Environmental Impact Statement/Environment Effects Statement

Appendix I

Underwater cultural heritage and archaeology

MARINUS LINK

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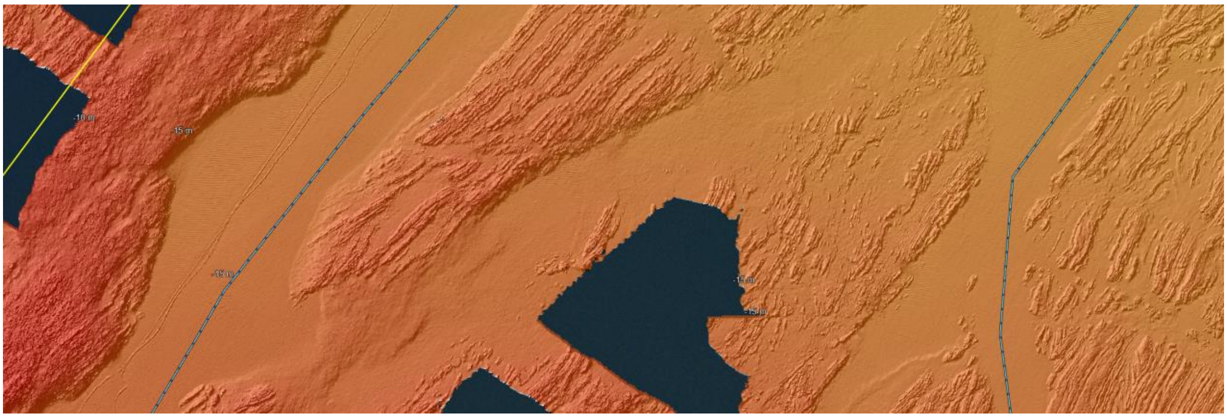
Marinus Link



Underwater Cultural Heritage and Archaeology Impact Assessment

Rev 0

Bass Strait

Gippsland, Victoria and NW Tasmania

May 2024

Marinus Link Project
Underwater Cultural Heritage and Archaeology Impact Assessment

Rev 0

Prepared for:

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Cosmos Archaeology Job Number J21/01

Cover image: Top left – *Concrete mooring block off Heybridge (Target BM15)* ***Top right -*** *Portion of rocky reef with sponge and algae growth in Waratah Bay (Target B4)****.*** ***Bottom –*** *Multi-beam sonar image of proposed cable route passing through submerged watercourses off Heybridge*

Revision	Description	Date	Originator	Reviewer	Approver
Rev 0	Report for exhibition	17/05/2024	CC, CM, JM, MO, CW	TC, CC	CC

EXECUTIVE SUMMARY

Introduction

Marinus Link Pty Ltd is proposing to construct a high-voltage direct current (HVDC) electricity interconnector between Tasmania and Victoria, to be known as Marinus Link (the project). Cosmos Archaeology has been commissioned by Tetra Tech Coffey Pty Ltd (Tetra Tech Coffey) to undertake an underwater cultural heritage and archaeology impact assessment for the project.

Approach to the study

The conclusions reached in the assessment are based on the examination of Government and historical records, relevant archaeological studies, marine geophysical datasets and maritime archaeological diving inspections.

To ensure the avoidance or minimisation of the loss of underwater cultural heritage values and assess impacts arising from the implementation of Marinus Link a sequence of steps have been followed. These steps are outlined in flow diagram below which includes the corresponding sections in this report where these steps are articulated.

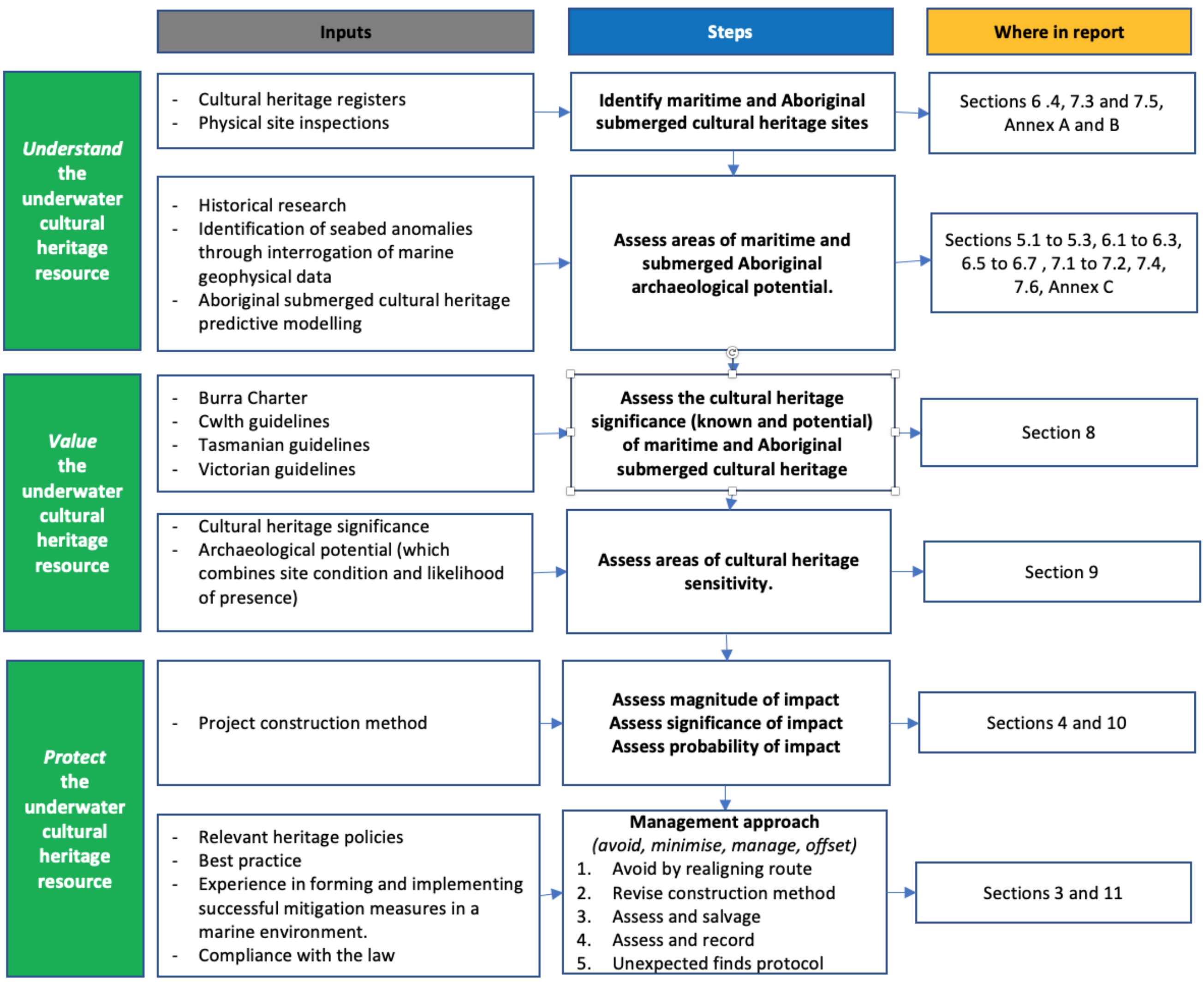

Figure 1-1: Flow chart of impact assessment methodology.

As part of the process of understanding and valuing the Aboriginal underwater cultural heritage, presentations were given outlining the findings of the assessment which included discussions on significance, impacts and mitigation.

Intangible underwater cultural heritage, that is, the practices, expressions, knowledge and skills that communities, groups and sometimes individuals recognise as part of their cultural heritage, and which do not create an archaeological record, are not assessed in this report. An Aboriginal cultural values assessment (CVA) program is currently underway. This program will obtain advice from relevant Traditional Owner groups regarding the tangible and intangible cultural heritage values that they associate with submerged landscapes within the project area. The information obtained during the CVA program will be incorporated into the two cultural heritage management plans (CHMP) being prepared for Victoria and will inform the UCH management plan and ongoing engagement with Traditional Owner groups which will help to identify information, record and share it as relevant.

Legislation

The cable routes pass through Victorian and Tasmanian state waters, as well as Commonwealth waters. The relevant statutory requirements concerning underwater cultural heritage for Commonwealth and state waters are outlined in Section 3. The jurisdiction for state legislation includes the seabed and the water column up to 3 nm from the coast; however, Commonwealth legislation may take precedence in some matters. The Commonwealth statutory requirements apply between the state waters.

There are no underwater cultural heritage sites currently listed as protected under applicable legislation. Should archaeological sites be discovered during the construction phase they may be applicable for statutory protection. A summary of the relevant legislation for the study is presented in the table below.

Table 1-1: Jurisdiction and protected sites under State and Commonwealth Legislation.

Legislation	Jurisdiction		Declared/Registered/Protected site(s) with UCH study area
	Commonwealth Waters	State Waters	
Aboriginal and Torres Strait Islander Heritage Protection Act 1987	√	√	None
Environment Protection and Biodiversity Conservation Act 1999	√	√	None
Underwater Cultural Heritage Act 2018	√	√ (shipwrecks only)	None
Aboriginal Heritage Act 1975 (Tas)		√	None
Historical Cultural Heritage Act 1995 (Tas)		√	None
Aboriginal Heritage Act 2006 (Vic)		√	None
Victorian Heritage Act 2017		√	None

Maritime Heritage

Historical records indicated that nine maritime heritage sites, these all being shipwrecks, could be possibly located within the project geophysical survey area, defined as the corridor in which geophysical surveys took place along the Marinus Link alignments. These wrecks are protected under state and Commonwealth legislation irrespective of whether they have been located.

A review of the available marine geophysical data – side-scan sonar, multibeam sonar and magnetometer – identified a number of seabed anomalies of potential cultural heritage significance as well as the former disused Tioxide Australia pipeline off Heybridge, Tasmania.

The most prospective seabed features (anomalies) shallower than 30 m water depth were inspected by divers at both Heybridge and Waratah Bay. Of the 17 targets inspected, only one (BM15) was found to be a cultural object - a concrete mooring block of very low cultural heritage significance located at 41.04896° S, 146.00736° E in the Tasmanian nearshore study area. Eight seabed anomalies considered to be of lesser likelihood of being anthropogenic or of cultural heritage significance were not investigated.

In deeper water, more than 30 m depth, 72 seabed anomalies were identified and their cultural heritage significance cannot be determined without further investigation. Of these, five are located within 10 m of the proposed cable alignment, and a further ten are within 50 m of the alignment. The alignment does avoid all anomalies in the Victorian near shore study area, however five are located within 10 m of the alignment in the offshore study area.

The study also found there is expected to be a very low density of non-shipwreck cultural material, primarily in the form of vessel discard, across the geophysical survey area. These objects would most likely have low cultural heritage values.

Aboriginal Heritage

Predictive modelling using marine geophysical data and terrestrial archaeological analogues identified a number of submerged and buried terrestrial landforms which could host archaeological sites from the late Pleistocene. These include an estuarine channel close to the Victorian coast, and beach ridges and an entrenched stream close to the Tasmanian coast. As can be seen in the figure below two of the submerged landform features, submerged beach ridges and estuarine channel, are located in Commonwealth waters, while the beach ridge strandplain is located in Victorian waters and the stream channel is located in Tasmanian waters.

Aboriginal sites and artefacts located within the state boundaries (3 nautical miles from shore) of Tasmania and Victoria are protected by the states' heritage laws. Aboriginal sites and artefacts beyond 3 nautical miles from shore can be declared protected under the *Underwater Cultural Heritage Act 2018*.

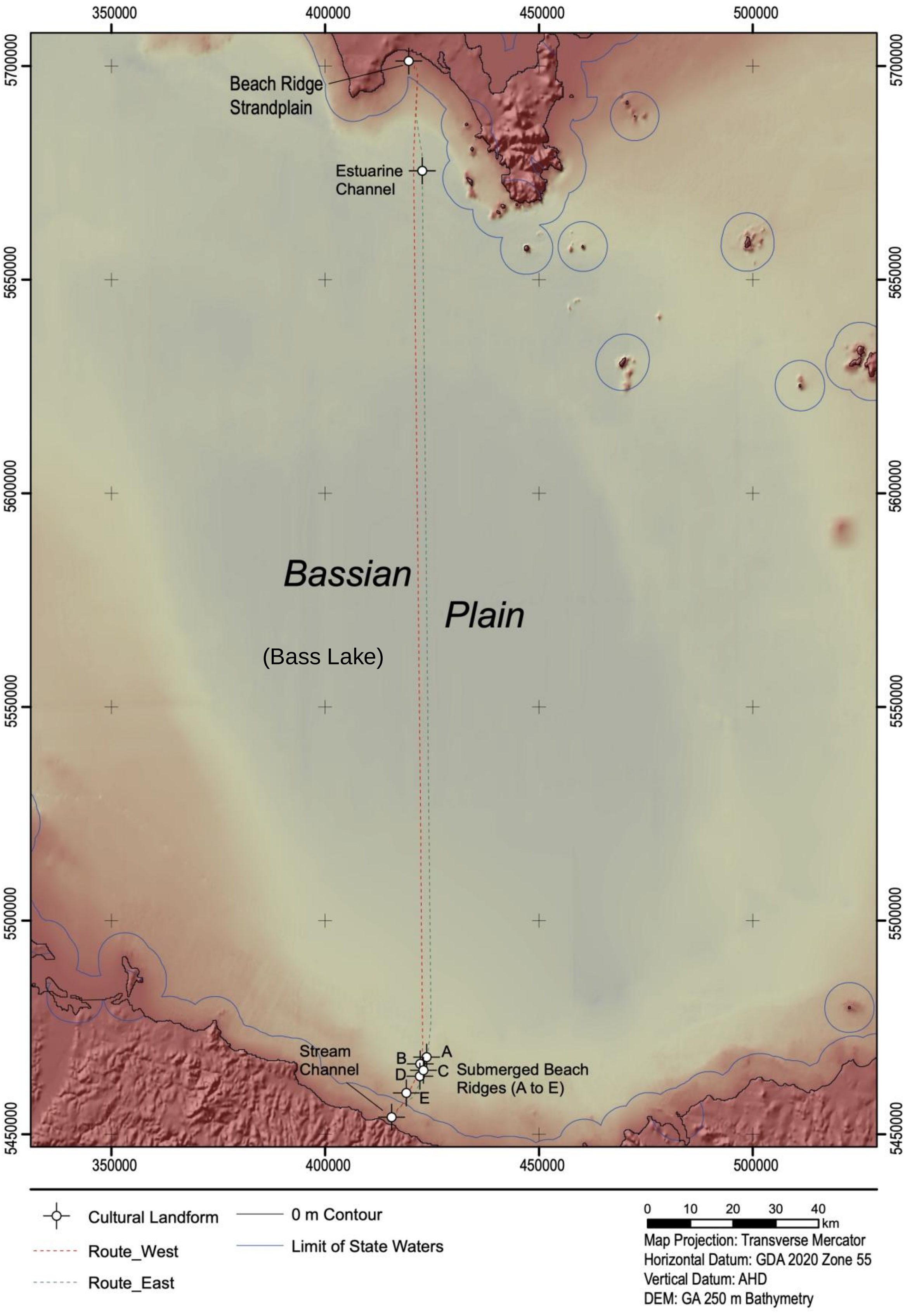

Figure 1-2: Identified submerged landforms of cultural heritage sensitivity.

Managing potential impacts on Maritime Heritage

It is highly probable that five of the unverified seabed anomalies in the offshore study area may be impacted by the laying of the cables. The significance of impact may be as great as moderate if any of the anomalies impacted are shipwrecks.

As it is not possible to survey these sites in deep water, it is recommended that in the next stage of design development the alignment is adjusted to avoid impacts to these anomalies, or any new anomalies that may be identified with any additional surveys completed for the final alignment, with buffers applied ranging from between 10 m to 50 m depending on the identity of the anomaly. For example, anomalies that appear to be a single discrete object would have a smaller buffer while anomalies that appear to be composed of a scatter of objects or parts of single buried object that is exposed above the seabed in places will have a larger buffer. The reasoning for the larger buffer being that it is more likely that there may be associated buried material nearby where there are scattered objects and/or partially exposed large objects. In circumstances where an anomaly cannot be avoided, the cultural heritage significance of the anomaly should be determined so as to assess the significance of impact. After this is determined, appropriate mitigation measures can be adopted, which could take the form of detailed survey and/or archaeological excavation.

If an anomaly cannot be avoided or is located within 10 m of the project alignment, a remotely operated vehicle (ROV) will be deployed during the pre-lay survey to determine if the anomaly has cultural heritage values or to confirm the anomalies within 10 m are able to be avoided. Leaving the identification of seabed anomalies to during the construction phase will add risk to the programme should it not be feasible to avoid an anomaly that is identified to have high cultural heritage values such as a wreck site. The programme could also be delayed if an identified site requires assessment and regulatory approval required to impact the site before construction can progress.

The remains of the former disused Tioxide Australia pipeline will be impacted (as it will be crossed by the cable alignment) but significance of the impact to the item will be very low on account of its very low cultural heritage values. There is no further action proposed to further safeguard the significance of this item.

It is almost impossible that unlocated shipwrecks (not including the as yet unverified anomalies discussed above) will be impacted by the proposed works; however, if this does occur, the significance of the impact may be as great as moderate. To help avoid or manage impacts to unlocated shipwrecks or other forms of potential maritime heritage, a Management Plan for Underwater Cultural Heritage should be developed and implemented. The plan would include, but not be confined to, contractor inductions, artefact identification, stop work / notification protocols and artefact / site recording standards.

Managing potential impacts on Aboriginal underwater cultural heritage

It is highly improbable that cable laying activities will intersect potential submerged terrestrial sites that may be present and associated with beach ridge landforms in the southern portion of Bass Strait. Recorded submerged Aboriginal archaeological sites are extremely rare within an Australian context due to an absence of archaeological investigations and the potential sites associated with the beach ridge landforms are likely to be in poor or fragmentary condition. Any surviving sites are considered to be very culturally sensitive from at least an archaeological/scientific criterion (the remaining intangible cultural values of such sites are not to be assessed in this study). Given the potential significance of such sites, even the partial loss of material and archaeological integrity the impact could be rated as having low significance.

To minimise any potential impacts to potential submerged terrestrial sites that may be present and associated with the beach ridge formation it is proposed that high resolution video and multi-beam data should be obtained prior to construction along the route where it crosses the beach ridge landforms. This would be for the purposes of creating a 3D model of the formation which could be enhanced to provide an interpretation of the formation as it could have appeared prior to sea level rise.

In addition, if mechanical trenching is unavoidable through the beach ridge formation a sampling strategy should be devised and implemented involving recovery of sediments along the alignment where it intersects the beach ridges. The aim of the sampling is to collect environmental data to assist in the re-creation of the landscape which should be provided to the Traditional Owners. The information obtained from the sampling would provide greater clarity on site formation processes on underwater cultural heritage on such formations in the southern part of Bass Strait. The frequency and manner of the sampling is to be determined when more information is known about the method of trenching. The re-alignment of the cable route around the beach ridge will avoid potential impact.

To mitigate the potential impacts of the proposed works this report presents the following Environmental Performance Requirements:

Table 1-2: Environmental Performance Requirements and relevant project development stages.

EPR ID	Environmental Performance Requirement	Project Stage
EPR – UCH01	***Undertake a magnetometer survey for the final Victorian shore crossing project alignment and additional geophysical surveys if the alignment is revised to be outside the study area.*** Prior to commencement of marine construction, undertake a magnetometer survey of the project alignment to assess the potential for maritime heritage sites for the final Victorian shore crossing. If the alignment is revised to a location outside the areas where geophysical surveys have been completed, undertake geophysical surveys for the revised section to the same standard as the rest of the alignment, prior to commencement of construction. Identified anomalies that cannot be avoided are to be assessed and managed as per EPR UCH02. Any additional geophysical survey must be done to the same standard, that is, the same data acquisition parameters, interpretation and presentation as the surveys completed by MLPL in 2019 and 2020 in the development of the subsea project alignment. That data must be reviewed by a suitably qualified maritime archaeologist with experience in maritime heritage and submerged Aboriginal heritage. The outcomes of these surveys must inform the development of the management plan for underwater cultural heritage (EPR UCH04).	Design
EPR – UCH02	***Avoid impacting unverified seabed anomalies identified in the marine geophysical survey*** Prior to commencement of marine construction, refine the subsea project alignment to ensure unverified seabed anomalies are avoided and apply a buffer of 10 to 50 m depending on the nature of the anomalies (Refer to Table 12-1 of EIS/EES Technical Appendix I for recommended buffer distances from identified anomalies). The buffer must be determined in consultation with a qualified maritime archaeologist. Where anomalies cannot be avoided by more than 10 m, further investigations should be undertaken to assess their cultural heritage values. These further investigations should include: 1. Visual inspections by diving in waters less than 30 m or a	Design

EPR ID	Environmental Performance Requirement	Project Stage
	remotely operate vehicle in deeper water. 2. The assessment of the maritime heritage values of an anomaly must be undertaken by a qualified maritime archaeologist. ***3.*** If culturally significant anomalies cannot be avoided, appropriate mitigation measures should be developed and implemented. Mitigation could take the form of a detailed survey and/or archaeological excavation which may require a permit. The outcomes of these investigations must inform the development of the management plan for underwater cultural heritage (EPR UCH04).	
EPR – UCH03	***Minimise potential impacts to the submerged beach ridge landforms*** Prior to commencement of marine construction, obtain sufficiently detailed information about the submerged beach ridge formations, which occur at the locations shown in Figure 9-2 and Table 9-3 of EIS/EES Technical Appendix I, to assist in refinement of design to minimise potential impact to cultural heritage values associated with the landscape prior to inundation. The sufficiently detailed information includes obtaining high resolution video and multi-beam data along the route where it crosses the beach ridges. By the completion of construction, have a 3D model prepared using the detailed information collected prior to construction to contribute to the interpretation of these formations as they could have appeared prior to sea level rise. This will be provided to the relevant First Peoples groups. If construction requires trenching through the beach ridge landform, the impacts must be assessed and minimised during construction, and mitigation measures implemented where required. These measures must be overseen by a qualified maritime archaeologist and inform the development of the management plan for underwater cultural heritage (EPR UCH04).	Design / Construction
EPR – UCH04	***Manage impacts and unexpected finds by developing and implementing a management plan for Underwater Cultural Heritage.*** Prior to commencement of marine construction, develop an underwater cultural heritage management plan detailing measures to avoid and minimise impacts on underwater cultural heritage and archaeology for both First Peoples and maritime heritage. The plan must be prepared by an experienced and qualified maritime archaeologist, informed by all available data collected for the alignment and be informed by engagement with First Peoples (EPR EM08). The plan must include: 1. An unexpected finds protocol. 2. Artefact and site recognition guide. 3. Artefact and site recording standards that conform to relevant State and Commonwealth requirements. 4. Detailed maps of no anchoring zones. 5. Inductions prepared for contractors and criteria for when different inductions are required to address separate work activities. 6. The required approach and frequency for site/sea floor inspections before, during construction and after construction (if required) where anomalies can't be avoided with a 10 m buffer or if significant sites are identified along the alignment. The plan must be implemented during construction.	Construction

In addition to the EPRs above, the other EPRs that would reduce the potential impacts to underwater cultural resulting from the project, include:

- Aboriginal and historical cultural heritage – CH02 Comply with the Cultural Heritage Management Plans (CHMPs) 18201 and 18244.
- Aboriginal and historical cultural heritage – CH03 Develop a cultural values assessment for land and sea country with First Peoples
- Environmental Management Framework – EM08 Develop and implement a strategy for ongoing engagement with First Peoples

A decommissioning management plan will outline how activities will be undertaken, assess potential decommissioning impacts and include measures to manage potential impacts as outlined in the EPRs. The EPR are presented in EIS/EES Volume 5, Chapter 2 – Environmental Management Framework.

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Abbreviations

The following abbreviations are used throughout this report:

AAG	Activity Advisory Group
AHS	Australian Hydrographic Service
AHS SD	Australian Hydrographic Service Sea Dumping in Australia
AH (Tas) Act	*Aboriginal Heritage Act 1975* (Tas)
AH (Vic) Act	*Aboriginal Heritage Act 2006* (Vic)
ATSIHP	Aboriginal and Torres Strait Islander Heritage Protection Act 1987
AUCHD	Australasian Underwater Cultural Heritage Database
AUV	Automated Underwater Vehicle
BP	Years Before Present
BLCAC	Bunurong Land Council Aboriginal Corporation
BLSC	Boonwurrung Land Sea Council Aboriginal Corporation
CHMP	Cultural Heritage Management Plan
DAWE	Department of Agriculture, Water and the Environment
DCCEEW	Department of Climate Change, Energy, the Environment and Water

DEM	Digital Elevation Model
DPC	Department of Premier and Cabinet
DTP	Department of Transport and Planning
EEZ	Economic Exclusion Zone
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
GLaWAC	Gunaikurnai Land and Waters Aboriginal Corporation
GPS	Global Positioning System
H (Vic) Act	*Victorian Heritage Act 2017*
HCH (Tas) Act	*Historic Cultural Heritage Act 1995*
HAT	Highest Astronomical Tide
HDD	Horizontal directional drilling
HVDC	High-voltage direct current
J	Joules
kHz	Kilohertz, measure of signal frequency
km	Kilometres
KP	Kilometres along proposed cable route (KP 0 at Victorian shore crossing to KP 255 at Tasmanian shore crossing)
LAT	Lowest astronomical tide
LGM	Last Glacial Maximum (maximum sea level elevation, ~25-20,000 BP)
LIG	Last interglacial
mag	Magnetometer
MBES	Multibeam echo sounder
MW	Megawatt
MNES	Matters of National Environmental Significance
MPUCH	Management Plan for Underwater Cultural Heritage
NEM	National Electricity Market
nm	Nautical Miles
nT	Nanoteslas, a measure of magnetic field strength, used in magnetometer geophysical survey readings
PSSS	Pseudo side scan sonar
RAP	Registered Aboriginal Party
ROV	Remote Operated Vehicle (often used for diving over 30m depth)
SBP	Chirp and boomer sub-bottom profiler
SSS	Side scan sonar
TSB	Territorial Sea Baseline
UCH	Underwater cultural heritage
UCH (Cwlth) Act	*Underwater Cultural Heritage Act 2018* (Commonwealth)
USV	Unmanned Surface Vehicle
VAHC	Victorian Aboriginal Heritage Council
VAHR	Victorian Aboriginal Heritage Register
VDLC	Van Diemen's Land Company
VHD	Victorian Heritage Database
VHR	Victorian Heritage Register

1 INTRODUCTION

1.1 Background

The proposed Marinus Link (the project) comprises a high voltage direct current (HVDC) electricity interconnector between Tasmania and Victoria, to allow for the continued trading and distribution of electricity within the National Electricity Market (NEM).

The project was referred to the Australian Minister for the Environment 5 October 2021. On 4 November 2021, a delegate of the Minister for the Environment determined that the proposed action is a controlled action as it has the potential to have a significant impact on the environment and requires assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act) before it can proceed. The delegate determined that the appropriate level of assessment under the EPBC Act is an environmental impact statement (EIS).

On 12 December 2021, the former Victorian Minister for Planning under the *Environment Effects Act 1978* (Vic) (EE Act) determined that the project requires an environment effects statement (EES) under the EE Act, to describe the project's effects on the environment to inform statutory decision making.

In July 2022, a delegate of the Director of the Environment Protection Authority Tasmania determined that the project be subject to environmental impact assessment by the Board of the Environment Protection Authority (the Board) under the *Environmental Management and Pollution Control Act 1994* (Tas) (EMPCA).

As the project is proposed to be located within three jurisdictions, the Victorian Department of Transport and Planning (DTP), Tasmanian Environment Protection Authority (Tasmanian EPA) and Australian Department of Climate Change, Energy, Environment and Water (DCCEEW) have agreed to coordinate the administration and documentation of the three assessment processes. One EIS/EES is being prepared to address the requirements of DTP and DCCEEW. Two EISs are being prepared to address the Tasmanian EPA requirements for the Heybridge converter station and shore crossing.

This report has been prepared by Cosmos Archaeology to address all jurisdictions as part of the EIS/EES being prepared for the project.

1.2 Project overview

The project is a proposed 1500 megawatt (MW) HVDC electricity interconnector between Heybridge in northwest Tasmania and the Latrobe Valley in Victoria (Figure 1). Marinus Link is proposed to provide a second link between the Tasmanian renewable energy resources and the Victorian electricity grids enabling efficient energy trade, transmission and distribution from a diverse range of generation sources to where it is most needed, and will increase energy capacity and security across the NEM.

Marinus Link Pty Ltd (MLPL) is the proponent for the project and is a wholly owned subsidiary of Tasmanian Networks Pty Ltd (TasNetworks). TasNetworks is owned by the State of Tasmania and owns, operates and maintains the electricity transmission and distribution network in Tasmania.

Tasmania has significant renewable energy resource potential, particularly hydroelectric power and wind energy. The potential size of the resource exceeds both the Tasmanian demand and the capacity of the existing Basslink interconnector between Tasmania and Victoria. The growth in renewable energy generation in mainland states and territories participating in the NEM, coupled with the retiring of baseload coal-fired generators, is reducing the availability of dispatchable generation that is available on demand.

Tasmania's existing and potential renewable resources are a valuable source of dispatchable generation that could benefit electricity supply in the NEM. Marinus Link will allow for the continued trading, transmission and distribution of electricity within the NEM. It will also manage the risk to Tasmania of a single interconnector across Bass Strait and complement existing and future interconnectors on mainland Australia. Marinus Link is expected to facilitate the reduction in greenhouse gas emissions at a state and national level.

Interconnectors are a key feature of the future energy landscape. They allow power to flow between different regions to enable the efficient transfer of electricity from renewable energy zones to where the electricity is needed. Interconnectors can increase the resilience of the NEM and make energy more secure, affordable and sustainable for customers. Interconnectors are common around the world including in Australia. They play a critical role in supporting Australia's transition to a clean energy future.

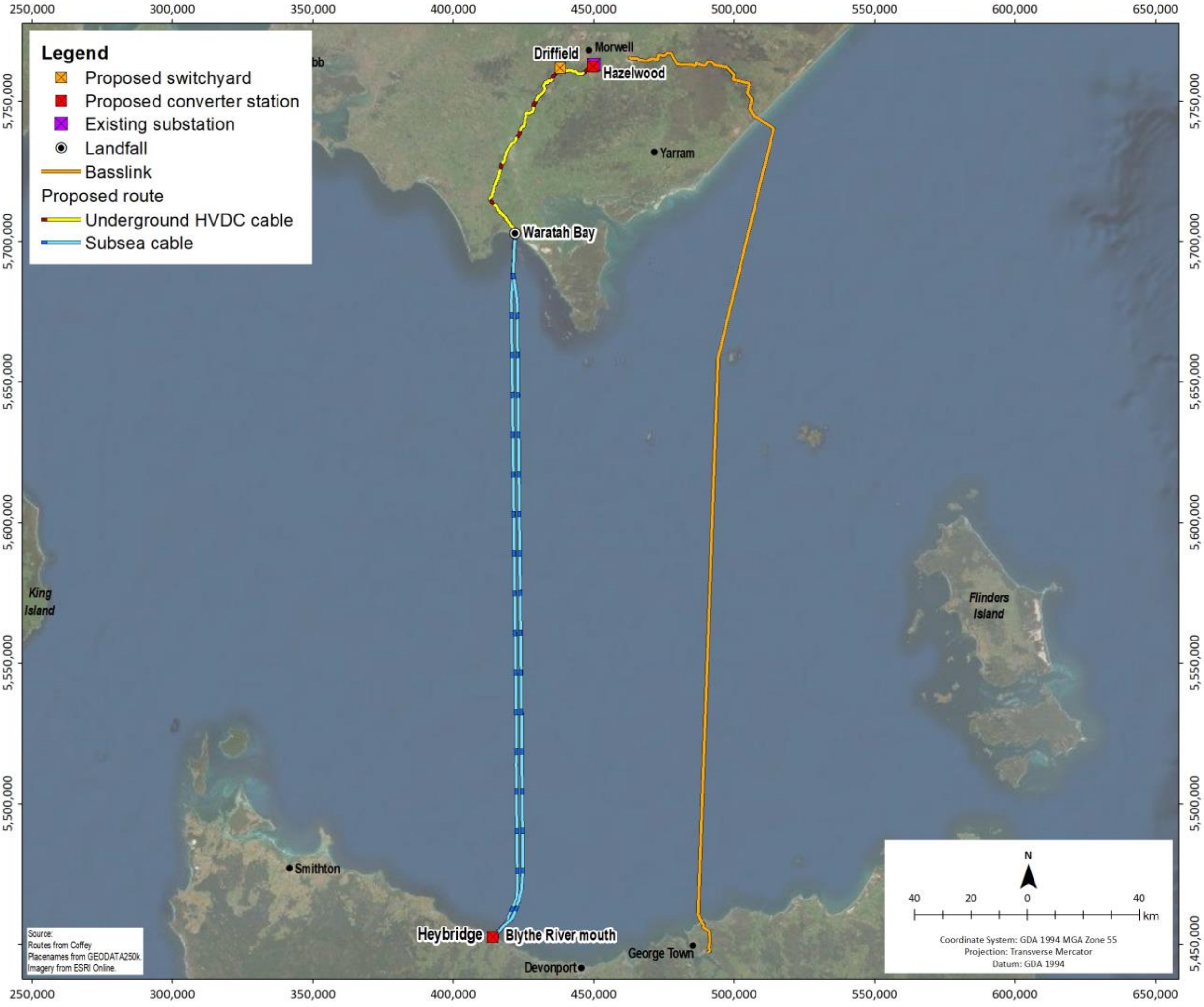

Figure 1-1: Marinus Link overview.

1.3 Commonwealth and state assessment guidelines and requirements

1.3.1 Commonwealth

DCCEEW published the following guidelines for the EIS: '*Guidelines for the Content of a Draft Environmental Impact Statement – Environment Protection and Biodiversity Conservation Act 1999* – Marinus Link underground and subsea electricity interconnector cable (EPBC 2021/9053)'.

The sections relevant to the underwater cultural heritage assessment are outlined in the Table 3.

Table 1-1: DCCEEW requirements and where in the report they are addressed.

Commonwealth Requirements	Where addressed in this report
Consider all relevant legislation, including (but not limited to) the *Underwater Cultural Heritage Act (2018)* (UCH (Cwlth) Act). Demonstrate how the proposed action will meet the requirements of relevant legislation and the environmental outcomes this achieves	Relevant legislation addressed in Section 3 and applied in Section 10 of this report
Identify any known or potential underwater cultural heritage, supported by maps (including the finalised route of the subsea cable) and appropriately detailed survey work and consultation	Sections 5 and 6, as well as Annexes A to C address the requirement with the exception of consultation which has commenced and has not been completed.
Details of the extent, severity and persistence of potential impacts to underwater cultural heritage both tangible and intangible (Indigenous and non-Indigenous)	This has been addressed in Sections 9 and 10 with the exception of intangible Indigenous cultural heritage which is outside of the scope of this report. Engagement with the Aboriginal stakeholders to complete the assessment of cultural heritage significance of identified areas of archaeological potential has commenced and has not been completed.
Details of any measures for ensuring effective management to address any potential impacts identified.	This is addressed in Section 10 of this report.

1.3.2 Tasmania

EPA Tasmania have published two sets of guidelines (September 2022) for the preparation of an EIS for the Marinus Link converter station and shore crossing. A separate set of guidelines have been prepared for each of these project components. The sections relevant to the underwater cultural heritage assessment are outlined in the following table.

This report addressed the EIS guidelines for the shore crossing.

Table 1-2: Tasmanian Heritage requirements for the shore crossing and where in the report they are addressed

Tasmanian Requirements	Where addressed in this report
Section 10; Potential Impacts: The evaluation of potential impacts should identify plausible worst-case consequences, the vulnerability of the affected environment to the potential impacts, and the reversibility of the impacts. Potential cumulative impacts of this proposal in light of other activities underway or approved also need to be addressed. Interactions between biophysical, socio-economic and **cultural impacts** should be identified.	This requirement is addressed in Section 9 and 10 of this report.

1.3.3 Victoria

The EES Scoping Requirements issued by the Minister for Planning (February 2023) outline the specific matters to be assessed across a number environmental and social disciplines relevant to the project, and to be documented in the EES for the project.
The EES Scoping Requirements inform the scope of the EES technical studies and define the EES evaluation objectives. The EES evaluation objectives identify the desired outcomes to be achieved and provide a framework for an integrated assessment of the environmental effects of a proposed project.

Evaluation objectives

The EES evaluation objective contained in Section 4.3 of the EES scoping requirements that is relevant to this underwater cultural heritage assessment is:

Protect, avoid and, where avoidance is not possible, minimise adverse effects on historic heritage values, and tangible and intangible Aboriginal cultural heritage values, in partnership with Traditional Owners.

Table 1-3: Victorian Heritage requirements and where in the report they are addressed.

Victorian Requirements	Where addressed in this report
Key Issues: • Potential for adverse effects on Aboriginal cultural heritage values including underwater Aboriginal cultural heritage, tangible and intangible both known and unknown. • Potential for adverse effects on historic cultural heritage values including underwater cultural heritage and archaeology, both known and unknown.	These are addressed in Section 9 of this report with the exception of intangible Aboriginal cultural heritage which is being addressed in a Cultural Values Assessment report being prepared separately. Engagement with the Aboriginal stakeholders to complete the assessment of cultural heritage significance of identified areas of archaeological potential has commenced and has not been completed.
Existing Environment: • Review land use history, previous studies and relevant registers to identify areas with known or potential Aboriginal cultural heritage value (including underwater Aboriginal cultural heritage, tangible and/or intangible). • Informed by meaningful engagement with Registered Aboriginal Parties and Traditional Owner groups, identify and characterise Aboriginal cultural heritage and areas of sensitivity cultural landscapes, or other tangible cultural heritage.	Sections 2, 4, 5, 6 and 8 as well as Annexes A to C address the requirement with the exception of intangible Aboriginal cultural heritage which is being addressed in a Cultural Values Assessment report being prepared separately. Engagement with the Indigenous stakeholders required to

Victorian Requirements	Where addressed in this report
• Review land and sea use history, previous studies, relevant registers and available seafloor survey data to identify and document known, potential and previously unidentified places, sites, objects and/or artifacts of historic cultural heritage significance potentially impacted by the project, including any areas of significant archaeological potential or value on land and underwater, in accordance with Heritage Victoria guidelines.	complete the assessment of cultural heritage significance of identified areas of archaeological potential is underway.
Likely effects: • Assess the potential effects on Aboriginal Cultural heritage. • Assess the potential effects on sites and places of historic cultural heritage significance (including underwater heritage and archaeology) including mapping site extents in relation to proposed works. Assessments are to be undertaken in accordance with the *Heritage Act 2017*, the Commonwealth *Underwater Cultural Heritage Act 2018*, Heritage Victoria's *Guidelines for Conducting Archaeological Surveys* (2020) or updates and other guidance documents.	This is addressed in Sections 3 and 9 with the exception of intangible Aboriginal cultural heritage which is being addressed in a Cultural Values Assessment report being prepared separately. Engagement with the Aboriginal stakeholders required to complete the assessment of cultural heritage significance of identified areas of archaeological potential is underway.
Mitigation: • Describe any plan(s) or partnerships with Traditional Owners, including any opportunities to respond to Country Plans and to protect intangible cultural heritage. • Describe and evaluate proposed design, management or site protection measures that could avoid or mitigate potential adverse effects on known or unknown Aboriginal or historical cultural heritage values. • Describe management and contingency measures, in accordance with the requirements for a Cultural Heritage Management Plan (CHMP) under the *Aboriginal Heritage Act 2006*; an Archaeology Management Plan that addresses requirements of the Heritage Act and Commonwealth Underwater Cultural Heritage Act; a survey of all areas of proposed works to identify currently unrecorded sites; recommendations for any required site avoidance, mitigation or site investigation processes; and the development of an Unexpected Finds Protocol, conducted by a qualified and experienced historical archaeologist for the land components and maritime archaeologist for the coastal and underwater components.	This has been addressed in Section 10 of this report. The contents of an Unexpected Finds Protocol and an 'Archaeology Management Plan' referred to as the Management Plan for Underwater Cultural Heritage have been outlined. The preparation of such documents is considered premature at this stage of the process.
Performance: * Describe the framework for monitoring and evaluating the measures implemented to mitigate Aboriginal cultural heritage and historic heritage effects and contingencies. • Describe the approach to supporting ongoing Traditional Owner participation in project development and implementation.	This has been addressed in Section 10 of this report and will be further detailed in the Unexpected Finds Protocol and Management Plan for Underwater Cultural Heritage .

1.4 The underwater cultural heritage study area

A project geophysical survey area has been provided by Tetra Tech Coffey, which defines the area for field investigations in which the project could be located. This area is 100 m either side of the cable routes, which are approximately 2 km apart, across Bass Strait. The Tasmanian nearshore survey area is approximately 1 km wide. The Victorian nearshore survey area is approximately 2.5 km wide at the coast, reducing to approximately 350 m before separation of the cables offshore.

The underwater cultural heritage study area is separated into three sections:

- Central Section: Bass Strait – Offshore (between the North and South nearshore sections, Figure 1-2)
- North Section: Victoria – Nearshore (between the shore and 3 nm from shore, Figure 1-3)
- South Section: Tasmania – Nearshore (between the shore and 3 nm from shore, Figure 1-4)

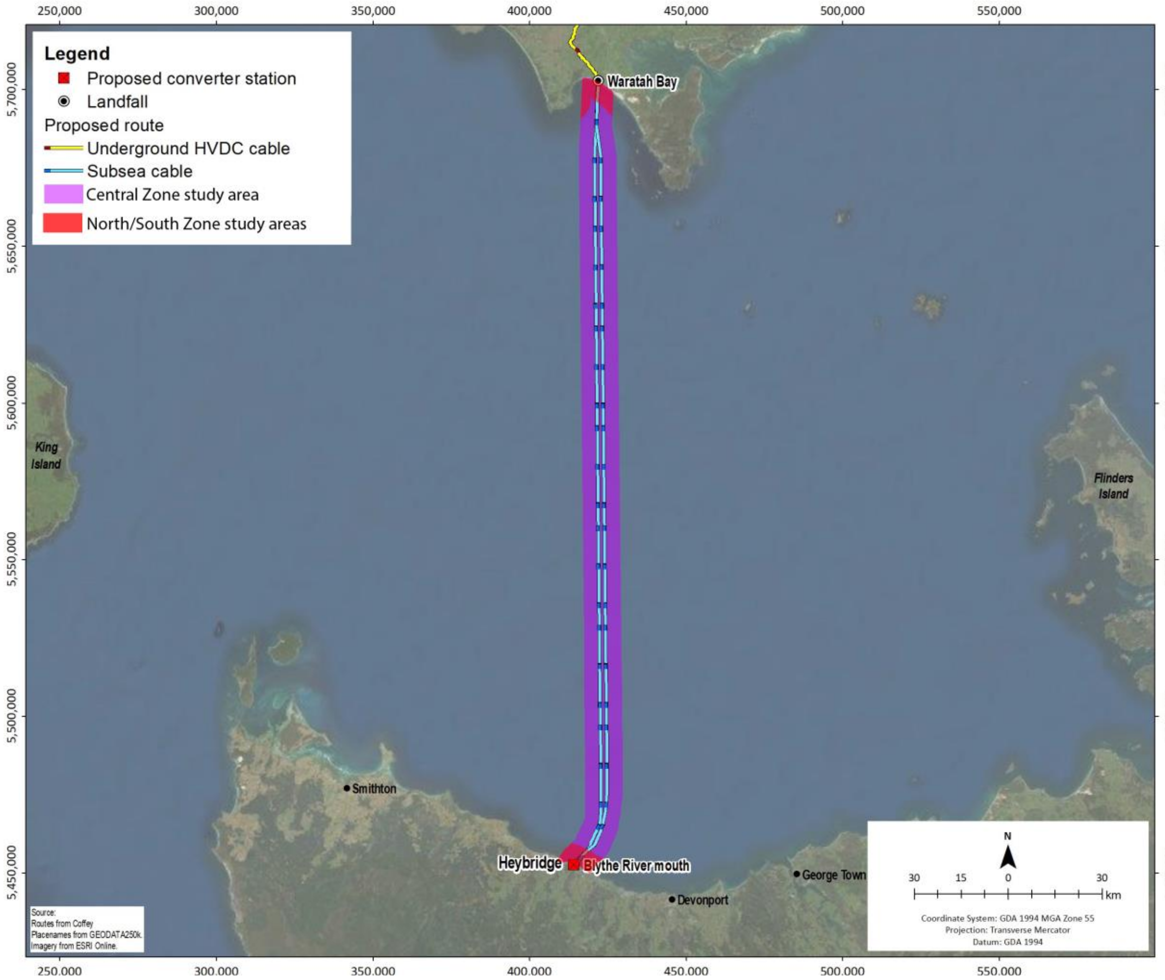

Figure 1-2: Offshore study area, in purple.

The nearshore study areas are defined as extending from the Highest Astronomical Tide (HAT - the highest level of water which can be predicted to occur under any combination of astronomical conditions) to 3 nautical miles (nm) into the sea for both Victoria and Tasmania. The offshore study area covers the seabed between the two nearshore sections. The study areas conform to the boundaries between State and Commonwealth waters. This has been done because the Victorian, Tasmanian and Commonwealth related heritage acts have particular definitions and thresholds with regards to underwater cultural heritage and as a result, differing permitting requirements.

The underwater cultural heritage study area defined by Cosmos Archaeology for this report is larger than the geophysical survey area and defines the area required to characterise baseline conditions and assess impacts for the underwater cultural heritage and archaeology impact assessment.

The study area has been defined as a broader area than the geophysical survey area as the exact positions of the majority of the documented shipwrecks in Bass Strait are not known and some shipwrecks could be potentially located over a wide area. Historical or estimated positions for some wrecks could have a margin of error of a few kilometres. The comparison between the geophysical survey area and the underwater cultural heritage study area is presented in Table 1-4 below.

Table 1-4: Definition of survey area and study area for nearshore and offshore sections of Marinus Link.

	Geophysical survey area		Study area	
	Corridor width	Distance either side of route centrelines	Corridor width	Distance either side of route centreline
Nearshore (HAT to 3 nm)	350 m to 2,500 m	175 m – 1,250 m (x2) – Victoria 500 m (x2) - Tasmania	10 km	Within 5 km (x2)
Offshore	200 x 2 m	100 m (x2) + 2 km distance between each centreline	12 km	5 km (x2) + 2 km distance between each centreline

The Marinus Link cable routes are represented in Figure 1-2 and the nearshore areas are represented in Figure 2 and Figure 3.

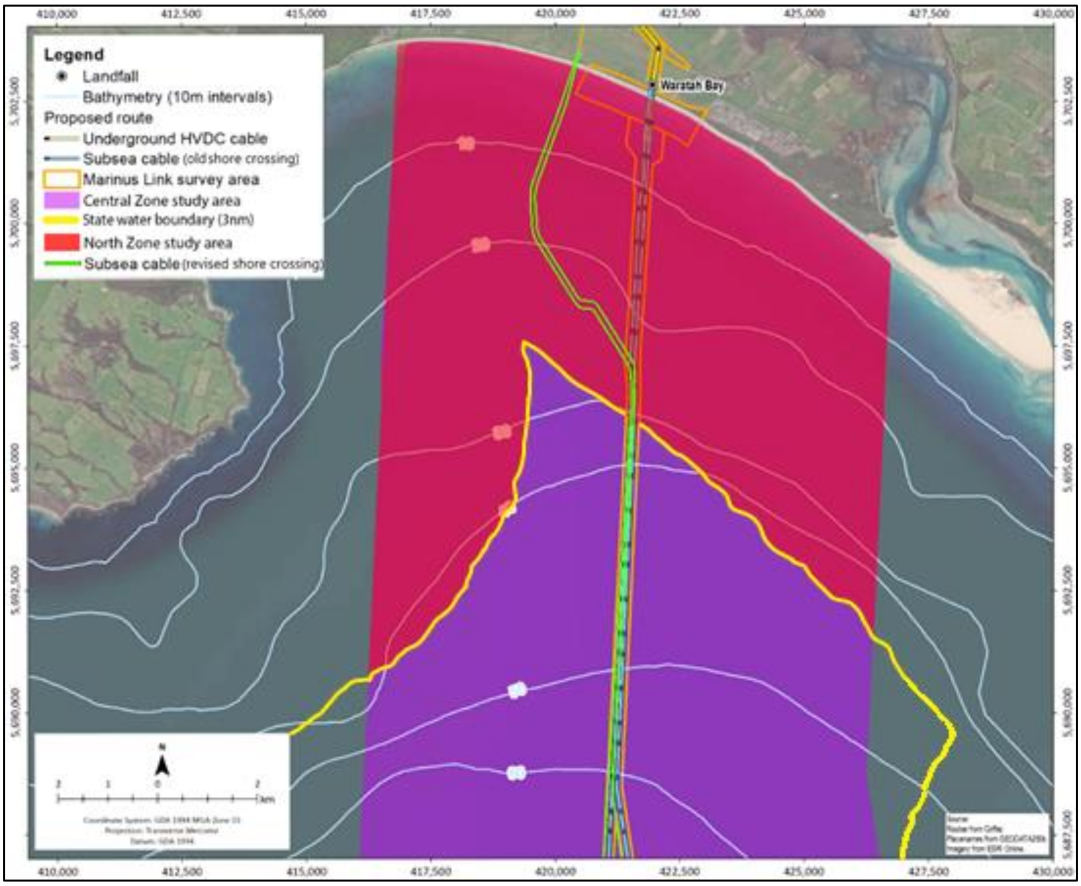

Figure 1-3: Victoria Nearshore study area, in red.

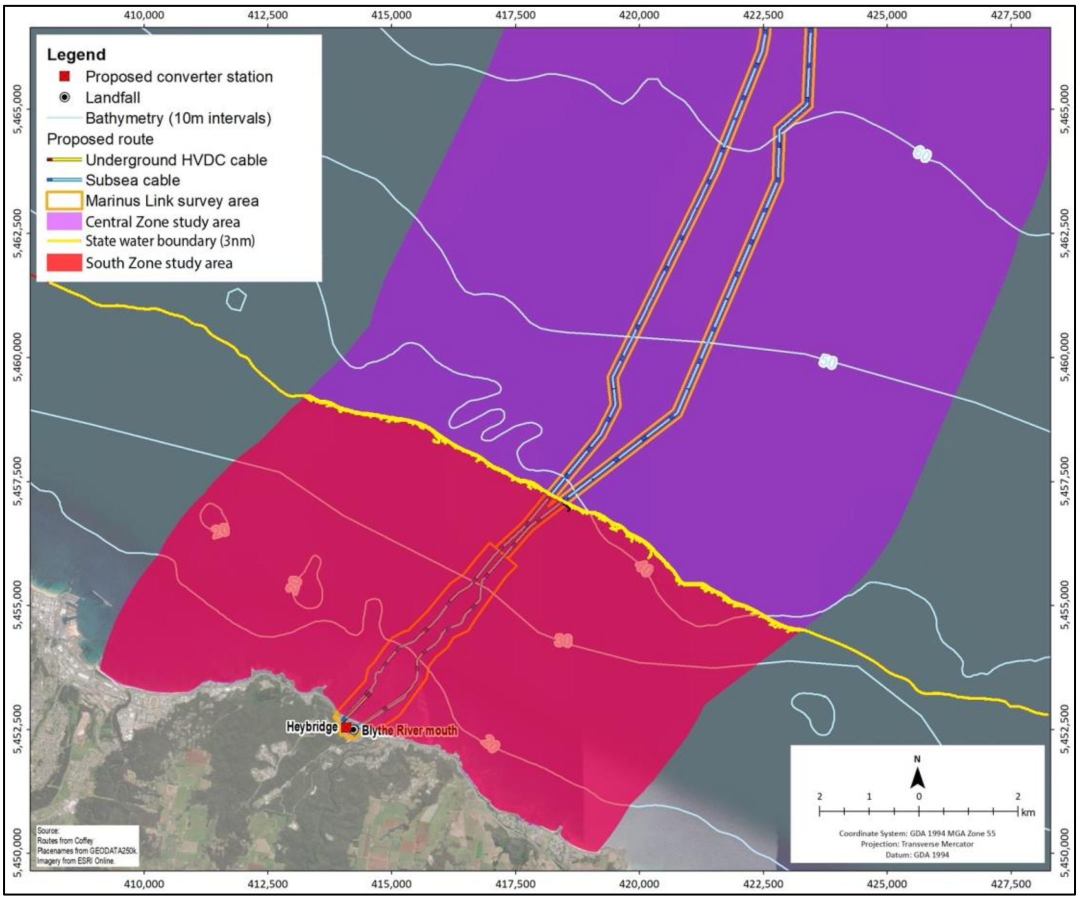

Figure 1-4: Tasmania Nearshore study area, in red.

1.5 Scope of the study

The study scope includes the following:

- Identify sites or areas of known and potential underwater cultural heritage significance (including submerged terrestrial sites that may be present) located within the study area.
- Assess the cultural heritage significance of the identified known and potential sites.
- Assess the potential impacts from the installation of the cables on the cultural heritage significance of the identified known and potential sites.
- Provide avoidance and mitigation measures proportionate to the assessed level of significance and potential impact to identified known and potential sites.

This study examines underwater cultural heritage sites which are defined as wrecks (ship or aircraft, dumped material, maritime infrastructure and associated deposits on, or under the seabed below the HAT). This report only addresses the potential cultural heritage aspects of dumped munitions. It does not provide any other information about unexploded ordnance (UXO) as that should be obtained from a suitably qualified UXO specialist or the Department of Defence.

The recent discovery of Aboriginal underwater cultural heritage sites within the protected waters of the Dampier Archipelago, Western Australia, has raised the question of whether submerged Aboriginal underwater cultural heritage may be present within other continental shelf depositional settings. At times of lower sea levels, the continental shelf under Bass Strait would have formed extensive wetland, lacustrine, estuarine, and low energy coastal habitats – ideal environments for human habitation. Therefore, within these submerged landscapes, there is potential for preserved archaeological evidence of early human occupation.

Because the proposed Marinus Link route crosses these submerged landscapes, this study includes an assessment of the potential impact of works on submerged terrestrial sites that may be present, defined as Aboriginal sites that became inundated with the sea level rise at the end of the Pleistocene, around 10,000 years ago. This study is confined to the investigation of the physical remains of cultural behaviour and does not undertake any assessment of intangible cultural heritage associated with submerged terrestrial landforms as expressed through stories and spiritual beliefs.

1.6 Assessment context

Cultural heritage is the glue that holds a polity together. It is an expression both of the physical and intangible manifestations of a society. For the Aboriginal community it is the expression of one the world’s oldest living cultures, evidence of possession, continuity and survival. For remaining population of this continent cultural heritage speaks to arrival, and with that loss, adaptation and acceptance.

Cultural heritage in its physical form, which in the context of this assessment are archaeological remains on and under the seabed, is regarded by Australians to be of sufficient importance that there are State and Commonwealth laws enacted to protect them. Such remains could take the form of shipwrecks, ruined jetties, anchors and Aboriginal sites that became submerged at the end of the last ice age.

1.7 Authorship

This report is comprised of contributions made by experienced and qualified specialists in maritime, Aboriginal and underwater archaeology as well as geomorphology and underwater cultural heritage management.

The primary author for this report is Cosmos Coroneos, Director of Cosmos Archaeology. Cosmos has over 25 years' experience as a terrestrial and underwater archaeologist having worked for a number of government agencies across Australia as a project archaeologist before forming Cosmos Archaeology in 1997. Since 1997 Cosmos archaeology has undertaken over 300 consultancies, many of which are underwater cultural heritage assessment. Jane Mitchell and Connor McBrian, maritime archaeologists with Cosmos Archaeology, contributed to this report as did Caroline Wilby, Senior Archaeologist who has wide variety experience as a terrestrial archaeologist and is a registered Heritage Advisor in Victoria. Also contributing to the report was marine geoscientist Dr Michael O' Leary, Associate Professor (Climate Geoscience) with the School of Earth Science at the University of Western Australia.

The structure and overall preparation of this document was overseen by Cosmos Coroneos, Director of Cosmos Archaeology. The authors of the individual sections in this report are identified below:

Executive Summary	Cosmos Coroneos
Section 1	provided by Tetra Tech Coffey.
Section 2.1	Connor McBrian
Section 2.2	Connor McBrian with contributions by Dr O'Leary.
Section 2.3	Connor McBrian using information from dive surveys conducted by Jane Mitchell (Victoria shore crossing) and contracted maritime archaeologist, James Parkinson (Tasmanian shore crossing)
Section 2.4	Cosmos Coroneos and Dr O'Leary.
Section 2.5	Connor McBrian and Cosmos Coroneos
Section 2.6	Cosmos Coroneos
Section 2.7	Cosmos Coroneos
Section 3	Connor McBrian
Section 4	provided by Tetra Tech Coffey
Section 5.1	Connor McBrian
Section 5.2	Dr O'Leary
Section 5.3	Connor McBrian
Section 6.1 to 6.5	Dr O'Leary
Section 6.6.1	Dr O'Leary
Section 6.6.2	Connor McBrian
Section 6.6.3	Dr O'Leary
Section 6.6.4	Caroline Wilby
Section 6.6.5	Cosmos Coroneos
Section 6.6.6	Cosmos Coroneos
Section 6.6.7	Cosmos Coroneos

Section 6.6.8	Cosmos Coroneos
Section 7	Connor McBrian using information from dive surveys conducted by Jane Mitchell (Victoria shore crossing) and contracted maritime archaeologist, James Parkinson
Section 8	Cosmos Coroneos
Section 9	Cosmos Coroneos and Connor McBrian
Section 10	Cosmos Coroneos
Section 11	Cosmos Coroneos
Section 12	Cosmos Coroneos
Section 13	Cosmos Coroneos
Annex A	James Parkinson
Annex B	Jane Mitchell
Annex C	Connor McBrian

2 APPROACH TO THIS STUDY

To ensure the avoidance or minimisation of the loss of underwater cultural heritage values and assess impacts arising from the implementation of Marinus Link a sequence of steps are followed. These steps are outlined in flow diagram presented in Figure 2-1 which includes the corresponding sections in this report where these steps are articulated.

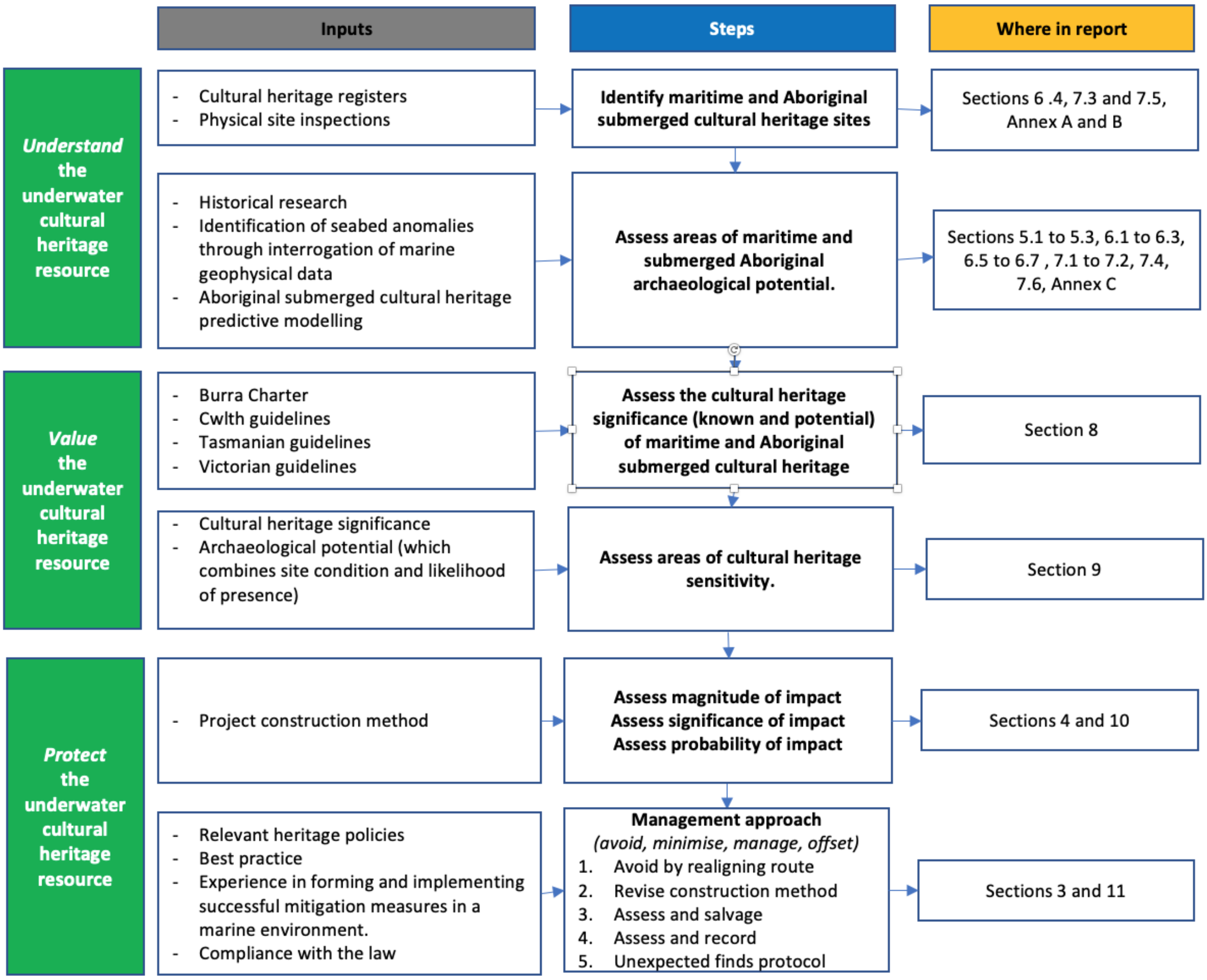

Figure 2-1 : Underwater cultural heritage impact assessment method

This section outlines the methods used to determine the existing conditions of the study area, assess the potential location of underwater cultural heritage landscapes, assess the potential impacts on underwater cultural heritage and formulate focused and appropriate mitigation measures proportionate to the cultural heritage significance of the identified underwater cultural heritage.

2.1 Maritime heritage

2.1.1 Baseline study

The start of the assessment process involved reviewing available information to form a basic understanding of the potential extent, variety, condition, and significance of maritime heritage within the study area; often referred to as a predictive model. The information obtained during this baseline study guided the direction and conduct of the field investigations, which in turn refined the understanding of the maritime heritage values. This allowed more informed assessments to be prepared on the heritage significance of the value, potential impacts on that value, and the formulation of suitable mitigation measures.

The baseline study comprised two main components: a desktop review of archival resources, heritage databases and previously completed heritage reports, and an examination of marine geophysical data. In 2019, Cosmos Archaeology produced a maritime archaeological desktop assessment for the project.[1] This report assessed the likelihood of maritime cultural heritage within the same study area but did not assess submerged terrestrial and underwater Aboriginal cultural heritage. The 2019 assessment included opportunistic review of underwater camera surveys to assess benthic ecology at Waratah Bay and three locations in Tasmania, and was updated with new legislation and new proposed cable routes in January 2020 and May 2021 respectively.

2.1.1.1 Desktop review

The results of the 2019 report are reproduced in this report, along with an updated search of the online maritime cultural heritage and historic resources.

Online sources include databases and websites. These sources are presented in Table 2-1. Past reports by Cosmos Archaeology were also consulted, including a 2002 maritime archaeological assessment of the Telstra BS-2 Cable in Victoria,[2] a 2007 report on a wreck identified during the installation of a submarine cable system[3] and one previous assessment for a cable route passing through Bass Strait.[4]

Table 2-1: List of online database sources used

Source	Online Location
Australian Government Department of the Environment and Energy – Australasian Underwater Cultural Heritage Database (AUCHD)	https://www.environment.gov.au/heritage/underwater-heritage/auchd Accessed 31 October 2022.
Australian Government Department of Defence and Australian Hydrographic Service – Sea Dumping in Australia (AHS SD)	http://www.hydro.gov.au/n2m/dumping/dumping.htm Accessed 31 October 2022.
Heritage Council Victoria – Victorian Heritage Database – Shipwrecks (VHD)	http://vhd.heritagecouncil.vic.gov.au/ Accessed 31 October 2022.

[1] **Cosmos Archaeology, 2019,** *Project Marinus – Second Interconnector Project: Maritime Archaeological Desktop Assessment*, report for Coffey Services Australia Pty Ltd (report updated May 2021).
[2] **Cosmos Archaeology, 2002,** Maritime archaeological assessment of the Telstra BS-2 Cable in Victoria
[3] **Cosmos Archaeology, 2007,** *Wreck Found During Geophysical Survey*, report for Alcatel Submarine Networks Ltd on behalf of Telstra.
[4] **Cosmos Archaeology, 2017,** Indigo Central Cable Maritime Archaeological Desktop Assessment.

It should be noted that, although the state of Victoria maintains an individual online database of shipwrecks and/or maritime cultural heritage, Tasmania relies on the AUCHD.

The data sources are described below.

AUCHD

The Australasian Underwater Cultural Heritage Database is managed by the Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) . The current database was launched in December 2009 and includes all known shipwrecks, aircraft and other maritime cultural heritage in Australasia. At the time of the production of this report, the database contained information on:

- 10,458 shipwrecks, with many whose locations are not known;
- 252 aircraft, of which less than 50% have been located, and;
- 255 items of other maritime cultural heritage, of which more than half have either been found, or have near exact locations.

Department of Defence and AHS SD

This database of sea dumping sites is managed by the Australian Government Department of Defence with information supplied by the Australian Hydrographic Service (AHS). It contains information on sea dumping in Australia, including links to information on specific sites.

Heritage Council Victoria –VHD

The shipwrecks area of the Victorian Heritage Database is managed by the Heritage Council of Victoria. It contains information and details of shipwrecks that are listed on the Victorian Heritage Register (VHR). At the time of the production of this report, the database contained 777 records of shipwrecks.

2.1.1.2 General statements on site locations

Few of the sites presented in this study have accurate positions. This is because most of the wrecks in the study area have not been located and, therefore, only broad areas within which they can be expected to be found can be presented with any confidence. As for the wrecks which have been located, designating accurate positions was not always possible as, in most cases, it is not known how their positions were recorded; for example, if locations were recorded with global positioning systems (GPS) or a compass/sextant. Furthermore, positions of known wrecks may have been inferred from nautical charts and, therefore, reductions in precision due to plotting and scaling could be expected. Coordinates provided in some databases could also have been inferred from vague historical accounts, which could place the site within a relatively large area. This issue is proportionately compounded for sites that are lost at increasingly greater distances from the coast of Australia.

GPS coordinates have become increasingly reliable; however, positions recorded with GPS in the 1980s to 1990s had accuracies of 100 to 300 metres. After the removal of selective availability in 2000, GPS accuracy improved to 5 metre accuracy and has continued to improve since. Sites found and recorded by GPS closer to shore are likely to have had their location updated over time, but sites further from the coast and/or sites that are less accessible may still be listed with inaccurate coordinates. There are also different geodetic datums used by GPS units, but the datum is sometimes not recorded with the coordinate which leads to errors when using the same coordinates with a different datum. User error can also occur when a recorder, or someone copying the location records or interprets the coordinates in the wrong style, such as reading coordinates in degrees, minutes, seconds as degrees, decimal minutes. Based on these scenarios, it is assumed that there is always a degree of inaccuracy with provided coordinates of sites.

To account for the various factors that contribute to the confidence in the accuracy of the positions provided, all the items presented in this study have been given an estimation of accuracy presented as a radius in metres from the position given. Standard accuracy radius estimates have been developed by CA through previous work and are provided in Table 2-2; however, some sites may be given a unique position accuracy depending upon the quality of information available regarding their position.

Table 2-2: Standard estimated accuracy radius distances.

Accuracy (radius)	Reasoning
200 m	Position derived from sonar survey or obtained by GPS since 2001 (removal of selective availability).
500 m	Site has been inspected by government archaeologists prior to 2001 and not visited since.
4,000 m	Positions provided by reliable source but are unverified.
10,000 m	Positions provided by unknown source.

AUCHD

Information presented in the AUCHD is compiled from each of the state and territory historic shipwreck agencies or supplied by collecting institutions holding historic shipwreck objects. The integrity or source of the information held by these agencies is unknown. The size of the area in which an individual wreck could be found varies depending on the historical information available. Located wrecks have a latitudinal and longitudinal position, but the accuracy of that position could not be determined as the method used in obtaining the position is not recorded in the AUCHD.

AHS SD

The locations of sea dumped materials provided by the Department of Defence are given by the AHS. Dumped materials of heritage value can include abandoned vessels and historic munitions, such as World-War-II-era aircraft components and Lend-Lease war materials provided by the United States to Britain, Australia, and other Allies during World War Two.[5] It is unclear how the AHS obtained the positions of the dumped materials. These locations are supposed to be where the materials were designated to be dumped, but not necessarily the actual final location of the dumped materials. An example of this was identified in a previous report by Cosmos Archaeology that found the Narrabeen Dumping Ground (a ship graveyard), Sydney, although having a high concentration of wrecks at its location, also had a dense concentration of sites between four to five kilometres east of the designated dumping area.[6]

[5] **Cosmos Archaeology, 2014,** INPEX Ichthys LNG Project : Nearshore Development – Dredging. East Arm, Darwin Harbour, Northern Territory. Relocation of Heritage Objects and Removal of debris. Prepared for Tek Ventures Pty Ltd.
[6] **Cosmos Archaeology, 2007b,** Submarine Cable System, Landfall Option – Collaroy: Underwater Heritage Impact Assessment Baseline Review, report prepared for Patterson Britton and Partners.

State Shipwreck Database (VHD)

Most of the shipwrecks obtained from this source have not been found or do not have an accurate position provided. Similar to the AUCHD, shipwrecks that do have a known location, either in the form of latitude and longitude, or a distance from a known point on land, do not have a known accuracy. The information can originate from public contribution or historic sources, and coordinates may originate from estimates. Shipwrecks that have been inspected by government archaeologists can be considered reliable; however, this is a very small proportion, possibly around 5%, of shipwrecks listed in this database.

2.2 Review of geophysical survey data

Multibeam echo sounder (MBES), side scan sonar (SSS), magnetometer (mag) and sub-bottom profiling data collected in 2019 and 2020 for Marinus Link was examined to identify anomalies and submerged landforms of potential cultural heritage significance. The geophysical survey data was collected along the proposed cable routes between Tasmania and Victoria.

The scope and method of the marine geophysical survey was reviewed on 27 February 2019 and was found to be acceptable for the purpose of identifying seabed anomalies of potential cultural origin as it utilised magnetometer in tandem with SSS along with MBES and seismic profiling. The use of a magnetometer will detect ferrous objects but will not provide reasonable estimates for the size of the ferrous objects or possible burial depth, unlike a gradiometer. This should not be an issue for the purpose of this project in identifying steel or iron hulled wrecks or timber wrecks with engines and/or anchors and/or chains. The marine geophysical data was examined for anomalies by Cosmos Coroneos and Connor McBrian. The marine geophysical data provided was of sufficient quality for the purposes of this assessment.

Further revision of the Marinus cable route design plan altered the location of the shore crossing in Waratah Bay in the Victoria Nearshore study area. The new location of the shore crossing meant that approximately 7 km of the new cable route had not been covered by marine geophysical surveys. As part of previous assessments, it was recommended that marine geophysical surveys be conducted in the location of the newly alignment of the subsea cable route in the Victoria Nearshore study area (see Figure 2-2 for additional survey area).

These geophysical surveys were conducted by XOCEAN using an XO-450 unmanned surface vessel (USV) to collect data. Surveys were conducted between 24-29 September 2023.[7] The data collected included MBES, Backscatter, Pseudo Side Scan Sonar (PSSS), and sub-bottom profiling. This survey (discussed further in Section 2.2.3) did not include the deployment of magnetometer and conventional SSS.

[7] **Xocean, September 2023**, Waratah Bay Geophysical Survey Results Report. 00681-MAR-AUS-CABL. Prepared for Marinus Link Pty Ltd.

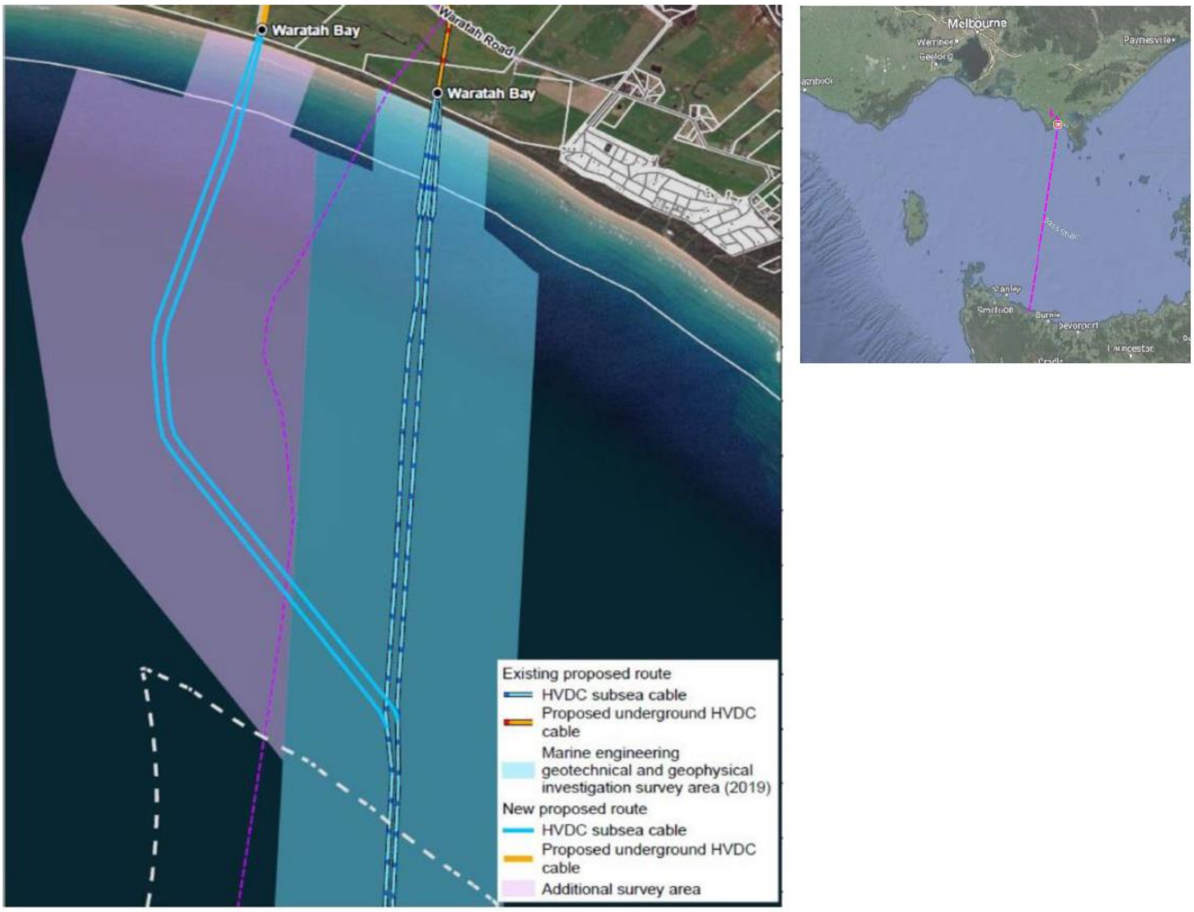

Figure 2-2: Location of new subsea cable route and additional marine geophysical survey area.[8]

2.2.1 Data source

The data examined for potential cultural seafloor targets were the 2019, 2020, and 2023 MBES bathymetry datasets, the 2019 and 2020 SSS datasets (provided in high and low frequency), 2023 PSSS and backscatter datasets provided by XOCEAN, 2019 and 2020 magnetometer targets provided by Fugro, and marine geophysical survey reports supplied by Fugro *t* and XOCEAN. These datasets were made available in a georectified (meaning that the images can be accurately placed on a map) format by Tetra Tech Coffey via the Marinus Link Webapp, powered by Esri. The marine geophysical data examined for sub seabed strata which could contain cultural deposits were the 2019, 2020, and 2023 sub-bottom profiling data sets. Raw data was also provided .

In addition, due to the narrow survey corridor for the geophysical surveys, additional data including the lower resolution Geoscience Australia 250 m Australian Bathymetry and Topography Grid, (2009) was used to create regional scale reconstruction of Bass Strait. This was pertinent for the assessment of potential submerged terrestrial sites. Digital elevation models of the Victorian and Northern Tasmanian coasts used the Geoscience Australia Digital Elevation Model (DEM) of Australia derived from 3D laser imaging (LiDAR) 5-metre Grid. Furthermore, for Waratah Bay the Victorian Coastal High-Resolution (10 m) Digital Elevation Model provided a regional scale bathymetry in the Bay and topography for the onshore terrain.

[8] **XOCEAN, 2023,** *Waratah Bay Geophysical Survey Results Report,* report completed for Marinus Link Pty Ltd, p.10, Figure 1.

Multibeam Echosounder

Multibeam bathymetry was provided as a colour coded map layer, with changing colour representing change in depth (see Figure 2-3 and Figure 2-4 – offshore study area not shown due to scale). The multibeam data provided some clear detail of seafloor features, but the 2020 data was of a much higher resolution than the 2019 data. Both data sets were examined to locate any features that appeared to be cultural in origin. The 2019 survey used two multibeam echosounders, an R2Sonic 2024 operating at 380 kilohertz (kHz) and a 100° swath continuous wave pulse, as well as a Kongsberg EM2040 varying between 400 kHz, 120° swath, and 300 kHz, 140° swath continuous wave pulse. The 2020 survey utilised the R2Sonic 2024 operating in multifrequency mode at 170, 310, and 450 kHz with a 130° swath for scouting lines and 120° (or less) swath for main survey lines, continuous wave pulse. The geophysical report notes that some very shallow areas were surveyed at single frequency 400 kHz, 120° or 140° swath.

MBES data provided for the realigned Victoria shore crossing was provided in 2023 as a high resolution geotiff, which was loaded onto QGIS to interrogate for potential cultural features. MBES data was collected using a Norbit Winghead B51s at 350 kHz. MBES data for the 2023 survey was provided at 1 m resolution. However, the dataset provided has an average point cloud density of >100 points per square metre and therefore was possible to grid the point cloud at a very high 0.25 m resolution.

Figure 2-3: 2020 multibeam echosounder survey coverage, nearshore Tasmania.

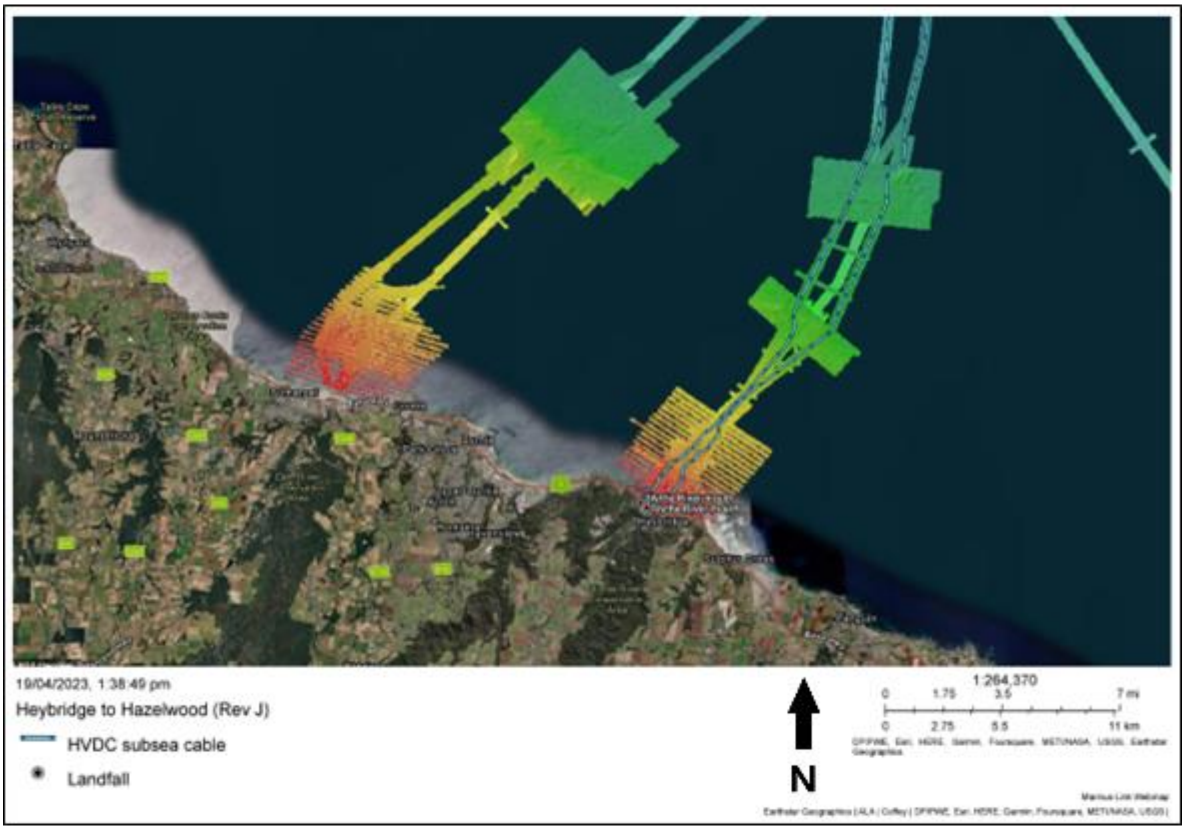

Figure 2-4: 2019 MBES survey data, nearshore Tasmania.

Figure 2-5: 2020 and 2023 MBES survey data for the Victoria Nearshore study area.

Side scan sonar

SSS data was provided as black and white imagery in high and low frequency for years 2019 and 2020, yielding four different data sets to examine (Figure 2-6 and Figure 2-7). Both surveys utilised an EdgeTech 4200FS with dual frequency 122 kHz/410 kHz, towed at a typical altitude of 12 to 16 m above the seabed, with a slant range of 150 m.

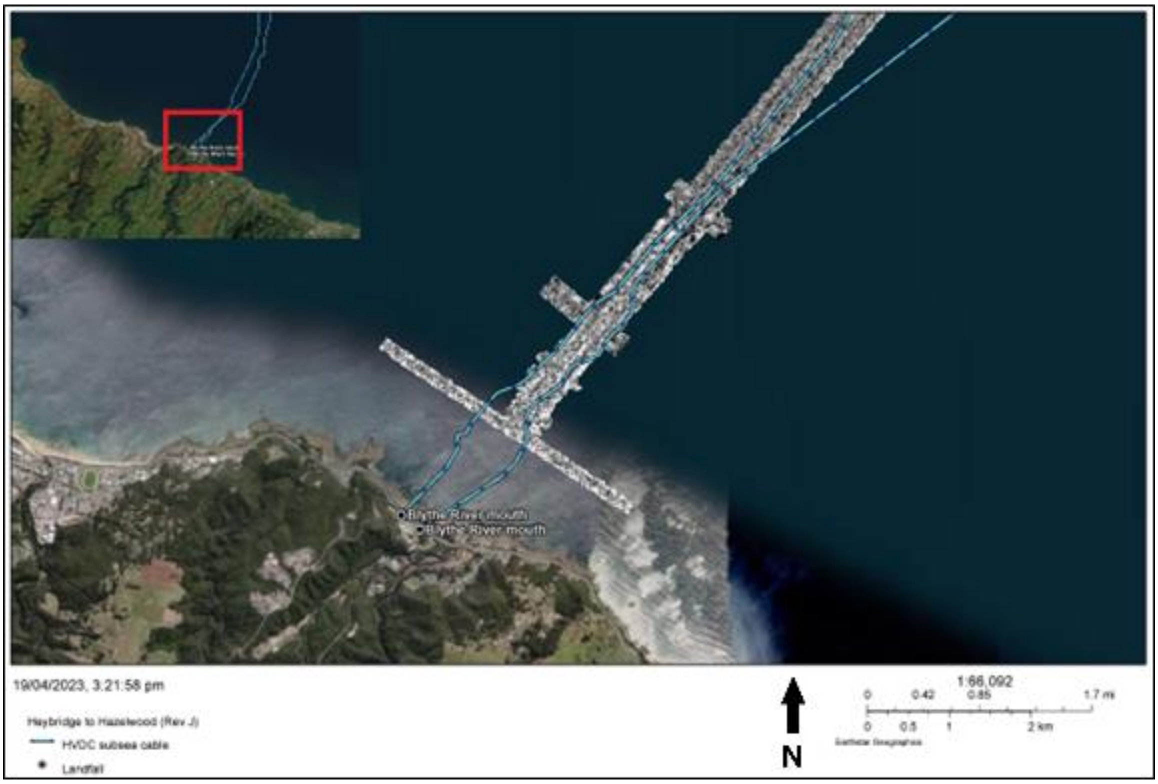

Figure 2-6: 2019 SSS data coverage at Tasmania shore crossing (high frequency).

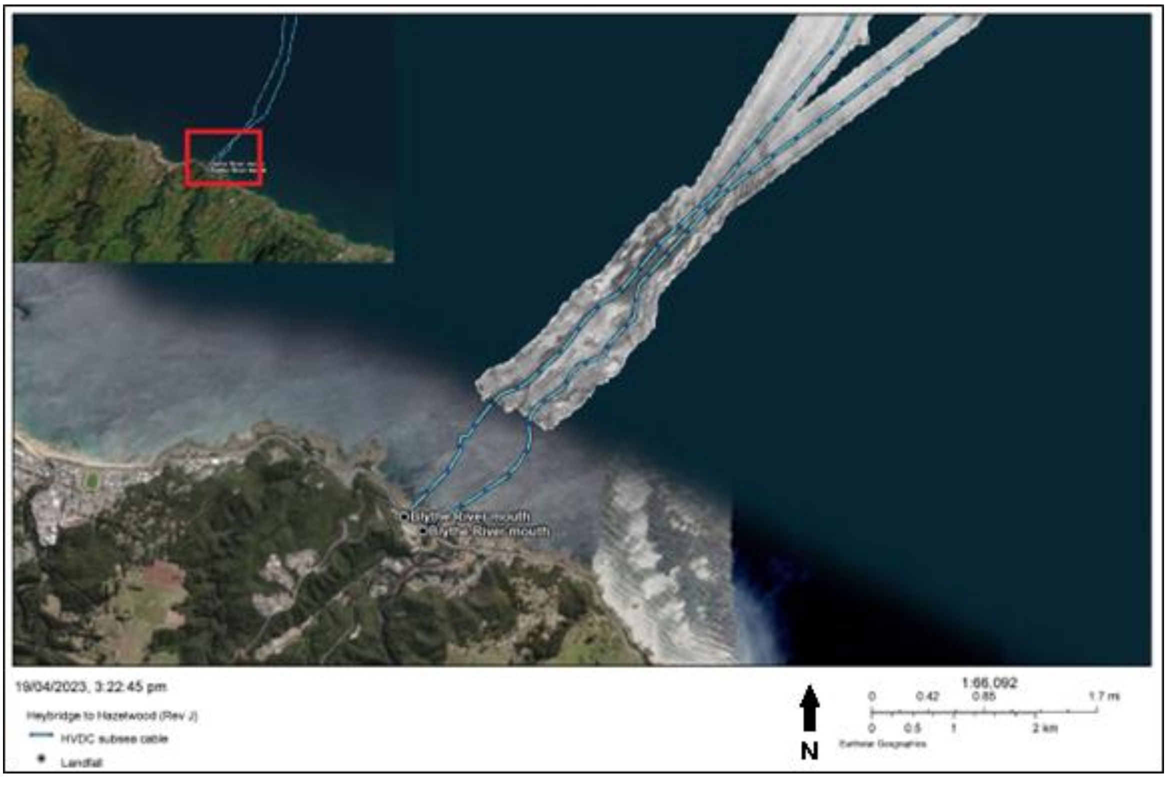

Figure 2-7: 2020 SSS data coverage at Tasmania shore crossing (high frequency).

Pseudo Side Scan Sonar

The 2023 survey utilized Sonarwiz software to produce PSSS images from the raw MBES data. Brightness of the resulting image processed from the raw data identified the reflectivity of seabed features, with darker colours representing more reflective features, while lighter shades showed less reflective features. As opposed to conventional SSS the typical ‘shadows’ that can identify an objects height above the seabed were absent. PSSS data was provided at 0.25 m resolution (see Figure 2-8).

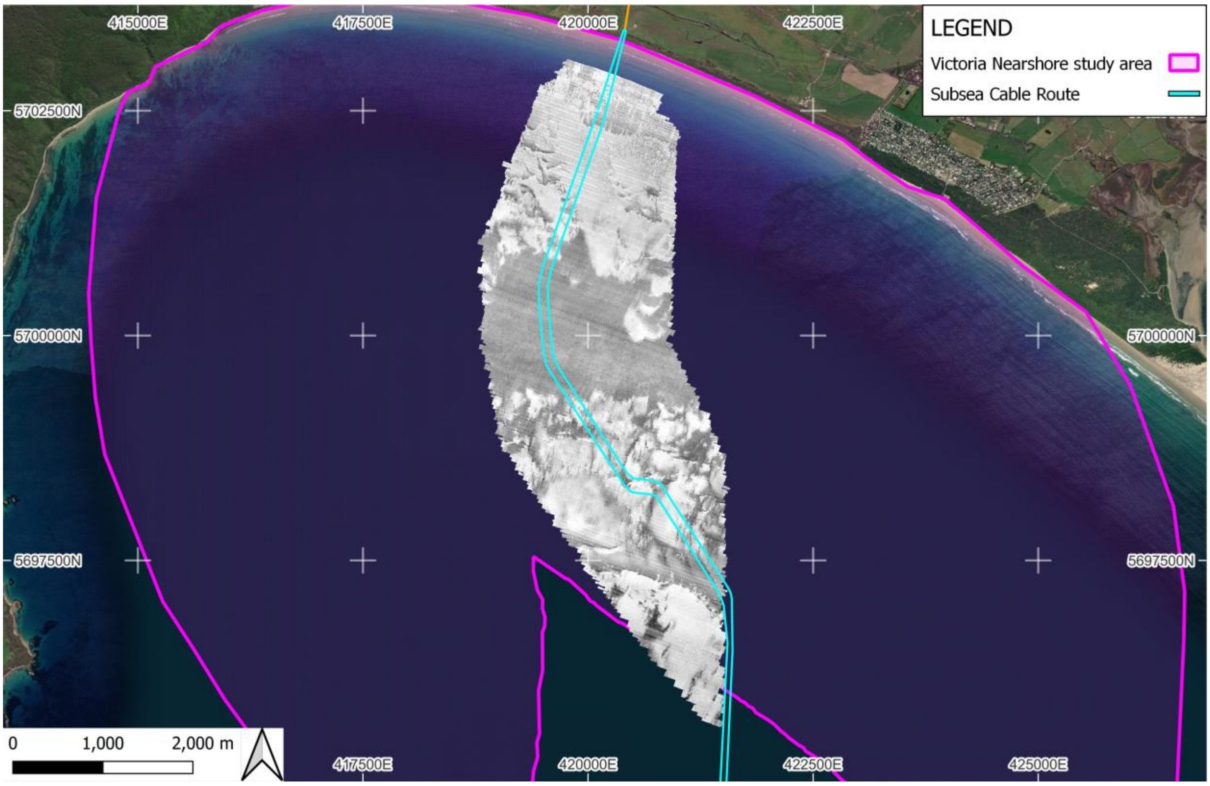

Figure 2-8: 2023 PSSS coverage of the altered subsea cable Victoria shore crossing in the Victoria Nearshore study area.

Magnetometer

Magnetometer targets were identified by Fugro and uploaded by Tetra Tech Coffey as data points on the Marinus Link Webapp (see Figure 2-9 and Figure 2-10). Although the Fugro integrated report appears to list mag surveys occurring in 2019 and 2020, all targets uploaded onto the Webapp were from the 2019 survey. The 2019 survey utilised a Marine Magnetics SeaSpy2 with a 2 Hz sample frequency piggybacked behind the SSS. The altitude of the mag was recorded at each contact location, and the strength of the magnetic anomaly amplitude was recorded in nanoteslas (nT). Nanoteslas as a measure of magnetic field strength, used in magnetometer geophysical survey readings. Fugro estimates that the positional accuracy of the mag to be within 10 m. The 2020 surveyed utilised a Geometrics G882 magnetometer with a 10 Hz sample frequency, also piggybacked on the SSS and towed at a depth between 14-19 m.

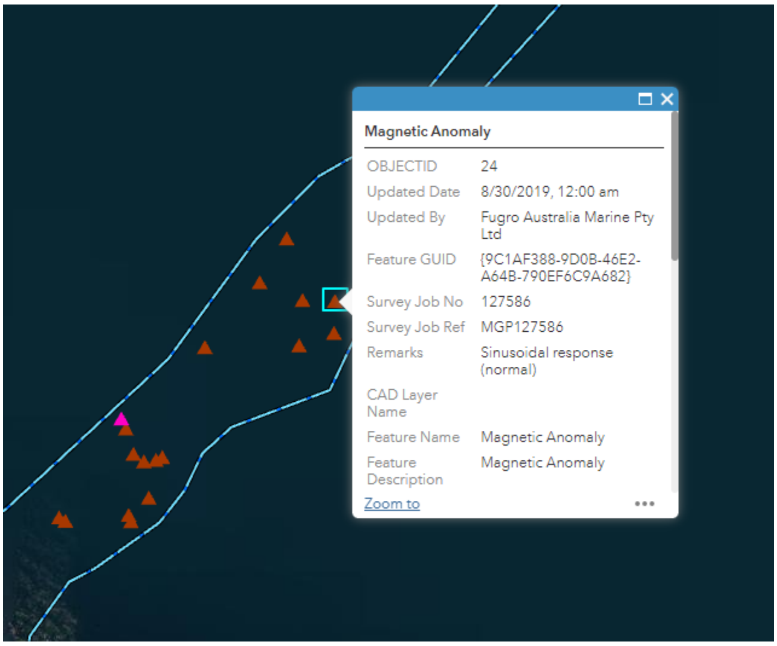

Figure 2-9: Example of magnetic anomaly information provided by Fugro and added to WebGIS Webapp platform (Tasmania nearshore). Magnetic anomalies are shown as brown triangles.

Figure 2-10: Example of magnetic anomaly information provided by Fugro and added to WebGIS Webapp platform (Whole route). Magnetic anomalies are shown as brown triangles.

Sub-bottom profiling

The available chirp and boomer sub-bottom profiler (SBP) data was used in the reconstruction of the submerged terrestrial landscapes within the survey corridor.

Fugro provided alignment drawings of the geophysical surveys that included sub-bottom profiling data, seabed features, sediment distribution, and bathymetric data with depth contours. On these pages, they noted mag and SSS target strikes, but did not include individual interpretation of targets. Fugro also provided an integrated report analysing the data acquired from the 2019 and 2020 surveys, which included analysis of seabed composition and seabed testing.

Sub-bottom profiling for the 2019 survey was accomplished using an EdgeTech Chirp (X-Star) at 0.7-12 kHz frequency spectrum towed approximately 20 m below water surface. The 2020 survey utilised the same sub-bottom profiler, in addition to an Applied Acoustics Boomer 20 element hydrophone, using predominantly 100 J (joules) power output at 3 Hz trigger frequency, with the source-receiver offset 12.7 m in water depths greater than 30 m, and 5.0 m offset in water depths less than 30 m. Power for this unit was set to 200 J and 300 J for increased penetration along a few lines in the Tasmanian Nearshore study area. For the 2023 survey the equipment used was an Innomar Medium SE2000 set at 8KHZ primary frequency and one pulse cycle. Unlike the 2019 and 2020 surveys which ran a single line along the proposed cable alignment, the 2023 survey undertook a series of parallel and cross lines across the Victorian Nearshore survey area.

2.2.2 Review methodology for maritime heritage

The geophysical survey data described above were reviewed to identify anomalies. Each data set was examined in full along the proposed centreline of the conceptual subsea cable route, beginning with the nearshore sections at Tasmania and Waratah Bay, then examining the portion of the route in Bass Strait. In the nearshore sections, data was reviewed from shallower areas, moving to deeper waters up to the 30 m mark (i.e., Waratah Bay followed a direction north to south; Heybridge followed a direction of south to north) because this is the maximum depth for a diver on SCUBA following the Australian/New Zealand Occupational Diving Standards (AS/NZS 2299.1-2015), marking the limit of dive surveys.[9]

Following the first pass of assessing the data and due to the 2020 bathymetry layer overlapping the 2019 layer, the 2020 was toggled off and the 2019 layer was checked a second time. The same direction of examination was completed to control consistency. This was to ensure the overlapping of data layers did not obscure any potential targets from the identification process. A similar process was used reviewing the 2023 MBES data for the Victoria Nearshore study area.

After the bathymetry data was assessed, the SSS data was examined. Again, the 2019 layer was opened first, and surveyed from shallowest recorded data to 30 m depth in the nearshore sections (to inform dive surveys), followed by the 2020 layer. The same process was then repeated for the offshore section. When a target was identified on one layer, it was checked again against all other datasets, including MBES. The PSSS data for the Victoria Nearshore study area was reviewed in the same way.

The numbering for the identified SSS and multibeam targets is arbitrary, beginning at the shallowest part of Waratah Bay, moving to the 30 m mark, then continuing from the shallowest part of Heybridge moving deeper. Magnetometer targets retain the numbering provided by Tetra Tech Coffey and Fugro, with an ‘M’ before the number (e.g., M31). Potential cultural targets identified in the Victoria Nearshore study area from the 2023 MBES and PSSS data were labelled WB23_00#, beginning at WB23_001.

The coordinates are recorded in decimal degrees.

2.2.3 Limitations

The marine geophysical data was of sufficient quality for the purposes of this assessment. However, some limitations affected the identification process. While gaps existed in some layers, all portions of the Marinus Link route were covered by at least one set of MBES data. Therefore, the only limiting factor was the inability to compare multiple datasets for these areas.

Seafloor contours are not visible within the data set. They are visible on land and stop at 0 m. Depths, however, are displayed in 5-m intervals. Thus, the depths recorded for each target are an approximate only where no clear indicator was visible.

Due to the realignment of the Victoria shore crossing in the Victoria Nearshore study area, new geophysical survey data was required. Review of the 2023 geophysical survey data identified several limitations beyond those identified from the 2019 and 2020 data.

Although the geophysical survey coverage was adequate, there remains a gap in the survey data for the final 380 m (approximate) distance of the shore crossing (see Figure 2-11). However, this is not an issue as the exit point for the cables will be at 10 m water depth which is within the boundaries of the 2023 survey (see Section 4).

[9] Australian/New Zealand Diving Standards, ADAS website, https://adas.org.au/australian-diving-standards/.

Furthermore, the 2023 survey also did not include magnetometer data, which eliminates the possibility of identifying ferrous and other metallic objects that may be buried in the seabed. Additionally, the PSSS data differs from conventional SSS data by identifying areas of high reflectivity, rather than identifying prominence of objects above the seabed. Due to data quality issues with sub-bottom profile data, buried landform interpretation was not attempted with this data.

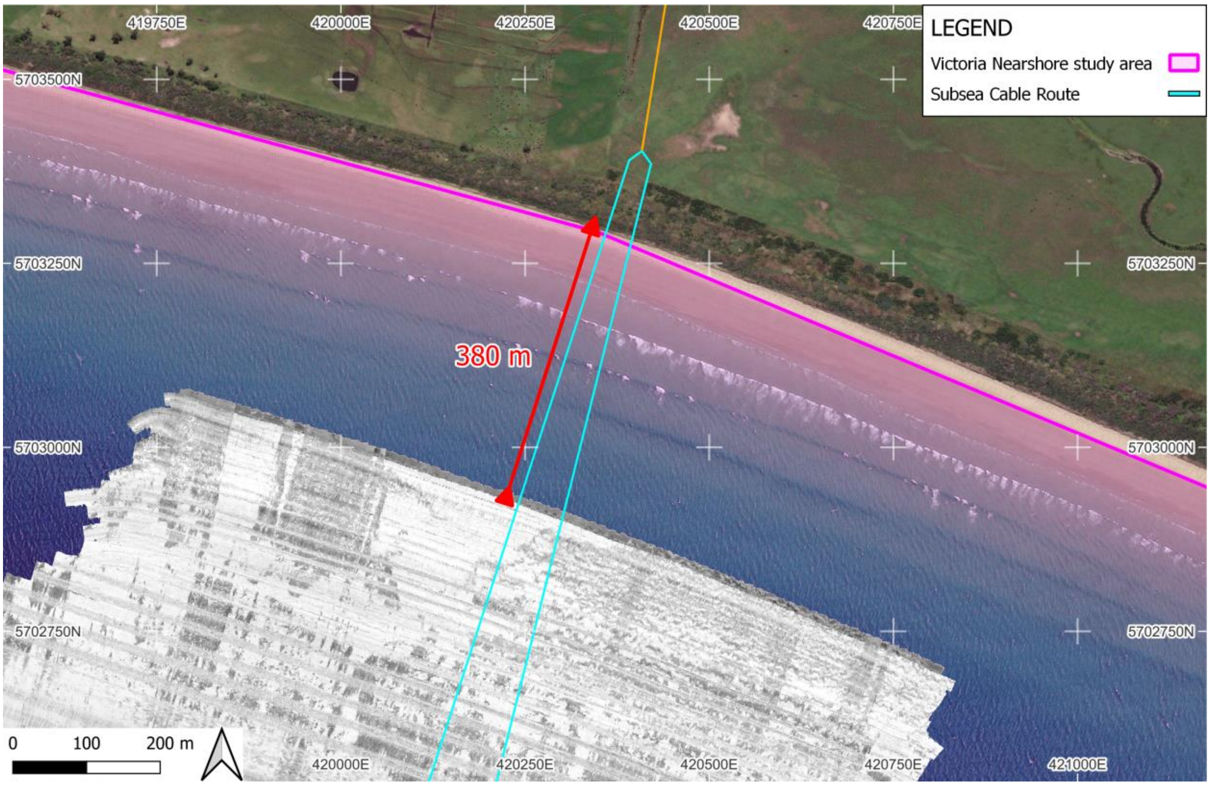

Figure 2-11: Location and distance of the 2023 geophysical survey data gap at the Victoria shore crossing.

