Environmental Impact Statement/Environment Effects Statement

Appendix G

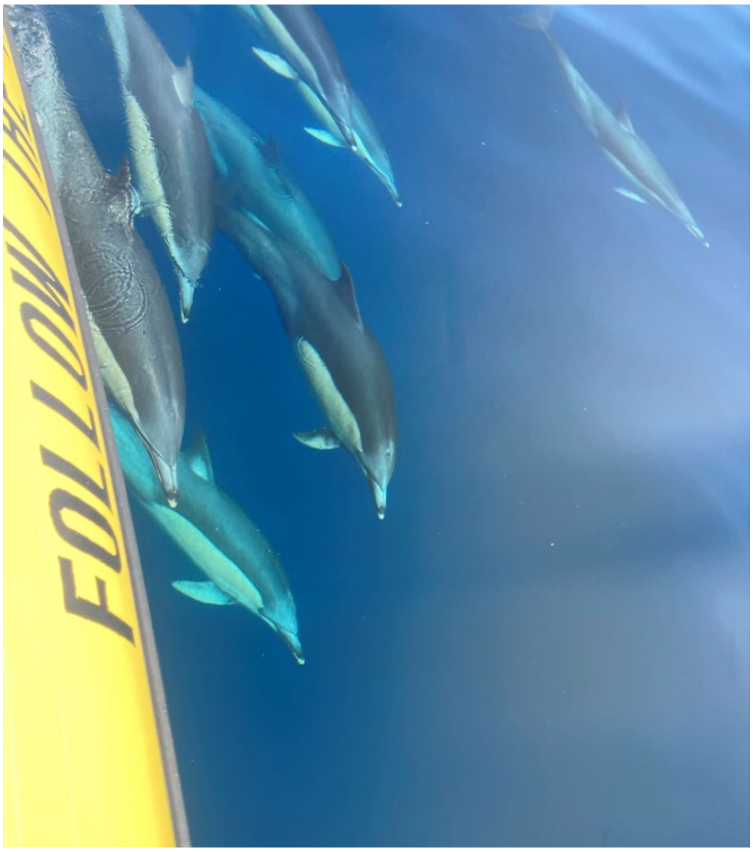
Benthic ecology

MARINUS LINK

Technical report to: Tetra Tech Coffey

Marinus Link

Marinus Link
Marine Benthic Habitat Characterisation



Technical Report

May 2024

CEE

cee.com.au

Executive Summary

Overview
CEE was engaged by Tetra Tech Coffey Pty Ltd (Tetra Tech) to characterise the existing marine benthic habitat which will inform the Marine Ecology and Resource Use Impact Assessment (EnviroGulf Consulting, 2024) for the Marinus Link project (the project).

The project is a proposed 1500 megawatt (MW) high voltage direct current (HVDC) electricity interconnector between Heybridge in northern Tasmania and the Latrobe Valley in Victoria (Figure 1). Marinus Link will provide a second link between the Tasmanian renewable energy resources and the national electricity grid. It will enable flow of electricity in both directions between Tasmania and Victoria, which will promote efficient energy trade, transmission and distribution from a diverse range of generation sources to where it is needed, and will increase energy capacity and security across the National Electricity Market (NEM).

Marinus Link will 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.

Marinus Link comprises two separate but parallel subsea 750 MW symmetrical monopole circuits, both crossing from Heybridge near Burnie on the north coast of Tasmania to Waratah Bay in Victoria. The western link alignment was designated ML1 and the eastern link alignment was designated ML2. The origin for chainage distances along the marine alignments was defined in the 2020 geophysical survey as the Waratah Bay shoreline connection. The alignments were routed across unconsolidated seabed for the entire lengths. The alignments avoid direct passage over known rock seabed habitat as far as practicable.

The Marinus Link subsea cable routes were defined in 2021 on the basis of available information and geophysical information collected in 2019 and 2020 (CEE 2021, Fugro 2020). The cable routes were selected to avoid rocky seabed. The seabed along the 250 km route from 4 km offshore from Tasmania through a maximum depth of 80.5 m to Waratah Bay comprised sand and silt with different physical characteristics determined by depth and wave exposure and depths along the route.

