Land Claims (ALC) initiated in 2009/10	Lands suggest as the Cable can be considered nationally important infrastructure a compulsory acquition easement over the Cable route from the BMH may be granted despite the existing ALCs.

Stakeholder	Issues Identified	Outcome
		As both BMH sites are utilised public reserves, Lands advise that the ALCs are likely not to be validated. As such, it would not be necessary to have the ALCs determined or seek consent from the claimant for the works to go ahead. Once a preferred site is selected it is understood that the drilling contractor will continue this engagement with Lands.

Table 22: Heritage and Aboriginal Affairs

Stakeholder	Issues Raised	Mitigation/ Response/ Recommendation
Office of Environment and Heritage (NSW)	The proposed cable route may potentially impact any State Heritage.	The proposed BMH location is in proximity to Wiley's Baths and McIver Women's Baths – public swimming areas on the cliff face at the south end of Coogee beach. The cable route from the BMH will be directed away from both sites, with the BMH a minimum of approx. 60 m away. As the BMH and cable are subterranean, defined as low impact under State legislation, and sufficiently far away, no impact to heritage values is expected at both Heritage listed sites
Department of Environment	The proposed cable route may potentially impact any Comonwealth Heritage.	The proposed BMH location is located approx. 1 km from the closest site on the Commonwealth Heritage list. This is over land in a built-up residential area, so no impacts are expected
Department of Environment/ Office of Environment and Heritage	The proposed cable route survey may potentially discover un-located shipwrecks	There are at least 22 shipwrecks without known positions that may be located within the study area and surrounds off NSW and in Commonwealth waters. If these are identified in the CRS, the appropriate State or Commonwealth authority should be notified, and a Maritime Archeologist consulted.
Office of Environment and Heritage (NSW)	The proposed cable route may potentially impact any Aboriginal Heritage.	A search of the Aboriginal Heritage Information System revealed that there are no Aboriginal Heritage items in proximity of the Cable route and landing.

Stakeholder	Issues Raised	Mitigation/ Response/ Recommendation
National Native Title Tribunal (NNTT)	The proposed Cable route may interact with Native Title land.	It was identified that there are no Native Title applications or determinations in proximity of the Cable or landing.

Table 23: Commercial Interests

Stakeholder	Issues Raised	Mitigation/ Response/ Recommendation
South East Trawl Fishing Industry Association (Peak industry body for Trawl Fishers) / AFMA	Survey and Installation Activities may cause business disruption for commercial trawl fishing. The installed cable may be fouled by trawlers	Trawling is prohibited in the SSPZ, and there are further trawl closures out to 200 nm, and around Norfolk Island. There is an area around Lord Howe Rise where trawling is permitted; however, SETFIA advise the depth capabilities of current trawling is 1,100 m. The cable will be buried over a shallow water (<1500 m WD) section (282 km) encountered crossing Lord Howe Rise, protecting it sufficiently from bottom fishing. Given the RPL, the fishing closures, and the limiting depth of trawl fishing – it is unlikely that there will be any interactions between trawlers and cable ships during cable survey and install activities in Australian waters. However, a prudent measure would be to notify SETFIA in advance of cable ships entering Australian waters, as SETFIA have systems in place to alert their members of potential hazards through text messages, which can be continually sent from 3 months prior, enabling safe coordination and planning.
Australian Fisheries Management Authority (AFMA)	Survey and Installation Activities may cause business disruption for commercial fishing as regulated by AFMA The installed cable may be fouled by commercial fishing as regulated by AFMA	**Business disruption:** The cable exists within the SSPZ until 2000 m water depths which prohibits trawling and seine fishing and regulates certain other activities; however the regulation allows pelagic longlining and minor lining (trolling), which are common techniques used to catch Tuna and Billfish. As these Fisheries may be operating in the SSPZ area (generally around 200m – 600m water depth), notice should be provided to AFMA before activities commence to avoid interactions and disruptions. As these species targeted are pelagic (mid-water) fish, the installed cable should not affect these fisheries.