2.3 Field survey

The purpose of the field survey was to:

- Visually examine the seabed along the proposed cable route from the shoreward limit of marine geophysical survey to the low tide zone of the beach at both the northern and southern nearshore study areas; referred to as a 'gap survey'. At the time this 'gap' survey was required because the shore crossing method was not finalised.
- Examine anomalies and submerged landforms (as determined from the geophysical data and literature review) of potential maritime heritage significance along the proposed cable route up to the 30 m depth contour. This limitation was due to commercial diver safety regulations, but also the focus was shallower waters closer to shore where options for cable realignment are generally more limited.

The diving inspection in the Tasmania nearshore study area at Heybridge took place on the 27th and 28th of September 2021. These investigations were led by maritime archaeologist James Parkinson, contracted by Cosmos Archaeology, directing a dive team from the environmental scientific company, Marine Solutions. A similar dive survey was undertaken in 2021 for the Victorian nearshore study area for the earlier proposed shore crossing, There was no requirement to undertake diving for the currently proposed Victorian shore crossing on account of the identified anomalies are sufficiently distant from the proposed alignment. Furthermore, since the 2021 dive inspections it has been confirmed that the project design will undertake Horizontal Directional Drilling (HDD) hence enabling the cable to exit the seabed at – 10 m LAT thereby avoiding any seabed impacts shoreward of that point (See Section 4).

The dive inspection were organised based on the review of geophysical data collected for Marinus Link.

Targets selected for underwater inspection were prioritised into two categories:

- Category A sites were those of top priority where images appeared to be cultural and representative of a 'site' such as a small wreck.
- Category B targets were images that appeared to be cultural but representative of an individual object or discard and less likely to constitute a site.

Consideration was also given to depth and approximation to the cable route in regard to categorization, with targets located closer to the proposed route typically given higher ranking than those more distant.

In the Tasmania nearshore study area at Heybridge, seven targets were identified for further investigation during the dive survey, consisting of four Category A targets and three Category B targets (Figure 2-12, Table 2-3).

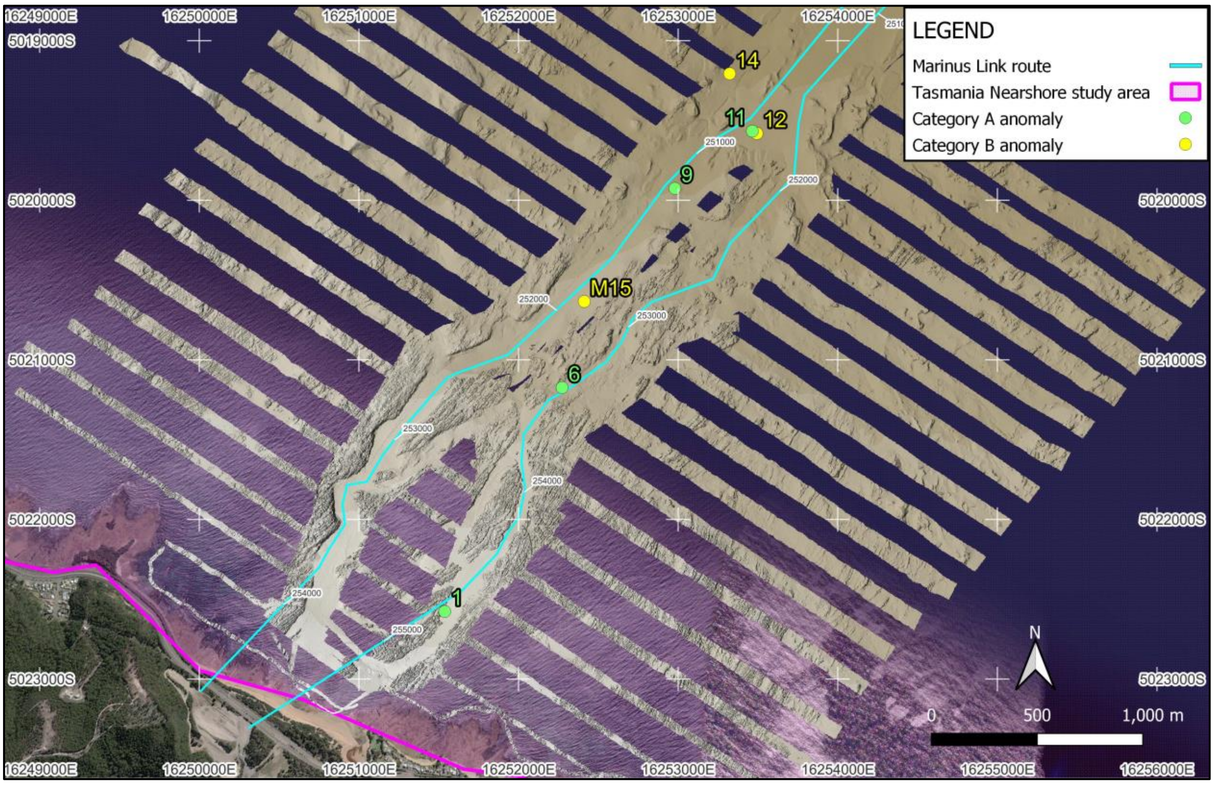

Figure 2-12: Tasmania nearshore study area target anomalies, overlaid on MBES data. (Base image: Google Earth).

Table 2-3: Anomalies identified for dive survey in Tasmania nearshore study area. Note, magnetometer measurements given in nT.

Category	Target ID	Lat	Long	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
A	1	-41.06936	145.99004	No	Possible small wreck or rock outcrop	Length: 12 m Width: 5 m	20 m	15 m
A	6	-41.05985	145.99665	No	Possible small wreck or rock outcrop	Length: 7.9 m Width: 2.9 m	20 m	15 m
A	9	-41.05140	146.00300	No	Possibility of shipwreck or dumped material, more likely rock outcrop	Length: 34.9 m Width: 8.5 m	26 m	37 m
A	11	-41.04896	146.00736	No	Debris or natural feature	Length: 10 m Width: 2 m	28 m	52 m
B	12	-41.04906	146.00761	No	Debris or natural feature	Length: 8 m Width: 5 m	28 m	80 m
B	14	-41.04652	146.00608	No	Linear feature across seafloor	Length: 47 m Width: 1 m	30 m	210 m
B	M15	-41.05620	145.99790	Yes	Magnetic anomaly	526.4 nT	20 m	64 m

Two transects were conducted to inspect the two landing routes of the cable at the Heybridge end Figure 2-13 shows the extent of the transects in Heybridge.

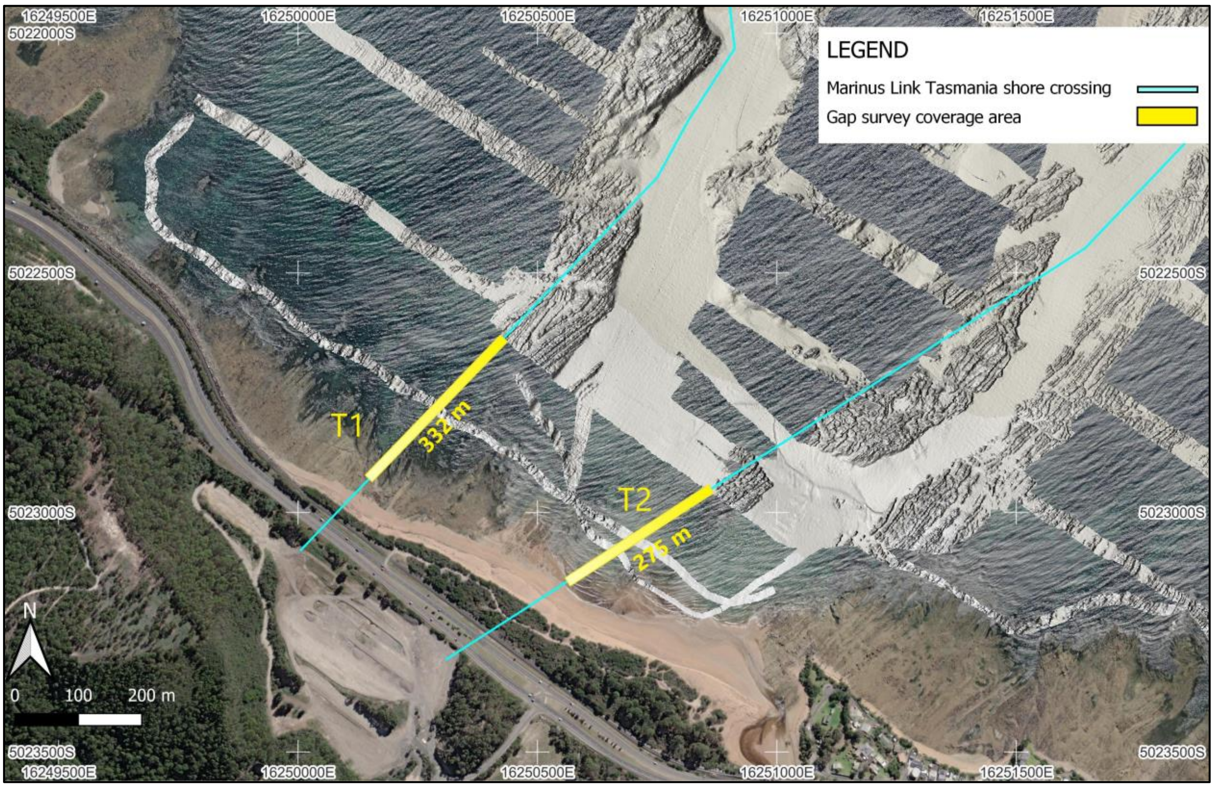

Figure 2-13: Areas and distances shown for the gap survey in the Tasmania nearshore study area at Heybridge. (Base image: QGIS Satellite imagery).

Furthermore, two transects were conducted in the Tasmania nearshore study area at Heybridge to investigate potential paleo-landscapes. A video survey transect was completed showing the transition from the sandy bottom of the paleo-channel across the interface with what may be the former banks of the paleo-channel (Figure 2-14). An opportunistic transect was also conducted using a remote operated vehicle (ROV) to record the seabed at a depth of 50 m at a potential submerged beach ridge site (Figure 2-15).

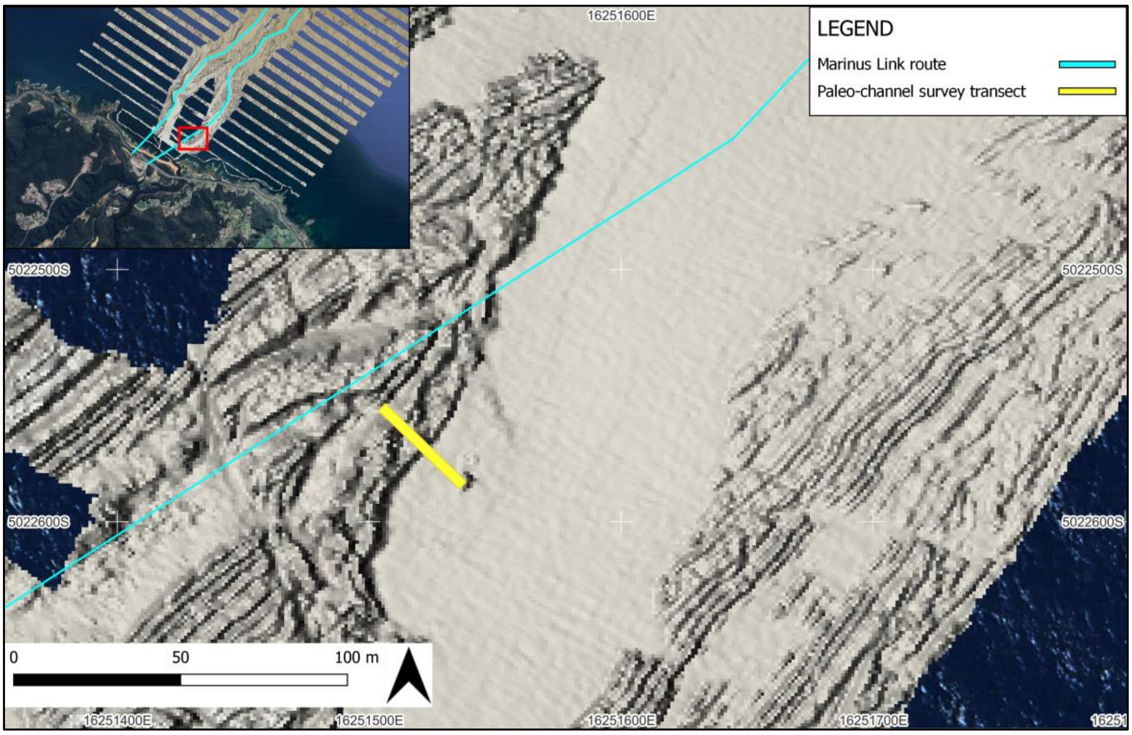

Figure 2-14: Location of paleo-channel survey transect in relation to proposed Marinus Link route.

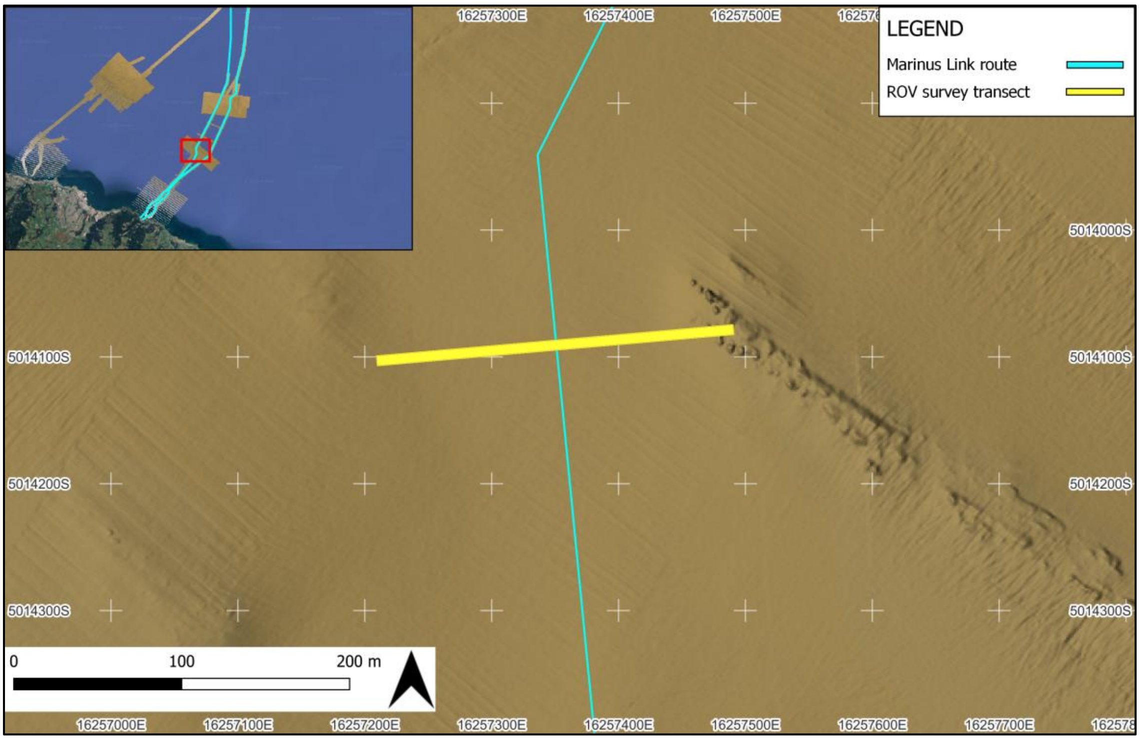

Figure 2-15: ROV transect location. Possible paleo beach ridge feature at right end of transect.

A total of 7 targets and four transects were examined for the dive inspection for the Tasmania nearshore study area at Heybridge. The findings of the dive inspection is discussed in Section 7.4. Annex A presents the method and results of the dive investigation in detail. While not discussed further in this report, the method and results for the 2021 Victoria nearshore study area dive investigation at Waratah Bay is presented in Annex B .

2.4 Establishment of submerged terrestrial predictive model

Since the first arrival of people into Australia and New Guinea approximately 65,000 years ago, at least two million square kilometres of once dry land has been submerged by post-glacial sea-level rise. Cultural landscapes created by thousands of generations of Aboriginal Australians were inundated and are now submerged up to 130 metres below present sea level. These early human populations arrived in the north of the continent and moved down both the east and west coasts and spread into most ecosystems by 50,000 years ago.[10] Most of the archaeological data that would illuminate these earliest periods of occupation, dispersal and subsequent environmental adaptions and technological changes is now submerged on the continental shelves of Sahul (the combined continent of Australia, New Guinea, and Tasmania at times of lower sea-level). Aboriginal oral traditions retain knowledge of now-inundated cultural landscapes in many parts of the continent.

It should be noted that the discipline of submerged Aboriginal archaeology is in its infancy in Australia. Only two offshore underwater archaeological sites have been recorded, both in the Dampier Archipelago in Western Australia in 2020.[11] In the northern hemisphere numerous projects have developed systematic approaches to predictive modelling for the discovery and subsequent investigation of submerged terrestrial archaeology, some specifically targeting hunter-gatherer archaeological evidence.[12] Similar models specific to Australia are being currently developed for ongoing seabed development projects and have not been made publicly available or published at this time. These models adopt a number of key elements which have been applied in the current approach.

The theoretical basis of predictive modelling for submerged archaeological evidence is that:

1. past human behaviour is patterned with respect to natural and cultural/social environments;
2. it is possible to learn about ancient peoples, past human behaviour, and their interactions with their environments by observing and recording the relationships between ancient human material residues (i.e., the archaeological record) and these natural and cultural/social environmental features; and,
3. we can predict where sites may and may not be located based on these relationships and their observed patterning.[13]

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[10] Clarkson et al. 2017; Dortch et al. 2020; McDonald et al. 2018; Veth et al. 2017

[11] **Benjamin et.al., 2020**, *Aboriginal Artefacts on the continental shelf reveal anchient drowned cultural landscapes in northwest Australia.* PLoS ONE 15(7):e0233912. https://doi.org/10.1371/journal.pone.0233912, accessed 10 May 2023.

[12] **Robinson, D., C. L. Gibson, B.J. Caccioppoli, J. W. King, 2020.** Developing Protocols for Reconstructing Submerged Paleocultural Landscapes and Identifying Ancient Native American Archaeological Sites in Submerged Environments: Geoarchaeological Modelling. Bureau of Ocean Energy Management Award M12AC00016. University of Rhode Island; **McCarthy, J., J. Benjamin, T. Winton and Van Duivenvoorde, W. Eds. 2019**. 3D Recording and Interpretation for Maritime Archaeology. Coastal Research Library. Cham, Springer International Publishing, **Cosmos Archaeology, 2020,** *Western Harbour Tunnel and Warringah Freeway Upgrade: Potential submerged sites assessment.* Roads and Maritime Services, **Cosmos Archaeology, 2020,** *Beaches Link and Gore Hill Freeway Connection: Potential submerged sites assessment.* Roads and Maritime Services and **Cosmos Archaeology, 2021,** *Kamay Ferry Wharves Project; Underwater Cultural Heritage Assessment.* Prepared for Transport for NSW.

[13] Op. Cit. Robinson, et al., 2020, p.5.

The approach used is to first acquire understanding of the terrestrial archaeological record, its landscape context, and the cultural values observed by traditional custodians today. Using this knowledge, predictions are made on the types of heritage which may occur within a similar or equivalent submerged cultural landscapes. These quantifiable predictions are entered into a risk matrix to provide policy direction for the proponent to avoid sensitive heritage landscapes where necessary.

The predictive model used in this study is an empirical tool for assessing the potential for, and significance of, cultural heritage sites being present within a range of submerged landscape contexts, and when combined with the age information, can;

(1) Define areas of high and low potential for submerged terrestrial heritage,

(2) Formulate focused and effective site investigation methodologies in order to validate the predictive model, and

(3) Lead to informed management decisions about potential impacts.

This approach is particularly useful at the initial stages of an assessment where extensive geophysical data has been generated as part of the environmental impact assessment process, and in the absence of ground-truthed data.

The process for preparing the archaeological predictive model for this assessment is captured in Figure 2-16 and involves eight Steps (A to H) which can be grouped into three stages; these being:

Stage 1 (Steps A to C)	Identify submerged terrestrial landforms
Stage 2 (Steps D to F)	Assess the potential occurrence of archaeological sites through comparison with terrestrial analogues.
Stage 3 (Steps G to H)	Assess the potential for the presence and condition of archaeological sites as a result of rising sea levels.

It should be noted that this approach has been specifically designed for identifying submerged cultural landscapes and predicting archaeological site types that are likely to be associated with each relic landform. This approach has been developed through a UWA-Cosmos Archaeology collaboration specific for these kinds of underwater archaeological assessments.

The approach presented utilises a variety of skill sets that requires the input from an interdisciplinary team. Such a team is comprised of individuals with a good understanding of geomorphology, especially in a marine context, Aboriginal archaeology and underwater site formation processes – namely a marine geoscientist, a terrestrial archaeologist and an underwater archaeologist.

In this report the submerged terrestrial predictive modelling was undertaken by the following individuals commensurate with their skill set:

Stage 1 (Steps A to C)	Dr O’Leary (marine geoscientist)
Stage 2 (Steps D to F)	Caroline Wilby and Cosmos Coroneos (terrestrial and underwater archaeologists)
Stage 3 (Steps G to H)	Cosmos Coroneos (underwater archaeologist)

These individual steps in this process are described in detail in the following sections.

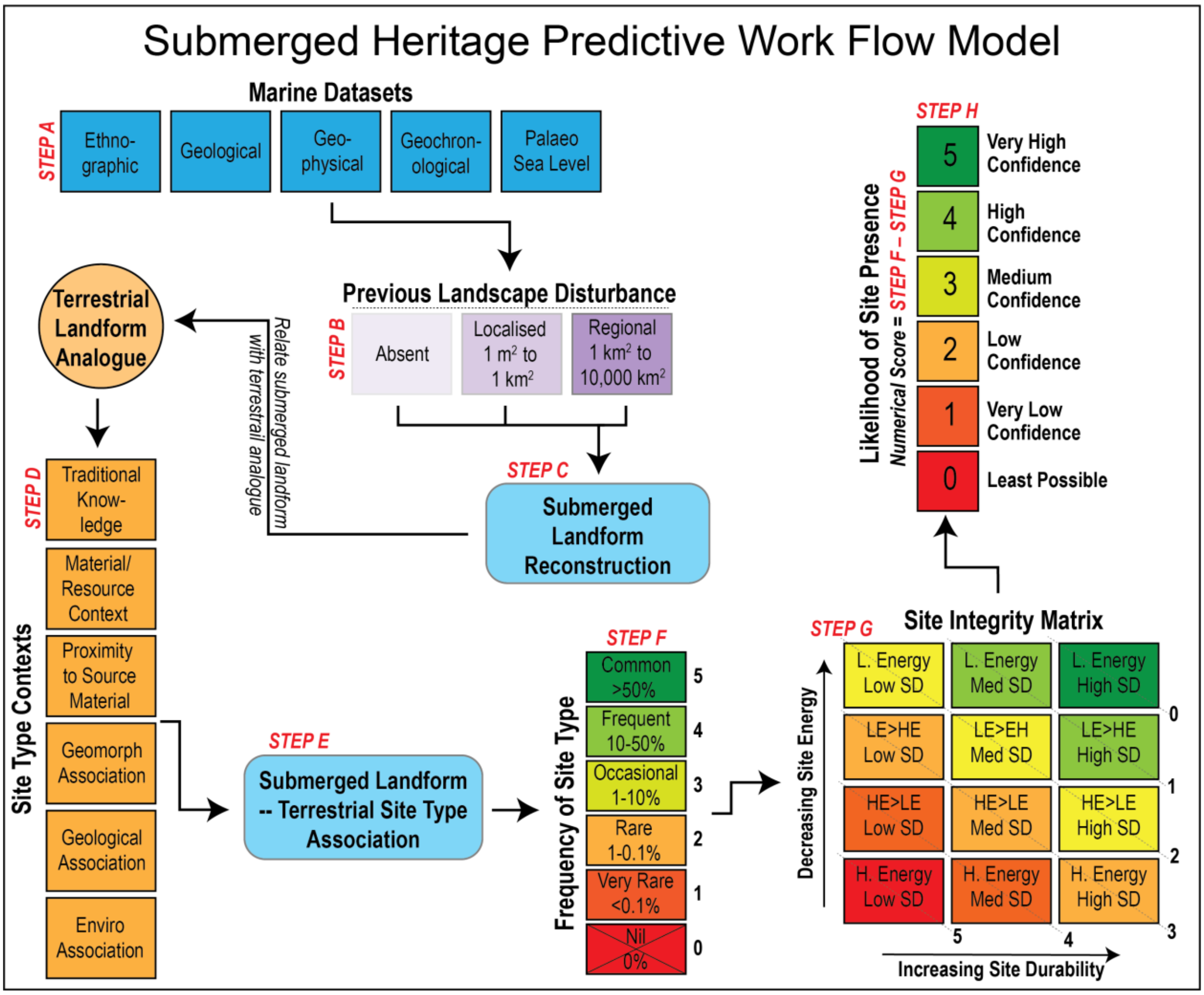

Figure 2-16 : Process to establish predictive model.

Step A - Reconstruct seabed geomorphology, subsurface geology and establish/infer age of landform formation

A range of geophysical datasets typically collected for geotechnical or environmental investigation can be repurposed to reconstruct the pre-inundation land surface and associated palaeoenvironments. Most critical are local multibeam echosounder (MBES) and regional scale (Airborne LiDAR; Satellite Derived Bathymetry; 3D Seismic Bathymetry) bathymetric datasets that provide information on seabed geomorphology and in turn, the presence/absence of relict terrestrial and coastal landforms. Sub-bottom seismic profile data can provide information on shallow subsurface stratigraphy, and rotary and/or vibrocores can ground-truth the sub-bottom survey data as well as recover geological material for age dating.

Radiometric age dating methodologies, including radiocarbon and uranium-series approaches, can be used to establish the age of submerged landforms. The accuracy of radiometric dating becomes less accurate beyond 28,650 years before present (BP) and has an upper age limitation of 40,000 years BP.

This maximum age dating limitation means that coastal deposits that formed between 65,000 and 45,000 years BP, the time period spanning the first arrival of humans in Australia, cannot be reliably dated using radiocarbon analysis. To accurately bridge this time period, uranium-thorium dating (u-series) is used. This dating method has an upper age limit of approximately 500,000 years, easily covering the period of early human arrival into Australia.

Where radiometric (radiocarbon/u-series) ages are not available, the age of a coastal feature can be inferred based on the shoreline's seabed depth and the known age of the former position of past sea levels.

Step B - Identifying previous seabed disturbance within the identified landscapes

Subsea developments often occur in areas where the seabed has already been modified by earlier marine infrastructure projects or other activities such as bottom trawling. The extent and depth of impact will vary, for example bottom trawling can be extensive over a large area of seabed but is confined vertically to the seabed surface where the sediments are most likely to be Holocene. The nature and extent of these earlier seabed disturbances are integrated into this landscape study. The types and levels of landscape disturbance are ranked based on identified disturbance categories (Table 2-4).

Table 2-4 : Types and scale of seabed disturbance.

Localised 1 m^2 to 1 km^2			**Regional 1 km^2 to 10,000 km^2**		
Excavation	Levelling	Dumping	Excavation	Levelling	Dumping
Bore hole Pile hole Trench Borrow pit Dredging - berth Dredging - borrow pit	Anchor drag Ploughed seabed	Rock dump Revetment	Dredging - channel	Ploughed seabed	Spoil ground Land reclamation Rock dump Revetment

Understanding the type and scale of disturbances that have taken place influences the assessment of site integrity and where extensive dredging has taken place into late Pleistocene surfaces, significant portions within a study area can be excised from further investigation.

Step C - The reconstruction and characterisation of submerged landscapes with suitable geomorphic and age criteria for potentially containing heritage sites

Landscapes can be classified into igneous terrains, coastal and marine terrains, alluvial/fluvial terrains, aeolian terrains, and karst terrains (see Table 2-5). These terrains are then subdivided into rock type or sedimentary facies/depositional environment and further into landforms and landform elements. Working backwards we use data from **Step A** to identify individual landforms (e.g., beach ridge), combining these individual landforms across local or regional scales it becomes possible to reconstruct pre-inundation landscapes and environment and infer a cultural association.

Table 2-5 : Landscape classifications

Geology	Igneous Geology		Calcarenite/Limestone Geology			Clastic Sedimentary Geology			Clastic/Carbonate Geology	
Rock Type/ Facies	Rhyodacite/ Granite	Basalt	Nearshore	Shoreface	Estuarine	Colluvial/ Alluvial	Fluvial	Lacustrine	Coastal/ Terrestrial	Terrestrial
Geomorphology	Igneous Landforms/Terrains		Coastal and Marine Landforms and Terrains			Alluvial/Fluvial Landforms and Terrains			Aeolian Landform	Karst Landforms
Landscape	Inselberg Bornhardt	Basalt Terrain	Marine plain	Beach ridge complex Cuspate foreland Chenier plain	Delta plain Estuarine inlet	Alluvial plain Alluvial terrace Peneplain	Flood plain Meander belt	Lacustrine plain Alluvial swamp	Aeolian dune field Aeolian sand sheet	Karst
Landform	Nubbin Castle Koppie Pillar Block field	Outcrop Columns Pinnacle Block field	Fringing reef Ebb tidal delta Nearshore shelf	Tidal flat Beach ridge Salient/ Tombolo Spit Chenier Ridge Barrier beach Barrier spit	Estuary Flood tidal delta Supratidal flat Lagoon	Alluvial terrace Bar plain Covered plain Sheet-flood fan	Fluvial terrace Stream channel Braided stream Meandering channel	Playa lakes Oxbow lake (Billabong) Claypan	Transverse dune Parabolic dune Longitudinal dune Lunette	Solution platform Cockpit karst Pavement karst
Landform element [Feature]	Block Boulder	Block Boulder	Sand banks Shell bank Longshore bar Point bar	Rock platform Beach face Berm Foredune	Mud bank Estuarine channel	Channel bar	Point bar Channel bar Scour (pool) Levey bank	Lake bed Lakes shoreline	Dune slack Interdune Slip face	Caves Swallow Hole
Erosional Landform	Ravine Gully Cave	Ravine Gully Cave	Wave-cut platform Stack	Terrace/riser Bench Rock platform Sea cave	Cut bank	Rill Gully	Cut bank		Blowout Deflation basin	
Anthropogenic (Artificial) Landform			Dredge channel Spoil bank Trench Burrow ground Anchor scar Revetment	Reclaimed land Embankment Fill-top Pit Quarry						

Step D. Establish the context between terrestrial site types, associated landforms, and local environments

The most direct way of establishing the cultural context of a submerged landform is to identify an analogous terrestrial landform and then establish the type of archaeology associated with that landform. The premise being that the cultural activities that occur in association with a landform (whether submerged or terrestrial) should be relatively persistent though time. Once a submerged landform of feature has been defined in **Step C**, equivalent terrestrial analogues situated within the immediate local area, or if none exist, within the broader region, are identified and their associated site types are then characterised (see flow chart link between steps **C** and **D**). These site characterisations include a number of independent variables that can be used to better validate the similarity between the defined submerged landform and the equivalent terrestrial analogue. These independent variables can include:

- Traditional knowledge: Is there a spiritual association with a particular landscape type that is not accounted for in the environmental datasets?
- Material/value context: What is the cultural material constructed from?
- Proximity to source material: How close does this cultural material typically occur to its geological/biological source material?
- Geomorphic association: What landform or feature is typically associated with the cultural material?
- Geological association: Is the cultural material/site type associated with – or constrained by – a particular geological terrain?
- Environmental association: What type of environments are typically associated with the cultural material?

Table 2-6 below provides an indicative listing for the purposes of demonstrating site types than can be associated with different landforms across Australia. This table was developed based on experience gained by Cosmos Archaeology on a range of projects.

Table 2-6 : General relationship between landforms and site types

Landscape	Landform	Erosional Landform		Site Type A	Site Type B	Site Type C	Site Type D	Site Type E
Bornhardt (Granite)	Nubbin			Artefact Scatter	Engraving	Quarry	Grinding Patches	
	Castle Koppie			Artefact Scatter	Engraving	Quarry	Grinding Patches	
	Pillar			Artefact Scatter	Engraving	Grinding Patches		
	Block field			Stone Structure	Stone Arrangement			
		Ravine		Water Source				
		Gully		Water Source				
		Cave		Cache/Repository	Artefact Scatter	Midden		
Basalt Terrain	Outcrop/Columns			Artefact Scatter	Engraving	Quarry	Grinding Patches	Standing Stones
	Pinnacle			Artefact Scatter	Engraving	Quarry	Grinding Patches	Standing Stones
	Block field			Stone Structure	Stone Arrangement			
		Ravine		Water Source				
		Gully		Water Source				
		Cave		Cache/Repository	Artefact Scatter			
Marine Plain	Fringing reef							
	Ebb tide delta							
	Nearshore shelf							
		Wave cut platform						
		Sea stack						
Beach Ridge Complex	Beach ridge			Artefact Scatter	Skeletal remains	Midden		
	Tombolo			Artefact Scatter	Skeletal remains	Midden		
Delta Plain	Spit			Artefact Scatter	Skeletal remains	Midden		
	Beach ridge beach			Artefact Scatter	Skeletal remains	Midden		

Landscape	Landform	Erosional Landform		Site Type A	Site Type B	Site Type C	Site Type D	Site Type E
Cuspate Foreland	Lagoon							
		Transgressive dune		Artefact Scatter	Skeletal remains	Midden		
		Dune blowout		Artefact Scatter	Skeletal remains	Midden		
Chenier Plain	Supratidal flat			Artefact Scatter	Midden			
	Chenier ridge			Artefact Scatter	Midden			
Rocky Coast		Low tide terrace		Fish Trap				
		Sea cave		Cache/Repository	Artefact Scatter			
		Riser/Bench		Artefact Scatter				
	Beach Ridge (cobble)			Midden	Stone Arrangement	Artefact Scatter	Quarry	
Estuarine Inlet	Beach ridge			Artefact Scatter	Skeletal remains	Midden		
	Supratidal flat			Artefact Scatter	Midden	Stone Arrangement		
	Tidal flat			Artefact Scatter	Midden	Stone Arrangement		
	Estuary			Mythological	Artefact Scatter	Midden		
	Tidal channel							
	Lagoon							
	Flood tide delta							
Alluvial Plain	Alluvial terrace			Artefact Scatter				
	Bar plain			Artefact Scatter				
	Covered plain			Artefact Scatter				
	Sheet-flood fan			Artefact Scatter				
Fluvial Plain	Fluvial terrace			Artefact Scatter				
	Stream channel			Mythological	Artefact Scatter	Midden	Quarry	Rock shelter
	Breaded stream			Mythological				

Landscape	Landform	Erosional Landform		Site Type A	Site Type B	Site Type C	Site Type D	Site Type E
	Meander channel			Mythological				
Lacustrine Plain	Playa lakes			Artefact Scatter				
	Oxbow lake			Mythological	Meeting Place	Artefact scatter		
	Claypan			Artefact Scatter	Skeletal material			
	Lunette			Artefact Scatter	Skeletal material			
Karst Terrain	Cockpit karst			Water Source	Artefact Scatter			
	Pavement karst			Artefact Scatter	Engraving			
	Doline			Water Source	Artefact Scatter			
	Cave			Artefact Scatter	Midden			

Step E. Submerged landscape site type associations

A key assumption in predictive modelling is that cultural site types associated with a particular terrestrial landform or feature are also likely to exist in a geomorphically similar submerged terrestrial landform or feature. Where these similar terrestrial and submerged landforms can also be shown to have similar geological or environmental associations then the assumption is strengthened. So, taking the data from **Step D** we are now able to take the reconstructed submerged cultural landform or feature and directly assign cultural site types and the frequency of occurrence of particular cultural material. If a landform has multiple site type associations, then these are treated separately.

Step F. Frequency of cultural material present within a defined landform or feature

A key challenge in modelling submerged landscape archaeology, and determining anthropological and ethnographic connection, is assessing the amount of cultural material that may exist at, or buried beneath, the seabed. The importance of this relates to both the likelihood of a given seabed disturbance impacting artefacts and the increased or decreased likelihood of archaeological sites having formed and survived in favourable 'micro-environments'.[14]

This requires the examination of those terrestrial landscape analogues which exhibit the most similar independent variables (see **Step D**) as those similarly defined submerged landforms or features. The amount of cultural material situated within a landform or feature can be defined in a number of ways:

> ***Abundance*** - A measure of the total amount of cultural items situated within a defined landform or feature.
>
> ***Density*** - The number of cultural items per unit area or volume within a defined landform or feature.
>
> ***Frequency*** - The proportion or percentage of observer points (observations) which contain cultural items within a defined landform or feature.

For example, abundance may be measured in single digits when quantifying fish traps along a stretch of coast but measured in the hundreds or thousands if measuring debitage within a quarry site. Equally, density maybe quantified as very low if counting several large middens situated on a coastal headland or quantified as very high if assessing lithics within a dune blowout at the same location. These particular approaches may lead to an under or over valuing of a particular type of cultural feature or material within a given landform or feature. The frequency approach measures the proportion of random observer points (randomly generated in GIS) which fall within the boundaries of a defined archaeological sites across a predefined area. A single large midden may have multiple observer points over its basal area and can therefore be counted more than once. Equally a high-density lithic scatter site may have a lower proportion of observer points with its site boundary compared to the total number of lithics. The Frequency approach eliminates the value bias towards high abundance cultural heritage site types such as lithic scatters or quarry sites and gives low abundance (and potentially more significant) site types such as middens, fish traps or engravings a greater proportional value.

Where such detailed data is available the approach to determining frequency is to first establish the boundaries of each terrestrial landform analogue. Terrestrial landforms that have undergone intensive archaeological survey with records of site types and abundance of cultural objects will yield more robust results. Using GIS software a uniform buffer is established around each recorded cultural object – usually based visual distance in which the object can be identified - and where multiple sites overlap they are merged to produce a

[14] **Benjamin J, O'Leary M, McDonald J, Wiseman C, McCarthy J, Beckett E, et al.** 2020 Aboriginal artefacts on the continental shelf reveal ancient drowned cultural landscapes in northwest Australia. *PLoS ONE 15(7)*: e0233912. https://doi.org/10.1371/journal.pone.0233912

final combined site boundaries for each site type. One hundred random point features (observer points) are randomly generated (using the *create random point* tool in ArcMap) within each of the landform boundaries, positive observer points are those that fall within site boundaries and negative observer points fall outside site boundaries. The percent positive observer points were then calculated, and frequency score using the ratio number of favourable outcomes (successful search) divided by the total number of outcomes (total search) for each site type within each terrestrial landform (see Table 2-6). This calculation was made to provide the likelihood of an artefact or site occurring within a given landform or in other words a value for artefact/site density. These can be ranked as:

5.	Common	Where cultural material occurs more than 50% of the time
4.	Frequent	Where cultural material occurs between 10-50% of the time
3.	Occasional	Where cultural material occurs between 1-10% of the time
2.	Rare	Where cultural material occurs between 1-0.1% of the time
1.	Very Rare	Where cultural material occurs less than 0.1% of the time
0.	Nil	Will not occur.

The analysis described above relates to areas and landforms that are relatable to those identified underwater that have been subjected to systematic, intensive and detailed investigation. The prevailing situation across Australia is that the majority of ‘sites’ are documented in an *ad hoc* manner, most often in response to development or narrow research foci. The biases inherent with this selective investigation regime as well as the varying levels of detail recorded for each investigation (and the relative difficulty in accessing such information) would make any analysis to the level described above meaningless and misleading.

In the majority of situations where detailed site/area data is not available, estimates of the frequency of site types recorded for a particular landform. Quite often these estimates will be based on the relative number of recorded sites. For example a number of archaeological surveys over a particular dune complex may have recorded stone artefact scatters as the majority site type with defined midden sites also being present in high proportion relative to the stone artefact scatters while burials are less so. From such limited information the general terms provided above will be assigned to each site type. With this and where there is a paucity of site data for a comparable landform, a conservative approach will be taken where as a minimum, site types will be assigned an “Frequent” rating.

Step G. Site Integrity: Predicting what sites might survive being submerged

The distinction between ‘durable’ and ‘non-durable’ contexts is crucial for drawing analogies between terrestrial cultural landforms and submerged cultural landforms. In durable contexts (i.e., rock art, quarry sites, stone structures, cemented middens, artefacts imbedded in beach rock), archaeological evidence should remain relatively intact with minimal impact from the numerous natural processes likely to destroy sites during their inundation. In contrast, more ephemeral geomorphic contexts (i.e., midden sites in dunes, superficial surface artefact scatters, and – depending on their orientation to the encroaching sea – occupation deposit within rockshelters) will be far more dependent on multiple sedimentary and other marine taphonomic processes through time; and these will not always be predictable.

Based on these considerations, the following frequent terrestrial sites that retain their archaeological integrity are the most likely to be detected underwater:

- Midden and artefacts within cemented dunes and beach rock deposits and around calcium carbonate encrusted waterholes on identified palaeo-creek lines;
- Stone fish trap constructions in soft sediments around palaeo-estuaries;
- Quarry outcrops, extraction pits and associated reduction debris on volcanic geologies, or on flat calcarenite surfaces adjacent to volcanic boulder features;
- Circular and curvilinear stone structures on pavements with associated midden;
- Standing stones jammed into hard rock platforms and into boulder piles;
- Erosional lag deposits of artefacts (and possibly midden) that may have formed pre and post inundation and deposited atop a hardpan landscape in suitable preservation conditions e.g., shallow declination shorelines in sheltered passages or on the leeward side of hard-rock/fringing reef causeways adjacent islands; and,
- Small overhangs and shelters with preserved deposits, facing away from the dominant wave and wind action.

The above discussion on site integrity focuses on the intactness of the potential archaeological deposits/features, that is the degree of retention of the spatial relationship between artefacts or diagnostic features (primary context) that made up a site at the time of inundation. Artefacts and features that may have survived inundation but have had a reduction in diagnostic attributes or lost any anthropogenic spatial connection (for example re-sorted by wave action) have a lesser archaeological value. Despite these obfuscating factors, the depth at which artefacts are found provides a latest possible date for their deposition, which can potentially contribute towards the understanding of changing cultural practices over time (such as changes in stone tool technology, resource exploitation or art). Furthermore, it should also be noted that the archaeological integrity of a site may not necessarily reduce the heritage values of the site.

The method for assessing site integrity has been undertaken by comparing what would be the assessed durability of a site type against site protection which is localised exposure to physical (wave, sand abrasion, tidal currents and salts), biological (bioerosion and bioturbation) and chemical (dissolution/cementation) processes.

The Site Integrity Matrix (Step G) refers to the assessed durability of a site type which is ranked as per the following categories:

- **High:** Cultural feature or site is able to maintain its original form despite being exposed to hydrodynamic processes throughout period of mid to late Holocene inundation
- **Moderate:** Cultural feature or site is only able to maintain its original form during the initial period of sea level inundation, requires post inundation burial or to be situated below wave base to maintain original form
- **Low:** Cultural feature or site loses its primary context during the process of inundation

The level of exposure to hydrodynamic processes a site has experienced is ranked as per the following categories: (LE = low energy and HE = high energy)

- **Protected (low energy):** Site has been largely protected from site degradation process
- **Limited Exposure (low energy more frequent – LE>HE):** Period or protection greater than period of exposure

- **Protracted Exposure (high energy more frequent – HE>LE**): Period of exposure greater than period of protection
- **Exposed (high energy):** Site has been largely exposed to site degradation processes

When these two variables are combined in the Site Integrity Matrix, they produce ranking from 5 (high energy/low site durability) to 0 (low energy/high site durability); i.e., the lower the number the higher the probability the site has maintained its original pre-inundation integrity. This produces the matrix presented in Figure 2-17. This approach means that the values for Step F and Step G are subtracted higher number will lower the original Frequency of Site Type value and decreasing the sites likelihood of presence value (see Step H).

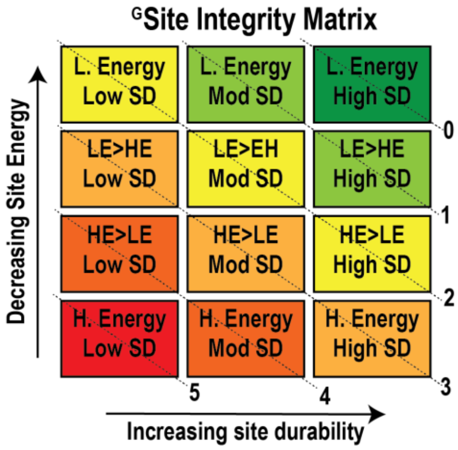

Figure 2-17 : Site integrity matrix based on scores for site durability and site protection.

Step H. Likelihood of site or cultural material presence and condition within a submerged landform or feature

In order to assess the likelihood of a site or cultural objects being present within a submerged landscape and in an archaeologically meaningful condition (i.e., the archaeological deposit not having been modified beyond recognition) the site exposure measure in Step G is subtracted from the cultural item frequency measure in Step F. This results in a ranked score from <1 to 5. This approach allows the site exposure measure to modulate the frequency value calculated from a terrestrial landform analogue. For example, a less durable site that has experienced higher wave energies since inundation will have a lower confidence of site preservation and cultural material being present. Alternatively, a site with a frequency score of 5 will have a higher confidence of site being preserved in its primary context. Nil confidence is used when there is no likelihood of any cultural material being present such as when dredging has taken place down into Pleistocene layers.

Ranked Score:

5	Very high confidence
4	High confidence
3	Medium confidence
2	Low confidence
≤1	Very low confidence
0	Nil

2.5 Definitions

In this study, underwater cultural heritage is defined as all *material* of potential heritage significance on or under the seabed below the HAT. This therefore excludes any assessment of intangible cultural heritage associated with submerged terrestrial landforms as expressed through stories and spiritual beliefs.

The following definitions are also used throughout this report:

- *Chart Depth* is becoming a common term that indicates the minimum water depth at Lowest Astronomical Tide (LAT).
- *Discard* includes items that have been accidentally or deliberately deposited in or on the seabed and now form an archaeological site.
- *Foreshore* includes areas in immediate contact with the edge of the coastline.
- *Karren* refers to repeating, surficial solution channels, grooves or other forms etched onto massive, bare limestone surfaces; types range in depth from a few millimetres to > 1 m and separated by ridges; the total complex (all varieties) of surficial solution forms found on compact, pure limestone.
- *Known* refers to archaeological sites known from historical records, such as a shipwreck event reported in a newspaper. A shipwreck identified in the historical record does not mean its wreck has been located. This would require field investigation and verification of an anomaly derived from the interrogation of marine geophysical data obtained from survey(s) undertaken for this project.
- *KP* refers to kilometres along the proposed cable route, starting from KP 0 at the Victorian shore crossing and terminating at approximately KP 255 at the Tasmanian shore crossing.
- *Located:* Actual position of shipwreck or underwater cultural heritage site has been located by archaeologists, heritage managers, or is publicly known. Located sites have an exact location.
- *Maritime heritage* refers to non-Aboriginal heritage archaeological sites, including, but not limited to, shipwrecks, aircraft wrecks, discard and dumping sites, and maritime infrastructure such as jetties, slipways, moorings, and undersea cables.
- *Potential:* Archaeological potential refers to archaeological sites that are predicted on the basis of cultural activity, which is usually not documented in the historical record. For example, at anchorage there will usually be anchors, chain and archaeological deposits formed by objects being discarded. Predicted submerged terrestrial sites derived from modelling can also be considered to be potential.
- *Seabed* includes sediments forming the floor of Waratah Bay, Bass Strait, and the Tasmanian coast.
- *Strandplain* is a prograded shore built seaward by waves and currents, and continuous for some distance along the coast. It is characterised by subparallel beach ridges and swales, in places with associated dunes.
- *Submerged* is used to describe land or archaeological heritage that is currently under water.
- *Tonnage:* Calculation of the interior volume of a ship. These volumes are expressed as tons where one ton measurement is 100 cubic feet capacity.
- *Underwater cultural heritage* covers both submerged Aboriginal terrestrial archaeological sites and maritime heritage sites.

2.6 Linkages to other reports

This report is informed by the technical assessments outlined in Table 2-7.

Table 2-7 : Technical assessments used in this study

Technical assessment	Relevance to this assessment
Eco Logical Australia 2023, *EIS/EES Technical Appendix J: Aboriginal and historical cultural heritage*	The site data in this report was accessed to inform the predictive modelling for the submerged Aboriginal terrestrial sites that may be present.
Fugro, 2020, *Project Marinus – Marine Engineering Geophysical Survey – Integrated Report*	The marine geophysical data in this report was interrogated to identify seabed anomalies of potential cultural heritage significance.
XOCEAN, 2023, *Waratah Bay Geophysical Survey Results Report, September 2023.*	Report detailing marine geophysical surveys conducted to cover the realigned Victoria shore crossing for the subsea cable in the Victoria Nearshore study area. This data was interrogated to identify seabed anomalies of potential cultural heritage significance.

2.7 Stakeholder engagement

The findings of the Aboriginal component of the underwater cultural heritage and archaeology impact assessment has been presented to the Aboriginal Advisory Group established for this project, Bunurong Land Council Aboriginal Corporation (BLCAC) and Boonwurrung Land Sea Council Aboriginal Corporation (BLSC). Presentations to the Gunaikurnai Land and Waters Aboriginal Corporation (GLaWAC) and relevant stakeholders from Tasmania were postponed and have not be held by the time of writing.

The presentation was in Powerpoint and was jointly presented online by Cosmos Coroneos and Dr. Mick O'Leary. It comprised 25 slides which covered the approach to the assessment, a brief introduction of sea level rise in Bass Strait, the process of investigation, the findings as well as the assessment of potential impacts and discussion on possible mitigation measures. Throughout the presentations any questions raised were answered and where time permitted at the end of each presentation questions were asked about the cultural heritage values of what was identified and what would be appropriate mitigation measures. The presentations went from 1 hour to 1.5 hours.

The summary of stakeholder engagement is presented in the table below:

Table 2-8: Summary of stakeholder engagement.

Stakeholder	Timings	Discussion points
Aboriginal Advisory Group	22nd March 2023	• Possibility of having RAPs on board vessel during ROV surveys of seabed. • Having RAPs on board vessels which are carrying out geotechnical surveys. • Present findings to RAP stakeholders
Gunaikurnai Land and Waters Aboriginal Corporation	15th May 2023	• Meeting postponed
Bunurong Land Council Aboriginal Corporation	15th May 2023	• Issue of intangible heritage raised with emphasis on kelp and maireener shell used for stringing necklaces. • Employment and diving. • Importance of dunes as places where burials took place. • Presentation not completed as ran out of time.
Boonwurrung Land Sea Council Aboriginal Corporation	15th May 2023	• The findings of the assessment contribute to story building. • The presentation is a start and this information will be taken away and discussed. • This would not be the last presentation. • The emphasis as dunes being very culturally sensitive.
Tasmanian Firs Nations stakeholders	30th May 2023	• Meeting postponed

3 LEGISLATION AND POLICY

The cable routes pass through Victorian and Tasmanian state waters, as well as Commonwealth waters. The relevant statutory requirements concerning maritime cultural heritage for Commonwealth and state waters are outlined in this section. The jurisdiction for state legislation includes the seabed and the water column up to 3 nm from the coast; however, Commonwealth legislation may take precedence in some matters. The Commonwealth statutory requirements apply between the state waters.

3.1 Commonwealth legislation

3.1.1 Aboriginal and Torres Strait Islander Heritage Protection Act 1987 [15]

The Aboriginal and Torres Strait Islander Heritage Protection Act 1987 (Cwlth) (the ATSIHP Act) is administered by DCCEEW. The ATSIHP Act was enacted to provide protection for Aboriginal heritage in circumstances where it could be demonstrated that such protection was not available at a state level. In certain instances, the ATSIHP Act overrides relevant state and territory provisions.

The major purpose of the ATSIHP Act is to preserve and protect Aboriginal and Torres Strait Islander cultural heritage areas and objects from injury and desecration. The ATSIHP Act enables immediate and direct action for protection of threatened areas and objects by a declaration from the Commonwealth Minister responsible for the Act, or from authorised officers. The ATSIHP Act must be invoked by, or on behalf of, an Aboriginal or Torres Strait Islander person or organisation.

Any Aboriginal or Torres Strait Islander person or organisation may apply to the Minster for a temporary or permanent 'Stop Order' for protection of threatened areas or objects of significant Indigenous cultural heritage.

The ATSIHP Act overrides State and Territory legislation if the Minister is of the opinion that the State or Territory legislation is insufficient to protect the threatened areas or objects. Thus, in the event that an application is made to the Minister for a Stop Order, the Minister will, as a matter of course, contact the relevant State or Territory agency to ascertain what protection is being imposed and/or what mitigation procedures have been proposed by the land user/developer.

In addition to the threat of a 'Stop Order' being imposed, the ATSIHP Act also provides for the following:

- If the Federal Court, on application from the Minister, is satisfied that a person has engaged or is proposing to engage in conduct that breaches the 'Stop Order', it may grant an injunction preventing or stopping such a breach (s.26). Penalties for breach of a court order can be substantial and may include a term of imprisonment.
- If a person contravenes a declaration in relation to a significant Aboriginal area, penalties for an individual are a fine up to $10,000 and/or five years imprisonment and for a corporation a fine up to $50,000 (s.22).
- If the contravention is in relation to a significant Aboriginal object, the penalties are $5,000 and/or two years imprisonment and $25,000 respectively (s.22).
- In addition, offences under s.22 are considered 'indictable' offences that also attract an individual fine of $2,000 and/or 12 months' imprisonment or, for a corporation, a fine of $10,000 (s.23). Section 23 also includes attempts, inciting, urging and/or being an accessory after the fact within the definition of 'indictable' offences in this regard.

[15] **Eco Logical Australia Pty Ltd 2021**, *Marinus Link Terrestrial Cultural Heritage Priority Baseline Study*, prepared for Marinus Link Pty Ltd, p. 17-18.

3.1.2 *Environment Protection and Biodiversity Conservation Act 1999* [16]

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) is the Australian Government's centrepiece of environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage sites—defined in the EPBC Act as matters of national environmental significance (MNES).

The nine MNES to which the EPBC Act applies are:

- world heritage places
- national heritage places
- wetlands of international importance (Ramsar wetlands)
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- a water resource, in relation to coal seam gas development and large coal mining development.

The EPBC Act is administered by the DCCEEW. The act provides for the assessment and approval of projects by the Australian Government Environment Minister if there is potential for a significant impact on one of the nine MNES.

Under the division of powers between the Australian Government and the states under the Australian Constitution, the states have the primary responsibility for environmental protection except where the state has no jurisdiction, such as the Commonwealth marine area.

The EPBC Act was amended in 2003 to provide protection for Indigenous and non-Indigenous cultural heritage sites, in addition to the original aims of protecting environmental areas and sites of national significance. Indigenous cultural heritage places protected under the EPBC Act include "…[the] *heritage value of the place that is of significance to Indigenous persons in accordance with their practices, observances, customs, traditions, beliefs or history*".

Items identified under this legislation are given the same protective measures and penalties as actions taken against environmentally sensitive sites. Sections of the EPBC Act specifically relevant to Indigenous cultural heritage include ss. 324A-324ZB.

The EPBC Act enables the identification and subsequent listing of items for inclusion on the Commonwealth and National Heritage Lists. The EPBC Act establishes the National Heritage List under s. 324D, which includes natural, historic and Indigenous places of outstanding significance to the nation, and the Commonwealth Heritage List under s. 341D, which includes sites of national and international significance that are owned or controlled by the Australian Government. Substantial penalties (and, in some instances, imprisonment) can be imposed on any person who damages items on the National or Commonwealth Heritage Lists (ss. 495 & 497) or provides false or misleading information in relation to certain matters under the EPBC Act (ss.488-490). In addition, the wrongdoer may be required to make good any loss or damage suffered due to their actions or omissions (s.500).

There are no listed sites within the underwater cultural heritage study area.

[16] *Op. Cit.,* Eco Logical Australia Pty Ltd 2021, pp.18-19.

3.1.3 Underwater Cultural Heritage Act 2018

The *Underwater Cultural Heritage Act 2018 (UCH (Cwlth) Act)* provides for the protection of Australia's underwater cultural heritage. The objectives of this Act are:

(a) to provide for the identification, protection, and conservation of Australia's underwater cultural heritage.

(b) to enable the cooperative implementation of national and international maritime heritage responsibilities.

I to promote public awareness, understanding, appreciation and appropriate use of Australia's underwater cultural heritage.

The act came into effect on 1 July 2019, replacing the *Historic Shipwrecks Act 1976.* Clause 16 of the act provides certain articles of underwater cultural heritage are automatically protected. This includes the remains of vessels and articles associated with the vessel or remains of the vessel that have been in Australian waters for at least 75 years. This means that articles removed from the wreck at the time of sinking are not automatically protected.

The act also extends automatic protection to the remains of aircraft and certain associated articles that have been in Commonwealth waters for at least 75 years.

It should be noted that the 75-year rolling date protection applies to when a vessel or aircraft entered the water, for instance when it was wrecked and sank, and does not relate to its age at that time. Therefore, a 75-year-old vessel that entered the water 10 years ago does not qualify for automatic protection at that time but does once it has been in the water for 75 years.

The automatic protection outlined in Clause 16 replaces the previous approach under the *Historic Shipwrecks Act 1976* whereby the Minister could declare all remains of ships to be historic and therefore protected under that act.

Other articles of underwater cultural heritage, including submerged terrestrial Aboriginal sites, as well as ships and planes sunk within the last 75 years, can be protected if the Minister is satisfied that the articles are significant. The criteria to be used to determine whether articles reach the threshold for protection have been published as part of a set of rules that accompany the act.[17] The criteria are presented in Section 8.3.2.

Such articles may be in Commonwealth waters, Australian waters or in waters beyond Australian waters, depending on the kind of article concerned. Some articles are, or can be, protected even if they have been removed from those waters. If an article is removed from waters after it becomes protected, that protection applies to the article regardless of its location.

The designation of Australian and Commonwealth waters is complex. These maritime boundaries are measured from what is defined as the Territorial Sea Baseline (TSB) (Figure 3-1).

The calculation of the TSB is also complex. The baseline follows the LAT along the coast except where the coastline is deeply indented and cut into, or where there is a fringe of islands along the coast in its immediate vicinity, or at the entrances to rivers and bays. In these instances, straight baselines or closing lines are drawn (Figure 3-2).

Commonwealth waters under the Act extend from the seaward boundary of coastal waters (3 nm from the TSB) to the seaward boundary of the Exclusive Economic Zone (200 nm from the TSB) and to the edge of the continental shelf and up to the borders of Papua New Guinea, Timor-Leste and Indonesia.

[17] Minister for the Environment, Commonwealth Government, 18 December 2018 *Underwater Heritage Rules 2018.*

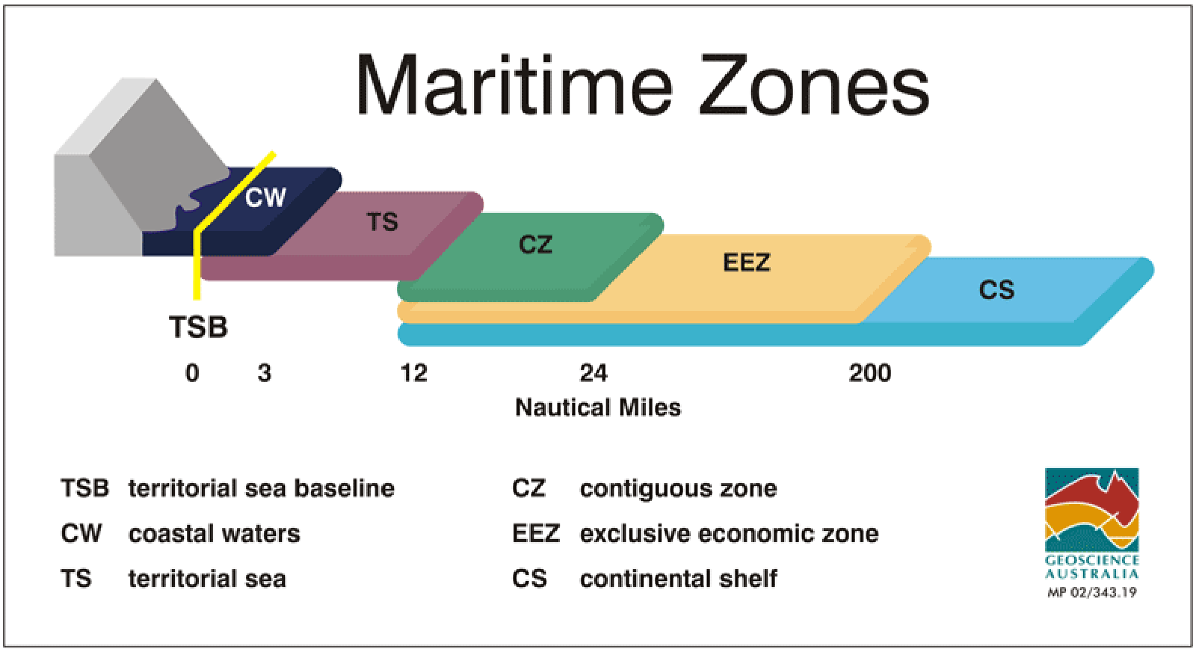

Figure 3-1: Maritime zone definitions.[18]

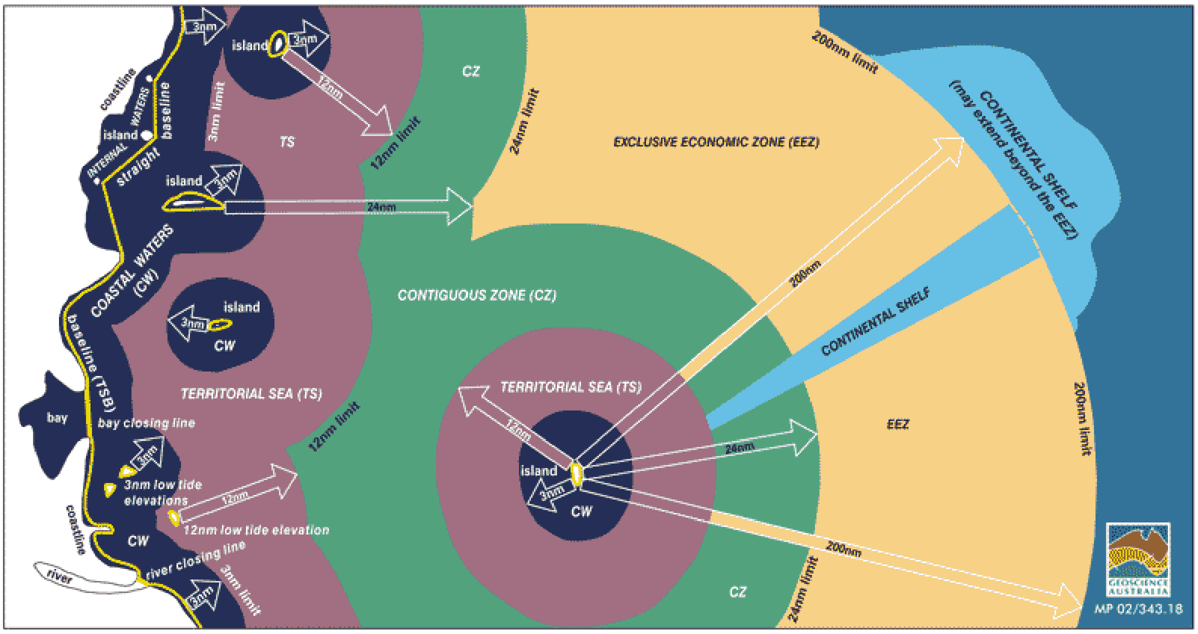

Figure 3-2: Maritime features, limits and zones.[19]

The definition of 'Australian Waters' appears to be peculiar to this act. This term covers the seabed of the continental shelf (from 12 nm to 200 nm from the TSB) and the territorial sea (up to 12 nm from the TSB) and *any waters on the landward side of the territorial sea* [that is, landward of the TSB] *of Australia that are not within the limits of a State*. The seabed landward of the TSB is considered to be internal waters but this does not mean the same as the *limits of the State* with respect to the act.[20]

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[18] Op. Cit., **Geoscience Australia** Maritime Boundary Definitions.
[19] Op. Cit., **Geoscience Australia** Maritime Boundary Definitions.
[20] For more information on maritime boundaries see **Geoscience Australia** *Maritime Boundary Definitions* https://www.ga.gov.au/scientific-topics/marine/jurisdiction/maritime-boundary-definitions

There is no known border or line available that delineates the limit of a State and the seabed landward of the TSB for the purposes of administrating the act. What constitutes the limits of a State when applying the act has to do with such things as the shape of a bay where the entrance is narrower than the width and depth of the bay and/or the distance between the headlands of a bay. Bodies of water such as Port Phillip, Jervis Bay, Botany Bay and Port Jackson (Sydney Harbour) are treated as being within the limits of the State.

The applicability of the act within shallow bays or bays with large entrances and/or bodies of water bounded by offshore islands such as Kangaroo Island, Cockburn Sound or Moreton Bay is not clear. In these situations, the legal status of an underwater cultural heritage site located landward of the TSB may need to be determined by legal opinion based on the application of formulas dedicated to defining the boundary of the 'limit of State' and 'Australian waters'. Because of the cost involved in doing this for the whole of the Australian coastline, the Commonwealth assesses the legal status of an underwater cultural heritage site landward of the TSB on a case-by-case basis.

In recent years a number of Historic Bays have been proclaimed as being within the limits of the State that would otherwise be considered to be in Australian waters. These bays are Anxious Bay, Encounter Bay, Lacepede Bay and Rivoli Bay in South Australia. Gulf St Vincent and Spencer Gulf have also been proclaimed to be within the limits of the State of South Australia.

In summary, Australian waters, for the purposes of the act, encompass waters between the TSB and a minimum 200 nm seaward to the Economic Exclusion Zone (EEZ) boundary;

- Vessels wrecked over 75 years ago are automatically protected.
- Younger shipwrecks can be declared protected by the Minister.

Commonwealth waters omit that portion of Australian waters from the coastal waters boundary (3 nm seaward of the TSB) to shore.

In summary, in Commonwealth waters:

- Planes wrecked over 75 years ago are automatically protected.
- Younger plane wrecks, as well as other forms of underwater cultural heritage such as submerged terrestrial (Aboriginal) sites can be declared protected by the Minister.

Any shipwreck located seaward of the TSB is clearly governed by the act while the status of a wreck landward of the TSB may need to be adjudicated by the Commonwealth. Figure 3-3 offers a visual representation of the geography of maritime jurisdictional zones within Bass Strait.

Certain conduct is prohibited under the act for protected sites without a permit, including:

- conduct that would or is likely to adversely impact the article (in the Act an article is a protected wreck, site, object, or object associated with a protected wreck, site, or object)
- possessing the article
- supplying, or offering to supply, the article
- importing or exporting the article.

Further, the Minister can declare an area containing protected underwater cultural heritage to be a protected zone if the area is within Australian waters and the declaration would be consistent with the objectives of the act. The declaration may regulate or prohibit the kinds of activities that can be carried out in the protected zone.

The act is aligned with the UNESCO 2001 *Convention on the Protection of the Underwater Cultural Heritage* and identifies a standard for the assessment and management of underwater cultural heritage in Australia.

The Australian Underwater Cultural Heritage Intergovernmental Agreement delegates roles and responsibilities to State organisations for permitting and other management decisions.[21] This is relevant if permits will be required under the Act.

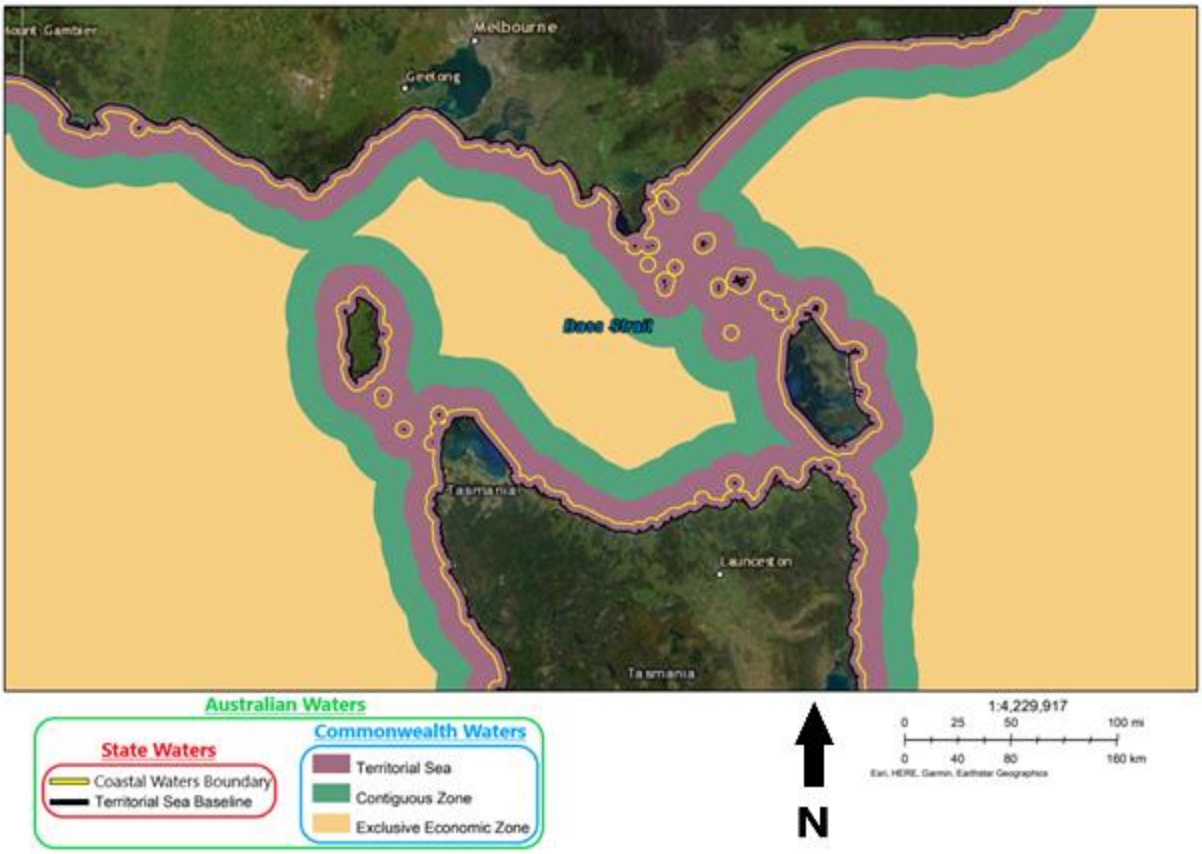

Figure 3-3: Map of Bass Strait showing various maritime jurisdictional zones. Note, Territorial Sea area within the Coastal Waters Boundary is regulated by state legislation.

There are no listed sites within the underwater cultural heritage study area.

3.2 Tasmanian legislation

3.2.1 Aboriginal Heritage Act 1975 (Tas) [22]

In Tasmania, the *Aboriginal Heritage Act 1975* (the AH (Tas) Act) is the primary statutory protection relating to the management of Aboriginal cultural heritage. The AH (Tas) Act is administered by the Department of Premier and Cabinet, (DPC). Aboriginal Heritage Tasmania is the regulating body for Aboriginal heritage in Tasmania.

The Act applies to 'relics' which includes any object, site, or place that bears signs of the activities of any such original inhabitants or their descendants, which is of significance to the Aboriginal people of Tasmania. Aboriginal relics are protected under the AH (Tas) Act and it is illegal to destroy, damage, deface, conceal or otherwise interfere with a relic, unless in accordance with the terms of a permit granted by the Minister. It is illegal to sell or offer for sale a relic, or to cause or permit a relic to be taken out of Tasmania without a permit (s. 2(4) qualifies and excludes 'objects made, or likely to have been made, for purposes of sale').

[21] **Australian Government, DCCEEW, 2010**, Australian Underwater Cultural Heritage Government Agreement.
[22] *Op.Cit.,* Eco Logical Australia Pty Ltd 2021, pp.21-21.

Under s.7 of the Act, where the Minister is satisfied that there is on, or in, any land a relic, the Minister may declare an area of land in which the relic is situated to be a protected site. This can be done only with the written consent of the landowner, excepting Crown Land which does not require landowner consent. The study area is considered to be within Crown Land.

It should be noted that with regard to the discovery of suspected human skeletal remains, the Coroners Act 1995 (Tas) takes precedence. The Coroners Act 1995 (Tas) comes into effect initially upon the discovery of human remains, however once determined to be Aboriginal, the AH (Tas) Act overrides the Coroners Act 1995 (Tas).

AHT has issued *Aboriginal Heritage Standards and Procedures* as guidelines under section 21A of the AH (Tas) Act. The Standards and Procedures assist proponents in complying with the AH (Tas) Act and describe the framework for managing Aboriginal heritage as well as technical aspects of the process. Section 21(1) of the AH (Tas) Act states that:

> "*It is a defence to a prosecution for an offence under section 9 or 14 if, in relation to the section of the Act which the defendant is alleged to have contravened, it is proved … that, in so far as is practicable … the defendant complied with the guidelines*".

There are no protected sites within the underwater cultural heritage study area.

3.2.2 Historic Cultural Heritage Act 1995

The Tasmanian *Historic Cultural Heritage Act 1995* is the primary piece of State legislation affording protection to all items of historic cultural heritage in Tasmania. The act aims to promote the identification, assessment, protection and conservation of places holding historic cultural heritage significance. It also establishes the Tasmanian Heritage Council, which is part of the State's resource management and planning system. Under this act, the Heritage Council is to maintain the Tasmanian Heritage Register of places, comprised of places deemed to be of State historic cultural heritage significance. Under Section 16 (2) of the act, an assessment of historic cultural heritage significance is based on the following criteria:

- *a) The place is important to the course or pattern of Tasmania's history;*
- *b) The place possesses uncommon or rare aspects of Tasmania's history;*
- *c) The place has the potential to yield information that will contribute to an understanding of Tasmania's history;*
- *d) The place is important in demonstrating the principal characteristics of a class or place in Tasmania's history;*
- *e) The place is important in demonstrating a high degree of creative or technical achievement;*
- *f) The place has strong or special associations with a particular community or cultural group for social or spiritual reasons;*
- *g) The place has a special association with the life or works of a person, or group of persons, of importance in Tasmania's history;*
- *h) The place is important in exhibiting particular aesthetic characteristics.*

Approval is required for any works at a registered place which, if carried out, may have an adverse effect on that place's historic cultural heritage significance. Part 6 of the act sets out the required process for approval to undertake works for places which are listed on the register.

Part 9 of the act applies to shipwrecks, including those which are at least 75 years old from the date of the wreck, as well as maritime relics. The Heritage Council may enter a shipwreck in the Heritage Register, which need only contain a general description of the shipwreck and its general location. A person must not undertake an activity which is likely to result in the physical disturbance or change to the fabric or condition of a shipwreck without the Heritage Council's approval. However, a person may apply to the Heritage Council for approval to undertake activities that may have this effect by lodging an application for approval.

Section 72 of the act states that a person who finds a shipwreck must report the finding to the Heritage Council within 30 days after finding it.

There are no protected sites within the underwater cultural heritage study area.

3.3 Victorian legislation

3.3.1 Aboriginal Heritage Act 2006 (Vic) / Aboriginal Heritage Regulations 2018[23]

The *Aboriginal Heritage Act 2006* (Vic) (the AH (Vic) Act) acts primarily to provide for the protection of Aboriginal cultural heritage in Victoria. The AH (Vic) Act allows several different organisations, groups and bodies to connect and better enforce and preserve policies regarding Aboriginal Heritage. It does this through:

- The establishment of a Victorian Aboriginal Heritage Council (VAHC) to provide a state-wide voice for Aboriginal people and to advise the Minister on issues relating to the management of cultural heritage.
- The introduction and management of a system of Registered Aboriginal Parties (RAPs) that allows for Aboriginal groups with connections to country to be involved in decision making processes around cultural heritage.
- Raising public awareness and understanding of Aboriginal cultural heritage in Victoria.
- Establishing the Victorian Aboriginal Heritage Register (VAHR) to record Aboriginal culture.
- The establishment of cultural heritage management plan (CHMP) and cultural heritage permit processes to manage activities that may impact Aboriginal cultural heritage.
- A system of cultural heritage agreements to support the development of partnerships around the protection and management of Aboriginal cultural heritage.
- Providing appropriate sanctions and penalties to prevent harm to Aboriginal cultural heritage.
- Clearer powers for Authorised Officers and Aboriginal Heritage Officers and increased fees and charges for breaches of the act.

The AH (Vic) Act was passed in 2006, came into effect in 2007, and was amended in 2016. It is administered by First Peoples – State Relations, within the Department of Premier and Cabinet (DPC).

It is an offence to harm Aboriginal cultural heritage, knowingly or unknowingly, without a cultural heritage permit or approved CHMP.

[23] *Op.Cit.,* Eco Logical Australia Pty Ltd 2021, pp.24-26.

The Aboriginal Heritage Regulations 2018 (the AH Regulations) give effect to the AH (Vic) Act. The AH Regulations prescribe standards, set out the circumstances in which a CHMP should be prepared, and set fees and charges. The AH Regulations include a set of ground disturbing activities that are defined as ‘high impact activities’ for the purposes of the AH (Vic) Act and define various areas of cultural heritage sensitivity. These are important elements of the legislation as the AH (Vic) Act requires a mandatory CHMP to be prepared for any high impact activity that is proposed in an area that intersects an area of cultural heritage sensitivity. These include land within 50 m of a registered Aboriginal cultural heritage place; land within 200 m of named waterways, and land within 200 m of coastal lagoon deposits, coastal dunes and the Victorian coastline.

Certain activities, however, such as the removal of sand and sandstone related to dredging for marine navigational purposes or the establishment of a port facility are not considered high impact activities (Regulation 53.2 (c) and (d)). Furthermore Regulation 21 of the AH Regulations states that *the development of the sea-bed of the coastal waters of Victoria or any sea within the limits of Victoria is an exempt activity*, an exempt activity being when a CHMP is not required (Regulation 8(b)). However, First Peoples – State Relations' interpretation of the AH Regulations with respect to the requirement for a CHMP in response to seabed impacts is that a CHMP is required when *all or part of an activity is a high-impact activity* (Regulation 7(b)) even if the only high impact occurs on land. It could also be argued that any trenching of the seabed within the limits of Victoria for the laying of cables is a high impact activity as Regulation 53.2 (c) and (d) only relates to disturbances related to navigation and port development. Furthermore, under S49 of the AH (Vic) Act, if an EES is required for a project under the Environment Effects Act, then a CHMP is mandatory.

The AH (Vic) Act recognises Aboriginal people as the primary guardians, keepers and knowledge holders of Aboriginal cultural heritage. Registered Aboriginal Parties are Aboriginal organisations recognised under the AH (Vic) Act with responsibilities for the management and protection of Aboriginal cultural heritage. They are also responsible for evaluating and approving CHMPs prepared for activity areas located within their RAP boundaries. In addition, the secretary and the Victorian Aboriginal Heritage Council (VAHC) have provisions to evaluate CHMPs in certain circumstances.

Section 60A of the AH (Vic) Act provides a mechanism whereby the Secretary responsible for the act can appoint an Activity Advisory Group (AAG) for a proposed activity in an area where a RAP has not been appointed. The purpose of this section is to provide a single Traditional Owner point of contact for CHMP sponsors, heritage advisors and decision-makers in non-RAP areas. The function of an AAG is to advise the Secretary on the proposed activity and its impact on Aboriginal cultural heritage. The Secretary must consider the views of an appointed AAG when considering an application for approval of a CHMP in a non-RAP area.

Part 5A of the AH (Vic) Act provides protection for Aboriginal intangible heritage. Aboriginal intangible heritage is defined in Section 79B as any ‘knowledge of or expression of Aboriginal tradition, other than Aboriginal cultural heritage, and includes oral traditions, performing arts, stories, rituals, festivals, social practices, craft, visual arts, and environmental and ecological knowledge, but does not include anything that is widely known to the public’.

Victorian Aboriginal Heritage Council (VAHC)

The VAHC is established under provisions of the AH (Vic) Act. Its role is to ensure that Traditional Owners throughout Victoria play a central role in the protection and management of their heritage.

The VAHC consists of up to 11 Traditional Owners who are appointed by the Minister. All members are resident in Victoria and have extensive experience or knowledge of Aboriginal cultural heritage in Victoria.

The work of the VAHC includes:

- making decisions on RAP applications
- overseeing RAP operations
- all matters relating to Aboriginal ancestral remains
- promoting obligations regarding secret or sacred objects in Victoria
- managing the Victoria Aboriginal Cultural Heritage Fund
- promoting understanding and awareness
- providing advice to the Minister for Aboriginal Affairs and the Secretary DPC

The VAHC has an interest in matters relating to the identification of Traditional Owner groups in Victoria and is directly involved in any decisions regarding applications for RAP status over lands along the Victorian alignments which are not currently allocated to a RAP. However, it is unlikely that the VAHC will want to engage directly with the project as long as MLPL can demonstrate that it has done its due diligence in identifying relevant Traditional Owners with an interest in relevant non-RAP areas.

Victorian Aboriginal Heritage Register (VAHR)

The VAHR was established under the AH (Vic) Act and holds the details of all registered Aboriginal cultural heritage places and objects within Victoria. The VAHR also holds information regarding each RAP, their area of responsibility and their contact details.

Section 5 of the AH (Vic) Act defines an Aboriginal place as:

> *"…an area in Victoria or the coastal waters of Victoria that is of cultural heritage significance to Aboriginal people generally or of a particular community or group of Aboriginal people in Victoria*."

In this instance, "area" includes any one or more of the following:

- an area of land
- an expanse of water
- a natural feature, formation or landscape
- an archaeological site, feature or deposit
- the area immediately surrounding anything referred to in items 3 and 4, to the extent that it cannot be separated from the thing without diminishing or destroying the cultural heritage significance attached to the thing by Aboriginal people
- land set aside for the purpose of enabling Aboriginal ancestral remains to be re-interred or otherwise deposited on a permanent basis
- a building or structure.

Under section 79C of the AH (Vic) Act, RAPs, registered native title holders, or traditional owner group entities may apply to the Secretary for details of any Aboriginal intangible heritage to be recorded on the Register

There are no listed sites within the Victoria nearshore underwater cultural heritage study area.

3.3.2 Victorian Heritage Act 2017

The Victorian *Heritage Act 2017* (H (Vic) Act) is the primary piece of state legislation affording protection to all items of cultural heritage significance in Victoria, including historic archaeological sites and artefacts, historic buildings, structures and precincts, cultural landscapes and places, gardens, trees and cemeteries, shipwrecks and significant objects. The *Heritage Act 2017* establishes the Victorian Heritage Register – a register of declared places considered to have state level cultural heritage significance; and the Victorian Heritage Inventory – a listing of all known historical archaeological sites and artefacts in Victoria.

Under Part 1, Section 3 of the Act, an archaeological artefact is defined as an object (other than a shipwreck artefact) which provides information of past activity in the State and:

a) *Is associated with an archaeological site; or*

b) *Is associated with a registered archaeological place; or*

c) *Is associated with an approved site of archaeological value; or*

d) *Is associated with a place that was an archaeological site, registered archaeological place or approved site of archaeological value;*

An archaeological site is defined as a place (other than a shipwreck) which:

a) *Contains an artefact, deposit or feature which is 75 or more years old; and*

b) *Provides information of past activity in the State; and*

c) *Requires archaeological methods to reveal information about the settlement, development or use of the place; and*

d) *Is not associated only with Aboriginal occupation of the place;*

A historic shipwreck is defined as:

(1) *Subject to subsection (5), a **historic shipwreck** is a shipwreck that has been situated in Victorian waters –*

   a. *For 75 years or more; or*

   b. *For the number of years specified under proclamation under section 6 (**a proclaimed number of years**).*

(2) *Subsection (1) applies whether or not the existence or location of the shipwreck is presently known.*

(3) *In addition, but subject to subsection (5), a shipwreck that has been removed from Victorian waters at any time becomes a **historic shipwreck –***

   a. *75 years after the likely date that the shipwreck first came to rest on the sea-bed; or*

   b. *If there is a number of years specified under proclamation under section 6, the proclaimed number of years after the likely date the shipwreck first came to rest on the sea-bed.*

(4) *Subsection (3) does not apply to a shipwreck that has been salvaged or recovered if the salvage or recovery was not contrary to any law in force at the time it occurred.*

(5) *A shipwreck is not a **historic shipwreck** if it is –*

   a. *A shipwreck specified under proclamation under subsection (6); or*

   b. *A shipwreck of a class specified under proclamation under subsection (6).*

(6) *The Governor in Council, by proclamation published in the Government Gazette, may specify a shipwreck, or a shipwreck of a specified class, is not a historic shipwreck.*

A historic shipwreck artefact is defined as:

*(1) Subject to subsection (5), a **historic shipwreck artefact** is a shipwreck artefact that has been situated in Victorian waters –*

  a. For 75 years or more; or

  *b. For the number of years specified under proclamation under section 6 (a **proclaimed number of years**).*

(2) Subsection (1) applies whether or not the existence or location of the object is presently known.

*(3) In addition, but subject to subsection (5), a shipwreck artefact that has been removed from Victorian waters at any time becomes a **historic shipwreck artefact –***

  a. 75 years after the likely date that the object first came to rest on the sea-bed; or

  b. If there is a number of years specified under proclamation under section 6, the proclaimed number of years after the likely date the object first came to rest on the sea-bed.

(4) Subsection (3) does not apply to an object that has been salvaged or recovered if the salvage or recovery was not contrary to any law in force at the time it occurred.

*(5) A shipwreck artefact is not a **historic shipwreck artefact** if it is –*

  a. An object specified under proclamation under subsection (6); or

  b. An object of a class specified under proclamation under subsection (6).

(6) The Governor in Council, by proclamation published in the Government Gazette, may specify an object or an object of a specified class, is not a historic shipwreck artefact.

The act expands the definition of *shipwreck* and *shipwreck artefact* by including any marine concretions and accretions that have become attached to shipwreck artefacts or to the remains or any part of the remains of the shipwreck.

Under section 73 of the *Heritage Act 2017*, it is an offence to remove any registered shipwrecks, historic shipwrecks, registered shipwreck artefacts and historic shipwreck artefacts from the State.

Under section 74, it is an offence to knowingly, negligently, or recklessly take, destroy, damage, remove, disturb, dispose of, or otherwise interfere with any registered shipwreck, historic shipwreck, registered shipwreck artefact or historic shipwreck artefact. Offences under this section are indictable.

Section 76 states it is an offence to be near registered shipwrecks, historic shipwrecks, registered shipwreck artefacts or historic shipwreck artefacts with certain equipment, including salvage or recovery equipment, explosives, instruments or other equipment that could be used to damage or interfere with the above. These actions may be allowed by a permit issued by the minister under sections 77 or 78.

Under section 80, a person who finds a shipwreck or shipwreck artefact must, within 7 days, provide the Executive Director a notice in writing, setting out a description of the shipwreck or shipwreck artefact and a description of the place it is situated which is sufficient to enable the shipwreck or shipwreck artefact to be located. Under section 80, it is also an offence to conceal the location of a shipwreck or shipwreck artefact.

Under sections 87, 88, and 89, it is an offence to knowingly, recklessly, negligently or otherwise: remove, relocate, or demolish, damage or despoil, develop or alter, or excavate all or any part of a registered place; or remove, relocate or demolish, or damage or despoil, or alter, a registered object; or disturb the position of an object that is a fixed registered object. These actions may be allowed by a permit issued by the minister under these sections.

Under section 123, it is an offence to knowingly or negligently deface, damage or otherwise interfere with, or carry out an act, likely to endanger a site recorded in the Heritage Inventory or an archaeological site not recorded in the Heritage Inventory. Furthermore, a person must not, without a permit, knowingly uncover or expose, or knowingly disturb or excavate any land for the purposes of uncovering or discovering a site recorded in the Heritage Inventory or an archaeological site not recorded in the Heritage Inventory. These actions may be allowed by a permit issued by the minister under section 124. Under section 127, if an archaeological site is discovered, it must be reported to the Executive Director within 30 days after the discovery.

There are no listed sites within the underwater cultural heritage study area.

3.4 Summary of relevant heritage legislation

The jurisdiction of the aforementioned legislation and sites listed as protected are presented in the following summary (Table 3-1).

Table 3-1 : Summary of relevant heritage legislations

Legislation	Jurisdiction		Declared/Registered/Protected site(s) with UCH study area
	Commonwealth Waters	State Waters	
ATSIHP Act 1987	√	√	None
EPBC Act 1999	√	√	None
UCH Act 2018	√	√ (shipwrecks only)	None
AH (Tas) Act 1975		√	None
HCH (Tas) Act 1995		√	None
AH (Vic) Act 2006		√	None
H (Vic) Act 2017		√	None

3.5 Heritage policies relevant to underwater cultural heritage

This report adheres to the principles outlined in the following heritage policies and guidelines.

3.5.1 UNESCO Convention on the Protection of the Underwater Cultural Heritage[24]

The United Nations Educational, Scientific and Cultural Organization (UNESCO) 2001 *Convention on the Protection of the Underwater Cultural Heritage* is an international treaty that was developed to provide a common framework for States Parties on how to better identify, research, and protect underwater heritage whilst ensuring its preservation and sustainability. The convention consists of a main text that sets out basic principles for the protection of underwater cultural heritage and provides a detailed State cooperation system, and an Annex that outlines widely recognised practical rules for the treatment and research of underwater cultural heritage. The UNESCO 2001 *Convention on the Protection of the Underwater Cultural Heritage* entered into force in 2009.

The Commonwealth of Australia supported the principles and drafting of the UNESCO 2001 Convention and is currently considering ratification of the convention. The UCH (Cwlth) Act was also developed specifically to align with the UNESCO 2001 Convention.

[24] **UNESCO 2001,** *Convention on the Protection of the Underwater Cultural Heritage,* available at http://www.unesco.org/new/en/culture/themes/underwater-cultural-heritage/2001-convention/.

In 2010, the Commonwealth, states, and the Northern Territory signed the *Australian Underwater Cultural Heritage Intergovernmental Agreement* that would enable the Australian Government to ratify the UNESCO 2001 Convention, should it so choose. The Agreement establishes the roles and responsibilities of Commonwealth, State and Northern Territory governments for the identification, protection, management, conservation, and interpretation of Australia's underwater cultural heritage. One of the key aims of the Agreement is for all parties to meet internationally recognised best practice management of Australia's underwater cultural heritage as outlined in the Rules in the Annex to the UNESCO 2001 Convention.

The main principles of the UNESCO 2001 Convention are as follows:

- Obligation to Preserve Underwater Cultural Heritage – States Parties should preserve underwater cultural heritage and take action accordingly. This does not mean that States would necessarily have to undertake archaeological excavations; they only have to take measures according to their capabilities. The Convention encourages scientific research and public access.
- In Situ Preservation as first option – The in situ preservation of underwater cultural heritage (i.e., in its original location on the seafloor) should be considered as the first option before allowing or engaging in any further activities. The recovery of objects may, however, be authorised for the purpose of making a significant contribution to the protection or knowledge of underwater cultural heritage.
- No Commercial Exploitation – The 2001 Convention stipulates that underwater cultural heritage should not be commercially exploited for trade or speculation, and that it should not be irretrievably dispersed. This regulation is in conformity with the moral principles that already apply to cultural heritage on land. It is not to be understood as preventing archaeological research or tourist access.
- Training and Information Sharing – States Parties shall cooperate and exchange information, promote training in underwater archaeology and promote public awareness regarding the value and importance of underwater cultural heritage.

The rules concerning activities directed at underwater cultural heritage as contained in the Annex of the UNESCO 2001 Convention (Annex I: General principles) are:

Rule 1. The protection of underwater cultural heritage through in situ preservation shall be considered as the first option. Accordingly, activities directed at underwater cultural heritage shall be authorised in a manner consistent with the protection of that heritage, and subject to that requirement may be authorised for the purpose of making a significant contribution to protection or knowledge or enhancement of underwater cultural heritage.

Rule 2. The commercial exploitation of underwater cultural heritage for trade or speculation or its irretrievable dispersal is fundamentally incompatible with the protection and proper management of underwater cultural heritage. Underwater cultural heritage shall not be traded, sold, bought or bartered as commercial goods.

Rule 3. Activities directed at underwater cultural heritage shall not adversely affect the underwater cultural heritage more than is necessary for the objectives of the project.

Rule 4. Activities directed at underwater cultural heritage must use non-destructive techniques and survey methods in preference to recovery of objects. If excavation or recovery is necessary for the purpose of scientific studies or for the ultimate protection of the underwater cultural heritage, the methods and techniques used must be as non-destructive as possible and contribute to the preservation of the remains.

Rule 5. Activities directed at underwater cultural heritage shall avoid the unnecessary disturbance of human remains or venerated sites.

Rule 6. Activities directed at underwater cultural heritage shall be strictly regulated to ensure proper recording of cultural, historical and archaeological information.

Rule 7. Public access to in situ underwater cultural heritage shall be promoted, except where such access is incompatible with protection and management.

Rule 8. International cooperation in the conduct of activities directed at underwater cultural heritage shall be encouraged in order to further the effective exchange or use of archaeologists and other relevant professionals.

3.5.2 The Burra Charter [25]

The *Australian ICOMOS Burra Charter for Places of Cultural Significance 2013* (Burra Charter) is the widely accepted reference document for heritage conservation standards in Australia. The Burra Charter was first adopted in 1979 and is periodically updated to reflect developing understanding of the theory and practice of cultural heritage management. The current version of the charter was adopted in 2013.

The charter can be applied to all types of places of cultural significance including natural, Indigenous, and historic places with cultural values. The Burra Charter advocates a cautious approach to change: do as much as necessary to care for the place and to make it useable, but otherwise change it as little as possible so that its cultural significance is retained. The charter includes 12 conservation principles which are further developed in the processes and practice sections of the charter.

The charter sets a standard of practice for those who provide advice, make decisions about, or undertake works to places of cultural significance, including owners, managers, and custodians. Many of the concepts and definitions commonly understood to apply to built heritage also apply to the physical remains associated with a site’s archaeological values. Concepts such as ‘place’ and ‘fabric’, when referred to in the Burra Charter, also capture archaeological sites and archaeological features and deposits.

In terms of the charter, cultural significance means aesthetic, historic, scientific, or social value for past, present, and future generations. It is a not a legal requirement to adopt the Burra Charter guidelines; however, the guidelines and principles are well-entrenched in heritage conservation policy.

3.5.3 Guidelines for the Management of Australia’s Shipwrecks [26]

The *Guidelines for the Management of Australia’s Shipwrecks* was produced as a combined publication by the Australian Institute for Maritime Archaeology Inc. (now the Australasian Institute for Maritime Archaeology) and the Australian Cultural Development Office (now the Australian Government DCCEEW) in 1994.

The guidelines comprise principles and practices that have been adopted by Australia’s professional maritime archaeologists and serve as useful models for other heritage management groups. The document includes a Statement of Principles governing the broad approach to be taken when dealing with historic shipwreck sites and related archaeological collections.

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[25] **Australia ICOMOS, 2013** *The Burra Charter*, available at https://australia.icomos.org/publications/charters/.

[26] **Australian Institute for Maritime Archaeology.** Special Projects Advisory Committee & Australian Cultural Development Office & Australian Institute for Maritime Archaeology 1994, *Guidelines for the management of Australia's shipwrecks*, Australian Institute for Maritime Archaeology and the Australian Cultural Development Office, Canberra.

4 PROJECT OVERVIEW

Marinus Link is proposed to be implemented as two 750 MW circuits to meet transmission network operation requirements in Tasmania and Victoria. Each 750 MW circuit will comprise two power cables and a fibre-optic communications cable bundled together in Bass Strait and laid in a horizontal arrangement on land. The two 750 MW circuits would be installed in two stages with the western circuit being laid first as part of stage one, and the eastern cable in stage two.

The key project components for each 750 MW circuit, from south to north, are:

- HVAC switching station and HVAC-HVDC converter station at Heybridge in Tasmania. This is where the project will connect to the North West Tasmania transmission network being augmented and upgraded by the North West Transmission Developments (NWTD).
- Shore crossing in Tasmania adjacent to the converter station.
- Subsea cable across Bass Strait from Heybridge in Tasmania to Waratah Bay in Victoria.
- Shore crossing at Waratah Bay approximately 3 kilometres (km) west of Sandy Point.
- Land-sea cable joint where the subsea cables will connect to the land cables in Victoria.
- Land cables in Victoria from the land-sea joint to the converter station site in the Driffield or Hazelwood areas.
- HVAC switching station and HVAC-HVDC converter station at Driffield or at Hazelwood, where the project will connect to the existing Victorian transmission network.

A transition station at Waratah Bay may also be required if there are different cable manufacturers or substantially different cable technologies adopted for the land and subsea cables. The location of the transition station will also house the fibre optic terminal station in Victoria. However, regardless of whether a transition station is needed, a fibre optic terminal station will still be required in the same location.

In Tasmania, a converter station is proposed to be located at Heybridge near Burnie. The converter station would facilitate the connection of Marinus Link to the Tasmanian transmission network. There will be two subsea cable landfalls at Heybridge with the cables extending from the convertor station across Bass Strait to Waratah Bay in Victoria. The preferred option for shore crossings is horizontal directional drilling (HDD) to about 10 m water depth where the cables would then be trenched, where geotechnical conditions permit.

Approximately 255 km of subsea HVDC cable will be laid across Bass Strait. The preferred technology for Marinus Link is two 750 MW symmetrical monopoles using ±320 kilovolt (kV), cross-linked polyethylene insulated cables and voltage source converter technology. Each symmetrical monopole is proposed to comprise two identical size power cables and a fibre-optic communications cable bundled together. The cable bundles for each circuit will transition from approximately 300 m apart at the HDD (offshore) exit to 2 km apart in offshore waters.

In Victoria, the shore crossing is proposed to be located at Waratah Bay with the route crossing at the Waratah Bay–Shallow Inlet Coastal Reserve. From the land-sea joint located behind the coastal dunes, the land cable will extend underground for approximately 90 km to the converter station. From Waratah Bay the cable will run northwest to the Tarwin River valley and then travel to the north to the Strzelecki Ranges. The project alignment crosses the ranges between Dumbalk and Mirboo North before descending to the Latrobe Valley where it turns northeast to Hazelwood. The Victorian converter station will be at either a site south of Driffield or Hazelwood adjacent to the existing terminal station.

This assessment is focused on the marine component of the project in Bass Strait. This report will inform the Environmental Impact Statement (EIS) being prepared to assess the project's potential environmental effects in accordance with the legislative requirements of the Commonwealth, Tasmanian and Victorian governments (see Figure 4-1).

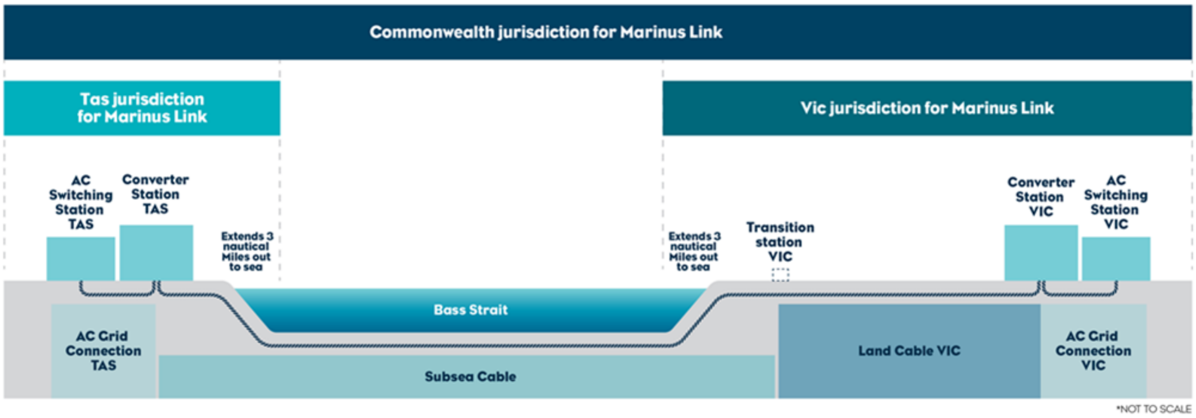

Figure 4-1: Project components under applicable jurisdiction (Marinus Link Pty Ltd 2022,).