The 2021 subsea cable route distances from the Heybridge shoreline origins to the Waratah Bay termination points are 253,100 m for the more direct western alignment, and 254,300 m for the eastern alignment which deviates to avoid rock outcrops in some places. The maximum seawater depth along the cable alignments is 80.5 m below low tide (LAT).

Information on the composition of seabed ecological habitats and associated plants and animals (biota) was required to inform assessment of cable options and potential construction and operation effects of the project on marine ecosystem values. Initial seabed surveys using underwater towed cameras along multiple potential alignments were completed by CEE Pty Ltd in 2019 to inform refinement of cable route options. The seabed survey site positions were planned used available information on seabed habitat distribution at that time. The results of those surveys were reported (CEE 2021) and relevant information from those surveys is incorporated into this 2022 technical report.

After the 2019 seabed habitat surveys on the Tasmanian and Victorian coasts, a geophysical survey of the potential paired cable routes across Bass Strait from coast to coast was completed in 2020 (Fugro 2020). The geophysical survey results enabled the preferred subsea cable alignments to be defined across Bass Strait from Heybridge on the north coast of Tasmania to Waratah Bay Victoria. The Fugro (2020) report nominated the western alignment as ML1 and the eastern alignment as ML 2, followed by the distance from the alignment survey origins at Waratah Bay.

Seabed habitats and associated marine biological conditions were further surveyed along the preferred alignments close to the Tasmanian and Victorian shore crossings and also across the central Bass Strait alignments using towed underwater cameras in 2021. The 2021 seabed habitat surveys were guided by the seabed descriptions and maps provided in the geophysical survey report (Fugro, 2020).

The 2021 seabed habitat survey sites were planned to provide representative images of seabed habitat and associated biological communities along the alignments at features identified in the geophysical survey report along and nearby the alignment. The marine seabed habitat survey used the geophysical survey convention for naming position along the alignments for consistency between the biological habitat and geophysical reports. ML 1 and ML 2 were the western and eastern alignments respectively followed by the distance from the geophysical survey alignment origin expressed as metres, in the case of the habitat surveys.

The 2021 towed underwater camera investigations described in this report were, like many tasks during the pandemic, constrained by Covid restrictions. The 2021 surveys were implemented in two parts: 39 sites were surveyed across Bass Strait in Tasmanian waters over 182 km from ML1 252,000 to ML1 70,000 by Marine Solutions Tasmania in August 2021; and 25 sites were surveyed over 39 km from ML1 40,000 to ML 1,000 by CEE offshore from the Victorian coastline in November 2021. Underwater images were collected at a total of 129 sites in Tasmanian waters and 53 sites in Victorian waters over the 2019 and 2021 surveys.

Bioregions are not directly legislative but inform marine scientists of expected ecological community composition at large spatial scales. In national marine biogeographic terms, the subsea alignment passes through four Integrated Marine and Coastal Regionalisation of Australia (IMCRA 1998) meso-scale bioregions:

1. the Heybridge nearshore alignment passes through the Boags nearshore marine bioregion that extends around 6 km from the north coast of Tasmania (approximately ML 254,000 to ML 243,000);
2. the open waters Bass Strait part of the alignment passes through the Central Bass Strait bioregion between Tasmania and Victoria (approximately ML 243,000 to ML 6,000); and
3. the Waratah Bay nearshore part of the alignment passes through the boundary area of the Central Victoria (to 6 km offshore) and Flinders (Wilsons Promontory and Bass Strait Islands) bioregions in Waratah Bay (ML 6,000 to ML 0).

Nearshore Tasmania (Heybridge)

The 2019 and 2021 marine biological habitat surveys together with the results of the 2020 geophysical surveys by Fugro showed that nearshore cable alignments at Heybridge follow sand gutters (underwater gullies or ‘palaeochannels’) that weave through the extensive rocky outcrops that characterise the nearshore seabed on this part of central northern Tasmanian coast. The sandy seabed of the palaeochannels at sites shallower than 30 m depth comprised relatively bare, mobile medium to coarse sand and shell, with no associated plants or animals (biota) visible in either the 2019 or 2021 surveys.