Stakeholder	Issues Raised	Mitigation/ Response/ Recommendation
		Cable fouling: Demersal long lining generally occurs in water depth less than 100 m WD. The Cable will exist in the SSPZ at these water depths, where demersal long lining is prohibited. Demersal fishing using J-hook terminal equipment is permitted up to 100 m water depth; however, the line breaking strain must be maximum of 50 kg. In these water depths, the Cable will either be buried or surface laid with SL17LWA. The breaking load of the cable is roughly 31,000 kg (306 kN), so the line should certainly break before the cable. Cable fouling from fishing is not expected.
Department of Primary Industries - Fisheries	Refer to Table 21	
NSW Ports (Port Botany)	The proposed cable route may cross restricted zones or anchorage zones.	The Cable exists within the SSPZ, and outside of the Port boundaries.No impact expected.
Geoscience Australia and the Japan Agency for Marine-Earth Science and Technology (JAMSTEC)	The proposed cable route may impact the Lord Howe Rise project – a geological investigation involving seismic survey and deep stratigraphic drilling of the Lord Howe Rise	Project site identified as straight line from Brisbane approx. 380 nm from the cable crossing of Lord Howe Rise. No impact expected.
Bounty Oil & Gas NL (PEP-11)	The proposed Cable route may cross title blocks and influence future operations.	NOPTA recently revised (June 2016) the concession blocks under the Standard halving rule, such that the Cable no longer crosses the Petroleum Exploration Permit – 11. No impact expected.
Energie Future Pty Ltd/ Energie Future NL (MELA9)	The proposed Cable route may cross title blocks and influence future operations.	The Cable crosses MELA9, a (coal) minerals exploration permit application block submitted by Energie Future; however it is unclear whether this licence will be granted. The Cable also crosses MELA9 within the SSPZ, so the Cable should be afforded protection under the legislation. No impact expected.

Stakeholder	Issues Raised	Mitigation/ Response/ Recommendation

Table 24: Cable and Pipeline Crossings

Owner	Issues Raised	Mitigation/ Response/ Recommendation
Telstra	The proposed Cable route crosses (existing and proposed) cables Tasman 2 and TGA	The Cable has been revised to cross the Telstra cables at crossing angles within the specified ICPC recommendations. Notice has been given of Hawaiki's RPL, Hawaiki will continue to consult. Formal MOUs or crossing agreements should be negotiatied No impact expected.
Southern Cross Cable Network	The proposed Cable route crosses the existing Southern Cross Cable in deep water, and parallels it within the SSPZ at a distance less than 2 water depths	Notice has been given of Hawaiki's RPL, and there are no objections to the crossing. Hawaiki will continue to consult. Formal MOUs or crossing agreements should negotiated. No impact expected.
Solomons Oceanic Cable Company (SOCC)	The proposed Cable route crosses the proposed SOCC cable and parallels it at a distance less than 2 water depths	Liaison with SOCC was undertaken, and the Hawaiki Cable route has been revised to avoid any crossings and to ensure parallels greater than 2 WD as per ICPC recommendations. No impact expected.
	No pipeline crossings in Australian Waters	N/A

5. Key Recommendations

The environmental impact assessment undertaken herein for the Hawaiki Submarine Cable has identified the following key environmental management measures for the proposed works. In implementing these measures the proposed project is unlikely to have any significant environmental or social impact.