Marinus Link is proposed to be constructed in two stages over approximately five years following the award of works contracts to construct the project. On this basis, stage 1 of the project is expected to be operational by mid-2030 and stage 2 will follow with final timing to be determined by market demand. The project would be designed for an operational life of at least 40 years.

After installation, periodic cable surveys by ROV will be conducted on subsea cables. The operational lifespan of the project is a minimum of 40 years. At this time the project will be either decommissioned or upgraded to extend its operational lifespan.

5 PHYSICAL SETTING

5.1 Existing characteristics

5.1.1 Offshore study area

Bass Strait, the body of water that separates mainland Australia from Tasmania, lies between Cape Otway and Wilsons Promontory on the northern (Victorian) side; and Cape Grim and Eddystone Point, Tasmania, on the southern side (Figure 5-1).

There is a deep fairway through Bass Strait, but the middle of its western entrance is obstructed by King Island, and in its eastern entrance there are numerous islands and rocks, the principal being the Furneaux Group, which lies in the southeast portion of that entrance. The bottom consists mostly of sand and shells in the northwest and more of mud, marl and soft mud deposits in the southeast portion.[27]

The main geological province that is traversed by Marinus Link is known as the Bass Basin (Figure 5-2). It is bounded by the Bassian Rise in the north and the King Island High in the west and encompasses an area of approximately 42,000 km^2. Bass Strait is bounded at either end by linear submarine ridges which restrict the oceanic flow through the strait. It is the extension of the southern Australian continental margin and is a protected shallow basin, in which water depths at the centre vary between approximately 53 m and 83 m.

Water flows predominantly eastwards, driven by westerly winds. Semidiurnal tides dominate Bass Strait, flowing in across the eastern and western sills. Thus, the tidal currents flow in opposite directions in the eastern and western half of the strait, resulting in minimal tidal flows in the central part. Strong oscillatory tidal currents occur in the vicinity of the aforementioned ridges. Localised strong currents lead to the removal of the mud fraction and formation of carbonate sand waves.[28]

[27] **1956,** *Australia Piot Vol.II,* fourth ed., Hydrographic Department, London.
[28] **Fugro, 2020,** Project Marinus – Marine Engineering Geophysical Survey – Integrated Report, report prepared for Tasmanian Networks Pty Ltd.

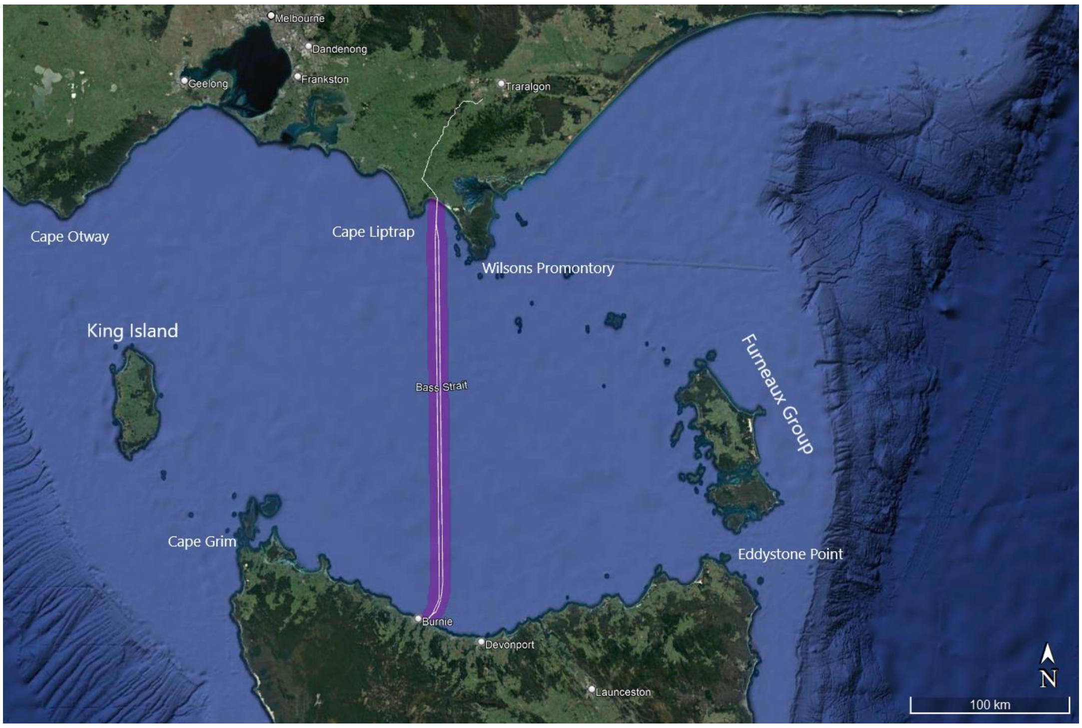

Figure 5-1: Map of Bass Strait showing cable route and study area, alongside relevant place names.

The surface seabed morphology within the offshore study area was identified as having three specific zones by geophysical surveys conducted by Fugro in 2020. The first zone, from KP (kilometres along proposed route) 14.5 to KP 87.5, is characterised as a gradual transition from the nearshore characteristics in Waratah Bay to a more marine setting. Surface sediments in this zone are classified as silty sand with increasing carbonate content towards deeper areas. With increasing distance from shore, silty and clayey layers begin to appear in this zone at 1.2 m below seafloor. The second zone, from KP 87.5 to KP 125, is characterised as a transition zone, with progressive fining of sediments, transitioning from silty sand to sandy silt, and, eventually, silt and mud. The third zone, from KP 125 to KP 237.2, is considered to be a marine setting with predominantly silts and eventually clay towards the central and southern, deepest part of Bass Strait. Subsurface geomorphology of the study area is addressed in Section 5.2.1.

5.1.2 Victoria nearshore study area

Waratah Bay is an arc of almost 50 km of coastline consisting of flat sandy beach bounded by rocky elevated headlands at Cape Liptrap in the west and Wilsons Promontory to the east. This beach is exposed to the prevailing westerly winds, especially in winter, which generate a relatively high wave profile for most of the year. Water depths increase gradually from the shoreline south, with the average seabed gradient predominantly less than one degree; however, local gradients are observed to be higher at rock outcrop edges and seabed depressions. The makeup of the seabed is typified by fine sand, developing into coarse sand with cobbles as water depth increases.

The seabed of Waratah Bay undulates topographically, particularly at shallower water depths closer to the Victorian coastline. Seabed features include furrows and ripples, indicating fluvial processes such as nearshore currents. Sediments in this zone, defined by Fugro as KP 0 to KP 14.5, is variable, with mostly sandy sediments. Most sediments can be classified as (silty) fine/fine to medium sand or medium to coarse sand with trace gravel and strong variation in carbonate content. Gravelly shells, cobbles and small reefs, as well as isolated rocky sections, are encountered.

5.1.3 Tasmania nearshore study area

The southern shore of Bass Strait, formed by the northern coast of Tasmania, extends approximately 270 km from Cape Grim on the northwest tip of the island to Eddystone Point, its northeast extremity. The whole of Tasmania's northern coast lies generally in very calm water, as the prevailing winds blow from offshore, and the long south-westerly swell outside is interrupted by the islands at the western entrance to Bass Strait.[29]

The seabed morphology of the Tasmania Nearshore study area is characterised by paleochannels in between outcropping sandstone, siltstone and mudstone. The sediments within these paleochannels are composed predominantly of coarse-grained sediments and sand. Visual surveys of the seafloor show sand and shells within paleochannels and cobbles, boulders and outcrop/reef on top of the high relief seabed sections.[30] Sediments in this zone, defined by Fugro as KP 237.2 to the Tasmanian shore, is considered the most highly variable zone within the study areas. This zone transitions from a marine to a nearshore setting with very diverse sedimentology. Surface sediments are sandy with occurrence of coarser fractions, e.g., cobbles, and outcropping rock in the nearshore areas.

5.2 Evolution of the submerged landscape

5.2.1 Geological/geomorphological setting

This section outlines the regional geological and morphological setting of Bass Strait as a whole. For areas specific to the study areas, refer to Section 5.

Bass Strait is a shallow (mean depth 60 m) sea in south-east Australia, which separates Tasmania from the mainland. The mean width (distance between the mainland and Tasmania) is 250 km, and the distance between the 200 m depth contours on the Strait's eastern and western sides is 550 km. The central portion of Bass Strait contains a shallow depression, with a maximum depth of 83 m near its centre. On the eastern and western margins, Palaeozoic basement rocks form shallow sills. The eastern ridge, known as the Bassian Rise (Figure 5-2), is associated with the Furneaux Group of islands, the largest of which is Flinders Island. Water depths across the sill are approximately 55 m. In the south-west, the King Island Rise forms a strait between King Island and Tasmania. Water depths in this area are also around 55 m. The King Island – Mornington Peninsula Basement Ridge in the north-east forms a slightly deeper (70 to 83 m maximum), less well-defined sill, between King Island and the mainland.

Surface sediments of Bass Strait have been described by in a number of studies. The two most significant were undertaken by Jones and Davies (1983) and Blom and Alsop (1988).[31] Jones and Davies (1983) mapped grain size distribution and carbonate content on the eastern and western margins. Blom and Alsop (1988) described the sediments in central Bass Strait. In general, the seabed is characterised by cool-water carbonates with a low terrigenous content. Fine-grained sediments (muds and silty sands) are restricted to the deeper waters of Bass Basin. Gravels and sands cover the remainder of the shelf.[32] Fine shelly sands occur along the inner shelf of the south-eastern Victorian coast and north of Flinders Island. Moderately well- and well sorted sediments are restricted to nearshore environments and to areas between Flinders Island and Mornington Peninsula. Sediments over the remainder of Bass Strait are poorly to very poorly sorted and include quartzose sands, and bryozoan sands and gravels.

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29 Op. Cit., Australia Pilot, 1956, p.125.

30 Op. Cit., **FUGRO, 2020,** p.82.

31 **Blom, W. M., & Alsop, D. B. 1988** Carbonate mud sedimentation on a temperate shelf: Bass Basin, southeast Australia. Sedimentary Geology, 60, 269-280; **Jones, H.A., Davies, P.J. 1983** Superficial sediments of the Tasmanian continental shelf and part of Bass Strait. Bureau of Mineral Resources, p. 25.

32 Op. Cit., Jones & Davies, 1983.

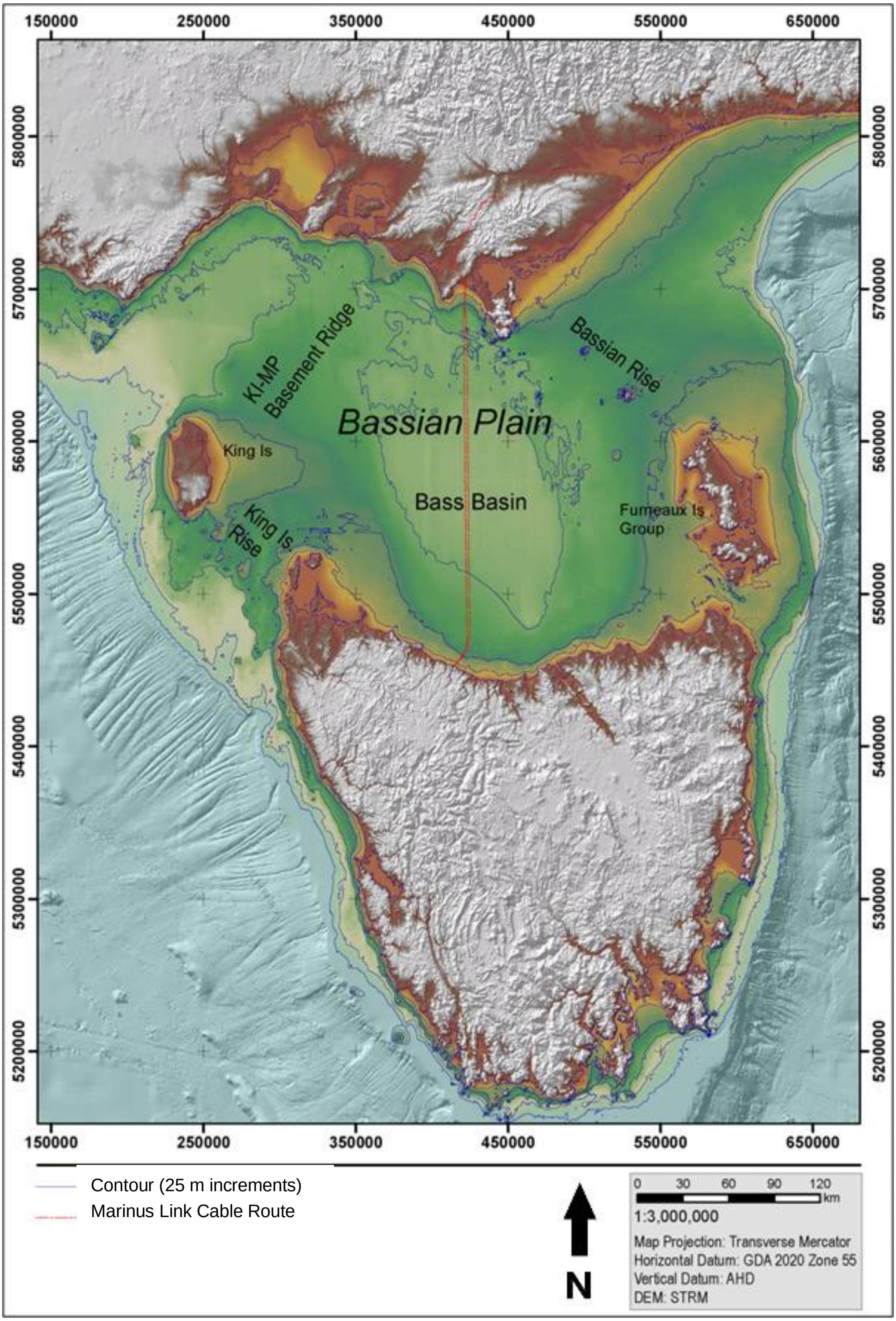

Figure 5-2: Bathymetry of Bass Strait.

5.2.2 Palaeosea level records

A deep-sea marine oxygen isotope curve was used as a proxy for past sea level spanning the last 120,000 years.[33] The oxygen isotope approach to sea level reconstructions has the advantage of providing a continuous sea level record but there is a large uncertainty of up to ±12 m in the correction from isotope values to sea level elevation.

From this curve, the mapped elevation of submerged coastal features or shorelines on the continental shelf can be attributed with an equivalent elevation on the sea level curve, from which an age of seabed can be assigned. This approach is particularly useful for assigning an assumed age where a submerged shoreline has not been directly dated. Using the known elevation of former sea levels, we are also able to show, at a landscape scale, where palaeoshorelines are likely to be found on the continental shelf. It enables the identification of shorelines that likely formed prior to first human arrival on the Australian continent and those shorelines that formed contemporaneously with deep time or with more recent human occupation.

Sea level at the time of earliest known arrival (65,000 years BP) was approximately 100 m lower than present (Figure 5-3).[34] Sea level at the peak of the last ice age, i.e., termination of the last glacial maximum (LGM; 20,000 years BP) was approximately 120 m lower than it is today.[35] Relic submerged palaeoshorelines have been identified on Australia's North West Shelf and likely formed during the last glacial cycle (80,000 to 10,000 years BP).

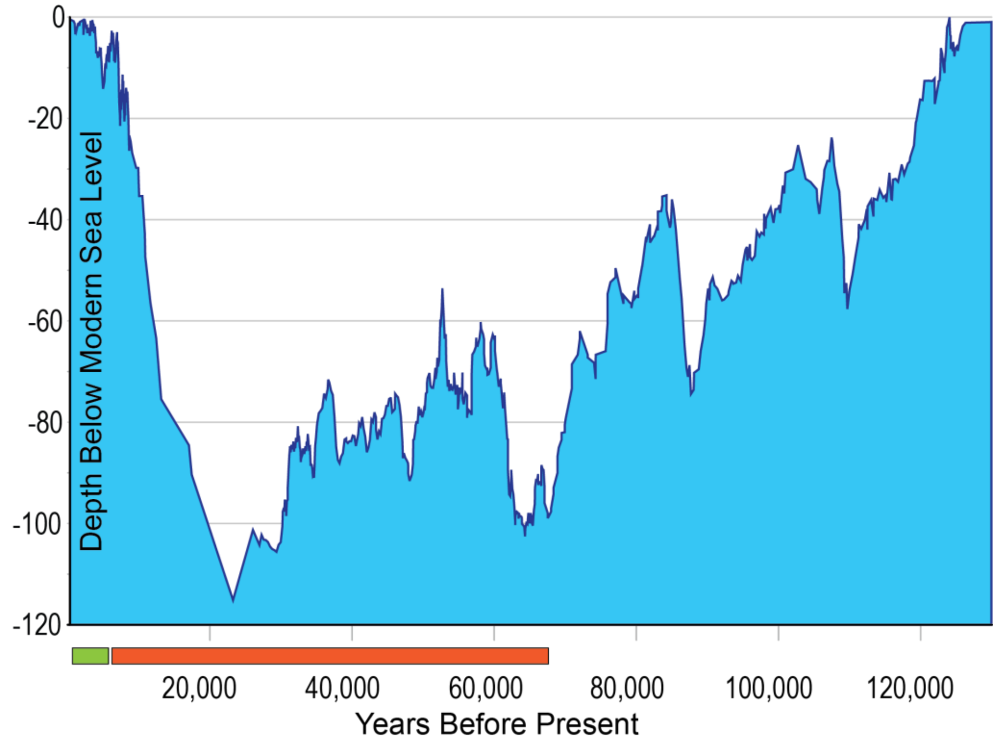

Figure 5-3: Depth below modern sea level from 120,000 years BP to present. The orange bar represents the period of occupation where sea levels were lower than present, and the green bar represents the period of occupation where sea levels were at modern levels.

[33] **Grant, K. M. et al. 2014.** Sea-level variability over five glacial cycles. Nature Communications, 5, 1–9.
[34] **De Deckker, P et al. 2019** Marine Isotope Stage 4 in Australasia: a full glacial culminating 65,000 years ago–global connections and implications for human dispersal. Quaternary Science Reviews, 204, 187-207.
[35] **Yokoyama, Y. et al. 2001** Sea-level at the Last Glacial Maximum: evidence from northwestern Australia to constrain ice volumes for oxygen isotope stage 2. Palaeogeography, Palaeoclimatology, Palaeoecology, 165(3-4), 281-297.

5.3 Site formation processes of maritime cultural heritage

The condition of any underwater archaeological value is affected by environmental and cultural factors as well as the nature of the seabed.

With regards to the study area, the following factors will have the greatest impact on site formation processes:

- Type of depositional event;
- Soft marine sediments;
- Mechanical damage caused by waves;
- Salvage;
- Anchor and trawl drags, and;
- Chemical and biological degradation.

For discussion on the site formation processes of submerged landforms see Section 2.4, particularly Step G.

5.3.1 Shipwrecks

Adverse weather is a primary reason for the loss of vessels. In heavy seas, vessels may founder, especially if they are poorly maintained or small in size. In most cases vessels are wrecked because they have lost steerage and collided with something, such as land or a submerged reef.

The likelihood of vessels wrecking further out to sea becomes increasingly unlikely with greater distance from shore. Despite this, the loss of a vessel by mishap such as a fire or unseaworthiness, though not common, can occur anywhere.

The wrecking event is the first factor that influences site formation. Depending on the reasons or forces behind wrecking, the ship may be mostly complete or extensively broken up. A vessel rarely falls or sinks as a result of little or no damage; it is more likely that a vessel would run aground, cause damage to the hull, and then sink with part of the vessel intact and part damaged. This scenario is still not the most common since usually the force of initial impact is sufficient to break the vessel and cause considerable damage[36]. The vessel would then sink in large pieces, depending on the damage, or remain stuck until it is broken up by physical or human forces. Another reason for a wrecking event is fire which, depending on the extent of the fire, can cause a considerable amount of breaking up and scrambling of the ship material before it reaches the seabed.

It is reasonable to assume that a large majority of shipwrecks within the study area were purposefully dumped or scuttled. In this scenario, the vessel's structural remains would remain highly intact, although it may have been salvaged for key parts before discard and it would have expected to be void of artefactual remains.

The seabed upon which a shipwreck lies has the greatest effect on site formation processes, in particular with wooden hulled vessels, with other factors also having contributory effects. Regarding salvage, it is a general rule that the deeper the water in which a vessel sinks and the more remote the location, the less likelihood of it being salvaged at the time of loss. Rapidly changing technology in recent times has allowed salvage at greater depths.

[36] **Muckelroy, K., 1978,** *Maritime Archaeology*, Cambridge University Press, Cambridge.

With regards to vessels coming to rest on a sandy or muddy seabed, the archaeological site will usually be formed in the following manner:

- Vessel comes to rest on the seabed;
- The wreck will settle into the seabed up to a certain depth, dependent on the resistance of the sediments and the weight of the vessel. It is a general rule, especially with iron hulled vessels, that wrecks sink into mud up to their waterline;
- Parts of the vessel which protrude above the water may be salvaged for re-use. Non-perishable, accessible and high value parts of the vessel situated underwater may also be removed;
- Biological processes will commence immediately, attacking the exposed timbers and other organic elements of the wreck. This will lead to the weakening of the hull's integrity and eventually disappearance of the organic elements above the seabed;
- If it is in shallow water, wind generated waves would act upon the broader surfaces of a wreck thereby breaking down exposed components into sections. These sections will orientate themselves to prove the least resistance to the direction from which the waves are more commonly generated;
- Large waves will raise sediments into suspension, thereby resulting in cultural objects, including the hull of the wreck, sinking further into the marine sediments. The older the wreck, the deeper it would be buried, unless a hard-alluvial substrate is present close to the surface of the seabed against which the wreck will rest;
- Cultural behaviour may have the effect of scrambling wreck sites and masking their presence, by spreading, moving or obscuring wreck materials, which could remove archaeological materials from their contexts or make a site unrecognisable. Dragging anchors and trawling will spread wreck material and may also result in the 'ploughing up' of buried cultural material;
- Salvaging will have a destructive effect on the hull and organic elements that have survived below the seabed, as well as by removing artefacts and creating a scatter of remaining material around the wreck site.

With regards to vessels coming to rest on a rocky seabed, the archaeological site will usually be formed in the following manner:

- Vessel comes to rest on the seabed;
- Parts of the vessel which protrude above the water may be salvaged for re-use. Non-perishable, accessible and high value parts of the vessel situated underwater may also be removed;
- Biological processes will commence immediately, attacking the exposed timbers and other organic elements of the wreck. This will lead to the weakening of the hull's integrity and eventually disappearance of the organic elements above the seabed;
- Elements of the vessel and cargo will deteriorate rapidly if left exposed on rock. Ferrous elements may survive but may be corroded to an extent that they are difficult to identify;
- Where there are pockets of sand within the reef, vessel and cargo elements may be present and buried. They could be exposed after large storms;
- Human activities, such as dragging anchors and trawling, will not greatly affect wrecks in areas where there is a rocky seabed;
- Salvaging will have a destructive effect on the hull and any organic elements that have survived below the seabed, as well as by removing artefacts and creating a scatter of remaining material around the wreck site.

Condition

Assessing the condition or, more precisely, the structural integrity of the shipwrecks is of relevance because this can provide an indication of the nature and scale of the obstacle that could affect the cable laying process. Shipwreck condition also relates to its 'detectability'. A number of factors influence the condition of shipwrecks, the primary ones being: the materials used in the construction of the vessel, the bottom type upon which the wreck rests, the depth of the wreck and its age.

Generally, the 'younger' the wreck is, and the deeper it sunk in the water column, the better preserved it would be, due to a general reduction in oxygen concentration, temperature and current, which yields greater preservation of shipwreck materials like wood and iron or steel. Also, a wreck resting on a sandy bottom would be better preserved than if it was resting on a rocky bottom. In conjunction with these factors, the method and type of construction of the vessel is the most important variable when it comes to assessing the condition of a wreck.

Iron/steel hulled wrecks

If resting on a sandy bottom, it could be expected that the hull integrity of the wreck would be relatively intact. The hull along midships may have collapsed but the stern and bow sections may still be upright or heeled to one side. The engine components, if any, would be largely intact and in situ. Such vessels on a rocky bottom would be relatively disarticulated, though the components of the vessel would still be present. Iron/steel wrecks on either bottom type can be detected using a magnetometer. Locating such a wreck site on a rocky bottom with SSS would be difficult but the opposite is true with such wrecks on a sandy seabed.

Wooden hulled wrecks with engines

In most cases the hulls of such wrecks would have disappeared. However, in situations where the wreck rests on a sandy bottom, sections of the hull may have been preserved under the sand. The engine components of such wrecks would be visible. A magnetometer can detect such wrecks on either bottom type. Such wrecks on a rocky bottom would be difficult to detect with SSS, but the opposite is true with wrecks on a sandy seabed.

Large tonnage (> 100 tons) wooden hulled wrecks (Sail)

In most cases, the hulls of such wrecks would have disappeared. However, in situations where the wreck rests on a sandy bottom, significant sections of the hull may have been preserved under the sand. There would be enough ferrous material present, such as anchors, chain and winches, for such wreck sites to be detected using a magnetometer. The identification of such wreck sites using SSS would be difficult as it could appear as scattered dumped debris, unless the cargo the vessel was carrying was non-perishable, in which case a linear mound may be visible.

Small tonnage (< 100 tons) wooden hulled wrecks (Sail)

The wreck characteristics would be the same as for large tonnage vessels except that the size of the wreck and the amount of ferrous material present would be considerably less. It would be difficult to detect using a magnetometer and may be mistaken for dumped material debris from SSS imaging.

5.3.2 Sea dumping

The locations of sea dumping of ammunition, boats, chemicals and other materials have been recorded and made available by the Australian Government Department of Defence and AHS. The location and amount of the material dumped is documented; however, the exact location of the dumped material may differ from that recorded due to the depth of water where the material was dumped and/or accuracy of the relocation of the dump site.

Information is provided by the AHS, including links to spreadsheets that contain information of specific sites. The sites are grouped into five main categories, including ammunition, boats, chemicals and other materials, as well as dumping grounds. Each record includes information such as latitude and longitude coordinates, date of dumping and description of materials. In addition, information on sea dumping has been made public through Australian Notices to Mariners since 1982.

The types of ammunition listed in sea dumping records include unexploded depth charges, guns and cartridges. It must be assumed that all ammunition is currently live and appropriate precautions should be taken in regard to these sites. The last category is ‘other materials’. This includes army medical stores, ceramics, residue from grain cleaning, iron ore, artificial reefs, dredge spoil, obsolete equipment and even food scraps.

Ammunition dumps could appear as a mound or as a low relief scatter of debris on the seabed. The site configuration depends on the speed of the dumping vessel at the time of disposal and the assumption that the ammunition was dumped inside its containers. Due to the relatively recent timing of these dumping events and the fact that the ammunition largely consists of iron, it is likely that any ammunition dumped is still largely intact.

If the ammunition, chemical and other dumping sites were formed in a mound they may have good relief against the seabed, especially a rocky seabed, and may be detected in SSS data as a mound. It is more likely that the dumps are low relief as a result of having been discarded from a moving vessel, in which case they may be identifiable as a scatter similar to a rocky seabed. Ammunition, drums and demolition materials on the seabed or only buried under shallow sediment would still be largely intact. This would result in the items being easier to detect via magnetometer due to their ferrous properties.

5.3.3 Maritime infrastructure sites and associated deposits

Maritime infrastructure refers to wharves, jetties, moorings, seawalls and other constructed buildings that extend beyond the shore or are located within a maritime context. Remains of these structures may still exist in the seabed in the form of cut-off piles, abandoned moorings, collapsed timbers and linear mounds of rock rubble which are known to be associated with 19th century jetty construction. These linear mounds of rock rubble can commonly be mistaken for modern groynes. Former slipways associated with ship building industries could also be located in nearshore areas.

Deposits associated with maritime infrastructure would have built up around and beneath the structures. Artefacts would have fallen beneath and between the deck planking of jetties and wharves as well as off the vessels moored alongside. Such deposits can include accidental and/or deliberate discard of items such as personal objects, food and drink containers, fishing equipment as well as damaged and removed material from maintenance of the structure. These smaller items may have fallen through the sandy seabed to become buried beneath the surface or similarly buried by any sedimentation in the area. As historic maritime infrastructure was frequently associated with industrial activities, there could be a higher concentration of tools and machinery parts under, within and around any remaining structures.

Archaeological deposits would have formed below vessels accessed and moored off maritime infrastructure sites. Discard of items from vessels can be accidental or deliberate, and can include personal objects, food and drink containers, ships fittings and equipment, fishing and boating equipment as well as cargo from vessels passing through the areas. Such deposits can consist of a range of materials and are mostly single items but can also occur in scatters created by one event or multiple events. Higher concentrations would be expected closer to shorelines.

6 ABORIGINAL HERITAGE

6.1 Deep time regional context of Bass Strait

The transition in global climate from warm interglacial, to cool stadial, to cold glacial, and back to warm interglacial conditions has played a major role in the story of anatomically modern human migrations out of Africa, between 70,000- and 60,000-years BP, and into northern Australia by 65,000 years BP.[37] It is understood that coastal regions were primary routes of initial dispersal, as they would have provided familiar resources and least-cost pathways of movement in an unfamiliar landscape.[38] Therefore, knowledge of the former position of sea levels during the period of human migration into and around the Australian continent, and the age and evolution of coastal environments that formed during this interval, is key for identifying those now submerged coastal landscapes that have a related cultural component.

An extensive review of the Aboriginal archaeology of Bass Strait was undertaken by Sandra Bowdler and details the long and complex association that Aboriginal peoples had with Bass Strait Islands following post glacial sea level rise.[39] Bowlder also describes an exposed lowland landscape (named the Bassian Plain) that joined the Australia mainland with Tasmania during periods of lower sea levels (Figure 6-1).

This now inundated landscape is thought to have represented a unique human-land relationship with a now vanished environment. Bowdler described the establishment of a Bassian Nation, representing a lowland people whose culture had adapted to an exposed, resource limited, and at times arid plain, some distance from coastal and upland resources. The archaeological record only hints at what this lost culture was like. These lowland Tasmanians would have also had to adapt to an ephemeral Bass Lake that formed within the Bassian Plains broad central basin, and at its maximum extent covered an area twice the size of Kati Thanda (Lake Eyre).

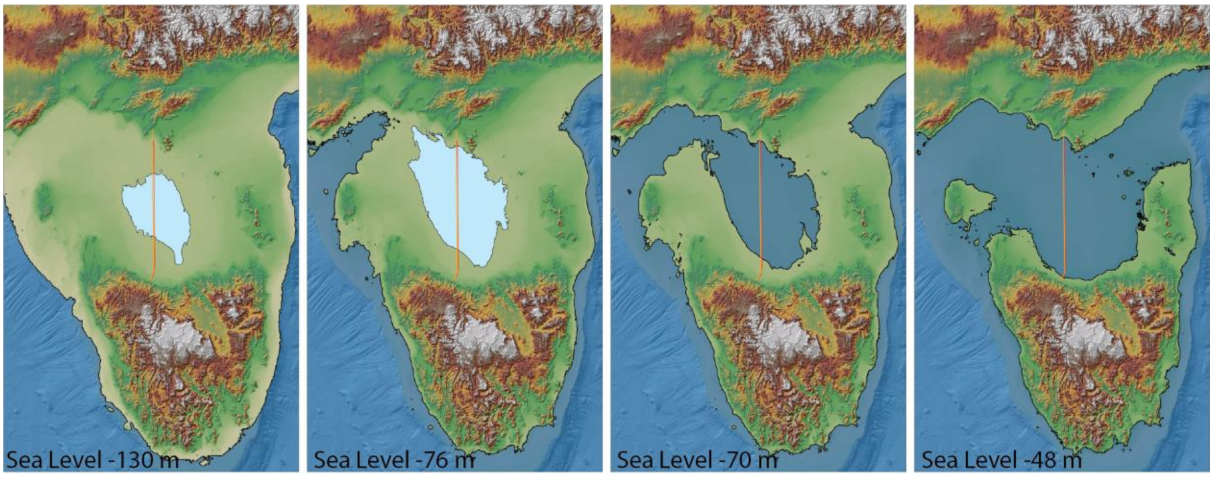

Figure 6-1: Shoreline of Bass Strait during different periods of sea level height. Sea level heights shown correspond roughly to sea levels at 20,000 BP (LGM), 14,000 BP, 13,000 BP, and 11,000 BP (left to right). Note, borders for Bass Lake are only indicative of possible maximum water level. Water level would have been ephemeral and seasonal, much like Kati Thanda (Lake Eyre).

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[37] **Clarkson, et al. 2017** Human occupation of northern Australia by 65,000 years ago. Nature 547(7663):306-310.
[38] **Bird, et al., 2018** Palaeogeography and voyage modelling indicates early human colonization of Australia was likely from Timor-Roti. Quaternary Science Reviews 191:431-439.
[39] **Bowdler, S. 2015** The Bass Strait Islands revisited. Quatern Int 385, 206–218.

6.2 Chronology of occupation in Bass Strait

The earliest evidence for the peopling of Tasmania is dated to around 35,000 years ago. A glacial sea level lowstand at this time would have allowed people to cross from mainland Australia and into Tasmania via the Bassian Plain. The onset of the LGM saw a drop in regional temperatures with glaciers and ice caps forming across Tasmania's central plateau region, and a period of enhanced aridity. These conditions spanning 25,000 and 16,000 years BP likely reduced the habitability of the Tasmanian uplands with the archaeological record showing a less intense presence in the uplands during this period. It is possible that people retreated to the Bassian Plain during this climate interval, with a number of Bass Strait sites showing an increased human presence from about 23,000 years ago.[40] These sites include Cave Bay Cave on Hunter Island in the southwest of the Bassian Plain, Beeton Cave on Badger Island and Mannalargenna Cave on Prime Seal Island on the east side of the Bassian Plain. During the LGM these sites would all have been located on hills arising out of a flat grassy landscape.[41]

The ultimate fate of the people inhabiting the Bassian Plain is not clear. As described above, the evidence for occupying this lowland landscape lasts from about 23,000 years until about 15,000 years ago. However, an apparent decline in the archaeological record at these sites from about 18,000 BP suggests that these lowland people were retreating towards the coastal areas of the Bassian Plain as environmental conditions deteriorated with drought conditions intensifying.

As the sea level began to rise following the termination of the LGM, people living on the Bassian Plain would have observed an extremely rapid inundation of their Country as the sea level rose above a geographic sill situated at – 70 m in the northwest, flooding the central basin and rapidly advancing across the plains' low lying coastal margins. These rising seas inundated their homelands, cutting off spiritually and culturally significant sites and places whose cultural connections may have spanned over 1,000 generations of people.

The formation of the Bass Strait Islands saw a period of early phase of occupation, with King Island seemingly abandoned about 10,000 years ago. The Hunter and Furneaux islands show evidence of periods of punctuated coastal occupation until approximately 4,000 years ago.[42] What happened to these Bass Strait islanders continues to be the subject of much speculation. Sim (1998) believes there may have been environmental reasons for changes in the human relationships with land and sea at this time, drawing on palaeoclimatic data suggesting the El Nino Southern Oscillation (ENSO) was exerting influence in the southern Australian seas between 5,000 and 3,000 years ago.[43] The possession of watercraft by 2,500 years ago is attested to by the revisitation of some of the islands, including Hunter Island and later King Island, but not Furneaux Island.

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[40] **Cosgrove, R. 1995** The Illusion of Riches: Scale, Resolution and Explanation in Tasmanian Pleistocene Human Behaviour. In: BAR International Series 608. Tempus Reparatum, Oxford; **Porch, N., Allen, J. 1995** Tasmania: archaeological and palaeo-ecological perspectives. Antiquity 69, 714e732.

[41] **Brown, S. 1991** Archaeological Investigations on Prime Seal Island, November 1989. A Report to Flinders Island Aboriginal Association, Tasmanian Aboriginal Centre, Tasmanian Aboriginal Land Council and Department of Parks, Wildlife and Heritage Hobart.

Brown, S. 1993. Mannalargenna Cave: a Pleistocene site in Bass Strait. In: Smith, M.A., Spriggs, M., Fankhauser, B. (Eds.), Sahul in Review: Pleistocene Archaeology in Australia, New Guinea and Island Melanesia, Occasional Papers in Prehistory No. 24. Department of Prehistory, Research School of Pacific

[42] **Bowdler, S. 2015** The Bass Strait Islands revisited. Quatern Int 385, 206–218; **Sim, R. 1998** *The Archaeology of Isolation? Prehistoric Occupation in the Furneaux Group of Islands, Bass Strait, Tasmania* (PhD thesis). Australian National University, Canberra.

[43] **Sim, R., 1998,** The Archaeology of Isolation? Prehistoric Occupation in the Furneaux Group of Islands, Bass Strait, Tasmania (PhD thesis). Australian National University, Canberra.

6.3 Bass Strait terrestrial archaeological site type and environments

Table 6-1 summarises the archaeological sites and their environmental associations based on available literature reported on Bass Strait Islands.[44] Sites on islands in Bass Strait are used as analogues for submerged sites, as they represent the only documented archaeological sites within Bass Strait. Their locations are shown in Figure 6-2.

Table 6-1: Archaeological site types and environmental associations on Bass Strait Islands.

Island	Archaeological site types	Likelihood of Occurrence	Material Context	Material Source Proximity	Geomorphological Association	Geological Association	Environmental Association
King Island	Artefact Scatters	Occasional	Lithics	Granite Terrain Distal to proximal	Dunes; Blowouts	Calcareous aeolian dunes Quartz aeolian dunes Palaeosols	Sandy coast
	Midden	Rare	Shells	-Shoreline -Proximal	Dune; Blowouts	Coastal sand in dunes; Marine sand reworked by wind	Sandy coast
	Skeletal Remains	Rare	Bones in stratified sediments	-Intimate	Sea Cave	Granite	Rocky shore
Erith Island	Cave	Rare	Lithics, Shells, Bones, Charcoal in stratified sediments	-Granite Terrain; Shoreline -Proximal	Coastal Cliffs	Granite	Rocky Shore
	Artefact Scatter	Occasional	Lithics	-Granite Terrain Proximal	Saddle/swale between two hills	Quartz sands; Palaeosols	Native grassland
Great Glennie Island	Midden	Rare	Shells	-Shoreline -Proximal	Dune; Blowouts	Coastal sand in dunes; marine sand reworked by wind	Sandy coast
	Rock Shelter	Rare	Shells (Limpets)	-Rocky Shoreline -Proximal	Coastal Cliffs	Granite	Rocky Shore
Badger Island (Furneaux Group)	Rock Shelter	Rare	Animal bones; Shells	-Rocky Shoreline -Proximal	Coastal Cliffs	Granite	Rocky Shore
	Artefact Scatters	Rare	lithics	-Granite -Proximal	Upland granite terrain Lowland alluvial plain	Granite Sandstone, sands and gravels	Heathland; Scrub Native grasslands
Clarke Island (Furneaux Group)	Artefact Scatters	Occasional	Lithics (Quartz)	-Granite -Proximal	Upland granite terrain Lowland alluvial plain	Granite Sandstone, sands and gravels	Heathland; Scrub Native grasslands
Preservation Island (Furneaux Group)	Artefact Scatters	Rare	Lithics (Quartz)	-Granite -Proximal	Coastal Cliffs	Granite	Rocky Shore Heathland; Scrub

[44] **Jones, R. 1971** 'Rocky Cape and the problem of the Tasmanians.' Unpublished PhD thesis, University of Sydney **,** **Bowdler, S. 1979** Hunter Hill, Hunter Island. Unpublished PhD thesis, Department of Prehistory, ANU, Canberra., **Sim, R. 1998** The Archaeology of Isolation? Prehistoric Occupation in the Furneaux Group of Islands, Bass Strait, Tasmania (PhD thesis). Australian National University, Canberra, **Sim, R. 2016** Prehistoric Sites On King Island In The Bass Strait Results Of An Archaeological Survey. Australian Archaeology 31, 34–43 and personal observations on Robbins Island by Dr. Mick O'Leary.

Island	Archaeological site types	Likelihood of Occurrence	Material Context	Material Source Proximity	Geomorphological Association	Geological Association	Environmental Association
Vanssitart Island (Furneaux Group)	Artefact Scatters	Rare	lithics	-Granite -Proximal	Low alluvial plain	Granite Sandstone, sands and gravels	Native grassland
Little Green Island (Furneaux Group)	Artefact Scatters	Rare	lithics	-Granite -Proximal	Low granite terrain	Granite	Rocky Shore Heathland; Scrub
Big Dog Island (Furneaux Group)	Artefact Scatters	Occasional	lithics	-Granite -Proximal	Low granite terrain	Granite	Rocky Shore Heathland; Scrub
Big Green Island (Furneaux Group)	Artefact Scatters	Occasional	lithics	-Granite -Proximal	Low granite terrain	Granite	Rocky Shore Heathland; Scrub
Anderson Island (Furneaux Group)	Artefact Scatters	Rare	lithics	-Granite -Proximal	Upland granite terrain Low alluvial plain	Granite	Rocky Shore Heathland; Scrub
East Kangaroo Island (Furneaux Group)	Artefact Scatters	Rare	lithics	-Granite -Proximal	Low granite terrain	Granite	Rocky Shore Heathland; Scrub
Prime Seal Island (Furneaux Group)	Cave	Rare	Lithics, Shells, Bones, Charcoal in stratified sediments	-Granite Terrain; Shoreline -Proximal	Coastal Cliffs	Granite	Rocky Shore
	Artefact Scatters	Rare	lithics	-Granite -Proximal	Low granite terrain	Granite	Native Grassland Heathland; Scrub
Babel Island (Furneaux Group)	Artefact Scatters	Rare	lithics	-Granite -Proximal	Upland granite terrain	Granite	Native Grassland Heathland; Scrub
Hunter Island	Cave	Rare	Lithics, Shells, Bones, Charcoal in stratified sediments	-Granite Terrain; Shoreline -Proximal	Coastal Cliffs	Granite	Rocky Shore
	Artefact Scatters	Rare	lithics	-Granite -Proximal	Low granite terrain	Granite	Native Grassland Heathland; Scrub
	Midden	Rare	Shells	-Shoreline -Proximal	Dune; Blowouts	Coastal sand in dunes; Marine sand reworked by wind	Sandy coast
Three Hummock Island	Midden	Rare	Shells	-Shoreline -Proximal	Dune; Blowouts	Coastal sand in dunes; Marine sand reworked by wind	Sandy coast
	Petroglyph	Rare	Granite	Intimate	Unknown	Granite	Unknown
Robbins Island	Stone Arrangement	Rare	Beach Cobbles	-Shoreline -Intimate	Depression in cobble storm beach	Dolerite	Rocky Coast

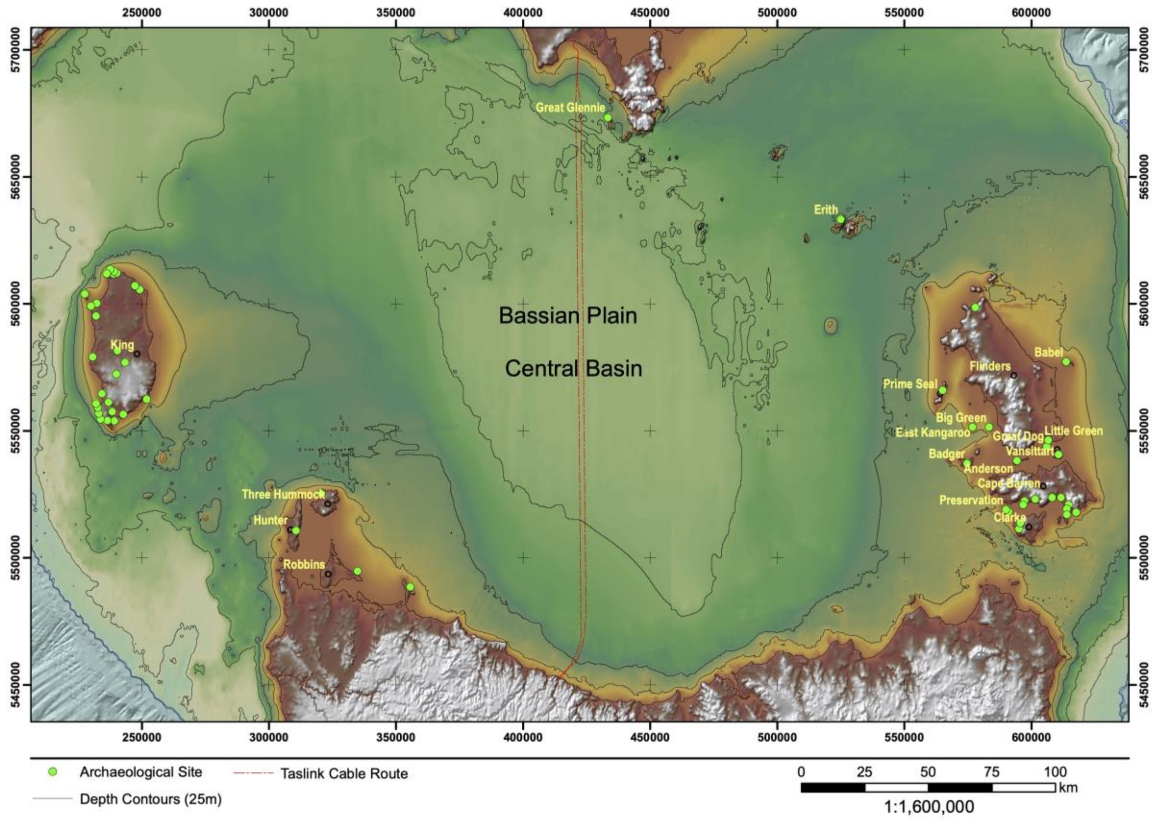

Figure 6-2: Aboriginal archaeological sites located on Bass Strait islands.

6.4 Submerged cultural landscapes

Submerged landscapes can provide a detailed archive of past sea level change and coastal evolution spanning the Quaternary. The addition of a cultural component to these landscapes becomes significant following the first arrival of Aboriginal people into Australia around 65,000 years ago.[45] Our understanding of early human behaviour is that these original inhabitants would have preferentially occupied coastal environments and used waterways as travel corridors into Australia's continental and arid interior by 50,000 years ago.[46] Thus, coastal landscapes that post-date first human arrival (i.e., younger than 65,000 years BP) are more likely to be prospective for cultural heritage as Aboriginal People would have been actively exploiting these environments as they formed and evolved with changing and stabilising sea levels. People occupying the lowstand coastlines and Bassian Plain would have sought a range of different resources, such as igneous deposits suitable for the manufacture of lithics, and groundwater springs and waterholes in interior inland ranges. We still do not know whether these early peoples moved briskly though these environments and kept moving, or whether these earliest groups spread only as they filled particular niches.

Coastal landscapes that pre-date the arrival of the first humans in Australia are unlikely to host cultural heritage sites associated with maritime activities. Instead, these older landforms would have been stranded inland during periods of lower sea levels (coinciding with the late Pleistocene human occupation period). These pre-occupation shorelines may still have

[45] Op. Cit., Clarkson et al., 2018.
[46] **Bird, M.I. et al. 2018** Palaeogeography and voyage modeling indicates early human colonization of Australia was likely from Timor-Roti. Quaternary Science Reviews 191:431-439.
Veth, P.M. 2017 Breaking through the radiocarbon barrier: Madjedbebe and the new chronology for Aboriginal occupation of Australia. Australian Archaeology 83(3): 165-167.
McDonald J. et al. 2018 Karnatukul (Serpent's Glen): A new chronology for the oldest site in Australia's Western Desert. PLoS ONE 13(9): 0202511. https://doi.org/10.1371/journal.pone.0202511 pmid:30231025

provided resource use such as waterholes forming within limestone terrains or resources for lithic production e.g., cobble beach landforms.

The potential for post depositional modification of coastal landforms and associated sites following post-glacial sea level transgression and inundation of coastal environments is also a major consideration when assessing the prospect of cultural heritage being present on the seafloor. Site modification can occur on active coastlines with the potential for coastal erosion and shoreline retreat either during sea level still stands or as rising sea levels transgressed over active and former shorelines. The rate of rise is also of consideration as it will determine the duration a particular feature or site is situated within the active wave/swash zone. For example, Melt Water Pulse 1a was a period of extremely rapid sea level rise of up to 6 m per century between 13,500- and 14,700-years BP. At this rate, a site could potentially pass through the intertidal zone in less than 100 years.

Following submergence, exposed shallow water sites would have been influenced by long period swells, or higher energy cyclonic events which would have had the potential to rework the seabed. As sites moved below wave base there was the potential for deep water waves such as internal waves or solitons to mobilise and transport unconsolidated materials away from the site of deposition.

6.5 Known submerged cultural landscapes within Bass Strait

There have been limited investigations into submerged landscapes within Bass Strait. Beaman identified parallel, low-relief (approximately 1 m relief) ridges typical of a coastal beach ridge strandplain located on the Gippsland Shelf, in Eastern Bass Strait.[47] The ridges are located in water depths of 65 to 75 m and adjacent to high relief granite reef. The palaeoenvironment is interpreted to have been a high energy, micro-tidal, mixed quartz carbonate sedimentary system. Nichol et al. (2009) similarly identified low (1 to 5 m high) ridges, east of the Freycinet Islands in water depths of 90 to 100 m.[48] These are interpreted to be beach ridges situated in a moderate-high energy, microtidal, carbonate sedimentary environment. Monk et al. (2016) identified outcropping reef features, up to 2 m in height, along the Northeast Tasmanian Shelf.[49] The ridges were often undercut forming small caves and ledges and extended along the shelf for distances of hundreds of metres to 1 km scales at depths of 60 to 90 m. Bezore et al. (2016) identified prominent relict shoreline cliffs with 14 m relief and sea stacks off Victoria's Otway coast in water depths of 60 m.[50]

6.6 Stage 1: Site type prediction for the Marinus Link study area

6.6.1 Step A: Geophysical data analysis and interpretation

Geophysical analysis of the interpretation of submerged terrestrial landforms, exposed on the seabed and buried, along the cable routes was made in 5 km sections beginning from the north (Figure 6-3). The results of the analysis are presented in Table 6-2. KP 0 to 10 incorporates the data obtained from the 2023 geophysical survey.

[47] **Beaman, R. J., Daniell, J. J., & Harris, P. T. 2005** Geology–benthos relationships on a temperate rocky bank, eastern Bass Strait, Australia. Marine and Freshwater Research, 56(7), 943-958.
[48] **Nichol, S. L. et al. 2009** Southeast Tasmania Temperate Reef Survey: Post-Survey Report.
[49] **Monk, J. et al. 2016** Outcropping reef ledges drive patterns of epibenthic assemblage diversity on cross-shelf habitats. Biodiversity and conservation, 25(3), 485-502.
[50] **Bezore, R., Kennedy, D. M., & Ierodiaconou, D. 2016** The drowned Apostles: the longevity of Sea stacks over Eustatic cycles. Journal of Coastal Research, (75 (10075)), 592-596.

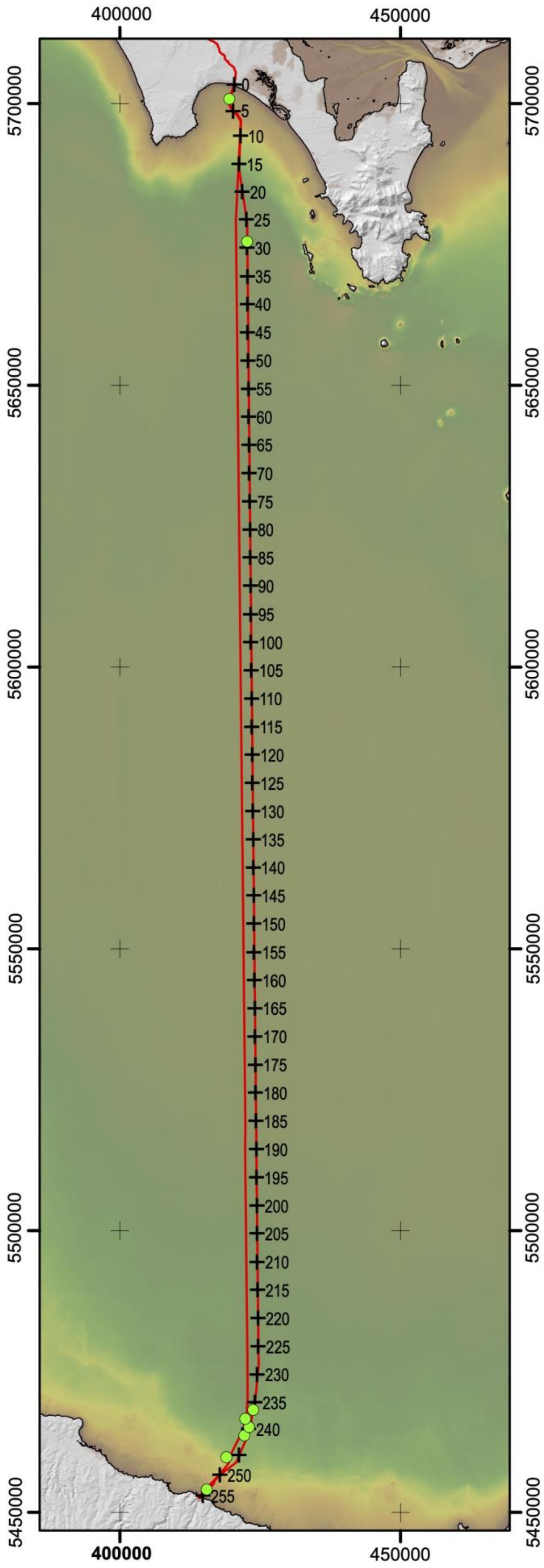

Figure 6-3: Marinus cable route with bathymetry. KPs (kilometres along route) marked by red dots and labelled.

Table 6-2: Geophysical and geomorphic landscape interpretation

Cable Route (Kilometre Point)	Min Depth (m)	Max Depth (m)	Min/Max Depth difference (m)	Seabed (SB) Sediments Seismic Unit (SU) Stratigraphy Acoustic Basement (AB) Stratigraphy > (*level where the seismic signal in attenuated or absorbed by a stratigraphic sedimentary layer*)	Geomorphology and landscape description	Age of Cultural Landform
0-5	0.8	21.0	19.2	SB: Medium to coarse sands and gravels SU 1: SB-R05 gentle dipping off lapping bedforms (Holocene) SU 2: R05-10 gentle dipping off lapping bedforms (Pleistocene?) Interpretation inferred from original alignment Sub-bottom data in Fugro Report 2020.	Low relief N-S fall in seabed profile, inflection point at -15 m where seabed fall shallows, low relief linear reef structures between -17 and -22 m interpreted as possible beach ridge strandplain. Holocene marine sediment thickness increasing towards the shoreface in water depths shallower than -15 m.	>65,000 years?
05-10	20.0	45.3	25.5	SB: Medium to coarse sands and gravels SU 1: SB-R5 steeply dipping off lapping bedforms (Holocene) AB: Highly attenuated (i.e., rapid shift in intensity of seismic signal)	Low relief N-S fall in seabed profile, long wavelength mound possibly relic sand body between -25 and -40 m depth	N/A (no diagnostic features found)
10-15	45.4	65.9	20.5	SB: Veneer of medium to coarse sands and gravels SU 1: SB-R10 1 m thick uniform unit, mostly acoustically transparent AB: Highly attenuated seismic reflections, possible hard seabed	N-S fall in profile with 1.5 km wide terrace feature at -50 m	Pleistocene
15-20	65.9	70.6	4.7	SB: Fine to medium sand shifting to coarse sands and gravels SB: Small 5 m wide 25 cm deep pockmarks SU 1: SB-R10 1 m thick uniform unit, mostly acoustically transparent SU 2: Below R10 Multiple reflectors, moderate amplitude with potential onlapping sedimentary units 16 to 20 km	Gently concave south slope, possible shoreface strata in seismic profile between 16 and 17 km	Pleistocene
20-25	70.6	72.1	1.5	SB: Medium to fine carbonate sand SU 1: SB to R10 faint low amplitude subparallel reflectors AB: Below R10 faint subparallel reflectors becoming attenuated at depth	Flat featureless seabed	N/A (no diagnostic features found)

Cable Route (Kilometre Point)	Min Depth (m)	Max Depth (m)	Min/Max Depth difference (m)	Seabed (SB) Sediments Seismic Unit (SU) Stratigraphy Acoustic Basement (AB) Stratigraphy > (*level where the seismic signal in attenuated or absorbed by a stratigraphic sedimentary layer*)	Geomorphology and landscape description	Age of Cultural Landform
25-30	72.0	74.2	2.3	SB: Medium to fine carbonate sand SU 1: SB-R10 multiple horizontal reflectors; asymmetric depression in R10 reflector between 27-27.5 km, SU 2: R10-R20 highly transmissible 5 m thick seismic unit reflectors which narrows and disappears at 28.5 km	Flat featureless seabed, buried 3 m deep tidal creek or estuarine channel at 27-27.5 km. Asymmetry suggests east-west flow direction. Possible lacustrine sedimentary unit bounded by R10 and R20 seismic reflectors 28.5 and 30 km. See **Section 6.6.3**.	Pleistocene
30-35	74.2	75.8	1.5	SB: Medium to fine carbonate sand SU 1: SB-R10 Thin unit pinching out towards the south SU 2: R10-20 Condensed sub parallel reflectors becoming attenuated AB: Faint subparallel reflectors becoming attenuated	Flat featureless seabed, possible lacustrine sedimentary unit bounded by R10 and R20 seismic reflectors	Pleistocene
35-40	74.2	76.0	1.8	SB: Medium to fine carbonate sand SU1: SB-R10 < 1 m thick unit becoming attenuated SU2: R10-R15 low amplitude sub horizontal reflector, becoming attenuated AB: low amplitude sub horizontal reflector, becoming attenuated	Flat featureless seabed, possible lacustrine sedimentary units bounded by R10 and R20 seismic reflectors	Pleistocene
40-45	73.8	75.3	1.4	SB: Medium to fine carbonate sand SU 1: SB-R10 < 1 m thick unit AB 2: R10-R20 Faint Sub parallel reflectors	Flat featureless seabed, possible lacustrine sedimentary unit bounded by R10 and R20 seismic reflectors	Pleistocene
45-50	74.3	75.9	1.6	SB: Medium to fine carbonate sand SU1: SB-R10 < 1 m thick low amplitude reflectors AB: Faint subparallel reflectors	Flat featureless seabed, possible lacustrine sedimentary unit bounded by R10 and R20 seismic reflectors	Pleistocene

Cable Route (Kilometre Point)	Min Depth (m)	Max Depth (m)	Min/Max Depth difference (m)	Seabed (SB) Sediments Seismic Unit (SU) Stratigraphy Acoustic Basement (AB) Stratigraphy > (*level where the seismic signal in attenuated or absorbed by a stratigraphic sedimentary layer*)	Geomorphology and landscape description	Age of Cultural Landform
50-55	74.8	76.1	1.3	SB: Medium to fine carbonate sand SU1: SB-R10 ~1 m thick unit with compact moderately faint subparallel reflectors SU2: R10-R20 Faint subparallel reflectors AB: Faint subparallel reflectors	Flat featureless seabed, possible lacustrine sedimentary unit bounded by R10 and R20 seismic reflectors	Pleistocene
55-60	76.0	76.5	0.5	SB: Medium to fine carbonate sand SU1: SB-R10 ~1 m thick unit with compact moderately faint subparallel reflectors SU2: R10-R20 Faint subparallel reflectors AB: Faint subparallel reflectors	Flat featureless seabed, possible lacustrine sedimentary unit bounded by R10 and R20 seismic reflectors	Pleistocene
60-65	75.1	76.3	1.2	SB: Medium to fine carbonate sand SU1: SB-R10 ~1 m thick unit with compact moderately faint subparallel reflectors SU2: R10-R15 Faint subparallel reflectors AB: Faint subparallel reflectors	Flat featureless seabed, possible lacustrine sedimentary unit bounded by R10 and R20 seismic reflectors	Pleistocene
65-70	75.2	76.3	1.1	SB: Medium to fine carbonate sand SU1: SB-R10 ~1 m thick unit with compact moderately faint subparallel reflectors AB: R10 reflector thick and compact subparallel reflectors becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)
70-75	74.9	78.1	3.2	SB: Medium to fine carbonate sand SU1: SB-R10 ~2 m thick; acoustically transparent AB: R10 Faint compact subparallel reflector becoming highly attenuated	Flat featureless seabed apart from a step drop in elevation from -75 to -78 m, at 73 km.	Pleistocene

Cable Route (Kilometre Point)	Min Depth (m)	Max Depth (m)	Min/Max Depth difference (m)	Seabed (SB) Sediments Seismic Unit (SU) Stratigraphy Acoustic Basement (AB) Stratigraphy > (*level where the seismic signal in attenuated or absorbed by a stratigraphic sedimentary layer*)	Geomorphology and landscape description	Age of Cultural Landform
75-80	77.8	78.4	0.6	SB: Medium to fine carbonate sand SU1: SB-R10 ~2 m thick; acoustically transparent AB: R10 Faint compact subparallel reflector becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)
80-85	78.0	79.0	1.0	SB: Medium to fine carbonate sand SU1: SB-R10 ~2 m thick; acoustically transparent AB: R10 Faint compact subparallel reflector becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)
85-90	78.4	79.2	0.7	SB: Medium to fine carbonate sand SU1: SB-R10 ~2 m thick; acoustically transparent AB: R10 Faint compact subparallel reflector becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)
90-95	78.8	79.2	0.3	SB: Medium to fine carbonate sand SU1: SB-R10 ~2 m thick; acoustically transparent AB: R10 Very faint compact subparallel reflector becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)
95-100	78.8	79.5	0.7	SB: Medium to fine carbonate sand SU1: SB-R10 ~2 m thick; acoustically transparent AB: R10 Very faint compact subparallel reflector becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)
100-105	79.3	79.7	0.4	SB: Medium to fine carbonate sand SU1: SB-R10 ~2 m thick; acoustically transparent AB: R10 Compact reflector at 83 m becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)

Cable Route (Kilometre Point)	Min Depth (m)	Max Depth (m)	Min/Max Depth difference (m)	Seabed (SB) Sediments Seismic Unit (SU) Stratigraphy Acoustic Basement (AB) Stratigraphy > (*level where the seismic signal in attenuated or absorbed by a stratigraphic sedimentary layer*)	Geomorphology and landscape description	Age of Cultural Landform
105-110	79.5	80.2	0.6	SB: Medium to fine carbonate sand SU1: SB-R10 ~2 m thick; acoustically transparent R10 Compact reflector at 83 m becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)
110-115	80.0	80.2	0.3	SB: Medium to fine carbonate sand SU1: SB-R10 ~2 m thick; acoustically transparent R10: Multiple compact subparallel reflectors at 83 m becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)
115-120	80.1	80.3	0.2	SB: Medium to fine carbonate sand SU1: SB-R10 ~2 m thick; acoustically transparent R10: Multiple compact subparallel reflectors between 83 to 85 m becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)
120-125	79.9	80.3	0.4	SB: Medium to fine carbonate sand SU1: SB-R10 ~2 m thick; acoustically transparent R10: Multiple compact subparallel reflectors between 82 to 86 m then becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)
125-130	79.8	80.2	0.3	SB: Carbonate Silt SU1: SB-R10 ~2 m thick; acoustically transparent R10: Multiple compact subparallel reflectors between 83 to 87 m then becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)
130-135	79.9	80.1	0.3	SB: Carbonate Silt SU1: SB-R10 ~2 m thick; acoustically transparent R10: Multiple compact subparallel reflectors between 82 to 88 m then becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)

Cable Route (Kilometre Point)	Min Depth (m)	Max Depth (m)	Min/Max Depth difference (m)	Seabed (SB) Sediments Seismic Unit (SU) Stratigraphy Acoustic Basement (AB) Stratigraphy > (*level where the seismic signal in attenuated or absorbed by a stratigraphic sedimentary layer*)	Geomorphology and landscape description	Age of Cultural Landform
135-140	79.7	80.0	0.3	SB: Carbonate Silt SU1: SB-R10 ~2 m thick compact faint parallel reflectors R10: Multiple compact subparallel reflectors between 82 to 88 m then becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)
140-145	79.3	79.8	0.4	SB: Carbonate Silt SU1: SB-R10 ~2 m thick compact faint parallel reflectors R10: Multiple compact subparallel reflectors between 82 to 88 m then becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)
145-150	79.2	79.6	0.4	SB: Carbonate Silt SU1: SB-R10 ~2 m thick compact faint parallel reflectors R10: Multiple compact subparallel reflectors between 82 to 88 m then becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)
150-155	79.0	79.3	0.3	SB: Carbonate Silt SU1: SB-R10 ~2 m thick compact faint parallel reflectors R10: Multiple compact subparallel reflectors between 82 to 90 m then becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)
155-160	78.5	79.1	0.6	SB: Carbonate Silt SU1: SB-R10 ~2 m thick compact faint parallel reflectors R10: Multiple compact subparallel reflectors between 82 to 89 m then becoming highly attenuated	Flat featureless seabed	N/A (no diagnostic features found)

Cable Route (Kilometre Point)	Min Depth (m)	Max Depth (m)	Min/Max Depth difference (m)	Seabed (SB) Sediments Seismic Unit (SU) Stratigraphy Acoustic Basement (AB) Stratigraphy > (*level where the seismic signal in attenuated or absorbed by a stratigraphic sedimentary layer*)	Geomorphology and landscape description	Age of Cultural Landform
160-165	77.8	78.6	0.8	SB: Carbonate Silt SU1: SB-R10 ~2 m thick compact faint parallel reflectors R10: Multiple compact subparallel reflectors between 82 to 88 m then becoming highly attenuated	Featureless seabed, very gentle N-S rise	N/A (no diagnostic features found)
165-170	77.1	77.8	0.8	SB: Carbonate Silt SU1: SB-R10 ~2 m thick compact faint parallel reflectors R10: Multiple compact subparallel reflectors between 79 to 85 m then becoming highly attenuated Multiple faint reflectors between -96 to -98 m with a gentle N-S rise	Featureless seabed, very gentle N-S rise	N/A (no diagnostic features found)
170-175	76.4	77.1	0.7	SB: Carbonate Silt SU1: SB-R10 ~2 m thick compact faint parallel reflectors R10: Multiple compact subparallel reflectors between 78 to 84 m then becoming highly attenuated Multiple faint reflectors between 92 to 96 m with a gentle N-S rise	Featureless seabed, very gentle N-S rise	N/A (no diagnostic features found)
175-180	75.7	76.5	0.8	SB: Carbonate Silt SU1: SB-R10 ~2 m thick compact faint parallel reflectors R10: Multiple compact subparallel reflectors between 76 to 80m then becoming highly attenuated Multiple faint reflectors between 88 to 91 m with a gentle N-S rise	Featureless seabed, very gentle N-S rise	N/A (no diagnostic features found)

Cable Route (Kilometre Point)	Min Depth (m)	Max Depth (m)	Min/Max Depth difference (m)	Seabed (SB) Sediments Seismic Unit (SU) Stratigraphy Acoustic Basement (AB) Stratigraphy > (*level where the seismic signal in attenuated or absorbed by a stratigraphic sedimentary layer*)	Geomorphology and landscape description	Age of Cultural Landform
180-185	75.0	75.7	0.7	SB: Carbonate Silt SU1: SB-R10 ~2 m thick compact faint parallel reflectors R10: Multiple compact subparallel reflectors between -76 to -80m then becoming highly attenuated Multiple faint reflectors between 88 and 92 m with a gentle N-S rise	Featureless seabed, very gentle N-S rise	N/A (no diagnostic features found)
185-190	74.2	75.1	0.9	SB: Carbonate Silt SU1: SB-R10 ~2 m thick compact faint parallel reflectors R10: Multiple compact subparallel reflectors between 75 to 77 m then becoming highly attenuated Multiple faint reflectors at -84 and -88 m with a gentle N-S rise	Featureless seabed, very gentle N-S rise	N/A (no diagnostic features found)
190-195	73.6	74.3	0.7	SB: Carbonate Silt SU1: SB-R10 ~2 m thick compact faint parallel reflectors R10: Multiple compact subparallel reflectors between 75 to 77 m then becoming highly attenuated Multiple faint reflectors at -82, -85 and -92 m	Flat featureless seabed, very gentle rise to the south	N/A (no diagnostic features found)
195-200	72.6	73.7	1.1	SB: Carbonate Silt Multiple single sub horizontal reflectors	Flat featureless seabed, very gentle rise to the south	N/A (no diagnostic features found)
200-205	70.3	72.8	2.5	SB: Carbonate Silt Multiple single sub horizontal reflectors	Flat featureless seabed, very gentle rise to the south	N/A (no diagnostic features found)

Cable Route (Kilometre Point)	Min Depth (m)	Max Depth (m)	Min/Max Depth difference (m)	Seabed (SB) Sediments Seismic Unit (SU) Stratigraphy Acoustic Basement (AB) Stratigraphy > (*level where the seismic signal in attenuated or absorbed by a stratigraphic sedimentary layer*)	Geomorphology and landscape description	Age of Cultural Landform
205-210	69.8	71.1	1.3	SB: Carbonate Silt Multiple single sub horizontal reflectors	Flat featureless seabed, very gentle rise to the south	N/A (no diagnostic features found)
210-215	68.2	69.8	1.7	SB: Carbonate Silt Multiple single sub horizontal reflectors	Flat featureless seabed, very gentle rise to the south	N/A (no diagnostic features found)
215-220	67.1	68.4	1.3	SB: Carbonate Silt Multiple single sub horizontal reflectors -68 to -72 m	Flat featureless seabed, very gentle rise to the south	N/A (no diagnostic features found)
220-225	67.1	68.8	1.7	SB: Carbonate Silt Multiple single sub horizontal reflectors	Flat featureless seabed apart from a step fall at 222 km	N/A (no diagnostic features found)
225-230	67.7	68.5	0.8	SB: Carbonate Silt Multiple single sub horizontal reflectors with fainter compact subparallel reflectors	Flat featureless seabed	N/A (no diagnostic features found)
230-235	65.8	67.8	2.0	SB: Carbonate Silt	Flat featureless seabed, rising to the south	N/A (no diagnostic features found)

Cable Route (Kilometre Point)	Min Depth (m)	Max Depth (m)	Min/Max Depth difference (m)	Seabed (SB) Sediments Seismic Unit (SU) Stratigraphy Acoustic Basement (AB) Stratigraphy > (*level where the seismic signal in attenuated or absorbed by a stratigraphic sedimentary layer*)	Geomorphology and landscape description	Age of Cultural Landform
235-240	55.7	65.8	10.2	SB: Medium to fine carbonate sand Multiple compact subparallel reflectors then becoming highly attenuated	Multiple limestone ridges present along profile or adjacent to profile. See **Section 6.6.3**.	Pleistocene
240-245	47.1	55.8	8.7	SB: Medium to fine carbonate sand and gravel High amplitude reflectors, becoming attenuated	Featureless seabed with a limestone beach ridge. See **Section 6.6.3**.	N/A (no diagnostic features found)
245-250	25.1	47.1	22.0	SB: Medium to fine carbonate sand and gravel Highly attenuated SB reflector	Minor bedforms and outcropping bedrock	N/A (no diagnostic features found)
250-255	5.4	25.1	19.7	SB: Medium to fine carbonate sand and gravel Highly attenuated SB reflector	Outcropping bedrock geology, incised by fluvial/stream entrenched channel. See **Section 6.6.3**.	Pleistocene

6.6.2 Step B: Previous landscape disturbance

Based on review of the geophysical data, there does not appear to have been any previous landscape disturbance along the proposed cable route.

6.6.3 Step C: Submerged landscape reconstruction

Three pre-inundation (submerged) landscapes have been identified along the cable route which are shown in Figure 6-4.

These cultural landscapes are:

- Beach ridge strandplain
- Estuarine channel
- Coastal beach ridge
- Entrenched stream gully or channel

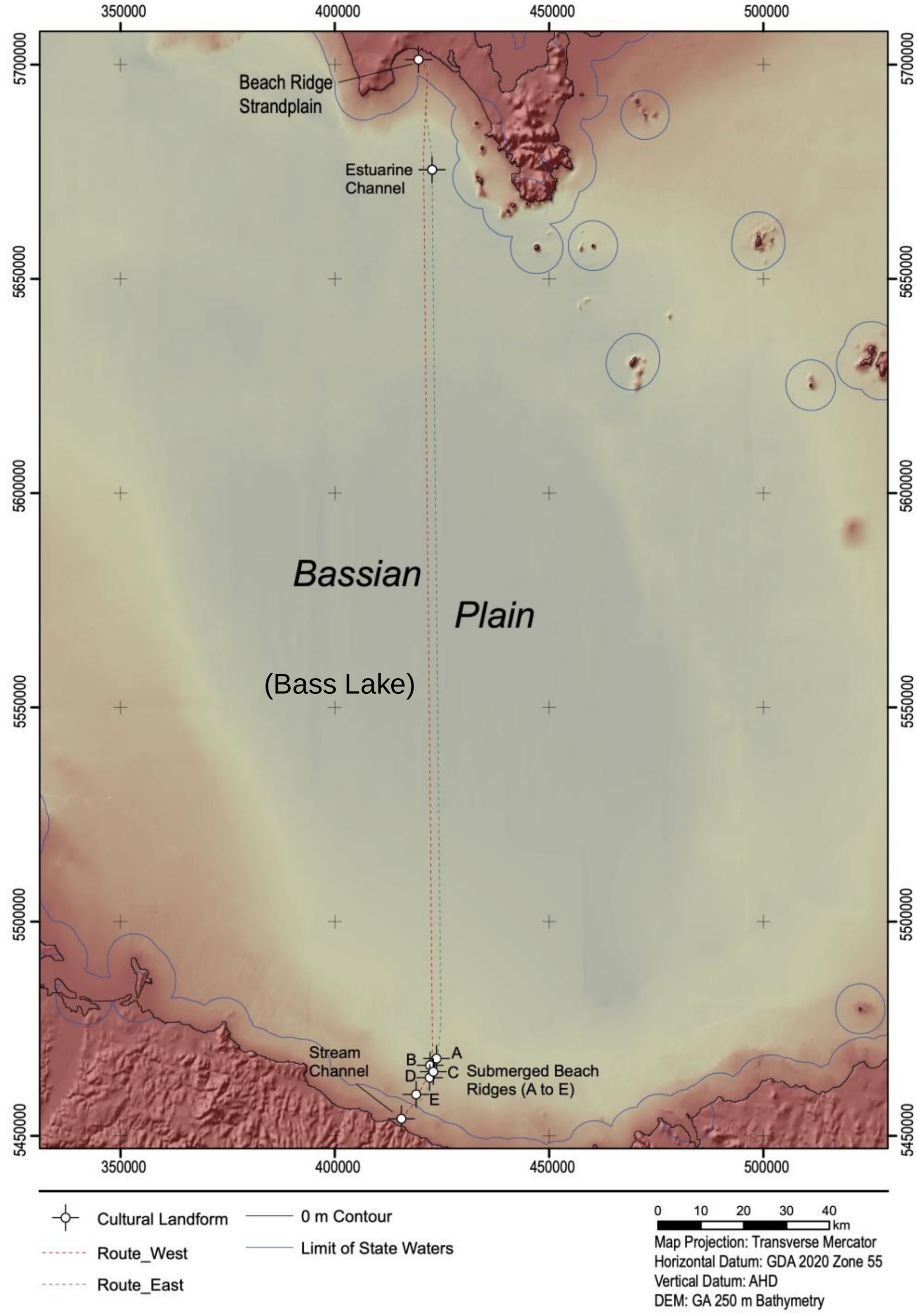

Figure 6-4 : Location of pre-inundation (submerged) landscapes.

6.6.3.1 Indurated beach ridge strandplain

Utilising the high-resolution MBES data obtained in 2023 for the Victorian nearshore study area it has been possible to identify four geomorphic zones (Figure 6-5).

Zone 1 extends approximately 850 m from the beach face (500 m from the inner edge of the survey area) to a depth of 12 m with a relatively steep 1.5° seaward slope representing the surf zone. This area would experience active sediment transport with the relatively steeper slope observed in the profile (compared to other Zones 2, 3 and 4), with the increasing profile steepness representative of a summer fair weather wave base.

Zone 2 is located between 500 m and 1,750 m along the profile and in water depths from 12.5 to 17.5 m. It has a uniform seaward slope of < 0.5°. An area of seabed within this zone is characterised by lineations which could be interpreted as being sand waves. The problem with this interpretation is that these features are orientated parallel to the prevailing wave direction which approaches the coast from an south-southwest direction and not perpendicular to wave direction. The alternate explanation is that these linear features represent a karren geomorphology (groove morphology) that is the result of physical abrasion of the underlying (inferred) limestone substrate through the oscillatory motion of waves moving sediment partials and clasts back and forth across this surface forming these grooves. Therefore, the presence of this particular morphology would suggest the presence of an indurated limestone substrate at the surface that has experienced ongoing surface erosion/abrasion following inundation.

Zone 3 is located in between 1,750 and 3,750 m along profile and in water depths from 15 to 20 m. This zone is characterised by low relief (< 2 m high) ledges or low (< 1 high) isolated outcrops of hard substrate. It is not possible to quantify the primary relief of the original Pleistocene land surface due to subsequent surface erosion following sea level inundation and subsequent (partial) burial with recent marine sediments. The presence of ripple bedforms on the seabed are most indicative of unconsolidated surficial sediments with an unknown thickness. The ledges are orientated landward away from the prevailing wave direction suggesting they have not formed as a result of erosional wave processes (Figure 6-6). It is a possibility that these indurated features may represent surface outcrops of the Devonian age Cape Liptrap marine sedimentary formation. However, where outcrops of this formation do occur seaward of Cape Liptrap, the surficial morphology is characterised by a blocky terrain with fissures and has a higher surface relief, very much unlike the seabed morphology within Zone 3. It is more likely these ledge/scarp features represent remnant shoreface or indurated beach (i.e., beach rock) formations. A more detailed reasoning is outlined below.

Zone 4 is located in between 3,750 m and along profile and in water depths from 20 to 30 m. This area of sea floor is largely featureless and exhibits broad gentle concave mounds and likely presents an area of unconsolidated sediments on the seafloor. The XOcean report based on the sub-bottom profiler data suggest a surficial sediment thickness of between 1 to 6 m in this area . This zone appears to overlay the indurated beach formations identified in Zone 3.

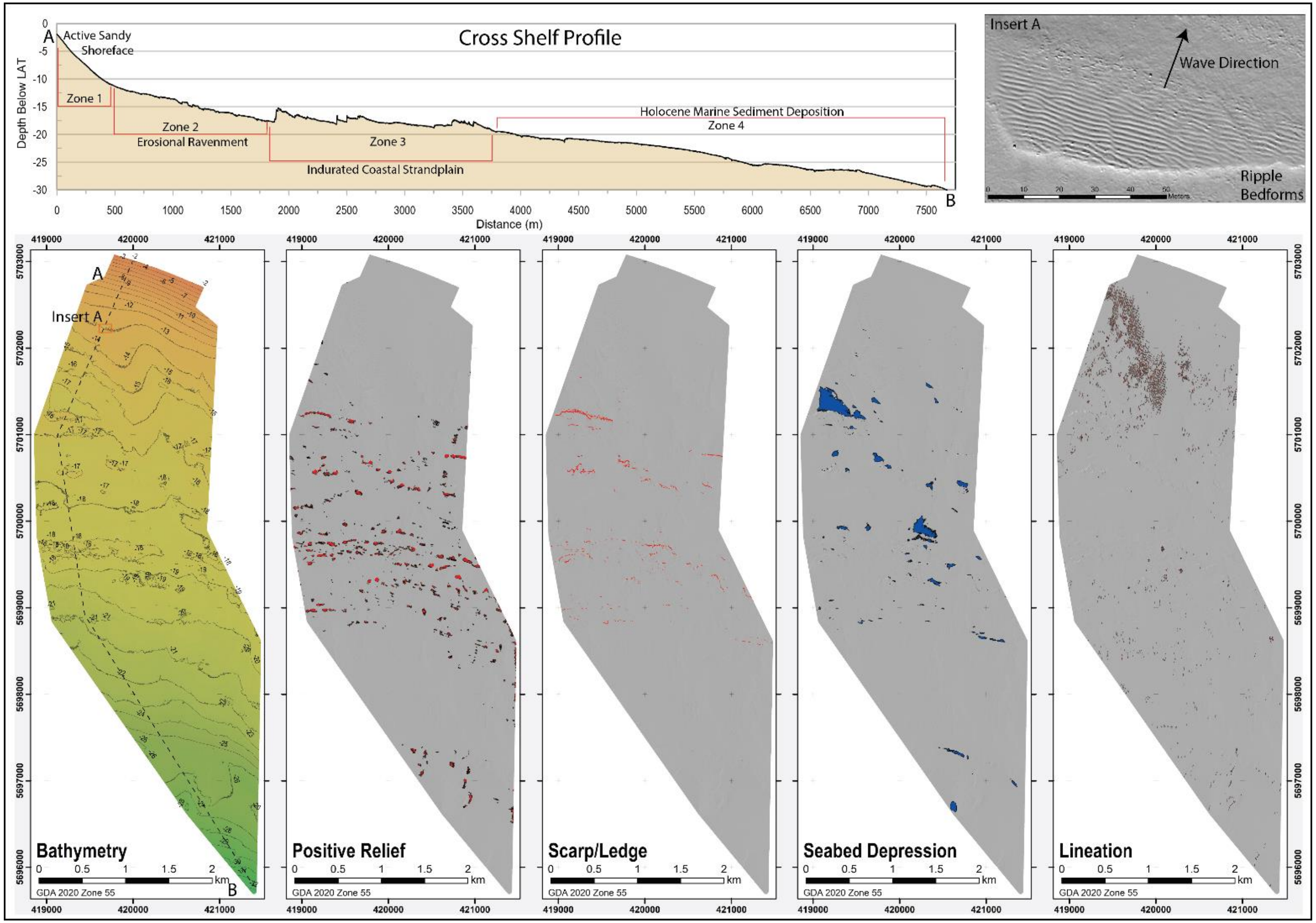

Figure 6-5 : Bathymetry and landform element map. Cross shelf profile location shown as dotted line in Bathymetry panel with the 4 geomorphic zones identified. Inset A location shown as red box in Bathymetry panel and shows typical wave ripple bedforms identified in the study area, ripple aspect that aligns with the prevailing modal wave direction. Note: The 0 point ('A') in the Cross Shelf Profile is approximately 380 m from the shoreline.

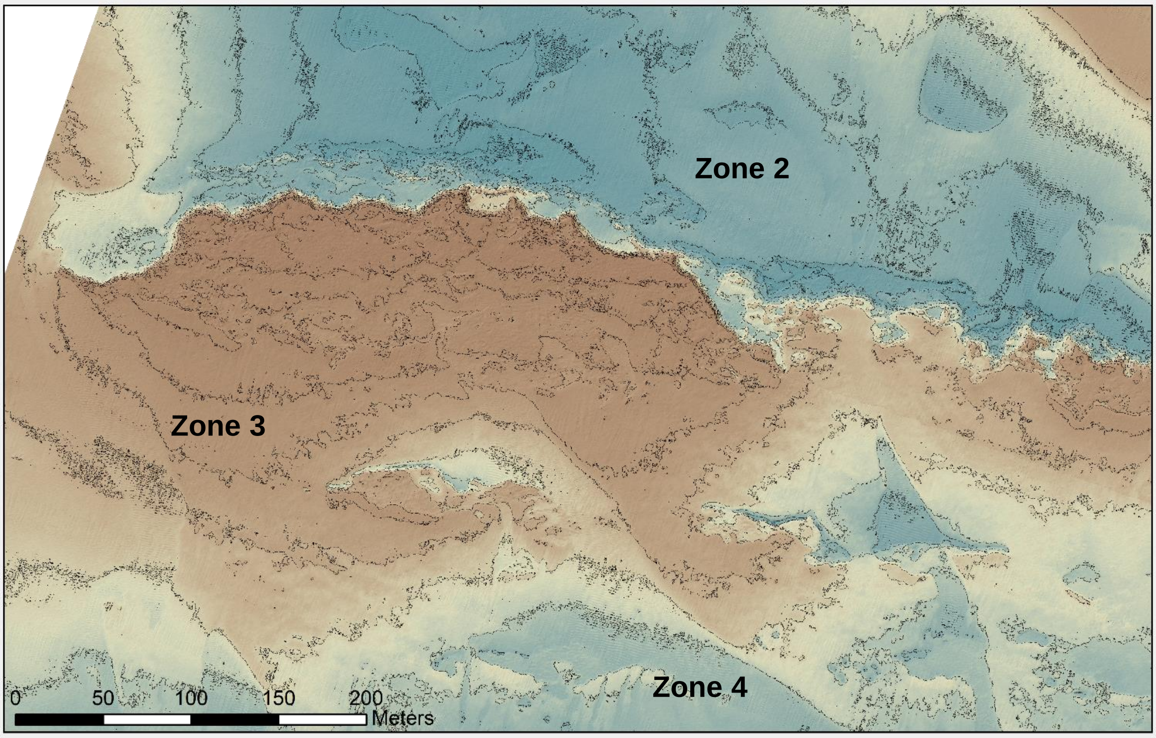

Figure 6-6 : DEM of a ledge/scarp within Zone 3

Of primary interest with respect to underwater cultural heritage is Zone 3. Waratah Bay would have been inundated by the ocean at various times in the recent geological past and it is likely that the underlying substrate (Zone 3) would have preserved a sedimentary record of these marine inundations. It is also likely coastal landforms would have developed within Waratah Bay during previous sea level still stands. With this understanding it is possible that these ledges may represent remnant beach deposits that were indurated/cemented though beachrock forming processes or alternatively may have become cemented though meteoric waters during an extended interval or subaerial exposure when sea levels were much lower.

Beach rock typically forms within the mid-to lower intertidal zone and at the interface between groundwater and seawater and will tend to preserve beach bedding and the bed slope. The formation of beach rock tends to fix in place the beach profile so when high energy events occur it will erode the unconsolidated sediments situated behind the beach rock formation resulting in the exposure of a ledge or scape facing leeward of the beach face (Figure 6-7). Such formations could contain extensive archaeological material should they have become indurated within the period of human occupation.[51]

[51] **Samiou, C, Lianos, J, Beness, L. Coroneos, C. *et al* 1995**. The Underwater Survey of Torone : A Preliminary Report of the 1993 Season, *MEDITARCH* Volume 7.

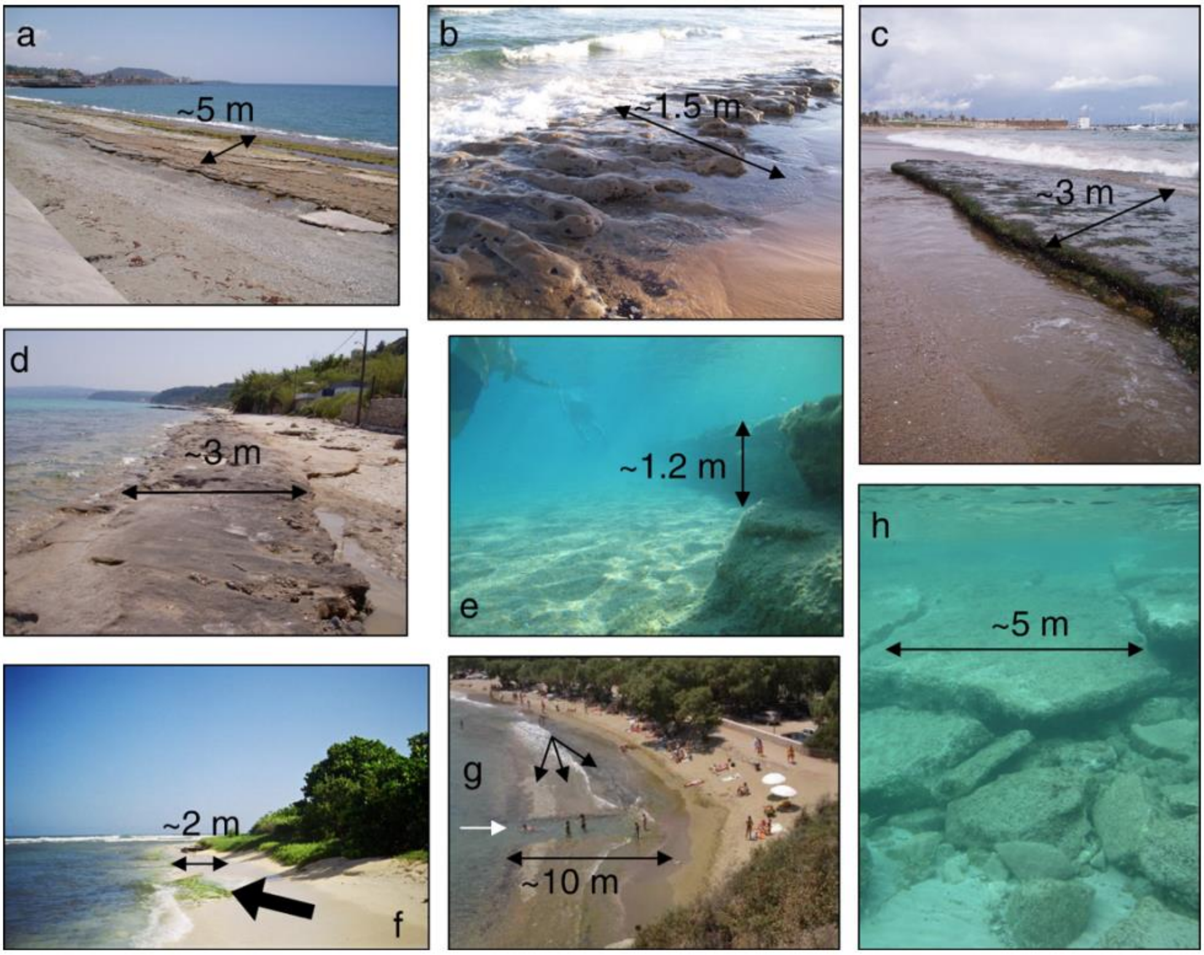

Figure 6-7 : Beachrocks: (a) Baracoa, Cuba; (b) Salvador, Bahia, Brazil; (c) Barcelona, Spain; (d) Athitos, N. Greece; (e) Mykonos Island, Greece; (f) Morrocoy, Venezuela; (g) Sifnos Island, Greece and (h) Attica, Greece (courtesy of I. Issaris).[52]

If these ledges and scarps are in fact relic beachrock formations that from during an earlier sea level still stand, then their age could be inferred by comparing beachrock elevation with a locally derived sea level curve. Also, given that this inferred zone of beachrock formation extends for almost 1.5 km across the inner shelf, the original landform may have been something akin to a beach ridge strandplain.

The 1.5 km wide beach ridge strandplain has an elevation ranging between -15 and -20 m. The last time sea level was at this elevation for any considerable length of time (long enough to produce a 1.5 km wide beach ridge strandplain was around 80,000 years ago (Figure 6-8). This time period is prior to the occupation of southeast Australia by First Peoples which has been dated to around 40,000 years BP. Post 80,000 years BP sea level then began to fall as the Earth entered a glacial climate state with the barrier strandplain forming a hinterland sand ridge system.

[52] **Vousdoukas, M.I., Velegrakis, A.F. and Plomaritis, T.A., 2007**. Beachrock occurrence, characteristics, formation mechanisms and impacts. *Earth-Science Reviews*, 85(1-2), pp.23-46.

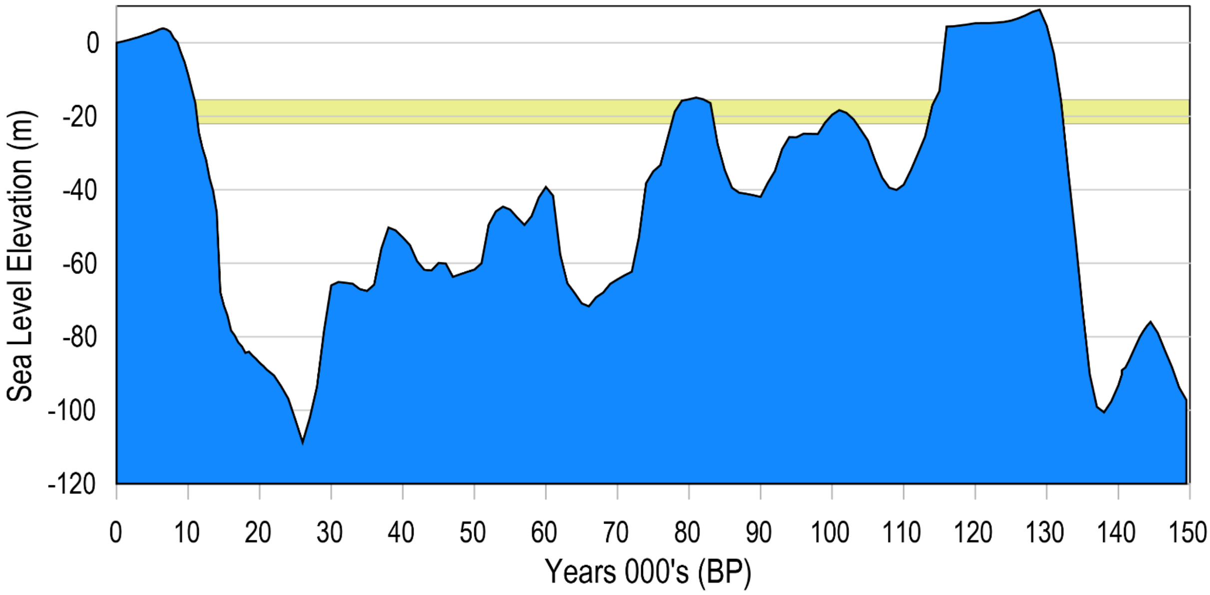

Figure 6-8 : Locally derived sea level curve for Waratah Bay extending from Present to 150,000 years. The green bar represents the elevation of the inferred beachrock formations within the Waratah Bay study area.

A Holocene age beach ridge system is not an appropriate landform analogue to compare the cultural potential of the submerged beach ridge strandplain as the Holocene beach ridge complex and associated environments would have been actively occupied in a strictly coastal environmental context while the submerged beach ridge strandplain would have been occupied for a long period within a hinterland environmental context. The nearest large body of surface water to this submerged beach ridge strandplain would have been Bass Lake (when at its maximum extent) the shoreline would have been approximately 25 km south of the now submerged beach ridge strandplain, and 5 km SW of the Shallow Inlet catchment.

The most appropriate landform analogue would be those beach ridge strandplains that formed during the last interglacial (approx. 130 to 120 thousand years BP). Because sea levels were higher (3 to 6 m above present) during the last interglacial compared to today many of these relic coastal landforms have survived inundation and are situated immediately inland of the modern coast.

The closest analogue for the submerged beach ridge strandplain is the last interglacial (LIG) strandplain that extends along the Ninety Mile Beach coast in Gippsland (Figure 6-9). The width of the two beach ridge strandplains is very similar (approx. 1.5 km), however the Ninety Mile Beach LIG strandplain would have been situated approximately 85 km from the open coast and 150 km from Bass Lake. It is likely the Gippsland lake/marsh system may have been a similarly extensive aquatic system during the late Pleistocene and proximal (> 1km) water sources to this particular LIG landform.

A LIG shoreline is present immediately landward of the modern shoreface at Waratah Bay, 3.5 km landward of the submerged beach ridge strandplain (Figure 6-16). It consists of a palaeobeach ridge/spit formed through a dominant west to east longshore sediment transport regime. While this particular landform is closer to the submerged beach ridge strandplain and therefore situated within the same regional environmental context, it appears to be a single beach ridge rather than multiple (broad) beach ridge complex.

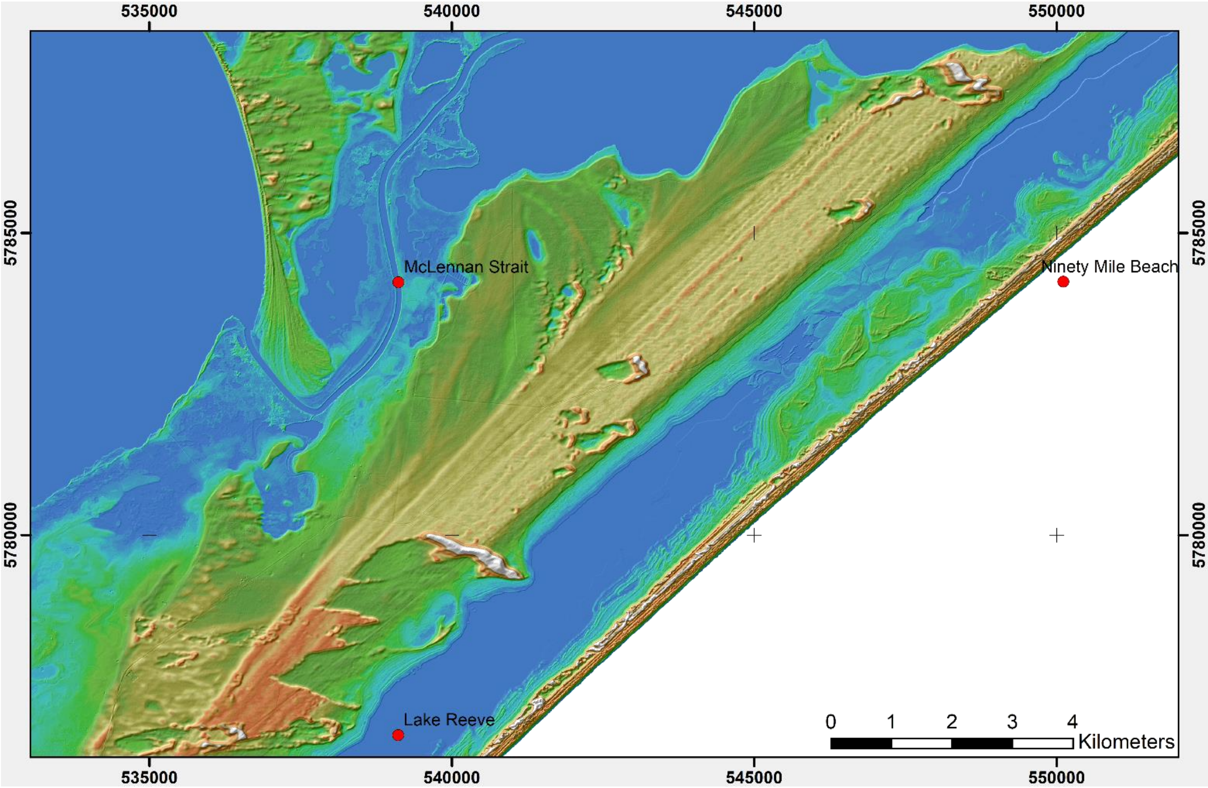

Figure 6-9 : LIG beach ridge strandplain at Ninety Mile Beach

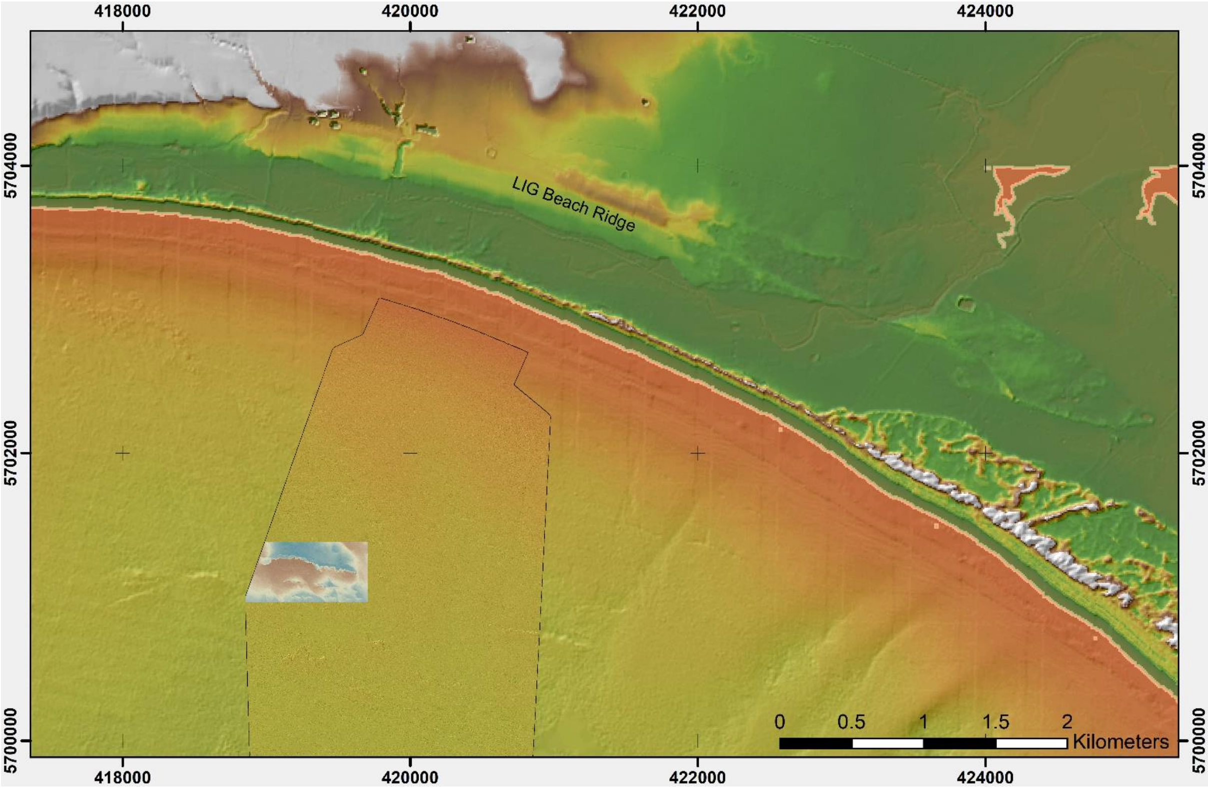

Figure 6-10 LIG Beach Ridge at Waratah Bay showing relationship to identified submerged beach ridge strandplain from 2023 marine geophysical survey.