The reef biological community around the sand gutters was typical of central north coast nearshore reefs. The reef biological community showed strong seasonal differences between the January 2019 and the August 2021 surveys. The reefs during summer supported a range of invertebrates and macroalgae. Filamentous, seasonal or short-lived (ephemeral) green and red macroalgae (seaweeds) dominated the reefs in summer from the shoreline to 30 m depth. Larger brown algae such as *Cystophora* and *Ecklonia* were restricted to depths less than around 5 m. Invertebrates were more abundant in images from sites deeper than 20 m. This contrasted strongly with the community in winter, when most filamentous algae were absent, and the reefs were characterised by bare rock with some encrusting coralline red algae, encrusting invertebrates and solitary ascidians.

During winter months, low light due to turbidity from runoff, low sun angle and reduced daylight combine to result in dormancy of the nearshore marine community. This creates a strongly seasonal changes in the abundance of marine biota.

The seabed at 31 m water depth at ML1 249,000 was medium to coarse grained sand waves. Shell and other organic material, including living and empty doughboy scallops, had accumulated in the sand wave troughs. Eleven-arm seastars (*Coscinasterias muricata*) were observed feeding on the scallops, which was likely responsible for the many still-joined dead shells in the troughs. Other biota observed on the medium to coarse sands of this habitat included solitary anemones and sand flathead fish.

As water depth increased from 31 m depth to 38 m, the sandy seabed showed progressively smaller wave-generated seabed ripples. The seabed became flatter and sandier, with decreasing abundance of plants and animals living on the seabed (epibiota) from ML 249,000 m to ML 247,400 m, where the flat and sandy seabed was characterised by sparsely distributed small stalked invertebrate animals (the bryozoans *Lanceopora smeatoni*); green algae *Caulerpa longifolia*; and doughboy and commercial scallops (*Mimachlamys asperrima* and Pecten alba). From 38 m to 41 m depth (ML 247,400 to 246,300), the seabed showed some wave created undulations and progressively more shell fragments. Small burrow mounds were visible. Stalked bryozoans *Lanceopora smeatoni* and *the* green algae *Caulerpa longifolia* were scatted in moderate abundance on the seabed. Doughboy scallops were sparse, while commercial scallops were present but scarce.

The habitats and associated marine biota along the Heybridge part of the offshore alignment are characteristic of the Boags marine bioregion. The marine biota associated with the seabed habitats described in the survey are therefore expected to be representative of similar seabed habitat, water depth, wave exposure and water quality conditions along approximately 300 km of the north coast of Tasmania shoreline from Cape Portland in the east, to Robins Island in the west to approximately 6 km offshore.

Offshore (Central Bass Strait)
In the Central Bass Strait region (ML 240,000 to ML 8,000) the seabed comprised soft silt and relatively flat seabed. Epifauna are the invertebrate animals that live on the seabed and comprised sparsely distributed tangled sponges and scarce Eunicid worm tubes, which increased in abundance as depth increased from 55 m to 60 m. Epifauna were sparse at sites from ML 210,000 to ML 100,000, where depth increased from 68 m to maximum depth site of 80 m (ML 140,000 and ML 120,000) before depth decreased again towards the Victorian coast. Sub-seabed biological activity (bioturbation) was visible along this 110 km central length of the alignment as abundant mounds up to around 8 cm high. Infauna are the animals that live within the sediments the seabed. Their mounds were absent, epifauna were scarce and the seabed was flat in appearance from ML 70,000 (75 m depth) to ML 20,000 (71 m depth). Eunicid worm tubes were highly visible but sparsely distributed on the flat seabed towards the Victorian coast at ML 10,000 (45 m depth) and ML 8,000 (42 m depth).

The seabed composition of this area comprised fine sands to silts as also mapped in the geophysical survey. Images of the seabed showed scarce epibiota along most of the alignment. Colonial Eunicid worm tubes stalks protruded as sparsely distributed erect solitary 40-cm-high stalks from the seabed at depths between around 40 m and 70 m on both the Victorian and Tasmanian ends of Bass Strait. Sponges and other epibiota were scarce at depths greater than about 72 m compared to regions closer to the shoreline.

The habitats and associated marine biota along the Central Bass Strait part of the offshore alignment are characteristic of the Central Bass Strait marine mesobioregion. The marine biota associated with the seabed habitats described in the survey are therefore expected to be representative of similar seabed habitat, water depth, wave exposure and water quality conditions within this 60,000 km^2 bioregion that includes the central basin of Bass Strait from water depths of approximately 40 m to 80 m between the coasts of Tasmania and Victoria and between the western and eastern Bass Strait islands.