Table 25: Key Recommendations

Key Recommendations
• It is recommended that the cable work be undertaken with careful planning based on available weather forecast in order to avoid potential storm events as well as cetacean migrations where possible
• Close to the shoreline, as good practice it is recommended that the residents are notified of construction works as part of the general notification procedures to stakeholders
• As a general rule, where there are natural hazards in the area, marine activities should be avoided.
• In the event of a potential tsunami, activities would be stopped and normal tsunami evacuation and marine safety guidelines would be followed.
• Use of directional lighting and light shields should be implemented.
• Ensure survey equipment sound energy density levels are below threshold of disturbance to marine mammals of 160 dB re 1µPa2
• Vessel deck lighting should be switched off unless required under navigation or safety standards (AMSA Marine Orders).
• Ensure sea-fastening of vessel objects.
• Ensure appropriate on-board lifting techniques.
• Ensure appropriate maintenance to vessel and machinery.
• Ensure Shipboard Oil Pollution Emergency Plan (SOPEP) and Shipboard Marine Pollution Emergency Plan (SMPEP) are current and valid.
• Adherence to MARPOL, Marine Orders and Protection of the Sea (Prevention of Pollution from Ships) Act 1983, International Convention of the Safety of Life at Sea (SOLAS) 1974 and the Navigation Act 2012.
• Ecologically sensitive areas should be identified through the site survey and avoided if possible.
• If vessel anchoring is required, it will avoid any ecologically sensitive areas such as seagrasses or rocky reefs.
• Notice to residence should be given before commencing the HDD works
• Ensure use of a non-toxic HDD lubricant
• Ensure recovery and disposal of HDD lubricant at an EPA approved waste facility
• Ensure disposal of HDD drill cuttings in EPA approved waste facility
• Ensure the contractor has an Environmental Management Plan in place which meets the recommendations of this EA
• Adhere to AQIS guidelines on quarantine and ballast water exchange.

Key Recommendations
• Adhere to International Convention on the Control of Harmful Anti-fouling Systems on Ships, 2001 (IMO, 2001; ratified on 17 September 2008) and follow the “National Biofouling Management Guidance for Non-Trading Vessels”.
• Interaction of all vessels with cetaceans, pinnipeds and whale sharks will be consistent with Part 8 of the Environment Protection and Biodiversity Conservation (EPBC) Regulations (2000).
• Australian Guidelines for Whale and Dolphin Watching (NRMMC, 2005) for sea-faring activities will be implemented across the entire project.
• Any exposed area of the cable is susceptible to marine organisms biofouling the cable. As such, burying and armouring the cable are recommended where possible.
• Prior to the installation works commencing, and subsequent to the marine survey, any data collected should be reviewed by a suitably qualified Maritime Archaeologist. This will enable identification of known or unidentified shipwrecks and other archaeological remains located within the proposed cable route. In the event that a shipwreck is identified it is a legal requirement to report the find to the Department of Environment.
• Formal MOUs or crossing agreements should be negotiatied with known cable crossing parties
• Once the BMH site is selected, and the landside RPL finalised, compulsory acquisition or an easement should be applied for to Crown Lands.
• Ensure vessel operators notify Department of Defence before entering military training areas