6.6.3.2 Estuarine channel

Sub-bottom profile data shows a 3-m-deep channel that is shallowly buried (<2 m) beneath a flat featureless seabed [27-27.5 KP] (kilometre point). This is the only example of a palaeochannel on the northern portion of the cable route in the offshore study area. The asymmetry and width of the cross-channel profile suggests the channel was likely meandering which is typical of a fluvio-estuarine morphology on a broad and flat coastal plain. Assuming the sub-bottom profile crosses the channel at a perpendicular angle, then the channel is up to 400 m wide.

There does not appear to be any strong reflectors within the channel, suggesting that coarser cobble or pebble layers are not representative of the channel sediments. The channel elevation of -76 m suggests the channel was draining into a lacustrine Bass Lake rather than a marine influenced embayment. With coastal uplands located to the north and west, it is likely the channel was flowing to the east. Given this interpretation, a possible modern analogue for this feature could be Shallow Inlet at Waratah Bay (Figure 6-11). This tidally influenced inlet has a single tidal channel with similar geomorphic dimensions to the buried palaeochannel observed in the sub-bottom profile data, and may even represent a seaward extension of Shallow Inlet.

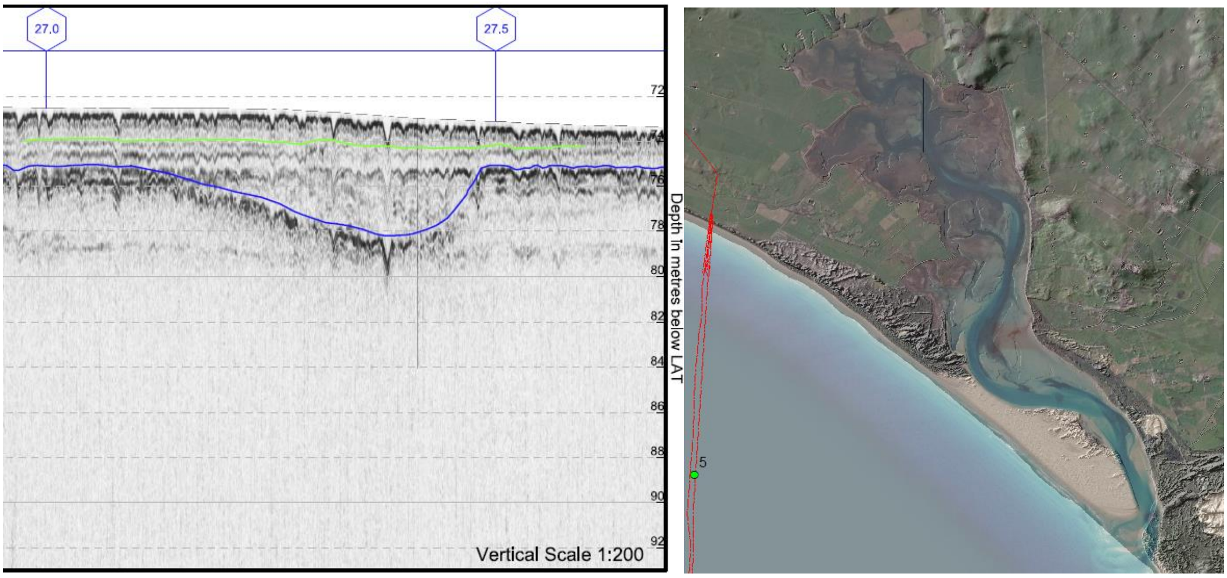

Figure 6-11: Channel identified in the sub-bottom profile data (left panel) and a terrestrial analogue located Shallow Inlet, Wilsons Promontory (right panel). The red line in the right panel shows the Marinus Link land crossing.

6.6.3.3 Coastal beach ridge

Multibeam bathymetry has revealed a series of submerged beach ridge formations situated within 20 km of the Tasmanian coast and at depths ranging from 45 to 70 m water depth (Referred to as Shoreline A to E in Figure 6-12). All mapped ridges have a broad (hundreds of metres) and low (less than 2 m) topographic relief but have the distinctive arcuate ridge-like geometry, which supports a submerged shoreline interpretation (Figure 6-13). The low-positive ridge relief may represent either a low energy (wind and wave) shoreline, or alternatively the primary beach ridge morphology has been eroded following inundation. The depth of each shoreline represents the position of a former sea level still stand; however, the timing and duration for shoreline development is unknown. The lack of preservation of shorelines on Bass Strait's Victorian margin may be the result of the higher Southern Ocean wave energies experienced along this margin, eroding former beach ridge formations.

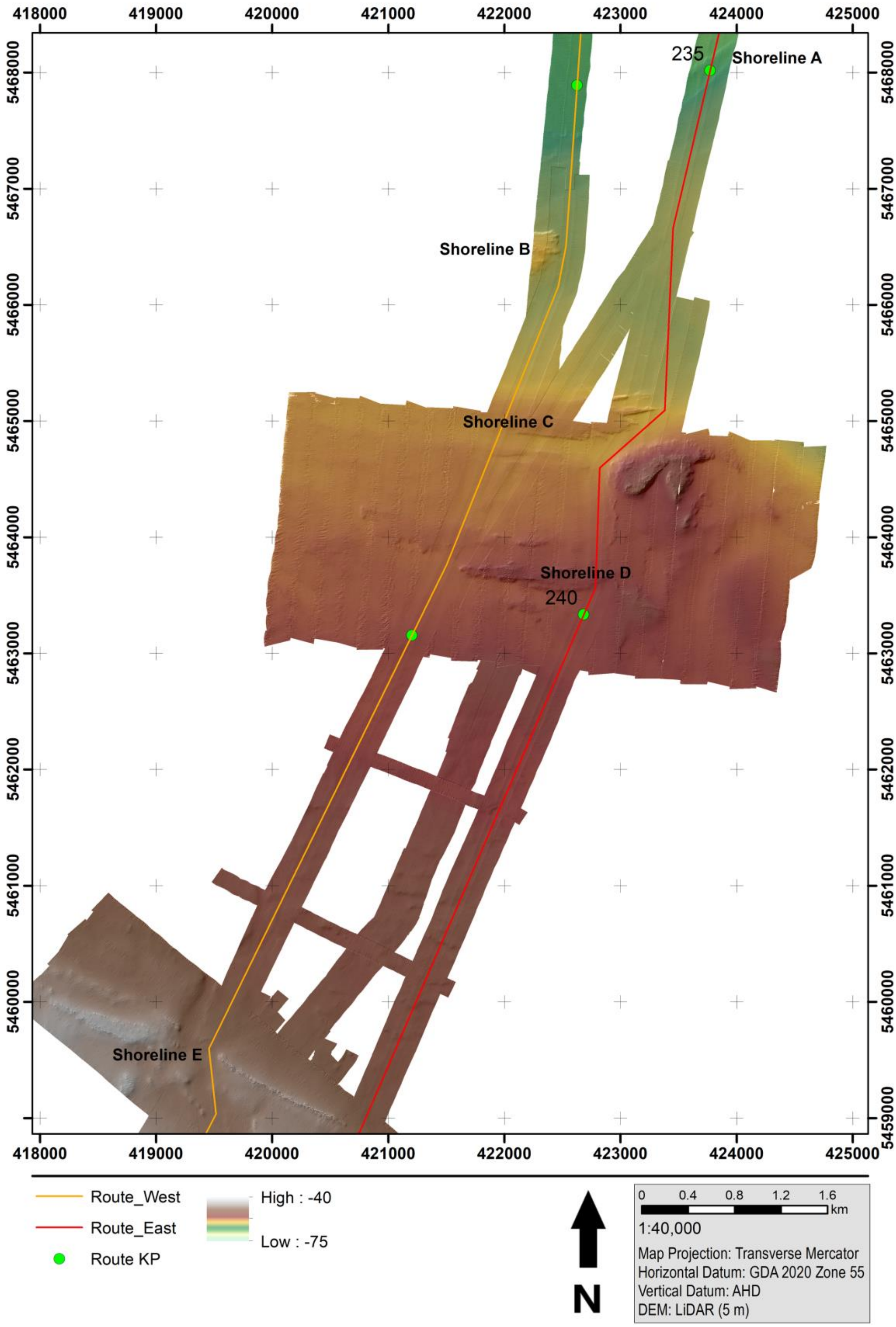

Figure 6-12 : Location of submerged beach ridge formations.

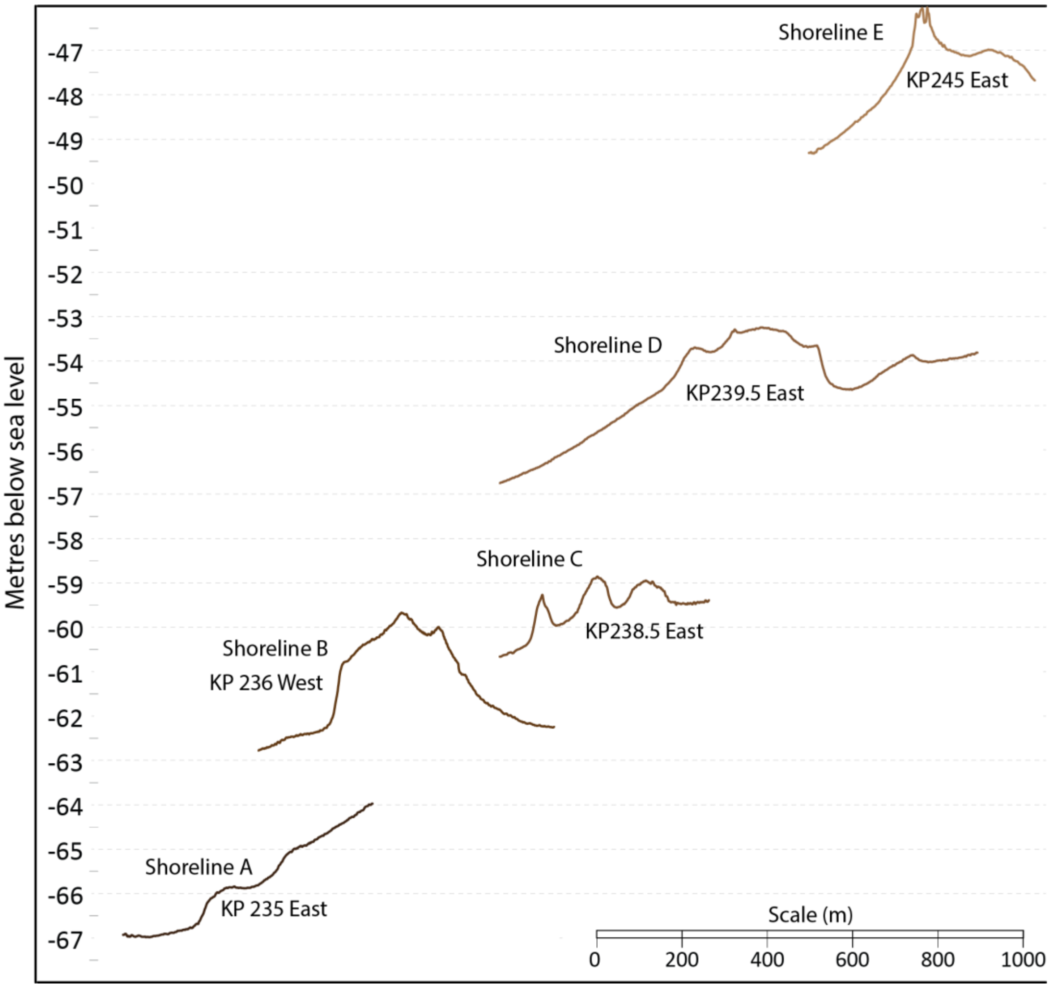

Figure 6-13: Topographic profiles of submerged beach ridge formations.

There are a number of modern beach formations along the Tasmanian coast that may provide indicative cultural landform analogues for the submerged beach ridge formations. One example is the Rocky Cape beach ridge system which provides an analogous geomorphic landform to those mapped submerged relic coastal landforms (Figure 6-14). Both modern and relic examples exhibit the typical ridge like arcuate geometry and beach ridge width. Individual ridges are generally absent from submerged relic beach ridges compared to modern coastal examples and may have been eroded during inundation. Also common to both modern and relic beach ridge systems is an estuarine tidal channel that breaches the beach ridge and connects a tidal flat/lagoon, that is situated in the lee of the beach ridge, to the ocean.

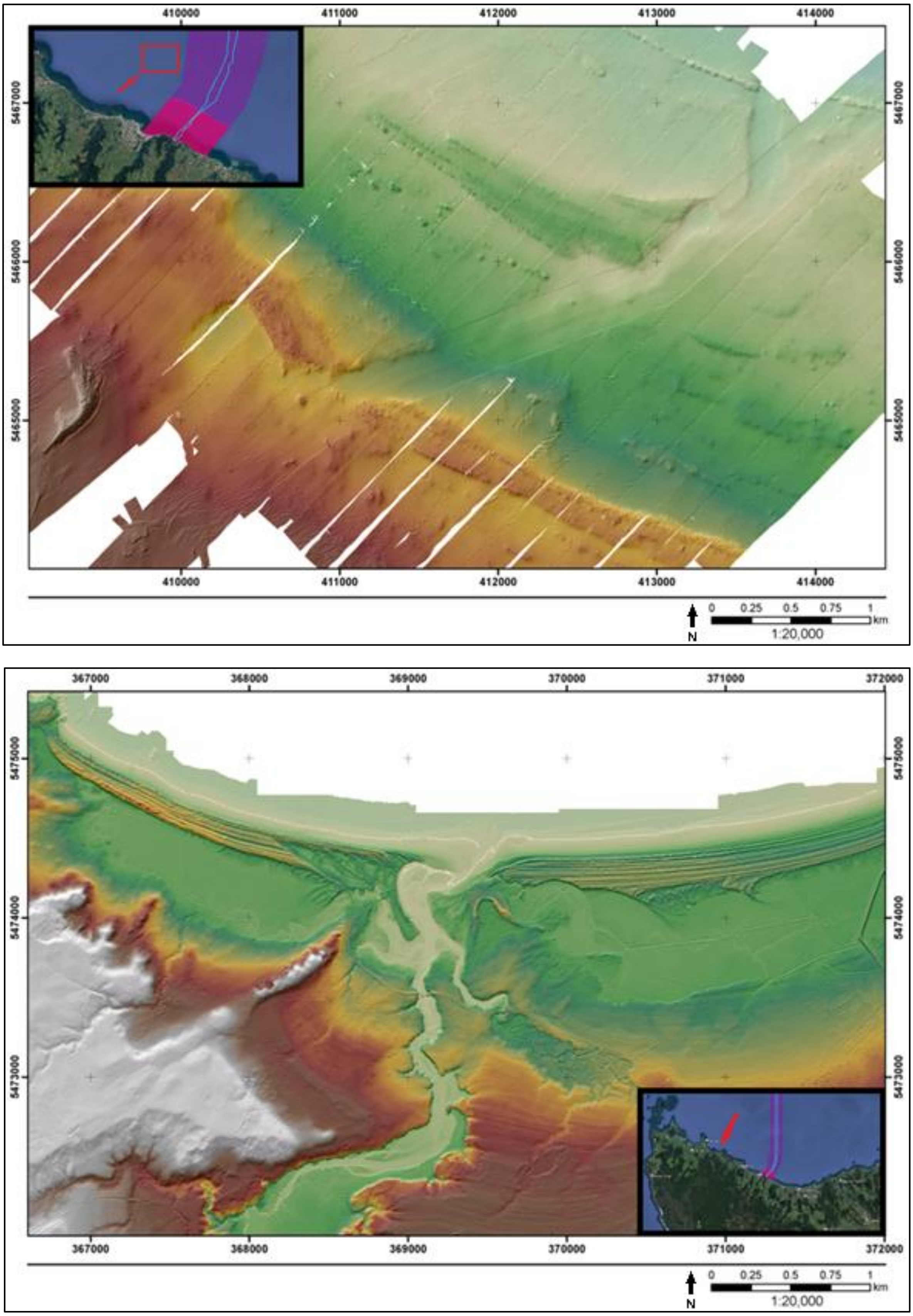

Figure 6-14: Digital elevation model (DEM) showing submerged beach ridge [upper panel] near the study area (red square on inset) and an analogous modern beach ridge system located at Rocky Cape (red arrow on inset) [lower panel], north west Tasmania.

6.6.3.4 Palaeochannel (Entrenched stream gully or channel)

Multibeam imagery has revealed a palaeochannel complex in the nearshore of Heybridge that continues offshore to depths of 25 m (Figure 6-15). The palaeochannels appear to be a continuation of the perennial Blyth River and are structurally controlled by a poly-deformed Neoproterozoic Greywacke which is also exposed along the Heybridge coast. Considering the fact that these channels are entrenched into a relatively hard metasedimentary rock type and drain the adjacent Blyth River catchment, it is likely these submerged palaeochannels have formed a relatively durable and stable geomorphic landform over the period of Aboriginal occupation.

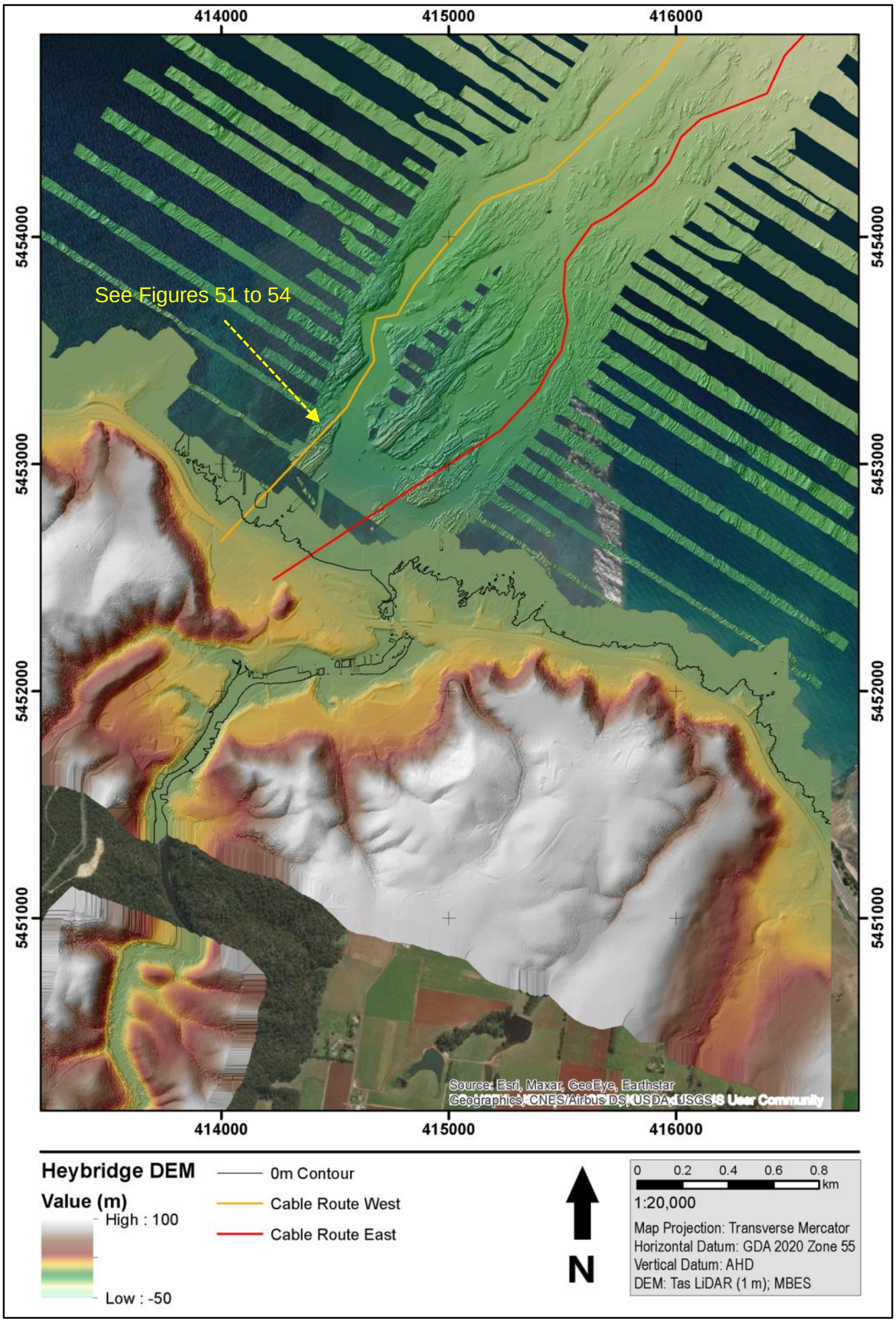

Figure 6-15: Digital elevation model (DEM) showing lower Blythe River catchment and nearshore submerged palaeochannels.

The western edge of one of the palaeochannels was inspected by divers as part of this assessment (see Annex A). The locations chosen was where Cable Route West crosses from the sediment filled channel onto what is now a rock reef (see Figure 6-15 – Latitude -41.06936° Longitude 145.99004°). This rock reef was once a river bank (Figure 6-20 to Figure 9-1). As can be seen any traces of soil and vegetation has been eroded away. Any artefacts that were present along the banks of the riverbank would have been washed into the palaeochannel or are mixed in amongst concentrations loose within depressions and crevices in the rock reef.

Figure 6-16: Interface where rock reef (former riverbank) meets the sand seafloor (former riverbed).

Figure 6-17: Interface where rock reef (former riverbank) meets the sand seafloor (former riverbed), facing west.

Figure 6-18: Detail of the rock reef (former riverbank)

Figure 6-19: Concentrations of rock on the former riverbank.

6.6.3.5 Borehole cores and radiocarbon dating results

Three borehole cores from the Tasmania nearshore study area, labelled cores VC01, VC02, and VC03, were tested using multisensory core logging, including x-ray imaging of the cores (Figure 6-20, Figure 6-21, and Figure 6-22). Organic components found in the three cores were then tested using C14 radiocarbon dating to determine their age.

In terms of the core lithology the upper metre of all cores, VC01, 02, and 03, consisted of a homogenous coarse shelly sand which represents the recent (last 10,000 years) marine sediment deposition during and after sea level transgression. The age of the basal layer of this upper sedimentary unit should represent the initial timing of sea level transgression at these locations. A comparison of sediment age-depth, determined by radiocarbon dating organic components within this layer (components VC01A; 02A & 03A), with the historic sea level curve closely matches the sea level elevation for contemporary periods (Figure 6-21).

Immediately underlying these recent marine sediments is a layer of basalt cobbles which were observed in cores VC01 and VC02. It is unclear how these clasts came to be deposited at these locations. However, the sub-bottom profile data indicates igneous basement geology close to the seabed. Ridge like features are expressed on the sea floor near to

VC01 and 02, and features may be formed from basalt rather than a constructional sedimentary shoreline (i.e., beach ridge). One scenario is that as sea level transgressed the shelf, higher wave energies may have eroded and transported clasts from these outcrops across or down slope and into the swale (VC01) or channel (VC02).

Only VC02 has recovered sediment below the cobble layer and consists of a finely laminated organic rich sandy mud with thin peaty layers. This type of structure and lithology is typical of a still water lagoonal-lacustrine-swamp type sedimentary environment. The preservation of the fine sedimentary laminations suggests little biological activity, due to the near absence of biotubation (the reworking of sediments by animals or plants) at the sediment-water interface. This is usually the result of waters with low dissolved oxygen levels which typically occurs where water circulation is limited, such as still water lagoons, lakes, or swamps. The only evidence for biotubation is from the layer just below the cobble deposit where near-vertical burrows are evident. This suggests that the incursion of open marine waters at this location provided an appropriate environment for marine burrowing organisms.

Radiocarbon dating of the woody material and charcoal found within these laminated sedimentary layers returned a tight cluster of ages of around 13,000 years BP. Sea level during this period was approximately 70 m below present, or 20 m below the seabed level of the VC02 core, which was taken at a depth of 50 m. This lower sea level supports sediment deposition occurring within a terrestrial-lacustrine palaeoenvironment.

The presence of ostracod fossils (small shrimp-like crustaceans) within the laminated sedimentary beds also supports a freshwater depositional environment. However, a very minor component of this laminated sedimentary sequence consists of very fine abraded bioclastic sediments, including bivalve fragments and benthic foraminifera (bottom dwelling, single celled marine organisms) which typically inhabit estuarine to open marine environments. A larger fragment of a marine bivalve shell (VC02-D) sampled from one of the lower laminated sedimentary layers returned an age of 17,560 years BP, approximate with the LGM when the sea level was 125 m lower than present. This result is perplexing, as the nearest shoreline to the site of VC02 would have been at least 200 km distant. It seems unlikely that the presence of this marine shell in a lacustrine environment can be explained by a natural mechanism, given the distance of VC02 from the nearest coast during this period (17,560 BP).

In summary:

1. The age of the basal layer of coarse shelly sand unit correlates with the timing or marine inundation of the terrestrial landscape following post glacial sea level rise;
2. The presence of a cobble layer immediately below this shelly layer suggests the transport of cobble clast from nearby outcropping basalt geology, likely occurring at the time these igneous terrains were being inundated following post glacial sea level rise;
3. The organic rich laminated sandy mud layers identified in core VC02 likely represent a terrestrial-lacustrine depositional environment. This is supported by the 13,000-year BP age of the woody-charcoal material, as the sea level did not transgress this location until approximately 11,000 years BP;
4. These laminated sediments represent the pre-inundation land surface and were being deposited during human occupation of the Bassian Plain;
5. The presence of trace amounts of very fine marine bioclastic sediments (bivalve shell fragments and foraminifera) in VC02 within this terrestrial depositional environment is highly unusual and will require further investigation to explain the timing and process of deposition, however this is not relevant for this impact assessment.

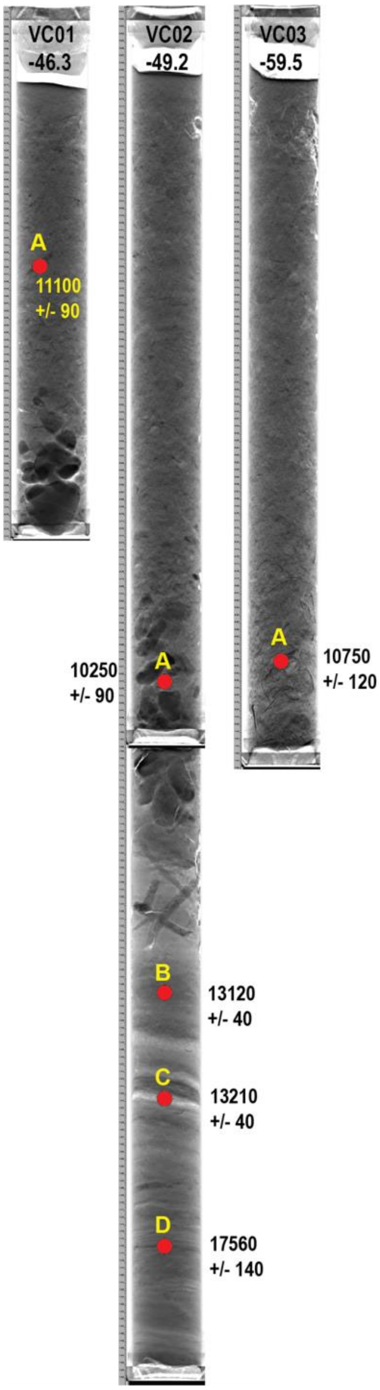

Figure 6-20: X-ray of cores VC01, 02, and 03, showing location of samples taken for carbon dating within each core. Note, C14 dates placed next to sample locations.

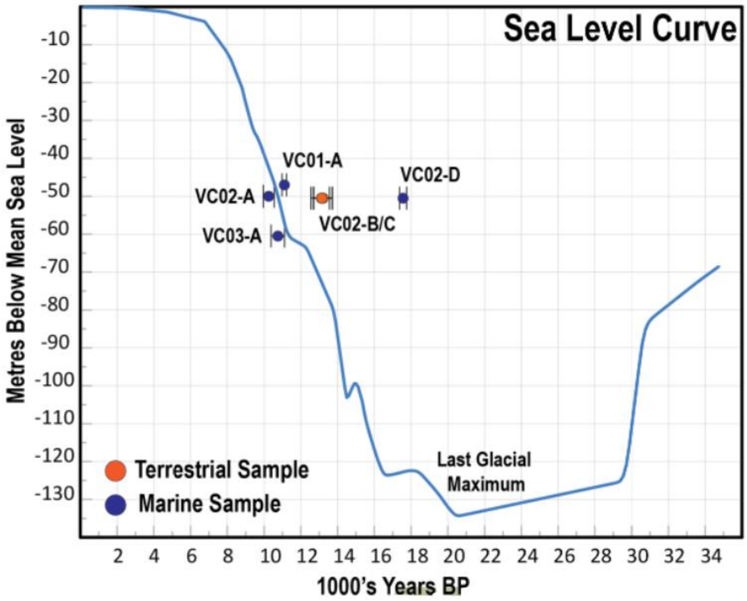

Figure 6-21: Historic sea level curve with core sample radiocarbon dates.

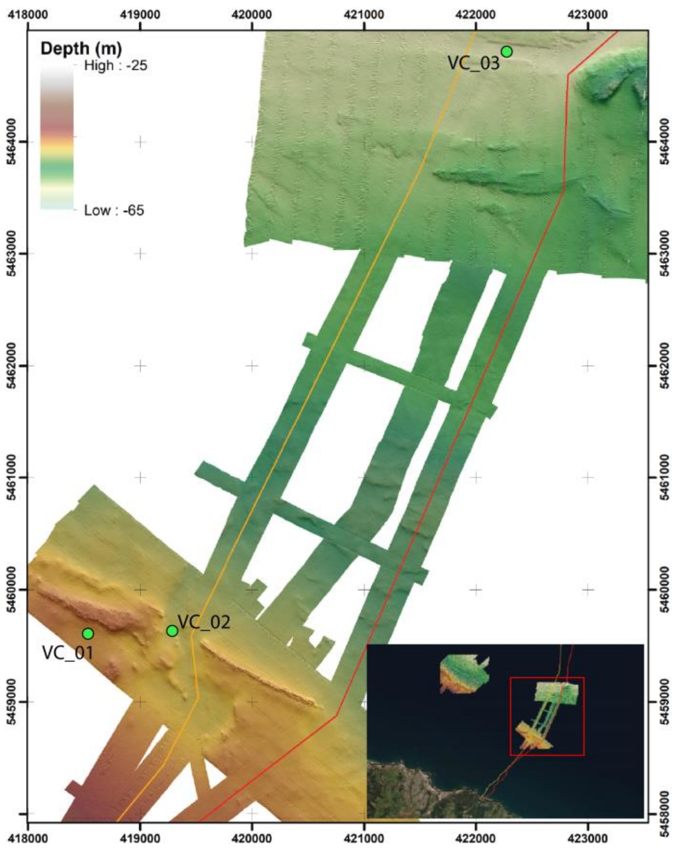

Figure 6-22: Location of cores in relation to proposed cable route.

The surprisingly thin bed of basalt cobble clasts that was recovered in VC02 and 03 prompted a review of the core x-ray data obtained from across this area of Bass Strait. Cobbles were identified in the majority of the HEY cores seaward of the Tasmanian coast and likely represent material sourced from the coastal uplands which comprise a basalt terrain and were transported seaward though fluvial processes. It is uncertain as to whether the more distal cobble deposits may have been sourced locally with the seabed topographic highs representing outcropping basalt formations rather than relic coastal sedimentary deposits.

Cobbles have clear diagnostic features in the x-ray imagery, with smooth massive surfaces, well rounded edges and visually opaque (A in Figure 6-23). However, further inspection of the x-ray imagery identified one core with what appears to be a clast which did not exhibit the smooth surfaces and rounded edges typical of riverine or beach cobbles. The apparent clast in core HEY-V-23 had a flattened spheroid morphology with concoidal surfaces with sharp edges (Figure 6-23). This type of morphology is typical of lithics that have been fabricated from cobble clasts. Hey-V-23 (5,463,569 E, 422,789 N) was located within the area where coastal beach ridges were identified in Section 6.6.3. This type of morphology is typical of lithics that have been fabricated from cobble clasts, however similar fracturing is also replicated in nature, especially in relatively high energy intertidal zones where there are cobble beaches.

Core HEY-V-23 were destructively sampled prior to the examination of the x-ray imagery by Cosmos Archaeology. It was therefore not possible to confirm the nature of this clast.

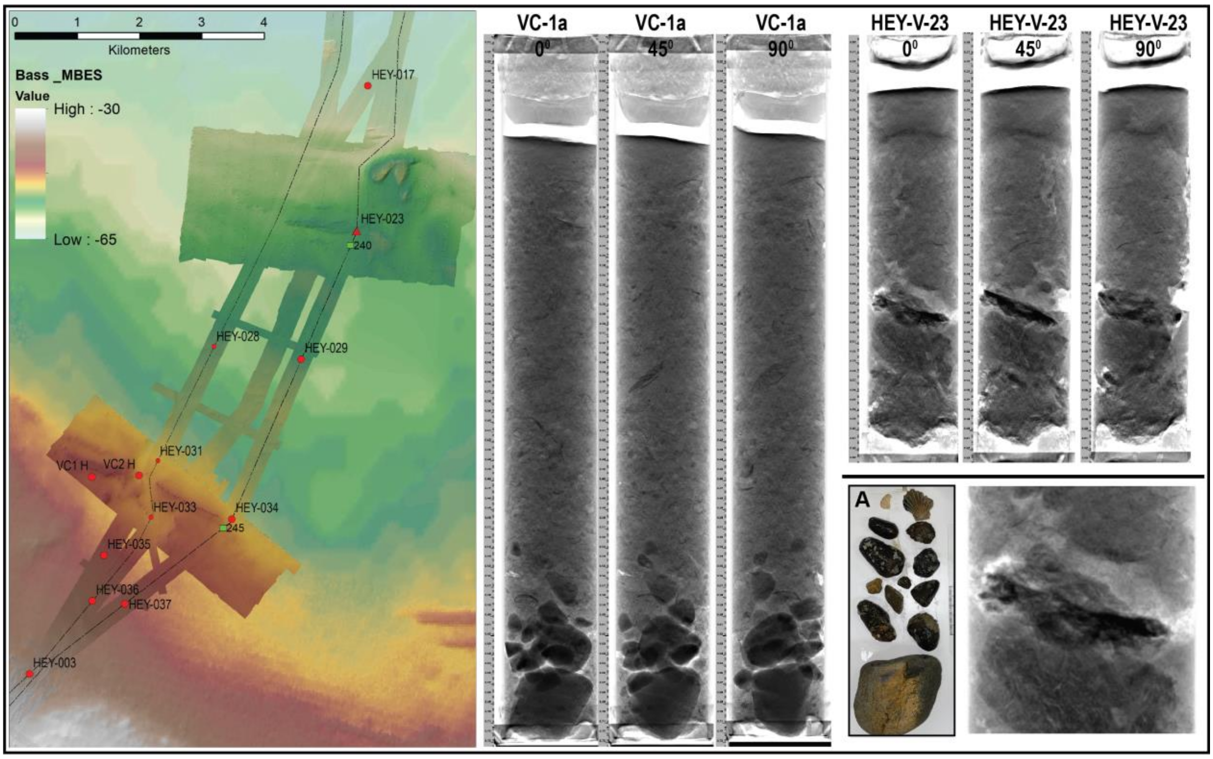

Figure 6-23 : Potential cultural artefact in Core HEY-V23. Map on the left in Figure 6-23 shows the location of the Heritage VC1 and 2 and those HEY geotechnical cores that contain cobble (larger red circles) and pebble (smaller red circles) clasts. Note the proximity of these clast types to linear ridges formations and isolated topographic highs. It might be inferred that these shoreline features may comprise cobble/pebble shoreface sediments.

Cobble beaches are common coastal landforms along the northern Tasmanian coast. They generally occur around and on the flanks of basalt headlands, with the grain size transitioning to smaller sand size particles within the lower energy bays. For example, cobble beaches are not present along Rocky Cape where the geology is primarily quartzite. However, Table Cape, which is located SE of Rock Cape, has a basalt geology and is fringed by boulder and cobble beaches.

Where basalt geology outcrops along the northern Tasmanian Coast, cobble beach deposits can be typically found. Other examples where cobble beaches are found in association with basalt headlands is the high energy Bluff Point on the NW tip of Tasmania, Guyot Point on Robbins Island, The Nut at Stanley, as well as Point Sorell and West Head located near the entrance to the Tamar River.

The presence of basalt cobbles on the North Tasmanian inner shelf can only be explained by the presence of a basalt terrain outcropping at the seabed. Several non-linear positive relief mounds on the seabed may in fact be outcropping basalt terrain and the source of the cobble clasts identified in the Heritage and Geotechnical cores. Shallow subbottom survey data along the cable route confirms presence of an underlying bedrock terrain shallowly buried by recent marine sediments.

While the linear ridge features have been assumed to have sandy beach ridge geomorphology, it is possible that they may be partly or solely formed from cobble clasts, however an exact classification of these features is not possible without ground truth validation.

6.6.3.6 Evidence of Bass Lake.

Geotechnical gravity and vibro cores collected along the Marinus cable route has also provided sedimentological evidence (i.e., finely laminated dark and light sedimentary layers) which are interpreted to have formed in a lacustrine (lake) depositional environment. Each couplet of dark and light laminae typically represents a summer (coarser lighter sediments) and winter (finer and darker sediments) depositional cycle.

These sedimentary deposits suggest that the Bassian Plain which is characterised by very flat low relief terrain and a broad central depression was also host to a shallow mega lake which would have formed once sea levels dropped below -75 m below present and likely fed by rivers draining the northern highlands of Tasmania and southern uplands of Victoria. These sediment cores represent the first direct evidence of Bass Lake and provides evidence of the lakes northern and southern most margins.

The geotechnical cores show these Pleistocene age lake sediments are overlain by post glacial Holocene marine sediments up to several metres thick. The laminated lacustrine sediments also range in thickness from several 10's of cm to several metres (Figure 6-24). Some geotechnical cores collected within the central basin did not recover laminated lake sediments and possible that some cores did not penetrate deep enough to recover these sediments, sediments were eroded or there was non-deposition.

Shallow subbottom survey data along the cable route recorded both the upper Holocene marine sedimentary facies and the lower laminated lacustrine sediments as two distinctive seismic units. The top seismic unit extends from the seabed (first dark reflector) to about 2 metres depth (see figure) and is characterised by a low and uniform acoustic return signal. The underlying seismic unit that incorporates the laminated sediments is characterised by a number of parallel seismic reflectors between 2 and 4 m depth that terminates on a major reflector, defined in the Fugro Project Marinus Marine Engineering Geophysical Survey report as *Reflector R10.* It should be noted that this geophysical report does define the seismic boundary between the Holocene marine and Pleistocene lacustrine sediments as *Reflector R5* and therefor can be used to trace the contact between the Holocene marine and Pleistocene lake sediments along the cable route.

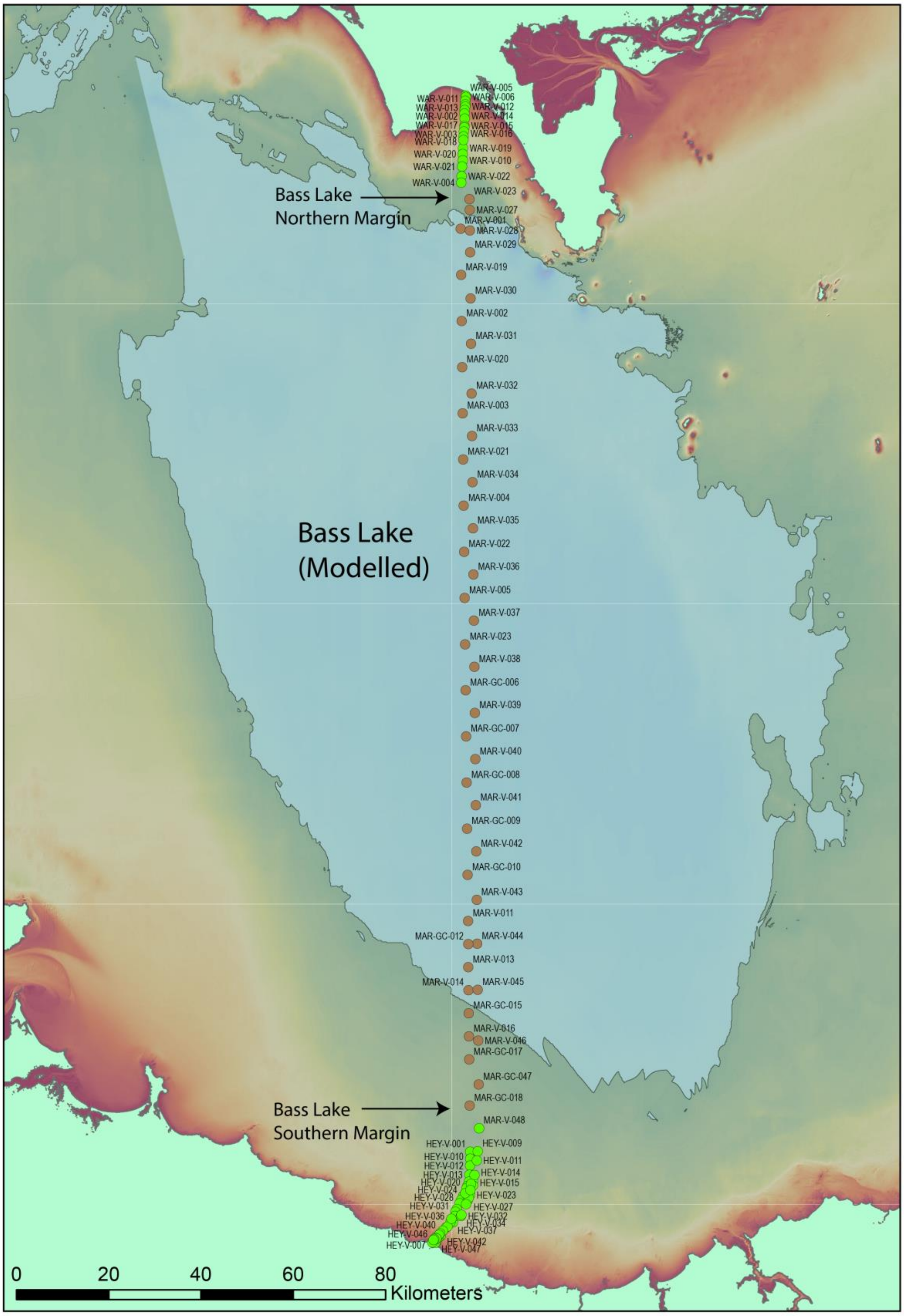

Figure 6-24 Core locations with those coloured brown showing evidence of lake sediments.

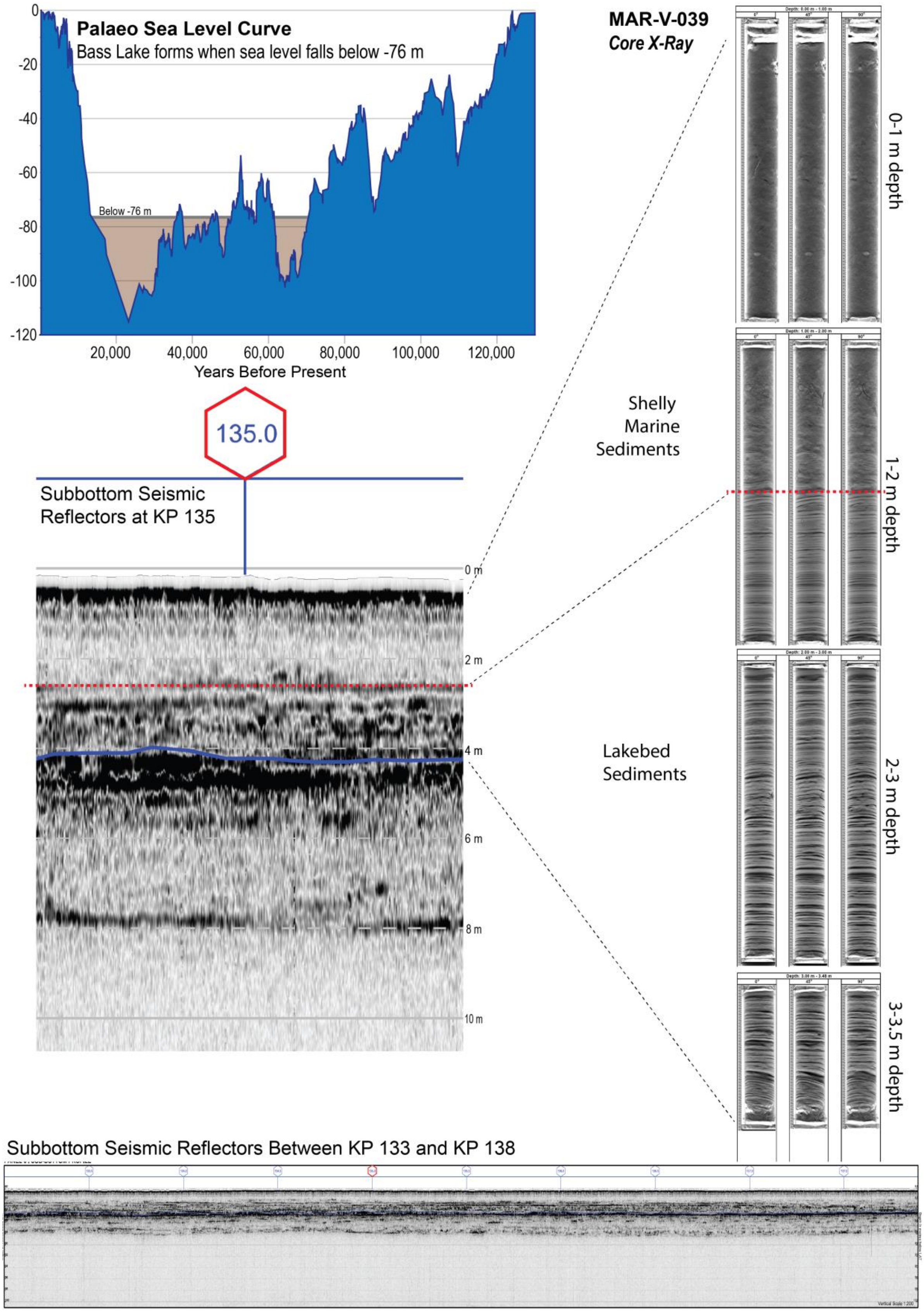

Figure 6-25 : X-ray of Core MAR-V-039 and corresponding sub-bottom profiling image.

6.6.4 Step D: Terrestrial site types and landscape/environmental associations

The most detailed archaeological investigations conducted along the northern Tasmanian coast and Bass Strait Islands have focused on stratified cave and rock shelter sites in northwest Tasmania,[53] and on Hunter Island.[54] Sim[55] undertook an archaeological survey of King Island prehistoric sites on thirty-one of the Furneaux Islands offshore from Flinders Island, respectively. On the Furneaux Islands a total of 64 prehistoric Aboriginal sites were recorded and all of these contained stone artefacts. Stone artefacts were found on 14 of the 32 islands surveyed. No prehistoric sites were recorded on the other 18 islands examined. All sites recorded were open sites comprising either isolated stone artefact finds or relatively low-density scatters of stone artefacts. On King Island, Sim identified 22 stone artefact sites. These were principally located along the west coast, and also around lagoons and water courses. The archaeology of the submerged landforms identified in Bass Straight lend themselves to more open site types, such as artefact scatters and middens, however the metasedimentary and granite uplands of King and the Furneaux Islands respectively do not represent an equivalent geomorphic analogue to the submerged landforms of Bass Strait.

As such the search for comparable terrestrial landforms has focused on the Tasmanian and Victorian mainlands. Shallow Inlet at Waratah Bay provides an excellent analogue for the estuarine tidal channel identified closer to the Victorian coast while NW Tasmania provides close approximations for the beach ridges and entrenched gullies found off the Tasmanian coast.

The potential impacts to tangible UCH on and in the lake bed sediments have not been assessed. This is because it is considered that the expected remote likelihood of archaeological deposits and structures formed in the lake and resulting extremely low density of any such sites being present coupled with the nature of the proposed works – water jetting up to 1.5 m through overlaying post glacial Holocene marine sediments (see Section 10.1) – does not reach the threshold to be assessed for impact. Bass Lake is included in this report so as to inform the intangible UCH values assessment of this feature in the CVAs.

6.6.4.1 Archaeology of hinterland beach ridge strandplain environments.

Two terrestrial examples of beach ridge strandplains in the Gippsland region that were formed during the last interglacial are nominated as geomorphic analogues to the identified submerged beach ridge strandplain within the project area. These include a former shoreline strandplain at Waratah Bay, about 3.5 km landward of the submerged beach ridge strandplain s, and a barrier strandplain landward of Ninety Mile Beach, extending between Seacombe and Loch Sport.

The former shoreline strandplain at Waratah Bay consists of a dune ridge couplet that is somewhat more compact and elevated than the identified submerged beach ridge strandplain within the project area. However, the Waratah Bay strandplain is the closest in geographical location and the most equivalent in regional environmental context to the identified submerged beach ridge strandplain – particularly with regard to proximity to the freshwater source of the Shallow Inlet estuary about 6 km east of both strandplains.

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[53] **Jones, R. 1971** Rocky Cape and the problem of the Tasmanians. Unpublished PhD thesis, University of Sydney.
[54] Op. Cit., Bowdler, S. 1979.
[55] Op. Cit., Sim, R. 1998 and Sim, R. 2016.

Several Aboriginal archaeological investigations have been undertaken around Waratah Bay since the early 1990s – including desktop assessments,[56] archaeological surveys,[57] and cultural heritage management plans (CHMPs).[58] These investigations have resulted in the identification of fifteen Aboriginal cultural heritage places at Waratah Bay, including nine middens and six stone artefact scatters.[59] All fifteen Aboriginal heritage places were identified as surface sites and / or exposures of surface and subsurface cultural material during archaeological surveys. It should also be noted that these previous archaeological investigations were focussed specifically on proposed development footprints and were not systematic samples of the landscape, and ground surface visibility during all previous surveys was reported to be low to very low (<5%).[60]

Three previously identified Aboriginal cultural heritage places at Waratah Bay occur on the elevated dune landforms of the former shoreline strandplain at Waratah Bay consisting of an isolated surface silcrete core, an isolated surface quartzite / sandstone river cobble hammerstone, and a low density surface scatter of two quartzite retouched flakes (Figure 6-26).[61] All three places are registered on the Victorian Aboriginal Heritage Register (VAHR) as artefact scatters; however, it is worth noting that these places were registered prior to the introduction of the Low Density Artefact Definition (LDAD) in 2012, and all three would now be identified as LDADs – i.e. stone artefacts occurring at densities of up to ten artefacts in any area of approximately 100 m^2.

Story (1993) determined that the scarcity of Aboriginal cultural places identified during the archaeological survey across the dune landforms of the former shoreline strandplain at Waratah Bay was an accurate reflection of the existing archaeological record. Whilst the occurrence of stone artefacts indicated Aboriginal occupation of the area, Story concluded that the elevated dune landforms behind the coastal zone and at a distance from major freshwater sources were likely only intermittently utilised or exploited for plant and animal resources. These findings conform with predicted Aboriginal occupation and land-use patterns developed in broader Aboriginal archaeological studies in adjacent areas along the south-east Victorian coast.[62]

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[56] **Clark, N. 1992**. AOTC Optical Fibre Cable Route Waratah Bay to Leongatha via Tarwin Lower: an assessment of the potential impact on archaeological sites. Report prepared by Clarkeology for AOTC Network Construction Group.; **Webb, C. 1992**. A Predictive archaeological study for the optical fibre cable landfall site: Flinders (Mornington Peninsula) to Tongue Point (Wilson's Promontory). Report prepared for Telecom Australia.

[57] **Harding, M. 1992**. *An Archaeological Survey of Waratah Bay.;* **Reich, A. & M. Green. 2023**. *Marinus Link EIS/EES Cultural Heritage Technical Study – Victorian Terrestrial Component*. Report prepared by Eco Logical For Marinus Link Pty Ltd.; **Story, A. 1993.** *Telecom Optical Fibre Cable Route Waratah Bay to Leongatha: An Archaeological Survey of The Landfall Site.* Report prepared by Clarkeology for Telecom Australia Network Construction Group, Melbourne, VIC.; **Thomson, M. Clark, V. & Stevens, A. 2002**. *Waratah Bay Waste Water Treatment Project. Cultural Heritage Study.* Report prepared for South Gippsland Water, VIC.

[58] **Hill, J. 2017**. Installation of NBN Co Infrastructure at Sandy Point. Cultural Heritage Management Plan. Prepared by Aurecon Group Pty Ltd for NBN Co.

[59] ACHRIS search of the Victorian Aboriginal Heritage Register (VAHR) undertaken by Eco Logical Australia Pty Ltd on 5 December 2022; **Harding, M. 1992; Hill, J. 2017; Story, A. 1993; Thomson *et al.* 2002**.

[60] Harding, M. 1992; Hill, J. 2017; Story, A. 1993; Thomson *et al.* 2002.

[61] Op. Cit, Story, A. 1993

[62] **Gaughwin, D. 1981**. *Sites of Archaeological Significance in the Western Port Catchment. Volume 1: Report.* Ministry for Conservation, Environmental Studies Series, Publication No. 367.; **Gaughwin, D. 1983**. *Coastal Economies and the Western Port Catchment.* Thesis (Master of Arts), Division of Prehistory, School of Humanities, La Trobe University.; **Hall, R. 1989**. *Archaeological survey of the Gippsland Lakes.* Unpublished report to the Victoria Archaeological Survey (VAS).; **Lomax, K. 1992**. *An Archaeological Survey of the Gippsland Lakes (Stage 2).* Unpublished report to the Victoria Archaeological Survey (VAS) and the Australian Heritage Commission (AHC).

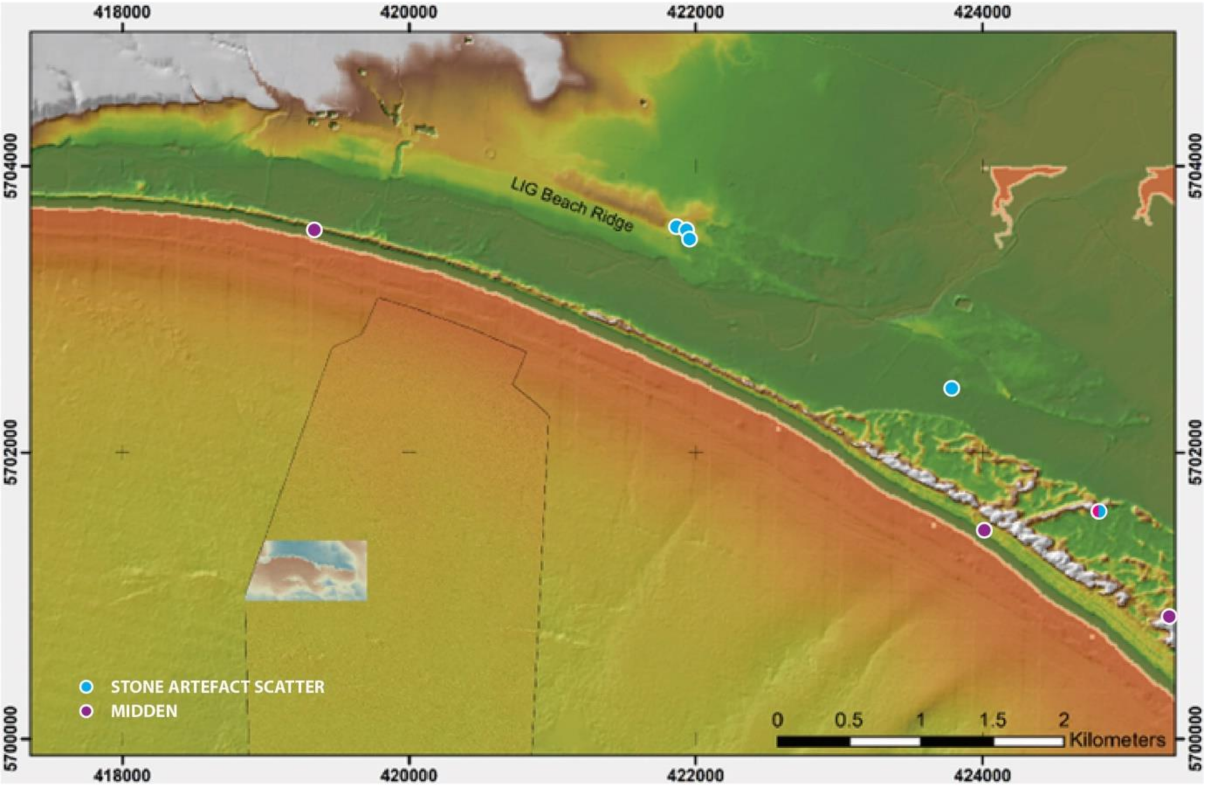

Figure 6-26 : VAHR Aboriginal cultural heritage places located on the former shoreline strandplain at Waratah Bay

The second nominated terrestrial analogue for the identified submerged beach ridge strandplain within the project area is a beach ridge strandplain that extends along the Ninety Mile Beach in Gippsland. The width of the Ninety Mile Beach strandplain is very similar (about 1.5 km) to the submerged beach ridge strandplain; however, the broader landscape and environmental context of the two strandplains differ in that Ninety Mile Beach beach ridge strandplain is adjacent to coastal and swamp resources whilst the submerged beach ridge strandplain would have been within a strictly hinterland environment during the terminal Pleistocene.

Numerous small and large-scale archaeological investigations have been undertaken across the Gippsland Lakes area since the 1980s. Of particular relevance are regional archaeological studies that cover the Ninety Mile Beach beach ridge strandplain landform and are directed towards the development of predictive modelling of archaeological site types and locations via analysis of VAHR records and systematic landform survey sampling.[63]

Two previously identified Aboriginal cultural heritage places in the area of Ninety Mile Beach occur on the elevated beach ridge strandplain; both consisting of low density (less than 10) surface scatters of quartz and silcrete flaked artefacts, and both situated along the southern margin of the beach ridge strandplain, on the edge of the current estuarine-marsh environment of Lake Reeve (Figure 6-27).

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63 **Birkett-Rees, J., B. David & B. Suttie. 2021**. *Gippsland Lakes Region Predictive Modelling.* Buchan Valley and Gippsland Lakes Cultural Mapping Project.; **Hall, R. 1989**. *Archaeological survey of the Gippsland Lakes.* Unpublished report to the Victoria Archaeological Survey (VAS).; **Hotchin, K. 1989**. *Environmental Evolution and Culture Change in the Gippsland Lakes Region, Victoria, Australia.* Unpublished PhD thesis, Australian National University.; **Lomax, K. 1992**. *An Archaeological Survey of the Gippsland Lakes (Stage 2).* Unpublished report to the Victoria Archaeological Survey (VAS) and the Australian Heritage Commission (AHC).

This low incidence of Aboriginal cultural heritage places and occurrence of low density stone artefact sites only across the beach ridge strandplain conforms with broad archaeological prediction models for the Gippsland Lakes. Regional archaeological studies incorporating the area of the Ninety Mile Beach beach ridge strandplain have found that whilst archaeological sites occur on all landforms throughout the Gippsland Lakes region and that flat areas on elevated landforms and former coastal shorelines – such as the beach ridge strandplain – have a higher overall archaeological potential, the vast majority of Aboriginal cultural places (about 70-95%) occur within 200 m of a perennial freshwater source. Furthermore, identified Aboriginal cultural places that occur beyond 200 m from a major freshwater source throughout the Gippsland Lakes region are generally much smaller and more spatially discrete, and appear to be associated with intermittent land use and short term and / or singular occupation events.[64]

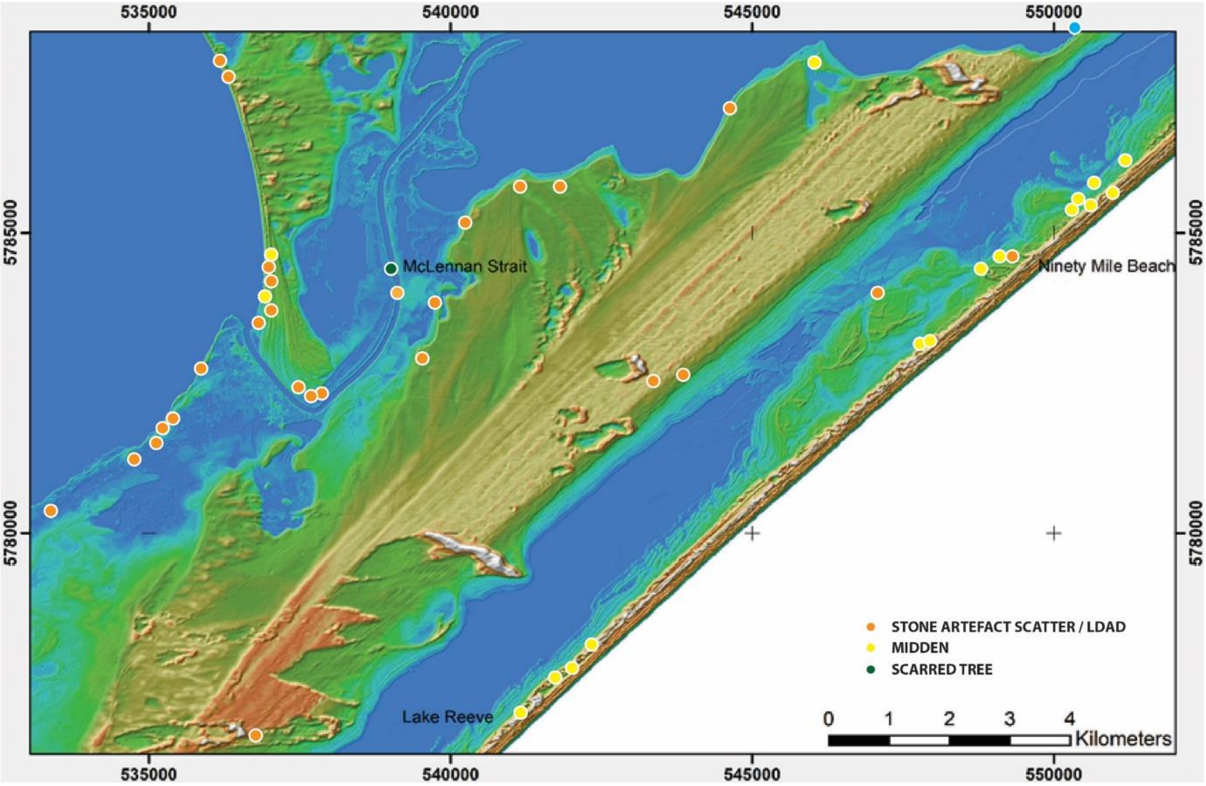

Figure 6-27 : VAHR Aboriginal cultural heritage places located on the beach ridge strandplain behind Ninety Mile Beach.

Overall, examination of the results of previous archaeological investigations, regional studies, and Aboriginal cultural heritage places registered on the VAHR for both terrestrial analogue strandplains indicates that the identified submerged beach ridge strandplain is likely to be of low Aboriginal archaeological sensitivity, with predicted cultural heritage materials consisting of infrequent isolated stone artefacts and low-density stone artefact scatters associated with intermittent and short-term occupation and land-use.

6.6.4.2 Archaeology of estuarine / tidal channel environments

The tidally influenced inlet of Shallow Inlet at Waratah Bay is nominated as a terrestrial analogue of similar morphology, location, and regional context to the buried estuarine palaeochannel identified in the northern part of the project area.

[64] Birkett-Rees, J., B. David & B. Suttie. 2021.; Hall, R. 1989.

Several Aboriginal archaeological investigations have previously been undertaken around Shallow Inlet, resulting in the identification of fifteen Aboriginal cultural heritage places to the south and west of Shallow Inlet, including nine middens and six stone artefact scatters[65] (Figure 6-28)[66]

Figure 6-28 : Registered Aboriginal cultural heritage places in the region of Shallow Inlet, Waratah Bay.

The majority of registered Aboriginal heritage places around Shallow Inlet – including all nine middens – occur within the coastal barrier landform of wave-deposited and aeolian sand dunes lining Sandy Point and Waratah Bay. These middens are all located on elevated terrain adjacent to the foreshore; with eight situated sandy dune rises and one on a rocky headland. Middens along the dune landforms are dominated by common pipi (*Plebidonax deltoides*) shells, whilst the rocky headland midden primarily contains common warrener / lightning turban (*Lunella undulata*) and common limpet (*Cellana tramoserica*) shells. Almost all of the recorded middens were observed to contain charcoal, and three also contained associated stone artefact scatters of silcrete, marine flint, and quartzite flakes and flaked pieces.

The registered Aboriginal heritage places located within the low-lying, backbarrier landforms around Waratah Bay and the Shallow Inlet estuarine channel and swamp environment include six stone artefact sites consisting of four isolated stone artefacts and two low-density (n = < 5) stone artefact scatters. All the recorded stone artefacts were located on elevated terrace and slope landforms overlooking the estuary and associated swamp / wetlands, with

65 Clark 1992, Harding 1992, Hill 2017, Reich & Green 2023, Story 1993, Thomson, Clark & Stevens 2002, and Webb 1992.

66 **ACHRIS** search of the Victorian Aboriginal Heritage Register (VAHR) undertaken by Eco Logical Australia Pty Ltd on 5 December 2022; Harding, M. 1992; Hill, J. 2017; Story, A. 1993; Thomson et al. 2002.

identified artefacts including silcrete and quartzite cores, flakes, and retouched flakes / tools, and a quartzite / sandstone hammerstone.

In general, previous archaeological investigations around Shallow Inlet have determined that the low-lying tidal estuarine plains behind the coastal barrier dunes at Waratah Bay, particularly areas within the inlet flood level, are likely to be of low Aboriginal archaeological sensitivity, with predicted cultural heritage materials consisting of infrequent isolated stone artefacts and low-density stone artefact scatters associated with intermittent exploitation of the coastal margin. Larger and potentially stratified stone artefact scatters are predicted to occur in greater frequency on more elevated, well-draining landforms such as terraces, relict levee banks, and dune ridges, adjacent to swamp and wetland areas; particularly in close proximity to freshwater sources. This predicted land-use model conforms to the findings of broader regional Aboriginal archaeological studies in adjacent areas along the south-east Victorian coast.[67]

6.6.4.3 Archaeology of beach ridge systems

As the identified beach ridges are located in relatively close proximity to the northwest coast of Tasmania comparable terrestrial analogues have been sought from this area. Also as it is unclear whether the beach ridges are composed primarily of sand (dunes) or cobbles archaeological sites associated with both formations are presented below.

Several previous Aboriginal archaeological investigations have examined areas of beach ridge landforms along the western north coast of Tasmania, including various regional archaeological surveys and analyses undertaken in the 1970s to 1990s,[68] and a number of smaller scale archaeological assessments carried out since the 2000s.[69] Via a collation of the observations obtained during these investigations, several patterns in the archaeological record for sand dune and cobble beach landforms along the western north coast can be identified.

Sand dune beach ridges:

The majority of Aboriginal cultural heritage places identified on sand dune beach ridge landforms along the western north coast of Tasmania are middens, followed by stone artefact scatters and isolated stone artefacts.

Documented middens on sand dunes in the region range from small, thin scatters to medium and high-density stratified linear deposits and mounds measuring up to 10-15 m in diameter. Midden contents are dominated by warrener / lightning turban (*Lunella undulata*) and whelk

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[67] **Gaughwin, D. 1981**. *Sites of Archaeological Significance in the Western Port Catchment. Volume 1: Report.* Ministry for Conservation, Environmental Studies Series, Publication No. 367.; **Gaughwin, D. 1983**. *Coastal Economies and the Western Port Catchment.* Thesis (Master of Arts), Division of Prehistory, School of Humanities, La Trobe University.; **Hall, R. 1989.** *Archaeological survey of the Gippsland Lakes.* Unpublished report to the Victoria Archaeological Survey (VAS).; **Lomax, K. 1992**. *An Archaeological Survey of the Gippsland Lakes (Stage 2).* Unpublished report to the Victoria Archaeological Survey (VAS) and the Australian Heritage Commission (AHC).

[68] **Dunnett, G. 1994.** *A Survey and Assessment of Aboriginal Archaeological Sites in the Northern Region of Tasmania*. A Report prepared for the Tasmanian Parks and Wildlife Service and Forestry Tasmania.; **Jones, R. 1971.** *Rocky Cape and the Problem of the Tasmanians.* PhD Thesis, University of Sydney, NSW.; **Macfarlane, I. 2001.** *A Regional Archaeological Site Survey of North-West Tasmania.* Report prepared for the Parks and Wildlife Service Hobart and the Australian Heritage Commission Canberra.; **Stockton, J. H. 1982.** *The Prehistoric Geography of Northwest Tasmania.* PhD thesis, Australian National University.

[69] **Huys, S. & G. Vernon. 2018.** *Western Plains Wind Farm Project, Stanley: Aboriginal Heritage Assessment Report.* Report prepared by Cultural Heritage Management Australia for Epuron.; **Huys, S. & G. Vernon. 2019.** *Robbins Island Renewable Energy Park: Aboriginal Heritage Assessment Report.* Report prepared by Cultural Heritage Management Australia for UPC Robbins Island Pty Ltd.; **Huys, S. & G. Vernon. 2021.** *Hawley Esplanade Shared User Path Project, Hawley Beach, Northern Region, Tasmania: Aboriginal Heritage Assessment Report.* Report prepared by Cultural Heritage Management Australia for Latrobe Council.

(*Dicathais* sp.) shells, with some middens located along low-energy coastlines or areas close to estuarine environments also containing mussel (*Mytilus planulatus*) and oyster (*Ostrea angasi*) shells. Numerous recorded middens also contain ash and charcoal, fragments of bird and mammal bones, and stone artefacts – most commonly consisting of cores and primary, unretouched flakes.

The greatest number and largest volume of recorded middens on the western north coast of Tasmania occur along high-energy coastlines in areas of mixed rocky headlands and short sandy beaches, with the majority located within 50-100 m of intertidal rock platforms. In areas of long sandy beaches, observed midden volume has been found to decline with increasing distance from rocky coasts, with sizeable middens located more than 200 m from intertidal rock platforms generally only occurring around creek and river mouths.

Middens in the western north coast region are also predominantly located within 500 m inland of the shoreline, with the largest and highest-density middens situated adjacent to the foreshore on elevated, well-draining, level to gently inclined dune terrain, located between 0-5 m above sea level, and providing 360° views. The majority of recorded coastal middens are also located within 200 m of a seasonal or perennial freshwater source. A few small middens have also been documented on sandy rises and dune ridges between 1-4 km from the shoreline, adjacent to inland lagoons, creeks, and rivers.

Stone artefact sites (i.e. those not directly associated with middens) along the western north coast of Tasmania have most commonly been recorded as low to moderate density scatters – averaging between 5-50 artefacts – and isolated artefacts. However, it must be noted that such observations have derived from surface surveys only, and the possible occurrence of higher density and / or subsurface and potentially stratified stone artefact deposits in sand dunes landforms along the coast cannot be discounted.

Stone artefact assemblages along the western north coast are dominated by black chert, spongolite, dolerite, quartzite, and quartz – the latter three material types readily available along local cobble beaches. Recorded artefact types consist predominantly of cores and primary or secondary, largely unretouched flakes and flaked pieces. The greatest number and highest density of stone artefact scatters in the coastal region occur on elevated, well-draining, relatively level dune ridges and crests, within 200 m of a freshwater source. Isolated stone artefacts, however, have been found to occur in all areas across all landscape types.

Cobble beaches

The majority of Aboriginal cultural heritage places identified on cobble beach landforms along the western north coast of Tasmania are middens and stone arrangements, followed by stone artefact scatters, isolated stone artefacts, and stone quarry sites.

The observed patterns in midden and stone artefact scatter location, form, and contents on cobble beaches on the western north coast are the same as those observed for sand dune ridges. Interestingly, documented middens in the region occur more frequently on cobble beaches than any other landform – however, this may simply be a reflection of the fact that much of the western north coast consists of cobble beaches.

Documented stone arrangements on Tasmanian western north coast cobble beaches include seal hides and fish traps. Seal hides consist of circular or semi-circular depressions excavated into cobble beach substrates, ranging from 1.5 m to over 4 m in diameter and up to 1 m in depth, and occasionally with a low wall of cobbles placed around the outer edge. Recorded seal hides occur along the western north coast on raised cobble beach ridges between 1 to 6 m above high tide mark and 10 to 60 m from the shore. On some cobble beaches, seal hides have been recorded as single, isolated depressions, whilst in other locations between 10-20 seal hide depressions have been found clustered together.

A number of fish traps have been recorded on and immediately adjacent to cobble beach landforms along the western north coast – particularly around the central part of the region where tidal range is in excess of 2 m. Documented fish traps consist of low, broadly linear, loosely piled stone walls extending through the intertidal to shallow subtidal zone, with walls generally measuring between 0.5 to 1 m in height and ranging from 20 m to up to 100 m in length. Some of these fish traps have been determined to be non-Aboriginal, historical constructions, however, several are believed to be Aboriginal or potentially Aboriginal in origin.

The final type of Aboriginal cultural heritage place recorded on cobble beaches along the Tasmanian western north coast are quarry sites, consisting of scatters of flaked cobble cores and primary flakes – particularly quartzite. Substantial proportions of stone artefacts manufactured from cobbles with water-rolled cortex – including quartzite, quartz, and dolerite – have also been identified in excavated lithic assemblages throughout the western north coast, indicating that regional cobble beaches were a significant contributor of raw materials for stone artefact manufacture.

Beach ridge formations also occur in the more protected embayments and along the Bass Strait islands' lower-energy east facing coasts. Archaeological surveys of these landforms have identified both midden and lithic scatters; however, they are typically rare and have usually been identified in the context of dune blowouts.[70]

6.6.4.4 Archaeology of entrenched stream gully/channel landforms

The entrenched stream gullies located off the Heybridge coastline represent a continuation of the Blythe River and would have been geomorphically active during periods of lower sea levels. The Blythe River valley provides an appropriate terrestrial site analogue to these submerged stream gullies particularly given the unique local geology.

Little Aboriginal cultural heritage investigation has previously been undertaken along the Blythe River valley and the Heybridge coast. There are only six registered Aboriginal heritage sites within a 4 km radius of Heybridge, comprising a shell midden on a small rocky promontory at Sulphur Creek ca. 4 km south-east of Heybridge, and five inland isolated stone artefact sites located between 0.6 km to 3.5 km from the coast; including one at Round Hill west of Heybridge, three at Stowport and Cuprona to the south / south-east, and only one in the Blythe River valley at Heybridge, ca. 0.75 km from the coast.[71] All of these sites were identified as surface occurrences or exposures during archaeological survey only.

Various regional Aboriginal archaeological studies of north-west Tasmania have been conducted in recent decades, however; directed towards identifying broad patterns of Aboriginal land use, occupation, and archaeological site distribution. These studies have involved systematic sample survey and analysis of both coastal and inland landscapes across the north-west region, with several incorporating the Blythe River catchment and Heybridge coast within the study area boundaries.[72]

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[70] Op. Cit., **Sim, R. 1998;** Op. Cit., **Bowdler, S. 1979; Jones, R. 1979** A note on the discovery of stone tools and a stratified prehistoric site on King Island, Bass Strait. Australian Archaeology, 9(1), 87-94.

[71] **Tasmanian Aboriginal Heritage Register** (AHR) searches undertaken by Cultural Heritage Management Australia for Marinus Link Project; **Huys, S. & V. Graham. 2020.** *Heybridge Converter Station Project, Northern Regional, Tasmania: Aboriginal Heritage Assessment Report.* Report by Cultural Heritage Management Australia for TasNetworks, 26 August 2020, Hobart, TAS.; **Eco Logical Australia. 2021.** *Marinus Link Terrestrial Cultural Heritage Priority Baseline Study*. Prepared for Marinus Link Pty Ltd.

[72] **Cosgrove, R. 1990.** "The Archaeological Resources of Tasmanian forests: Past Aboriginal Use of Forested Environments." *Occasional Paper No. 27*. Department of Parks, Wildlife and Heritage, Hobart, TAS.; **Dunnett, G. 1994.** *A Survey and Assessment of Aboriginal Archaeological Sites in the Northern Region of Tasmania*. A Report prepared for the Tasmanian Parks and Wildlife Service and Forestry Tasmania.; **Jones, R. 1971.** *Rocky Cape and the Problem of the Tasmanians.* PhD Thesis, University of Sydney, NSW.; **Macfarlane, I. 2001.** *A Regional Archaeological Site Survey of North-West Tasmania.* Report prepared for the Parks and Wildlife Service Hobart and the Australian Heritage Commission Canberra, ACT.; **Pickering, M.** 1991. Report on the Archaeological Site Survey of the Surrey Hills Region, North Western Tasmania. Report to the Department of Archaeology, La Trobe University, Bundoora, VIC.; **Stockton, J. H. 1982.** *The Prehistoric Geography of Northwest Tasmania.* PhD thesis, Australian National University, ACT.

As a whole, these regional investigations have determined that the most likely Aboriginal archaeological site types to occur along the western north coast around the mouths of rivers and streams, such as Blythe River, include shell middens, stone artefact scatters, stone wall fish traps, and seal hides and quarry sites in suitable cobble beach landforms – see Section 6.6.4.3.

The vast majority of Aboriginal archaeological sites identified in north-western regional studies along rivers and streams through inland areas beyond the coastal margin consist of stone artefact scatters and isolated stone artefacts. A small number of quarry sites – particularly brecciated chert quarries – and rockshelter occupation sites have also been identified along inland river valley systems where suitable rock outcrops and formations occur.

Inland Aboriginal archaeological sites through the north-west of Tasmania have generally been found to occur in low numbers across the landscape and to be relatively small, with isolated stone artefact sites being common, followed by low-density stone artefact scatters (< 10-20 artefacts). Higher density stone artefact scatter sites have been identified; particularly along the southern edge of the coastal plain where it meets the inland hills and along freshwater courses across the region from Rocky Cape to Surrey Hills. However, large, high-density stone artefact sites are considered to be comparatively rare.

Landforms associated with freshwater river and stream valley systems throughout the north-west, such as the Blythe River valley, are among the most archaeologically sensitive inland areas. The majority of identified isolated stone artefact and stone artefact scatter sites have been found on relatively level to gently sloping, well-drained terrain within river / stream valleys or on adjacent alluvial terraces and flats within 100-200 m of the waterway.

Documented stone artefact sites throughout the inland north-western region are dominated by quartzite and brecciated chert, followed by quartz, silcrete, hornfels, chalcedony, and spongolite. Identified artefact types consisted largely of flakes, followed by flaked pieces and cores, and small percentages of retouched flakes and tools.

Overall, regional Aboriginal archaeological studies across the north-west of Tasmania have concluded that the higher numbers and densities of sites along coastal margins indicate a strong coastal economic focus, with inland archaeological sites reflecting low-density selective exploitation of widely-dispersed resources, usually associated with waterways, resulting from short-term occupation and land use by small, highly mobile population groups.

6.6.5 Step E Submerged landscape site type association

Based on the examination of terrestrial analogues across the wider Bass Strait region (see Section 7.6.4), the following site types have been identified, which could be associated with the submerged landforms identified within the study area (Table 6-3).

Table 6-3: Site types associated with submerged landforms

Submerged landforms	Depositional context	Site Type Association
Beach Ridge Strandplain, indurated	Coastal intertidal – formation, terrestrial alluvial/colluvial	Artefact, scatter
Beach Ridge	Coastal intertidal/aeolian – Sand dune	Midden
		Artefact, scatter
		Artefact, isolated
	Coastal intertidal – Cobbles	Midden
		Stone arrangement (hide, fish trap)

		Artefact, scatter
		Artefact, isolated
		Quarry
Estuarine / Tidal Channel	Coastal intertidal/fluvial	Artefact Scatter
		Midden
Entrenched Stream Gully / Channel	Terrestrial fluvial	Artefact, scatter
		Artefact, isolated
		Midden
		Quarry
		Rock shelter

6.6.6 Step F Predicted frequency of terrestrial cultural heritage site type occurrences

While analogous terrestrial landforms have been identified along the northern Tasmanian and Gippsland coast of Victoria, there has been limited or an absence of archaeological investigations within these proximal landform types to establish accurate site density, abundance, and/or frequency. Therefore, without comprehensive archaeological surveys of these proximal analogous landforms it becomes more challenging to provide a detailed and accurate assessment of the predicted frequency of occurrence for each site type within each landform.

From such limited information each site type has been assigned a frequency rating based on the number of recorded site measured against other site types in the same proximal analogous landform (as presented in Section 6.6.4). Where there is a relative paucity of site data for a comparable landform, a conservative approach has been taken where as a minimum, site types will be assigned an “Frequent” rating.

Note that Step F for this assessment only applies to tangible heritage, that is, archaeological sites. The assignation of the frequency of intangible sites such as Dreaming locations and Named places in the same manner as tangible sites would be misleading and not relevant given the context of this report.

Table 6-4 provides an estimate of site frequency and density.

Table 6-4 : Predicted frequency of terrestrial cultural heritage site type occurrences

Submerged landforms	Depositional context	Site Type Association	Frequency Score / 5
Beach Ridge Strandplain, indurated	Coastal intertidal – formation, terrestrial alluvial/colluvial	Artefact, scatter	2
Beach Ridge	Coastal intertidal/aeolian – Sand dune	Midden	5
		Artefact, scatter	4
		Artefact, isolated	4
	Coastal intertidal – Cobbles	Midden	5
		Stone arrangement (hide)	4
		Stone arrangement (fish trap)	4

		Artefact, scatter	4
		Artefact, isolated	4
		Quarry	3
Estuarine / Tidal Channel	Coastal intertidal/fluvial	Artefact Scatter	3
		Midden	3
Entrenched Stream Gully / Channel	Terrestrial fluvial	Artefact, scatter	4
		Artefact, isolated	4
		Midden	3
		Quarry	2
		Rock shelter	2

6.6.7 Step G: Site integrity matrix

The site integrity matrix uses two independent variables: site durability and site exposure. These are described below.

(1) Site durability

High: Cultural feature or site is able to maintain its primary context despite being exposed to hydrodynamic processes throughout period of mid to late Holocene inundation.

Moderate: Cultural feature or site is only able to maintain its primary site context during the initial period of sea level inundation, and requires post inundation burial or to be situated below wave base to maintain primary context.

Low: Cultural feature or site loses its primary context during the process of inundation.

(2) Site Exposure

Protected (low energy): Site has been largely protected from site degradation process.

Limited Exposure (low energy more frequent – LE>HE): Period or protection greater than period of exposure.

Protracted Exposure (high energy more frequent – HE>LE): Period of exposure greater than period of protection.

Exposed (high energy): Site has been largely exposed to site degradation processes.

Midden durability will be dependent on the size and volume of the midden, where it has low or high relief, size and hydrodynamic properties of the shell material, and whether there has been any secondary cementation. The durability of these particular midden types is likely to be low; i.e., middens are likely to lose their primary context during the process of inundation. Preservation would only be possible if the midden was sufficiently buried prior to inundation so that it would be protected from erosion until rising sea levels situate the site below wave base. This could have happened with middens present in wetlands/swamp environments associated with estuarine landforms.

Midden sites in dune systems in northern Tasmania can be up to 15 m in diameter and if these dunes have become indurated during inundation there is a possibility that some sites may have survived with a high degree of archaeological integrity. Middens, as would in cobble formations would penetrate though the voids between the cobbles thereby protecting them from abrasion and percussion damage. The corollary of that would be that such sites would lose considerable archaeological cohesion.

Durability of lithics in open scatter sites can be measured in their ability to remain in their primary depositional context, as well as the loss of diagnostic features through impact and abrasion of lithics. Therefore, the mass and composition of a lithic will determine its:

1) ability to be transported away from the site, and;

2) its tendency to lose its diagnostic scarring features.

The open lithic scatter sites associated with coastal dune deposits and while finer sands may be winnowed through wave and current processes during and post inundation, the more massive lithics can become concentrated into a stony deflation pavement. The depths of the submerged beach ridge deposits are presently below storm wave base and therefore lithics would have only been exposed to wave energies during the initial inundation period. This may have led to winnowing and concentration of lithic deposits and may have limited abrasion and preserved the lithic's diagnostic features. However should the dunes become indurated site survival increases. The beach ridges identified in this study have survived inundation and so could possibly have become indurated if they are composed of sand. If the beach ridges are composed of cobbles then as with the middens, sites composed of lithics (whether scatters or associated with a quarry) alone would permeate through the cobble formation protecting them from erosion though the archaeological integrity would be diminished.

With regards to indurated submerged beach ridge strandplains at the time of human occupation, these formations would have appeared as an expanse of rock outcrops interspersed with relatively thin deposits of topsoil. Such formations as they became subjected to inundation would have had their topsoil stripped, except in relatively isolated narrow and deep depressions within the indurated surface of the submerged beach ridge strandplain. Artefacts within the topsoil and on the rocky surface will have mobilised and accumulated in depressions or fallen into cracks. The archaeological integrity of these artefacts would have been substantially diminished having effectively passed from an archaeological into a geomorphological/geological context.

The rocky entrenched steams are situated between 5 m and 25 m below sea level so it is unaffected by fair weather wave base; however, pebble and cobble size grains may be transported either through rolling or sliding during higher energy storm events. However these streams passed through the intertidal zone and were exposed to high wave energy for a period. The effects of this are clearly show in Figure 6-16 to Figure 6-19 where the soils that covered the river bank had been washed away leaving higher density rocks behind. There maybe identifiable artefacts within the rubble however their archaeological integrity has been lessened. There is a slightly higher likelihood of archaeological deposits within rock shelters having survived if their entrances were blocked by rock fall before inundation and/or they faced away from the incoming waves, i.e towards the south.

The integrity of the predicted site types within the study area are estimated in Table 6-5, ranking from 5 (high energy/low site durability) to 0 (low energy/high site durability), with lower numbers indicating a greater degree of site integrity.

Table 6-5: Site integrity of predicted site types within the study area

Submerged landforms	Depositional context	Site Type Association	Durability	Energy	Site integrity 0=high and 5=low
Beach Ridge Strandplain, indurated	Coastal intertidal – formation, terrestrial alluvial/colluvial	Artefact, scatter	Low	HE>LE	4
Beach Ridge	Coastal intertidal/aeolian – Sand dune	Midden	Moderate	LE>HE	2
		Artefact, scatter	Moderate	LE>HE	2
		Artefact, isolated	Low	LE>HE	3
	Coastal intertidal – Cobbles	Midden	Low	LE>HE	3
		Stone arrangement (hide)	Moderate	LE>HE	2
		Stone arrangement (fish trap)	High	HE	1
		Artefact, scatter	Moderate	LE>HE	2
		Artefact, isolated	Moderate	LE>HE	2
		Quarry	Moderate	LE>HE	2
Estuarine / Tidal Channel	Coastal intertidal/fluvial	Artefact Scatter	Low	LE>HE	3
		Midden	Low	LE>HE	3
Entrenched Stream Gully / Channel	Terrestrial fluvial	Artefact, scatter	Low	HE>LE	4
		Artefact, isolated	Low	HE>LE	4
		Midden	Low	HE>LE	4
		Quarry	Low	HE>LE	4
		Rock shelter	Moderate	HE>LE	3

6.6.8 Step H: Likelihood of site presence and condition

The likelihood of site presence, and condition, is calculated by subtracting the values attained for Site Integrity Matrix (Step G) from Frequency of Site Type (Step F) – see Table 6-6.

Table 6-6 : Likelihood of site presence and condition within the study area

Submerged landforms	Depositional context	Site Type Association	Frequency of site	Site integrity	Likelihood of site presence and condition
Beach Ridge Strandplain, indurated	Coastal intertidal – formation, terrestrial alluvial/colluvial	Artefact, scatter	2	4	≤1- Very low confidence
Beach Ridge	Coastal intertidal/aeolian – Sand dune	Midden	5	2	3 – Medium confidence
		Artefact, scatter	4	2	2 – Low confidence
		Artefact, isolated	4	3	≤1- Very low confidence
	Coastal intertidal – Cobbles	Midden	5	3	2 – Low confidence
		Stone arrangement (hide)	4	2	2 – Low confidence
		Stone arrangement (fish trap)	4	1	3 – Medium confidence
		Artefact, scatter	4	2	2 – Low confidence
		Artefact, isolated	4	2	2 – Low confidence
		Quarry	3	2	≤1- Very low confidence
Estuarine / Tidal Channel	Coastal intertidal/fluvial	Artefact Scatter	3	3	≤1- Very low confidence
		Midden	3	3	≤1- Very low confidence
Entrenched Stream Gully / Channel	Terrestrial fluvial	Artefact, scatter	4	4	≤1- Very low confidence
		Artefact, isolated	4	4	≤1- Very low confidence
		Midden	3	4	≤1- Very low confidence
		Quarry	2	4	≤1- Very low confidence
		Rock shelter	2	3	≤1- Very low confidence

In summary there is minimal to very low confidence in artefact scatters being present, that is having survived with a recognisable degree of archaeological integrity, within an indurated Beach Ridge Strandplain, Estuarine / Tidal Channel and Entrenched Stream Gully / Channel landforms. There is a slightly higher likelihood, albeit with a low to medium confidence, of middens and artefact scatters being present in submerged beach ridge formations. Stone fish traps because of their locations in higher energy environments are considered to have a higher likelihood for survival and so this is reflected in the medium confidence assessment for their presence in the area where the beach ridges have been identified, if these formations are composed of cobbles. The medium confidence assigned to fish traps with the beach ridge zone also reflects that the review of the available side scan sonar and MBES data did not reveal what could be interpreted as such structures visible above the seabed.

7 MARITIME HERITAGE

7.1 Historical activities

7.1.1 Offshore study area

From the 1830s, interstate shipping to and from colonial ports on the southern, western and eastern coasts of Australia travelled through the notoriously rough Bass Strait, a journey that was 600 nm shorter than going around the south of Tasmania. Bass Strait is studded with islands, shoals and reefs, which has produced a disproportionately large number of shipwrecks. Installation of navigational aids and the construction of lighthouses to reduce the loss of shipping commenced in the 1830s.[73]

Although the earliest settlers in southern Victoria and northern Tasmania fished on a small scale for sustenance and trade, and sealing was conducted on many Bass Strait islands during the early colonial period, major commercial exploitation of Bass Strait fisheries only began with the scallop fisheries in 1970. Prior to 1970, commercial scallop fisheries in southeast Australia focused on inshore regions, in particular the D'Entrecasteaux Channel and east coast regions of Tasmania, and within Port Philip Bay and Lakes Entrance in Victoria. By the late 1970s, most inshore regions had been completely exploited, and focus shifted to newly discovered scallop beds off the Furneaux Islands and Banks Strait. Overexploitation of these scallop beds led to a complete collapse of the Bass Strait scallop fishery by the early 1980s.[74] Currently, the area of Bass Strait is managed as the Bass Strait Central Zone Scallop Fishery, with 10 active boats harvesting around 3,000 tonnes of scallops each year (Figure 7-1).[75]

[73] **Australian Government, n.d**., 'Early Australian shipwrecks', [Online] http://www.australia.gov.au/about-australia/australian-story/early-austn-shipwrecks, accessed 20 Oct 17.
[74] **Haddon, M., et al., 2006,** Juvenile Scallop Discard Rates and Bed Dynamics: Testing the Management Rules for Scallops in Bass Strait, FRDC Final Report, p.13.
[75] **Australia Fisheries Management Authority,** Bass Strait Central Zone Scallop Fishery website, afma.gov.au/fisheries/bass-strait-central-zone-scallop-fishery, accessed 7 August 2022.

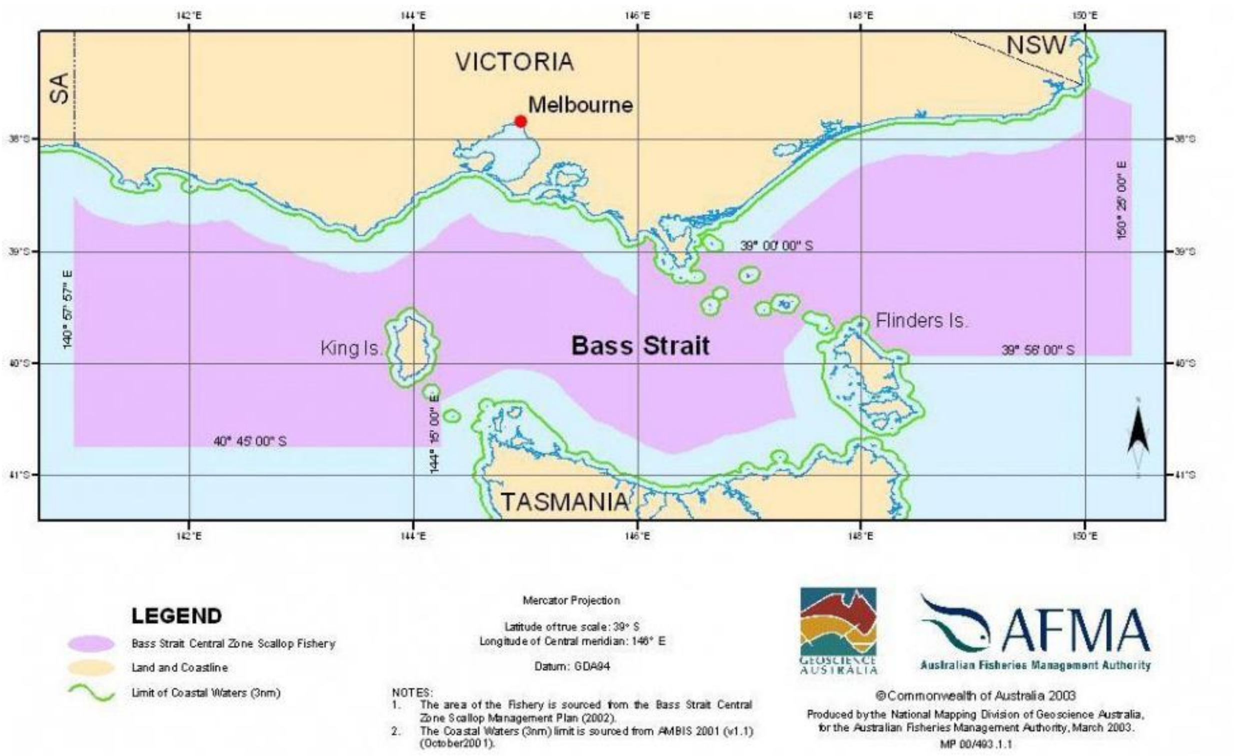

Figure 7-1: Map of Bass Strait Central Zone scallop fishery, highlighted in purple.[76]

One of the largest islands in Bass Strait that was notoriously hazardous for ships is King Island with over 60 recorded shipwrecks.[77] Bass Strait separates Tasmania from the mainland of Australia and had to be traversed regularly by ships carrying passengers and materials to Tasmania. The crossing to Tasmania was one of the longest trips of overnight passenger ferry services in the world.[78]

Just outside of Port Phillip Bay is a formal vessel disposal area (Figure 7-2). This is located at 38° 21' S, 144° 25.5' E, with a diameter of 3 miles (4.83 km, 2.61 nm). This area was established as one of 14 Commonwealth areas in Australian waters designated for the disposal of ships in an attempt to control watercraft abandonment. Though, as stated in Section 2.1.1.2, dumping is likely to have occurred outside of this zone. The zone is approximately 150 km to the northwest of the study area.[79] No dumped material associated with the designated Commonwealth Disposal Area 3 will be located within the study area.

During World War II, German naval forces covertly laid mines in Bass Strait. The German navy utilised captured Norwegian tanker ship, *Storstad,* to lay mines off Wilsons Promontory and Cape Otway in late October, 1940. The mines laid by *Storstad* were responsible for sinking the British steamer *Cambridge,* two-and-a-half miles south of Wilsons Promontory on 8 November 1940. Less than 24 hours later, the American merchant ship, *City of Rayville* was sunk off Cape Otway. The Naval Board closed Bass Strait to shipping and began minesweeping operations, eventually removing a total of twelve mines from two minefields. Although the minesweeping operation was considered successful, and Bass Strait was quickly reopened for shipping, mines continued to wash ashore in subsequent years.[80]

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[76] **AFMA,** Map of Bass Strait Central Zone Scallop Fishery, https://www.afma.gov.au/fisheries/bass-strait-central-zone-scallop-fishery, accessed 22 Feb. 22.
[77] Australasian Underwater Cultural Heritage Database
[78] **Hopkins, David, 1994**, The Shipping History of the Bass Strait Crossing, Devonport, Tasmania.
[79] **Richards, N., 2002,** *Deep Structures: An Examination of Deliberate Watercraft Abandonment in Australia*, thesis for Doctor of Philosophy, Department of Archaeology, Flinders University of South Australia: 242
[80] **Hermon, Gill G 1957,** *Volume I: Royal Australian Navy*, 1939 - 1942. pg. 270-271.

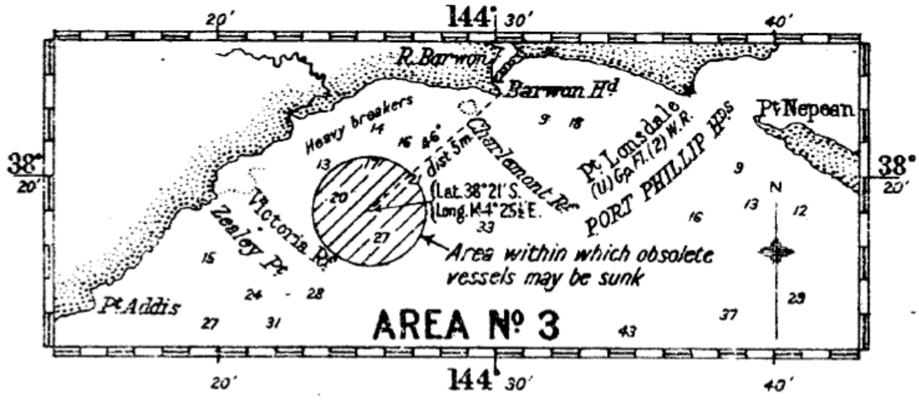

Figure 7-2: Commonwealth disposal area 3 (Melbourne and Geelong).[81]

7.1.2 Victoria nearshore study area

Waratah Bay has a coastline approximately 50 km in length. It is roughly semi-circular in shape and extends from Darby River, Wilsons Promontory National Park, northwest to Shallow Inlet and Walkerville, and then southwest to Cape Liptrap in South Gippsland, Victoria.[82] Waratah Bay is listed on the National Trust, is of State Significance (Place ID: 70489) and is listed on the Victorian Heritage Register.

In 1803 it was originally named Paterson Bay by French navigator Baudin during an expedition to map the coast of Australia. In 1858, it was renamed Waratah Bay after the ship S.S. *Waratah,* captained by William Bell, became disabled with a damaged rudder while rounding Wilsons Promontory on its way between Sydney and Melbourne. The ship sought shelter in the bay and reported it to be a good, safe anchorage, giving rise to the name Waratah Bay.[83]

From 1878, the western area of Walkerville in Waratah Bay was mined for limestone, with six kilns constructed in close proximity to the lime deposits of the cliffs adjacent to Walkerville South Beach. The majority of the lime was sent to Melbourne, but shipments were also made to Sydney, as well as to more local destinations such as Lakes Entrance. Production of limestone reached its peak in the 1890s; however, by the end of WW1 lime mining had been replaced by other building materials such as concrete.[84] In 1926 the Walkerville Lime Kilns were closed.

7.1.3 Tasmania nearshore study area

In 1824, the Van Diemen's Land Company (VDLC) was founded in order to develop a sheepherding industry in Tasmania. The company applied for land and was granted 250,000 acres in the north western region of Tasmania (Figure 7-3). The company established a port at what is now Burnie, on Emu Bay, building a company store and a small jetty.

The development of Burnie followed the establishment of other ports on the northern coast of Tasmania, including George Town in 1804, and Launceston in 1824. Today, Burnie is Tasmania's largest port, handling over 4 million tonnes of freight in 2014-2015 along with 55% of Tasmania's container task.

[81] *Op. Cit.* Richards, N., 2002: 452.
[82] **Victoria Heritage Database Report 2005,** Statement of Significance, Waratah Bay. Report accessed: 18 Jan 19.
[83] **Victorian Places 2019b, '**Walkerville' [Online] https://www.victorianplaces.com.au/walkerville, accessed 18 Jan 2019.
[84] **Victoria Heritage Database Report 2005**, Statement of Significance, Walkerville Lime Kilns. Report accessed: 18 Jan 2019.