Nearshore Victoria (Waratah Bay)

The seabed along the subsea alignment in Waratah Bay (ML 1,000 m to 8,000 m) was predominantly fine mobile sand, with patches of cobble and small patches of isolated low relief reef. The sand was generally bare of epibiota except for sparsely distributed patches of low to moderate density *Heterozostera tasmanica* seagrass between 10 m and 15 m water depth and sea pens (*Pseudogorgia godeffroyi*) between 14 m and 30 m depth.

Patches of unconsolidated rock cobble and small isolated rock outcrops were mapped among the sand in the central part of the 2021 Waratah Bay cable alignments (ML 2,000 to ML 4,000). The cobble was characterised by sparse ephemeral (seasonal or short-lived) seaweeds, whereas the larger rock was characterised by sponges and ephemeral seaweeds. The seabed character of the 2022 Waratah Bay alignment is the same as the original alignment, traversing predominantly sand, with patches of hard rock.

Attached kelps were absent from the reef on the alignments. However, unattached, drifting kelps, including *Ecklonia radiata,* were observed accumulated along the reef edges in places. Accumulations of macroalgae drifting across the seabed may result in misidentification of nearshore reef, macroalgae and seagrass from aerial imagery. More substantial and extensive rock reefs occur on the western shore or Waratah Bay and around Cape Liptrap to the west of the cable alignment.

The habitats and associated marine biota along the Central Bass Strait part of the offshore alignment are characteristic of the Flinders Bioregion to the east and the Central Victorian Bioregion to the west. The marine biota associated with the seabed habitats described in the survey are therefore expected to be representative of similar seabed habitat, water depth, wave exposure and water quality conditions within these bioregions that, in combination, extend approximately 400 km west from McGaurans Beach on the 90 Mile Beach, around Wilsons Promontory and westward to Apollo Bay.

Overall key findings

The cable alignments pass through habitats that are commonly represented within their respective bioregions. The seagrass *Heterozostera tasmanica*, was observed offshore from Waratah Bay from around 10 m to 31 m depth. This species is listed on the Victorian Flora and Fauna Guarantee Act 1988 Threatened species list. This seagrass is widespread in a similar patchy or sparse distribution, in suitable sand-seabed habitat and wave climate on the open coast of Victoria east of Wilsons Promontory, along the west Victorian coast through to the west of South Australia, and along the north and east coasts of Tasmania. It was the only marine species observed near the project alignment with threatened status. Additional information on seagrass *Heterozostera tasmanica* seagrass has been provided in this report. Surveys did not identify any other individual species or collections of plants and animals (biological assemblages) that could be considered particularly sensitive to the project, along its alignment. Particularly sensitive species could be those with a restricted range or restricted habitat availability, particular sensitivity to project activities and/or special conservation significance.

In 2022, the final 7 km of the project alignment in Waratah Bay was moved approximately 2 km west of the originally surveyed route. The new (2022) alignment was assessed by review of desktop information including a report on a 2023 geophysical survey of the new alignment. The 2023 geophysical survey included multibeam echosounder (MBES) bathymetry and backscatter of seabed reflectivity. No underwater imagery was collected.

Comparison of the 2023 geophysical outputs with CEE's 2019 and 2021 towed underwater camera surveys showed that the seabed habitat categories were consistently scattered across the original and new project alignment in Waratah Bay. The 2022 proposed subsea cable alignment through Waratah Bay appeared to follow sandy habitat and avoided the cobble and reef mapped in the 2019 and 2021 surveys, those mapped on DEECA's CoastKit (https://mapshare.vic.gov.au/coastkit/), and features visible in aerial images. It is possible that there are isolated patches of cobble and reef along the 2022 alignment that are not visible on available aerial images. It is expected that the character of any marine communities associated with habitat on the 2022 alignment in Waratah Bay would be the same as those documented in similar habitats in the 2019 and 2021 surveys, about 2 km to the east.