Appendices

Appendix A – Descripton of Existing Environment

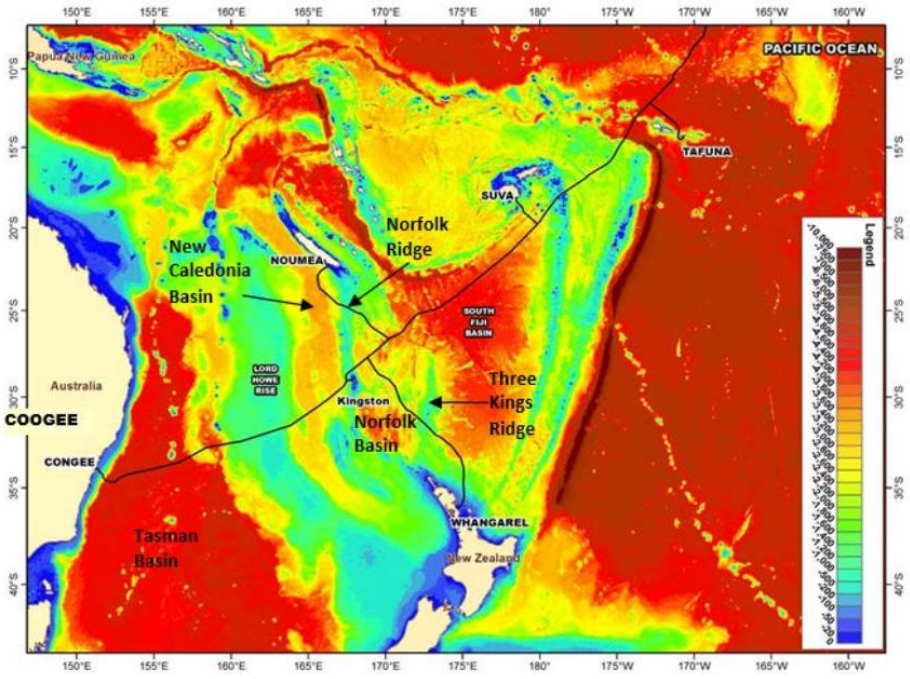
A-1 Physical Environment

This section provides an overview of the existing environment in regards physical environmental factors. This is intended to be descriptive of the current situation and potential interactions with the Cable project and justifies the assessment summarised in the main body of the report. Mitigation measures or recommendations are included as appropriate.

A-1.1 Bathymetry

Australian Region

The proposed cable route for the Australian component lies in water depths ranging from 0 m to 5,000 m. The inshore bathymetry of the proposed route is depicted in Figure A-1 and Figure A-15. Water depths along the cable route from the Sydney landing site at Coogee out to the end of the SSPZ is presented in Figure A-2.



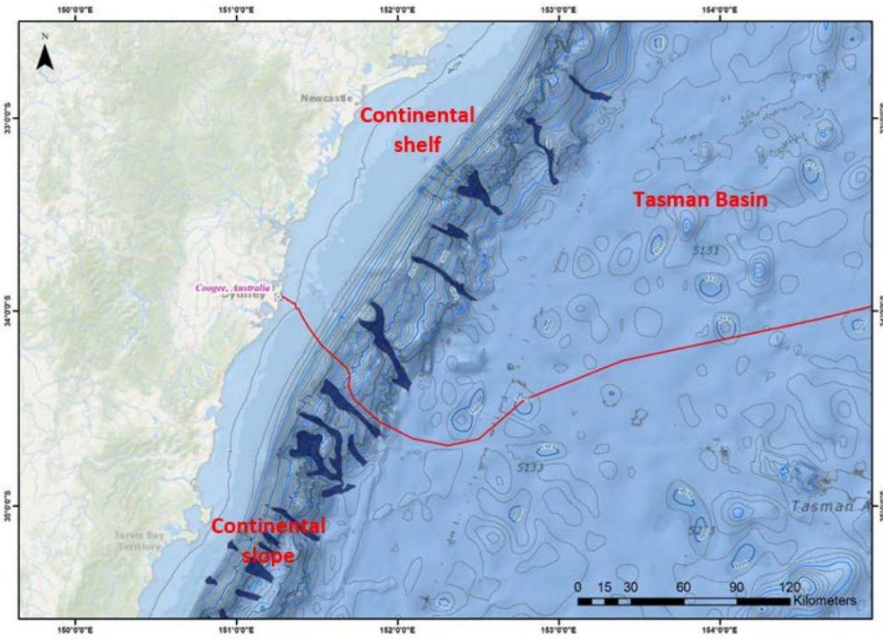


Figure A-1 Physiography East of Australia (TE Subcom 2016)