Further maritime industries throughout the north western area of Tasmania were located at the Cam River and Leith Point. The Cam River industries included several boatyards and shipbuilders from the mid-19th century. James Dyson is credited with building the first ship on the Cam River, launching *Maldon Lewis* on 31 October 1867.[85] The construction site of the *Maldon Lewis* was described as being on "the east side of the river," near a ferry house owned by Mr. R.W. Turner. Shipbuilding also took place near Leith, on the River Forth from at least 1852. Notable ships built there included the *Red Gauntlet,* a wooden steamship built by Henry Charles Stephens in 1890.[86]

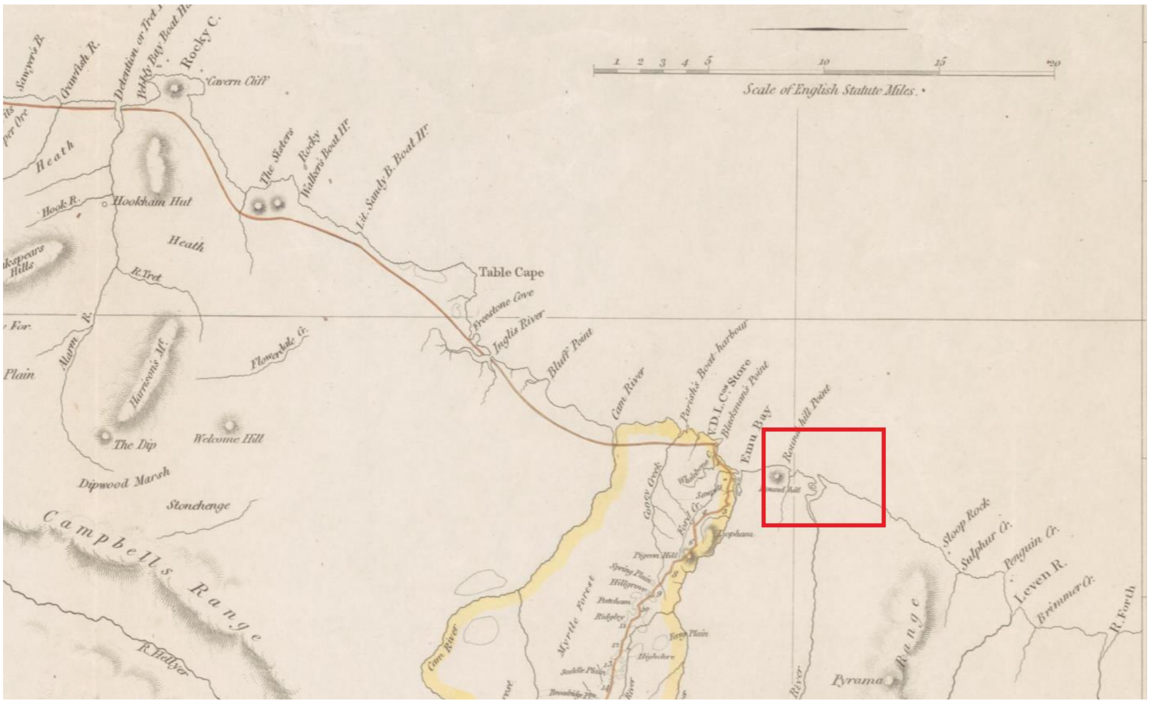

Figure 7-3: Map of the grants of land to the VDLC in the north-western area of Tasmania. VDLC land grant outlined in yellow, approximate Marinus Link landfall outlined in red.[87]

In addition to shipping and shipbuilding, the north coast was the site of a number of fisheries, including shore-based whaling from at least the early 1830s. Contemporary maps show numerous "fisheries" located on the nearshore and intertidal zones on the northwest coast, and the VDLC is known to have operated an unsuccessful whaling station near Circular Head from 1833 to 1834[88] (Figure 7-4). A number of shore-based whaling sites have been archaeologically excavated, exhibiting similar characteristics towards the choice of location, and were frequently built near river mouths and headlands.[89]

[85] **Launceston Examiner 1867** 'RIVER CAM', *(Tas:1842 - 1899)*, 9 November, p. 5. , Viewed 18 Jan 2019, http://nla.gov.au/nla.news-article36647132.
[86] **Launceston Examiner 1890** 'LAUNCH OF THE S.S. RED GAUNTLET', (*Tas: 1842 - 1899)*, 21 August, p. 2. Viewed 18 Jan 2019, http://nla.gov.au/nla.news-article39554109.
[87] **Van Diemen's Land Company Records, 1824-1930**, Reels M337-64, M585-89 Van Diemen's Land Company 35 Copthall Avenue London EC2 National Library of Australia State Library of New South Wales Filmed: 1960-
[88] **Nash, Michael 2003** The Bay Whalers: Tasmania's Shore-based Whaling Industry, Navarine Publishing, 84-85.
[89] **Lawrence, Susan 2006** 'Whalers and Free Men Life on Tasmania's Colonial Whaling Stations', *Australian Scholarly*, 42-43.

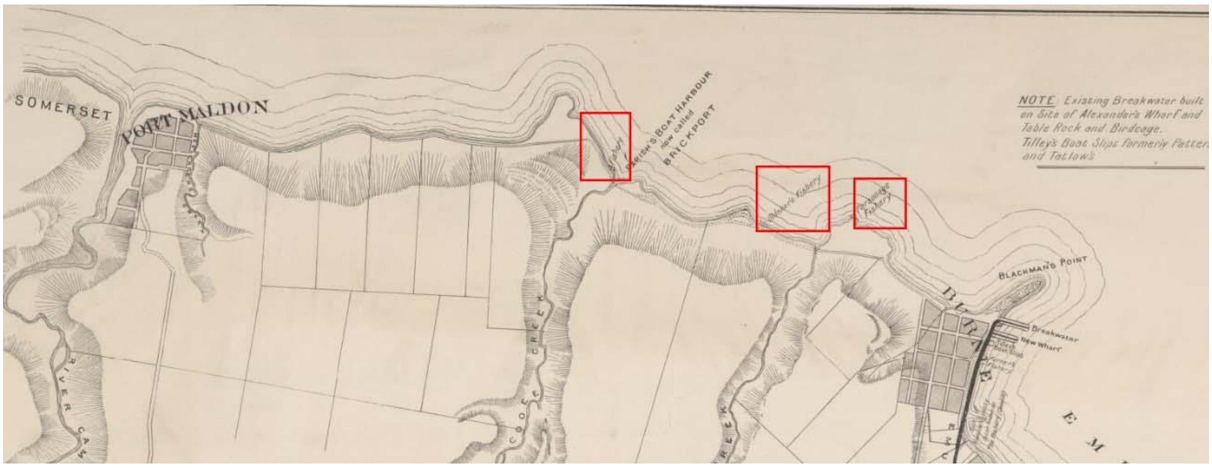

Figure 7-4: Fisheries located near Burnie, Tasmania. Fisheries shown in red.[90]

7.2 Summary of historic maritime cultural activities

From the review of the known history of the study area, the following activities were identified as previously and/or currently occurring across Bass Strait:

- Colonisation and the development of ports and harbours;
- Fishing, sealing, and whaling;
- Intrastate and interstate shipping;
- International shipping, and;
- Sea dumping of ammunition, boats, chemicals and other items.

7.3 Types of maritime heritage sites

From the historical and archaeological summary presented above, the following maritime heritage site types could be expected to be found within the study area:

- Shipwrecks, and;
- Sea dumping sites.

7.4 Located maritime heritage sites

7.4.1 Shipwrecks

No shipwreck sites have been located within the Waratah Bay, Tasmania, or Bass Strait sections of the study area. A review of the AUCHD, VHD, and available historical resources have identified 16 ships known to have wrecked, with a wrecking location possibly within the study area; however, none of these have been located. They are discussed further in Section 7.5.1.

7.4.2 Other finds

Mooring blocks

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[90] **Van Diemen's Land Company. 1901-13?**, A diagram of the northern part of the Van Diemens Land Company Estate of Emu Bay. Truscott & Son, [London] viewed 18 January 2019 https://nla.gov.au/nla.obj-229928301/view

One mooring block (Target BM15 – latitude -41.05620 and longitude 145.99790) was located in the Tasmanian section of the study area during the dive inspections (see Annex A). The concrete mooring block was approximately 1 m high and 1 m wide with embedded steel wire (Figure 7-5 and Figure 7-6). There was also a short length of wire leading away from the block. Figure 7-5 shows the location of this mooring block.

Figure 7-5: Concrete mooring block (BM15) surrounded by a sandy seabed. (Image taken 28 September 2021).

Figure 7-6: Top of concrete mooring block (BM15). Scale in 10 cm increments. (Image taken 28 September 2021).

Tioxide pipeline

A disused pipeline associated with the Tioxide Australia plant, operating from 1949 to 1996, is extant within the study area in Tasmania (Figure 7-7 and Figure 7-8).

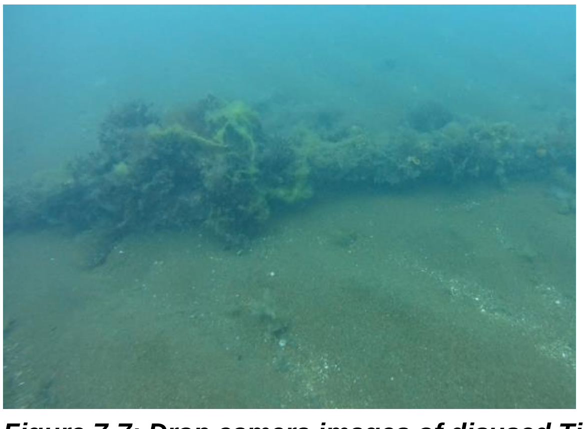

Figure 7-7: Drop camera images of disused Tioxide Australia pipeline; video recorded in 2018. Left image: Latitude -41.064099 and Longitude 145.984916, right image: Latitude - 41.060456 and Longitude 145.987590. Image taken during drop camera surveys conducted by Fugro, 2018.

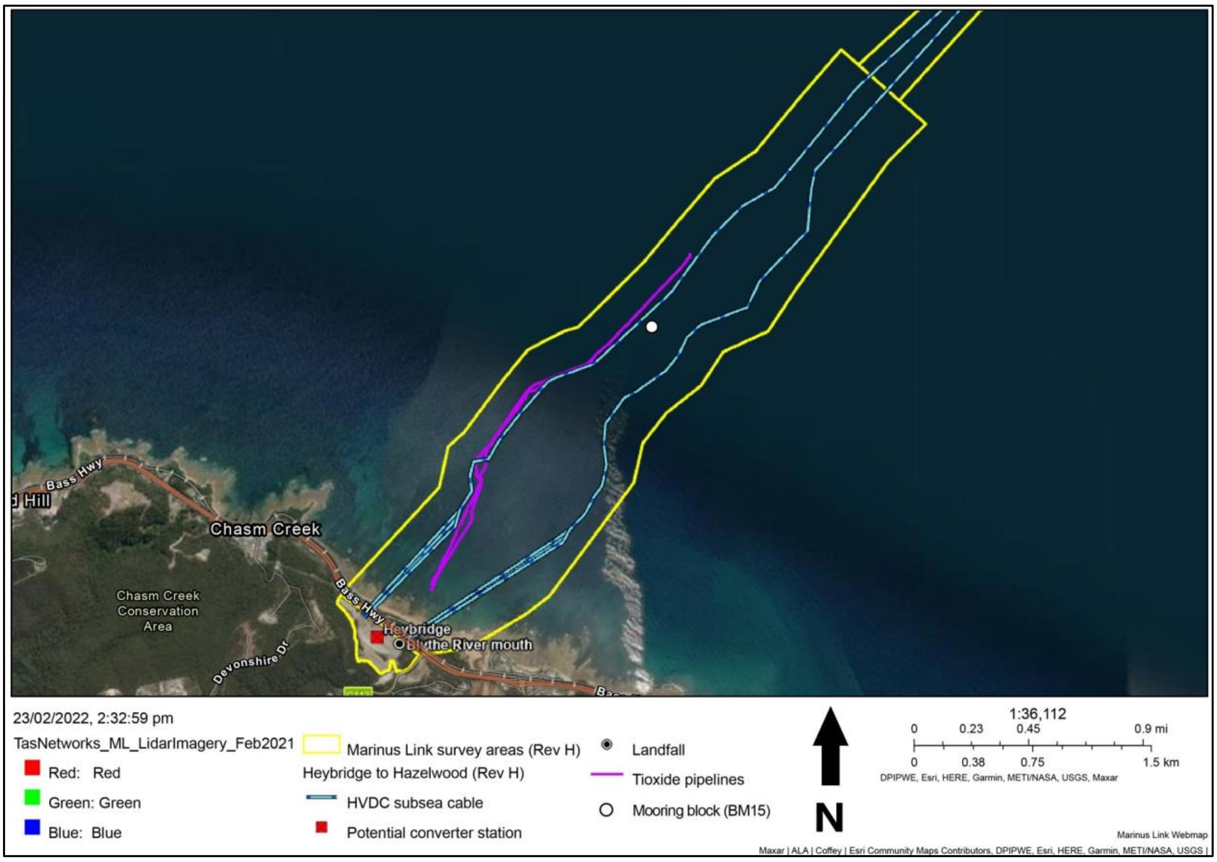

Figure 7-8: Map of Tasmanian portion of study area showing disused Tioxide Australia pipeline (purple lines) and mooring block BM15 (white dot) in relation to proposed cable route (blue lines).

7.4.3 Summary of located maritime heritage

The located maritime heritage within the study area is summarised in Table 7-1.

Table 7-1 Summary of located maritime heritage

Located finds	Victoria Nearshore	Tasmania Nearshore	Offshore
Shipwrecks	None located	None located	None located
Sea dumping	None located	None located	None located
Other finds	None located	• Mooring Block • Disused Tioxide Australia Pipeline	None located

7.5 Potential maritime heritage sites

7.5.1 Shipwrecks

There are at least 16 potential shipwrecks and AHS SD dumped boats located within 5 km of the subsea cables' centrelines. The construction of these vessels includes iron, steel, and wood, built between 1834 and 1945, with tonnages ranging between 10 tons to 7,000 tons.

The main sources used for determining the likelihood of shipwrecks are the AUCHD and the VHR database. While all shipwrecks listed on the VHR have been included on AUCHD, the VHR often does not supply a location for the shipwreck and AUCHD does, based on a sometimes-vague description from historical accounts. Although the positions in AUCHD have been searched and those near the subsea cables' centrelines have been included in Table 7-3, Table 7-4, and Table 7-5, it is possible that many of the AUCHD positions are highly inaccurate. As a result, many shipwrecks that have been discounted could actually be located within the study area, while others could be located well outside the study area.

There is a possibility that there may be further unreported shipwrecks within the study area. However, the northern coast of Tasmania is more indented than the Victorian coast and has historically been more densely settled. As a result, there are more accounts of wrecking events and more geographical features to act as a reference point. Wrecks that have not been found can be more precisely located based on these historical accounts.[91] As such, the AUCHD locations provided for wrecks that have not been found in Tasmanian waters can be considered more accurate than those from other states.

7.5.1.1 Offshore study area

Of the 16 shipwrecks, two shipwrecks are identified to be possibly within 5 km of the Bass Strait offshore cables' centrelines (Table 7-3 and Figure 7-9).

One of the wrecks, the S.S *Kanowna,* was lost in 1929 when it struck a rock off Wilsons Promontory in foggy conditions and drifted into Bass Strait and sank in deep water. The position of where it sank has been given as 22 km (12 nm) southwest of Cleft Island. In 2005, a dive team, Southern Ocean Explorations, announced they had found the wreck in 80 m of water, 50 km into Bass Strait.[92,93] No coordinates were given and though it is almost certain that the wreck was found by the dive team, this does not appear to have been recognised by the relevant government agency – Heritage Victoria.

The other wreck, *Martha & Jane*, sprung a leak 43 km (24 nm) northeast of Table Cape. There are no known reports of this wreck being found.

It should be emphasised that these two wrecks are of sufficient size to have been detected using SSS, magnetometer and multi-beam sonar deployed for this project. However, wreckage associated with these ships may have drifted into the project study area and could be difficult to identify.

The approximate positions of both wrecks place them within 5 km of the subsea cables' centrelines. Due to the general nature of the recorded positions, a 9.5 km accuracy has been assigned to these sites. This means that wreckage associated with these vessels could potentially be located within the study area and/or on the centreline of the dual conceptual cable routes.

There is a potential for other maritime archaeological sites to be located within the study area or surrounds that have not yet been found and/or provided a position (see glossary: potential). This is more relevant for deeper, offshore waters, because they are less-commonly accessed by recreational boat users or divers, and therefore have less chance of being found. The Australian Hydrographic Office lists two ammunition dump sites possibly located within the study area, consisting of small arms dumped in 1969. As the two entries are identical in location, date, and description, it is possible that this represents one dump site entered into the database twice.

Table 7-2 details shipwrecks listed on the VHR which are not supplied with locations but which have been described as being in Bass Strait (without any further specification of location). This list is by no means exhaustive as many other shipwrecks in Bass Strait have not been located, and there is a potential for many other unknown shipwrecks as well.

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91 *Op. Cit.* Diversity Commercial Diving & Maritime Archaeology, 1999: 10.
92 **Southern Ocean Exploration Website: (**Archived) https://web.archive.org/web/20150228134855/http://www.southernoceanexploration.com/, accessed 13 Jun. 19.
93 **The Age: Fyfe, Melissa,** 2005 "A mystery laid to rest as Gallipoli ship found off the Prom" June 6, p.1.

Table 7-2: Shipwrecks that have unknown locations within Bass Strait.

Name	Year Built	Year Wrecked	Construction	Tonnage	Rough Location	Source
Bat	1865	1882	Iron	194	Bass Strait	VHR
Content	1872	1877	UNK	124	Bass Strait	VHR
Favourite	1849	1852	Wood	UNK	Bass Strait	VHR
Kenmore	1882	1894	Iron	UNK	Bass Strait	VHR
Handa Isle	1881	1918	Wood	UNK	Bass Strait	VHR
Mercator	1863	1893	UNK	UNK	Bass Strait	VHR
Result	1852	1880	Wood	UNK	Bass Strait	VHR
Ruby	1834	1859	UNK	UNK	Bass Strait	VHR
Vixen	UNK	1856	UNK	UNK	Possibly Victorian waters	VHR
Victoria	1886	1908	UNK	UNK	Bass Strait	VHR
May Jennings	UNK	1890	Wood	UNK	Bass Strait	VHR
Adelheid	1870	1873	Wood	UNK	Bass Strait	VHR
Madagascar	1837	1853	Wood	952	Bass Strait	VHR

**UNK denotes unknown*

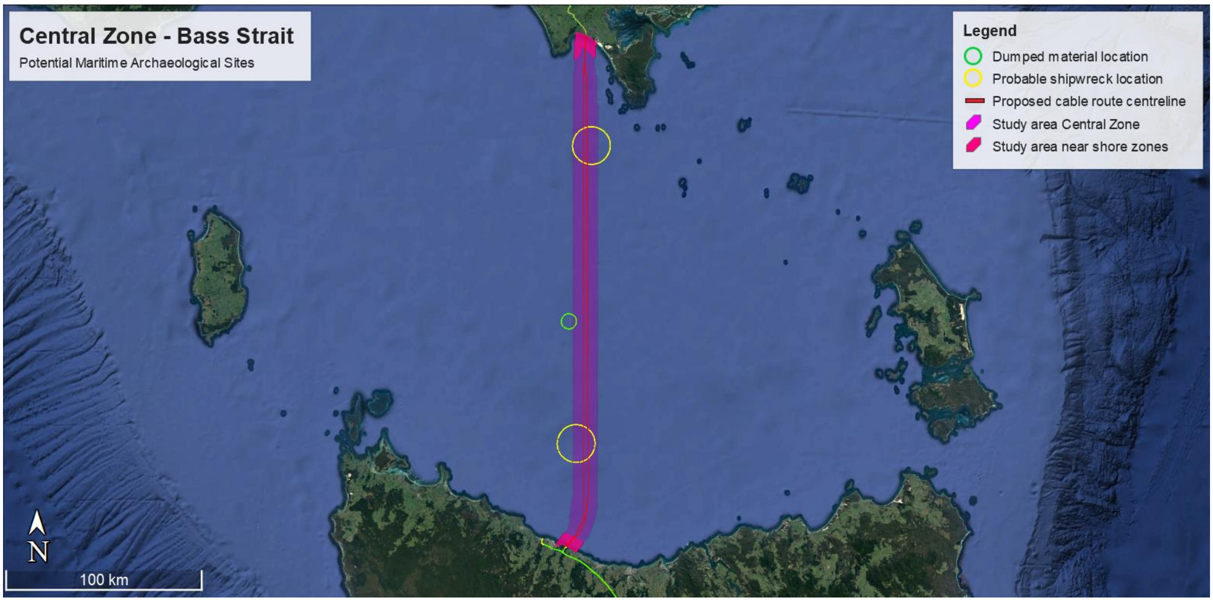


Figure 7-9: Potential sites located within the Bass Strait offshore study area. Note, the AHS SD shows the location for both ammunition dump sites as identical. It is possible that this is only one dump site, added twice to the database.

Table 7-3: Known but unlocated maritime sites within the Bass Strait offshore maritime archaeological study area

Object	Location (UTM Zone 55 G/H)		Location (Lat/Long Decimal Degrees)		Centre point distance from cable (km)	Position accuracy (km)	Source	Description	Year Built	Construction	Engine	Tonnage	Notes
	Easting (m E)	Northing (m S)	Latitude (S)	Longitud(E)									
Shipwreck	418800	5502982	40.62000	146.04000	3.70	9.25	AUCHD	*Martha & Jane*	1869	Wood	No	86	1878, sprang a leak and abandoned 23 miles NE Table Cape.
Shipwreck	424994	5648460	39.31000	146.13000	4.07	9.25	AUCHD	*S.S. Kanowna*	1903	Steel	Yes	7000	1929, struck a rock and sank twelve miles SW Cleft Island, Wilsons Promontory.
Ammunition Dump	414743	5562514	40.08333	145.99999	7.17	4.0	AHS SD	Small arms	N/A	N/A	N/A	N/A	Small arms. 4 tons. 9/7/69
Ammunition Dump	414743	5562547	40.08303	146.00000	7.20	4.0	AHS SD	Small arms	N/A	N/A	N/A	N/A	

7.5.1.2 Victoria nearshore study area

Six maritime heritage sites were identified as being possibly located within 5 km from the dual cables' centrelines in the Waratah Bay nearshore study area (Table 7-4 and Figure 7-10). All six sites are shipwrecks. A review of the SSS, magnetometer and multibeam data, followed up with diving on possible anthropogenic anomalies did not reveal any shipwreck sites within the project geophysical survey area. Nevertheless, there is a possibility that small wreckage – and therefore more difficult to detect - associated with these wreck events may have floated into the vicinity of the Marinus Link alignments.

None of the wrecks have been reported found. The positions for these sites were supplied by the Australasian Underwater Cultural Heritage Database (AUCHD). However, the location provided by the AUCHD for these six wrecks is believed to be a "placeholder" location, as all six sites are given the same coordinates. The associated historical record indicates that these ships either ran aground or were sunk near the shore in Waratah Bay. The large semi-circular polygon in Figure 7-10 is used to visualise the shore area of Waratah Bay, while the small semi-circle refers specifically to the wreck of Domain, known to have run aground near Shallow Inlet. The size and shape of the polygons is associated with the level of accuracy in the records. Note that any of those shipwrecks not noted as running aground could potentially be located within the Bass Strait offshore section of the study area. Refer to Section 2.1.1.2 for a discussion of the assessment of accuracy.

Based on the assessed accuracies of the six wrecks, all are possibly located within the vicinity of the project study area and wreckage, including disarticulated portions of a ship's hull or other associated objects, from one or more could conceivably be located within the vicinity of one or both of the Marinus Link alignments.

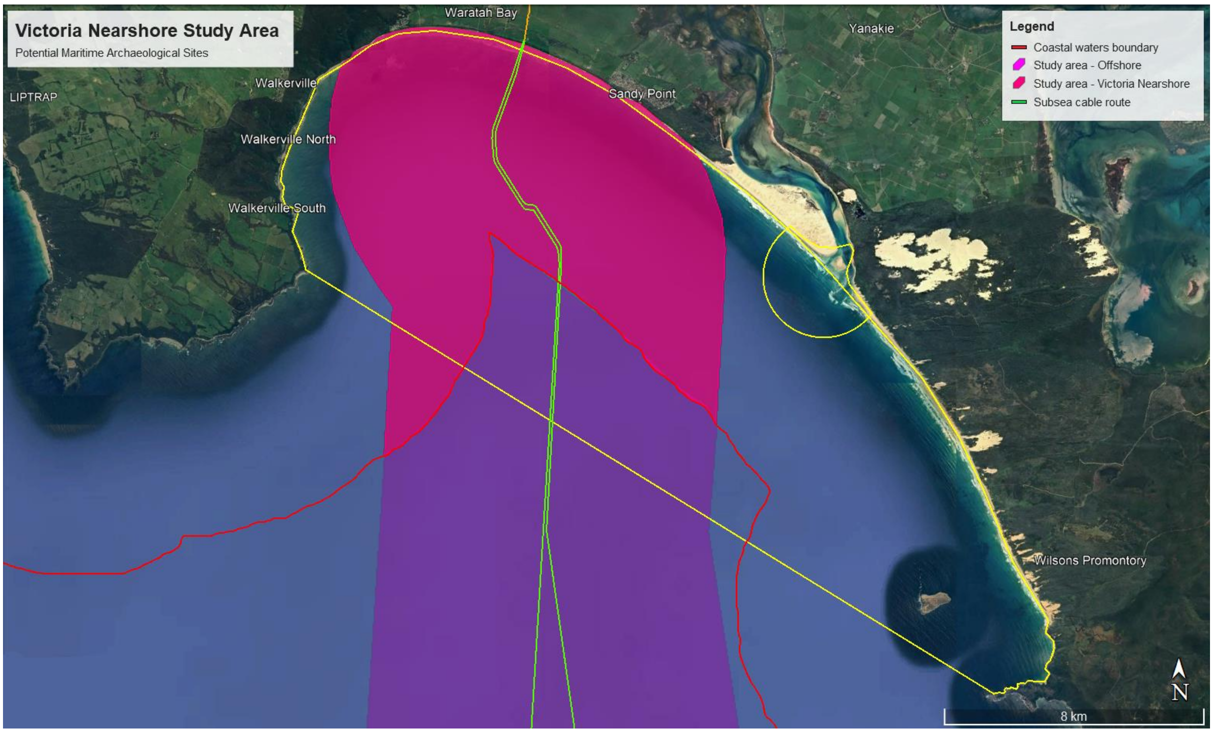


Figure 7-10: Potential sites located within the Victoria nearshore maritime archaeology study area (magenta). Yellow semi-circle and polygons indicate the areas within which shipwrecks could be located based on the level of accuracy noted with the records (note: some shipwrecks noted as wrecking in Waratah Bay might be outside the state water 3 nm mark).

Table 7-4: Known, but unlocated, underwater cultural heritage sites within the Waratah Bay maritime archaeological study area

Object	Location (UTM Zone 55 G/H)		Location (Lat/Long Decimal Degrees)		Centre point distance from cable (km)	Position accuracy (km)	Source	Description	Year Built	Construction	Engine	Tonnage	Notes
	Easting (m E)	Northing (m S)	Latitude (S)	Longitude (E)									
Shipwreck	419463	5683366	38.99500	146.06999	1.43	9.25	AUCHD	*Domain*	1834	Wood	No	UNK	1846, the vessel was blown ashore in Waratah Bay near Shallow Inlet by a gale.
Shipwreck	419463	5683366	38.99500	146.07000	1.43	9.25	AUCHD	*Alcandre*	1862	Wood	No	UNK	1877, sprung a leak and sank near shore.
Shipwreck	419463	5683366	38.99500	146.07000	1.43	9.25	AUCHD	*Bravo*	1866	Wood	No	297	1877, wrecked Waratah Bay, raised and sold as hulk, fate unknown.
Shipwreck	419463	5683366	38.99500	146.07000	1.43	9.25	AUCHD	*Spencer*	UNK	UNK	No	UNK	1854, blown ashore between Cape Liptrap and Wilsons Promontory.
Shipwreck	419463	5683366	38.99500	146.07000	1.43	9.25	AUCHD	*Coquette*	1883	Wood	No	UNK	1892, foundered in Waratah Bay.
Shipwreck	419463.26	5683366.96	38.995000	146.070000	1.43	9.25	AUCHD	*Orbost*	1885	UNK	UNK	UNK	1904, dragged anchors and driven ashore near Wilsons Promontory.

7.5.1.3 Tasmania nearshore study area

Eight shipwrecks were identified as being possibly located within 5 km of the project alignment's centrelines in the Heybridge nearshore study area (Table 7-5 and Figure 7-11). A review of the SSS, magnetometer and multibeam data followed up with diving on possible anthropogenic anomalies did not reveal any shipwreck sites within the geophysical survey area. Nevertheless, there is a possibility that small wreckage – and therefore more difficult t– detect - associated with these wreck events may have floated into the vicinity of the dual conceptual cables' centrelines.

None of the wrecks have been reported as being found. The positions for these items were supplied by the Australasian Underwater Cultural Heritage Database (AUCHD). The accuracy of the wreck locations varies according to the historical information available. Those vessels wrecked close to or on shore at or near an identifiable location such as Sulphur Creek or Emu Bay were given an accuracy position of ±2 km.

Based on the assessed accuracies of one shipwreck, *Midge,* could potentially be located within the vicinity of the cable centreline, and wreckage could be located within the vicinity of one or both of the cable centrelines.

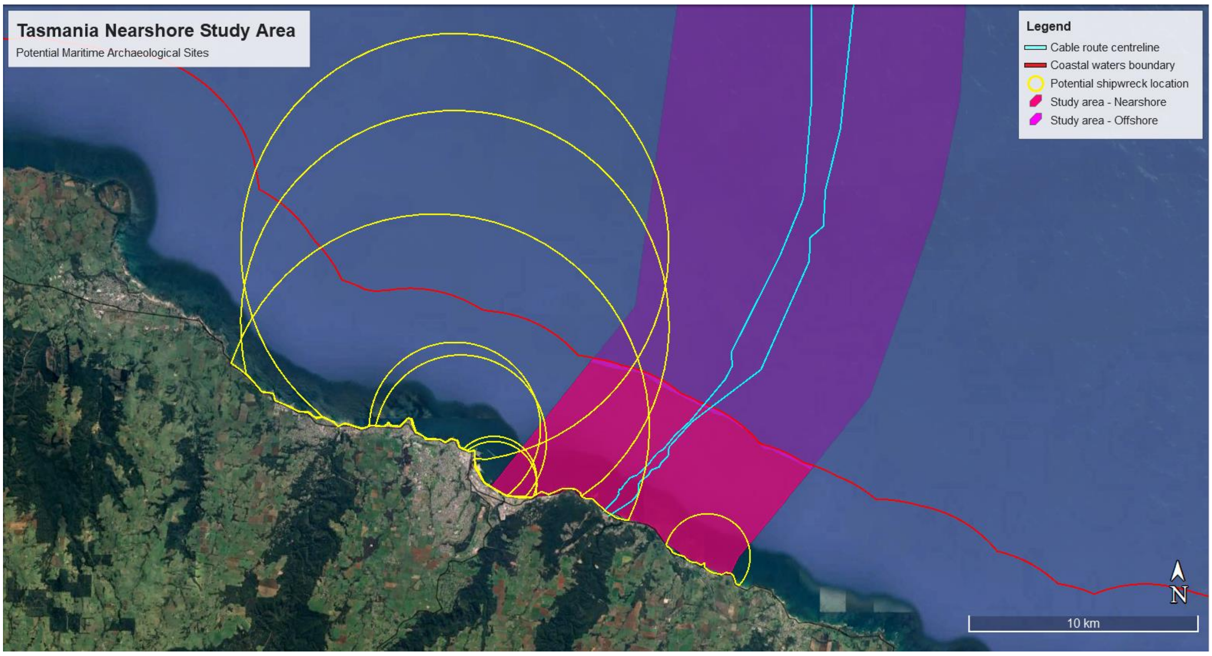


Figure 7-11: Potential sites located within the Tasmania nearshore maritime archaeology study area. (Base Image: Google Earth).

Table 7-5: Known, but unlocated, underwater cultural heritage sites within the Heybridge maritime archaeological study area

Object	Location (UTM Zone 55 G/H)		Location (Lat/Long Decimal Degrees)		Centre point distance from cable (km)	Position accuracy (km)	Source	Description	Year Built	Construction	Engine	Tonnage	Notes
	Easting (m E)	Northing (m S)	Latitude (S)	Longitude (E)									
Shipwreck	418532	5450798	41.09000	146.02999	4.28	2.0	AUCHD	*Swallow*	1854	Wood	No	66	1876, vessel sprung a leak, capsized and foundered near Sulphur Creek, Emu Bay.
Shipwreck	409254	5453798	41.06200	145.91999	5.32	2.0	AUCHD	*James Gibson*	1842	Wood	No	16	1844, vessel driven ashore from anchorage during gale, Emu Bay.
Shipwreck	409252	5454020	41.06000	145.92000	5.43	2.0	AUCHD	*Wave*	1854	Wood	No	33	1855, vessel driven ashore from anchorage during gale, Emu Bay.
Shipwreck	409252	5454020	41.06000	145.92000	5.43	2.0	AUCHD	*Lucy*	1852	Wood	No	25	1863, vessel driven ashore from anchorage during gale, Emu Bay, Burnie.
Shipwreck	407487	5460660	41.00000	145.89999	0.78	9.25	AUCHD	*Meteor*	1881	Wood	Yes	22	1893, vessel sprang a leak and foundered offshore, Cam River.
Shipwreck	407445	5463990	40.97000	145.89999	1.56	9.25	AUCHD	*Blythe Star*	1945	Wood	Yes	138	1959, explosion and fire on board, vessel eventually foundered off Burnie, Bass Strait.
Shipwreck	406702	5456209	41.04000	145.88998	3.32	9.25	AUCHD	*Midge*	UNK	Wood	No	10	1868, parted from anchors while sheltering from gale, Emu Bay, near West Park.
Shipwreck	407543	5456219	41.04000	145.89999	3.93	4.0	AUCHD	*Ariel*	1850	Wood	No	49	1853, vessel drifted onto Blackmans Reef, Emu Bay, hull broke up completely.
Shipwreck	407802	5455667	41.045008	145.902993	7.4	4.0	AUCHD	*Hope*	1848	Wood	No	13	Went ashore at Round Hill, on the eastern side of Emu Bay and was driven further west, on the night of 4 April 1848. All hands landed safely and the cargo was saved, but the vessel appears to have been a total loss.

7.5.2 Other maritime heritage sites

Ammunition dumps

There are two ammunition dump sites recorded as being potentially present within the offshore study area. The positions of the dumped ammunition sites place them beyond 5 km of the subsea cable alignments, but the accuracy of the positions have been assessed as being ±4 km. This means that dumped material could be situated within the project study area. It should be noted that such dump sites could cover a wide area that could extend for a few kilometres.

It is unlikely that there are unknown relatively recent dumping locations as the Australian Government *Environment Protection (Sea Dumping) Act 1981* includes the requirement of a permit to dump material, which is kept on record and made public through Australian Notices to Mariners. It is possible, but unlikely, that the Australian military undertook further dumping in Bass Strait that went unrecorded, especially prior to World War II.

Maritime infrastructure

Maritime infrastructure relating to the Walkerville Limestone mining and kilns in Victoria, including small unrecorded lime boat shipwrecks, cargo, jetties, and wharves may be located to the west of the Waratah Bay study area, but is most likely outside of the study area. Maritime infrastructure features can include pile stumps, linear mounds of rock ballast, artefact deposits, anchors, and other types of moorings.

Unexploded ordnance (UXO)

During World War II, Bass Strait was mined by German U-boats (see Section 7.1). Though these events took place to the east of the study area, there is the remote possibility that the mooring and chain from a mine or a sunken mine itself may be in the vicinity of the Marinus Link.

7.5.3 Unverified anomalies

Geophysical anomalies within the three study areas have been identified through remote sensing data collected by Fugro (see Section 2.2). Geophysical survey data was then analysed by CA to identify any anomalies that could be of cultural origin (see Section 2.2 for discussion of available survey data). Visual dive inspection of anomalies was limited to those located in the nearshore study areas (Victoria and Tasmania) in water depths less than 30 m due to occupational diving standards. Within the areas of both dive inspections, only certain geophysical anomalies were chosen to inspect, due to limitations of depth and time. Only those most likely to be cultural were inspected. Anomalies not inspected, either due to depth or time, are unverified, and remain potentially culturally significant until visually identified.

7.5.3.1 Offshore study area

No geophysical anomalies identified as potential cultural heritage targets were inspected within the offshore study area. In order to visually inspect these geophysical survey anomalies, an ROV survey would be required, as Australian commercial diving regulations limit diving in water depths below 30 m. Within the offshore study area, there are 72 geophysical survey anomalies. Seven anomalies were designated Priority A, meaning that they are potentially culturally significant and within 50 m of the cable alignment. Twenty-five were designated Priority B, meaning that they are potentially culturally significant but beyond 50 m of the cable alignment. Twenty-six anomalies were designated Priority C, meaning that they are most likely natural, not cultural, in origin. Fourteen anomalies were designated

Priority X, lowest priority, including known non-culturally significant features such as the Indigo Cable, trawl scars, and lone magnetometer anomalies. For a more detailed list of all geophysical anomalies within the offshore study area, see Annex C. The locations of the anomalies are shown in Figure 7-12 and an abbreviated table of Priorities A to C anomalies is presented in Table 7-6. Details of the five anomalies (ID: 25, 39, 44, 61, and 67) located within 10 m of the proposed cable route are shown in Table 7-7 and Figure 7-13.

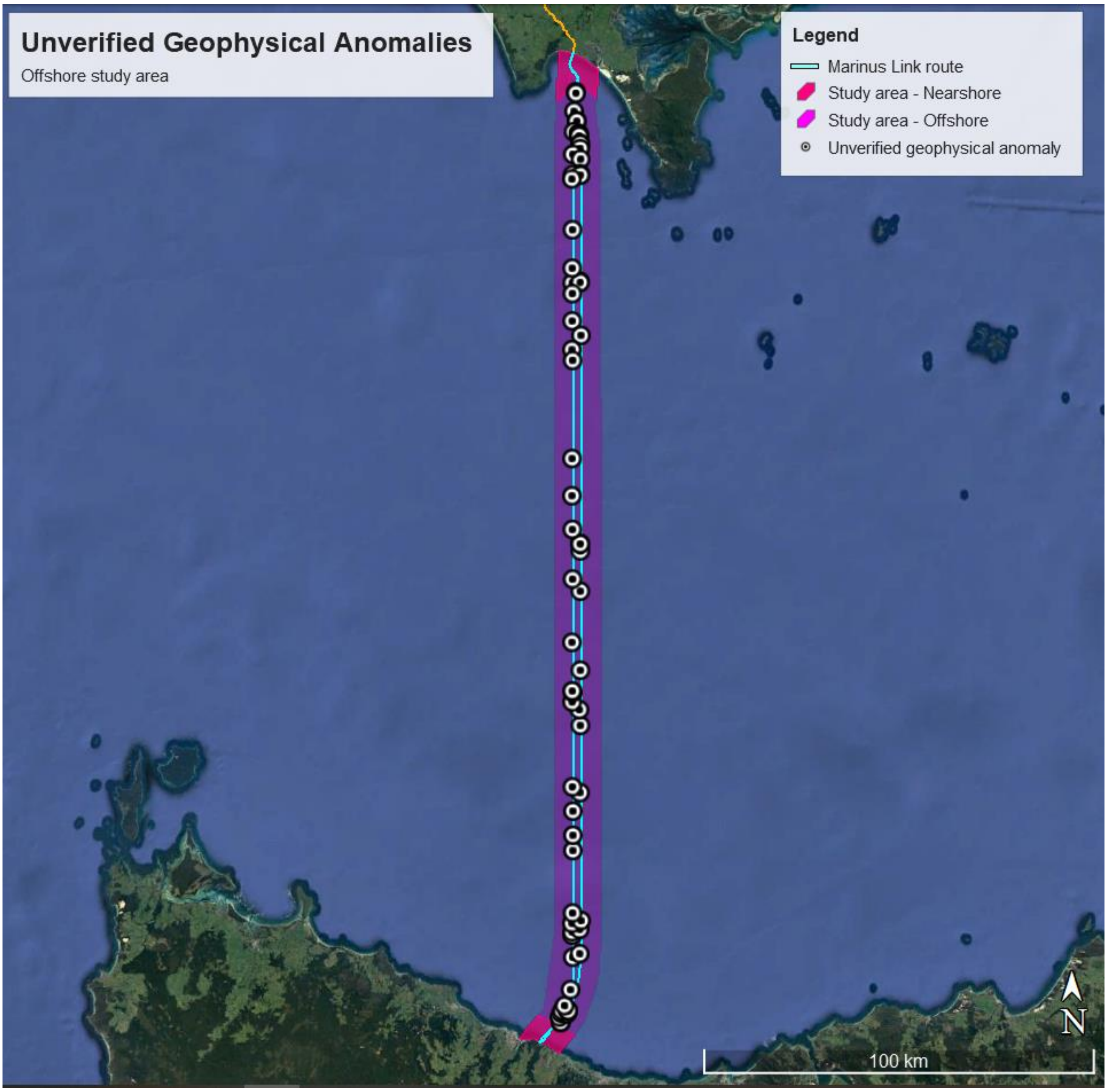
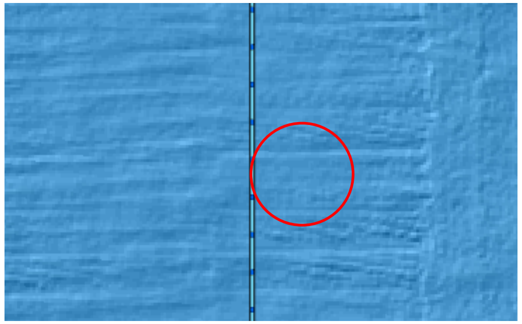
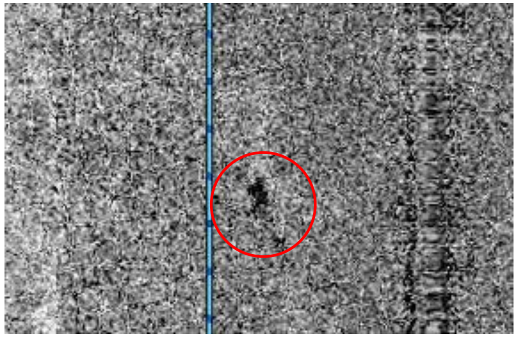
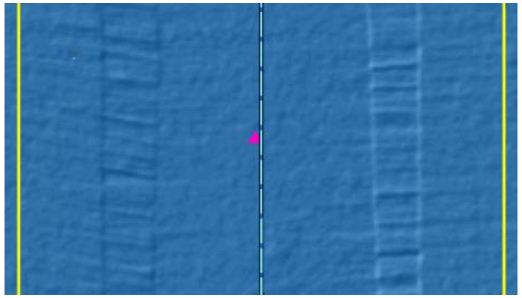
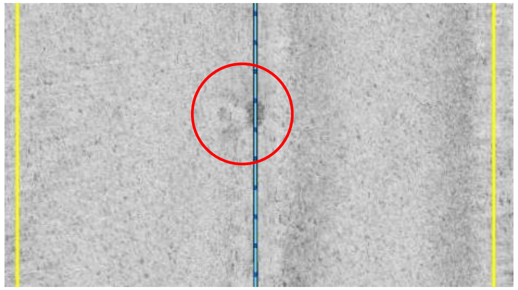
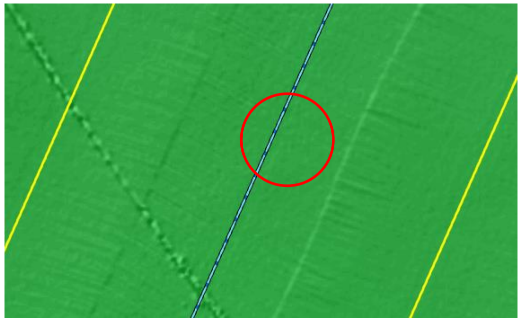
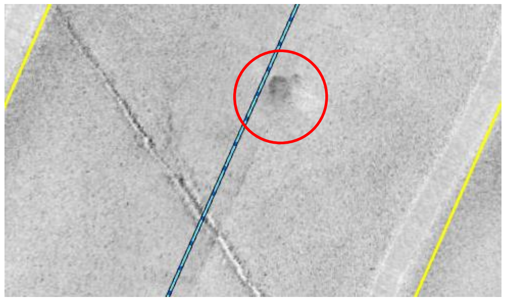


Figure 7-12: Unverified geophysical survey anomalies, offshore study area. See Annex C for images of the targets.

Table 7-6 : Unverified anomalies – Priority A to C – within offshore study area. Anomalies within 10 m of the cable alignment have distances highlighted in red.

Priority	Target ID	ITRF2014		Distance from cable alignment (m)	Priority	Target ID	ITRF2014		Distance from cable alignment (m)	Priority	Target ID	ITRF2014		Distance from cable alignment (m)
		Latitude	Longitude				Latitude	Longitude				Latitude	Longitude	
A	13	-39.0329	146.1066	34	B	31	-39.8238	146.0822	135	C	19	-39.1023	146.0823	86
A	21	-39.3060	146.0833	20	B	38	-40.1580	146.0830	132	C	28	-39.4915	146.0825	103
A	25	-39.3639	146.0836	10	B	45	-40.4868	146.0830	120	C	29	-39.5165	146.0850	134
A	41	-40.2710	146.0845	38	B	47	-40.5412	146.0846	105	C	32	-39.9003	146.0833	44
A	44	-40.3460	146.1069	0	B	49	-40.6310	146.0844	88	C	35	-39.9491	146.1073	48
A	61	-40.9969	146.0697	3	B	53	-40.8111	146.1045	211	C	39	-40.2205	146.1069	2
B	3	-38.9475	146.0888	106	B	54	-40.8168	146.0825	107	C	40	-40.2674	146.0826	125
B	4	-38.9691	146.0966	160	B	56	-40.8667	146.1046	132	C	42	-40.2927	146.0824	136
B	5	-38.9703	146.0968	170	B	65	-41.0043	146.0644	57	C	43	-40.3102	146.1041	238
B	6	-38.9943	146.0874	94	B	68	-41.0244	146.0473	85	C	48	-40.5961	146.0844	100
B	7	-39.0026	146.1033	222	B	72	-39.8011	146.0821	136	C	52	-40.7973	146.0812	173
B	8	-39.0041	146.1037	230	C	1	-38.9029	146.09373	20	C	55	-40.8244	146.0821	100
B	10	-38.9980	146.1020	220	C	2	-38.9063	146.0944	31	C	57	-40.8748	146.0838	47
B	11	-39.0210	146.1060	167	C	9	-39	146.1030	220	C	58	-40.9497	146.0779	172
B	12	-39.0226	146.1069	214	C	14	-39.0460	146.0850	129	C	60	-40.9972	146.052	66
B	15	-39.0577	146.1088	163	C	16	-39.0899	146.1062	16	C	63	-41.0039	146.0499	177
B	20	-39.2182	146.0841	122	C	17	-39.0927	146.0843	85	C	64	-41.0034	146.0644	93
B	22	-39.3349	146.1041	208	C	18	-39.0937	146.1074	86	C	67	-41.0231	146.0471	10
B	30	-39.7391	146.0826	102										

Table 7-7: MBES and SSS imagery and details of five anomalies within 10 m of the proposed cable route.

	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
Offshore Study Area										
A	25	-39.36396	146.08369			No	Object, low relief, potentially covered in relatively thin layer of sediment.	Length: 10m; Width: 5m	75m	10m
A	44	-40.34603	146.10693			No	FUGRO Object ID: 161; Possible Possibly item of debris – dumped or wreckage.	Length: 10.1m; Width: 8m	80m	0m
A	61	-40.99690	146.06970			No	Debris, non-ferrous with some relief, See Target ID 62. Trawler scar is visible in image.	Length: 10m; Width: 8m	50m	3m

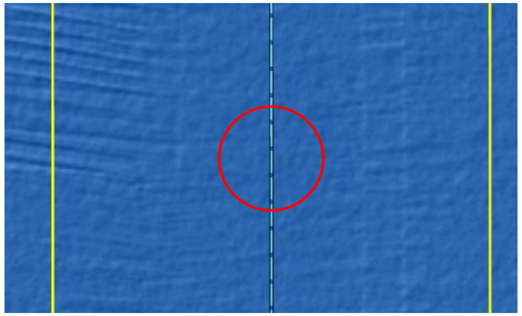
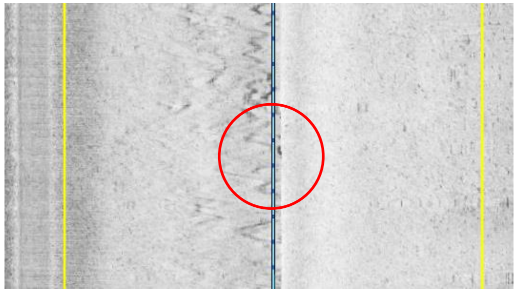
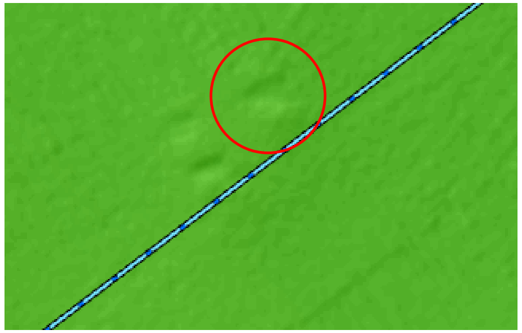
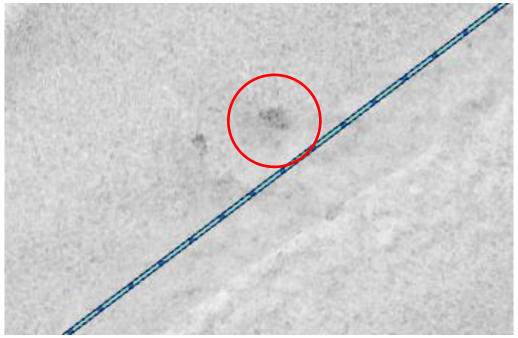
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
C	39	-40.2205	146.1069			No	Possible data acquisition error	Length: 4m; Width: 2m	80m	2m
C	67	-41.02316	146.04717			No	Probable natural feature, isolated reflective patch within what may be shallow depressions.	Length: 10m; Width: 6m	45m	10m

Figure 7-13: Locations of five targets within 10 m of the proposed cable route in offshore study area. A class targets are green; C class targets are red. KPs marked every 10 km.

7.5.3.2 Victoria nearshore study area

Prior to the alignment of the project Victoria shore crossing, ten geophysical survey anomalies were inspected in the Victoria Nearshore study area, while a further twelve targets were not inspected. None of these unverified anomalies are within 200 m of the new subsea cable Victoria shore crossing alignment.

Review of the 2023 geophysical survey data covering the realigned Victoria shore crossing identified 7 geophysical anomalies of potential cultural origin (see Figure 7-14 and Table 7-8). Only one of these, target WB23_004 is within 200 m of the proposed subsea cable route and this has been interpreted as a natural anomaly. None of the unverified targets identified from the 2023 data have been visually inspected.

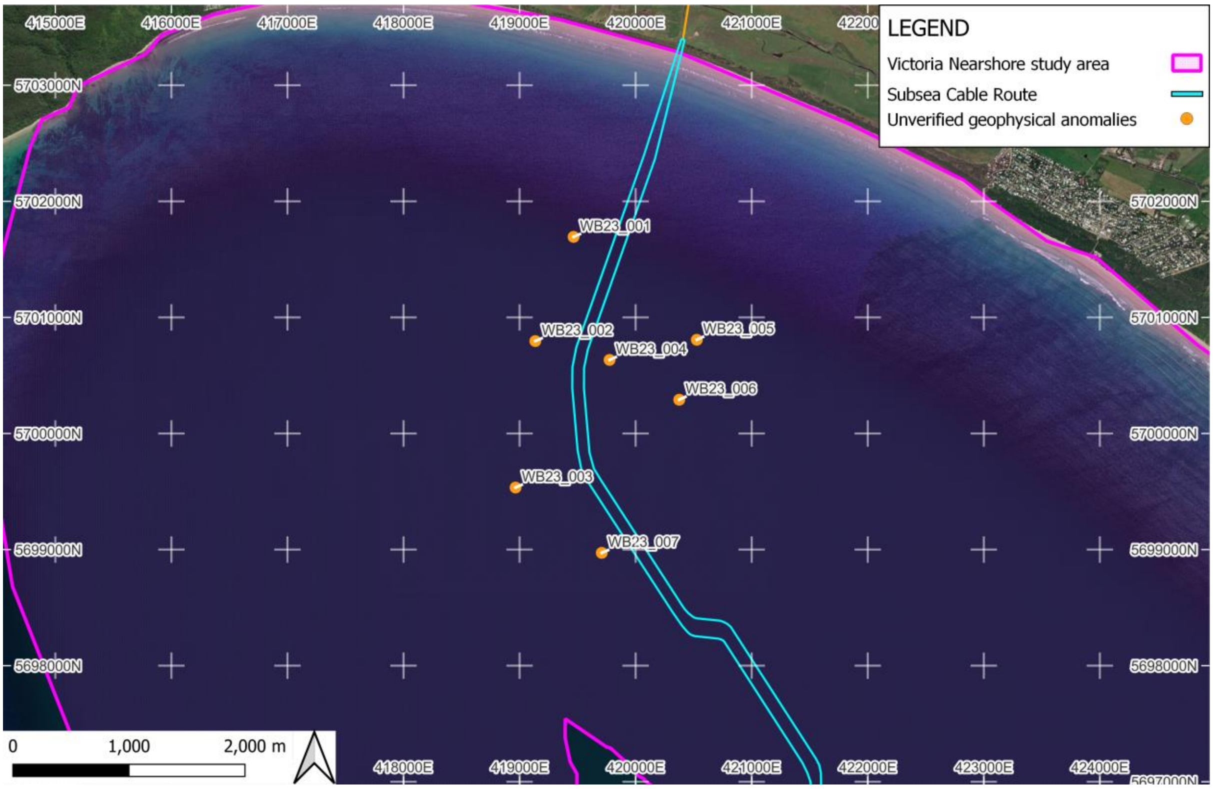


Figure 7-14: Unverified geophysical survey anomalies within the Victoria Nearshore study area.

Table 7-8: Uninspected geophysical anomalies in the Victoria Nearshore study area.

Priority	Target ID	ITRF2014		Depth (LAT)	Description
		Latitude	Longitude		
C	WB23_001	-38.830	146.072	16	Isolated object, debris or natural. 3.7 m x 3.5 m x 0.4 m high
B	WB23_002	-38.838	146.068	17	Linear feature, rock outcrop or debris. 6.1 m x 1.4 m x 0.5 m high
C	WB23_003	-38.849	146.066	19	Likely natural feature. 6.8 m x 2.6 m x 0.5 m high.
C	WB23_004	-38.839	146.076	17	Natural feature
B	WB23_005	-38.838	146.084	17	Possible wreck, more likely rock outcrop. 30.9 m x 9.5 m x 0.75 m high.

Priority	Target ID	ITRF2014		Depth (LAT)	Description
		Latitude	Longitude		
B	WB23_006	-38.843	146.082	18	Linear feature, possible chain. 29.7 mx 1 m x 0.6 m high.
C	WB23_007	-38.854	146.075	20	Isolated object or natural feature. 4.2 m x 1.7 m x 0.3 m high.

7.5.3.3 Tasmania nearshore study area

Seven geophysical survey anomalies were inspected in the Tasmania nearshore study area, including all targets designated priority A and B (see Section 2.3, Figure 2-12, and Table 2-3). The inspections concluded that six of the seven anomalies were not of cultural heritage origin and will not be further assessed in this report. The other anomaly was that of a mooring block (BM15). A further 29 targets were not inspected, six Priority C and 23 Priority X. Priority C targets were made up of small, isolated objects, most likely natural rocks and boulders. Priority X targets included the disused Tioxide plant outfall pipelines, and 20 magnetometer targets with no associated MBES or SSS signatures. For a detailed listing of all geophysical anomalies, including coordinates, see Annex C.

Figure 7-15: Unverified geophysical survey anomalies, Tasmania nearshore study area.

Table 7-9 : Unverified anomalies – Priority C – within Tasmania nearshore study area

Priority	Target ID	ITRF2014	
		Latitude	Longitude
C	10	-41.04895	146.00684
C	7	-41.05598	145.99770
C	5	-41.05807	145.99336
C	2	-41.06711	145.98425
C	15	-41.04384	146.01084
C	13	-41.05675	146.00523

7.6 Predicted condition of maritime heritage sites

7.6.1 Shipwrecks

There are no located wrecks in the study area, and it is very unlikely that relatively large-engine vessels have been wrecked in the area and remained undocumented or undetected by the MBES, SSS and magnetometer surveys conducted for this project. There is the possibility that smaller watercraft – timber, aluminium or even fibreglass – may have been lost in the area and these would be more difficult to detect.

Of the known shipwrecks and boat dumps potentially situated in the vicinity of the study area that have known tonnage, the majority of shipwrecks (13 out of 16) were of wooden construction and all but one were less than 300 tons. These range from construction dates of 1832 to 1945. Out of the 13 wooden shipwrecks, two had engines.

Wooden hulled vessels generally survive poorly above the surface of the sediment, with a possibility of significant sections of the hull preserved beneath the sand. The engine components of such wrecks would be visible and may appear on a magnetometer.

For larger vessels, there may be a significant amount of ferrous material from ship fittings that would resist the degradation experienced by wooden elements and create a debris pile on top of the sediment. The ferrous remains may appear in SSS data but would be difficult to identify as it would appear as a scatter of dumped debris rather than having the shape of a ship. This would be even less likely for smaller vessels with less ferrous remains.

Only one of the 16 identified shipwrecks, SS *Kanowna*, was identified as being of steel or iron construction. If an iron or steel shipwreck is found, it is likely that a large amount of the hull would still remain for these vessels along with engine components and other large internal features. If located on a rocky seabed, these shipwrecks would likely be of high relief. Even if the seabed is sandy, these shipwrecks may still be prominent features due to their size and loss within the last 150 years; although this is a considerable amount of time for natural forces to break down the wreck or cover it with sediment, the size of the wrecks are large enough to endure these processes with only minimal to medium effect. These wrecks would likely be very visible in SSS data as a long-defined feature. The high relief of the vessel would likely create a considerable amount of 'shadow' in the data.

If a shipwreck is found of iron and steel constructed vessels, smaller than 500 tons, a reasonable amount of the hull would likely still remain for these shipwrecks and dumps, more so for the newer built and larger vessels. On rocky seabed they would likely be of high relief but on sandy seabed it may be that these smaller shipwrecks have sunk further into the seabed or experienced sedimentation and so would have a much lower relief. These shipwrecks and dumps may still appear in SSS data similar to the larger vessels but would have smaller features and perhaps less definition.

Timber-hulled watercraft would have broken up in the relatively shallow water in a relatively short period of time, as the integrity of the structure would have been weakened by marine borer damage. Watercraft built from polymers or metal alloys would survive intact for longer.

In the sandy parts of the study area, it is possible that wreckage could be partially buried. The nature of the seabed – being coarse sand – suggests that wreckage would not be entirely buried, with parts of wrecks expected to protrude into the water column.

Wreckage from vessels wrecked outside the study area could have washed in and become partially buried. Outboard motors that have fallen off the transoms of small dinghies are not an uncommon find in popular fishing locations or around anchorages.

7.6.2 Other

Discard from vessels

Losses and discards from vessels can include personal objects, food and drink containers, ships fittings and equipment, fishing and boating equipment. Loss of cargo is less likely in the Waratah Bay study area as there are no historic port facilities, and the area is not within major shipping lanes to Port Philip Bay. It is more likely near the Tasmanian coast, due to the proximity to the ports of Burnie and Devonport, but still unlikely within the study area. Lost cargo being present in the Bass Strait study area is considered very unlikely, but possible.

If lost accidentally, these items may have been in use and were functional at the time of the incident, but if discarded, these items may be damaged or broken pieces for disposal. They can consist of a range of materials and are mostly single items but can occur in scatters created by one event or multiple events. Higher concentrations would be closer to shore where vessels were more likely to be moored or anchored, rather than in the shipping channel, however the sections of the study area in Waratah Bay and near the Tasmanian coast are not well protected and would be an unlikely place for vessels to moor.

7.7 Summary of maritime heritage potential

Underwater maritime heritage potential is determined through historical and comparative site research augmented with the findings of the diving and geophysical and geotechnical investigations undertaken for this project. The conditions of the underwater cultural heritage value is also predicted based on the understanding of the site conditions and underwater maritime heritage site formation processes.

Within the three study areas there is potential for archaeological remains associated with shipwrecks, and on-water activity to be present. By combining known sites, the assessed distribution of potential sites, and the understanding of historical activities within the study area, a rating of differing ‘maritime heritage potential’ have been defined (Table 7-10). The term ‘likelihood of presence’ used in this study refers to the likelihood of a site type being present, such as a shipwreck. With regards to archaeological deposits formed around moorings, maritime infrastructure and general discards from vessels underway, the ‘likelihood of presence’ could be considered an estimated measure of the density of such deposits across the seabed.

Table 7-10: Defining maritime heritage (archaeological) potential

Maritime Heritage Potential	Likelihood of presence
Certain	100%
Very likely	85–99%
Likely	50–84%
Unlikely	16–49%
Very unlikely	1–15%
Remote	< 1%

The potential for maritime heritage sites within the study area has been assessed from historical sources, marine geophysical data and underwater dive inspections and is presented in Table 7-11 to Table 7-13.

Table 7-11: Maritime heritage potential within the offshore study area.

Site type	Maritime Heritage potential	Known or predicted location
Shipwrecks	Very unlikely	No located shipwrecks within the study area. Review of geophysical data did not identify any obvious shipwrecks. There is the possibility for the remains of small watercraft to be present such as dinghies, tenders, canoes, kayaks, surf skis as well as wreckage from the recorded or known wrecks.
Discard	Very unlikely	The relative remoteness of Bass Strait and the offshore location of most of the study area would suggest discard from vessels was not a common occurrence.
Dumping	Very unlikely	Review of geophysical data did not identify any obvious dump or debris scatters. Known dump sites are located well outside of the Offshore study area.
UXO	Very unlikely	The magnetometer data provided did not provide any clarity on the presence or otherwise of UXO.

Table 7-12: Potential maritime heritage within the Victoria nearshore study area.

Site type	Maritime Heritage potential	Known or predicted location
Discard	Likely	Potentially immediately adjacent to the shoreline, within the vicinity of Sandy Point. Such discard is unlikely to be of historic significance, and is more likely to be modern in origin, owing to the relatively modern (second half 20th century) development of Sandy Point as a tourist town. Such material would not, necessarily, have been detected by marine geophysical survey.
Shipwrecks (where marine geophysical survey conducted)	Very unlikely	No located shipwrecks within the study area. Small likelihood that shipwreck material may have washed into the study area. Also, the possibility for the remains of small watercraft to be present such as dinghies, tenders, canoes, kayaks, surf skis.
Shipwrecks (where marine geophysical survey not conducted, that is, the new shore crossing alignment)	Unlikely	

Table 7-13: Potential maritime heritage within the Tasmania nearshore study area.

Site type	Maritime Heritage potential	Known or predicted location
Discard	Likely	Potentially immediately adjacent to the shoreline. Such discard is unlikely to be of historic significance, and is more likely to be modern in origin, possibly related to the former Tioxide Australia plant. Such material would not necessarily have been detected by marine geophysical survey.
Shipwrecks	Very unlikely	No located shipwrecks within the study area. Small likelihood that shipwreck material may have washed into the study area. Also, the possibility for the remains of small watercraft to be present such as dinghies, tenders, canoes, kayaks, surf skis.

8 CULTURAL HERITAGE SIGNIFICANCE

8.1 Introduction

An assessment of cultural heritage significance seeks to understand and establish the importance or value that a site, place or landscape may have to the community at large. The concept of cultural heritage significance is intrinsically connected to the physical components of a site, its location, setting and relationship with its surrounds; as well as the traditional, spiritual, historical social, and scientific meaning attached to the site. The assessment of cultural significance is ideally a holistic approach that draws upon the response that all of these factors evoke from the community, as well as the professional judgement of heritage managers regarding the characteristics of the site and its historical context, with consideration for relevant legislative, policy and guideline frameworks.

Understanding the cultural heritage significance of a known or potential underwater cultural heritage site is critical in determining an appropriate level of mitigation, proportionate to the level of significance of the site. The criteria and process for assessing cultural heritage significance can differ for Aboriginal and non-Aboriginal heritage due to different treatment in State and Commonwealth legislation. The significance criteria are detailed below, followed by significance assessments for the known sites and potential site types.

8.2 Aboriginal heritage significance criteria

The Australian ICOMOS *Charter for the Conservation of Places of Cultural Significance 1999* – the Burra Charter – divides heritage significance into four main categories for the purpose of assessment: social, historical, scientific and aesthetic values.[94] These values as they relate to Aboriginal heritage are described as follows:

Social value

Social value refers to the spiritual, traditional, historical or contemporary associations and attachments which the place or area has for the Aboriginal community. Places of social significance have associations with contemporary community identity, and social or cultural value is seen as the way in which people express their connection with a place and the meaning that place has for them. These places can have associations with tragic or warmly remembered experiences, periods, or events. Communities can experience a sense of loss should a place of social significance be damaged or destroyed. These aspects of heritage significance can only be identified through consultation with relevant Aboriginal communities.

Historic value

Historic value refers to the associations of a place with a person, event, phase, or activity of importance to the history of an Aboriginal community. Places of historic value may or may not have physical evidence of their historical importance (such as structures, planted vegetation or landscape modifications). These places may also have ‘shared’ historic values with other (non-Aboriginal) communities – i.e., places of post-contact Aboriginal history.

[94] **NSW Office of Environment and Heritage, Department of Premier and Cabinet, 2011**, Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW.

Scientific value

Scientific value refers to the importance of a landscape, area, place, or object because of its archaeological and/or other technical aspects. Assessment of scientific value is often based on the likely research potential of the area, place, or object and would consider the importance of the data involved, its rarity, quality or representativeness, and the degree to which it may contribute further substantial information.

Aesthetic value

Aesthetic value refers to the sensory, scenic, architectural, and creative aspects of the place. It is often closely linked with social values and may include consideration of form, scale, colour, texture, and material of the fabric or landscape, and the smell and sounds associated with the place and its use.

In Tasmania the above significance criteria from the Burra Charter are followed however the statement of social significance is prepared by the Aboriginal Heritage Officer who is a Tasmanian Aboriginal community member whose key role is to liaise with the Aboriginal community, and/or the Aboriginal community.[95]

In Victoria a similar range of broad values are used to assess significance; these being:

(a) archaeological, anthropological, contemporary, historical, scientific, social or spiritual significance; and

(b) significance in accordance with Aboriginal tradition.[96]

These values can be ascribed to those listed in the Burra Charter as follows:

Table 8-1: Burra charter significance values and their relevant Victorian Aboriginal Cultural Heritage Significance Values.

Burra Charter significance values	Victorian Aboriginal Cultural Heritage Significance Values
Social	*Anthropological, Contemporary, Social, Spiritual and Tradition*
Historic	*Historical*
Scientific	*Archaeological, scientific*
Aesthetic	N/A

8.3 Maritime heritage significance criteria

An assessment of maritime cultural heritage significance seeks to understand and establish the importance or value that a place, site or item may have to the community, as well as heritage managers and professionals. The Australian ICOMOS Charter for the Conservation of Places of Cultural Significance (the Burra Charter 1979, most recently revised in 2013) is the standard adopted by most heritage practitioners in Australia when assessing

[95] **Aboriginal Heritage Tasmania, September 2022**, Aboriginal Heritage – Standards and Practice.
[96] **Aboriginal Victoria August 2016** Guide to preparing a Cultural Heritage Management Plan. For the purposes of the Aboriginal Heritage Act 2006.

significance. It defines cultural significance as "aesthetic, historic, scientific or social value for past, present or future generations".

This value may be contained in the fabric of the item, its setting and relationship to other items, the response that the item stimulates in those who value it now, or the meaning of that item to contemporary society.

The sections below outline the Commonwealth, Tasmanian and Victorian criteria for ascribing cultural heritage significance.

8.3.1 Commonwealth heritage criteria

The Commonwealth lists nine criteria against which the heritage values of a place are tested for inclusion on the Commonwealth Heritage List:

1. The place has significant heritage value because of the place's importance in the course, or pattern, of Australia's natural or cultural history
2. The place has significant heritage value because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history
3. The place has significant heritage value because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history
4. The place has significant heritage value because of the place's importance in demonstrating the principal characteristics of:
    - a class of Australia's natural or cultural places; or
    - a class of Australia's natural or cultural environments
5. The place has significant heritage values because of the place's importance in exhibiting particular aesthetic characteristics values by a community or cultural group
6. The place has significant heritage value because of the place's importance in demonstrating a high degree of creative or technical achievement at a particular period
7. The place has significant heritage value because of the place's strong or special association with a particular community or cultural group for social, cultural, or spiritual reasons
8. The place has significant heritage value because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history
9. The place has significant heritage value because of the place's importance as part of Indigenous tradition.

8.3.2 Underwater Cultural Heritage Act 2018 Criteria

On 18th December 2018 the Minister for the Environment issued a set of Rules to accompany the UCH 2018 Act.[97] Part 2 of the Rules describes the criteria to be used for articles (such as archaeological sites and artefacts) not automatically protected under the act. These are as follows:

(a) the significance of the article in the course, evolution or pattern of history;

(b) the significance of the article in relation to its potential to yield information contributing to an understanding of history, technological accomplishments or social developments;

(c) the significance of the article in its potential to yield information about the composition and history of cultural remains and associated natural phenomena through examination of physical, chemical or biological processes;

[97] Minister for the Environment, Commonwealth Government, 18 December 2018 *Underwater Heritage Rules 2018.*

(d) the significance of the article in representing or contributing to technical or creative accomplishments during a particular period;

(e) the significance of the article through its association with a community in contemporary Australia for social, cultural or spiritual reasons;

(f) the significance of the article for its potential to contribute to public education;

(g) the significance of the article in possessing rare, endangered or uncommon aspects of history;

(h) the significance of the article in demonstrating the characteristics of a class of cultural articles.

8.3.3 Tasmanian heritage criteria [98]

Assessments of significance are made by applying the following standard evaluation criteria provided by Heritage Tasmania to establish a statement of significance. These criteria are based on the Burra Charter:

- Criterion (a): It is important in demonstrating the **evolution or pattern** of Tasmania's history.
- Criterion (b): It demonstrates **rare, uncommon or endangered aspects** of Tasmania's heritage.
- Criterion (c): It has **potential to yield information** that will contribute to an understanding of Tasmania's history.
- Criterion (d): It is important as a representative in **demonstrating the characteristics** of a broader class of cultural places.
- Criterion (e): It is important in demonstrating a **high degree of creative or technical** achievement.
- Criterion (f): It has strong or special meaning for any group or community because of **social, cultural or spiritual associations**.
- Criterion (g): It has a special association with the **life or work of a person, a group or organisation** that was important in Tasmania's history.

8.3.4 Victorian heritage criteria [99]

In 2008, the Heritage Council of Victoria adopted a set of heritage assessment criteria; Criterion G was updated in 2019. These criteria are based on the Burra Charter:

- Criterion (a): Importance to the **course, or pattern**, of Victoria's cultural history.
- Criterion (b): Possession of **uncommon, rare or endangered aspects** of Victoria's cultural history.
- Criterion (c): **Potential to yield information** that will contribute to an understanding of Victoria's cultural history.
- Criterion (d): Importance in **demonstrating the characteristics** of a class of cultural places and objects.

[98] **Department of Primary Industries, Parks, Water and Environment 2011**, *Assessing Historic Heritage Significance for Application with the* Historic Cultural Heritage Act 1995.
[99] **Heritage Council of Victoria 2019**, Victorian Heritage Register Criteria and Threshold Guidelines.

- Criterion (e): Importance in demonstrating a **high degree of creative or technical** achievement at a particular period.
- Criterion (f): Strong or special association with a particular present-day community or cultural group for **social, cultural or spiritual reasons**.
- Criterion (g): **Special association** with the life or work of a person, or group of persons, of importance in Victoria's cultural history.

8.4 Grading of heritage significance criteria

All cultural heritage sites and objects have a level of significance. Some sites or objects are more culturally significant than others. The cultural heritage significance of a site or object is usually measured against factors such as representativeness or rarity, and cultural value on local, regional, state, national and international levels. Significance also takes into consideration the physical condition of a site. For this study, the condition of the predicted sites within the study area cannot be proven or validated without an underwater dive inspection or test excavation. Therefore, the significance of the predicted site types within the study area will be described without reference to their presence or condition. It is anticipated that should field surveys/testing take place and presence of sites are verified, their significance will be re-evaluated taking into consideration their verifiable condition.

Table 8-2 describes the levels of cultural heritage significance assigned to this assessment for scientific/archaeological and historical values.

Table 8-2: Grading of cultural heritage significance

Grading	Description
Outstanding	A unique or rare site type that can change our understanding of cultural practices in Australia or associated with a signature event in the development of the Australian nation.
High	A unique or rare site type that makes an important contribution to the understanding of cultural practices in Tasmania or Victoria.
Medium	A relatively common site type that contributes to the understanding of cultural practices in Tasmania or Victoria.
Low	A relatively common site type that provides some understanding of cultural practices in Tasmania or Victoria.
Very low	A relatively ubiquitous site type that would provide little new information to cultural practices in Tasmania or Victoria.

8.5 Significance assessment of underwater Aboriginal heritage

The assessment of cultural heritage significance assesses the potential scientific and/or archaeological values of the predicted archaeological sites and/or features that are most likely to be found in association with the submerged landforms identified in this report (see Section 6.6.3). The assessment of the significance of the scientific/archaeological values of the predicted archaeological sites/features is based on predictive modelling as the presence and condition of the predicted sites has not been confirmed.

With regards to submerged Aboriginal archaeological sites that may be present, any surviving sites would likely have high scientific significance because of the potential to yield information that would contribute to an understanding of Australia's (including Tasmania and Victoria) cultural history (

Table 8-3). Maritime Aboriginal archaeological sites and Pleistocene Aboriginal archaeological sites are both rare site types within a national Australian context. The identification of submerged Aboriginal archaeological values within the survey project area would be the first discovery of its kind in south-eastern Australia. An examination and analysis of such archaeological sites would contribute substantial information about Aboriginal technologies, land use strategies and exploitation of natural resources during the Pleistocene era. Additionally, such sites would yield important information about post-depositional processes and survival rates of Aboriginal archaeological sites and landscapes after sea level rise and inundation.

Table 8-3 : Assessed scientific/archaeological significance of predicted site types within study area

Submerged landforms	Depositional context	Site Type Association	Scientific/Archaeological significance	Significance
Beach Ridge Strandplain, indurated	Coastal intertidal – formation, terrestrial alluvial/colluvial	Artefact, scatter	The significance of these site types are generally equivalent to those on land but would likely have enhanced values on the basis that they are associated with an older inundated Pleistocene landscape.	High
Beach Ridge	Coastal intertidal/aeolian – Sand dune	Midden		
		Artefact, scatter		
		Artefact, isolated		
	Coastal intertidal – Cobbles	Midden		
		Stone arrangement (hide)		
		Stone arrangement (fish trap)		
		Artefact, scatter		
		Artefact, isolated		
		Quarry		
Estuarine / Tidal Channel	Coastal intertidal/fluvial	Artefact Scatter		
		Midden		
Entrenched Stream Gully / Channel	Terrestrial fluvial	Artefact, scatter		
		Artefact, isolated		
		Midden		
		Quarry		
		Rock shelter		

Formal advice has not yet been obtained from the Traditional Owner groups consulted during the preparation of this report regarding the traditional significance of the Aboriginal cultural heritage values of the potential archaeological sites and the potential intangible heritage significance of submerged landforms identified in this assessment. An Aboriginal cultural values assessment (CVA) program is currently underway. This program will obtain advice from Traditional Owners regarding the tangible and intangible cultural heritage values that they associate with submerged landscapes within Victorian waters. The information obtained during the CVA program will then be incorporated into the cultural heritage management plan (CHMP) that are being prepared for the Victorian portion of the project. Given the absence of formal advice, the significance assessment has adopted a view expressed by many Traditional Owners that all Aboriginal cultural heritage is highly significant, and for this reason the assessments determined for all Aboriginal cultural values against the social criterion were all rated as High (places or values which have a highly significant social connection for a cultural group at either the local and/or state and/or national level).

8.6 Significance assessment of maritime heritage

The assessment of the cultural significance of maritime heritage sites will be separated into located sites where their condition is understood and unlocated maritime heritage by site type. An attempt has been made to inspect as many remote sensing anomalies as possible within the 30-m occupational diving depth limit in both nearshore study areas. Any anomalies not visually inspected cannot have their cultural heritage significance confidently assessed. No visual survey was conducted in the offshore study area, as it was determined by the client that re-aligning the cables to avoid geophysical anomalies was more practical than inspection by ROV or offshore diving.

8.6.1 Cultural heritage significance of located maritime heritage sites

The cultural heritage significance of the only two located maritime heritage sites are presented in Table 8-4. They are both in Tasmanian waters and are assessed according to that state's criteria.

Table 8-4 : Cultural heritage significance of located maritime heritage sites

Site	Criterion A (Historical)	Criterion B (Rare, uncommon or endangered)	Criterion C (ability to yield information)	Criterion D (Characteristic)	Criterion E (Creative/technical)	Criterion F (Social, cultural, spiritual)	Criterion G (Person, group, or organisation)	Significance Level
Mooring block (BM15)	It is not known what the mooring was used for. Its proximity to the disused Tioxide Australia pipeline suggests a connection with its installation. **Very low**	Concrete moorings are ubiquitous in Tasmania. **Very low**	There is very little new relevant information that can be obtained from the further study of this item. **Very low**	This item can be considered to be characteristic of concrete moorings but not a standout example. **Very low**	The item is expected to be of general construction and display little technical innovation. **Very low**	No known social cultural or spiritual connections to any known group or culture. **Does not meet threshold**	No known association with well-known person(s). **Does not meet threshold**	**Very low**
Tioxide Australia Pipeline	Tioxide Australia was a major industry and employer in northwest Tasmania. The pipeline was used to eject industrial waste product into the sea. It is a reminder of earlier times when environmental controls were limited. **Very Low**	Effluent pipelines were commonplace for many industries located along shorelines in 20th century. **Very Low**	There is very little new relevant information that can be obtained from the further study of this item. **Very low**	This item can be considered to be characteristic of pipelines but not a standout example. **Very Low**	The item is expected to be of general construction and display little technical innovation. **Very low**	The pipeline has some connection with inhabitants of Heybridge and those who worked there. **Very Low**	No known association with well-known person(s). **Does not meet threshold**	**Very low**

8.6.2 Cultural heritage significance by site type

General statements of cultural heritage significance for potential site types have been prepared in accordance with the relevant criteria listed in Sections 8.3.1 to 8.3.4, and are provided in Table 8-5. The statements incorporate what is known or predicted about site types within the three areas of this assessment. The range of gradings reflects the fact that the cultural heritage significance of sites cannot be fully assessed until their identify, nature and condition is known.

Table 8-5: Significance assessment by site type - Commonwealth

Site Types	Criterion 1 (Historical)	Criterion 2 (Rare, uncommon or endangered)	Criterion 3 (ability to yield information)	Criterion 4 (Characteristic)	Criterion 5 (Aesthetic)	Criterion 6 (Creative/technical)	Criterion 7 (Community, cultural, social spiritual)	Criterion 8 (Person)	Significance Level
Shipwrecks	Shipwrecks within the study area would reflect the changing waterborne activities in Bass Strait, from commercial based fishing, cargo and passenger carrying to recreational boating. **Medium** to **high**	There is a limited number of shipwrecks recorded in Bass Strait, and locally built vessels from the 19th and early 20th century, particularly inshore craft like fishing or recreational boats or even work punts and barges, are under-reported. **Medium** to **high**	Early (19th to mid-20th century) locally built boats, both commercial and recreational, are rare and the wrecks of such vessels would contribute to our understanding of early Australian boat building traditions. **Medium** to **high**	Early colonial ships could be characteristic of in early Australian shipbuilding traditions. **Medium** to **high**	Any shipwrecks present within the study area would be of low relief and mostly buried giving them little aesthetic appeal. **Low**	Recorded shipwrecks in the wider area would be expected to be of general construction and display little technical innovation. **Low**	No known community or cultural/social or spiritual association. **Does not meet threshold**	No known association with well-known person(s). **Does not meet threshold**	**Potentially medium to high**
Sea dumping sites	Sea dumping sites are varied in their content. Ship abandonment sites would likely be more historically significant than chemical or ammunition dump sites. **Low**	Sea dumping sites are common across Australia. **Low**	Sea dumping sites would possibly supply some information on whether what was dumped matched the historical record **Low**	Sea dumping sites may appear on the seabed in a variety of forms. There wouldn't necessarily be a characteristic type. **Very low**	Sea dumping sites would have some aesthetic appeal as an artificial reef. **Very low**	Sea dumping sites would not be expected to have any technical merit. **Very low**	No known community or cultural/social or spiritual association. **Does not meet threshold**	No known associations with well-known person(s) **Does not meet threshold**	**Low**
Discard from vessels	Discard from vessels would reflect the changing habits and material culture of those engaged in waterborne activities in Bass Strait over time. **Low.**	The presence of cultural material on the seabed within Bass Strait would be ubiquitous. **Very low.**	Discard from vessels would generally be of minimal cultural heritage significance. The exception would be unusual items (in character or date of manufacture), which could provide some new understanding of the cultural development of the project area that is not readily available in the historical record. **Low.**	Discard is unlikely to have intrinsic characteristic properties. Unusual and singular items could be potentially characteristic of historic industries, such as sealing and shore whaling. **Low.**	Discard from vessels within the study area would have very little aesthetic appeal. **Very low.**	Discard from vessels within the study area would unlikely have any technical merit. **Low**	No known community or cultural/social or spiritual association. **Does not meet threshold**	No known association with well-known person(s). **Does not meet threshold**	**Low**

Table 8-6: Significance assessment by site type - Tasmania

Site Types	Criterion A (Historical)	Criterion B (Rare, uncommon or endangered)	Criterion C (ability to yield information)	Criterion D (Characteristic	Criterion E (Creative/technical)	Criterion F (Social, cultural, spiritual)	Criterion G (Person)	Significance Level
Shipwrecks	Shipwrecks within the study area would reflect the changing waterborne activities in Bass Strait and the north west Tasmanian coastline, from commercial based fishing, cargo and passenger carrying to recreational boating. **Medium** to **high**	There is a limited number of shipwrecks recorded off the north west Tasmanian coast, and locally built vessels from the 19th and early 20th century, particularly inshore craft like fishing or recreational boats or even work punts and barges, are under-reported. **Medium** to **high**	Early (19th to mid-20th century) locally built boats, both commercial and recreational, are rare and the wrecks of such vessels would contribute to our understanding of early Australian boat building traditions. **Medium** to **high**	Early colonial ships could be characteristic of in early Australian shipbuilding traditions. **Medium** to **high**	Recorded shipwrecks in the wider area would be expected to be of general construction and display little technical innovation. **Low**	No known community or cultural/social or spiritual association. **Does not meet threshold**	No known association with well-known person(s). **Does not meet threshold**	**Potentially medium to high**
Sea dumping sites	Sea dumping sites are varied in their content. Ship abandonment sites would likely be more historically significant than chemical or ammunition dump sites. **Low**	Sea dumping sites are common across Australia and in Bass Strait. **Low**	Sea dumping sites would possibly supply some information on whether what was dumped matched the historical record **Low**	Sea dumping sites would may appear on the seabed in a variety of forms. There wouldn't necessarily be a characteristic type. **Very low**	Sea dumping sites would not be expected to have any technical merit. **Very low**	No known community or cultural/social or spiritual association. **Does not meet threshold**	No known associations with well-known person(s) **Does not meet threshold**	**Low**
Discard from vessels	Discard from vessels would reflect the changing habits and material culture of those engaged in waterborne activities off the north west Tasmanian coast over time. **Low.**	The presence of cultural material on the seabed off the north west Tasmanian coast would be ubiquitous and forms ambient background 'noise' in the underwater landscape. **Very low.**	Discard from vessels would generally be of minimal cultural heritage significance. The exception would be unusual items (in character or date of manufacture), which could provide some new understanding of the cultural development of the project area that is not readily available in the historical record. **Low.**	Discard is unlikely to have intrinsic characteristic properties. Unusual and singular items could be potentially characteristic of historic industries, such as sealing and shore whaling. **Low.**	Discard from vessels within the study area would unlikely have any technical merit. **Low**	No known community or cultural/social or spiritual association. **Does not meet threshold**	No known association with well-known person(s). **Does not meet threshold**	**Low**

Table 8-7: Significance assessment by site type - Victoria

Site Types	Criterion A (Historical)	Criterion B (Uncommon, rare or endangered)	Criterion C (Historical information)	Criterion D (Characteristic)	Criterion E (Creative/technical)	Criterion F (Social, cultural, spiritual)	Criterion G (Person)	Significance Level
Shipwrecks	Shipwrecks within the study area would reflect the changing waterborne activities in Bass Strait and off the Victorian coast, from commercial based fishing, cargo and passenger carrying to recreational boating. **Medium** to **high**	There is a limited number of shipwrecks recorded off the Victorian coast, and locally built vessels from the 19th and early 20th century, particularly inshore craft like fishing or recreational boats or even work punts and barges, are under-reported. **Medium** to **high**	Early (19th to mid-20th century) locally built boats, both commercial and recreational, are rare and the wrecks of such vessels would contribute to our understanding of early Australian boat building traditions. **Medium** to **high**	Early colonial ships could be characteristic of in early Australian shipbuilding traditions. **Medium** to **high**	Recorded shipwrecks in the wider area would be expected to be of general construction and display little technical innovation. **Low**	No known community or cultural/social or spiritual association. **Does not meet threshold**	No known association with well-known person(s). **Does not meet threshold**	**Potentially medium to high**
Sea dumping sites	Sea dumping sites are varied in their content. Ship abandonment sites would likely be more historically significant than chemical or ammunition dump sites. **Low**	Sea dumping sites are common across Australia and in Bass Strait. **Low**	Sea dumping sites would possibly supply some information on whether what was dumped matched the historical record **Low**	Sea dumping sites would may appear on the seabed in a variety of forms. There wouldn't necessarily be a characteristic type. **Very low**	Sea dumping sites would not be expected to have any technical merit. **Very low**	No known community or cultural/social or spiritual association. **Does not meet threshold**	No known associations with well-known person(s) **Does not meet threshold**	**Low**
Discard from vessels	Discard from vessels would reflect the changing habits and material culture of those engaged in waterborne activities off the Victorian coast over time. **Low.**	The presence of cultural material on the seabed off the Victorian coast would be ubiquitous and forms ambient background 'noise' in the underwater landscape. **Very low.**	Discard from vessels would generally be of minimal cultural heritage significance. The exception would be unusual items (in character or date of manufacture), which could provide some new understanding of the cultural development of the project area that is not readily available in the historical record. **Low.**	Discard is unlikely to have intrinsic characteristic properties. **Low.**	Discard from vessels within the study area would unlikely have any technical merit. **Low**	No known community or cultural/social or spiritual association. **Does not meet threshold**	No known association with well-known person(s). **Does not meet threshold**	**Low**

9 AREAS OF CULTURAL HERITAGE SENSITIVITY

9.1 Establishing cultural heritage sensitivity

Underwater cultural heritage sensitivity combines underwater cultural heritage potential and cultural heritage significance. This is an effective way to address the nature of submerged cultural remains where archaeological deposits can cover wide areas and associated with certain submerged landforms, as well as for discrete archaeological sites such as a wreck or the archaeological deposits around a jetty.

This approach also assesses the significance of impacts and guides the devising of appropriate mitigation measures. For example, there may be extensive areas with high concentrations of dumped material. The archaeological potential would be considered very likely but be of low heritage value, thereby being considered to be sensitive. Alternatively, a discrete area such as an early 19th century wreck site with an archaeological potential assessed as to be very unlikely but with high cultural heritage values resulting in the seabed where this wreck could be being considered to be a very sensitive area. The grading of maritime heritage sensitivity is presented in Table 9-1.

Table 9-1: Grading of maritime heritage sensitivity

Term	Heritage Sensitivity
Extremely sensitive	Site or site type whose archaeological potential is certain or very likely, assessed to be of State or National significance and assessed to be, or likely to be, in good condition.
Very sensitive	Site or site type whose archaeological potential is unlikely or very unlikely assessed to be of State or National significance in poor or fragmentary condition, or;
	A site/site type or object of Local significance whose archaeological potential is certain or likely to be present and assessed to be, or likely to be, in good condition, or;
	An uncommon site type such as a shipwreck whose significance could only be determined by further investigation.
	A seabed anomaly that has not had its cultural heritage significance assessed.
Sensitive	An isolated object of local significance or a site of local significance in poor or fragmentary condition, or;
	A site or site type which may be of State or National significance where there is very low potential for archaeological remains to be present.
Not very sensitive	Site which has been disturbed and so unlikely to have any archaeological potential.
Not sensitive	Seabed has been disturbed by dredging and has removed all cultural material down to bedrock.

With regards to submerged terrestrial sites that may be present, the assessment of heritage sensitivity is more nuanced, largely because of the paucity of such sites having been recorded in Australia. Figure 9-1 combines the likelihood of presence category defined in **Step H** (Section 2.4) against the cultural heritage significance assessment in Section 8.4 into a ranked scale from 1 to 9. A low number represents a feature or landform that has a low likelihood of hosting a site which is assessed to be of low potential heritage significance, while a high number represents a feature or landform that has a high likelihood of hosting a site of high potential significance. Site types that are either high likelihood of presence and low significance or low likelihood of presence and high significance will have a similar ranking, that being 5.

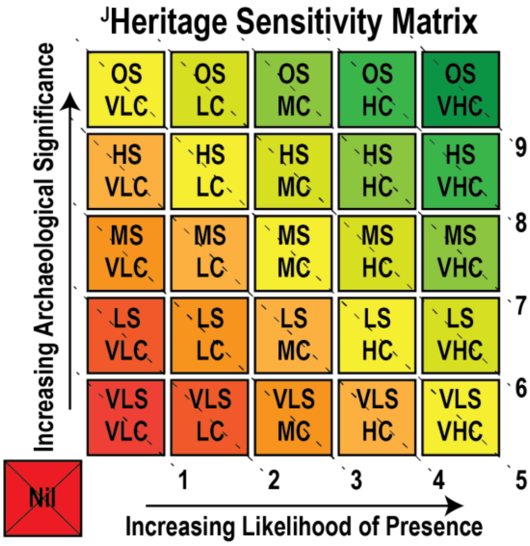


Figure 9-1: Submerged terrestrial sites heritage sensitivity matrix. Significance level on top of box, ranking from very low significance (VLC) to low (LS), medium (MS), high (HS), and outstanding (OS); likelihood of presence on bottom of box, ranking from very low confidence (VLC), low confidence (LC), medium confidence (MC), high confidence (HC), and very high confidence (VHC).

The gradings used for the heritage sensitivity of the submerged terrestrial sites that may be present correlate with the maritime heritage sensitivity ratings as follows in Table 9-2:

Table 9-2: Heritage sensitivity grading

Maritime heritage sensitivity	Submerged terrestrial heritage sensitivity
Extremely sensitive	8 to 9
Very sensitive	6 to 7
Sensitive	3 to 5
Not very sensitive	1 to 2
Not sensitive	Nil

9.2 Underwater Aboriginal heritage sensitivity

The assessment of the heritage sensitivity of submerged terrestrial sites that may be present within the project study area is presented in Table 9-3 and Figure 9-2. The recent marine sediments and submerged landforms are assessed as having minimal confidence of artefacts being present. The sensitivity ratings were determined using the sensitivity matrix in Section 2.4.

Table 9-3 : Cultural heritage sensitivity of predicted submerged terrestrial sites that may be present within the study area

Submerged landforms	Depositional context	Site Type Association	Presence and condition	Sig.	Cultural Heritage Sensitivity Matrix Low 1 to 9 High	Chart Depth* (m)	KP (km)	Study Area
Beach Ridge Strandplain, indurated	Coastal intertidal – formation, terrestrial alluvial/colluvial	Artefact, scatter	Very low confidence	High	4 (Sensitive)	-15 to -20	1.8 to 3.7	Victorian Nearshore
Estuarine / Tidal Channel	Coastal intertidal/fluvial	Artefact Scatter	Very low confidence	High	4 (Sensitive)	-76	27-27.5	Offshore
		Midden	Very low confidence	High	4 (Sensitive)	-76	27-27.5	Offshore
Beach Ridge	Coastal intertidal/aeolian – Sand dune	Midden	Medium confidence	High	6 (Very sensitive)	-45 to -65	235 - 245	Offshore
		Artefact, scatter	Low confidence	High	5 (Sensitive)	-45 to -65	235 - 245	Offshore
		Artefact, isolated	Very low confidence	High	4 (Sensitive)	-45 to -65	235 - 245	Offshore
	Coastal intertidal – Cobbles	Midden	Low confidence	High	5 ((Sensitive)	-45 to -65	235 - 245	Offshore
		Stone arrangement (hide)	Low confidence	High	5 (Sensitive)	-45 to -65	235 - 245	Offshore
		Stone arrangement (fish trap)	Medium confidence	High	6 (Very sensitive)	-45 to -65	235 - 245	Offshore
		Artefact, scatter	Low confidence	High	5 (Sensitive)	-45 to -65	235 - 245	Offshore
		Artefact, isolated	Low confidence	High	5 (Sensitive)	-45 to -65	235 - 245	Offshore
		Quarry	Very low confidence	High	5 (Sensitive)	-45 to -65	235 - 245	Offshore
Entrenched Stream Gully / Channel	Terrestrial fluvial	Artefact, scatter	Very low confidence	High	4 (Sensitive)	0 to -25	250 - 255	Tasmania Nearshore
		Artefact, isolated	Very low confidence	High	4 (Sensitive)	0 to -25	250 - 255	Tasmania Nearshore
		Midden	Very low confidence	High	4 (Sensitive)	0 to -25	250 - 255	Tasmania Nearshore
		Quarry	Very low confidence	High	4 (Sensitive)	0 to -25	250 - 255	Tasmania Nearshore
		Rock shelter	Very low confidence	High	4 (Sensitive)	0 to -25	250 - 255	Tasmania Nearshore

* indicates the minimum water depth at lowest astronomical tide.

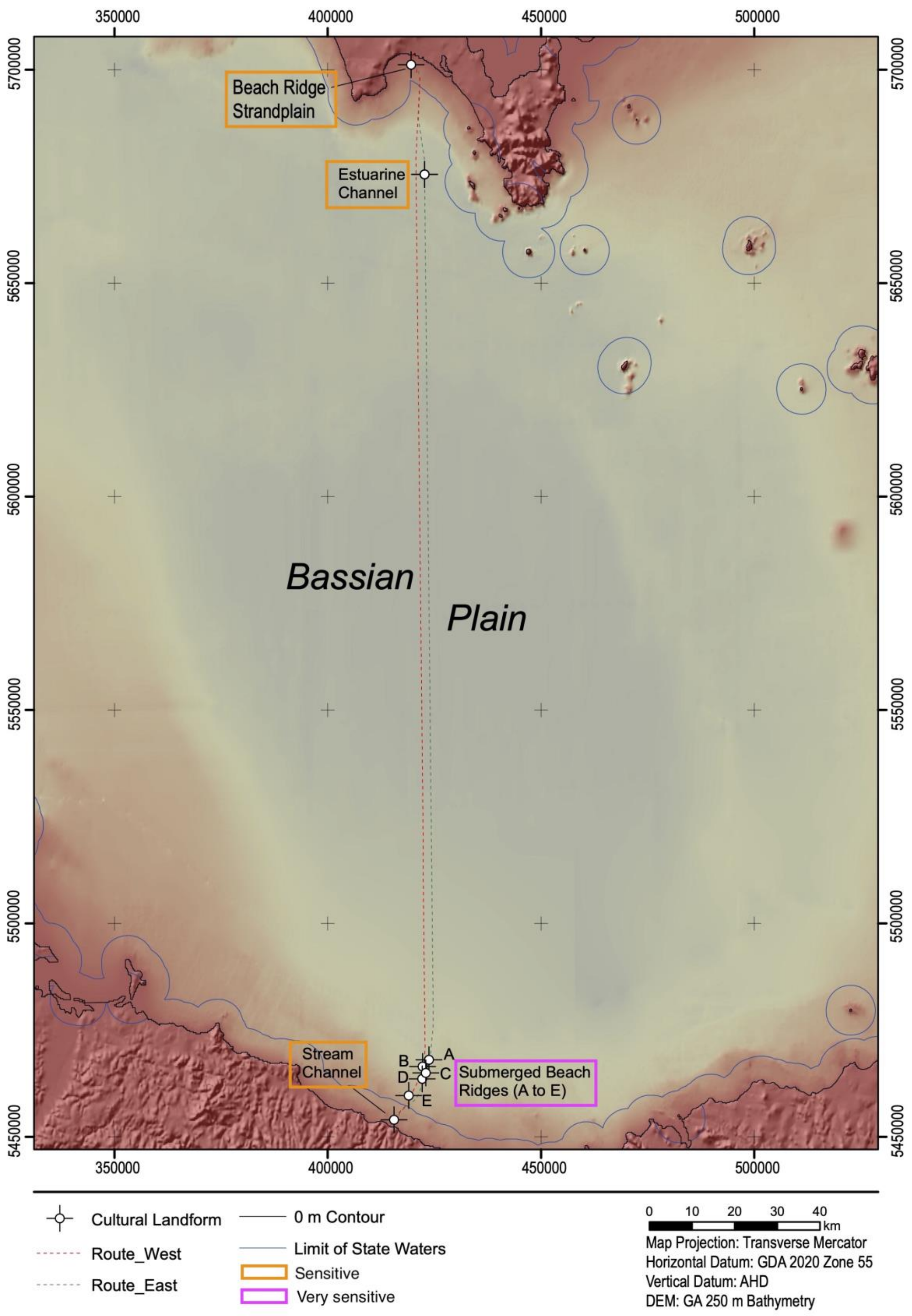


Figure 9-2 : Location of predicted submerged terrestrial sites within the study area

9.3 Assessment of cultural heritage sensitivity

9.3.1 Offshore study area

The majority of the offshore study area is categorised as 'sensitive' with regards to maritime cultural heritage, on the basis that sufficient investigation has been carried out to have confidence that shipwrecks are very unlikely to be present. The exception to this sensitivity classification is the unverified geophysical survey anomalies detailed in section 7.5.3.1. Because these anomalies have not been visually inspected as yet, there is no way of determining for certain their level of cultural significance. Though it is likely that many of these anomalies may be of low cultural significance, or even natural features, there is a possibility that one or more of the anomalies may be wreckage or other culturally significant items. Because of this, they cannot be dismissed as being just sensitive and are designated as being very sensitive (Figure 9-3). The uncertainty surrounding these anomalies will not be an issue if they are not impacted by the proposed works.

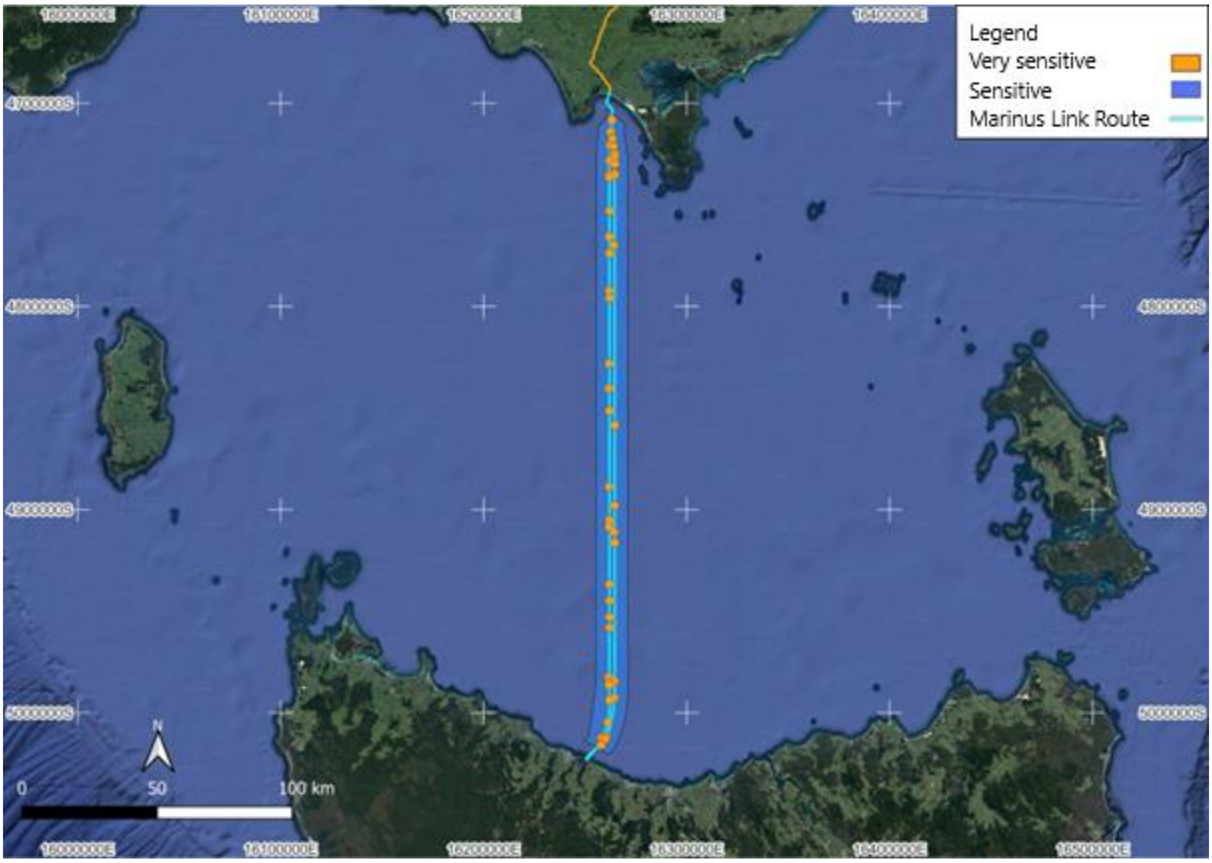


Figure 9-3: Heritage sensitivity, offshore study area (note: size of circles is not to scale of size of geophysical anomalies, indicative of location only).