The marine seabed habitats documented along the Marinus Link alignments in 2019 and 2021 appear to be widespread based on the 2023 National Seamap (https://seamapaustralia.org) and Victorian CoastKit marine environmental databases. The benthic marine communities and species documented in the surveys reflect the character of the respective Bioregions and local factors such as seabed composition characteristics, water depth and wave exposure.

Contents

Figures

Tables

Appendix

Technical Report

Report to:
T W
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“Marinus Link: Benthic Marine Ecological Habitat Characterisation. May 2024” CEE Technical Report to Tetra Tech Coffey Pty Ltd. Report by S C, N G and M N, CEE Pty Ltd Melbourne Australia cee.com.au.

Cover Image: Common dolphin *Delphinus delphis* offshore from Waratah Bay November 2021. CEE 2021

Glossary

Assemblage, biological	A recognisable collection of plants and/or animals
Biogeography	The geographic distribution of plants and animals
Biota	Plants and animals of a particular area
Bioturbation	The disturbance of sediments by living organisms
Consolidated	Compacted or cemented to become relatively solid...
Ephemeral	Plants or animals that live only for weeks or months
Epibiota	Plants and animals that live on the seabed surface
Epifauna	Animals that live on the seabed surface
Infauna	Animals that live under the seabed surface
Palaeochannel	Remnant stream channel filled by younger sediment
Unconsolidated, sediment	Sediment material that is loosely packed on the seabed and capable of disturbance by waves or animals

1 Introduction

The project is a proposed 1500 megawatt (MW) high voltage direct current (HVDC) electricity interconnector between Heybridge in northwest Tasmania and the Latrobe Valley in Victoria (Figure 1-1). 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.

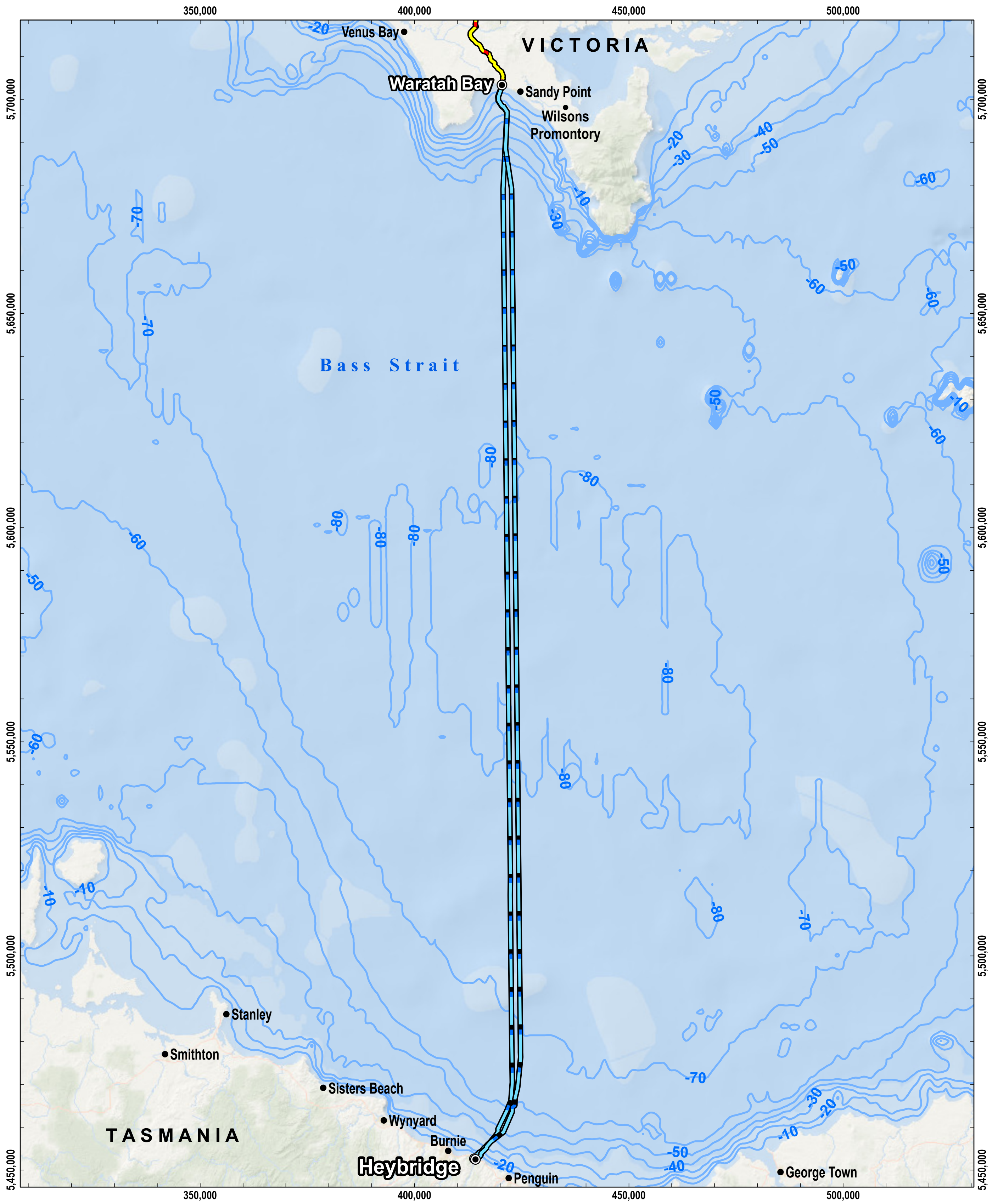
Tasmania's existing and potential renewable resources are a valuable source of dispatchable generation that could benefit electricity supply in the NEM. Marinus Link will allow for the continued trading, transmission and distribution of electricity within the NEM. It will also manage the risk to Tasmania 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.