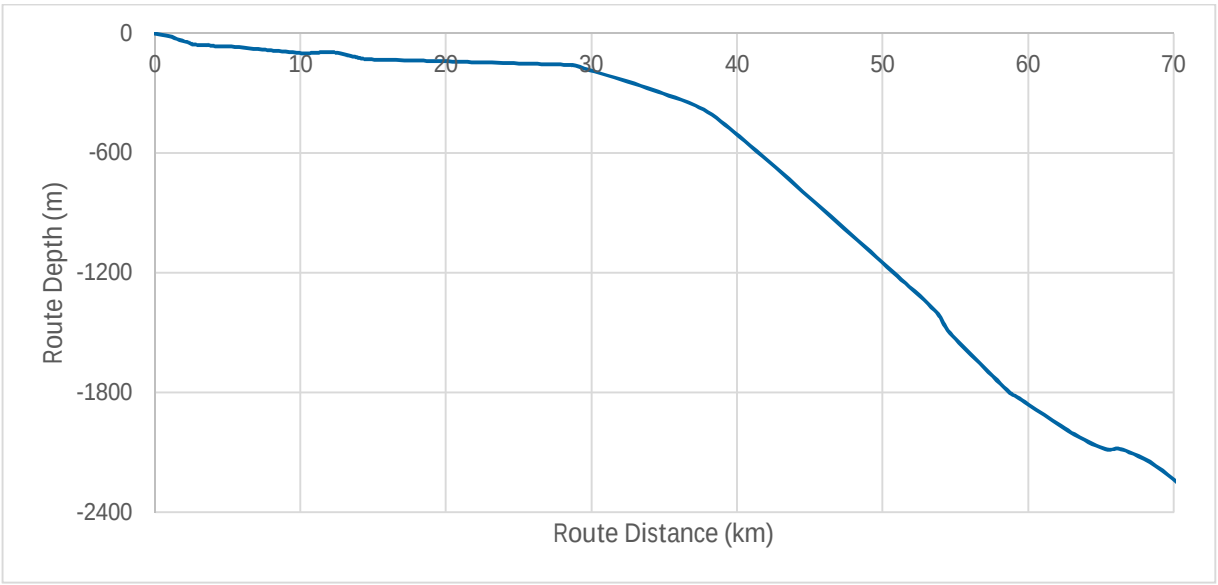


Figure A-2 Water Depth - Cable route nearshore Sydney

The cable route for the Australian segment starts on the southern headland of Coogee Beach from a BMH located within proximity of Trennery Reserve (see Figure A-14). The cable then extends east south-east, passing south of Wedding Cake Island to the pop out point at a water depth of 20 metres.

The cable then crosses the narrow eastern Australian continental shelf via the southern boundary of the Southern Sydney Protection Zone (SSPZ), a distance of approximately 30 km in water depths down to 200 metres. On the continental shelf, sandwaves and sand deposits are present which leads to localised variation in the seabed level. In addition, outcrops of westerly dipping strata rise to about 30 m above the surrounding seabed level in some sections.

The edge of the continental shelf is marked by an abrupt slope over a distance of 30 km down to approximately 2,000 metres depth, an average grade of 6%, where a small break in the shelf slope occurs. The end of the SSPZ is located in this zone some 65 km south east of the coast. Further offshore the continental shelf slope continues down to 5000 m at about 110 km from the coast into the Tasman Sea.

Beyond the continental shelf, the cable route extends east then north east, passing south of the Taupo Tablemount before crossing the Dampier Ridge. The Dampier Ridge lies to the east of the Tasman Basin and is an elongated segment of continental crust, trending north-south. It culminates in water depths of approximately 3000 m towards the south.

After crossing the Dampier Ridge, the proposed route descends to the Lord Howe Basin and then climbs up the Lord Howe Rise. The Lord Howe Rise is an underwater plateau that lies 800 km offshore of Australia.

Norfolk Island Region

The north-south trending Norfolk Ridge lies east of the New Caledonia Basin (Figure A-3). Water depths along the cable route near Norfolk Island, which range from 1,500 to 3,500 metres, are presented in Figure A-4.