Significance for potential site types such as shipwrecks, discard, and sea dumping is addressed in Table 8-5 in Section 8.6.2. As sea dumping and discard sites are most likely to be of low significance, and their occurrence within the offshore study area is considered unlikely, they are rated as not being very sensitive.

A summary of the heritage sensitivity of potential sites and unverified anomalies is presented in Table 9-4:

Table 9-4 : Maritime heritage sensitivity within the offshore study area.

Potential Site Type	Maritime Heritage Sensitivity
Shipwrecks	Very sensitive
Sea dumping sites	Not very sensitive
Discard from vessels	Not very sensitive
Unverified anomalies	Very sensitive

9.3.2 Victoria nearshore study area

The majority of the Victoria nearshore study area is considered to be sensitive with regards to maritime cultural heritage, on the basis that sufficient investigation has been carried out to have confidence that shipwrecks are unlikely to be present. The exceptions to this sensitivity classification are the unverified geophysical survey anomalies detailed in Section 7.5.3.2. Because these anomalies have not been visually inspected, there is no way of determining for certain their level of cultural significance. Though it is likely that many of these anomalies may be of low cultural heritage significance, or even natural features, there is a possibility that one or more of the anomalies may be wreckage or other culturally significant items. Because of this, they cannot be dismissed as being just sensitive and are designated as being very sensitive (Figure 9-4).

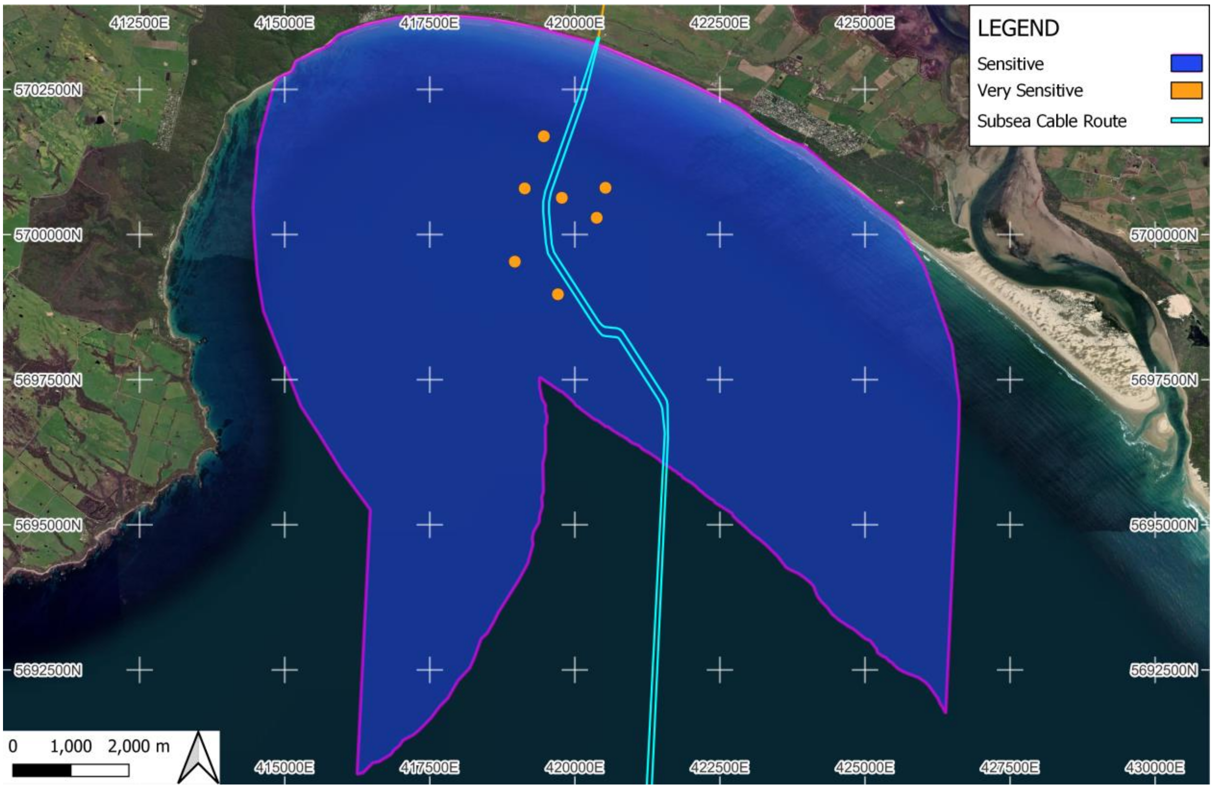


Figure 9-4 : Heritage sensitivity, Victoria nearshore study area. Unverified anomalies shown as orange circles. Size of circles is not to scale of size of geophysical anomalies, indicative of location only

A summary of the heritage sensitivity of potential sites and unverified anomalies is presented in Table 9-5.

Table 9-5 : Maritime heritage sensitivity within the Victoria nearshore study area.

Potential Site Type	Maritime Heritage Sensitivity
Shipwrecks	Very sensitive
Sea dumping sites	Sensitive
Discard from vessels	Sensitive
Unverified anomalies	Very sensitive

9.3.3 Tasmania nearshore study area

The majority of the Tasmania nearshore study area is considered to be of low maritime cultural heritage sensitivity, on the basis that:

- Sufficient investigation has been carried out to have confidence that shipwrecks are unlikely to be present.
- Visual dive inspections revealed only one item of cultural heritage, a mooring block, determined to be of very low cultural heritage significance.
- Camera surveys and geophysical survey review revealed the existence of an outflow pipeline associated with the disused Tioxide Australia Plant, this pipeline has been determined to be of very low cultural heritage significance.
- Material opportunistically or accidently discarded and deliberately dumped from vessels have been assessed to be of low significance.

The exception to this sensitivity classification is the portion of the study area in Emu Bay near Burnie and the unverified geophysical survey anomalies detailed in Section 7.5.3.3.

From an understanding of the historical record of settlement in Burnie, it is likely that items of maritime cultural heritage would occur more frequently near the port and harbour. Because this area is well outside of the proposed works footprint, no geophysical surveys or dive surveys were conducted.

The unverified geophysical survey anomalies have not been visually inspected and so there is no way of determining for certain their level of cultural significance. Though it is likely that many of these anomalies may be of low cultural significance, or even natural features, there is a possibility that one or more of the anomalies may be wreckage or other culturally significant items. Because of this, they cannot be dismissed as being sensitive and are designated as being very sensitive.

A summary of the heritage sensitivity of potential sites and unverified anomalies are presented in Table 9-6:

Table 9-6 : Maritime heritage sensitivity within the Tasmania nearshore study area.

Potential Site Type	Maritime Heritage Sensitivity
Mooring block (BM15)	Not very sensitive
Disused Tioxide pipeline	Not very sensitive
Shipwrecks	Very sensitive
Sea dumping sites	Sensitive
Discard from vessels	Sensitive
Unverified anomalies	Very sensitive

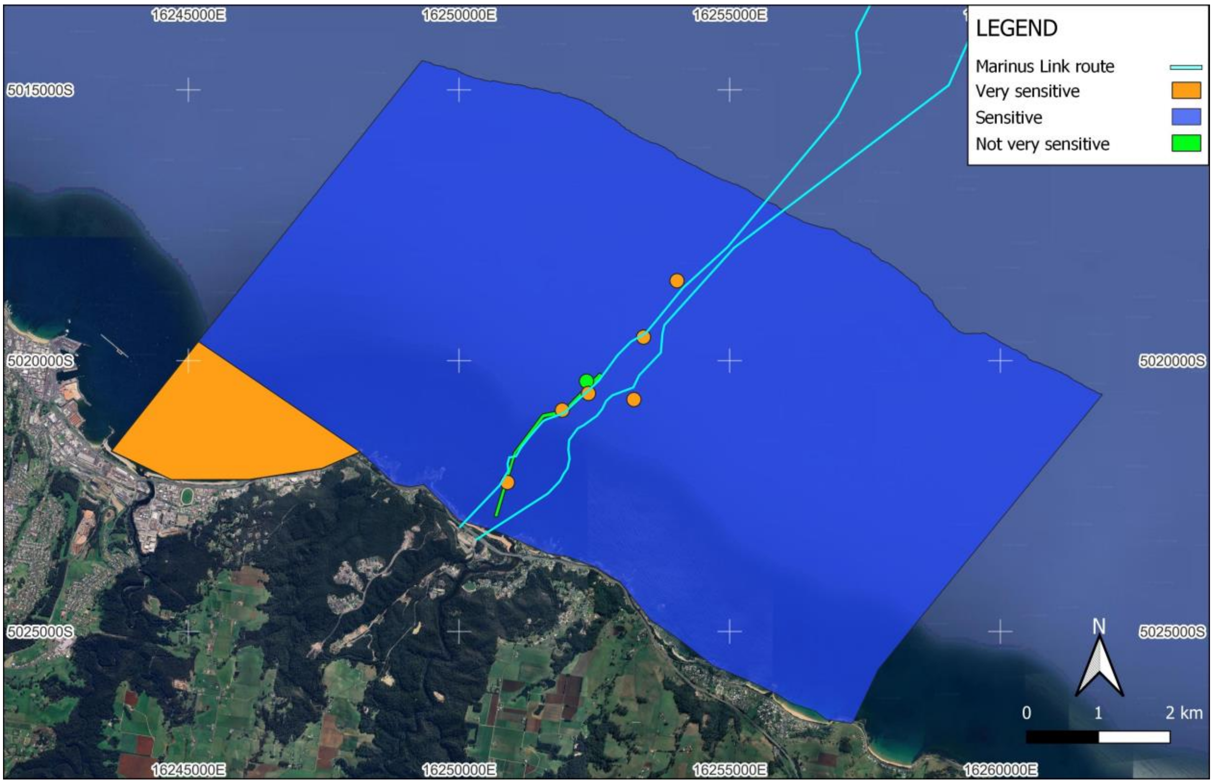


Figure 9-5: Heritage sensitivity, Tasmania nearshore study area. Unverified anomalies shown as orange circles, Emu Bay/Burnie Harbour shown as orange polygon (note: size of circles is not to scale of size of geophysical anomalies, indicative of location only).

10 IMPACTS ON UNDERWATER CULTURAL HERITAGE AND ARCHAEOLOGY

10.1 Proposed works

The proposed works relevant to this assessment are associated with the installation of a subsea cable across Bass Strait. It is intended that the shore crossings will be constructed using HDD to approximately 10 m water depth. Depending on ground conditions, there may be a requirement to partially trench. The subsea cables will be installed in ducts inserted into the HDD boreholes.

10.1.1 Offshore study area

Subsea cables will extend approximately 250 km across Bass Strait from the Tasmanian shore crossing to the Victorian shore crossing. The subsea cables for each 750 MW Link will be laid in a bundle comprising two power cables and a fibre-optic cable. The cable bundles for each link will transition from approximately 300 m apart at the HDD exit to 2 km apart in offshore waters. The subsea cable routes primarily run due north-south along longitude 146°05' across Bass Strait. The subsea cable routes deviate from this longitude in approximately 60 m water depth off the Tasmanian coast and near Tongue Point, Wilsons Promontory National Park to their respective landfalls and shore crossings.

Prior to laying each of the subsea cables a pre-lay grapnel run and targeted pre-lay ROV surveys will be completed by a suitable vessel. The grapnel will cut/collect any seabed debris on the cable route, such as discarded fishing nets, anchor chains, and other obstacles to prevent these from damaging or impeding the works. The pre-lay ROV survey allows for finalisation of the exact route prior to lowering the cable.

After the pre-lay survey, the cable will be lowered across the seabed. Once laid, a number of smaller local vessels will be deployed as guards to prevent damage to the cables from third parties.

A burial vessel will then locate, bury, and survey the cable on the sea floor. Typically for the majority of Bass Strait this work will be done by using water jetting tools with harder substrate requiring mechanical trenching tools. Cables will be buried to a depth between 0.5 – 1.5 m, depending on the substrate (Figure 10-1). In some locations, such as the nearshore approaches in Tasmania and existing subsea service crossings, alternative protection methods will be used, such as cast iron shells, concrete mattresses or possibly rock-placement.

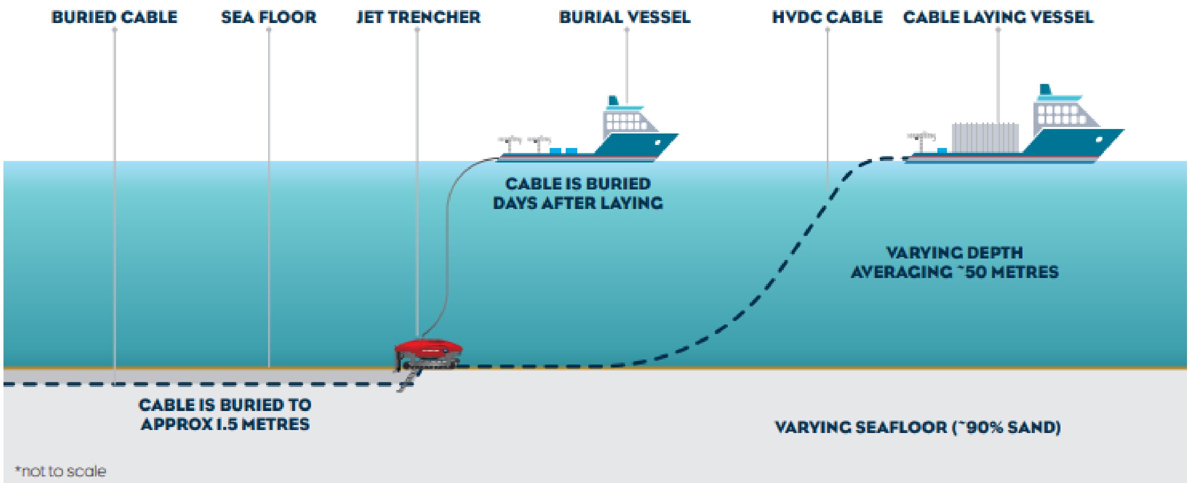


Figure 10-1: Diagram outlining the basic method for laying and subsequent burial of cable through Bass Strait.

After installation, periodic cable surveys by ROV will be conducted on subsea cables. The operational lifespan of the project is a minimum of 40 years. At this time the project will be either decommissioned or upgraded to extend its operational lifespan.

10.1.2 Victoria nearshore study area

In Victoria, the shore crossing will be in Waratah Bay, west of Sandy Point. It is intended that the Victorian shore crossing will be constructed using HDD to approximately 10 m water depth (Figure 10-2). The subsea cables will be installed in ducts inserted into the HDD boreholes. The HDDs are expected to extend between 800 m and 1,200 m offshore. Three boreholes will be required for each link.

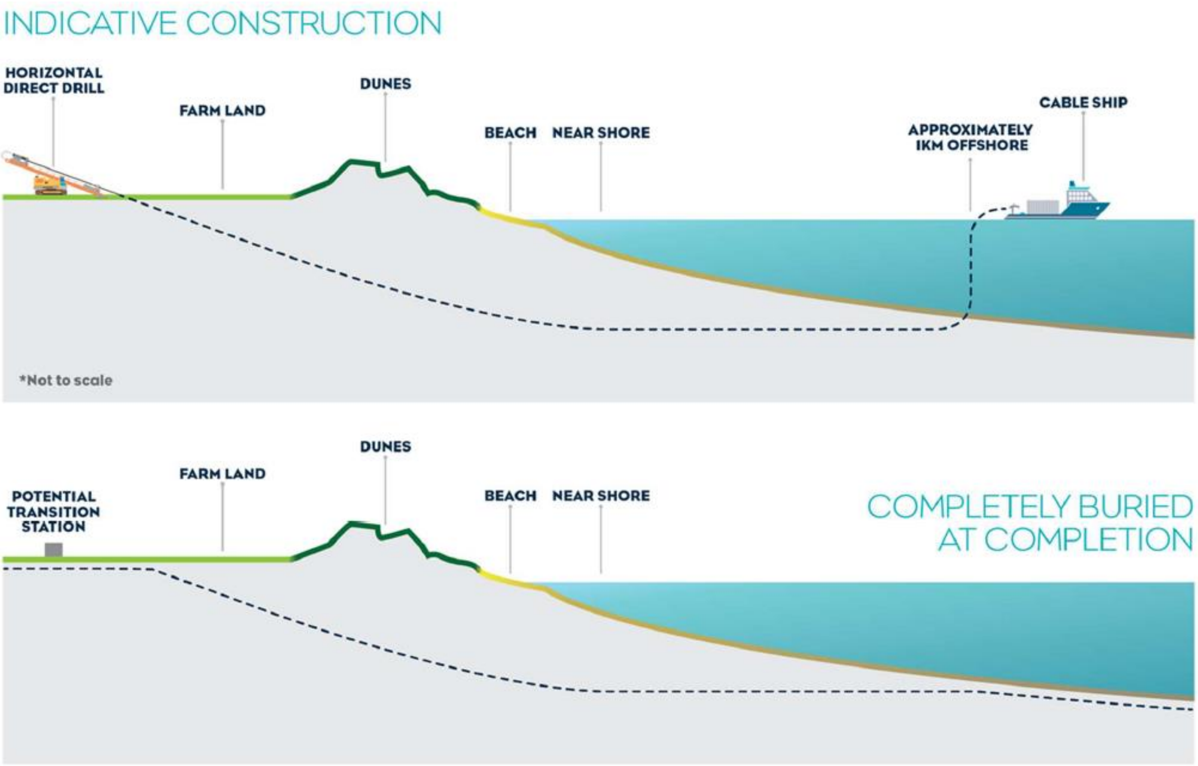


Figure 10-2: Indicative shore crossing construction.

10.1.3 Tasmania nearshore study area

The Tasmanian landfall and shore crossing is west of the Blythe River mouth, in the vicinity of the former disused Tioxide plant outfall pipeline.

The drilling rigs will be located within the Heybridge site and will drill outwards towards the subsea alignment. The drilling length will be such that the end of the drill is in approximately 10 m of water depth which will allow the subsea cables to be pulled from the vessel onto land.

Ducts for the subsea cables will be installed under Bass Highway, the coast, and nearshore using HDD. The HDD exit points will align with the sand-filled paleochannels in the rock platform that extends offshore from the beach. The former Tioxide plant outfall pipeline occupies the western paleochannel and will need to be crossed.

The HDDs are expected to extended between 800 m and 1,200 m offshore and to be bored through competent rock to the paleochannels. Link 1 subsea cables will be in the western paleochannel and Link 2 cables within the eastern paleochannel. Three boreholes will be required for each link.

10.2 Types of impacts

10.2.1 Direct impact

This impact is defined as a physical change occurring to an underwater cultural heritage site or item during construction and operation resulting in a loss of cultural heritage value. Direct impact may include minor and peripheral changes, or large-scale removal and destruction. Direct impacts that may occur as a result of the proposed works are as follows:

- **Pre-lay grapnel** – use of a grapnel will almost certainly cause damage to any underwater cultural heritage within the grapnel's path. Individual objects may be damaged or relocated, decreasing their archaeological potential by removing them from their context, while larger sites such as shipwrecks may be disarticulated or partially destroyed.
- **Laying and burial of cable –** It is expected that the cable will be laid in the immediate location of the grapnel path. It is still possible for the laying of heavy cables to damage less robust underwater cultural heritage and damage or disarray archaeological sites. Burial will utilise water jets or mechanical trenching from a depth of 0.5 to 1.5 m below the seabed. The width of the trench would range from 1 to 2 m. Trenching for cable burial could have a significant negative impact on buried archaeological artefacts and sites, and could expose previously protected and buried artefacts to mechanical, biological and chemical attack.
- **Installation of rock armour and/or mattresses –** This would take place in lieu of trenching. The covering of an underwater heritage site will have the effect of making it more difficult to access/study the site into the future but will also protect it. This could be considered to be a net negligible impact. Though, according to the installation methodology, a grapple would have ploughed the seabed prior to the laying of the cable the footprint of the rock armour/mattress would cover a wider area than the relatively narrow linear impact of the grapple.
- **HDD exit point –** where the cables exit the seabed from the HDD, there is potential for the HDD to impact an artefact or archaeological site through drilling.
- **Shore crossing trenching –** in the event HDD is not feasible. Same impact pathway as the laying and burial of cable outlined above.

10.2.2 Potential direct impact

Potential direct impact is defined as physical impacts occurring to an underwater cultural heritage site or item from unplanned or unforeseen project activities, resulting in the reduction of the cultural heritage values of that site or item. Where these impacts occur is not possible to determine at this stage as such actions are often dictated by operational and safety requirements on a day-to-day basis. Potential direct impacts may include a variety of changes including inappropriate access by vessels during the construction and operational phases, which can be managed or mitigated by appropriate measures such as no anchoring zones over areas of medium to high heritage sensitivity. Potential direct impacts that may occur to the identified underwater cultural heritage are as follows:

- **Vessel anchoring** – if vessels are required to anchor to complete works. Vessel and barge anchors and associated swinging chains can impact underwater cultural heritage sites by directly damaging fabric and moving objects around, thereby deflating and scrambling a site.

10.2.3 Indirect impact

Defined as a secondary or long-term impact on an underwater cultural heritage site or item which would reduce the cultural heritage significance of that site or item. Indirect impacts are also associated to the operational phase of a project.

The potential for indirect impact varies according to the nature of the heritage item, and its proximity to the project. Indirect impact as it may relate to underwater cultural heritage may include vibration, settlement, accretion, erosion and visual (impacts that obscure a site by making it less visible). Indirect impacts relevant to this project that could occur to underwater cultural heritage are as follows:

- **Sediment erosion and accretion** – Changed conditions on the seabed may stimulate erosion within the vicinity of the proposed works. This includes scouring along the toe of rock armour and any mattresses. The loss of sediment from the seabed may result in increased exposure of underwater archaeological sites. Conversely the changed conditions could result in the burial of sites protecting them from damage caused by hydrodynamic processes, marine borers, chemical processes and certain forms of cultural activity.

10.3 Limitations of assessment

A number of limitations have been identified in this assessment which have or can be addressed so as to reduce the likelihood of delays to the works programme in the event of unexpected finds. These limitations are:

- Magnetometer, SSS, and MBES surveys – these surveys covered the study area with the exception of close into shore where the survey vessel could not safely go. This limitation was offset by covering the shallower ends of the potential shore crossings with a visual dive inspection. However, after the realignment of the Victoria shore crossing, no nearshore visual survey has been conducted in the Waratah Bay nearshore area. This risk is ameliorated as the proposed HDD out to about 10 m water depth will mean that any maritime heritage located between 0 and -10 m LAT will not be impacted by the laying of the cable.
- SSS and, to a lesser extent MBES, are not as effective in identifying maritime heritage features in areas where the seabed is rocky. This has been mitigated to an extent by the availability of magnetometer information with the exception of the 2023 marine geophysical survey in the Victoria Nearshore study area.
- The 2023 marine geophysical survey did not include a magnetometer. The pseudo side scan sonar (PSSS) affixed to a USV is not as effective in identifying anomalies of potential cultural heritage significance as a conventional SSS or a PSSS kept at a constant height above the seabed -whether towed or affixed to an Automated Underwater Vehicle (AUV). The interrogation of the high quality MBES data along the alignment within the Victorian Nearshore area however has substantially reduced the likelihood of maritime heritage being situated on or close to the route but not with the same level of confidence as those sections of the alignment that deployed a magnetometer and towed side scan sonar.
- No visual inspection has been carried out within the study area corridor in the offshore Bass Strait section. This is partly due to the size of the study area, and partly due to the depth limitations of AS/NZS 2299 safety standards, prohibiting diving beyond 30 m without advanced offshore training. With the identification of potentially culturally sensitive anomalies from the geophysical surveys, the most appropriate method to mitigate this limitation is to alter the cable route to avoid said anomalies. If anomalies cannot be avoided, it would likely be necessary to conduct ROV surveys on suspected cultural targets.

10.4 Assessing impacts to underwater cultural heritage

This assessment considers direct, potentially direct and indirect impacts. The significance of the impact depends on the heritage sensitivity of each heritage item in the study area based on the definitions and framework for assessing severity of impacts from the *EPBC Act Significant Impact Guidelines 1.2.*[100] For this study impact is defined and rated based on three components:

1. Magnitude or scale of impact on an underwater cultural heritage site or item.
2. Significance or consequence of the impact on the cultural heritage values of a site or item.
3. Probability of impact on an underwater cultural heritage site or item.

To determine appropriate mitigation measures, the probability and magnitude of impact is compared to heritage sensitivity of the feature. Features with higher heritage sensitivity, a higher probability of impact, and a larger significance of impact, typically require more robust mitigation than features of low sensitivity, those less likely to be impacted, or those where the magnitude of impact is smaller.

10.4.1 Magnitude of impact

The magnitude of an impact refers to the level of loss of the physical integrity of a cultural heritage site which results in the reduction of its cultural heritage values. The grading of the magnitude of impacts appears in Table 10-1.

Table 10-1 : Magnitude of impact on physical condition of cultural heritage sites

Term	Magnitude
Major	Complete loss of cultural heritage values intrinsic to the site or archaeological deposits.
Moderate	Substantial reduction in cultural heritage values intrinsic to the site.
Minor	Detectable to partial reduction in cultural heritage values intrinsic to the site.
Negligible	No discernible alterations to existing natural and human processes already impacting on cultural heritage sites.

10.4.2 Significance of impact

The significance, or consequence, of an impact on an underwater heritage site is a combination of the magnitude of impact and its heritage sensitivity. A moderate impact to a sensitive site or item will be of less significance to the underwater heritage value than a moderate level of impact on to an extremely sensitive site or item. For example, dredging could have a major impact on any underwater heritage site within the footprint however if this heritage is assessed to be sensitive, then the significance of the impact could be considered low. Alternatively, if dredging were to impact an extremely sensitive underwater heritage site, such as a rare site type, then the significance of impact would be major. Table 10-2 presents a matrix of impact magnitudes of the proposed works on the heritage values of a site, while Table 10-3 describes the varying levels of the significance to cultural heritage values that the impacts could have.

[100] **Department of Sustainability Environment Water Population and Communities 2013** Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies: Significant Impact Guidelines 1.2, Canberra.

Table 10-2 : Assessment of significance of impacts.

Magnitude of Impact	Heritage Sensitivity				
	Extremely sensitive (8 to 9)	Very sensitive (6 to 7)	Sensitive (3 to 5)	Not very sensitive (1 to 2)	Not sensitive (Nil)
Major	Major	High	Moderate	Very low	N/A
Moderate	High	Moderate	Low	Very low	N/A
Minor	Moderate	Low.	Very low.	Very low	N/A
Negligible	Low	Very low	Very low	Very low	N/A

Table 10-3 : Significance of impact

Term	Description
Major impact	Results in the complete or near complete loss of the cultural heritage values of a site of State or National significance in good condition.
High impact	Results in the substantial loss of the cultural heritage values of a site of State or National significance in good condition, or;
	The complete loss of the heritage values of a site type assessed to be of State or National significance in poor or fragmentary condition, or;
	The complete loss of the heritage values of a site/site type of Local significance assessed to be in good condition.
	Also be applied to the complete loss of an uncommon site type such as a shipwreck whose significance could only be determined by further investigation.
Moderate impact	Results in the partial loss of the cultural heritage values of a site of State or National significance in good condition, or;
	The substantial loss of the heritage values of a site type assessed to be of State or National significance in poor or fragmentary condition, or;
	The substantial loss of the heritage values of a site/site type of Local significance assessed to be in good condition, or;
	The complete loss of an isolated object of local significance, or;
	The complete loss of a site of local significance in poor or fragmentary condition, or;
	The complete loss of a site or site type which may be of State or National significance where the potential for archaeological remains to be present is remote.
Low impact	Results in a detectable loss of cultural heritage values of a site of State, or National significance in good condition, or;
	The partial loss of the heritage values of a site type assessed to be of State, or National significance in poor or fragmentary condition, or;
	The partial loss of the heritage values of site/site type of Local significance assessed to be in good condition.
Very low impact	No discernible alterations to existing natural and human processes already impacting on a cultural heritage site of State or National significance in good condition, or;
	The detectable loss of the heritage values of a site type assessed to be of State or National significance in poor or fragmentary condition, or;
	A site/site type of Local significance assessed to be in good or poor condition, or;
	Any impact within an area of very low heritage sensitivity.

10.4.3 Probability of impact

When assessing the potential impacts of a large-scale development on underwater heritage there is always a level of uncertainty that needs to be considered. This is because the understanding of the underwater archaeological value is largely reliant on the interpretation of geotechnical and geophysical data. The limitations of available technologies that obtain such data mean that the presence or absence of underwater maritime heritage sites of significance cannot be stated with complete confidence. In addition, it is difficult to monitor construction activities around underwater sites as the sites themselves are not visible and impacts may not always be noticed at the time they occur. Such uncertainties can be addressed by the design of appropriate mitigation measures to prevent or minimise impacts on known and potential underwater cultural heritage sites as well as assessing the probability of impact.

For example, with regard to the probability of an impact, activities such as dredging it would be highly probable that it would disturb any underwater heritage sites that may be present within the footprint of this activity. By contrast, there would be a lower probability of the chain of an anchored project vessel potentially damaging an underwater heritage site. The grading system for determining the probability of impact is presented in Table 10-4.

Table 10-4 : Terms defining probability of impact.

Term	Probability
Certain	100%
Highly probable	85–99%
Probable	50–84%
Improbable	25–49%
Highly improbable	1–14%
Almost impossible	< 1%

10.5 Assessed potential impacts to cultural heritage values

10.5.1 Assessed potential impacts to Aboriginal submerged terrestrial sites that may be present

The following sections assess potential impacts in the offshore, Victorian and Tasmanian nearshore study area.

10.5.1.1 Direct impacts

Cable installation (including pre-lay grapnel, trenching and rock armour/mattresses)

Within the offshore study area, where a buried paleo-estuarine channel has been identified at KP 27 – 27.5, the only possible direct impact will be the actual laying of the cable, as the grapple will not penetrate the seabed deep enough to impact the buried Pleistocene surface. Trenching will only go to 1.5 m below the seabed and as such may not reach the buried Pleistocene surfaces, which are around 2 m below the seabed. It is therefore considered almost impossible that an impact would occur to any buried submerged terrestrial site during the installation of cable across in this area. If such an impact did occur, it would be considered to have a negligible impact to this site type, because the shallow depth of trenching is unlikely to disturb pre-inundation archaeological deposits.

Elsewhere where Pleistocene land surfaces may be exposed or closer to the seabed than 1. 5 m such as the identified Beach Ridge formations at KP 235 – 245. The proposed cable routes avoid these formations for the most part which would therefore avoid middens and other site types that form on these features. The cable routes however follow what appear to be former water courses or other forms of breaches in these beach ridge systems and these places are more likely to have hosted stone fish traps – if the beach ridges are composed of cobbles. The process of grappling and trenching would have an impact on a submerged terrestrial site though it would not completely destroy it. It is considered highly improbable that a site will be impacted by the grappling and/or trenching and that the impact could result in a partial (minor) reduction in the cultural heritage values of a submerged terrestrial site. Conversely the placement of rock armour/mattress over a site will have a negligible impact and could also be beneficial as it would protect the site though it should be noted that a grapple would have passed through the area prior to its installation.

Table 10-5: Identified submerged landforms in the Offshore study area and the identified impacts of cable installation (grapple/trenching).

Submerged landforms	Depositional context	Site Type Association	KP (km)	Cultural Heritage Sensitivity	Cable installation (grapple/trenching)		
					Magnitude	Significance	Probability
Estuarine / Tidal Channel	Coastal intertidal/fluvial	Artefact Scatter	27-27.5	Sensitive	Negligible	Very low	Almost impossible
		Midden	27-27.5	Sensitive	Negligible	Very low	Almost impossible
Beach Ridge	Coastal intertidal/aeolian – Sand dune	Midden	235 – 245	Very sensitive	Minor	Low	Highly improbable
		Artefact, scatter	235 – 245	Sensitive	Minor	Very low	Highly improbable
		Artefact, isolated	235 – 245	Sensitive	Minor	Very low	Highly improbable
	Coastal intertidal – Cobbles	Midden	235 – 245	Sensitive	Minor	Very low	Highly improbable
		Stone arrangement (hide)	235 – 245	Sensitive	Minor	Very low	Highly improbable
		Stone arrangement (fish trap)	235 – 245	Very sensitive	Minor	Low	Highly improbable
		Artefact, scatter	235 – 245	Sensitive	Minor	Very low	Highly improbable
		Artefact, isolated	235 – 245	Sensitive	Minor	Very low	Highly improbable
		Quarry	235 – 245	Sensitive	Minor	Very low	Highly improbable

Table 10-6: Identified submerged landforms in the Offshore study area and the identified impacts of cable installation (rock armour/mattress).

Submerged landforms	Depositional context	Site Type Association	KP (km)	Cultural Heritage Sensitivity	Cable installation (rock armour/mattress)		
					Magnitude	Significance	Probability
Estuarine / Tidal Channel	Coastal intertidal/fluvial	Artefact Scatter	27-27.5	Sensitive	N/A	N/A	No impact
		Midden	27-27.5	Sensitive	N/A	N/A	No impact
Beach Ridge	Coastal intertidal/aeolian – Sand dune	Midden	235 – 245	Very sensitive	Negligible	Very low	Highly improbable
		Artefact, scatter	235 – 245	Sensitive	Negligible	Very low	Highly improbable
		Artefact, isolated	235 – 245	Sensitive	Negligible	Very low	Highly improbable
	Coastal intertidal – Cobbles	Midden	235 – 245	Sensitive	Negligible	Very low	Highly improbable
		Stone arrangement (hide)	235 – 245	Sensitive	Negligible	Very low	Highly improbable
		Stone arrangement (fish trap)	235 – 245	Very sensitive	Negligible	Very low	Highly improbable
		Artefact, scatter	235 – 245	Sensitive	Minor	Very low	Highly improbable
		Artefact, isolated	235 – 245	Sensitive	Minor	Very low	Highly improbable
		Quarry	235 – 245	Sensitive	Minor	Very low	Highly improbable

Within the Tasmania nearshore study area, the proposed alignment of the cables has utilised the soft marine sediments that fill the paleo-watercourses (fluvial channels / entrenched stream gullies) so clearly evident in the multibeam sonar imagery (see Figure 6-15). This action will have no impact on any submerged terrestrial sites that may be present as the sediments filling the channels are recent (Holocene). Closer to shore, the alignment passes over the former river 'banks' in less than 10 m water depth. However, HDD will cross this area and exit the sea floor in water depths of approximately 10 m which will be within the former river floor. As such there will be no impacts related to the installation of the cable of the former river banks.

Table 10-7: Identified submerged landforms in Tasmania nearshore study area and the identified impacts of cable installation (grapple/trenching).

Submerged landforms	Depositional context	Site Type Association	KP (km)	Cultural Heritage Sensitivity	Cable installation (grapple/trenching)		
					Magnitude	Significance	Probability
Entrenched Stream Gully / Channel	Terrestrial fluvial	Artefact, scatter	250 – 255	Sensitive	Negligible	Very low	No impact
		Artefact, isolated	250 – 255	Sensitive	Negligible	Very low	No impact
		Midden	250 – 255	Sensitive	Negligible	Very low	No impact
		Quarry	250 – 255	Sensitive	Negligible	Very low	No impact
		Rock shelter	250 – 255	Sensitive	Negligible	Very low	No impact

Table 10-8: Identified submerged landforms in Tasmania nearshore study area and the identified impacts of cable installation (rock armour/mattress).

Submerged landforms	Depositional context	Site Type Association	KP (km)	Cultural Heritage Sensitivity	Cable installation (rock armour/mattress)		
					Magnitude	Significance	Probability
Entrenched Stream Gully / Channel	Terrestrial fluvial	Artefact, scatter	250 – 255	Sensitive	N/A	N/A	No impact
		Artefact, isolated	250 – 255	Sensitive	N/A	N/A	No impact
		Midden	250 – 255	Sensitive	N/A	N/A	No impact
		Quarry	250 – 255	Sensitive	N/A	N/A	No impact
		Rock shelter	250 – 255	Sensitive	N/A	N/A	No impact

Within the Victorian nearshore area there are exposed and buried indurated Beach Ridge Strandplain formations close to the Victorian shore. It is almost impossible that the cable installation will impact a submerged terrestrial site and the magnitude of impact would be negligible. This assessment is further reinforced by the understanding that the installation of the cable will seek to avoid mechanical trenching through hard rock and will attempt to stay within recent Holocene marine sediments or place rock mattressing.

Closer to shore the HDD exit will be somewhere either in Zone 1 or 2, to the north of the indurated beach ridge strandplain (see Section 6.6.3.1). This area is subjected to a high wave energy as is evidenced by a relatively steep active beach profile (Zone 1) and an erosional revetment expressed as mobile sandwaves (Zone 2). No submerged terrestrial archaeological sites would have survived in such an environment. As such there will be no impacts arising from the exiting of the cable from the seabed as part of the HDD process.

Table 10-9: Identified submerged landforms in the Victorian nearshore study area and the identified impacts of cable installation (grapple/trenching).

Submerged landforms	Depositional context	Site Type Association	KP (km)	Cultural Heritage Sensitivity	Cable installation (grapple/trenching)		
					Magnitude	Significance	Probability
Beach Ridge Strandplain, indurated	Coastal intertidal – formation, terrestrial alluvial/colluvial	Artefact, scatter	1.8 to 3.7	Sensitive	Negligible	Very low	Almost impossible

Table 10-10: Identified submerged landforms in the Victorian nearshore study area and the identified impacts of cable installation (rock armour/mattress).

Submerged landforms	Depositional context	Site Type Association	KP (km)	Cultural Heritage Sensitivity	Cable installation (rock armour/mattress)		
					Magnitude	Significance	Probability
Beach Ridge Strandplain, indurated	Coastal intertidal – formation, terrestrial alluvial/colluvial	Artefact, scatter	1.8 to 3.7	Sensitive	Negligible	Very low	Almost impossible

10.5.1.2 Potential direct impacts

Anchoring

Within the offshore study area any anchoring which is to take place in the area where submerged terrestrial sites that may be present and associated with the estuarine channel are predicted to have no impact due to the shallow nature of the impact and the depth at which Pleistocene landscapes are buried under more recent sediments. However, anchoring could impact a site associated with a submerged beach ridge with the same level of impact as could occur with trenching.

Table 10-11: Identified submerged landforms in the Offshore study area and the identified impacts of vessel anchoring.

Submerged landforms	Depositional context	Site Type Association	KP (km)	Cultural Heritage Sensitivity	Anchoring		
					Magnitude	Significance	Probability
Estuarine / Tidal Channel	Coastal intertidal/fluvial	Artefact Scatter	27-27.5	Sensitive	N/A	N/A	No impact
		Midden	27-27.5	Sensitive	N/A	N/A	No impact
Beach Ridge	Coastal intertidal/aeolian – Sand dune	Midden	235 – 245	Very sensitive	Minor	Low	Highly improbable
		Artefact, scatter	235 – 245	Sensitive	Minor	Very low	Highly improbable
		Artefact, isolated	235 – 245	Sensitive	Minor	Very low	Highly improbable
	Coastal intertidal – Cobbles	Midden	235 – 245	Sensitive	Minor	Very low	Highly improbable
		Stone arrangement (hide)	235 – 245	Sensitive	Minor	Very low	Highly improbable
		Stone arrangement (fish trap)	235 – 245	Very sensitive	Minor	Low	Highly improbable
		Artefact, scatter	235 – 245	Sensitive	Minor	Very low	Highly improbable
		Artefact, isolated	235 – 245	Sensitive	Minor	Very low	Highly improbable
		Quarry	235 – 245	Sensitive	Minor	Very low	Highly improbable
		Rock shelter	250 – 255	Sensitive	Negligible	Very low	Almost impossible

Within the Tasmanian nearshore study area it is unlikely that anchoring will take place in the rocky / hard ground that submerged terrestrial sites that may be present and associated with entrenched stream formations would be present. In the almost impossible event this does occur the artefacts associated with such sites that are impacted would be displaced rather than destroyed resulting in a negligible impact.

Table 10-12: Identified submerged landforms in Tasmania nearshore study area and the identified impacts of vessel anchoring.

Submerged landforms	Depositional context	Site Type Association	KP (km)	Cultural Heritage Sensitivity	Anchoring		
					Magnitude	Significance	Probability
Entrenched Stream Gully / Channel	Terrestrial fluvial	Artefact, scatter	250 – 255	Sensitive	Negligible	Very low	Almost impossible
		Artefact, isolated	250 – 255	Sensitive	Negligible	Very low	Almost impossible
		Midden	250 – 255	Sensitive	Negligible	Very low	Almost impossible
		Quarry	250 – 255	Sensitive	Negligible	Very low	Almost impossible
		Rock shelter	250 – 255	Sensitive	Negligible	Very low	Almost impossible

Within the Victorian nearshore area it is unlikely that anchoring will take place on the exposed indurated strandplain formations because they are not optimal locations to set anchors. In any case if anchoring takes place it will be almost impossible that it will impact a submerged terrestrial site and the magnitude of impact would be negligible.

Table 10-13: Identified submerged landforms in Victorian nearshore study area and the identified impacts of vessel anchoring.

Submerged landforms	Depositional context	Site Type Association	KP (km)	Cultural Heritage Sensitivity	Anchoring		
					Magnitude	Significance	Probability
Beach Ridge Strandplain, indurated	Coastal intertidal – formation, terrestrial alluvial/colluvial	Artefact, scatter	1.8 to 3.7	Sensitive	Negligible	Very low	Almost impossible

10.5.1.3 Indirect impacts

Scouring arising from rock armour or mattress placement

While the placing of rock armour/mattresses will protect the cable(s) there is a possibility that scouring at the toe of the rock/mattress could expose and destabilise buried archaeological sites that may be present. This process could also continue into or even commence during the operational phase of the project. While it is not certain where and if rock armour/mattresses will be placed within Offshore study area it appears that the installation will occur where trenching is not feasible, such as where the cable crosses an expanse of rocky or hard seabed. The area of where the estuarine channel is located is covered in a sand/silt seabed and therefore it is considered highly improbable that rock armour/mattress will be installed at this location. If this was to occur, it is assessed that the impact would be negligible.

The placement of rock armour/mattress over a site located in the beach ridge landform is not anticipated to generate scouring as it is anticipated that such landforms may have become indurated since submersion and hence resistant to scouring.

Table 10-14: Identified submerged landforms in the Offshore study area and the identified impacts of seabed scouring.

Submerged landforms	Depositional context	Site Type Association	KP (km)	Cultural Heritage Sensitivity	Scouring		
					Magnitude	Significance	Probability
Estuarine / Tidal Channel	Coastal intertidal/fluvial	Artefact Scatter	27-27.5	Sensitive	Negligible	Very low	Highly improbable
		Midden	27-27.5	Sensitive	Negligible	Very low	Highly improbable
Beach Ridge	Coastal intertidal/aeolian – Sand dune	Midden	235 – 245	Very sensitive	Negligible	Very low	Highly improbable
		Artefact, scatter	235 – 245	Sensitive	Negligible	Very low	Highly improbable
		Artefact, isolated	235 – 245	Sensitive	Negligible	Very low	Highly improbable
	Coastal intertidal – Cobbles	Midden	235 – 245	Sensitive	Negligible	Very low	Highly improbable
		Stone arrangement (hide)	235 – 245	Sensitive	Negligible	Very low	Highly improbable
		Stone arrangement (fish trap)	235 – 245	Very sensitive	Negligible	Very low	Highly improbable
		Artefact, scatter	235 – 245	Sensitive	Negligible	Very low	Highly improbable
		Artefact, isolated	235 – 245	Sensitive	Negligible	Very low	Highly improbable
		Quarry	235 – 245	Sensitive	Negligible	Very low	Highly improbable

While it is not certain where and if rock armour/mattresses will be placed within the Tasmania nearshore study area, it appears that the installation will occur where trenching is not feasible, such as where the cable crosses an expanse of rocky or hard seabed. The placement therefore of rock armour/mattress over a site associated with entrenched stream formations is not anticipated to generate scouring as it is anticipated that such landforms would be resistant to scouring.

Table 10-15: Identified submerged landforms in Tasmania nearshore study area and the identified impacts of seabed scouring.

Submerged landforms	Depositional context	Site Type Association	KP (km)	Cultural Heritage Sensitivity	Scouring		
					Magnitude	Significance	Probability
Entrenched Stream Gully / Channel	Terrestrial fluvial	Artefact, scatter	250 – 255	Sensitive	Negligible	Very low	Highly improbable
		Artefact, isolated	250 – 255	Sensitive	Negligible	Very low	Highly improbable
		Midden	250 – 255	Sensitive	Negligible	Very low	Highly improbable
		Quarry	250 – 255	Sensitive	Negligible	Very low	Highly improbable
		Rock shelter	250 – 255	Sensitive	Negligible	Very low	Highly improbable

While it is not certain where and if rock armour/mattresses will be placed within the Victorian nearshore study area, it is understood that it would be used where trenching is not feasible, such as where the cable crosses an expanse of rocky or hard seabed. The placement therefore of rock armour/mattress over a submerged terrestrial site associated with indurated beach ridge strandplain formations is not anticipated to generate scouring as it is anticipated that such landforms would be resistant to scouring.

10.5.2 Assessed potential impacts to maritime heritage sites

10.5.2.1 Direct impacts

Cable installation (including pre-lay grapnel, trenching and rock armour/mattresses)

With the offshore study area, the only likely direct impact will be the actual laying of the cable. It is considered highly probable however that the installation of cable across Bass Strait will impact geophysical anomalies identified during the geophysical survey review. Five anomalies, ID: 44, 61, 25, 67, and 39, are located within 10 m of the proposed subsea cable route. The magnitude of impact to these anomalies cannot be stated with any certainty as their significance is currently not understood.

Because none of the anomalies within the offshore study area have been visually inspected to date, it is impossible to state with certainty whether or not they are cultural in origin, and whether they have any cultural heritage value. They have provisionally been designated as 'very sensitive'. Any impacts to these anomalies could have a negligible to moderate impact.

An additional ten anomalies, ID: 13, 41, 71, 16, 1, 2, 32, 64, 57, and 35, are located beyond 10 m, but within 50 m, of the proposed subsea cable route and are less likely to be impacted. In addition to these anomalies, the proposed cable route crosses the path of the Indigo Cable and several trawl scars identified to likely be of no heritage significance and therefore the impact on these features are not assessed in this report.

The placement of rock armour/mattresses is considered to have a net negligible impact on any maritime heritage present.

Table 10-16: Identified known and potential maritime cultural heritage in the Offshore study area and the identified impacts of cable installation (grapple/trenching).

Site	Sensitivity	Cable installation (grapple/trenching)		
		Magnitude	Significance	Probability
Potential shipwrecks	Very sensitive	Minor to moderate	Low to moderate	Almost impossible
Potential discard	Sensitive	Minor	Very low	Highly improbable
Geophysical anomalies ID: 25, 39, 44, 61, and 67	Very sensitive	Negligible to moderate	Very low to moderate	Highly probable
Geophysical anomalies ID: 1, 2, 13, 16, 32, 35, 41, 57, 64, and 71	Very sensitive*	Negligible to moderate	Very low to moderate	Improbable

**Unverified anomalies are designated very sensitive until visually inspected.*

Table 10-17: Identified known and potential maritime cultural heritage in the offshore study area and the identified impacts of cable installation (rock armour/mattress).

Site	Sensitivity	Cable installation (rock armour/mattress)		
		Magnitude	Significance	Probability
Potential shipwrecks	Very sensitive	Negligible	Very low	Almost impossible
Potential discard	Sensitive	Negligible	Very low	Highly improbable
Geophysical anomalies ID: 25, 39, 44, 61, and 67	Very sensitive*	Negligible	Very low	Highly probable
Geophysical anomalies ID: 1, 2, 13, 16, 32, 35, 41, 57, 64, and 71	Very sensitive*	Negligible	Very low	Improbable

**Unverified anomalies are designated very sensitive until visually inspected.*

It is highly improbable that the installation of the cable would impact the remains of unlocated maritime heritage within the Victorian nearshore study area. This probability is marginally higher than in the offshore study area (almost impossible) because of the reduced confidence in the survey data from the 2023 Victorian geophysical survey.

Impacts to the unverified geophysical survey anomalies could range from negligible to moderate, as their cultural heritage significance cannot be accurately determined without visual survey. As with the unverified anomalies in the offshore section, these have provisionally been designated as very sensitive. These anomalies are over 100 m from the proposed alignment and will not be impacted by the cable installation.

The placement of rock armour/mattresses should have a negligible impact on the maritime heritage.

Table 10-18: Identified known and potential maritime cultural heritage in the Victoria nearshore study area and the identified impacts of cable installation.

Site	Sensitivity	Cable installation (grapple/trenching)			Cable installation (rock armour/mattress)		
		Magnitude	Significance	Probability	Magnitude	Significance	Probability
Potential shipwrecks	Very sensitive	Minor to moderate	Low to moderate	Highly improbable	Negligible	Very low	Highly improbable
Potential discard	Sensitive	Minor	Very low	Highly improbable	Negligible	Very low	Highly improbable
Geophysical anomalies ID: WB-23_001 to 007	Very sensitive*	Negligible to moderate	Very low to moderate	N/A	N/A	N/A	No impact

**Unverified anomalies are designated very sensitive until visually inspected.*

It is certain that the installation of the cable would impact the remains of the disused Tioxide Australia pipeline, unless the cable route is altered, or the pipeline is avoided by elevating the cable to go over it. However, as the pipeline is assessed as not being very sensitive, the impacts from the cable installation would be considered minor.

Impacts to the six unverified anomalies could range from negligible to moderate, as their cultural heritage significance cannot be accurately determined without visual survey, however they range in distance from the cables from 26 m to 164 m and so it is highly improbable they will be impacted.

Table 10-19: Identified known and potential maritime cultural heritage in the Tasmania nearshore study area and the identified impacts of cable installation.

Site	Sensitivity	Cable installation (grapple/trenching)			Cable installation (rock armour/mattress)		
		Magnitude	Significance	Probability	Magnitude	Significance	Probability
Former disused Tioxide Australia pipeline	Not very sensitive	Negligible	Very low	Certain	Negligible	Very low	Certain
Concrete mooring block (BM15)	Not very sensitive	Minor	Very low	Improbable	Negligible	Very low	Improbable
Potential shipwrecks	Very sensitive	Minor to moderate	Low to moderate	Almost impossible	Negligible	Very low	Almost impossible
Potential discard	Sensitive	Minor	Very low	Highly improbable	Negligible	Very low	Highly improbable
Geophysical anomalies ID : 2, 5, 7, 10, 13 and 15	Very sensitive*	Negligible to moderate	Very low to moderate	Highly improbable	Negligible	Very low	Highly improbable

**Unverified anomalies are designated very sensitive until visually inspected.*

HDD exit point

It is almost impossible that the HDD exit point would impact maritime heritage artefacts or sites within the Victorian nearshore study area. Review of the historical record, available cultural heritage databases, and geophysical survey data indicate that no maritime cultural heritage is located within the vicinity of the HDD exit point. No unverified anomalies are within the proposed location of the HDD exit point.

Table 10-20: Identified known and potential maritime cultural heritage in the Victoria nearshore study area and the identified impacts of HDD drilling.

Site	Sensitivity	HDD exit point		
		Magnitude	Significance	Probability
Potential shipwrecks	Very sensitive	Minor	Low	Almost impossible
Potential discard	Sensitive	Negligible	Very low	Almost impossible
Geophysical anomalies ID: WB-23_001 to 007	Very sensitive*	Minor	Low	No impact

**Unverified anomalies are designated very sensitive until visually inspected.*

It is almost impossible that the HDD exit point would impact maritime heritage artefacts or wreck sites in the Tasmanian nearshore study area. There are no unverified anomalies within the proposed location of the HDD exit point.

Table 10-21: Identified known and potential maritime cultural heritage in the Tasmania nearshore study area and the identified impacts of HDD drilling.

Site	Sensitivity	HDD exit point		
		Magnitude	Significance	Probability
Former disused Tioxide Australia pipeline	Not very sensitive	Negligible	Very low	Almost impossible
Concrete mooring block (BM15)	Not very sensitive	N/A	N/A	N/A
Potential shipwrecks	Very sensitive	Minor	Low	Almost impossible
Potential discard	Sensitive	Negligible	Very low	Almost impossible
Geophysical anomalies ID: 2, 5, 7, 10, 13 and 15	Very sensitive*	Minor	Low	Almost impossible

**Unverified anomalies are designated very sensitive until visually inspected.*

10.5.2.2 Potential direct Impacts

Anchoring

It is almost impossible that anchoring, should it take place, will impact a maritime heritage site within the offshore study area. The anchor and associated chain would displace loose objects on the seabed thereby limiting the magnitude of impact however for fixed sites, such as shipwrecks, the impact could be greater.

Table 10-22: Identified known and potential maritime cultural heritage in the Offshore study area and the identified impacts of vessel anchoring.

Site	Sensitivity	Anchoring		
		Magnitude	Significance	Probability
Potential shipwrecks	Very sensitive	Minor to moderate	Low to moderate	Almost impossible
Potential discard	Sensitive	Minor	Very low	Almost impossible
Geophysical anomalies ID: 25, 39, 44, 61, and 67	Very sensitive*	Negligible to moderate	Very low to moderate	Highly improbable
Geophysical anomalies ID: 1, 2, 13, 16, 32, 35, 41, 57, 64, and 71	Very sensitive *	Negligible to moderate	Very low to moderate	Highly improbable

**Unverified anomalies are designated very sensitive until visually inspected.*

If vessels are required to anchor as part of works, it is considered highly improbable that any anchoring activities would impact the potential remains of maritime heritage within the Victorian nearshore study area. The impacts from the cable installation could range from low to moderate if the remains of a shipwreck is disturbed.

It is highly improbable that unverified geophysical survey anomalies would be impacted by vessel anchoring, but if they were, impacts would be considered negligible to moderate, as their cultural heritage significance cannot be accurately assessed without visual survey.

Table 10-23: Identified known and potential maritime cultural heritage in the Victoria nearshore study area and the identified impacts of vessel anchoring.

Site	Sensitivity	Vessel anchoring		
		Magnitude	Significance	Probability
Potential shipwrecks	Very sensitive	Minor to moderate	Low to moderate	Almost impossible
Potential discard	Sensitive	Minor	Very low	Highly improbable
Geophysical anomalies ID: WB-23_001 to 007	Very sensitive*	Minor to moderate	Low to moderate	Highly improbable

**Unverified anomalies are designated very sensitive until visually inspected.*

If vessels are required to anchor within the Tasmanian nearshore study area as part of works, it is considered improbable to highly improbable that any anchoring activities would impact the potential remains of maritime heritage. The impacts from the cable installation could range from low to moderate if the remains of a shipwreck is disturbed. It is unlikely that unverified anomalies would be impacted by vessel anchoring, but if they were, impacts would be considered negligible to moderate, as their cultural heritage significance cannot be accurately assessed without visual survey.

Table 10-24: Identified known and potential maritime cultural heritage in the Tasmania nearshore study area and the identified impacts of vessel anchoring.

Site	Sensitivity	Vessel anchoring		
		Magnitude	Significance	Probability
Former disused Tioxide Australia pipeline	Not very sensitive	Negligible	Very low	Improbable
Concrete mooring block (BM15)	Not very sensitive	Negligible	Very low	Highly improbable
Potential shipwrecks	Very sensitive	Minor to moderate	Low to moderate	Almost impossible
Potential discard	Sensitive	Minor	Very low	Highly improbable
Geophysical anomalies ID: 2, 5, 7, 10, 13 and 15	Very sensitive*	Negligible to moderate	Very low to moderate	Highly improbable

**Unverified anomalies are designated very sensitive until visually inspected.*

10.5.2.3 Indirect impacts

Scouring arising from rock armour or mattress placement

While the placing of rock armour/mattresses will protect the cable(s) there is a possibility that scouring at the toe of the rock/mattress could expose and destabilise a buried portion of a maritime heritage site. This process could also continue into or even commence during the operational phase of the project. While it is not certain where and if rock armour/mattresses will be placed within the offshore study area it appears that the installation will occur where trenching is not feasible, such as where the cable crosses an expanse of rocky seabed. Such areas can mask the presence of maritime heritage from available remote sensing techniques. Having said this, scouring at such locales would not be as severe.

Table 10-25: Identified known and potential maritime cultural heritage in the Offshore study area and the identified impacts of seabed scouring.

Site	Sensitivity	Scouring		
		Magnitude	Significance	Probability
Potential shipwrecks	Very sensitive	Negligible to minor	Very low to Low	Almost impossible
Potential discard	Sensitive	Negligible to minor	Very low	Highly improbable
Geophysical anomalies ID: 25, 39, 44, 61, and 67	Very sensitive*	Negligible to minor	Low	Highly probable
Geophysical anomalies ID: 1, 2, 13, 16, 32, 35, 41, 57, 64, and 71	Very sensitive*	Negligible to minor	Low	Improbable

**Unverified anomalies are designated very sensitive until visually inspected.*

While it is not certain where and if rock armour/mattresses will be placed within the Victoria nearshore study area it appears that the installation will occur where trenching is not feasible, such as where the cable crosses an expanse of rocky seabed. Such areas can mask the presence of maritime heritage from available remote sensing techniques. Having said this, scouring at such locales would not be as severe. The unverified geophysical anomalies will be not impacted by the cable installation and so will also not be impacted by the placement of rock armour / mattresses.

Table 10-26: Identified known and potential maritime cultural heritage in the Victoria nearshore study area and the identified impacts of seabed scouring.

Site	Sensitivity	Scouring		
		Magnitude	Significance	Probability
Potential shipwrecks	Very sensitive	Negligible to minor	Very low to Low	Almost impossible
Potential discard	Sensitive	Negligible to minor	Very low	Highly improbable
Geophysical anomalies ID: WB-23_001 to 007	Very sensitive*	Negligible to minor	Low	No impact

**Unverified anomalies are designated very sensitive until visually inspected.*

While it is not certain where and if rock armour/mattresses will be placed within the Tasmania nearshore study area it appears that the installation will occur where trenching is not feasible, such as where the cable crosses an expanse of rocky seabed. Such areas can mask the presence of maritime heritage from available remote sensing techniques. Having said this, scouring at such locales would not be as severe.

Table 10-27: Identified known and potential maritime cultural heritage in the Tasmania nearshore study area and the identified impacts of seabed scouring.

Site	Sensitivity	Scouring		
		Magnitude	Significance	Probability
Former disused Tioxide Australia pipeline	Not very sensitive	Negligible	Very low	Highly improbable
Concrete mooring block (BM15)	Not very sensitive	Negligible	Very low	Highly improbable
Potential shipwrecks	Very sensitive	Negligible to minor	Very low to low	Almost impossible
Potential discard	Sensitive	Negligible to minor	Very low	Highly improbable
Geophysical anomalies ID: 2, 5, 7, 10, 13 and 15	Very sensitive*	Negligible to minor	Very low to low	Highly improbable

**Unverified anomalies are designated very sensitive until visually inspected.*

10.5.3 Cumulative impacts

Cumulative impacts are identified as those which arise from the successive, incremental, and/or combined effects of an action, project, or activity when added to other planned, and/or reasonably anticipated future ones.

There are a number of projects planned for in Bass Strait which will impact the seabed and hence potentially impact UCH. The projects considered for cumulative impact assessment across Bass Strait are the offshore Victorian wind development declared areas in Gippsland including:

- Star of the South Offshore Wind Project (SOTS).
- Great Eastern Offshore Wind (Corio Generation).
- Greater Gippsland Offshore Wind Project (BlueFloat Energy)
- Seadragon Project (Flotation Energy).
- Yolla Infield Well Project

The more advanced project, the Star of the South Offshore Wind Farm project off the Gippsland coast is planned for commencement of construction around 2025. With up to 200 turbines proposed as well as connecting cables this project will potentially impact a substantially greater area of seabed, and hence potentially UCH, than Marinus Link.

The nature, depth and extent of seabed impact for the Star of the South Offshore Wind Farm project, and the other aforementioned projects is presently not known and so there is insufficient detail to assess potential cumulative impacts. Nevertheless these projects will be required to avoid/manage impacts to a similar level and be reasonably well separated from the Marinus Link cable.

This assessment has identified that all potential impacts can be avoided and or minimised – ranging from low to very low residual impacts – with the successful implementation of the EPRs. As such, no cumulative impacts are expected between Marinus Link and other mentioned future projects.

10.5.4 Summary of potential impacts

The assessment of the potential impacts – direct, potential direct and indirect – on the identified underwater cultural heritage - both located and unlocated/predicted - found that for the most part *that without mitigation* there was an almost impossible to improbable likelihood of impacts occurring with magnitudes greater than minor with respect to the loss of cultural heritage significance. The exceptions to this are:

- *Unlocated shipwrecks across the whole study area which has been covered by marine geophysical and diving surveys*. The review of the geophysical data and the resulting dive inspections in the nearshore study areas have provided confidence to state that it would be almost impossible for a shipwreck, and associated wreckage, to be impacted by the proposed works. However, should such an impact occur the magnitude of loss of cultural heritage significance for a particular wreck site could reach moderate. This statement is made with the understanding that one or more of the geophysical anomalies that have yet to be verified across the study area may be the remains of vessels which may upon inspection have high cultural heritage significance.
- *Unverified geophysical anomalies in the offshore study area*. There are five seabed anomalies along the proposed alignments where it will be highly probable that they will be impacted by the proposed cable laying process. If one or more of these anomalies are wrecks or wreckage the magnitude of the impact to the cultural heritage values of the site could be as great as moderate.
- *Unverified geophysical anomalies in the nearshore study areas*. There are fourteen seabed anomalies within the nearshore zones whose cultural heritage values are

unknown. They are some distance from the proposed cable alignments and so it is highly improbable, or not possible, that they will be impacted by the proposed works. If one or more are the remains of a vessel the magnitude of impact could reach moderate.

- *The former disused Tioxide Australia pipeline* will be certainly impacted by the pre-lay grapnel. The very low cultural heritage values of this feature means that the significance of the impact would be very low.
- *Submerged terrestrial sites that may be present and associated with the Beach Ridge landforms in the offshore study area*. It is highly improbable that the proposed works will impact artefacts associated with such sites but if this occurs the magnitude of the impact could reach moderate.

Based on our understanding of the significance of the unmitigated impacts, the identified unmitigated impacts of the project do not trigger requirements or legislative approvals. This applies to the *former disused Tioxide Australia pipeline,* which is not protected under applicable heritage legislation. This is not the case for unknown artefacts or wreckage as impacts to these will be mitigated by implementing the EPRs outlined in Section 11.

Section 12 outlines a number of mitigation measures that can be undertaken to reduce the likelihood and magnitude of any impacts.

11 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

The following environmental performance requirements are proposed for the project to mitigate the significance of potential impacts from the project on underwater cultural heritage.

See Section 12 for measures that could be implemented to achieve these EPRs.

In addition to the EPRs below, the other EPRs that would reduce the potential impacts to underwater cultural heritage resulting from the project include those proposed for the Aboriginal cultural heritage assessment (EPR CH02, EPR CH03, EPR EM08).

Decommissioning management plans will outline how activities will be undertaken, assess potential impacts, and outline how potential impacts managed as outlined in the EPRs. The EPRs are presented in EIS/EES Volume 5, Chapter 2 – Environmental Management Framework.

Table 11-1: Environmental Performance Requirements and their relevant project development stages.

EPR ID	Environmental Performance Requirement	Project Stage
EPR – UCH01	***Undertake a magnetometer survey for the final Victorian shore crossing project alignment and additional geophysical surveys if the alignment is revised to be outside the study area.*** Prior to commencement of marine construction, undertake a magnetometer survey of the project alignment to assess the potential for maritime heritage sites for the final Victorian shore crossing. If the alignment is revised to a location outside the areas where geophysical surveys have been completed, undertake geophysical surveys for the revised section to the same standard as the rest of the alignment, prior to commencement of construction. Identified anomalies that cannot be avoided are to be assessed and managed as per EPR UCH02. Any additional geophysical survey must be done to the same standard, that is, the same data acquisition parameters, interpretation and presentation as the surveys completed by MLPL in 2019 and 2020 in the development of the subsea project alignment. That data must be reviewed by a suitably qualified maritime archaeologist with experience in maritime heritage and submerged Aboriginal heritage. The outcomes of these surveys must inform the development of the management plan for underwater cultural heritage (EPR UCH04).	Design

<table>
<thead>
<tr><th>EPR ID</th><th>Environmental Performance Requirement</th><th>Project Stage</th></tr>
</thead>
<tbody>
<tr><td>EPR – UCH02</td><td>Avoid impacting unverified seabed anomalies identified in the marine geophysical survey
Prior to commencement of marine construction, refine the subsea project alignment to ensure unverified seabed anomalies are avoided and apply a buffer of 10 to 50 m depending on the nature of the anomalies (Refer to Table 12-1 of EIS/EES Technical Appendix I for recommended buffer distances from identified anomalies). The buffer must be determined in consultation with a qualified maritime archaeologist. Where anomalies cannot be avoided by more than 10 m, further investigations should be undertaken to assess their cultural heritage values.
These further investigations should include:
1. Visual inspections by diving in waters less than 30 m or a remotely operate vehicle in deeper water.
2. The assessment of the maritime heritage values of an anomaly must be undertaken by a qualified maritime archaeologist.
3. If culturally significant anomalies cannot be avoided, appropriate mitigation measures should be developed and implemented. Mitigation could take the form of a detailed survey and/or archaeological excavation which may require a permit.
The outcomes of these investigations must inform the development of the management plan for underwater cultural heritage (EPR UCH04).</td><td>Design</td></tr>
<tr><td>EPR – UCH03</td><td>Minimise potential impacts to the submerged beach ridge landforms
Prior to commencement of marine construction, obtain sufficiently detailed information about the submerged beach ridge formations, which occur at the locations shown in Figure 9-2 and Table 9-3 of EIS/EES Technical Appendix I, to assist in refinement of design to minimise potential impact to cultural heritage values associated with the landscape prior to inundation.
The sufficiently detailed information includes obtaining high resolution video and multi-beam data along the route where it crosses the beach ridges.
By the completion of construction, have a 3D model prepared using the detailed information collected prior to construction to contribute to the interpretation of these formations as they could have appeared prior to sea level rise. This will be provided to the relevant First Peoples groups.
If construction requires trenching through the beach ridge landform, the impacts must be assessed and minimised during construction, and mitigation measures implemented where required.
These measures must be overseen by a qualified maritime archaeologist and inform the development of the management plan for underwater cultural heritage (EPR UCH04)..</td><td>Design</td></tr>
</tbody>
</table>

<table>
<tr><th>EPR ID</th><th>Environmental Performance Requirement</th><th>Project Stage</th></tr>
<tr><td>EPR – UCH04</td><td>Manage impacts and unexpected finds by developing and implementing a management plan for Underwater Cultural Heritage.
Prior to commencement of marine construction, develop an underwater cultural heritage management plan detailing measures to avoid and minimise impacts on underwater cultural heritage and archaeology for both First Peoples and maritime heritage. The plan must be prepared by an experienced and qualified maritime archaeologist, informed by all available data collected for the alignment and be informed by engagement with First Peoples (EPR EM08). The plan must include:
1. An unexpected finds protocol.
2. Artefact and site recognition guide.
3. Artefact and site recording standards that conform to relevant State and Commonwealth requirements.
4. Detailed maps of no anchoring zones.
5. Inductions prepared for contractors and criteria for when different inductions are required to address separate work activities.
6. The required approach and frequency for site/sea floor inspections before, during construction and after construction (if required) where anomalies can't be avoided with a 10 m buffer or if significant sites are identified along the alignment.
The plan must be implemented during construction.</td><td>Construction</td></tr>
</table>

12 MANAGING POTENTIAL IMPACTS

The measures proposed and to be implemented to reduce of the significance of the identified actual and potential impacts to the underwater cultural heritage is based on the consideration of several factors such as:

- Relevant heritage policies
- Best practice
- Consultant experience in forming and implementing successful mitigation measures in a marine environment

The underlying principle in safeguarding the cultural heritage significance of underwater cultural heritage is to avoid or minimise any impacts (immediate or long-term) on an object or site. This approach is nuanced depending on the level of cultural heritage significance of an item or site, the magnitude of impact and the probability of impact. The significance or consequence of impact relates to the degree or loss – immediate or gradual – of cultural heritage significance.

Generally, the selection of an appropriate mitigation measure for a site follows the principles set out below:

- For cultural heritage objects or sites of outstanding or high cultural heritage values, where the significance of the impacts to be high or major, the appropriate mitigation measure would be to avoid the site and apply a 10 m buffer. This could require re-designing a project element. Where the impacts are less, archaeological recording, excavation and/or monitoring during and after construction would be more suitable. Monitoring involves the appointment of a maritime archaeologist to be available to respond to unexpected finds and ensure that maritime heritage management protocols are being followed. Such monitoring does not require the archaeologist to be on the cable laying vessel at all times and may only be required aboard if something of significance is found.
- For cultural heritage objects or sites of medium cultural value, where the significance of impacts could range from low to high, some form of archaeological recording and/or excavation may be a more appropriate form of mitigation. In areas of medium cultural heritage sensitivity monitoring during and after construction would ensure that undiscovered sites are not adversely affected.
- For cultural heritage objects or sites of low cultural heritage value, or for which the significance of impact is low or very low, some form of sampling or monitoring during construction would be an appropriate form of mitigation.
- Where the significance of impact on objects or sites with medium cultural heritage values or higher are very low; or the likelihood of impact is highly improbable, some form of monitoring during and after constructions may be appropriate to ensure that the assessed impacts are avoided or do not increase. Monitoring protocols should also be established for works within areas of very low heritage sensitivity in the event of unexpected finds such as the discovery of a shipwreck

The details of the monitoring procedures and its various components should be contained within a management plan for Underwater Cultural Heritage (MPUCH) (EPR UCH04). The MPUCH should include:

1. Unexpected finds protocols such as:
    a. When work is to stop in the event of a find.
    b. Who makes that decision.
    c. When is the regulator to be contacted.
    d. When a permit may be required.

   e. Roles and responsibilities of key people such as the proponent, contractor, and project archaeologist.
   f. A decision tree clearly defining the above points. More than one decision tree may be required depending on the work activity.
2. Artefact and site recognition guide.
3. Artefact and site recording standards.
4. No anchoring zones.
5. Inductions prepared for contractors. More than one induction may be required to address separate work activities.
6. Objectives, conduct and frequency of any site inspections before, during and post construction. Any such sites would have been discovered through the unexpected finds procedures.

The mitigation measures proposed to reduce the likelihood and significance of any impacts of the identified underwater cultural heritage value are presented in Table 12-1. The table only addresses those identified potential impacts for each site type which have the highest likelihood for occurring and greatest significance with regards to the loss of cultural heritage significance. The table also presents potential approvals that may be required, depending on the mitigation option chosen.

Table 12-1 : Proposed mitigation measures to reduce impacts to the identified underwater cultural heritage.

UCH item	Study area	Predicted significance and probability of impact (pre-mitigation)	Proposed mitigation measure	Legislative compliance	Predicted residual impact (and relevant EPRs)
Located Maritime Heritage					
Former disused Tioxide Australia pipeline	Tasmanian	*Direct impacts*: **Cable laying** – Certain to impact this item and the significance of impact considered very low *Potential direct impacts*: **Anchoring** – It is considered improbable that anchoring will impact this item and the significance of impact would be very low.	The information recording this feature as presented in this assessment is considered adequate mitigation proportional to the level of cultural heritage significance of the item.	Not protected and approval not required	Very low
Concrete mooring block (BM15)	Tasmanian	*Direct impacts*: **Cable laying** – It is considered improbable that cable laying will impact this item and the significance of impact considered very low. *Potential direct impacts*: **Anchoring** – It is considered highly improbable that anchoring will impact this item and the significance of impact would be very low.	The information recording this feature as presented in this assessment is considered adequate mitigation proportional to the level of cultural heritage significance of the item.	Not protected and approval not required	Very low

UCH item	Study area	Predicted significance and probability of impact (pre-mitigation)	Proposed mitigation measure	Legislative compliance	Predicted residual impact (and relevant EPRs)
Unverified Maritime Heritage					
Anomalies ID: 44, 61, 25, 67, and 39	Offshore	*Direct impacts:* **Cable laying** – It is considered highly probable that cable laying will impact these anomalies without mitigation. The significance of impact could be up to moderate, depending on heritage values (currently unknown as anomalies have not been inspected). *Potential direct impacts:* **Anchoring** – It is considered highly improbable that anchoring will impact these anomalies. The significance of impact could be up to moderate, depending on heritage values (currently unknown as anomalies have not been inspected). *Indirect impacts:* **Scour** – It is considered highly improbable that scouring will impact these anomalies. The significance of impact could be up to moderate, depending on heritage values (currently unknown as anomalies have not been inspected).	The significance of the potential impact to the potential cultural heritage values of these items could be negated by **re-alignment of cable to avoid impact**. The following buffers are recommended for these anomalies: Anomaly ID 25: 10 m Anomaly ID 39: 10 m Anomaly ID 44: 25 m Anomaly ID 61: 25 m Anomaly ID 67: 25 m	Approval not required	Nil (EPR–UCH2)
			If avoidance not feasible the item(s) should be assessed for its cultural heritage values – by visual inspection using an ROV initially - so that an acceptable level of mitigation could be implemented ranging from **archival survey to archaeological excavation**. The pre-lay survey includes the use of an ROV and a visual inspection could be done at this stage if the anomaly is directly on the alignment.	*UCH Act* applies. If associated with a ship or plane wreck over 75 years old (from date of wrecking), it is automatically protected and would require approval to disturb. If other form of UCH, could be declared protected if of outstanding cultural heritage significance.	Low (EPR–UCH2)
Anomalies ID: 13, 41, 71, 16, 1, 2, 32, 64, 57, and 35	Offshore	*Direct impacts:* **Cable laying** – It is considered improbable that cable laying will impact these anomalies. The significance of impact could be up to moderate, depending on heritage values (currently unknown as anomalies have not been	Should the alignment be altered then the significance of the potential impact to the potential cultural heritage values of these items could be negated by **re-alignment of cable to avoid impact**. It is recommended that a buffer of 25 m placed around the centre point of each of these anomalies.	Approval not required.	Nil (EPR–UCH2)

UCH item	Study area	Predicted significance and probability of impact (pre-mitigation)	Proposed mitigation measure	Legislative compliance	Predicted residual impact (and relevant EPRs)
		inspected). *Potential direct impacts:* **Anchoring –** It is considered highly improbable that anchoring will impact these anomalies. The significance of impact could be up to moderate, depending on heritage values (currently unknown as anomalies have not been inspected).	If re-alignment not feasible the item(s) should be assessed for its cultural heritage values – by visual inspection using an ROV initially - so that an acceptable level of mitigation could be implemented ranging from **archival survey to archaeological excavation**. It is recommended that a buffer of 25 m placed around the centre point of this anomaly. The pre-lay survey includes the use of an ROV and a visual inspection could be done at this stage if the anomaly is directly on the alignment.	UCH (Cwlth) Act applies. If ship or plane wreck over 75 years is automatically protected and would require approval to disturb. If other form of UCH, could be declared protected if of high cultural heritage significance.	Low (EPR–UCH2)
Anomalies WB-23_001 to 007	Victoria	*Direct impacts:* **Cable laying** These anomalies are too far away to be impacted by the cable installation. *Potential direct impacts*: **Anchoring –** It is considered highly improbable that anchoring will impact these anomalies. The significance of impact could be up to moderate, depending on heritage significance (currently unknown as anomalies have not been inspected).	Should the currently proposed alignment be altered then the significance of the potential impact to the potential cultural heritage values of this item would be negated by **re-alignment of cable to avoid impact.**	Approval not required.	Nil (EPR–UCH1)
			If avoidance not feasible the item should be assessed for its cultural heritage values – by visual inspection using an ROV initially - so that an acceptable level of mitigation could be implemented ranging from **archival survey to archaeological excavation**. The pre-lay survey includes the use of an ROV and a visual inspection could be done at this stage if the anomaly is directly on the alignment.	UCH (Cwlth) Act and H (Vic) Act apply. If shipwreck over 75 years is automatically protected and would require approval to disturb. If other form of UCH, could be declared protected if of high cultural heritage significance.	Low (EPR–UCH2)
Anomalies ID: 2, 5, 7, 10, 13 and 15	Tasmanian	*Direct impacts:* **Cable laying** – It is considered improbable that cable laying will impact these anomalies. The significance of impact could be up to moderate, depending on heritage	Should the alignment be altered then the significance of the potential impact to the potential cultural heritage values of these items could be negated by **re-alignment of cable to avoid impact**.	Approval not required.	Nil (EPR–UCH2)

UCH item	Study area	Predicted significance and probability of impact (pre-mitigation)	Proposed mitigation measure	Legislative compliance	Predicted residual impact (and relevant EPRs)
		significance (currently unknown as anomalies have not been inspected). *Potential direct impacts*: **Anchoring –** It is considered highly improbable that anchoring will impact these anomalies. The significance of impact is considered to be up to moderate, depending on heritage significance (currently unknown as anomalies have not been inspected).	If re-alignment not feasible the item(s) should be assessed for their cultural heritage values – by visual inspection using an ROV initially - so that an acceptable level of mitigation could be implemented ranging from **archival survey to archaeological excavation**. The pre-lay survey includes the use of an ROV and a visual inspection could be done at this stage if the anomaly is directly on the alignment.	UCH (Cwlth) Act and HCH (Tas) Act apply. If shipwreck over 75 years is automatically protected and would require approval to disturb. If other form of UCH, could be declared protected if of high cultural heritage significance.	Low (EPR–UCH2)
Potential Maritime Heritage					
Potential shipwrecks	All study areas	*Direct impacts:* **Cable laying –** It is considered almost impossible that cable laying will impact potential shipwrecks, as no sign of shipwrecks has been observed in the study area. The significance of impact to a shipwreck site would be considered moderate. *Potential direct impacts:* **Anchoring –** it is considered almost impossible that anchoring will impact potential shipwrecks, as no sign of shipwrecks has been observed in the study area. The significance of impact to a shipwreck site would be considered moderate.	To ensure that impacts to unlocated shipwrecks are avoided or minimised a **MPUCH** is to be created and implemented during the works. The plan would include: • Unexpected finds protocols • Artefact identification • Artefact and site recording standards • No anchoring zones • Contractor inductions • Site inspections (if required)	In the event of a wreck being found during construction a permit in accordance with UCH (Cwlth) Act, H (Vic) Act and HCH (Tas) may be required if over 75 years old or considered to be of sufficient cultural significance that the relevant Minister declares it protected.	Nil to Low (EPR–UCH4)

UCH item	Study area	Predicted significance and probability of impact (pre-mitigation)	Proposed mitigation measure	Legislative compliance	Predicted residual impact (and relevant EPRs)
Potential Discard	All study areas	*Direct impacts:* **Cable laying –** It is considered highly improbable that cable laying would impact vessel discard. The significance of impact would be considered very low. *Potential direct impacts:* **Anchoring –** It is considered highly improbable that anchoring would impact vessel discard. The significance of impact is considered very low.	To ensure that impacts to unlocated shipwrecks are avoided or minimised a **MPUCH** is to be created and implemented during the works. The plan would include: • Unexpected finds protocols • Artefact identification • Artefact and site recording standards • No anchoring zones • Contractor inductions • Site inspections (if required)	In the event of a non-shipwreck being found during construction a permit in accordance with UCH (Cwlth) Act, H (Vic) Act and HCH (Tas) maybe required if considered to be of sufficient cultural significance that the relevant Minister declares it protected.	Nil to low (EPR–UCH4)
Predicted submerged terrestrial sites that may be present					
Estuarine channel	Offshore	*Direct impacts:* **Cable laying –** It is considered almost impossible that cable laying would impact Pleistocene estuarine channels, due to the depth of Holocene sediments and the shallow nature of proposed works. The significance of impact is considered very low. *Indirect impacts:* **Scour –** It is considered highly improbable that scouring would impact this feature. The significance of impact considered very low.	No further action required. In the event of a change in stated design where the trenching for the cable will go deeper than the 1.5 m, the potential impact to predicted sites at this location should be re-assessed.	Approval not required.	Very low (EPR–UCH3)

UCH item	Study area	Predicted significance and probability of impact (pre-mitigation)	Proposed mitigation measure	Legislative compliance	Predicted residual impact (and relevant EPRs)
Beach ridge	Offshore	*Direct impacts:* **Cable laying –** It is considered highly improbable that cable laying would impact archaeological sites associated with this feature. The significance of impact is considered low. *Potential direct impacts:* **Anchoring –** It is considered highly improbable that anchoring will impact this feature. The significance of impact would be low.	To reduce the likelihood of impact the following measures could be undertaken; - Obtain high resolution video and multibeam sonar of the alignment and formation to allow for detailed 3D modelling so as to digitally recreate the submerged landscape.	Approval not required.	Very low (EPR–UCH3)
			- In addition if trenching takes place, design and implement a sampling strategy involving recovery of sediments along the alignment where it intersects the beach ridges. The location of HEY-V-23 would be such a place that should be sampled if it is potentially impacted. Note that re-aligning the cable to avoid the beach ridge will result in no likelihood of impact	Approval not required If a site is identified it may be declared protected under the UCH (Cwlth) Act.	Very low (EPR–UCH3)

UCH item	Study area	Predicted significance and probability of impact (pre-mitigation)	Proposed mitigation measure	Legislative compliance	Predicted residual impact (and relevant EPRs)
Beach Ridge Strandplain (indurated)	Victoria	*Direct impacts:* **Cable laying –** It is considered almost impossible that cable laying would impact archaeological sites associated with this feature. The significance of impact is considered very low. *Potential direct impacts:* **Anchoring –** It is considered almost impossible that anchoring will impact this feature. The significance of impact would be very low.	No mitigation required, as proposed works are not likely to penetrate modern sediments or trench through the Pleistocene indurated beach ridge strandplain.	Approval not required.	Very low
Entrenched stream	Tasmania	*Direct impacts:* **Cable laying –** It is considered almost impossible that cable laying will impact archaeological sites associated with this feature. Significance of impact is considered to be very low. *Potential direct impacts:* **Anchoring –** It is considered almost impossible that anchoring will impact archaeological sites associated with this feature. Significance of impact is considered to be very low.	No mitigation required, as proposed works are not likely to penetrate modern sediments or trench through the former riverbank to impact Pleistocene landforms.	Approval not required.	Very low (EPR–UCH3)

13 CONCLUSION

Table 13-1 outlines the relevant criteria from the MNES Significant impact guidelines 1.1 that apply to underwater cultural heritage, along with a statement on whether the criteria for a significant impact are met. Also included are brief supporting justifications and cross references to the relevant sections of the report where further detail is provided.

Table 13-1 Underwater cultural heritage matters of national environmental significance and consistency with EPBC significant impact assessment guidelines

Criteria	Significant impact criteria met?	Justification
Commonwealth marine environment		
An action is likely to have a significant impact on the environment in a Commonwealth marine area if there is a real chance or possibility that the action will: - have a substantial adverse impact on heritage values of the Commonwealth marine area, including damage or destruction of an historic shipwreck	No	- According to historical sources, sixteen shipwrecks may be present in the study area. There is a possibility that further unreported shipwrecks may be present. However, none have been located within the study area through geophysical surveys and diving inspections. With the implementation of measures to comply with EPRs that require avoiding unverified seabed anomalies and managing unexpected finds via a Management Plan for Underwater Cultural Heritage, and the relatively small area of seabed disturbance, it is very unlikely that a shipwreck and/or associated material will be significantly impacted (sections 10.5.2, 10.5.4 and 12). - The remains of the former disused Tioxide Australia pipelines will be impacted (as it will be crossed by the cable alignment) but the significance of the impact on the cultural heritage values of the item is very low due to its low cultural heritage significance. As such, no further actions are proposed for this item (section 10.5.2) - There are five unverified anomalies within 10m of the alignment which will be inspected prior to construction if they cannot be avoided by applying a protection buffer of at least 10m. If found to have cultural heritage value and potentially impacted by construction, appropriate mitigation measures will be adopted that would reduce the significance of impact to an acceptable level(section 10.5.2). - Submerged terrestrial landforms were identified in the study area. These are estuarine/tidal channel, beach ridge, entrenched stream/gully and beach ridge strandplain (Section 6). Due to the relatively shallow depths, and narrow linear nature of seabed disturbance and the low likelihood of cultural material being present, it is highly improbable that cable laying activities will intersect and impact potential submerged terrestrial sites and associated sites and artefacts (Section 10.5.1). Recorded submerged Aboriginal archaeological sites are extremely rare and the predicted condition of the potential sites associated with the submerged landforms are likely to be in poor or fragmentary condition due to their age and the action of waves and currents over thousands of years. However any surviving sites are considered to be very culturally sensitive from at least an archaeological/scientific criterion. The partial loss of artefacts and archaeological integrity of such sites would result in impacts of low significance.
World heritage properties		
An action is likely to have a significant impact on the World Heritage values of a declared World Heritage property if there is a real chance or possibility that it will cause: - one or more of the World Heritage values to be lost - one or more of the World Heritage values to	No	- There are no world heritage properties in the study area. Therefore no impacts to world heritage properties will occur.

be degraded or damaged, or - one or more of the World Heritage values to be notably altered, modified, obscured or diminished.		
National heritage places		
An action is likely to have a significant impact on the National Heritage values of a National Heritage place if there is a real chance or possibility that it will cause: - one or more of the National Heritage values to be lost - one or more of the National Heritage values to be degraded or damaged, or - one or more of the National Heritage values to be notably altered, modified, obscured or diminished.	No	- There are no national heritage places in the study area. Therefore no impacts to world heritage properties will occur.

This study makes the following conclusions:

- Historical records indicated that nine maritime heritage sites, these all being shipwrecks, could be possibly located within the project study area. These wrecks are protected under State and Commonwealth legislation.
- A review of the available marine geophysical data – SSS, PSSS, MBES and mag – identified a number of seabed anomalies of potential cultural heritage significance along the offshore and nearshore study areas, as well as the former disused Tioxide Australia pipeline off Heybridge, Tasmania.
- The proposed route for the Victorian shore crossing has been altered (July 2022) during the preparation of this assessment. Marine geophysical surveys for the realigned Victoria shore crossing were undertaken by XOCEAN in September 2023. The resulting MBES, PSSS, and sub-bottom profiler data has been provided to the MA and interrogated to identify anomalies of potential cultural heritage significance.
- The most prospective seabed anomalies shallower than 30 m water depth were inspected by divers at Heybridge in Tasmania. Of the 17 targets inspected, only one (BM15) was a cultural object, being a concrete mooring block of low cultural heritage significance. Eight seabed anomalies considered to be of lesser likelihood of being anthropogenic or of cultural heritage significance were not investigated. Review of the 2023 marine geophysical survey data for the realigned Victoria shore crossing identified 7 anomalies of possible cultural origin. These have not been visually inspected.
- In deeper water, more than 30 m depth, 72 seabed anomalies were identified from the geophysical survey data and their cultural heritage significance cannot be determined without further investigation. Of these, five are located within 10 m of the proposed cable alignment, and a further ten are located beyond 10 m, but within 50 m of the alignment.
- Predictive modelling using marine geophysical data sets and terrestrial archaeological analogues identified a number of potential submerged and buried terrestrial landforms – an estuarine channel, beach ridges and an entrenched stream – which could host archaeological sites from the late Pleistocene. Aboriginal sites and artefacts located within the state boundaries (3 nm from shore) of Tasmania and Victoria are automatically protected by the States' heritage laws. Aboriginal sites and artefacts beyond 3 nm from shore can be declared protected under the *UCH (Cwlth) Act 2018*.
- The study also found there is expected to be a very low density of non-shipwreck cultural material, primarily in the form of vessel discard, across the study area. These objects would most likely be of low cultural heritage significance.
- The remains of the former disused Tioxide Australia pipeline will be impacted (as it will be crossed by the cable alignment) but the significance of the impact on the cultural heritage values of the item will be very low on account of its low cultural heritage significance. As such, no further actions are proposed for this item.
- It is highly probable that five of the unverified seabed anomalies in the offshore study area may be impacted by the laying of the cables. The significance of the loss of cultural heritage values may be as great as moderate if any of the anomalies impacted are shipwrecks. To avoid impacts to these features, it is proposed that the cable alignments are adjusted to avoid the anomalies, with buffers ranging from between 10 m to 50 m depending on the nature of the anomaly (refer to Table 76). In circumstances where an anomaly cannot be avoided the cultural heritage values of the anomaly should be determined so as to assess the significance of impact. After this is determined, appropriate mitigation measures can be adopted which could take the form of detailed survey and/or archaeological excavation if the anomalies are assessed to have cultural value.

- The pre-lay survey will deploy an ROV to determine whether these anomalies that can't be avoided or are located within 10 m of the project alignment will be impacted and to determine if the anomalies have cultural heritage values. Leaving the identification of seabed anomalies during the construction phase will increase the risk of delays to the programme should it not be feasible to avoid an anomaly with high cultural heritage values. The delay, in this case, would be attributed to the implementation of required mitigation measures.
- It is highly improbable that cable laying activities will intersect potential submerged terrestrial sites associated with beach ridge landforms that may be present in the southern portion of Bass Strait. Recorded submerged Aboriginal archaeological sites are extremely rare within an Australian context due to an absence of archaeological investigations and the predicted condition of the potential sites associated with the beach ridge landforms are likely to be in poor or fragmentary condition. Any surviving sites are considered to be very culturally sensitive from at least an archaeological/scientific criterion (the remaining cultural values of such sites are yet to be assessed in this study). Given the potential significance of such sites even the partial loss of material and archaeological integrity the impact could be rated as having low significance. To minimise any potential impacts to submerged terrestrial sites that may be present and associated with the beach ridge formation it is proposed that high resolution video and multi-beam data should be obtained along the route where it crosses the beach ridge landforms for the purposes of creating a 3D model of the formation, which could provide an interpretation of the formation as it could have appeared prior to sea level rise.
- In addition, if mechanical trenching is unavoidable through the beach ridge formation a strategy should be devised and implemented involving recovery of sediments along the alignment where it intersects the beach ridges. The location of HEY-V-23 would be such a place that should be sampled if it is impacted. The aim of the sampling is to collect past environmental data so as to assist in the recreation of the landscape and be provided to Traditional Owners. The information obtained from the sampling would provide greater clarity on site formation processes on underwater cultural heritage on such formations in the southern part of Bass Strait. The frequency and manner of the sampling to be determine when more information is known about the method of trenching. The re-alignment of the cable route around the beach ridge will avoid potential impact.
- It is almost impossible that unlocated shipwrecks (not including the as yet unverified anomalies discussed above) will be impacted by the proposed works, however if this does occur the significance of the impact may be as great as moderate. To ensure that such impacts are avoided or minimised to unlocated shipwrecks or other forms of potential maritime heritage a Management Plan for Underwater Cultural Heritage should be created and implemented. The plan would include but not be confined to contractor inductions, artefact identification, stop work and notification protocols, artefact and site recording standards, and no-anchoring zones.

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ANNEX A – HEYBRIDGE DIVE INSPECTION REPORT

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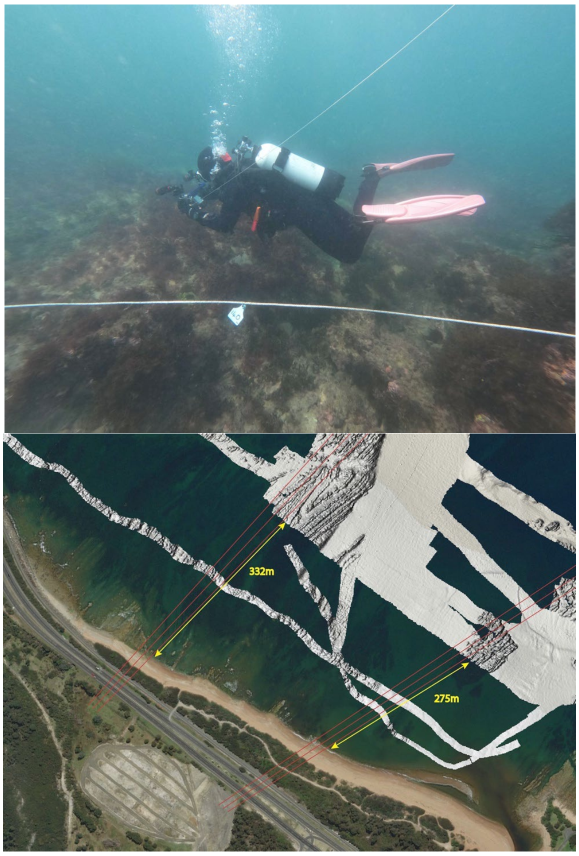
Marinus Link
Heybridge



Maritime Archaeology
Dive Survey

Heybridge
Tasmania

Marinus Link
Heybridge Maritime Archaeology Dive Survey

Prepared for:

Tetra Tech Coffey

By:

Jane Mitchell

James Parkinson

Kurt Bennett

Cosmos Archaeology Job Number J21/01

Cover Image: *Diver running transect (top); Gap survey locations (bottom).*

TABLE OF CONTENTS

Abbreviations

GPS	Global Positioning System
m	Metres
MBES	Multibeam Echosounder
ROV	Remotely Operated Vehicle
SCUBA	Self-Contained Underwater Breathing Apparatus
SSS	Side Scan Sonar

1 INTRODUCTION

1.1 Study Area

The survey area is located near the small township of Heybridge, Tasmania. The survey area extends northeast from the beach, between Heybridge and Chasm Creek (Figure 1). Two cable routes are planned to make landfall, and both intersect this coastal margin.

Figure 1: Survey area, Heybridge, Tasmania. (Base image: Google Earth).

1.2 Objectives

The objectives of this dive survey were to:

- Visually examine the seabed along the proposed cable route from the shoreward limit of the marine geophysical survey to the low tide zone of the beach at Heybridge. This is referred to as the 'gap survey'.
- Examine anomalies and submerged landforms of potential maritime heritage significance along the proposed cable route up to the 30 m depth contour.

2 ARCHAEOLOGICAL DIVE SURVEY

2.1 Dates and Personnel

The dive surveys were carried out on the 27th and 28th September 2021. James Parkinson, from Cosmos Archaeology was the maritime archaeologist supervising the inspections. Dive support was provided by Marine Solutions, who supplied two divers, self-contained underwater breathing apparatus (SCUBA) and a dive platform. Diving operations were run and supervised by Marine Solutions. Personnel involved during the inspection are listed in Table 1.

Table 1: Dive inspection personnel

Name	Title	Company
James Parkinson	Maritime Archaeologist	Cosmos Archaeology
Joanna Smart	Diver	Marine Solutions
Laura Smith	Diver	Marine Solutions
Tim Alexander	Boat skipper	Marine Solutions

2.2 Weather and Tide Conditions

The weather and tide conditions for the two days of survey and the days prior were relatively benign. The days of the survey had very little wind and sea conditions were optimal for diving. The tide was taken into consideration for the deeper targets as there is a 3 m tidal range and these targets were dived at low tide (Table 2 and Table 3).

Table 2: Tides for the days of survey.[1]

27-09-2021	Time	0359	1010	1558	2222
	Height (m LAT)	3.17	1.0	3.14	0.64
28-09-2021	Time	0436	1044	1632	2258
	Height (m LAT)	3.16	1.04	3.12	0.65

Table 3: Rain and wind conditions for the three days previous to the dive inspection and the days of the inspection.[2]

Date	Rain (mm)	Wind 09:00 (km/h)	Wind 15:00 (km/h)
24-09-2021	7.2	35 W	39 W
25-09-2021	5.4	22 WSW	22 W
26-09-2021	0.2	9 S	19 NNW
27-09-2021	0.0	0	17 NNE
28-09-2021	0.2	11 SE	13 NE

[1] **Willy Weather 2021,** *Heybridge Tide Times and Heights*, available https://tides.willyweather.com.au/tas/north-western/heybridge.html, accessed 27 September 2021.
[2] **Bureau of Meteorology, Australian Government, 2021,** *Wynyard Tasmania September 2021 Daily weather observations*, http://www.bom.gov.au/climate/dwo/IDCJDW7057.latest.shtml, accessed 29 September 2021.

2.3 Conduct of Survey

The underwater survey was conducted with the use of a dive crew from Marine Solutions under the direction of the maritime archaeologist. The inspections were conducted on SCUBA in accordance with AS/NZS 2299.1: 2015 diving operational standards.

Footage of each location was filmed by the divers with both a Go Pro Hero 9 and Sony NEX-5 camera in an Aquapazza underwater housing with two INON LF 3100-EW video lights (Figure 2).

For depths that exceeded the maximum diver limits of 30 m, a Remotely Operated Vehicle (ROV) was used. The ROV dives were conducted using a Chasing M2 professional ROV with a 200 m tether and a live stream to the surface (Figure 3). The ROV had a mounted Go Pro Hero 9 to take additional video footage.

Figure 2: Diver swimming transect line with camera equipment. (Image taken 28th September 2021).

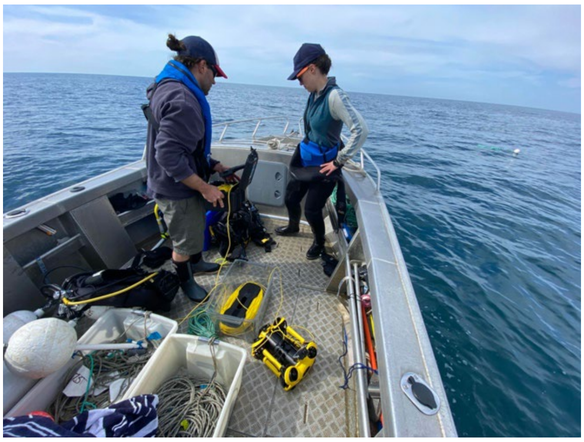


Figure 3: Chasing M2 ROV getting ready to dive. (Image taken 28th September 2021).

Several methods were employed to investigate the study area. These are outlined in **Sections 2.3.1 to 2.3.4.**

2.3.1 *Gap Survey*

A systematic underwater archaeological survey was conducted in areas between the shoreline and the existing geophysical survey data (**Error! Reference source not found.**).

The gap survey was undertaken using two long transects. These transects were planned along the proposed cable routes and were designed to search the area between the existing geophysical data and the shoreline for any archaeological remains. The gap survey covered the entire length of the cable routes located within the 'gap' indicated by missing geophysical data. The transect information is displayed in Table 4, Table 5 and Figure 4.

Table 4: Coordinate information for Transect 1.

TRANSECT 1	Lat	Long	Total Distance	Bearing
Start	-41.07158	145.97802	349 m	225°
End	-41.06982	145.98033		

Table 5: Coordinate information for Transect 2.

TRANSECT 2	Lat	Long	Total Distance	Bearing
Start	-41.07317	145.98112	283 m	235°
End	-41.7177	145.98392		

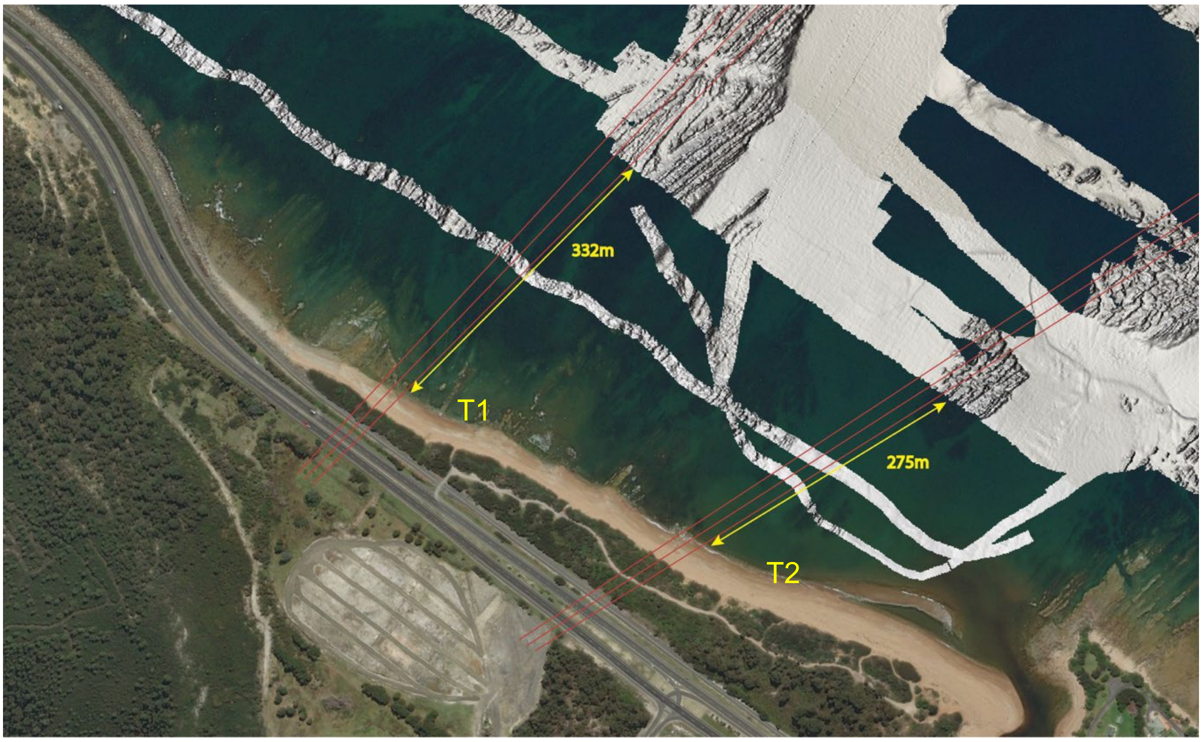


Figure 4: Areas and distances shown for the proposed gap survey. *(Base image: QGIS Satellite imagery).*

The gap survey was conducted by divers visually inspecting the seafloor. A weighted transect line was run from the dive boat. The boat ran the transect on the required bearing until the water depth was too shallow for the vessel's draft, with the divers continuing the bearing until they reached shallow water (Figure 5). The divers then recorded the transect swimming on the back bearing until they reached the transect line and then swam either side of the transect line taking video of the seafloor and searching for any cultural heritage material. One diver towed a GPS recording the track of each transect (Figure 6).

Figure 5: Divers following bearing to reach the shallow end of the transect. (Image taken 28th September 2021).

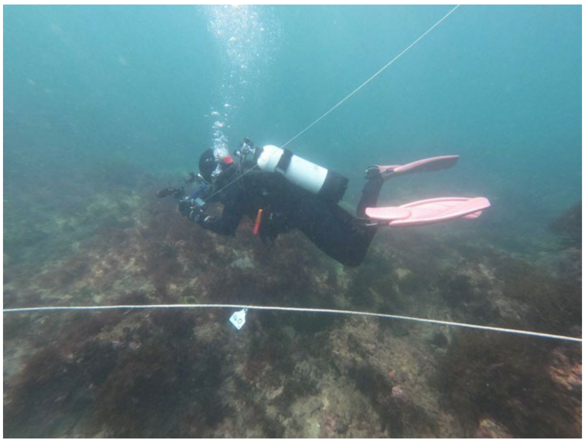


Figure 6: Diver following weighted transect line and towing GPS unit on the water surface. (Image taken 28th September 2021).

2.3.2 *Target Inspection Dives*

The targeted inspection dives required a diver to inspect previously identified seafloor anomalies from existing geophysical data up to 30 m depth. A GPS unit was used to locate the potential targets and a shot line was placed on the seabed. Two divers conducted a visual circle-search on the seafloor to locate and record the targets.

Seven targets were identified for further investigation during the dive survey. These targets were then given a priority status for the targeted inspections (Figure 7). These were:

- A = top priority (4 targets)
  - Images appear to be cultural and representative of a 'site' such as a small wreck. These targets also consider depth and approximation to cable.
- B = secondary (3 targets)
  - Images appear to be cultural but are representative of an individual object, or discard and less likely to constitute a site.

Figure 7: Target list identified from geophysical data. Green is top priority and orange is medium priority. (Base image: Google Earth).

2.3.3 *Possible Paleo-channel Transect*

A video survey transect was completed showing the transition from the sandy bottom of the paleo-channel across the interface with what may be the former banks of the paleo-channel. This survey transect was conducted at a bearing of 315° (northwest) to a distance of 30 m from the centre of Target 1 (Figure 8). A transect line was run and the divers swam down the line, recording the topography of the seafloor.

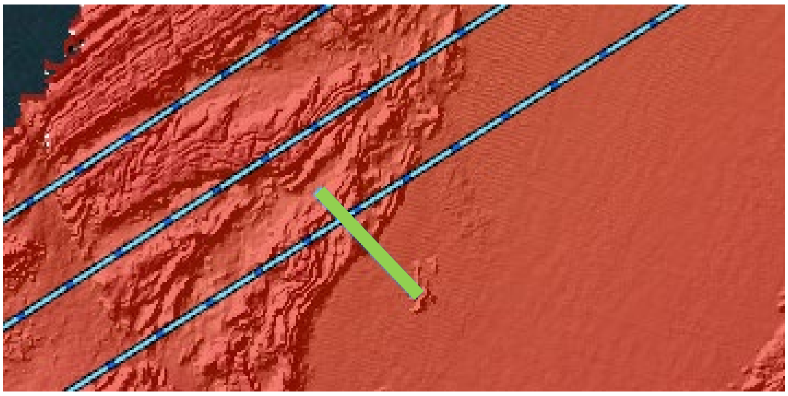


Figure 8: Green line shows direction and length of the paleo-channel video survey. The three cyan lines are the proposed route of the cables.

2.3.4 *ROV Dives*

An opportunistic transect was run using the ROV to record the seabed at a potential target for submerged terrestrial landscapes. A shot line was dropped on the target location and the

ROV followed the bearing provided for approximately 150 m in order to cross the proposed cable route (Figure 9 and Table 6).

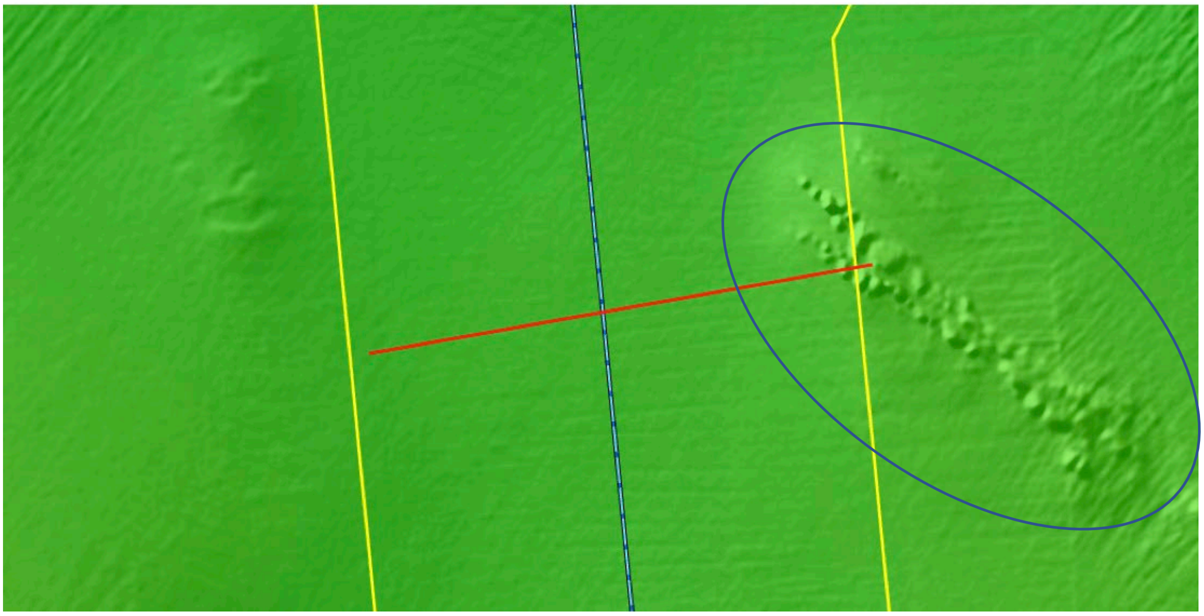


Figure 9: ROV10_transect location. Red line shows length and bearing of transect and cyan and black line is proposed route of cable. Blue circle highlights paleo beach ridge formation.

Table 6: ROV10_Beach Ridge transect information.

ROV_10	Lat	Long	Total Distance	Bearing
Start	-41.07158	145.97802	150 m	260°

2.4 Findings of the Diving Survey

2.4.1 *Gap Survey*

2.4.1.1 Transect 1

The coordinate information for Transect 1 is outlined in Table 7, while the dive information for the transect is outlined in Table 8.

Table 7: Coordinate information for Transect 1.

TRANSECT 1	Lat	Long	Total Distance	Bearing
Start	-41.07158	145.97802	349 m	225°
End	-41.06982	145.98033		

Table 8: Dive information for Transect 1.

Transect 1		
Date: 28-09-2021	**Method:** SCUBA	**Tide:** Ebbing
Distance and direction: 300 m on bearing 225°		**Divers**: James Parkinson / Joanna Smart
Swim start (min): 1044	**Swim end (min):** 1102	**Total time (min):** 18
Depth: 5 m	**Water visibility:** 10 m	**Seabed visibility:** Excellent

The dive boat was unable to reach the start point of the transect due to the shallow water depth. The transect line was dropped at -41.07108, 145.97881 and the divers followed the bearing for a further 60 m until they reached the shallows. The divers were recording their location with a surface GPS and the transect route, in relation to the cable route, is displayed in Figure 10.

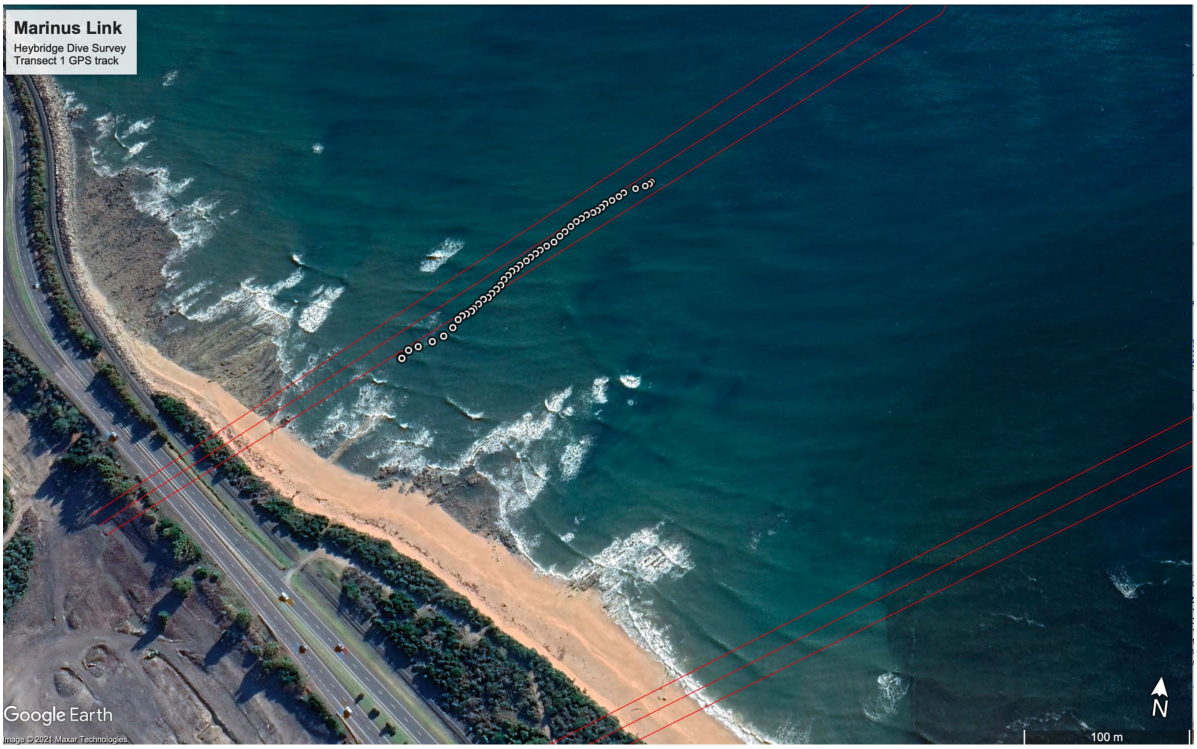


Figure 10: GPS track of Transect 1 (white dots) in relation to cable route in red. (Base image: Google Earth).

The seabed at the shallow end (start) of the transect was characterised by rocky boulders, smaller rocks and cobbles, all covered in a heavy layer of seaweed (Figure 11 and Figure 12).

Sixty metres along the transect line, the seaweed had reduced in thickness, revealing a generally rocky seabed with low profile rock outcrops and small patches of sand (Figure 13). At 120 m, the seabed was still rocky, but the rock outcrops were higher, up to 1 m in places with larger patches of sandy seabed in between (Figure 14).

For the final 150 m of the transect, the seabed consisted of channels of sandy seabed with long stretches of rock outcrops and reefs with seaweed growth (Figure 15 and Figure 16).

No cultural heritage material was observed along the transect.

Figure 11: Start of T1. Image 2021_09_28_CA_T1_1; 00:03).

Figure 12: Seabed at beginning of T1 characterised by rock boulders with a heavy covering of seaweed. (Image 2021_09_28_CA_T1_1; 00:10).

Figure 13: Example of seabed 60 m along T1. (Image 2021_09_28_CA_T1_1; 04:52).

Figure 14: Example of seabed 120 m along T1. (Image 2021_09_28_CA_T1_2; 01:43).

Figure 15: Example of seabed 150 m along T1. (Image 2021_09_28_CA_T1_2; 04:20).

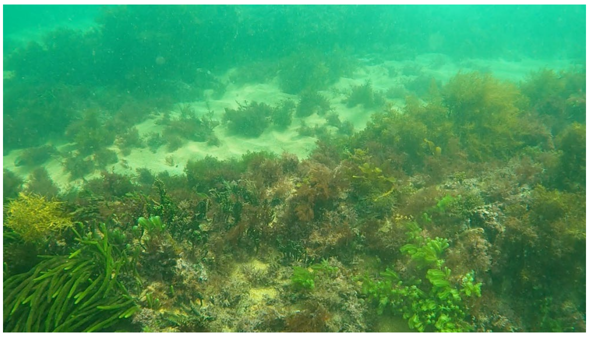


Figure 16: Example of seabed for the final 50 m of T1. (Image 2021_09_28_CA_T1_3; 03:47).

2.4.1.2 Transect 2

The coordinate information for Transect 2 is outlined in Table 9 while the dive information for the transect is outlined in Table 10.

Table 9: Coordinate information for Transect 2.

TRANSECT 2	Lat	Long	Total Distance	Bearing
Start	-41.07317	145.98112	283 m	235°
End	-41.7177	145.98392		

Table 10: Dive information for Transect 2.

Transect 2		
Date: 28-09-2021	**Method:** SCUBA	**Tide:** Ebbing
Distance and direction: 285 m on bearing 240°		**Divers**: Laura Smith / Joanna Smart
Swim start (min): 1208	**Swim end (min):** 1245	**Total time (min):** 37
Depth: < 5 m	**Water visibility:** 10 m	**Seabed visibility:** Excellent

The dive boat was unable to reach the start point of the transect due to the shallow water depth. The transect line was dropped at -41.07292, 145.98143 and the divers followed the bearing for a further 40 m until they reached the shallows. The divers were recording their location with a surface GPS and the transect route, in relation to the cable route, is displayed in Figure 17.

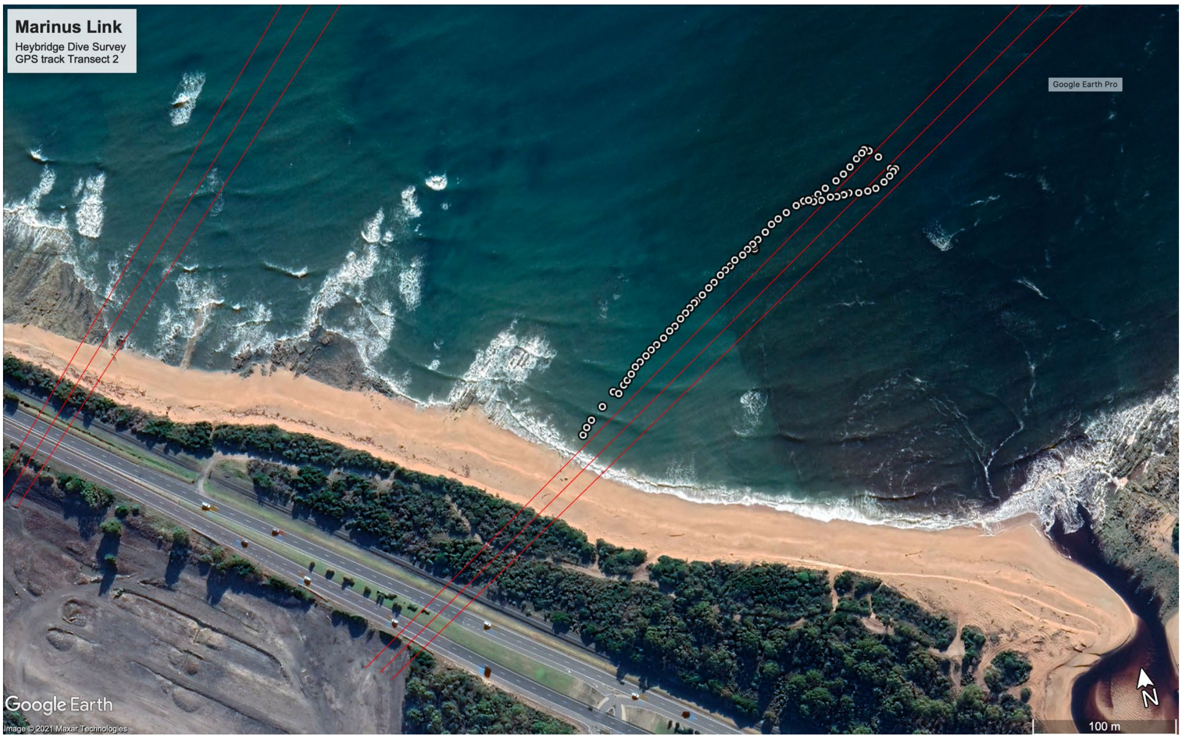


Figure 17: GPS track of Transect 2 (white dots) in relation to cable route in red.

The seabed at the shallow end (start) of the transect was characterised by a featureless, sandy seabed (Figure 18 and Figure 19).

From the 50 m mark of the transect, loose small rocks and cobbles became obvious on and in the sandy seabed. As the divers followed the line, the rocks increased in frequency and size at the 70 m mark (Figure 20 and Figure 21). For approximately 30 m the rocks almost entirely obscured the sandy seabed (Figure 22). By the 100 m mark of the transect, the small loose rocks had largely been replaced with a sandy seabed and small, low-profile rocky outcrops (Figure 23).

At 180 m along the transect, a timber was located, partially buried in the seabed, resting perpendicular to the transect line. This timber measured 5 m long with a diameter of 0.5 m and had seaweed stands growing across its length. The exposed surface was heavily degraded and showed evidence of marine borer damage (Figure 24 and Figure 25). No obvious evidence of fastenings or attachment holes was observed.

At 200 m, the seabed consisted of a heavy sand and shell matrix formed into distinctive wave patterns with the seaweed growth developing at 240 m (Figure 26 and Figure 27). The final length of the transect consisted of rocky outcrops of up to 1 m high rising out of the sandy seabed.

No cultural heritage features were observed during the transect.

Figure 18: Start of T2. (Image 2021_09_28_CA_T2_1; 00:03).

Figure 19: Featureless sandy seafloor characterised the beginning of T2. (Image 2021_09_28_CA_T2_1; 00:42).

Figure 20: Small rocks (10 – 30 cm) scattered on and in the sandy seafloor began to appear at 50 m along T2. (Image 2021_09_28_CA_T2_1; 03:41).

Figure 21: Larger rocks (30 – 60 cm) scattered on and in the sandy seafloor increased in frequency at 70 m along T2. (Image 2021_09_28_CA_T2_1; 04:23).

Figure 22: Example of seabed at 90 m along T2, showing rocky cobbles. (Image 2021_09_28_CA_T2_1; 07:00).

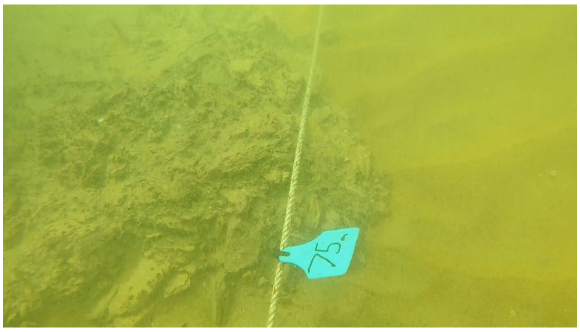


Figure 23: 100m along T2, the rock cobbles had been replaced by a sandy seafloor with low-profile rock outcrops. Note transect marker plus 40 m. (Image 2021_09_28_CA_T2_2; 00:55).

Figure 24: Timber located at 180 m along T2. Note timber is heavily marine borer damaged. (Image 2021_09_28_CA_T2_3; 00:22).

Figure 25: Timber located at 180 m along T2. ***(***Image 2021_09_28_CA_T2_3; 00:35).

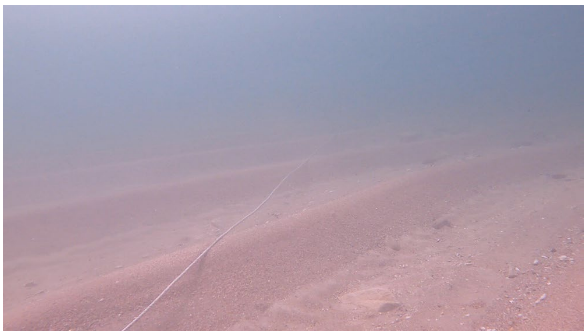


Figure 26: Example of seafloor at 200 m along T2 consisting of sandy seabed with distinct wave patterns. (Image 2021_09_28_CA_T2_4; 01:36).

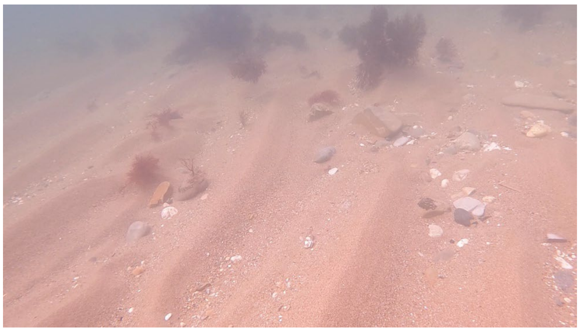


Figure 27: Seaweed is present after 240 m along T2. (Image 2021_09_28_CA_T2_5; 00:21).

Figure 28: Seabed at 260 m to the end of T2 was characterised by a sandy seabed with large rock outcrops up to 1 m high. (Image (Image 2021_09_28_CA_T2_5; 02:25).

2.4.2 *Target Inspection Dives*

A total of five dives and one ROV inspection were undertaken to identify the targeted anomalies.

2.4.2.1 Target A9

Target ID	Lat	Long	Interpretation	Dimensions	Depth	Distance from cable
A9	-41.05140	146.00300	Possibility of shipwreck or dumped material, more likely rock outcrop (Figure 29 and Figure 30).	Length: 34.9 m Width: 8.5 m	26 m	37 m

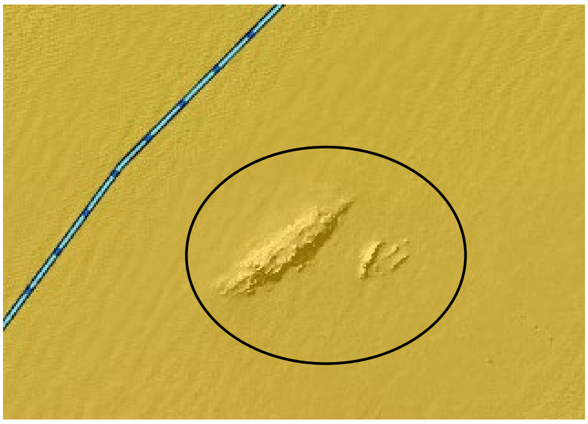


Figure 29: Multibeam image of target A9. Proposed cable route in blue.

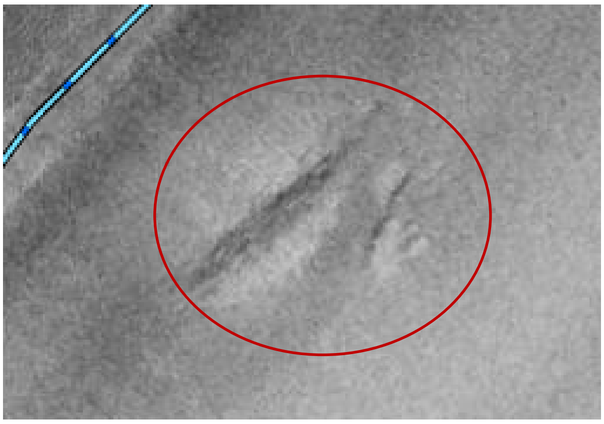


Figure 30: Side scan sonar image of target A9. Proposed cable route in blue.

Inspection details for Target A9		
Date: 27-09-2021	**Method:** SCUBA	**Tide:** Flooding
Distance and direction: Circular search		**Diver**: James Parkinson
Swim start (min): 1308	**Swim end (min):** 1318	**Total time (min):** 10
Depth: 29 m	**Water visibility:** 5 – 10 m	**Seabed visibility:** Excellent

Target description: Low-profile reef with rocks, boulders and cobble. The height of the formation is approximately 1.5 m, with a length of 34 m and width of 8 m. The rock appears to be sedimentary and layered with the strata varying in thickness from 25 mm to 35 mm and with very straight edges. Evidence of scour of the sandy seabed surrounding outcrop (Figure 31 to Figure 36).

No cultural heritage features located.

Figure 31: Section of rock outcrop at A9. (Image taken 27 September 2021).

Figure 32: Target A9 with scale in 10 cm increments. (Image taken 27 September 2021).

Figure 33: Section of rock outcrop at A9. (Image taken 27 September 2021).

Figure 34: Section of rock outcrop at A9. (Image taken 27 September 2021).

Figure 35: Detail of flaking rocks at base of outcrop. Scale in 10 cm increments. (Image taken 27 September 2021).

Figure 36: Rock outcrop at A9 surrounded by a sandy seabed. Scale in 10 cm increments. (Image taken 27 September 2021).

2.4.2.2 Target A6

Target ID	Lat	Long	Interpretation	Dimensions	Depth	Distance from cable
A6	-41.05985	145.99665	Possible small wreck or rock outcrop (Figure 37 and Figure 38).	Length: 7.9 m Width: 2.9 m	20 m	15 m

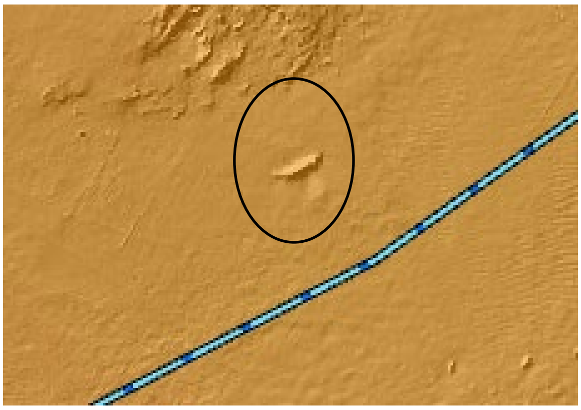


Figure 37: Multibeam image of target A6. Proposed cable route in blue.

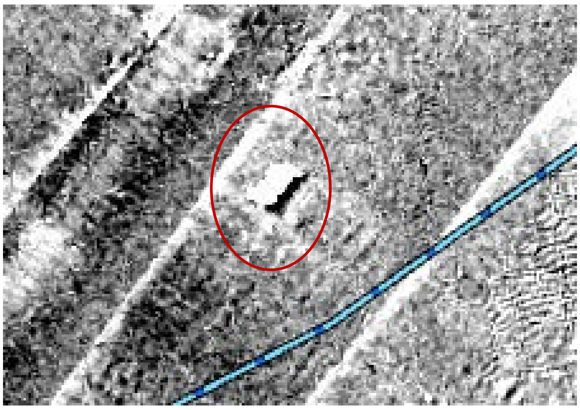


Figure 38: Side scan sonar image of target A6. Proposed cable route in blue.

Inspection details for Target A6		
Date: 27-09-2021	**Method:** SCUBA	**Tide:** Flooding
Distance and direction: Circular search		**Diver**: James Parkinson
Swim start (min): 1400	**Swim end (min):** 1414	**Total time (min):** 14
Depth: 24 m	**Water visibility:** 5 – 10 m	**Seabed visibility:** Excellent

Target description: A6 is a section of low-profile rock with a height of approximately 1 m, length of 7 m and a width of 2 m. The rock appears to be sedimentary and layered, similar in nature to target A9 with the strata varying in thickness from 25 mm to 35 mm and with very straight edges. Evidence of scour in the sandy seabed that surrounds the outcrop. (Figure 39 to Figure 43).

No cultural heritage features located.

Figure 39: Target A6 on descent; shot line in foreground. (Image taken 27 September 2021).

Figure 40: Target A6 surrounded by a sandy seabed. Scale in 10 cm increments. (Image taken 27 September 2021).

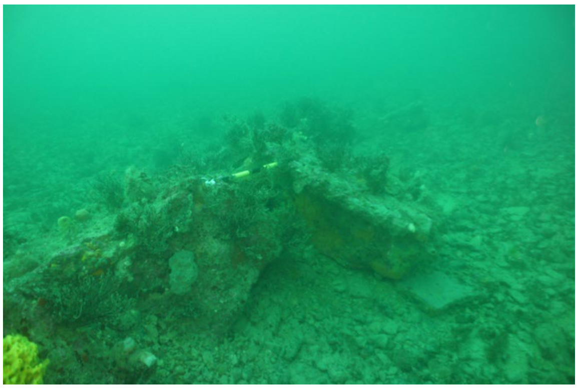


Figure 41: Target A6. (Image taken 27 September 2021).

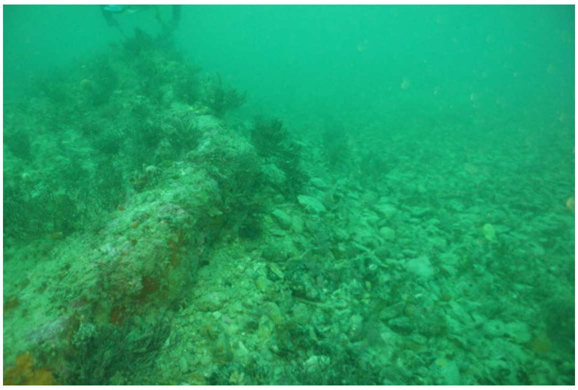


Figure 42: Target A6. (Image taken 27 September 2021).

Figure 43: Detail of target A6. (Image taken 27 September 2021).

Figure 44: Target A6. (Image taken 27 September 2021).

2.4.2.3 Target A1

Target ID	Lat	Long	Interpretation	Dimensions	Depth	Distance from cable
A1	-41.06936	145.99004	Non-ferrous debris scatter, or natural rock outcrop (Figure 45).	Length: 12 m Width: 5 m	10 m	20 m

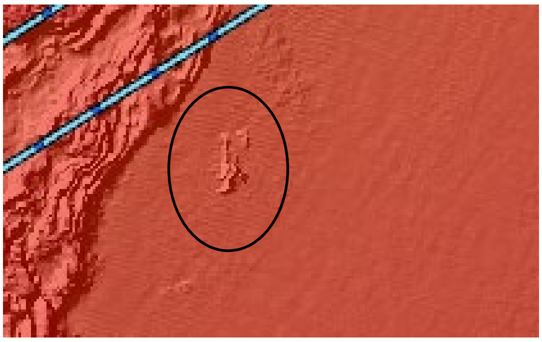


Figure 45: Multibeam image of target A1. Side scan sonar image N/A. Proposed cable route in blue.

Inspection details for Target A1		
Date: 27-09-2021	**Method:** SCUBA	**Tide:** Flooding
Distance and direction: Circular search		**Diver**: James Parkinson
Swim start (min): 1503	**Swim end (min):** 1526	**Total time (min):** 13
Depth: 13 m	**Water visibility:** 10 – 15 m	**Seabed visibility:** Excellent

Target description: Small rocky outcrop. Height of approximately 1 m. Length 10 m. Width 5 m. The rock appears to be sedimentary and layered, similar in nature to target A9 and A6 with the strata varying in thickness from 25 mm to 35 mm and with very straight edges. Evidence of scour surrounding outcrop. Sand seabed surrounding outcrop (Figure 46 to Figure 51).

No cultural heritage features located.

Figure 46: Example of seabed surrounding target A1. Scale in 10 cm increments. (Image taken 27 September 2021).

Figure 47: Target A1 was a small rocky outcrop surrounded by a sandy seabed. Scale in 10 cm increments. (Image taken 27 September 2021).

Figure 48: Rock outcrop appears to be sedimentary and layered. Scale in 10 cm increments. (Image taken 27 September 2021).

Figure 49: Rock outcrop appears to be sedimentary and layered. Scale in 10 cm increments. (Image taken 27 September 2021).

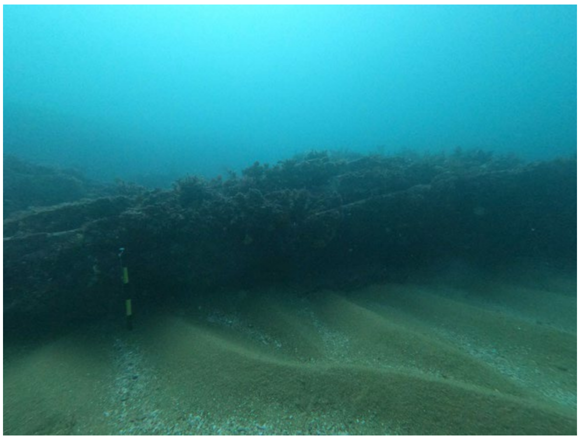


Figure 50: Target A1. Scale in 10 cm increments. (Image taken 27 September 2021).

Figure 51: Target A1. Scale in 10 cm increments. (Image taken 27 September 2021).

2.4.2.4 Target A11

Target ID	Lat	Long	Interpretation	Dimensions	Depth	Distance from cable
A11	-41.04896	146.00736	Debris or natural feature (Figure 52 and Figure 53).	Length: 10 m Width: 2 m	28 m	52 m

Geophysical images are shown in Figure 52 and Figure 53.

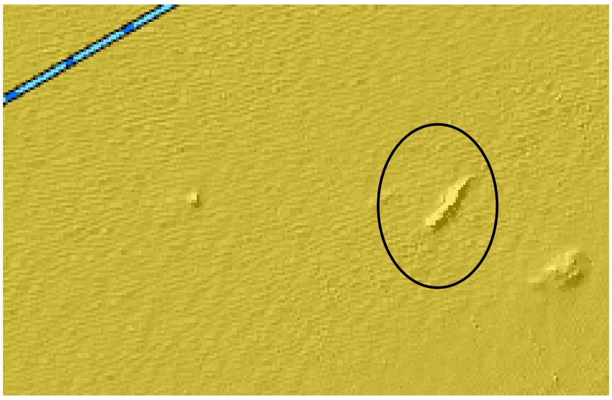


Figure 52: Multibeam image of target A11. Proposed cable route in blue.

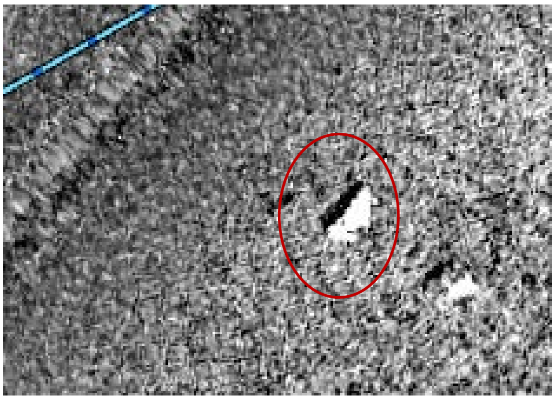


Figure 53: Side scan sonar image of target A11. Proposed cable route in blue.

Inspection details for Target A11		
Date: 28-09-2021	**Method:** SCUBA	**Tide:** Ebbing
Distance and direction: Circular search		**Diver**: James Parkinson
Swim start (min): 0929	**Swim end (min):** 0937	**Total time (min):** 8
Depth: 29 m	**Water visibility:** 10 m	**Seabed visibility:** Excellent

Upon arriving on site, both A11 and B12 were in 31.5 m. The divers did not go past 29 m. Close up video and images were not able to be taken, however, the divers still filmed the targets from between 27 and 29 m.

Target description: A11 was another rock outcrop of similar nature to the targets A1, A6 and A9. A11's dimensions were approximately 10 m long and 2 m wide (Figure 54 to Figure 59).

No cultural heritage features located.

Figure 54: Target A11. (Image taken 28 September 2021).

Figure 55: Target A11. (Image taken 28 September 2021).

Figure 56: Target A11. (Image taken 28 September 2021).

Figure 57: Target A11. (Image taken 28 September 2021).

Figure 58: Target A11. (Image taken 28 September 2021).

Figure 59: Target A11. (Image taken 28 September 2021).

2.4.2.5 Target B12

Target ID	Lat	Long	Interpretation	Dimensions	Depth	Distance from cable
B12	-41.04906	146.007618	Debris or natural feature (Figure 60 and Figure 61).	Length: 8 m Width: 5 m	28 m	80 m

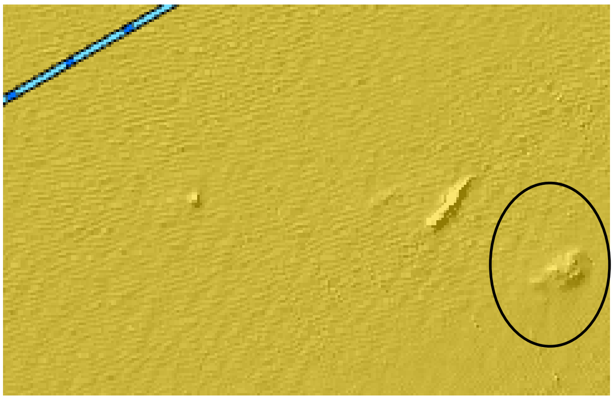


Figure 60: Multibeam image of target B12. Proposed cable route in blue.

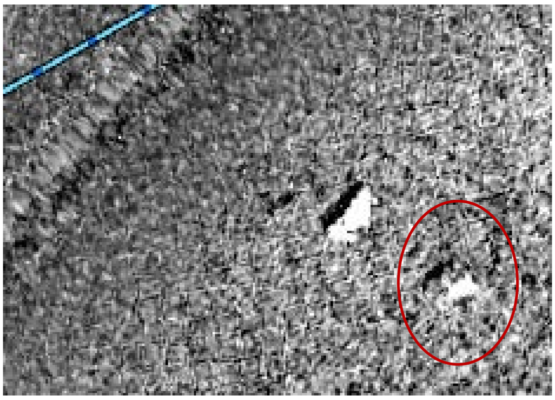


Figure 61: Side scan sonar image of target B12. Proposed cable route in blue.

Inspection details for Target B12		
Date: 28-09-2021	**Method:** SCUBA	**Tide:** Ebbing
Distance and direction: 25 m from A11 on bearing 320°		**Diver**: James Parkinson / Laura Smith
Swim start (min): 0929	**Swim end (min):** 0937	**Total time (min):** 8
Depth: 29 m	**Water visibility:** 10 m	**Seabed visibility:** Excellent

Target description: B12 was also located to the southeast of A11. B12 is a rock outcrop on a smaller scale to A11 and with much less profile. Sand waves were visible in the sandy seabed surrounding the formation (Figure 62 to Figure 67).

No cultural heritage features located.

Figure 62: Target B12. (Image taken 28 September 2021).

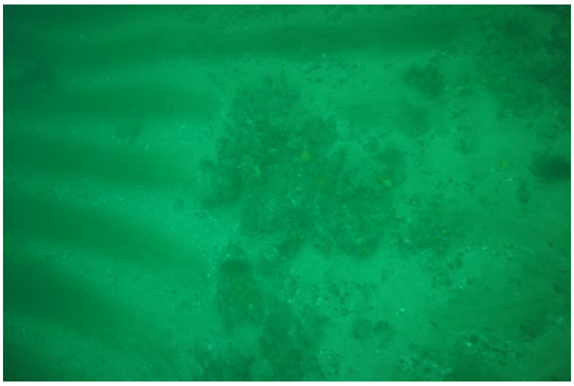


Figure 63: Target B12. Note the sand waves visible to the left of the image. (Image taken 28 September 2021).

Figure 64: Target B12. (Image taken 28 September 2021).

Figure 65: Target B12. (Image taken 28 September 2021).

Figure 66: Target B12. (Image taken 28 September 2021).

Figure 67: Target B12. (Image taken 28 September 2021).

2.4.2.6 Target BM15

Target ID	Lat	Long	Interpretation	Dimensions	Depth	Distance from cable
BM15	-41.05620	145.99790	Magnetic anomaly, may be associated with nearby SSS contact (Figure 68 and Figure 69).	526.4 nT	20 m	64 m

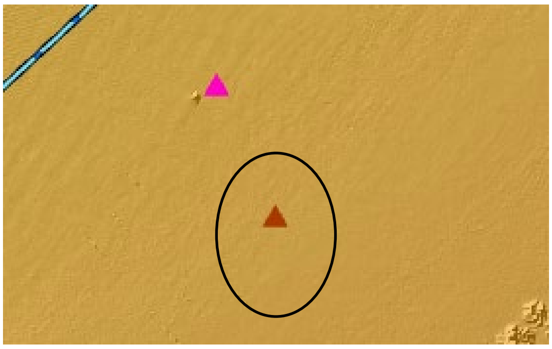


Figure 68: Multibeam image of target BM15. Proposed cable route in blue.

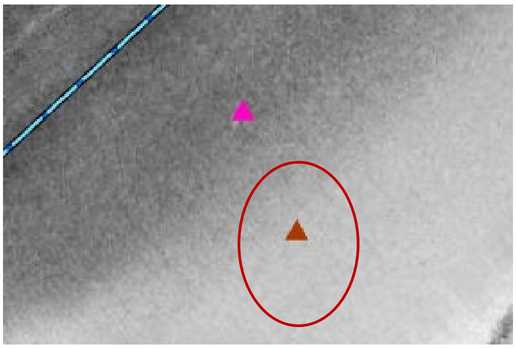


Figure 69: Side scan sonar image of target BM15. Proposed cable route in blue.

Inspection details for Target BM15		
Date: 28-09-2021	**Method:** SCUBA	**Tide:** Ebbing
Distance and direction: Circular search		**Diver**: James Parkinson
Swim start (min): 1300	**Swim end (min):** 1349	**Total time (min): 49**
Depth: 25 m	**Water visibility:** 10 – 15 m	**Seabed visibility:** Excellent

Target description: Divers located a concrete mooring block 1 m high and 1 m wide, approximately 28 m from the entry location (Figure 70 to Figure 75). The concrete mooring block has embedded steel wire. Right beside the concrete block is a car tyre. Divers noted that there was steel wire coming out of the seabed near the concrete mooring block, which may have caused the anomaly picked up by the magnetometer.

No other cultural heritage features were located.

Figure 70: Concrete block surrounded by a sandy seabed. (Image taken 28 September 2021).

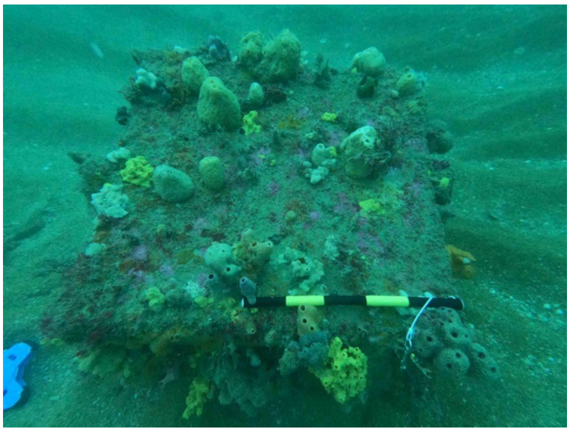


Figure 71: Top of concrete block. Scale in 10 cm increments. (Image taken 28 September 2021).

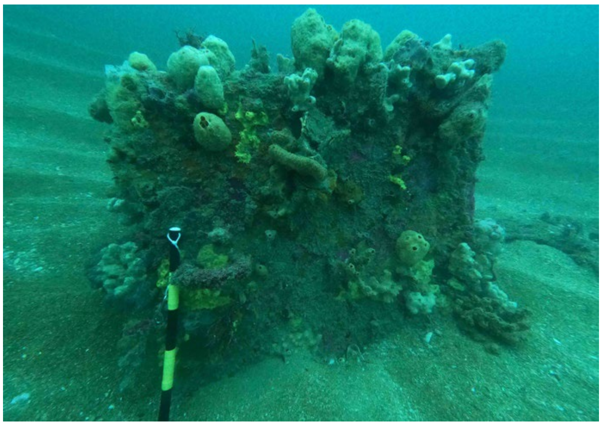


Figure 72: Side of concrete block, note tyre to right of image. Scale in 10 cm increments. (Image taken 28 September 2021).

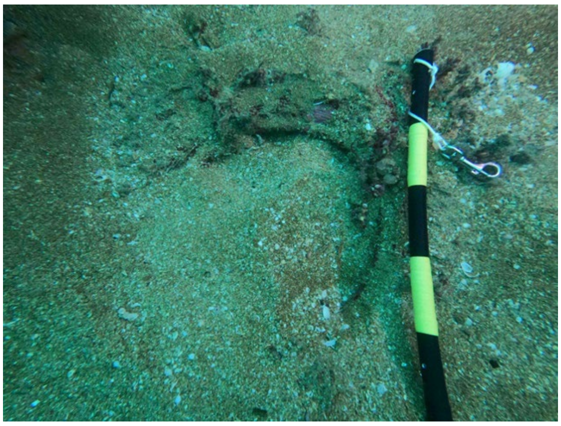


Figure 73: Detail of partly buried tyre adjacent to the concrete block. Scale in 10 cm increments. (Image taken 28 September 2021).

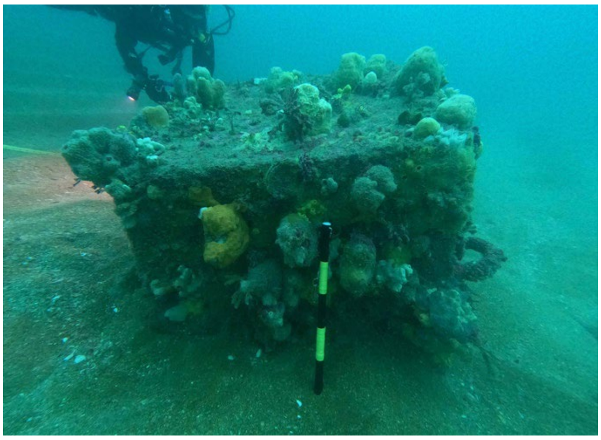


Figure 74: Side of concrete block showing steel loop to the right of the block. Scale in 10 cm increments. (Image taken 28 September 2021).

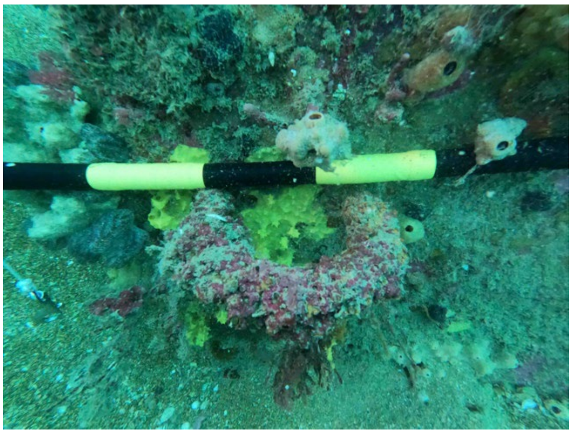


Figure 75: Detail of loop attached to the side of the concrete block. Scale in 10 cm increments. (Image taken 28 September 2021).

2.4.2.7 Target B14

Target ID	Lat	Long	Interpretation	Dimensions	Depth	Distance from cable
B14	-41.04652	146.006083	Lineal feature across seafloor (Figure 76 and Figure 77).	Length: 47 m Width: 5 m	30 m	210 m

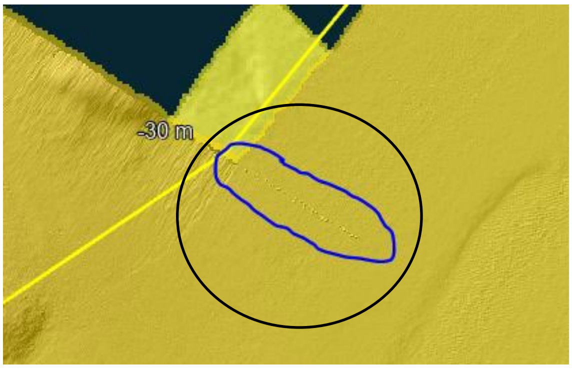


Figure 76: Multibeam image of target B14.

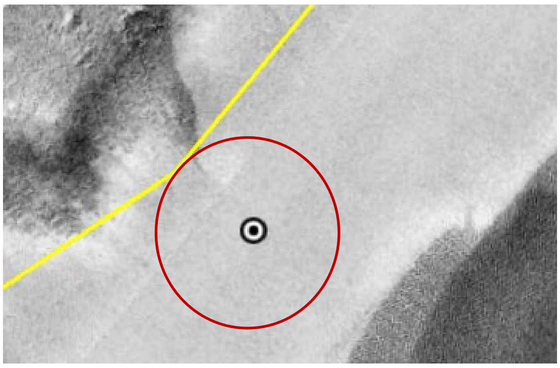


Figure 77: Side scan sonar image of target B14.

Inspection details for Target B14		
Date: 28-09-2021	**Method:** ROV	**Tide:** Flooding
Distance and direction: Circular search		**Diver**: N/A
Swim start (min): 1402	**Swim end (min):** 1421	**Total time (min):** 19
Depth: 31 m	**Water visibility:** 10 – 15 m	**Seabed visibility:** Excellent

Target description: The seabed within the circular search for target B14 was a featureless sandy seabed (Figure 78 and Figure 79).

No cultural heritage features located.

Figure 78: Example of seabed at location of target B14. (Image from 21_09_28_ROV_B14_1; 08:22).

Figure 79: Example of seabed surrounding location of target B14. (Image from 21_09_28_ROV_B14_2; 02:32).

2.4.3 *Possible Paleo-channel Transect*

Paleo-channel transect from target A1		
Date: 27-09-2021	**Method:** SCUBA	**Tide:** Flooding
Distance and direction: 30 m on bearing 315°		**Divers**: James Parkinson / Joanna Smart
Coordinates transect start	-41.06936°	145.99004°
Coordinates transect end	-41.069208°	145.989751°
Swim start (min): 1503	**Swim end (min):** 1526	**Total time (min):** 13
Depth: < 5 m	**Water visibility:** 10 m	**Seabed visibility:** Excellent

Divers laid a 30 m transect from the outcrop at a bearing of 315 degrees across the paleo-channel and onto the reef to the northwest of A1. Figure 80 shows the target A1 and Figure 81 shows the sandy seafloor at 15 m highlighting large sand waves up to 300 mm in height. Divers filmed the transect from 30 m to 0 m. The distance from A1 to the reef formation was 15 m.

Target description: The reef consists of exposed sedimentary rock formations that show significant weathering. The reef is undercut with a slight overhang at the interface between the reef and sandy seabed (Figure 82 and Figure 83).

The sedimentary strata are fragmenting into mostly angular pieces with straight edges which collect within depressions within the reef (Figure 84 and Figure 85). These fragments become rounded over time due to the high energy (wave) environment (Figure 86).

No cultural heritage features located.

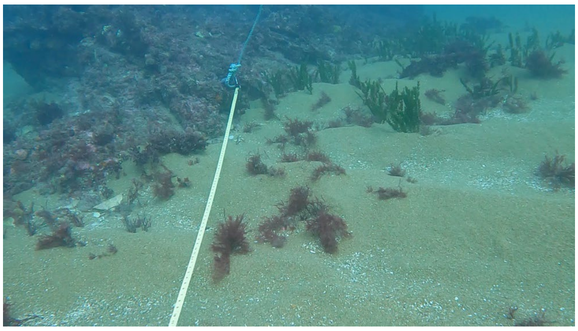


Figure 80: Example of seabed at Target A1. Image facing start of transect line. (Image 2021_09_27_A1 paleo-channel transect (2); 00:48).

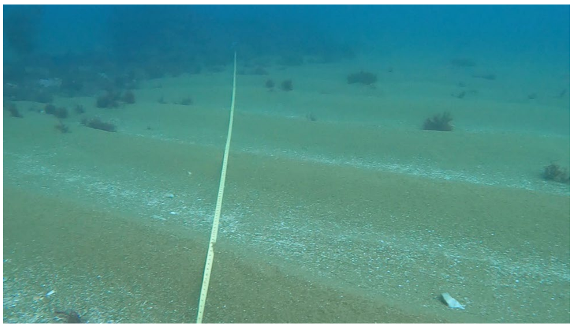


Figure 81: At the 10 m mark of the transect, there is a sandy seabed in distinct wave formations. Target A1 is visible in the background. (Image 2021_09_27_A1 paleo-channel transect (2); 00:23).

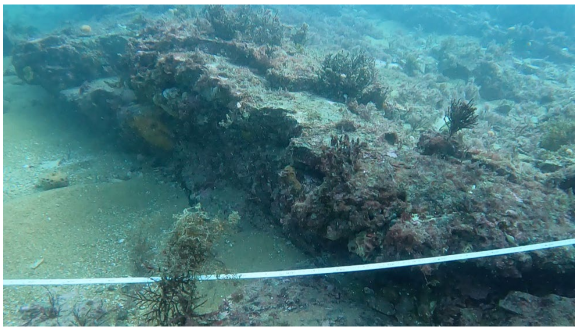


Figure 82: At the 15 m mark, a rock reef meets the sand seafloor. (Image 2021_09_27_A1 paleo-channel transect (2); 00:01).

Figure 83: At the 15 m of transect, facing W. (Image 2021_09_27_A1 paleo-channel transect (1); 03:46).

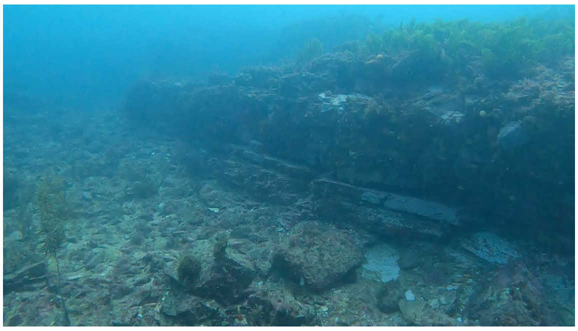


Figure 84: At the 20 m of transect, facing W. (Image 2021_09_27_A1 paleo-channel transect (1); 02:18).

Figure 85: At the 28 m of transect, facing W. (Image 2021_09_27_A1 paleo-channel transect (1); 01:01).

Figure 86: Example of rounded fragments due to high energy environment. (Image 2021_09_27_A1 paleo-channel transect (1); 0:41).

2.4.4 *ROV_10 Beach Ridge ROV Survey*

Inspection details for ROV_10		
Date: 28-09-2021	**Method:** ROV	**Tide:** N/A
Distance and direction: 150 m transect on a bearing of 260°		**Diver**: N/A
Depth: 53 m	**Water visibility:** 10 m	**Seabed visibility:** Excellent

The shot line for the ROV was dropped on the coordinates which was the edge of the potential beach ridge formation (Figure 87). However, the ROV moved away from the feature videoing the sea floor where it would cross the cable route. The seabed through the survey was silty sand, with some algae growth. No cultural or submerged landscapes were located during the transect.

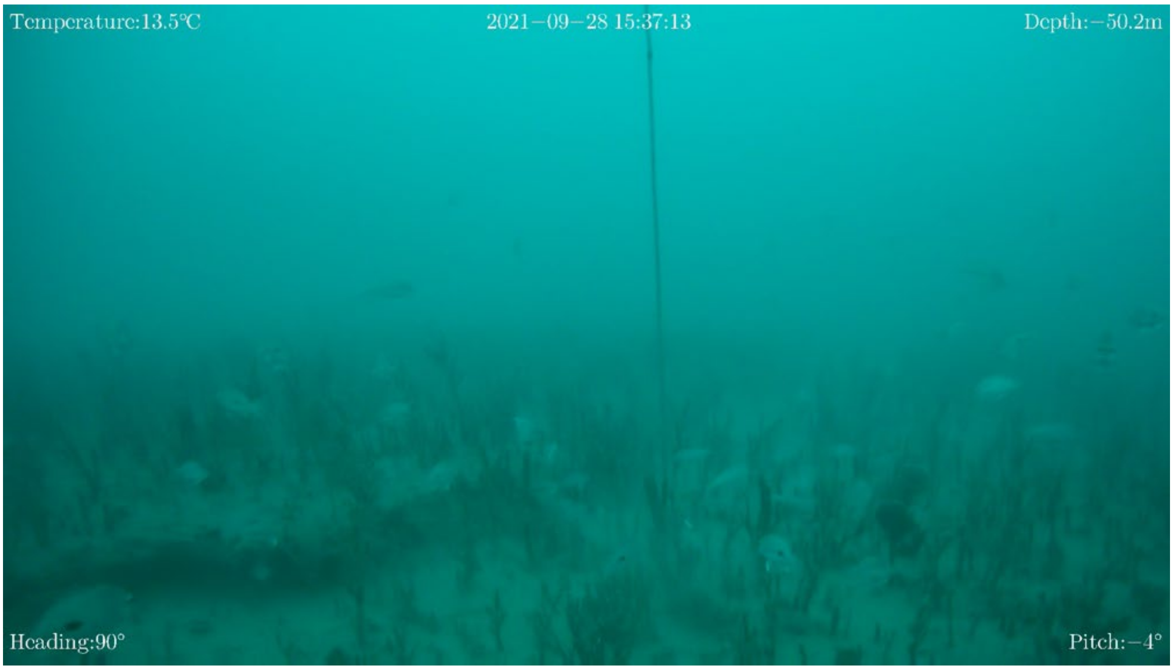


Figure 87: Seabed at base of shot line and beginning of transect. (Image 2021_09_28 ROV10_Beach ridge; 03:28).

ANNEX A – DIVE LOG

Date	Divers	Max depth (m)	Objective of dive	Left surface	Left bottom	Total bottom time (min)
27-09-2021	James Parkinson / Laura Smith	29	Locate and record target A9	1308	1318	10
27-09-2021	James Parkinson / Laura Smith	24	Locate and record target A6	1400	1414	14
27-09-2021	James Parkinson / Joanna Smart	13	Locate and record target A1 / Run paleo-channel transect	1503	1526	13
28-09-2021	James Parkinson / Laura Smith	29	Locate and record targets A11 and B12	0929	0937	12
28-09-2021	James Parkinson / Joanna Smart	5	Record transect 1	1044	1102	18
28-09-2021	Joanna Smart / Laura Smith	5	Record transect 2	1208	1245	37
28-09-2021	James Parkinson / Laura Smith	24	Locate and record target BM15	1330	1349	19
Total Dives	**7**			Total bottom time		**123**

ANNEX B – VIDEO LOG

Target	Name	File	Size (MB)	Length
Transect 1	2021_09_28_CA_T1_1	MP4	4000	08:52
	2021_09_28_CA_T1_2	MP4	1930	04:16
	2021_09_28 T1 (1)	MTS	2000	15:33
	2021_09_28 T1 (2)	MTS	889.9	06:54
Transect 2	2021_09_28_CA_T2_1	MP4	4010	08:52
	2021_09_28_CA_T2_2	MP4	4010	08:52
	2021_09_28_CA_T2_3	MP4	3870	08:34
	2021_09_28_CA_T2_4	MP4	4010	08:52
	2021_09_28_CA_T2_5	MP4	1310	02:53
	2021_09_28_CA_T2_6	MP4	736.8	01:38
	2021_09_28 T2 (1)	MTS	2110	16:22
	2021_09_28 T2 (2)	MTS	1820	14:07
	2021_09_28 T2 (3)	MTS	385.5	03:00
A1	2021_09_27_CA A1	MP4	941.8	02:05
	2021_09_27 A1	MTS	164.9	01:17
	2021_09_27 A1 (2)	MTS	52.8	00:24
A1 transect paleo channel	2021_09_27_A1 paleo-channel transect (1)	MP4	2350	05:21
	2021_09_27_A1 paleo-channel transect (2)	MP4	451.2	01:00
	2021_09_27_A1 paleo-channel transect (3)	MP4	0.63	00:01
	2021_09_27_A1 paleo-channel transect (4)	MP4	584.2	01:17
	2021_09_27_MS A1 paleo-channel transect 1	MTS	835.7	06:31
A6	2021_09_27_CA_A6_1	MP4	1340	02:58
	2021_09_27_CA_A6_2	MP4	189.4	00:25
	2021_09_27 A6	MTS	359.1	02:47
A9	2021_09_27_CA_A9_1	MP4	1650	03:38
	2021_09_27_CA_A9_2	MP4	282.6	00:37
	2021_09_27 A9	MTS	273.5	02:07
	2021_09_27 A9 (2)	MTS	77.5	00:36
	2021_09_27 A9 (3)	MTS	27.2	00:12
A11	2021_09_28_CA_A11_1	MP4	1710	03:47
	2021_09_28_CA_A11_2	MP4	183.9	00:24
	2021_09_28 A11 (1)	MTS	119.3	00:56
	2021_09_28 A11 (2)	MTS	106.3	00:49
B12	2021_09_28_CA_A11 to B12	MP4	2250	04:58

Target	Name	File	Size (MB)	Length
	2021_09_28 B12	MTS	331	02:34
B14	2021_09_28_ROVGoPro_B14_1	MP4	4000	08:53
	2021_09_28_ROVGoPro_B14_2	MP4	4000	08:52
BM15	2021_09_28_CA_BM15_1	MP4	721.5	01:36
	2021_09_28_CA_BM15_2	MP4	1090	02:24
	2021_09_28_CA_BM15_3	MP4	1540	03:25
	2021_09_28 M15	MTS	208.3	01:37
ROV10	2021_09_28 ROV10	MP4	2850	20:34
	2021_09_28_ROVGoPro_ROV10_1	MP4	4010	08:53
	2021_09_28_ROVGoPro_ROV10_2	MP4	4000	08:51
	2021_09_28_ROVGoPro_ROV10_3	MP4	4010	08:53

ANNEX B – WARATAH BAY DIVE INSPECTION REPORT

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Cover Image: *Rocky reef covered in sponge and algae growth, Target B15*

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Abbreviations

EANx	Nitrox breathing gas
GPS	Global Positioning System
m	Metres
MBES	Multibeam Echosounder
PDS	Professional Diving Services
SCUBA	Self-Contained Underwater Breathing Apparatus
SSS	Side Scan Sonar

1 INTRODUCTION

1.1 Study Area

Waratah Bay is located near the small township of the same name. The survey area extends south from the beach, between the towns, Waratah Bay and Sandy Point (Figure 1). One main cable route is planned to make landfall within this coastal margin.

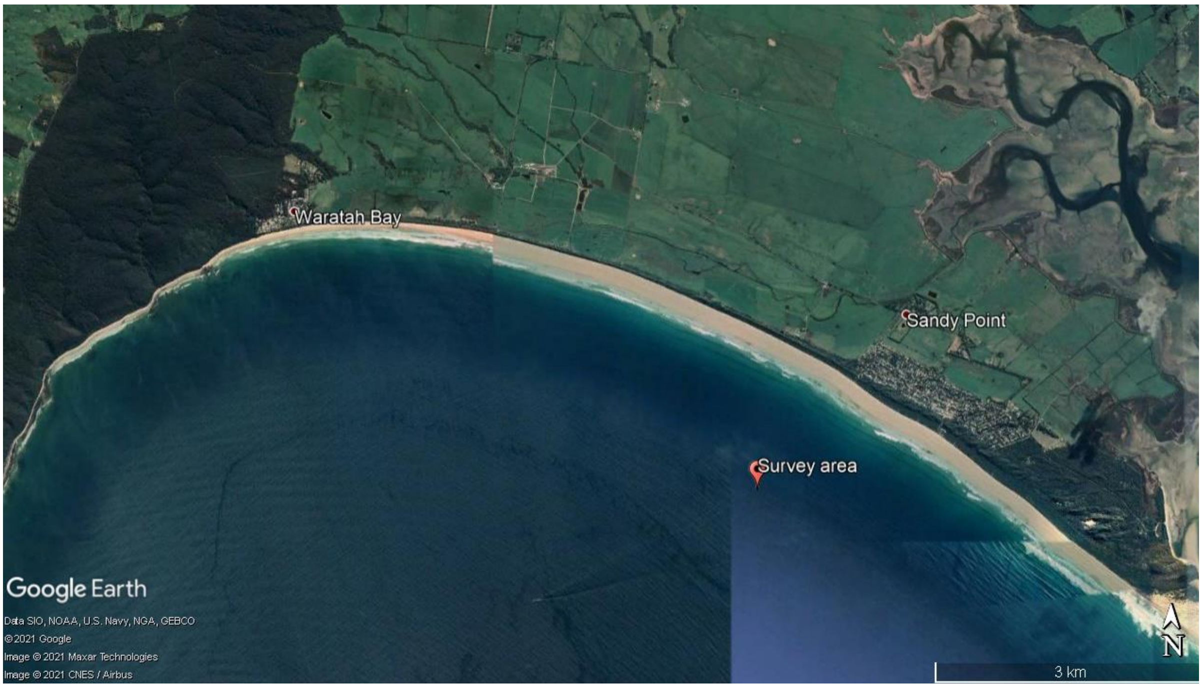

Figure 1: Survey area, Waratah Bay, Victoria. *(Base image: Google Earth).*

1.2 Objectives

The objectives of this dive survey were to:

- Visually examine the seabed along the proposed cable route from the shoreward limit of the marine geophysical survey to the low tide zone of the beach at Waratah Bay.
- Examine anomalies and submerged landforms of potential maritime heritage significance along the proposed cable route up to the 30 m depth contour.

2 ARCHAEOLOGICAL DIVE SURVEY

2.1 Dates and Personnel

The dive survey was carried out on 29th November 2021. Jane Mitchell, from Cosmos Archaeology was the maritime archaeologist supervising the inspections. Dive support was provided by Professional Diving Services in the form of the supply of two divers, self-contained underwater breathing apparatus (SCUBA) and a dive platform. Diving operations were run and supervised by Professional Diving Services (PDS). Personnel involved during the inspection are listed in Table 1.

Table 1: Dive inspection personnel

Name	Title	Company
Jane Mitchell	Maritime Archaeologist	Cosmos Archaeology
Malcolm Venturoni	Supervisor / Diver	Professional Diving Services
Felix Venturoni	Supervisor / Diver	Professional Diving Services
Colin Silvey	Supervisor / Diver	Professional Diving Services

2.2 Weather and Tide Conditions

The tide was a factor in the timing of the survey as crossing the Inverloch Bar can only be undertaken at high tide (Table 2). The study area at Waratah Bay is an exposed location and subject to large swells and strong winds, therefore weather was also a strong factor in the timing of the survey.

Table 2: Tides for the days of survey.[1]

29-11-2021	Time	0030	0712	1316	1929
	Height (m LAT)	0.65	2.43	0.87	2.23

Table 3: Rain and wind conditions for the three days previous to the dive inspection and the day of the inspection.[2]

Date	Rain (mm)	Wind 09:00 (km/h)	Wind 15:00 (km/h)
26-11-2021	0.0	26 ESE	26 ESE
27-11-2021	0.0	20 ESE	26 E
28-11-2021	0.0	15 E	26 E
29-11-2021	0.0	20 ENE	22 E

[1] **Magic Seaweed 2021,** *Inverloch Tide Tables*, available https://magicseaweed.com/Inverloch-Surf-Report/7224/Tide/?start=1638147600&end=1638925200, accessed 28 November 2021.
[2] **Bureau of Meteorology, Australian Government, 2021,** *Yanakie Victoria November 2021 Daily weather observations*, http://www.bom.gov.au/climate/dwo/202111/html/IDCJDW3103.202111.shtml, accessed 2 December 2021.

2.3 Conduct of Survey

The underwater survey was conducted with the use of a dive crew from PDS under the direction of the maritime archaeologist. The inspections were conducted on SCUBA using nitrox breathing gas in accordance with AS/NZS 2299.1: 2015 diving operational standards.

Footage of each location was filmed by the divers using a Sony RX-100V camera in a Nauticam underwater housing with two video lights.

Several methods were employed to investigate the study area. These are outlined in **Sections 2.3.1 to 2.3.2.**.

2.3.1 *Gap Survey*

A systematic underwater archaeological survey was conducted in the area between the shoreline and the existing geophysical survey data.

The gap survey was undertaken using one long transect. This transect was planned along the proposed cable route and was designed to search the area between the existing geophysical data and the shoreline for any archaeological remains. The transect information is displayed in Table 4 and Figure 2.

Table 4: Coordinate information for Transect 1.

TRANSECT 1	Lat	Long	Total Distance	Bearing
Start (beach)	-38.82267	146.10051	220 m	200º
End	-38.82456	146.10027		

Figure 2: Area and distance shown for the proposed gap survey. (Base image: QGIS Satellite imagery).

The gap survey was conducted by a diver visually inspecting the seafloor. The boat went as close to the transect start location as possible until the water depth was too shallow for the vessel's draft. The diver then recorded the seabed on the bearing until the surf zone, where it became too rough to continue inshore. The diver then filmed the seabed on the return to the boat.

2.3.2 *Target Inspection Dives*

The targeted inspection dives required a diver to inspect previously identified seafloor anomalies from existing geophysical data up to 30 m depth. A GPS unit was used to locate the potential targets and a shot line was placed on the seabed. Two divers conducted a visual circle-search on the seafloor to locate and record the targets. The divers were tethered to the shot line using 5 m tethers, thereby being able to undertake a circle-search with a visual radius of 20 m. The divers also carried thin fibreglass rods, marked at 100 mm intervals for probing into the seabed.

Ten targets were identified for further investigation during the dive survey. These targets were then given a priority status for the targeted inspections (Figure 3). These were:

- A = top priority (5 targets)
    - Images appear to be cultural and representative of a 'site' such as a small wreck. These targets also consider depth and approximation to cable.
- B = secondary (5 targets)
    - Images appear to be cultural but are representative of an individual object, or discard and less likely to constitute a site.

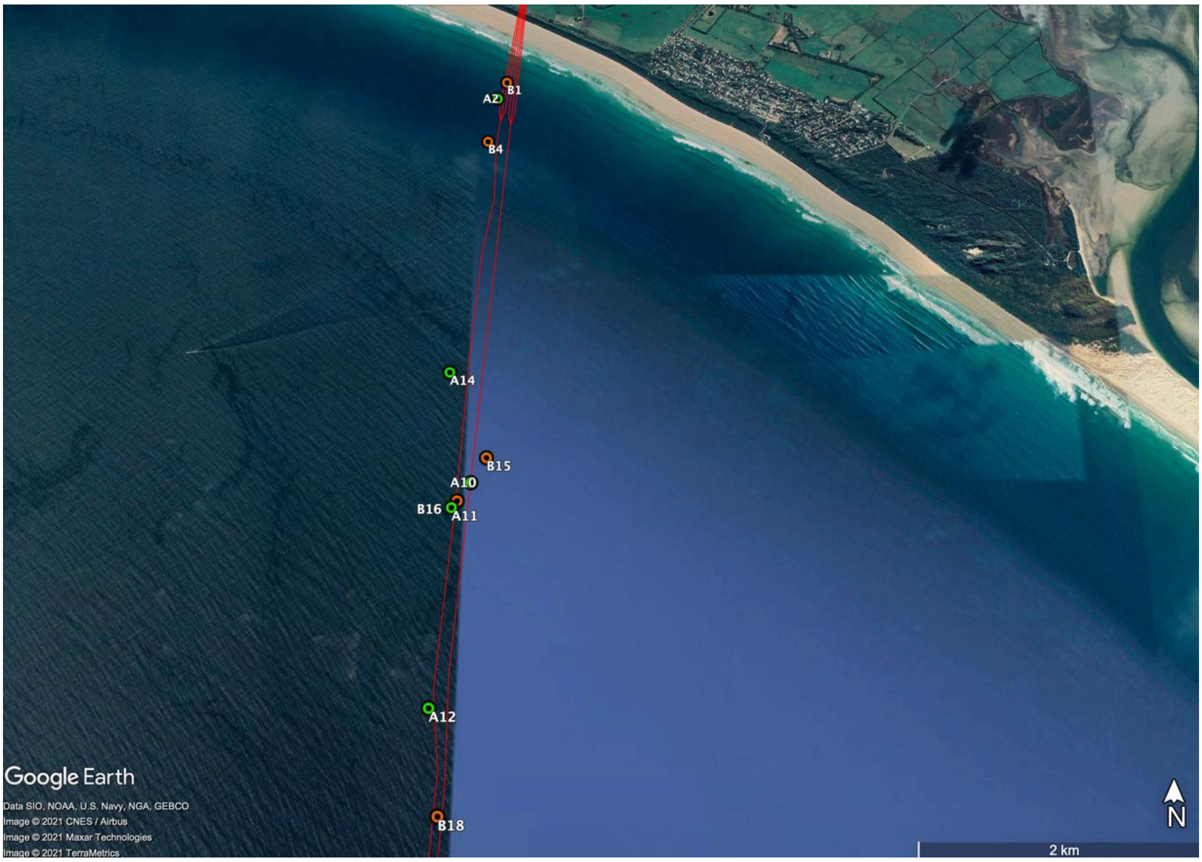

Figure 3: Target list identified from geophysical data. Green is top priority and orange is medium priority. (Base image: Google Earth).

2.4 Findings of the Diving Survey

2.4.1 *Gap Survey*

2.4.1.1 Transect 1

The planned coordinate information for Transect 1 is outlined in Table 5 while the actual coordinates are displayed in Table 6 and Figure 4. The dive information for the transect is outlined in Table 7.

Table 5: Coordinate information for Transect 1

TRANSECT 1	Lat	Long	Total Distance	Bearing
Start (beach)	-38.82267	146.10051	220 m	200º
End	-38.82456	146.10027		

Table 6: Actual transect coordinates for Transect 1

TRANSECT 1	Lat	Long	Total Distance	Bearing
Start (deep end)	-38.825367	146.10051	200 m	200º
End (surf zone)	-38.823621	146.099483		

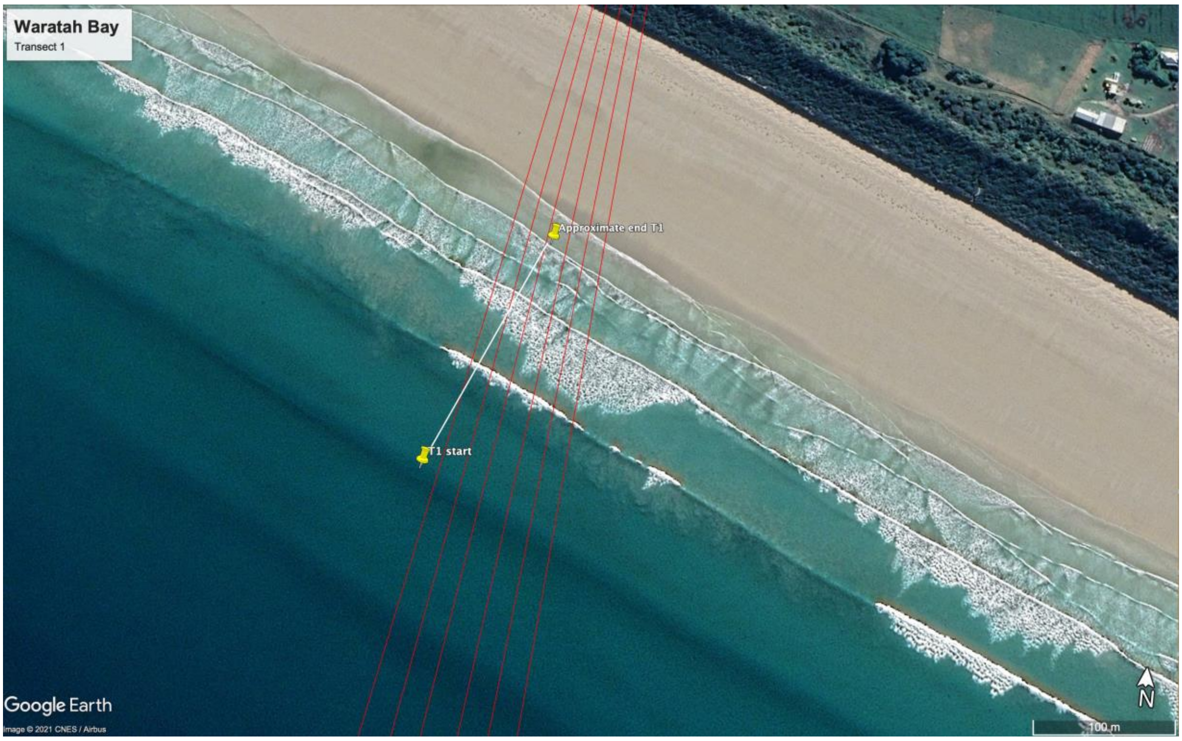

Figure 4: Actual track of Transect 1. (Base image: Google Earth).

Table 7: Dive information for Transect 1

Transect 1		
Date: 29-11-2021	**Method:** EANx SCUBA	**Tide:** Ebbing
Distance and direction: 200 m on bearing 186°		**Divers**: Colin Silvey
Swim start (min): 1300	**Swim end (min):** 1313	**Total time (min):** 13
Depth: 3 m	**Water visibility:** 15 m	**Seabed visibility:** Excellent

The dive boat was unable to reach the start point of the transect due to the shallow water depth. The boat was anchored at -38.825367°, 146.099483° and the diver followed the bearing 200º until reaching the surf zone and then returned to the dive boat, videoing the sea floor.

The seabed along the length of the transect was characterised by beach sand with occasional patches of loose algae (Figure 5 and Figure 6).

No cultural heritage material was observed along the transect.

Figure 5: Example of seabed at deep end of transect. (Image taken from 211129_Waratah Bay_T1_VID_2, 00:12).

Figure 6: Example of seabed at shallow end of transect. (Image taken from 211129_Waratah Bay_T1_VID_2, 05:36).

2.4.2 *Target Inspection Dives*

A total of 10 dives were undertaken to identify the targeted anomalies.

2.4.2.1 Target A2

Target ID	Lat	Long	Interpretation	Dimensions	Depth	Distance from cable
A2	-38.82875	146.09878	Possible paleo-shoreline, debris field or dumping site (Figure 7).	Length: 18 m Width: 8 m	9 m	10 m

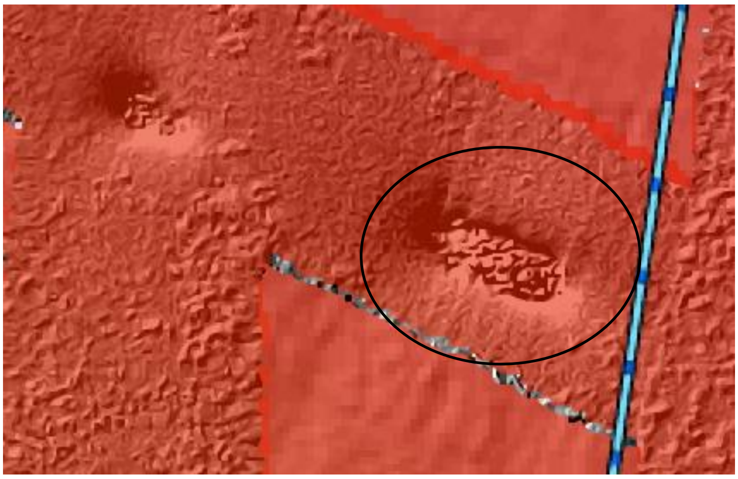

Figure 7: Multibeam image of target A2. Proposed cable route in blue.

Inspection details for Target A2		
Date: 29-11-2021	**Method:** EANx SCUBA	**Tide:** Ebbing
Distance and direction: Circular search 20 m radius		**Diver**: Felix Venturoni / Colin Silvey
Swim start (min): 1230	**Swim end (min):** 1235	**Total time (min):** 5
Depth: 9 m	**Water visibility:** 15 m	**Seabed visibility:** Excellent

Target description: A2 is a section of broken up rocky reef covering an area of approximately 20 m x 10 m. Sections of the reef were up to 1 m in height. The seabed around the reef outcrop was characterised by sand. The reef was covered in algae growth and sponges (Figure 8 to Figure 11). In the gaps between the rocky reef, the seabed was sandy, with shells and small rocks present (Figure 12 and Figure 13). Probing in and around the feature was only 100 mm deep but the diver indicated this was due to the coarse sand and shell rubble rather than refusal or obstruction.

No cultural heritage material was observed within the search area.

Figure 8: A2 is a rocky broken up reef up to 1 m high, surrounded by a sandy seafloor. (Image Professional Diving Services).

Figure 9: A2 is more broken up on the northern end with larger gaps between the reef. (Image Professional Diving Services).

Figure 10: A2 has sponges and algae growth on the higher reef elements. (Image Professional Diving Services).

Figure 11: Detail of reef with sponge growth and the gaps in between. (Image Professional Diving Services).

Figure 12: The gaps within the reef contain trapped shells and small rocks. (Image taken from 211129_Waratah Bay_A2, 02:20).

Figure 13: Detail of shells and small rocks amongst the larger reef elements. (Image taken from 211129_Waratah Bay_A2, 03:16).

2.4.2.2 Target A10

Target ID	Lat	Long	Interpretation	Dimensions	Depth	Distance from cable
A10	-38.85784	146.09753	Small debris or natural feature (Figure 14 and Figure 15).	Length: 4 m Width: 4 m	20 m	10m

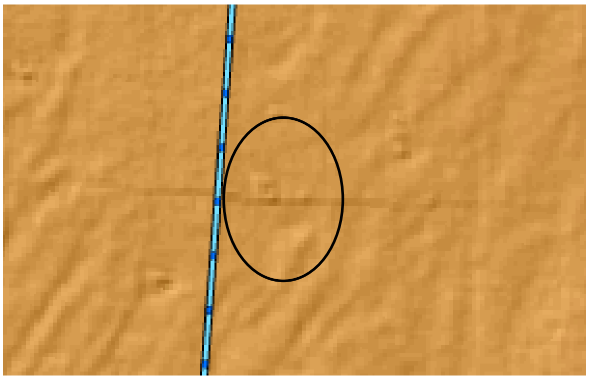

Figure 14: Multibeam image of target A10. Proposed cable route in blue.

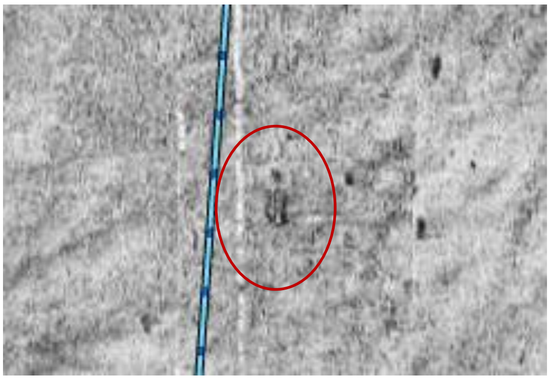

Figure 15: Side scan sonar image of target A10. Proposed cable route in blue.

Inspection details for Target A10		
Date: 29-11-2021	**Method:** SCUBA	**Tide:** Ebbing
Distance and direction: Circular search 20 m radius		**Diver**: Felix Venturoni / Colin Silvey
Swim start (min): 1103	**Swim end (min):** 1108	**Total time (min):** 5
Depth: 20 m	**Water visibility:** 15 m	**Seabed visibility:** Excellent

Target description: A10 appears to be a low-profile stone or rocky outcropping. A large patch of algae rested over the top. The total area of visible features measured approximately 5 m x 5 m. The algae was surrounded by a sandy seabed with broken shell rubble and the seabed underneath the algae contained sand with shell rubble and some small rocks (Figure 16 to Figure 21). Probing in and around the feature was only 100 mm deep but the diver indicated this was due to the coarse sand and shell rubble rather than refusal or obstruction.

No cultural heritage material was observed within the search area.

Figure 16: Algae at the base of the shot line in the centre of the circular search area. (Image Professional Diving Services).

Figure 17: Area surrounding the main algae patch contained patchy algae over a hard sandy seabed. (Image Professional Diving Services).

Figure 18: Detail of seabed outside main algae and rocky patch was a sandy seafloor with shell rubble. (Image Professional Diving Services).

Figure 19: Detail of shells found within the algae patch. (Image Professional Diving Services).

Figure 20: Detail of seabed within search area showing shells and small rocks. (Image Professional Diving Services).

Figure 21: Base of A10 showing rock outcropping. (Image Professional Diving Services).

2.4.2.3 Target A11

Target ID	Lat	Long	Interpretation	Dimensions	Depth	Distance from cable
A11	-38.85954	146.09594	Debris or natural feature (Figure 22 and Figure 23).	Length: 19 m Width: 6 m	20 m	20 m

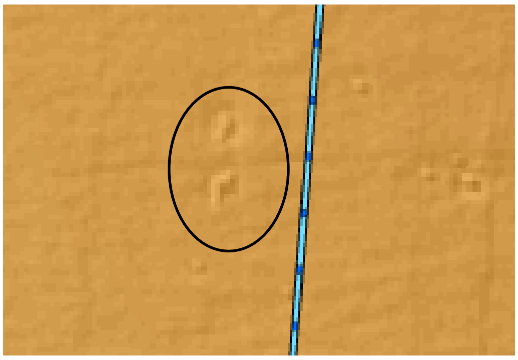

Figure 22: Multibeam image of target A11. Side scan sonar image N/A. Proposed cable route in blue.

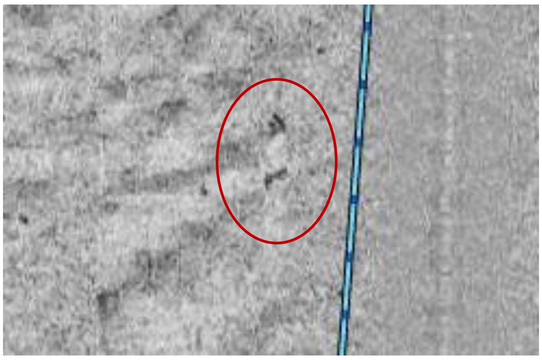

Figure 23: Side scan sonar image of target A11. Proposed cable route in blue.

Inspection details for Target A11		
Date: 29-11-2021	**Method:** EANx SCUBA	**Tide:** Ebbing
Distance and direction: Circular search 20 m radius		**Diver**: Felix Venturoni / Colin Silvey
Swim start (min): 1017	**Swim end (min):** 1023	**Total time (min):** 6
Depth: 21 m	**Water visibility:** 15 m	**Seabed visibility:** Excellent

Target description: The seabed within the search area was sandy with patches of algae growth. The dominant feature was a large patch of algae approximately 15 m x 3 m with no discernible height. Underneath the algae was a sandy sea floor with patches of shells and small rocks (Figure 24 to Figure 29). Probing in and around the feature was only 100 mm deep but the diver indicated this was due to the coarse sand and shell rubble rather than refusal or obstruction.

No cultural heritage material was observed within the search area.

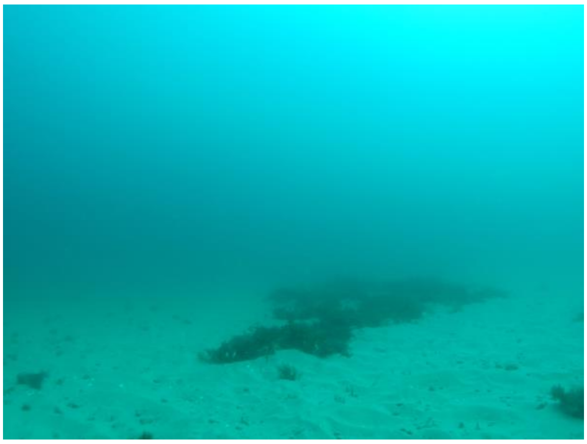

Figure 24: Large patch of algae growth within search area. (Image Professional Diving Services).

Figure 25: Algae patch with dimensions of approximately 15 m x 3 m. (Image Professional Diving Services).

Figure 26: A11 is a large patch of algae growth. (Image Professional Diving Services).

Figure 27: Example of the sandy seabed around the algae patch. (Image Professional Diving Services).

Figure 28: The seabed within and underneath the algae patch contained patches of shell and small rocks. (Image Professional Diving Services).

Figure 29: Detail of shell and small rocks within the algae patch. (Image Professional Diving Services).

2.4.2.4 Target A12

Target ID	Lat	Long	Interpretation	Dimensions	Depth	Distance from cable
A12	-38.87245	146.09475	Single non-ferrous object, or rock (Figure 30 and Figure 31).	Length: 3 m Width: 3 m	25 m	40 m

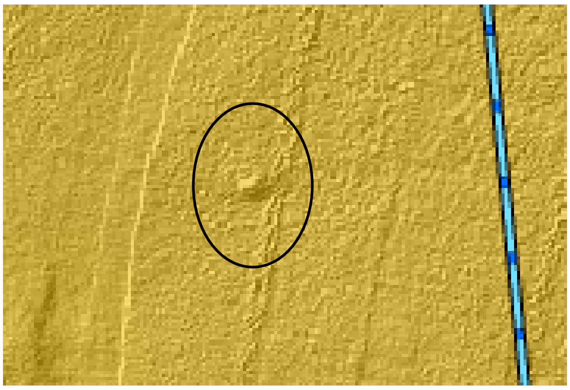

Figure 30: Multibeam image of target A12. Proposed cable route in blue.

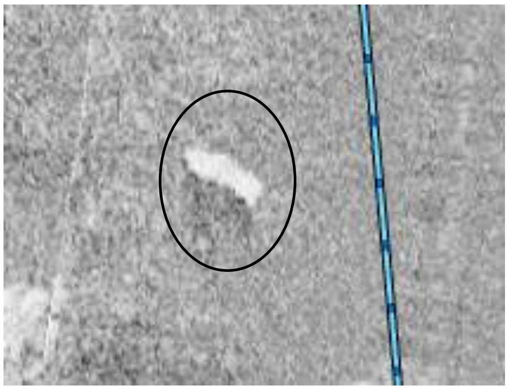

Figure 31: Side scan sonar image of target A12. Proposed cable route in blue.

Inspection details for Target A12		
Date: 29-11-2021	**Method:** EANx SCUBA	**Tide:** Ebbing
Distance and direction: Circular search 20 m radius		**Diver**: Felix Venturoni / Colin Silvey
Swim start (min): 0952	**Swim end (min):** 1000	**Total time (min):** 8
Depth: 27 m	**Water visibility:** 15 m	**Seabed visibility:** Excellent

Target description: There was no discernible feature located within the A12 search area. The sea floor consisted of a sandy seabed in wave formations with shell debris caught in the troughs. Shells identified included the native mud oyster and mussel shells (Figure 32 to Figure 37). Probing in and around the feature was only 100 mm deep but the diver indicated this was due to the coarse sand and shell rubble rather than refusal or obstruction.

No cultural heritage material was observed within the search area.

Figure 32: Diver at base of shot line at the location of A12. (Image Professional Diving Services).

Figure 33: General view of location at A12. (Image Professional Diving Services).

Figure 34: Seabed showing sand wave formations. (Image Professional Diving Services).

Figure 35: Detail of sand wave formations at A12. (Image Professional Diving Services).

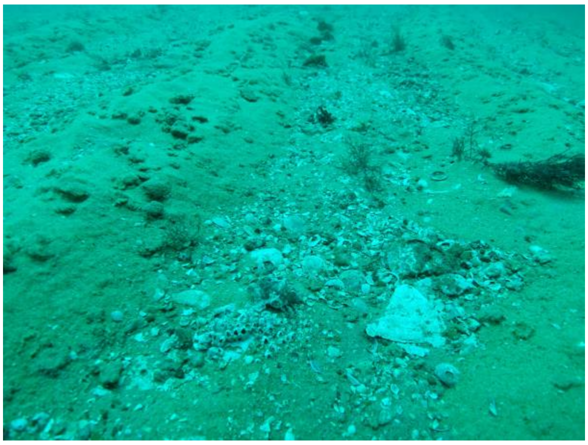

Figure 36: Shell debris caught in the sand troughs. (Image Professional Diving Services).

Figure 37: Mussel shell at A12. (Image Professional Diving Services).

2.4.2.5 Target A14

Target ID	Lat	Long	Interpretation	Dimensions	Depth	Distance from cable
A14	-38.85008	146.09532	Possible rock outcrop or cultural feature. (Figure 38 and Figure 39).	Length: 16 m Width: 14 m	18 m	130 m

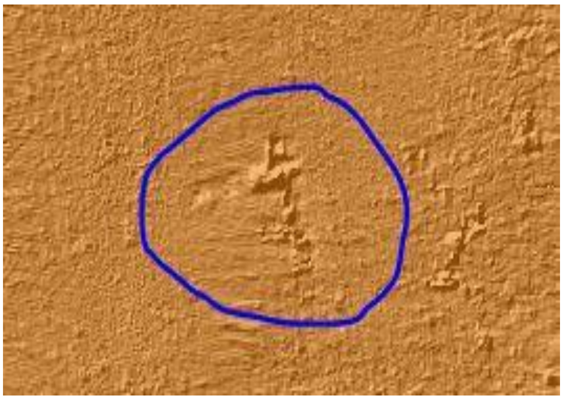

Figure 38: Multibeam image of target A14.

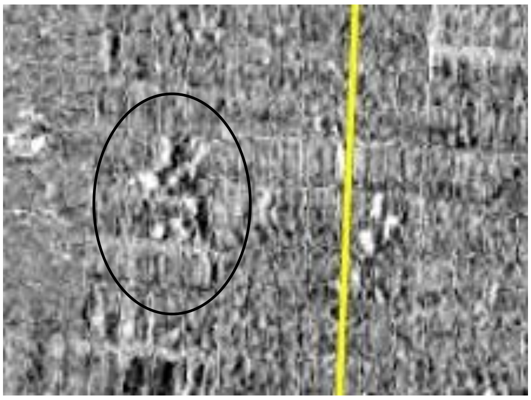

Figure 39: Side scan sonar image of target A14. Proposed cable route in yellow.

Inspection details for Target A14		
Date: 29-11-2029	**Method:** EANx SCUBA	**Tide:** Ebbing
Distance and direction: Circular Search 20 m radius		**Diver**: Felix Venturoni / Colin Silvey
Swim start (min): 1145	**Swim end (min):** 1150	**Total time (min):** 5
Depth: 19 m	**Water visibility:** 15 m	**Seabed visibility:** Excellent

Target description: A14 was a scattered rocky reef, covered in sponges and algae. The most distinct part of this reef was approximately 12 m x 8 m and was up to 1 m in height. The reef surrounding the large section consisted of smaller broken up sections up to 0.5 m high. The seabed was sandy but overlaid with a shell debris matrix. Probing in and around the search area was only 100 mm deep but the diver indicated this was due to the coarse sand and shell debris rather than refusal or obstruction.

No cultural heritage material was observed within the search area.

Figure 40: The sea floor at the base of the shot line was a coarse sandy rubble and shell debris mix. (Image Professional Diving Services).

Figure 41: Section of large rocky reef. (Image Professional Diving Services).

Figure 42: Section of large rocky reef. (Image Professional Diving Services).

Figure 43: An example of a smaller section of rocky reef, approximately 3 m x 2 m, surrounded by coarse shell debris. (Image Professional Diving Services).

Figure 44: Another example of a small section of rocky reef, approximately 2 m x 1 m. (Image Professional Diving Services).

Figure 45: Example of the seabed in and around the rocky reef. (Image Professional Diving Services).

2.4.2.6 Target B1

Target ID	Lat	Long	Interpretation	Dimensions	Depth	Distance from cable
B1	-38.82738	146.09961	Angular piece of debris, possible concrete block (Figure 46).	Length: 2 m Width: 2 m	5 m	0 m

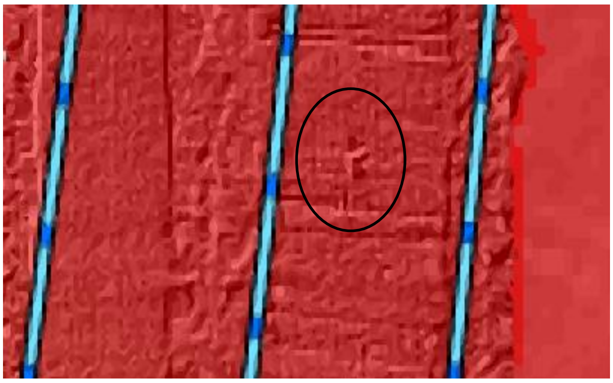

Figure 46: Multibeam image of target B1.
Proposed cable route in blue.

Inspection details for Target B1		
Date: 29-11-2029	**Method:** EANx SCUBA	**Tide:** Ebbing
Distance and direction: Circular search 20 m radius		**Diver**: Felix Venturoni / Colin Silvey
Swim start (min): 1242	**Swim end (min):** 1248	**Total time (min):** 6
Depth: 6 m	**Water visibility:** 15 m	**Seabed visibility:** Excellent

Target description: No features were located within the search area for B1. The seabed was a compact sand with small wave formations. No shells or rocky reef were found (Figure 47 to Figure 50). Probing in and around the search area was only 100 mm deep but the diver indicated this was due to the coarse sand rather than refusal or obstruction.

No cultural heritage material was observed within the search area.

Figure 47: Sandy seabed with wave formations at base of shot line. (Image Professional Diving Services).

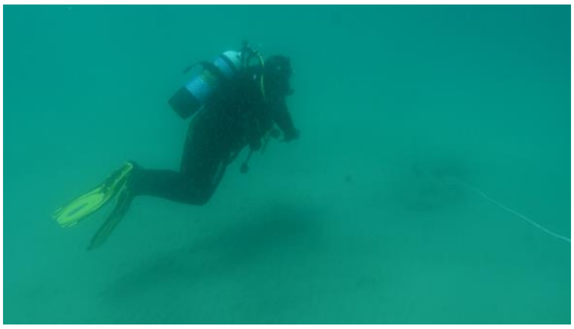

Figure 48: Diver at base of shot line showing featureless surrounds. (Image Professional Diving Services).

Figure 49: Featureless sandy seabed throughout the search area. (Image Professional Diving Services).

Figure 50: Featureless sandy seabed throughout the search area. (Image Professional Diving Services).

2.4.2.7 Target B4

Target ID	Lat	Long	Interpretation	Dimensions	Depth	Distance from cable
B4	-38.832300	146.098000	Possible paleo-shoreline, debris field or dumping site (Figure 51 and Figure 52).	Length: 29 m Width: 8 m	12 m	42 m

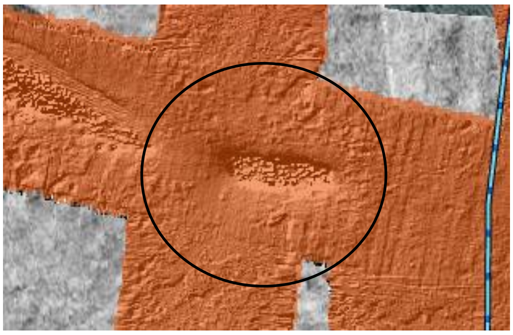

Figure 51: Multibeam image of target B4. Proposed cable route in blue.

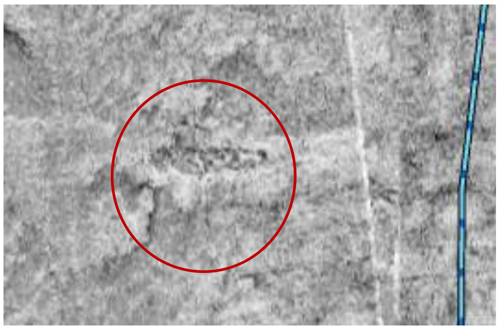

Figure 52: Side scan sonar image of target B4. Proposed cable route in blue.

Inspection details for Target B4		
Date: 29-11-2021	**Method:** EANx SCUBA	**Tide:** Ebbing
Distance and direction: Circular search 20 m radius		**Diver**: Felix Venturoni / Colin Silvey
Swim start (min): 1212	**Swim end (min):** 1218	**Total time (min):** 6
Depth: 14 m	**Water visibility:** 15 m	**Seabed visibility:** Excellent

Target description: The target B4 is a large section of broken up rocky reef surrounded by a sandy seabed. The reef covered an area of approximately 30 m x 10 m and was between 0.3 and 0.8 m high. The seabed in and around the reef was a sand with a matrix of shell grit and rubble (Figure 53 to Figure 58). Probing in and around the feature was only 100 mm deep but the diver indicated this was due to the coarse sand and shell rubble rather than refusal or obstruction.

No cultural heritage material was observed within the search area.

Figure 53: Example of seabed at the base of the shot line. (Image Professional Diving Services).

Figure 54: Larger section of rocky reef with sponge and algae growth. (Image Professional Diving Services).

Figure 55: Smaller section of broken rocky reef. (Image Professional Diving Services).

Figure 56: Another example of small section of broken rocky reef. (Image Professional Diving Services).

Figure 57: Detail of seabed in and around the rocky reef. (Image Professional Diving Services).