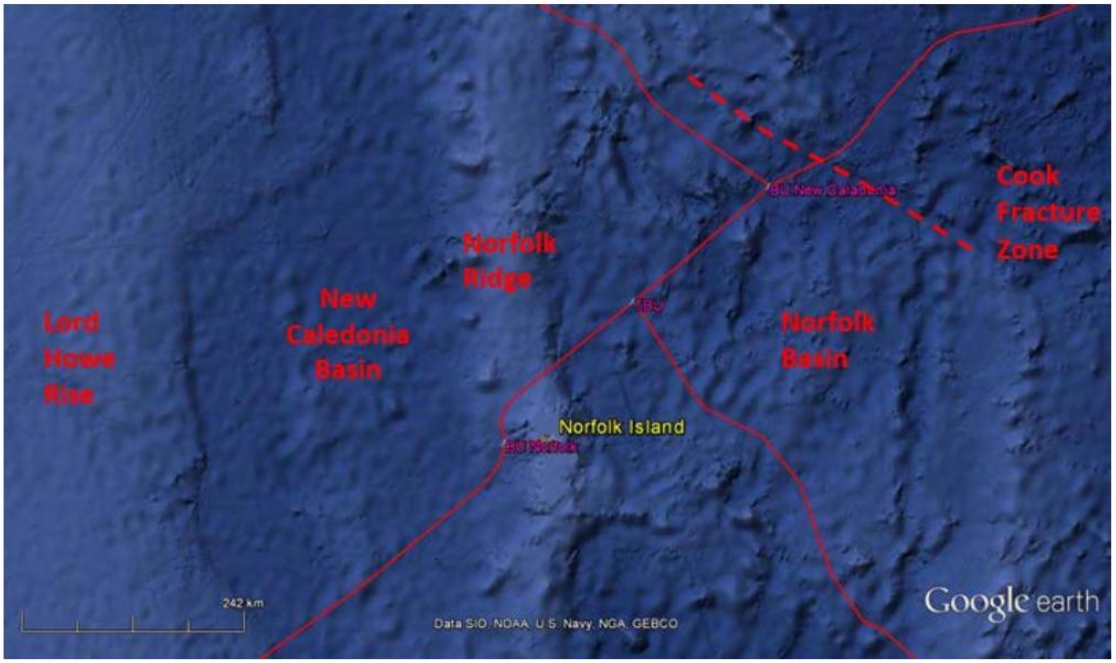


Figure A-3 Physiography near Norfolk Island (TE Subcom 2016)

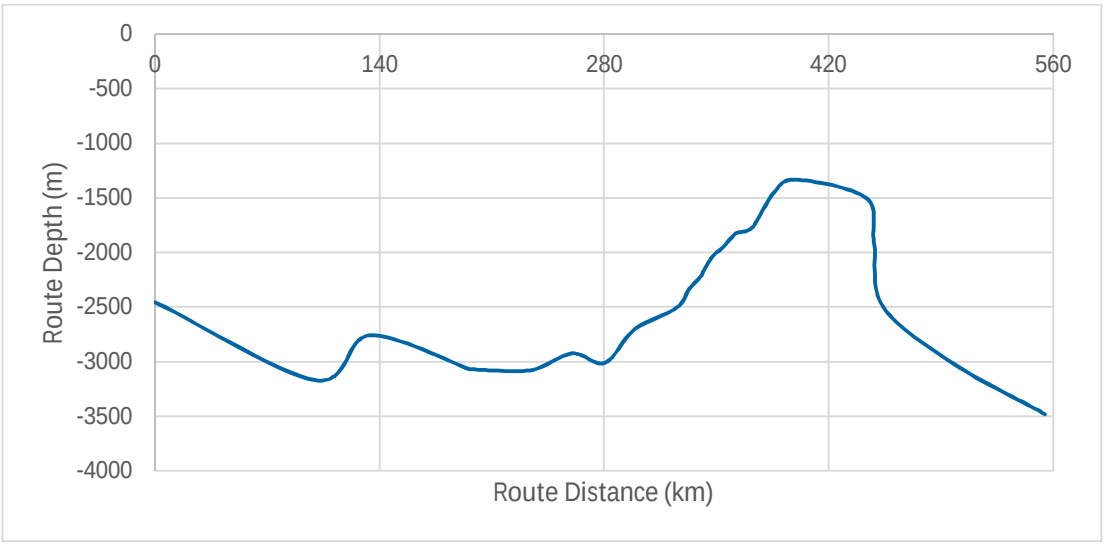


Figure A-4 Water Depth – Cable Route for Norfolk Island region

Assessment

The main constraints that water depth can impose on the placement of a cable are in regard to possible restrictions on the work methods that can be employed. Offshore of Sydney within the SSPZ, the preferred plan for the cable landing would be HDD from the BMH to the pop out point which would be in approximately 20 metre water depth. Beyond the pop out point, the cable would be laid via a combination of burial by ploughing (in water depth less than 1500 m where geology allows) and surface laying...

The water depth and corresponding distance offshore are not expected to present an access problem for the cable ship for commencement of the cable laying process. Nevertheless, divers would need to carry out certain activities at the pop out point.

The placement and maintenance of the cable would not affect the existing bathymetry in the SSPZ.

Within the EEZ offshore of Sydney and offshore Norfolk Island, the cable would be laid via a series of surface laying and plowing/jetting. This is not expected to affect the seabed bathymetry due to the small footprint and size of the cable.

A-1.2 Seabed conditions

Australian Region

The proposed route starts within the Sydney beaches system which, within 0 to 25 metres depth, is mostly composed of fine to medium sand with shells. The sand quickly gives way to exposed reef rocks. Sandy channels are also present and composed of sand, mud and shells.

In water depths between 25 to 70 metres depth, elongated bodies of sand and shelly sands are present and sharp crested mega ripples are common but generally of low amplitude and wave length.

Within the mid-shelf zone (70 m to 150 m water depth) the sediment is composed of fine sand and silts. Between 120 m to 150 m depth, a thin layer of medium dense sand with clay is present, which lies above a layer of very dense sand and a deeper layer of cemented carbonate sands and shells. These dense layers have the potential to reduce potential burial of the cable.

On the continental shelf slope, sediment consists of carbonate sand and silts becoming finer with increasing depth. Below 500 metres soft silts and clays are present with overlying rock intermittently exposed.

The cable is anticipated to be buried in water depths up to 1500 metres with a target burial depth of 1.5 metres.

Norfolk Island Region

Relatively little is known about the geology of the Norfolk Island Ridge. It is a steep-sided, narrow and elongated feature (about 1000 km long and 70 km wide), characterized by horst and graben structures containing up to 3000 m of basin sediment fill. It deepens and widens to the south where it is presently covered by carbonate deposits. The seafloor of the Norfolk Ridge is more rugged than the Lord Howe Rise.

The Norfolk Island landfall, located in Kingston, is on a deeply weathered erosional remnant of a volcano lying on the Norfolk Ridge, midway between New Caledonia and New Zealand. Erosion of the island's coast by the surrounding sea has formed the high cliffs that now make up much of its rugged coastline. As observed during a previous survey conducted by EGS (Figure A-5) the sides of the Norfolk Ridge are very steep and rugged. Rock outcrops are expected in areas of rough terrain. Route adjustment may be required to find the optimum route.