Figure 58: Example of shell grit and debris in and around the rocky reef. (Image Professional Diving Services).

2.4.2.8 Target B15

Target ID	Lat	Long	Interpretation	Dimensions	Depth	Distance from cable
B15	-38.856124	146.098802	Unidentified feature, potentially cultural. (Figure 59 and Figure 60).	Length: 3.8 m Width: 6 m	20 m	109 m

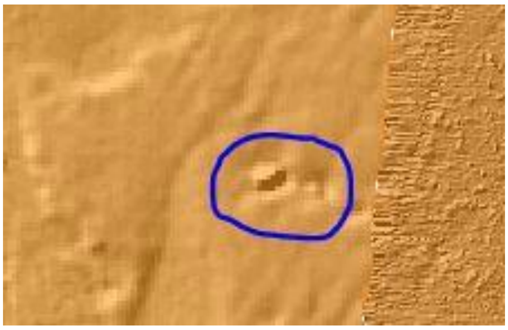

Figure 59: Multibeam image of target B15.

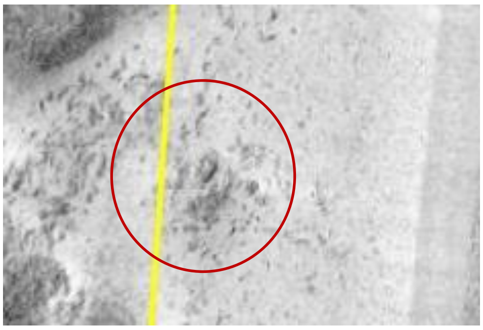

Figure 60: Side scan sonar image of target B15. Cable route in yellow.

Inspection details for Target B15		
Date: 29-11-2021	**Method:** EANx SCUBA	**Tide:** Ebbing
Distance and direction: Circular search 20 m radius		**Diver**: Felix Venturoni / Colin Silvey
Swim start (min): 1122	**Swim end (min):** 1130	**Total time (min):** 8
Depth: 20 m	**Water visibility:** 15 m	**Seabed visibility:** Excellent

Target description: Target B15 was a mound of rocky reef, almost round, approximately 6 m x 5 m and 0.7 m in height. The reef was heavily covered in sponge and algae growth. There were some small overhangs along the edges of the reef but there was only minimal penetration into the sandy seafloor with the probe within these cavities. The reef was surrounded by a sandy sea floor with some mussel and oyster shells in scatters (Figure 61 to Figure 66). Probing the reef was only 100 mm deep but the diver indicated this was due to the coarse sand and shell rubble rather than refusal or obstruction.

No cultural heritage material was observed within the search area.

Figure 61: Target B15 viewed from the shot line on descent. (Image Professional Diving Services).

Figure 62: Target B15 viewed from the seabed. (Image Professional Diving Services).

Figure 63: Mussel and oyster shells among the sand at B15. (Image Professional Diving Services).

Figure 64: Detail of reef and sponge growth at B15. (Image Professional Diving Services).

Figure 65: Example of small overhangs along edge of reef. (Image Professional Diving Services).

Figure 66: Detail of seabed in and around the reef at B15. (Image Professional Diving Services).

2.4.2.9 Target B16

Target ID	Lat	Long	Interpretation	Dimensions	Depth	Distance from cable
B16	-38.859078	146.096406	Possible rock outcrop or cultural feature (Figure 67 and Figure 68).	Length: 20 m Width: 17 m	20 m	20 m

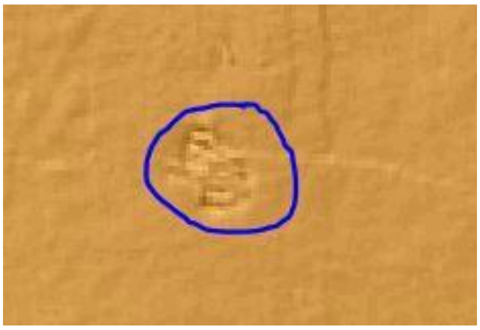

Figure 67: Multibeam image of target B16.

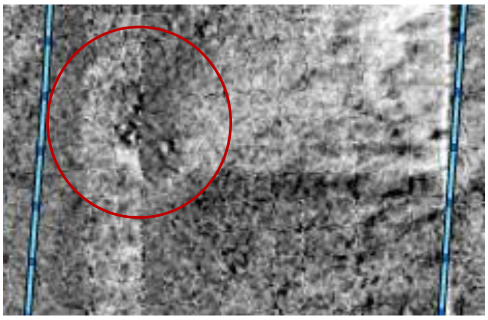

Figure 68: Side scan sonar image of target B16. Proposed cable route in blue.

Inspection details for Target B16		
Date: 29-11-2021	**Method:** EANx SCUBA	**Tide:** Ebbing
Distance and direction: Circular search 20 m radius		**Diver**: Felix Venturoni / Colin Silvey
Swim start (min): 1046	**Swim end (min):** 1052	**Total time (min):** 6
Depth: 20 m	**Water visibility:** 15 m	**Seabed visibility:** Excellent

Target description: Target B16 appears to be a large patch of algae growth covering small rocks and sandy patches. The sea grass spread out over an approximate area of 20 m x 20 m and a height of 200 mm (Figure 69 to Figure 74). Probing in and around the seagrass was only 50 - 100 mm deep but the diver indicated this was due to the coarse sand, small rocks and shell rubble rather than hard refusal or obstruction.

No cultural heritage material was observed within the search area.

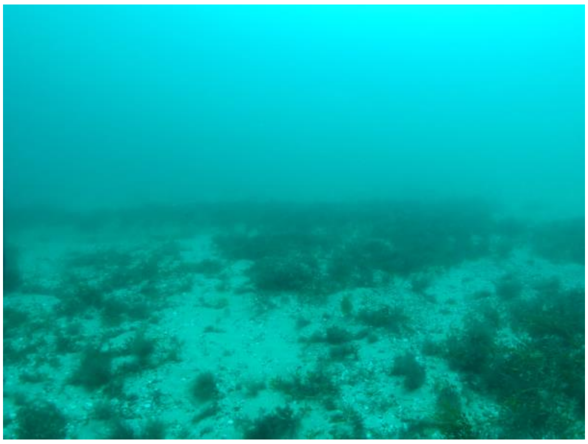

Figure 69: Target B16 overview. (Image Professional Diving Services).

Figure 70: Section of algae growth at B16. (Image Professional Diving Services).

Figure 71: Rocks and shells underneath algae growth. (Image Professional Diving Services).

Figure 72: Another example of rocks and shells underneath algae growth. (Image Professional Diving Services).

Figure 73: Examples of shells and rocks in and around the algae growth. (Image Professional Diving Services).

Figure 74: Patchy algae growth at the base of the shot line. (Image Professional Diving Services).

2.4.2.10 Target B18

Target ID	Lat	Long	Interpretation	Dimensions	Depth	Distance from cable
B18	-38.878921	146.095831	Possible cultural feature. Square in shape. (Figure 75 and Figure 76).	Length: 4 m Width: 2.8 m	27 m	22 m

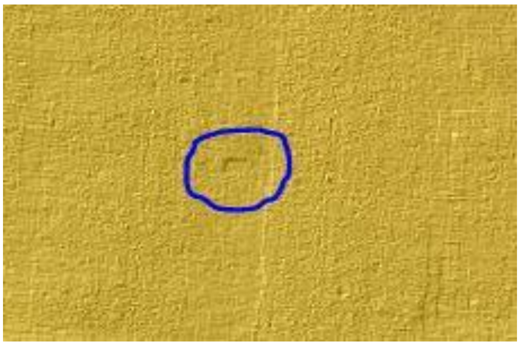

Figure 75: Multibeam image of target B18.

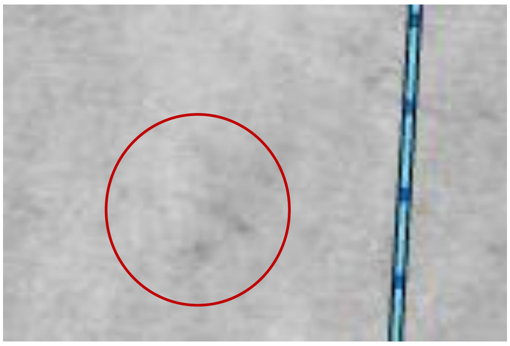

Figure 76: Side scan sonar image of target B18. Proposed cable route in blue.

Inspection details for Target B18		
Date: 29-11-2021	**Method:** EANx SCUBA	**Tide:** Ebbing
Distance and direction: Circular search 20 m radius		**Diver**: Felix Venturoni / Colin Silvey
Swim start (min): 0928	**Swim end (min):** 0936	**Total time (min):** 8
Depth: 29 m	**Water visibility:** 15 m	**Seabed visibility:** Excellent

Target description: No apparent feature located at the coordinates. Sea floor was a hard sand with polychaete worms (Figure 77 to Figure 80). Probing the seabed penetrated only 50 - 100 mm but the diver indicated this was due to the coarse sand and shell rubble rather than refusal or obstruction.

No cultural heritage material was observed within the search area.

Figure 77: Overview of the search area at B18. (Image Professional Diving Services).

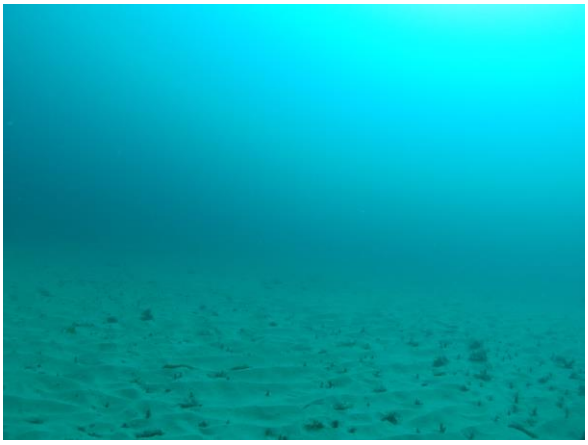

Figure 78: Another view of B18 search area. (Image Professional Diving Services).

Figure 79: View of sand with small wave formations at B18. (Image Professional Diving Services).

Figure 80: Example of a polychaete worm at B18. (Image Professional Diving Services).

ANNEX A – DIVE LOG

Date	Divers	Max depth (m)	Objective of dive	Left surface	Left bottom	Total bottom time (min)
29-10-2021	Felix Venturoni / Colin Silvey	29	Locate and record target B18	0928	0936	8
29-10-2021	Felix Venturoni / Colin Silvey	27	Locate and record target A12	0952	1000	8
29-09-2021	Felix Venturoni / Colin Silvey	21	Locate and record target A11	1017	1023	6
29-09-2021	Felix Venturoni / Colin Silvey	20	Locate and record target B16	1046	1052	8
29-09-2021	Felix Venturoni / Colin Silvey	20	Locate and record target A10	1103	1108	5
29-09-2021	Felix Venturoni / Colin Silvey	20	Locate and record target B15	1122	1130	8
29-09-2021	Felix Venturoni / Colin Silvey	19	Locate and record target A14	1145	1150	5
29-09-2021	Felix Venturoni / Colin Silvey	14	Locate and record target B4	1212	1218	6
29-09-2021	Felix Venturoni / Colin Silvey	9	Locate and record target A2	1230	1235	5
29-09-2021	Felix Venturoni / Colin Silvey	5	Locate and record target B1	1242	1248	6
29-09-2021	Colin Silvey	3	Record Transect 1	1300	1314	14
Total Dives	**11**			Total bottom time		**79**

ANNEX B – VIDEO LOG

Target	Name	File	Size (MB)	Length
Transect 1	211129_Waratah Bay_T1_VID_1	MP4	1050	02:43
	211129_Waratah Bay_T1_VID_2	MP4	4060	10:30
A2	211129_Waratah Bay A2	MP4	918.6	02:21
A10	211129_Waratah Bay A10	MP4	146.8	00:22
A14	211129_Waratah Bay A10	MP4	209.7	00:32
B1	211129_Waratah Bay B1	MP4	4018	10:48
B4	211129_Waratah Bay B4	MP4	931.2	02:24
B15	211129_Waratah Bay_B15_1	MTS	725.7	01:52
	211129_Waratah Bay_B15_2	MP4	398.5	01:00
B16	211129_Waratah Bay_B16_VID_1	MP4	142.6	00:22
	211129_Waratah Bay_B16_VID_2	MTS	142.6	00:21

ANNEX C – BASS STRAIT TARGETS AND LANDFORMS

Sydney 46 Gale Road
Maroubra, NSW, 2035

Northern NSW 2 Queen St
Murwillumbah, NSW
P.O. Box 42 Condong, 2484

A.B.N. 83 082 211 498

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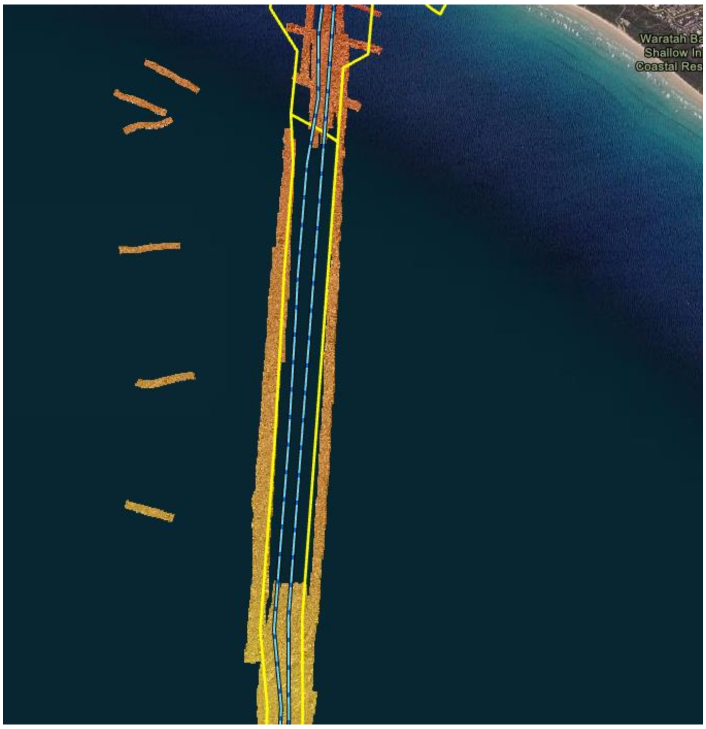
Marinus Link

Anomalies and landforms of potential cultural heritage significance: Bass Strait

Targets to be avoided during geotechnical work



Bass Strait

Australia

1.1 Introduction

Multibeam echo sounder (MBES), side scan sonar (SSS), and magnetometer (mag) data collected in 2019 and 2020 for Project Marinus was examined to identify potential archaeological seafloor deposits. The desktop assessment followed the proposed cable routes between Tasmania and Victoria. Within the Bass Strait portion of the cable route (beyond water depths of 30m) 78 anomalies and landforms of potential cultural heritage significance were identified.

1.2 Data source

The data examined for potential cultural seafloor targets were the 2019 and 2020 bathymetry datasets, the 2019 and 2020 side scan sonar datasets (provided in high and low frequency), and the magnetometer targets provided by FUGRO. These datasets were made available by Tetra Tech Coffey via the Project Marinus Link Webapp, powered by Esri.

Multibeam Echosounder

Multibeam bathymetry was provided as a colour coded map layer, with changing colour representing change in depth. The multibeam data provided some clear detail of seafloor features, but the 2020 data was of a much higher resolution than the 2019 data. Both data sets were examined to locate any features that appeared to be anthropogenic.

Side Scan Sonar

SSS data was provided as black and white imagery in high and low frequency for years 2019 and 2020, yielding four different data sets to examine. Both surveys utilized an EdgeTech 4200FS with dual frequency 122 kHz/410 kHz, towed at a typical altitude of 12 to 16 m (above seabed), with a slant range of 150 m.

Magnetometer

Magnetometer targets were identified by FUGRO and uploaded by Coffey as data points on the Project Marinus Link Webapp. Although the FUGRO integrated report appears to list magnetometer surveys occurring in 2019 and 2020, all targets uploaded onto the Webapp were from the 2019 survey. The 2019 survey utilized a Marine Magnetics SeaSpy2 with a 2 Hz sample frequency piggybacked behind the side scan sonar. The altitude of the magnetometer was recorded at each contact location, and the strength of the magnetic anomaly amplitude was recorded in nanoteslas (nT). Fugro estimates that the positional accuracy of the magnetometer to be within 10 m.

FUGRO reports

Fugro provided alignment drawings of the geophysical surveys that included sub-bottom profiling data, seabed features, sediment distribution, and bathymetric data with depth contours. On these pages, they noted mag and SSS target strikes, but did not include individual interpretation of targets. Fugro also provided an integrated report analysing the data acquired from the 2019 and 2020 surveys, which included analysis of seabed composition and seabed testing. Fugro also identified 21 sonar contacts they believed to be debris, and 14 “high-reflective” patches of seabed. These targets have been included in the following target list.

1.3 Methodology

The method followed toggling on the separate data layers. Starting from shallow water and panning through the data to deeper water, potential cultural seabed features were identified (i.e Waratah Bay followed a direction north to south; Heybridge/Blythe River Mouth followed a direction of south to north). A maximum water depth of 30 m was used as the limit of this review, because it is the maximum depth for an ADAS qualified diver on SCUBA. Targets identified in less than 30 m are in the process of being inspected.

Following the first pass of assessing the data and due to the 2020 bathymetry layer overlapping the 2019 layer, the 2020 was toggled off and the 2019 layer was checked a second time. The same direction of examination was completed to control consistency. This was to ensure the overlapping of data layers did not obscure any potential targets form the identification process.

After the bathymetry data was assessed, the SSS data was examined. Again, the 2019 layer was opened first, and surveyed from shallowest recorded data to 30 m depth, followed by the 2020 layer. When a target was identified on one layer, it was checked again against all other datasets, including multibeam.

The numbering for the identified SSS and multibeam targets in Bass Strait begins at the northern end near Victoria and increases south towards Tasmania. Magnetometer targets retain the numbering provided by Coffey and FUGRO, with an M before the number (i.e., M31).

The coordinates are recorded in decimal degrees to the fifth decimal, corresponding to an accuracy of less than one metre at the latitudes in Bass Strait. The datum used by FUGRO and in the Webapp is ITRF2014.

1.4 Limitations:

Some limitations affected the identification process. The Webapp only allows the user to zoom in to the 2020 SSS and MBES layers to a certain point, limiting the ability to accurately assess and attempt the identification of the potential cultural seafloor targets. Even with these limitations, objects less than a metre in size were identified. Further limitations arose from the coverage of certain data sets, with holes or gaps existing in the coverage of some multibeam and SSS layers (Figure 1), however, there was no area within the study area that did not have any data coverage. The gap identified in Figure 1 is only in the 2020 data, 2019 MBES and SSS covered that area, allowing for interpretation.

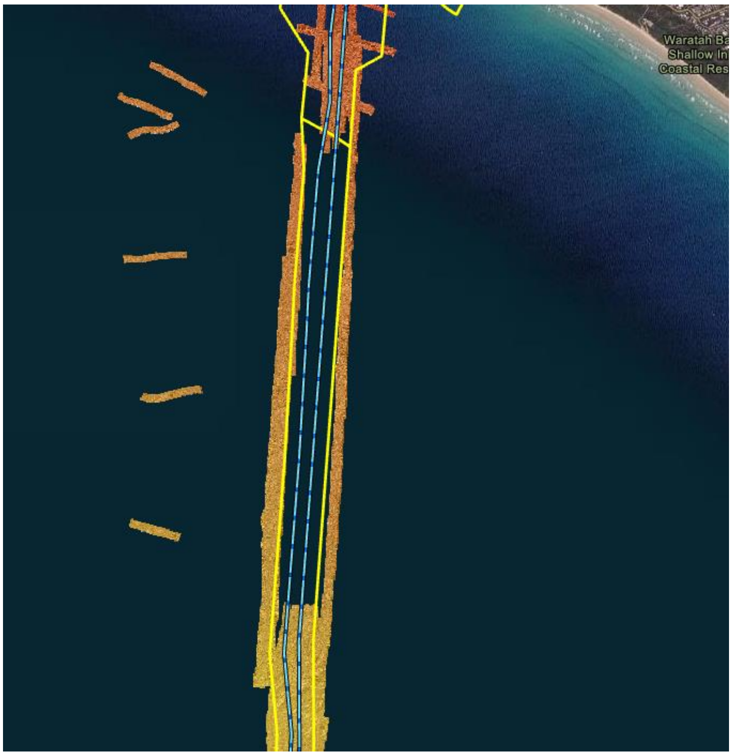


Figure 1: Section of geophysical survey in Waratah Bay nearshore area showing gap in data for 2020 MBES survey. The gap in 2020 data in this area is covered by 2019 survey data showing MBES and SSS.

Seafloor contours are not visible within the data set. They are visible on land and stop at 0 m. Depths, however, are display in -5 m intervals. Thus, the depths recorded for each target are an approximate only where no clear indicator was visible.

Finally, the raw data for the magnetometer was not provided, so was unable to be assessed by the maritime archaeologists. Instead, only the targets identified by FUGRO could be examined.

2.0 Identified targets

The following table shows the identified geophysical targets that should be avoided during geotechnical work.

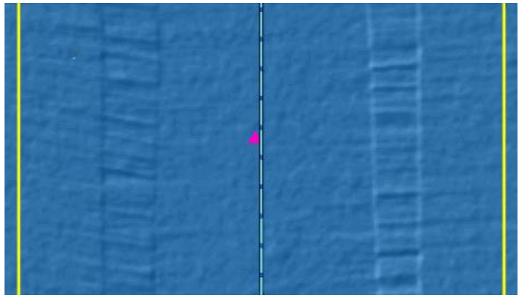
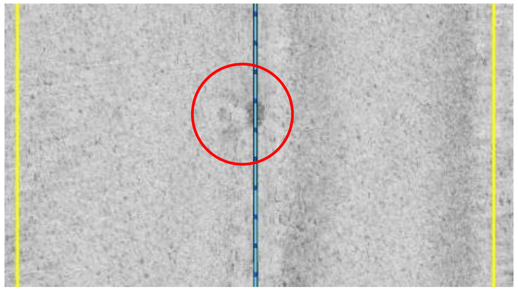
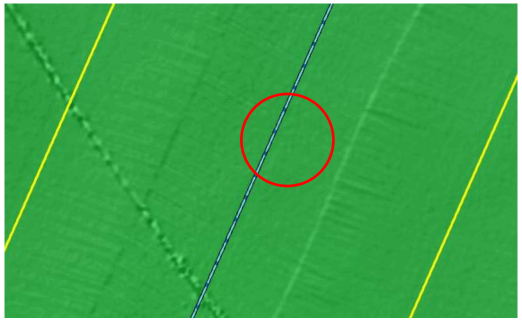
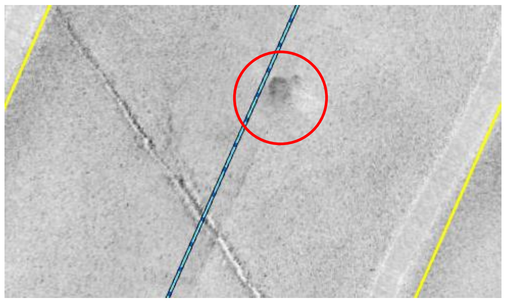
A = Primary – Within 50 m of proposed cable route. Please maintain a buffer around the target of 100 m.

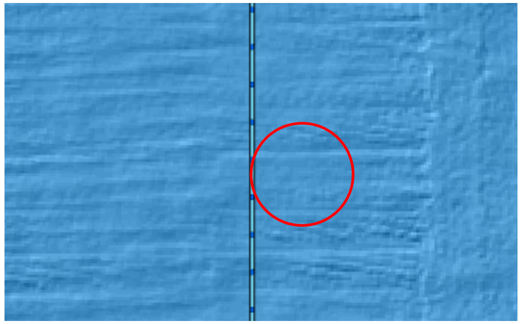
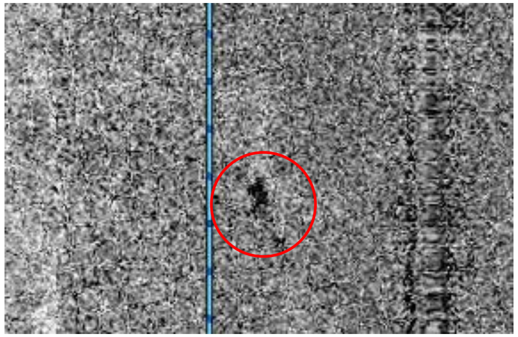
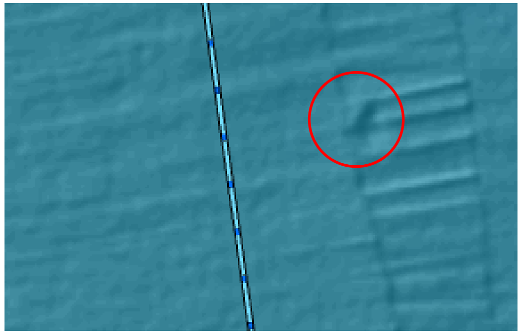
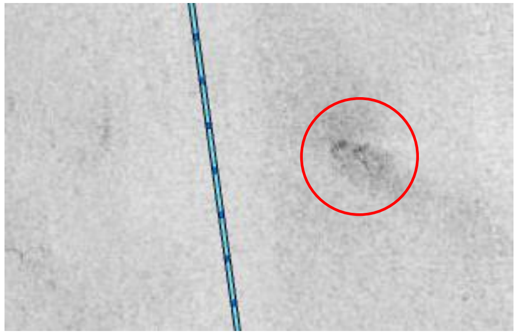
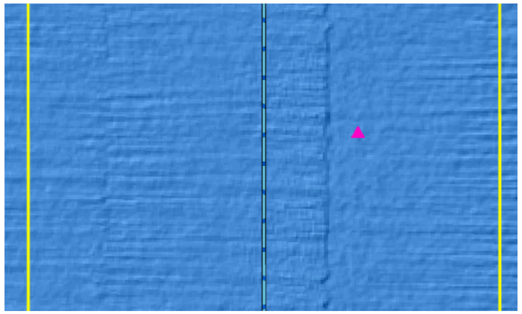
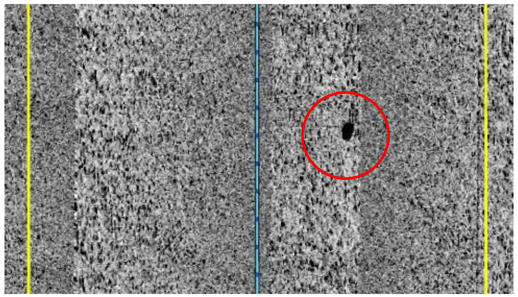
B = Secondary – Beyond 50 m of proposed cable route. Please maintain a buffer around the target of 100 m.

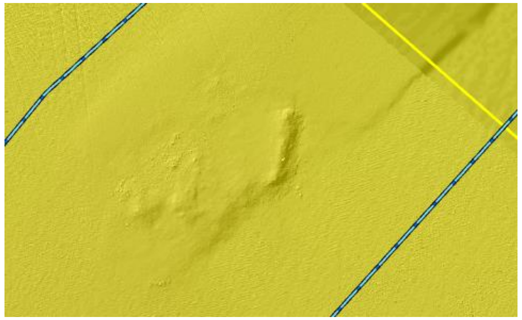
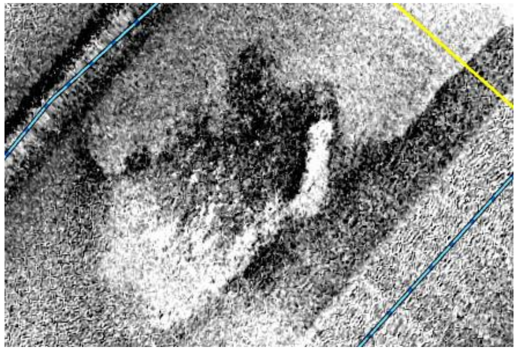
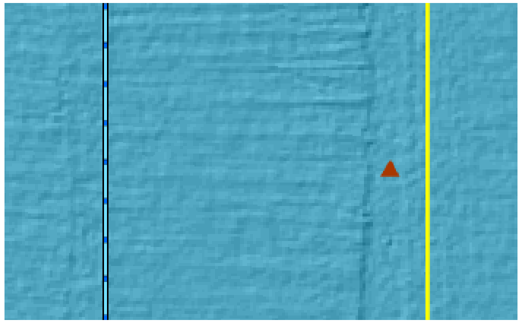
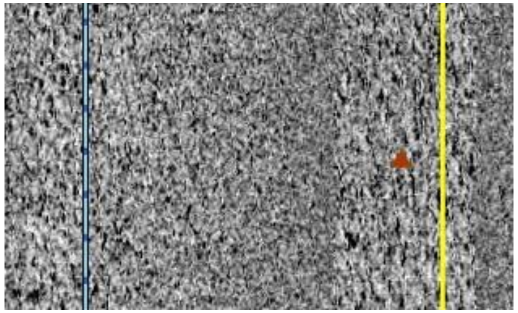
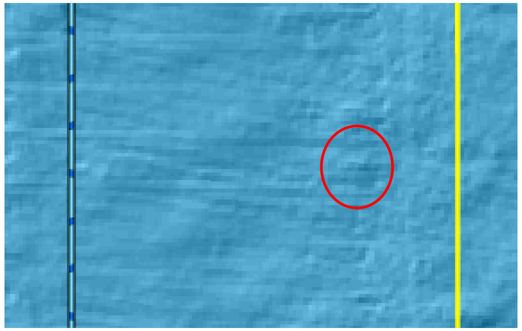
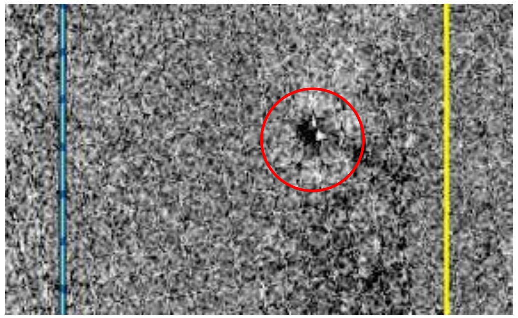
C = Low priority – Please maintain a buffer around the target of 100 m if possible.

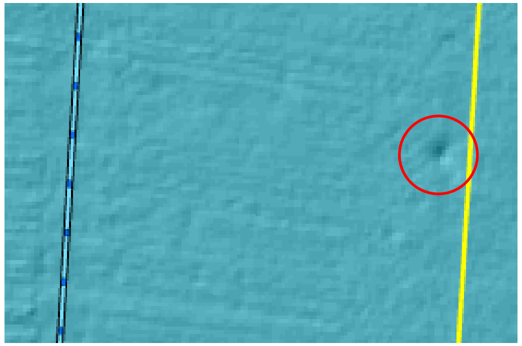
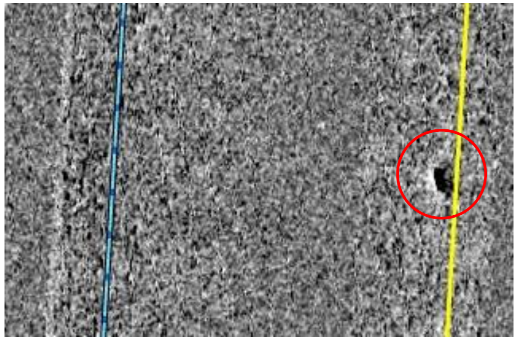
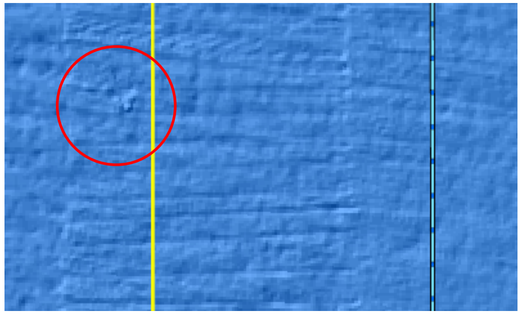
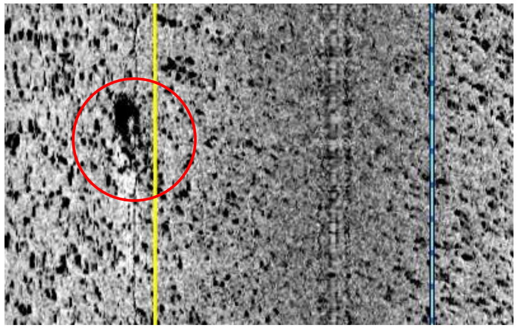
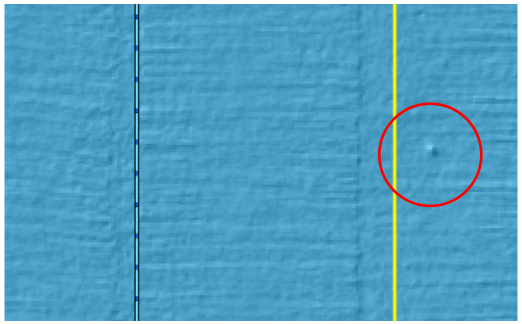
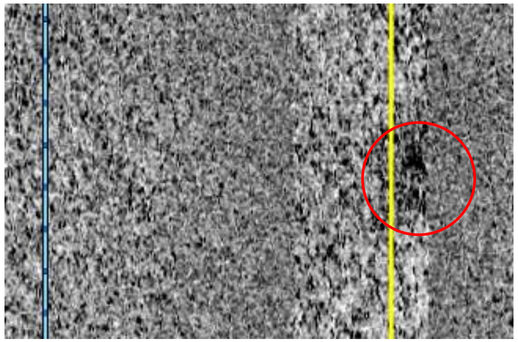
X = No priority. Active cable or otherwise known and not culturally significant, or not enough information to assess – such as magnetometer anomaly.

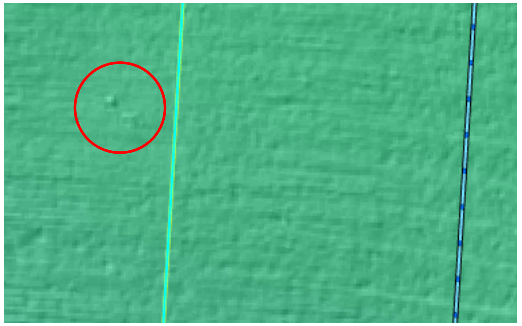
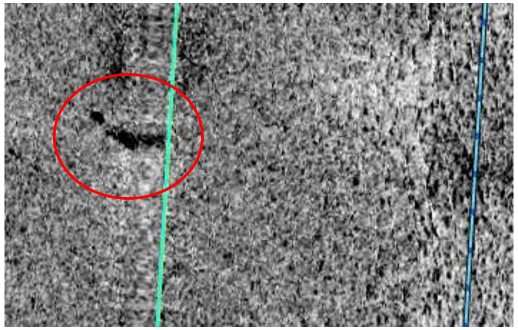
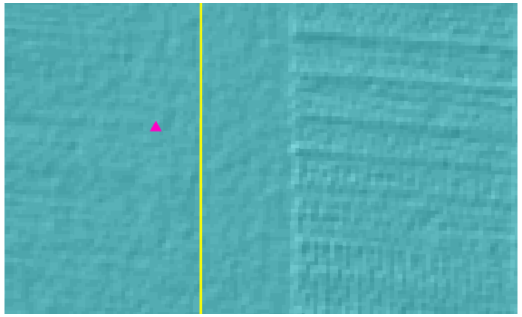
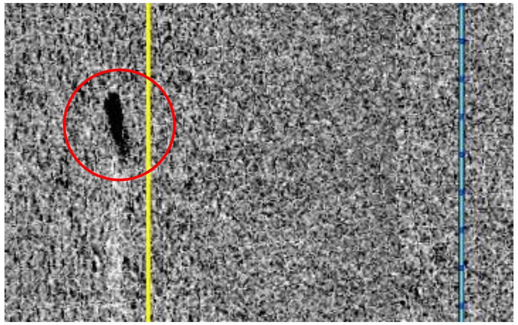
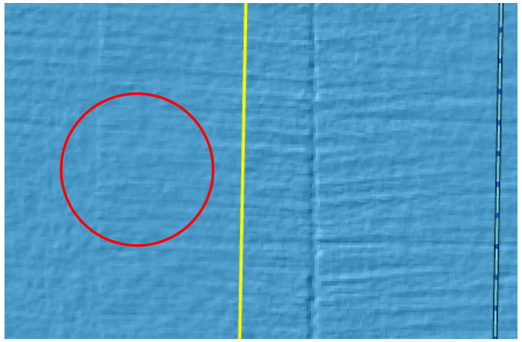
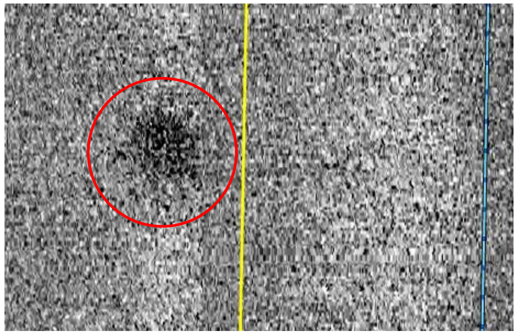
Where SSS coverage didn't overlap MBES, and was unavailable, N/A is stated in column "Image SSS".

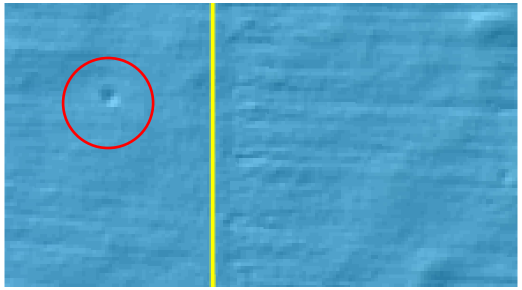
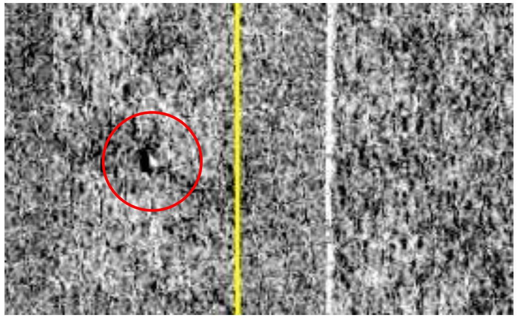
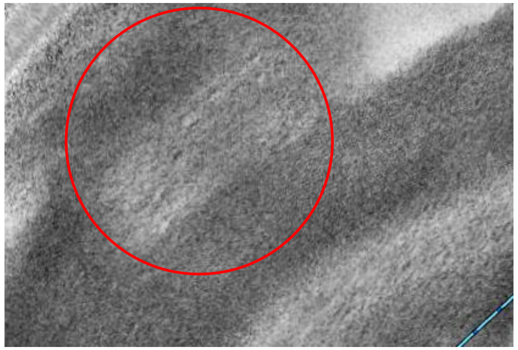
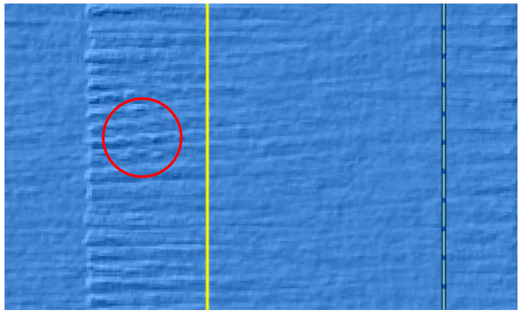
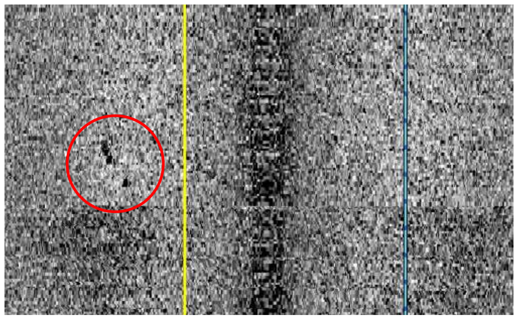
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
Bass Strait										
A	44	-40.34603	146.10693			No	FUGRO Object ID: 161; Possible Possibly item of debris – dumped or wreckage.	Length: 10.1m; Width: 8m	80m	0m
A	61	-40.99690	146.06970			No	Debris, non-ferrous with some relief, See Target ID 62 fr trawler scar.	Length: 10m; Width: 8m	50m	3m

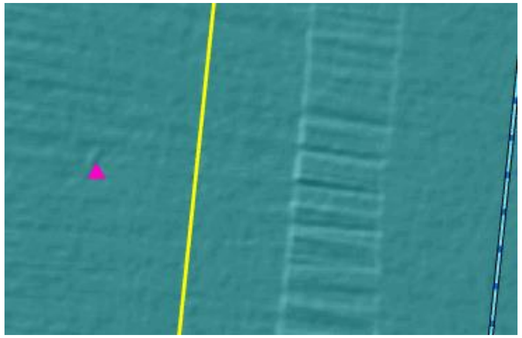
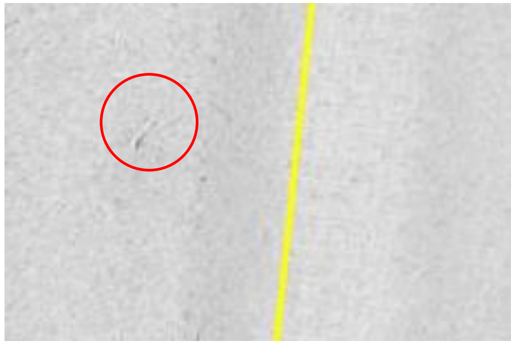
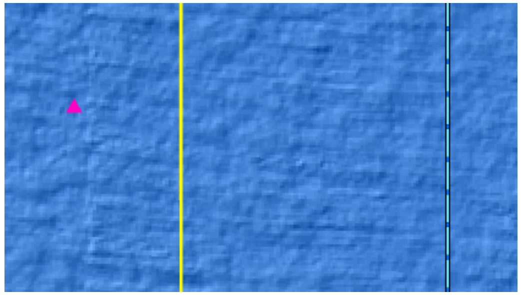
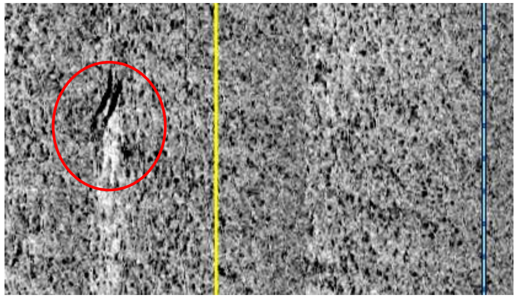
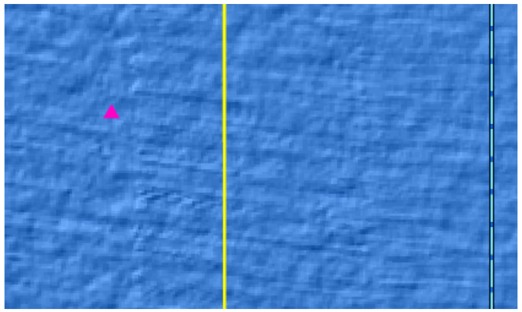
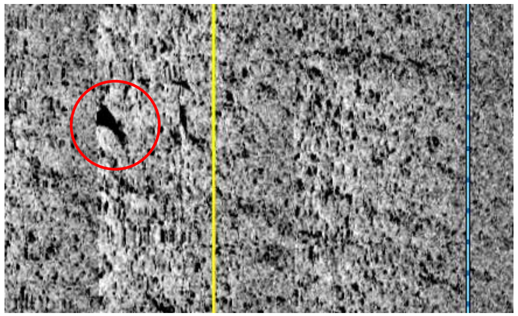
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
A	25	-39.36396	146.08369			No	Object, low relief, potentially covered in relatively thin layer of sediment.	Length: 10m; Width: 5m	75m	11m
A	13	-39.03297	146.10669			No	FUGRO Object ID: 149; Appears low relief objects or single object with high points protruding from seabed.	Length: 5.5m; Width: 3m	70m	34m
A	41	-40.27101	146.08456			No	FUGRO Object ID: 91; Isolated high-reflective patch	Length: 6.5m; Width: 4.5m	80m	38m

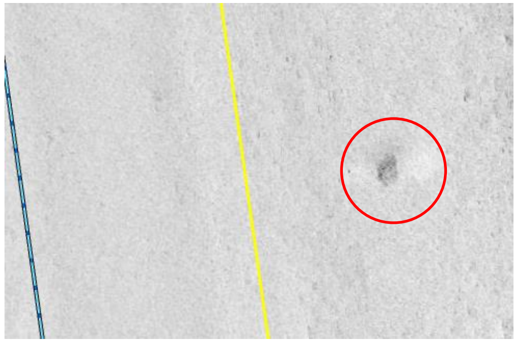
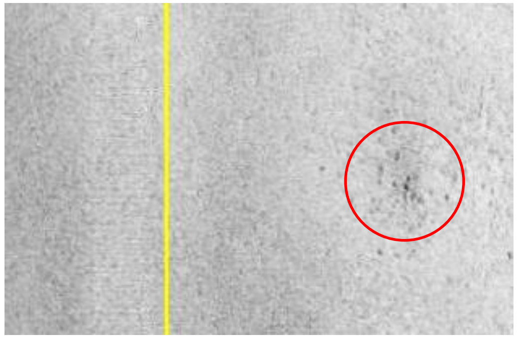
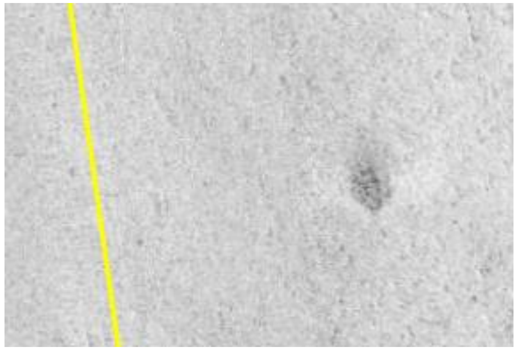
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
A	71	-41.04301	146.01459			No	Most likely natural feature or rock outcrop but could be a wreck and wreck scatter. There are no other outcrops in the immediate vicinity.	Length: 36m; Width: 10m	35m	46m
B	49	-40.63102	146.08440			Yes, FUGRO Object ID: 74	Buried ferrous object, high reading on magnetometer	nT: 36.5	75m	88m
B	20	-39.21829	146.08418			No	Debris or natural feature	Length: 9.7m; Width: 6.5m	75m	65m

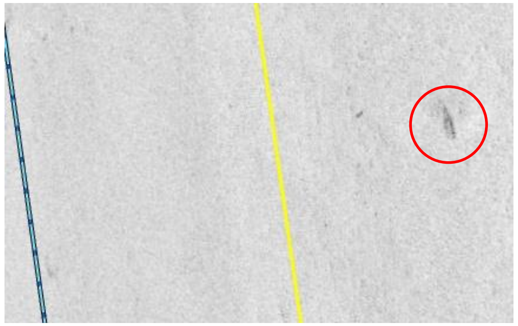
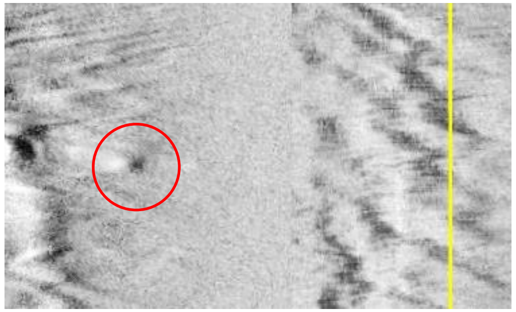
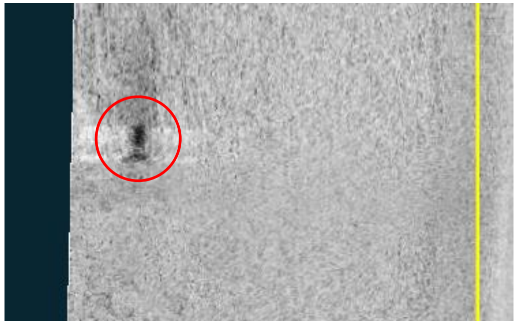
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
B	6	-38.99436	146.08748			No	FUGRO Object ID: 96; Possibly small boat with non-ferrous hull or engine.	Length: 7m; Width: 2m	70m	94m
B	30	-39.7391	146.0826			No	Possible debris scatter	Length: 30m; Width: 7m	80m	102m
B	47	-40.5412	146.0846			No	FUGRO Object ID: 89; Possible boulder or debris/cultural object	Length: 2.8m; Width: 1.6m	75m	105m

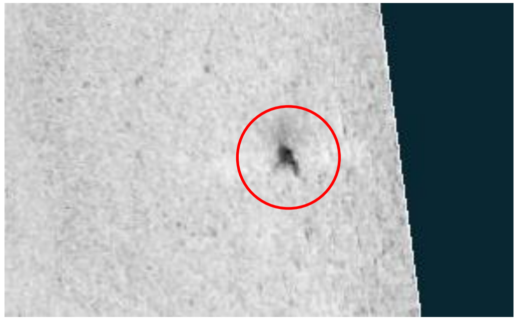
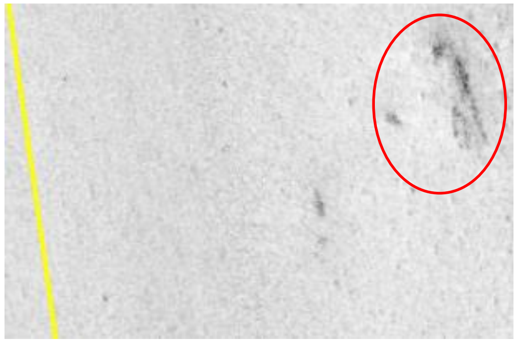
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
B	3	-38.9475	146.0888			No	Outcrop of rock or large area of debris	Length: 25; Width: 7m	60m	106m
B	54	-40.8168	146.0825			No	FUGRO Object ID: 86; High reflective patch with low reflective tail	Length: 20.4m; Width: 4.7m	65m	107m
B	45	-40.4868	146.0830			No	Highly reflective patch with no relief.	Length: 30m; Width: 30m	75m	120m

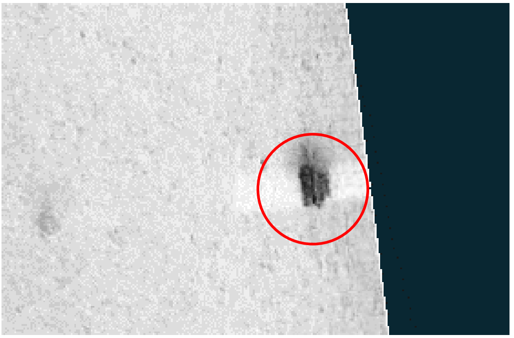
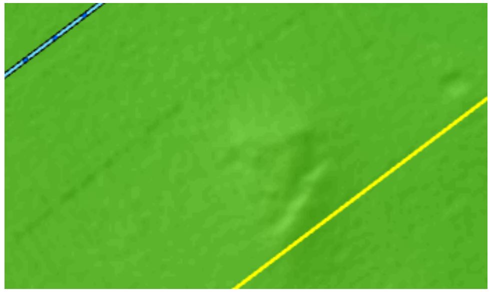
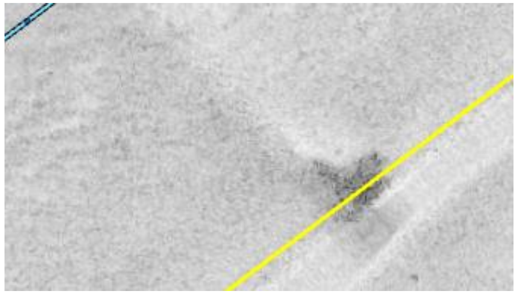
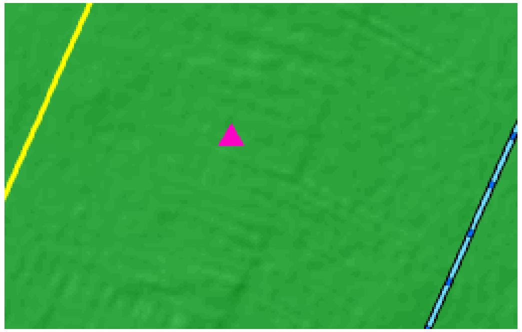
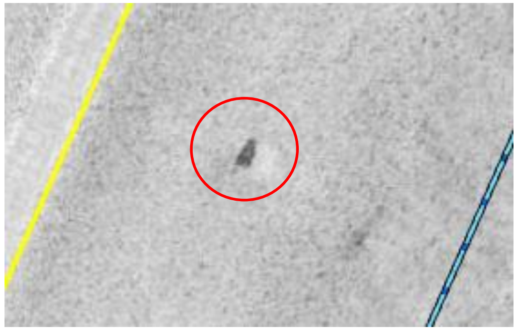
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
B	20	-39.1933	146.0825			No	FUGRO Object ID: 95; Possible boulder or debris with scouring	Length: 4.7m; Width: 1.2m	75m	122m
B	70	-41.0419	146.0124			No	Debris field or natural feature, rocky reef of low relief and covered mostly in coarse sediment.		35m	125m
B	38	-40.1580	146.0830			No	Boulder or non-ferrous debris	Length: 10m; Width: 3m	80m	132m

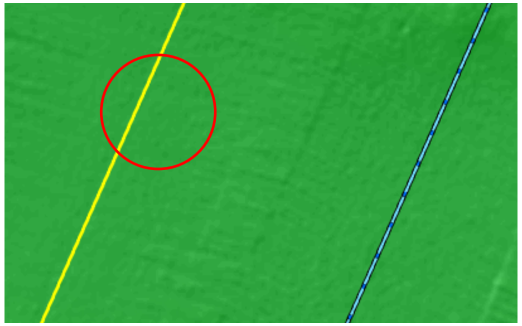
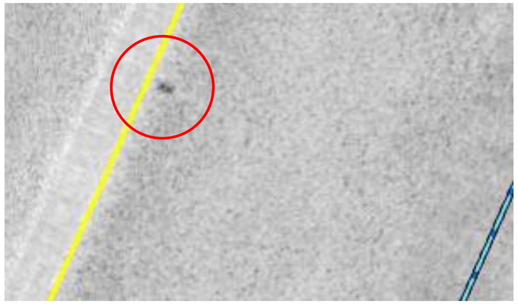
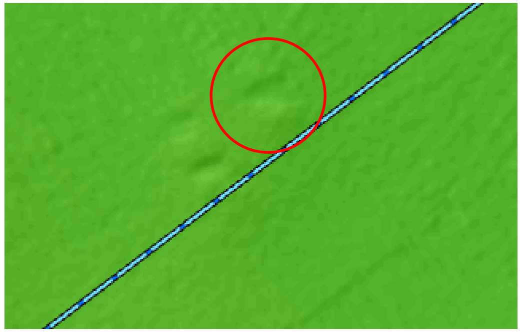
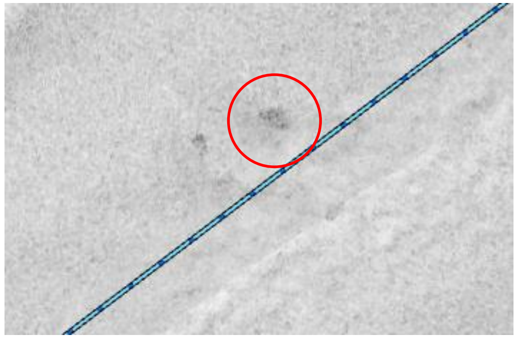
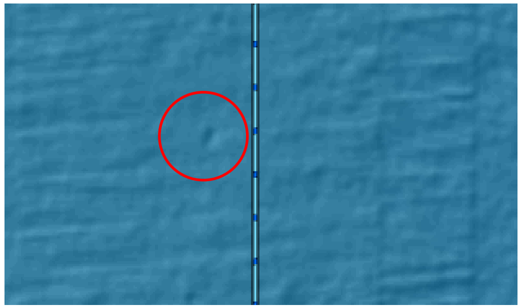
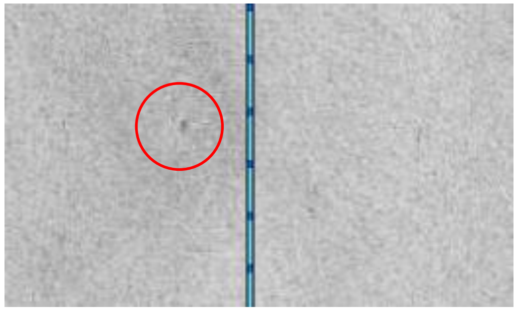
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
B	56	-40.8667	146.1046			No	FUGRO Object ID: 137; Possible debris	Length: 5.63m; Width: 0.64m	65m	132m
B	31	-39.8238	146.0822			No	FUGRO Object ID: 93; Two high-reflective features with tail shadow – possible wreck	Length: 13.5m; Width: 1.7m	80m	135m
B	72	-39.8011	146.0821			No	FUGRO Object ID: 94; Cluster of five high-reflective patches	Length: 86.6m; Width: 38.8m	80m	136m

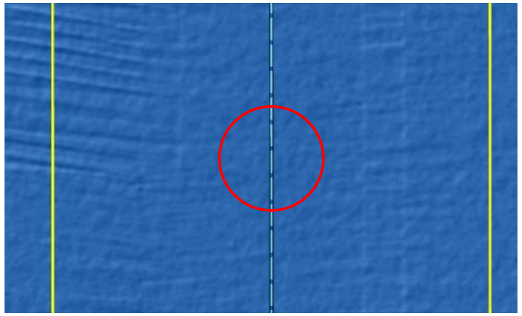
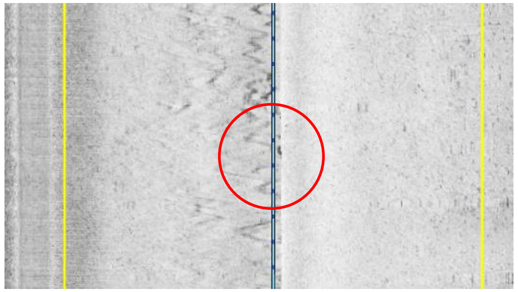
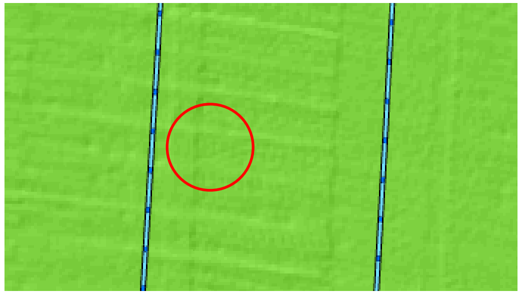
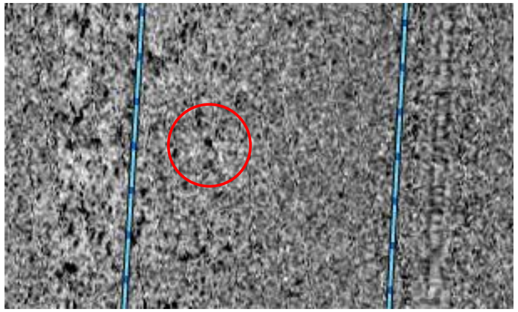
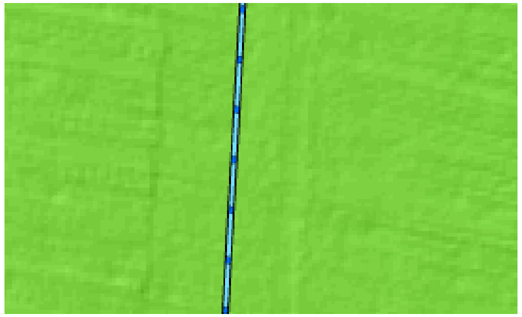
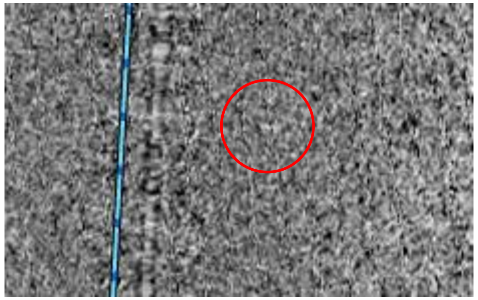
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
B	4	-38.9691	146.0966	N/A		No	FUGRO ObjectID: 154; Low highly reflective mound. Possible cultural object, likely natural feature.	Length: 12m; Width: 8m	70m	160m
B	15	-39.0577	146.1088	N/A		No	Debris scatter	Length: 20m; Width: 15m	75m	163m
B	11	-39.0210	146.1060	N/A		No	Low highly reflective mound. Possible cultural object, likely natural feature.	Length: 11m; Width: 9m	70m	167m

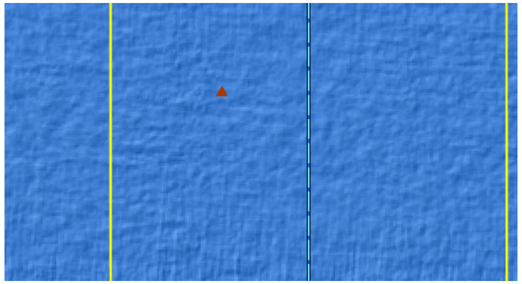
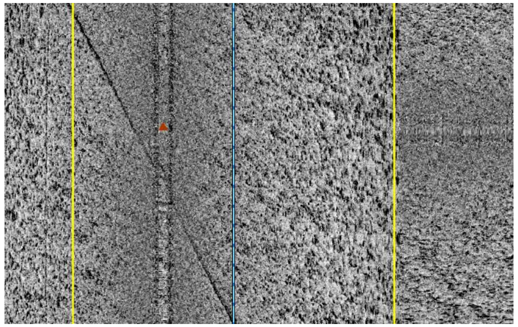
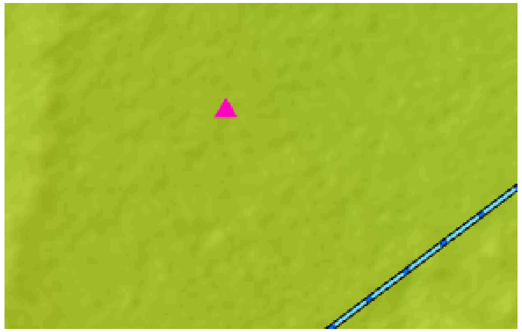
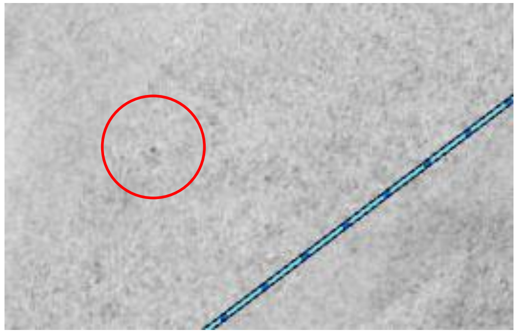
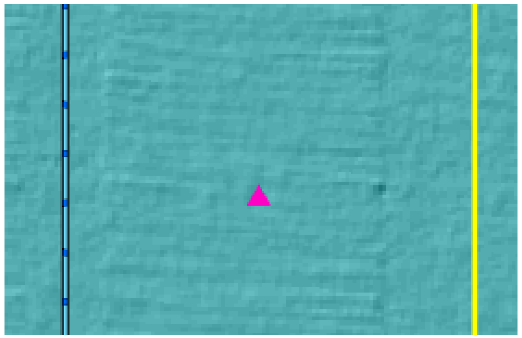
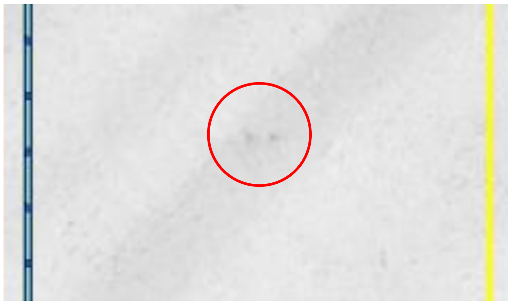
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
B	5	-38.9703	146.0968	N/A		No	FUGRO objectID: 155; Possible wreck or dumped object.	Length: 13; Width: 8	70m	170m
B	22	-39.3349	146.1041	N/A		No	FUGRO Object ID: 157; Possible debris, close to thermocline noise band	Length: 3.84m; Width: 2.59m	75m	208m
B	53	-40.8111	146.1045	N/A		No	FUGRO Object ID: 143; Likely low relief debris.	Length: 9.47m; Width: 5.08m	65m	211m

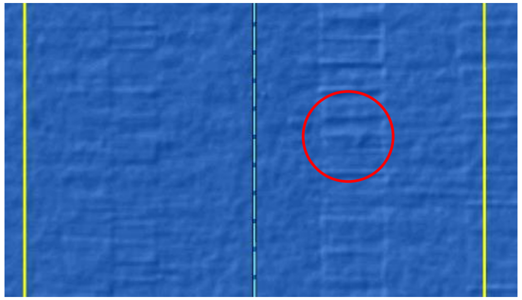
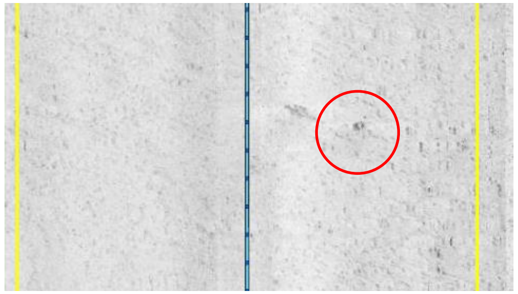
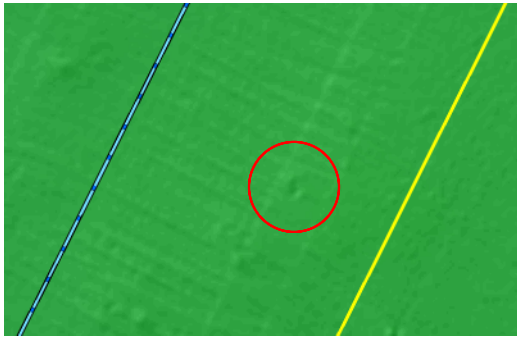
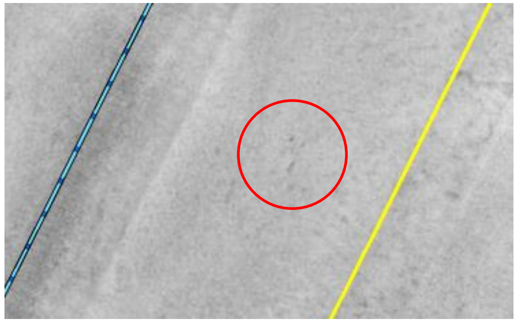
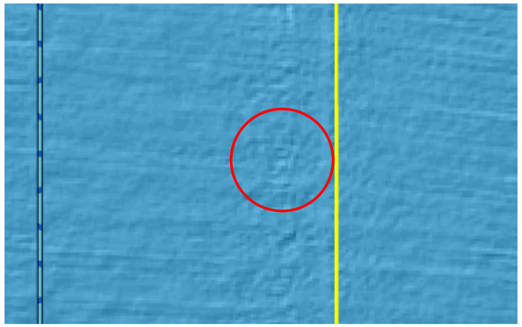
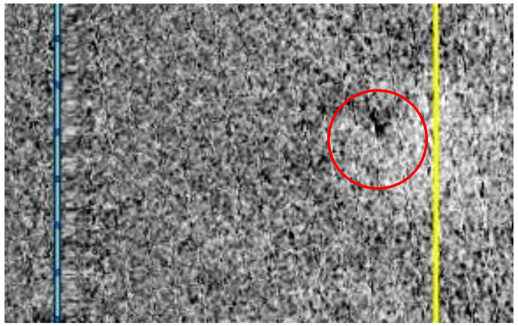
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
B	12	-39.0226	146.1069	N/A		No	FUGRO Object ID: 150; Highly reflective low relief object	Length: 10m; Width: 4m	70m	214m
B	10	-38.9980	146.1020	N/A		No	Likely cultural debris scatter around central point – possible wreck	Length: 30m; Width: 8m	70m	220m
B	7	-39.0026	146.1033	N/A		No	FUGRO Object ID: 152; Likely cultural. Possible debris plume emanating from a wreck.	Length: 12m; Width: 5m	70m	222m

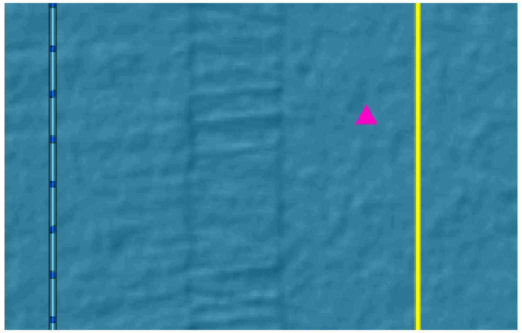
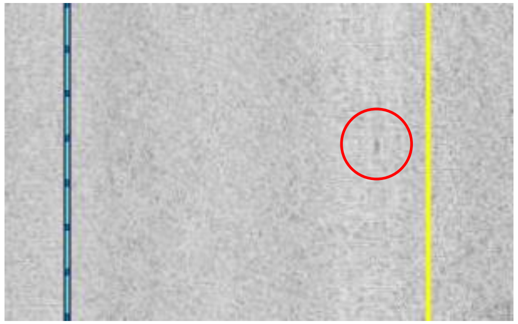
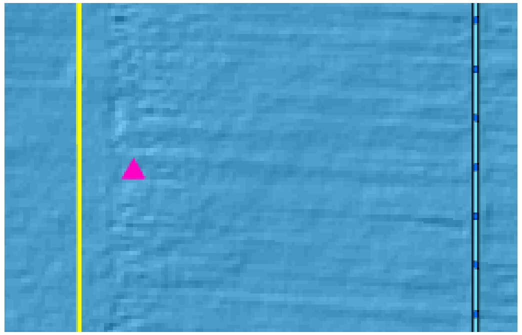
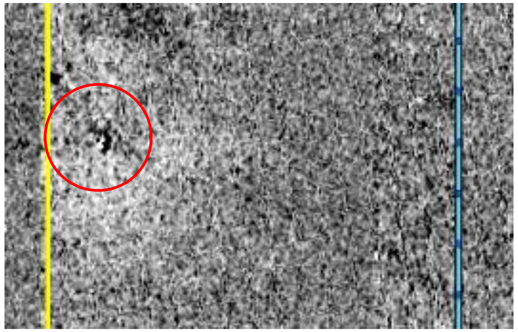
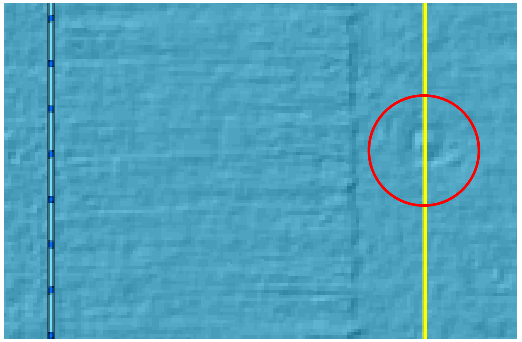
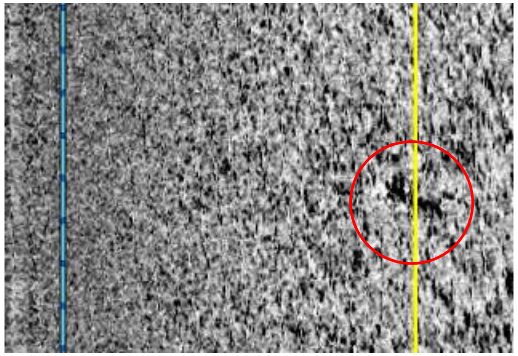
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
B	8	-39.0041	146.1037	N/A		No	FUGRO Object ID: 153; Single dumped object, possible wreck.	Length: 10m; Width: 6m	70m	230m
B	68	-41.0244	146.0473			No	Patch of coarser sediments and/or low relief reef.	Length: 18m; Width: 17m	45m	85m
B	65	-41.00432	146.06444			No	FUGRO Object ID: 131; High reflective patch or low relief object.	Length: 7.23m; Width: 3.77m	50m	57m

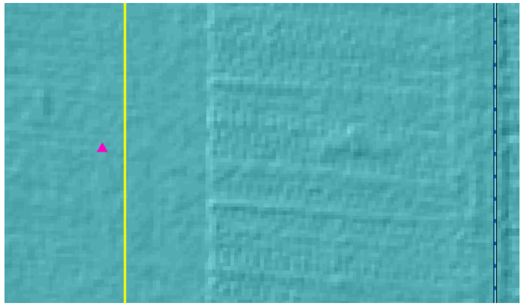
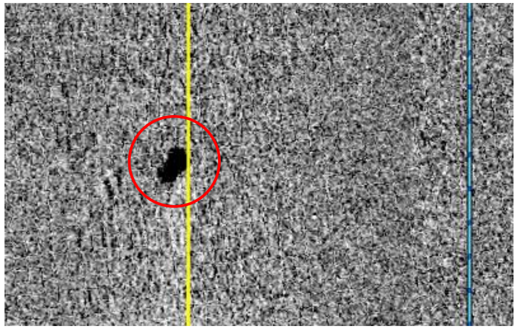
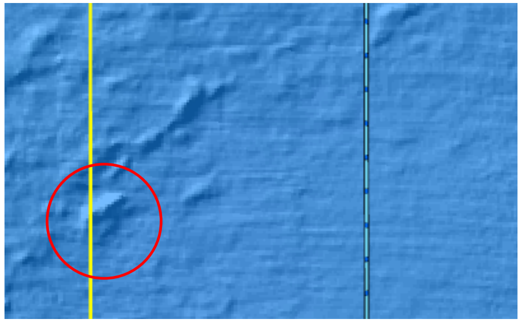
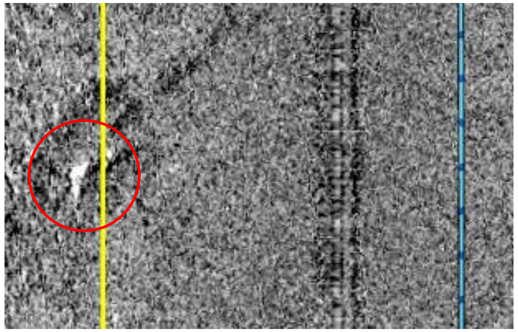
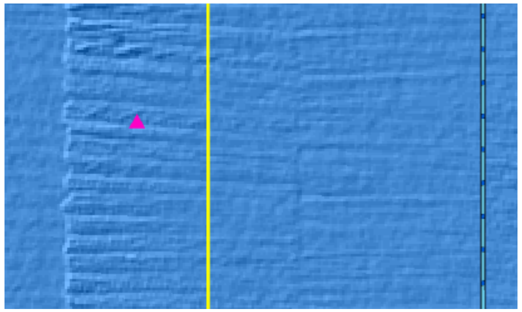
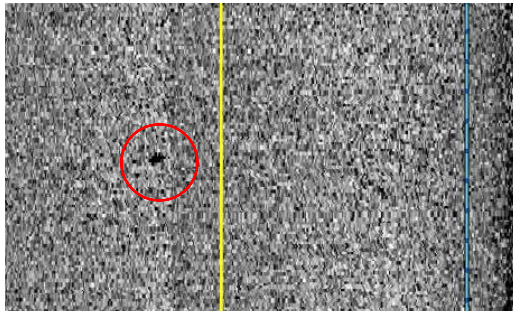
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
C	64	-41.00349	146.06446			No	Single non-ferrous object, such as a concrete block	Length: 3.5m; Width: 2m	50m	93m
C	67	-41.02316	146.04717			No	Probable natural feature, isolated reflective patch within what may be shallow depressions.	Length: 10m; Width: 6m	45m	10m
C	16	-39.08992	146.10628			No	FUGRO Object ID: 148; Boulder/debris	Length: 2m; Width: 1.6m	75m	16m

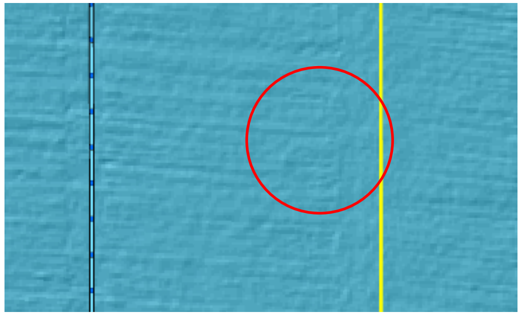
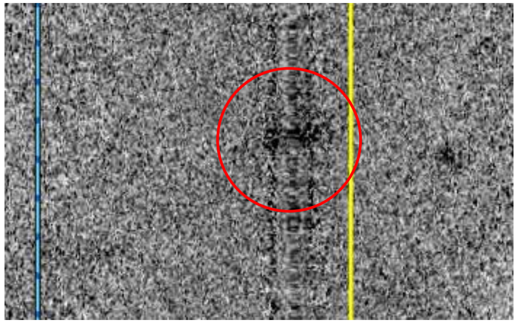
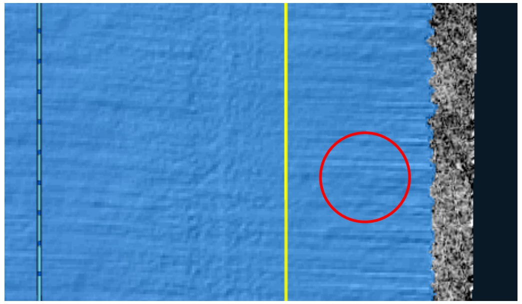
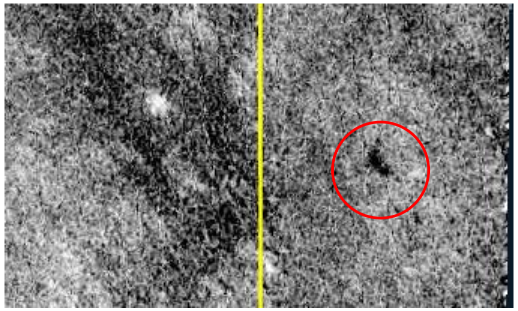
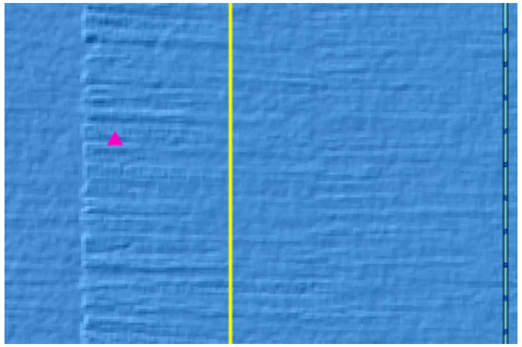
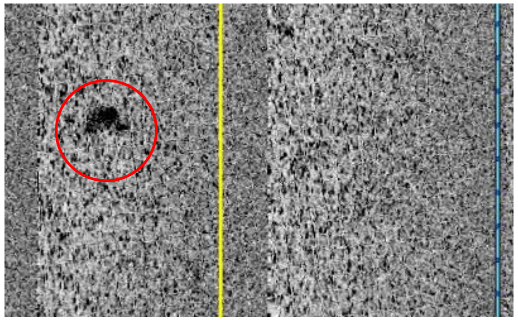
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
C	39	-40.2205	146.1069			No	Possible data acquisition error	Length: 4m; Width: 2m	80m	2m
C	1	-38.90299	146.09373			No	Single small object, piece of debris or rock.	Length: 2m; Width: 2m	45m	20m
C	2	-38.90638	146.09446			No	Single small object, piece of debris or rock.	Length: 1m; Width: 1m	45m	31m

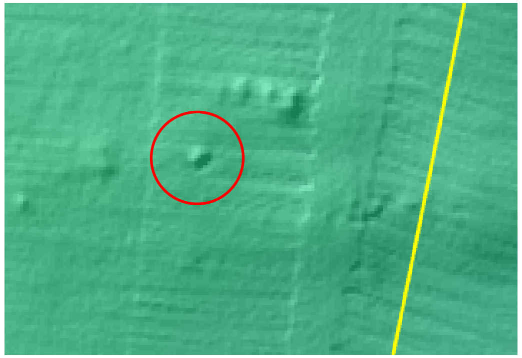
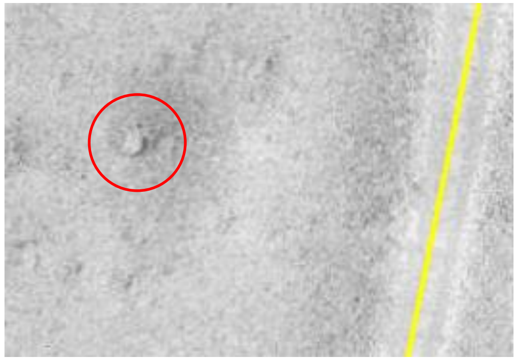
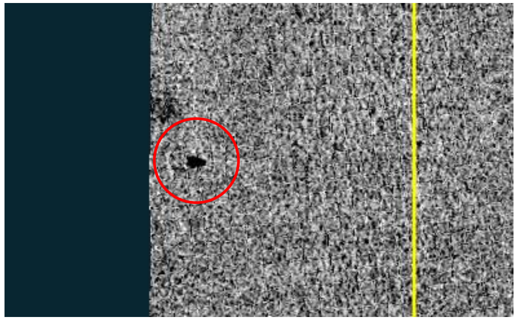
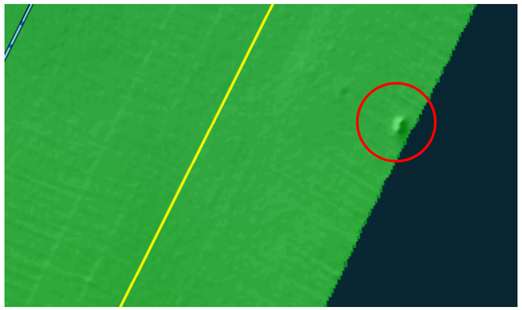
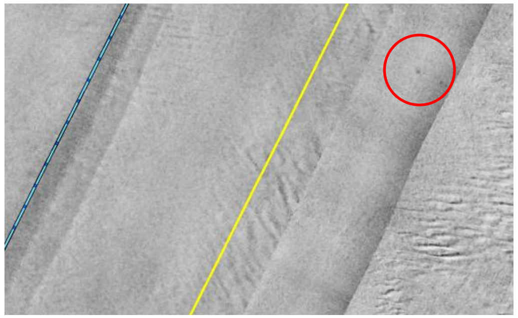
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
C	32	-39.90032	146.08335			Yes, mag ID: 1	FUGRO Object ID: 1; Mag target associated with trawl scar	nT: 2.7	80m	44m
C	69	-41.03439	146.02657			No	FUGRO Object ID: 132; Possible debris	Length: 1.9m; Width: 1.35m	40m	41m
C	57	-40.87481	146.08389			No	FUGRO Object ID: 140; Possible debris	Length: 1.89m; Width: 0.75m	65m	47m

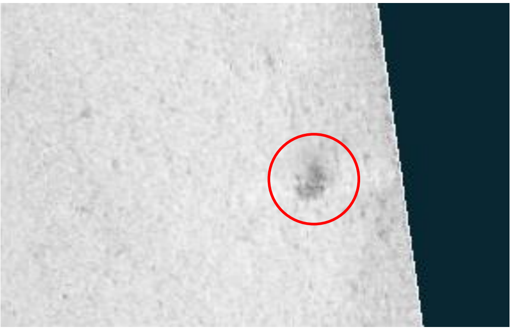
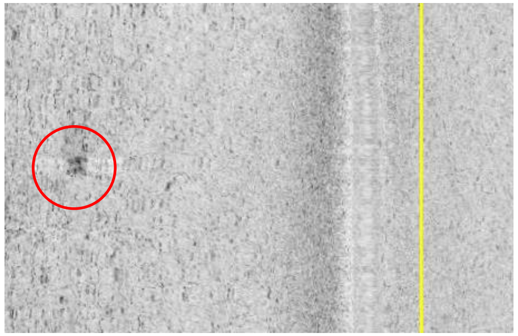
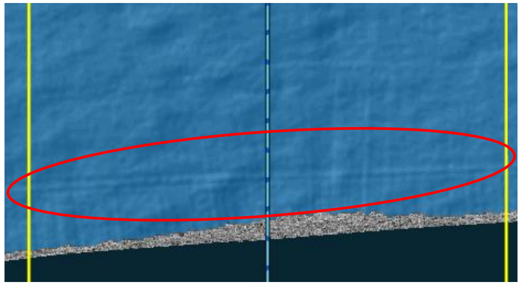
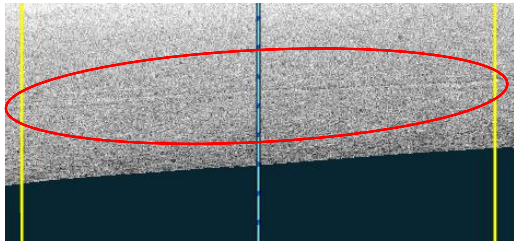
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
C	35	-39.94918	146.10735			No	Single object, boulder or debris, non-ferrous	Length: 4m; Width: 3m	80m	48m
C	60	-40.99729	146.05202			No	FUGRO Object ID: 136; Possible debris with scour	Length: 3.65m; Width: 0.77m	55m	66m
C	17	-39.09274	146.08435			No	Single object, boulder or debris, non-ferrous	Length: 8m; Width: 6m	75m	85m

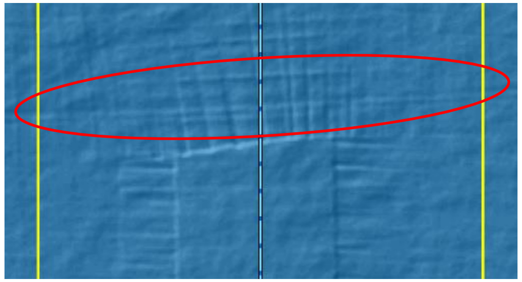
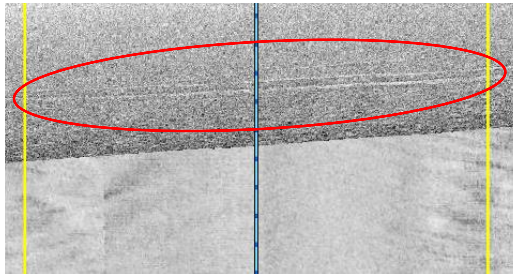
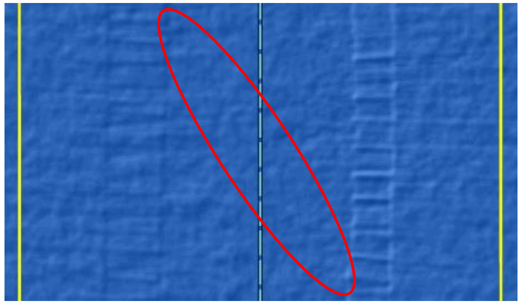
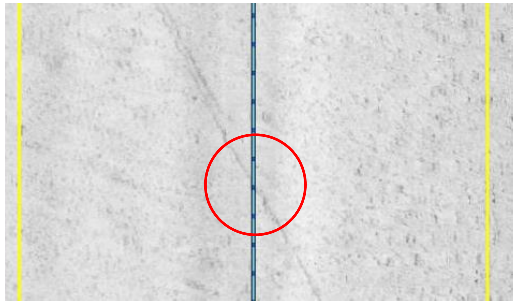
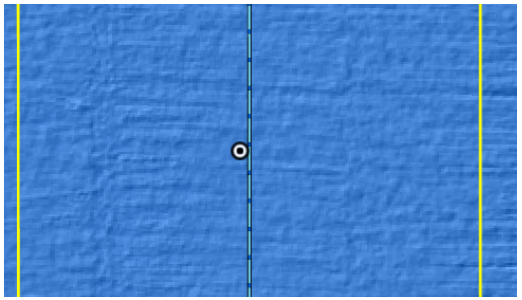
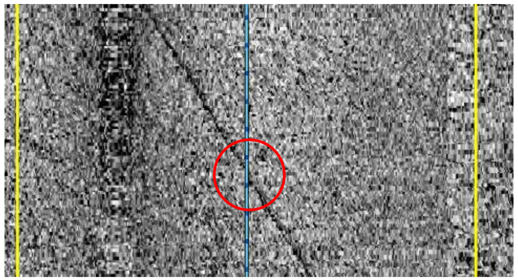
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
C	18	-39.09379	146.10747			No	FUGRO Object ID: 151; Debris	Length: 3.38m; Width: 1.39m	75m	86m
C	19	-39.10230	146.08238			No	FUGRO Object ID: 97; Boulder or cultural debris	Length: 4m; Width: 1.6m	75m	86m
C	48	-40.59619	146.08448			No	Boulder or debris	Length: 18m; Width: 7m	75m	100m

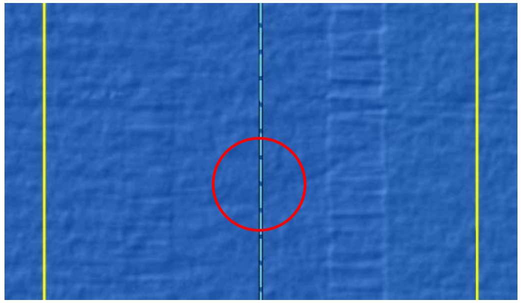
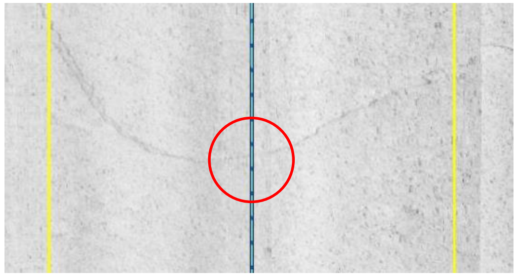
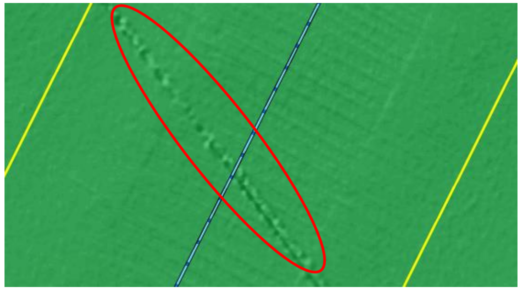
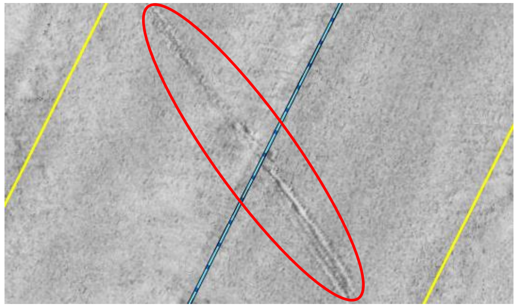
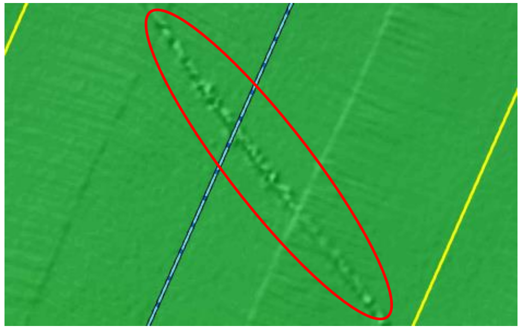
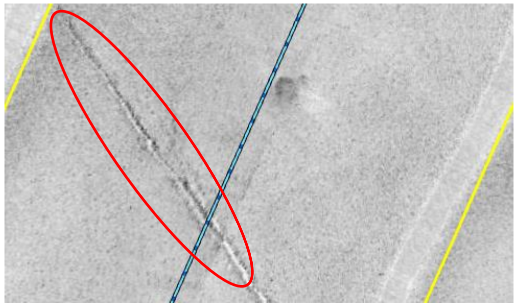
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
C	55	-40.8244	146.0821			No	FUGRO Object ID: 87; Isolated high-reflective patch	Length: 12.5m; Width: 6m	65m	100m
C	28	-39.4915	146.0825			No	Natural Very likely natural feature, rock outcrop	Length: 15m Width: 4m	75m	103m
C	40	-40.2674	146.0826			No	FUGRO Object ID: 92; Isolated high-reflective patch. Non-ferrous debris	Length: 4.4m; Width: 3m	80m	125m

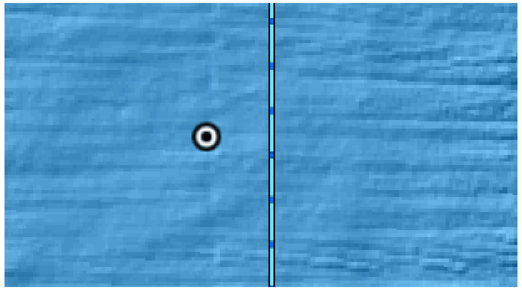
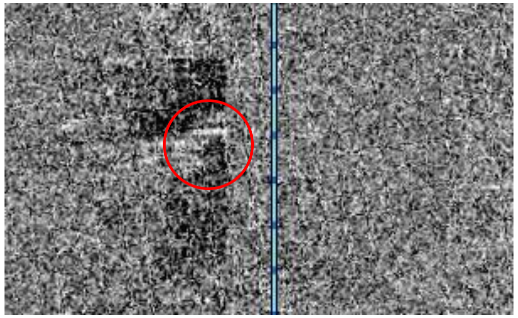
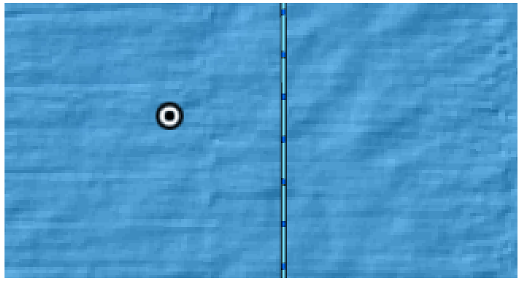
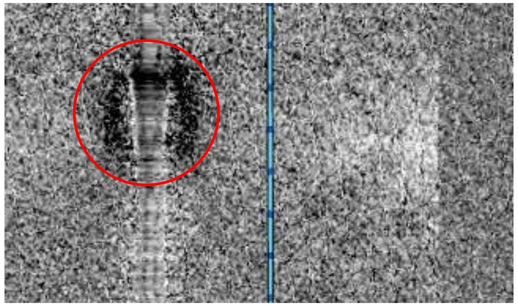
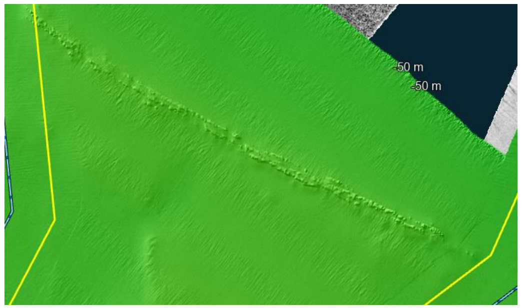
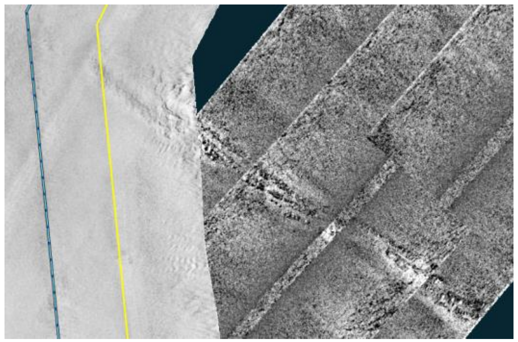
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
C	14	-39.0460	146.0850			No	Reflective patch possibly combined with data acquisition error.	Length: 8m; Width: 7m	75m	129m
C	29	-39.5165	146.0850			NO	High reflective patch.	Length: 8m; Width: 3m	75m	134m
C	42	-40.2927	1446.0824			No	FUGRO Object ID: 90; Isolated high-reflective patch	Length: 11.2m; Width: 8.7m	80m	136m

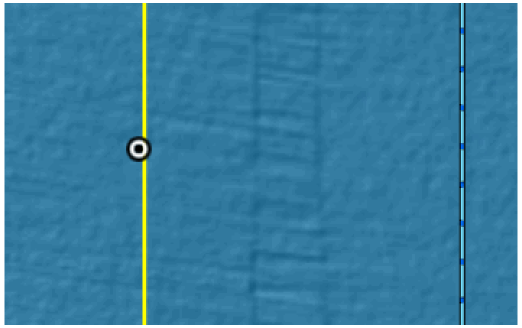
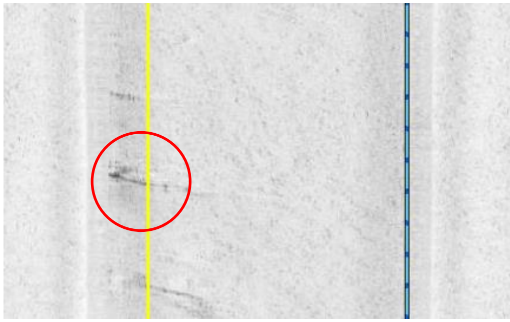
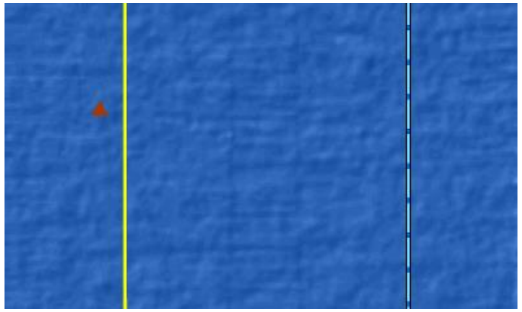
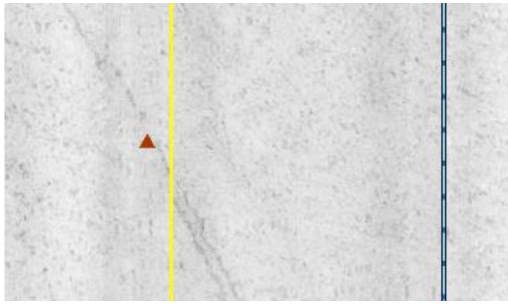
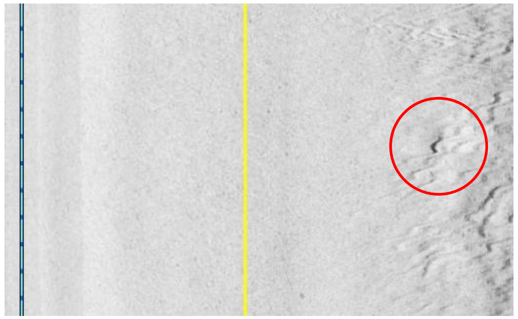
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
C	58	-40.9497	146.0779			No	Probable natural feature, possible debris	Length: 5m; Width: 4m	60m	172m
C	52	-40.7973	146.0812	N/A		No	FUGRO Object ID: 88; Isolated high-reflective patch	Length: 5.8m; Width: 3.2m	65m	173m
C	63	-41.0039	146.0499			No	Single non-ferrous object, possible boulder	Length: 7m; Width: 4m	50m	177m

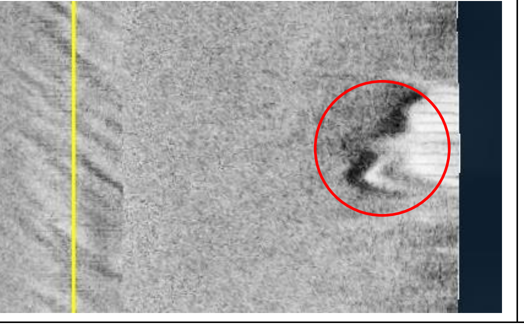
	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
C	9	-39.0000	146.1030	N/A		No	DebrisMedium reflective patch. Possibly cultural.	Length: 8m; Width: 8m	70m	220m
C	43	-40.3102	146.1041	N/A		No	FUGRO Object ID: 145; High-reflective patch	Length: 9.05m; Width: 7.4m	80m	238m
X	24	-39.3394	146.0835			Yes, mag ID: 84, 85	Indigo Cable	Length: Width:	75m	0m

	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
X	23	-39.3385	146.1066			Yes, mag ID: 101, 102, 103	Indigo Cable	Length: Width:	75m	0m
X	34	-39.9336	146.1068			No	Trawl scar	Length:; Width: 2m	80m	0m
X	36	-40.0133	146.0839			No	Trawl scar	Length:; Width: 2m	80m	0m

	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
X	37	-40.0406	146.1068			No	Trawl scar	Length:; Width: 2m	80m	0m
X	59	-40.9857	146.0589			No	Trawl scar	Length:; Width: 3m	55m	0m
X	62	-40.9974	146.0693			No	Trawl scar. Anomaly above is Target No. 61	Length:; Width: 2m	50m	0m

	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
X	21	-39.3065	146.0833			No	Likely data acquisition error	Length: 4m; Width: 4m	75m	13m
X	26	-39.4258	146.0832			No	Likely data acquisition error.		75m	24m
X	66	-41.0117	146.0434			No	Large natural feature, rock outcrop	Length: 1147m; Width: 40m	45m	80m

	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
X	46	-40.4995	146.1058			No	Likely data acquisition error.	Length: 10m; Width: 5m	75m	106m
X	33	-39.9318	146.1055			Yes, FUGRO Object ID: 113	Mag target associated with trawl scar	nT: 2.5	80m	108m
X	51	-40.7910	146.1098	N/A		No	Possible data error. Likely rock outcrop	Length: 5m; Width: 2m	65m	184m

	Target ID	ITRF2014		Image MB	Image SSS	Mag Target	Interpretation	Dimensions	Depth	Distance from cable
		Lat	Long							
X	27	-39.4595	146.1095	N/A		No	Possible data error from thermocline	Length: 49m; Width: 13m	75m	203m