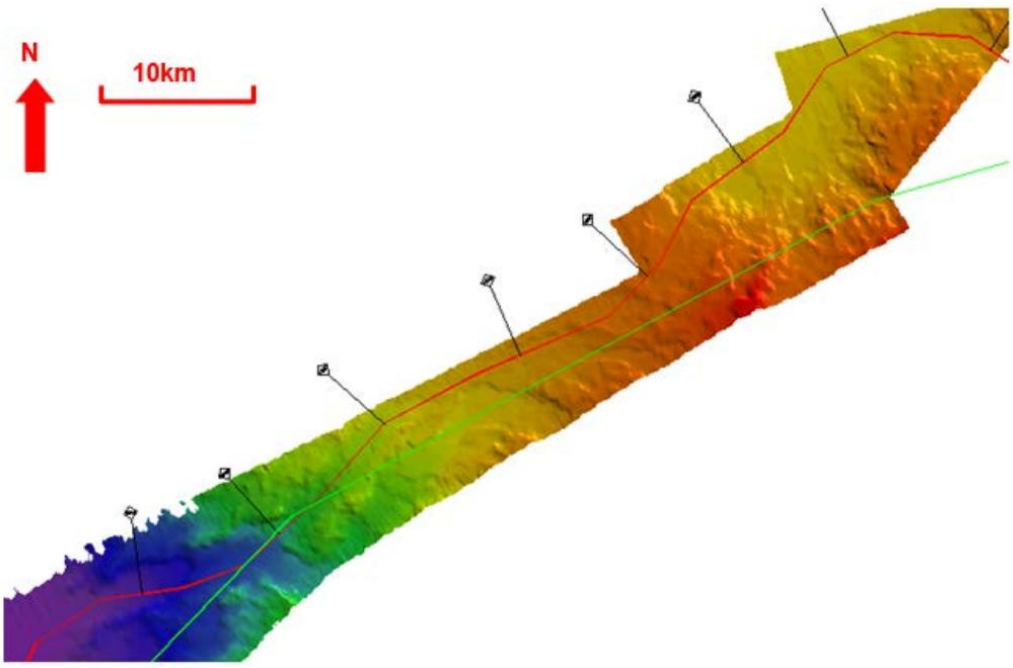


Figure A-5 Bathymetry data example of west flank of Norfolk Ridge (TE Subcom 2016)

Assessment

The cable route offshore of Sydney and across the continental shelf will encounter a range of sediment types and features which will locally limit the achievable burial and may lead to some rerouting.

If crossings of sandwave fields are inevitable offshore of Sydney and near Norfolk Island, routes should as far as possible be developed to follow troughs between sandwaves. Where sandwave crossings are unavoidable, the crossing should be at right angles to the crest. Consequently, route development may be required in sandwave areas. The morphology of the sandwaves should be assessed to estimate how fast they are moving and the depth of the stable substrate.

The proposed route of the cable is expected to avoid hard ground where practical. Therefore, issues resulting from abrasion of the cable against rock and the impact of cable placement on rock reef/algae habitat would not be expected to occur.

Should hard ground be encountered, cable burial will not be possible and it is recommended that the armour of the cable be increased and additional slack be deployed to minimise risks from cable strum. Further geotechnical investigations may be required to confirm the depth of the sandy material over firmer strata to confirm feasibility of construction methodology.

A-1.3 Water Level Variation

Australian Region

Water level variations along the NSW coastline result from one or more of the following natural causes:

- Eustatic and tectonic changes;
- Tides;
- Wind set-up and the inverse barometer effect;

- Wave set-up;
- Wave run-up;
- Fresh water flow;
- Tsunamis;
- Global changes in meteorological conditions.

Near Sydney, tides are typically semi-diurnal such that there are two high and two low tides each day. On rare occasions there may be only one high or low tide a day because the lunar tidal constituents have a period of approximately 25 hours. There may also be a significant diurnal difference, that is, a significant difference between successive high tides and successive low tides.

Tidal planes derived from long-term records at Fort Denison, Sydney Harbour are shown in

Table 26 (Australian Hydrographic Service 2012). Tidal planes for Coogee Bay and the study area correspond to those for Sydney Harbour.

Table 26 Tidal Planes for Sydney

Tidal Plane	Water Level	
	m LAT	m AHD
Highest Astronomical Tide (HAT)	2.1	1.12
Mean High Water Springs (MHWS)	1.6	0.62
Mean High Water Neaps (MHWN)	1.4	0.42
Mean Sea Level (MSL)	1.0	0.02
Mean Low Water Neaps (MLWN)	0.6	-0.38
Mean Low Water Springs (MLWS)	0.4	-0.58

Table 27 presents extreme water levels for typical Average Recurrence Intervals (ARI), also derived from Fort Denison water level records (Watson & Lord 2008).

Table 27 Extreme Water Levels in Sydney Harbour

Average Recurrence Interval (years)	Water Level	
	m LAT	m AHD
20	2.36	1.38
50	2.40	1.42
100	2.42	1.44

Norfolk Island Region

Tidal variations near Norfolk Island are of similar magnitude to those presented in

Table 26.

Assessment

Given the construction methodology, water level variation and storms that result in elevated water levels may pose a constraint to the placement of cables. However, in the case of cable placement off Sydney beyond the pop out point to the EEZ boundary and offshore Norfolk Island, the amount of water level variation presented above is relatively small compared to the water depths involved and would have little impact on the cable or cable operations.

Near Coogee Beach, the proposed BMH is to be located sufficiently inland or on high enough ground not to be affected by extreme water level events.