Initially three shore-crossing options were considered in northern Tasmania and one in Victoria. Towed underwater camera surveys of marine habitat at landfall options in January and February 2019 (CEE 2021) and subsequently geophysical surveys (Fugro 2020) along the alignments informed evaluation of the options by TasNetworks. Due to terrestrial route considerations, an alignment was identified in 2020 from Heybridge near Burnie on the north coast of Tasmania to Waratah Bay in Victoria, which provided the basis for further seabed investigations in 2021 (as shown in Figure 5-2 and Figure 5-3). A revised route to the landfall in Waratah Bay was determined in 2022, which is shown below in Figure 1-1, and in more detail in Figure 7-1 and Figure 7-2.

Further seabed habitat surveys in August and November 2021 focussed on the adopted, preferred two-link alignments between Heybridge and Waratah Bay. Geophysical survey outputs reported by Fugro (2020) were used to inform the design of the surveys.

This technical report provides descriptions of the benthic habitats along the preferred alignments based on 2019 nearshore surveys (CEE 2021) and further nearshore and offshore habitat surveys in 2021 and desktop review of the revised 2022 Waratah Bay alignment, which moved about 2 km to the west of the original route.



LEGEND

- Landfall

Proposed route

- HVDC subsea cable
- Underground HVDC cable
- Bathymetry contours (m)

MARINUS LINK

SCALE 1:1,250,000
PAGE SIZE: A4
PROJECTION: GDA2020 MGA Zone 55

SOURCE
Proposed route from Tetra Tech Coffey.
Bathymetry from Geosciences Australia.
Imagery from ESRI Online.

MARINUS LINK PTY LTD

MARINUS LINK
MARINE BENTHIC HABITAT CHARACTERISATION

FIGURE 1-1

Marinus Link interconnector route August 2022

TETRA TECH COFFEY

DATE: 16.05.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CEE_EIS_F001.1

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SAVED BY: HELEN.UNKOVICH 16.05.24 5:33 PM

1.1 Survey Objectives

The objectives of the surveys were to:

- Validate available seabed substrate mapping of the nearshore zones at and adjacent to the shore crossings and depth zones along Bass Strait cable crossing alignments.
- Survey and document seabed and associated benthic biological characteristics at representative areas of seabed character and depth identifiable from available information.
- Identify potential benthic ecological constraints on subsea cable routes.
- Prepare a technical report on the surveys to be used to by others to assess potential project impacts pathways of the project on environmental values and prepare project documents for wider distribution and reading.

1.2 Scope of Work

The scope of work for the marine benthic characterisation surveys and descriptions was to:

- Review existing habitat mapping literature
- Plan and conduct 2019 surveys of seabed habitat to document benthic conditions in representative locations within a 1 km 'buffer' either side of the interconnector route options, from the shoreline to the 40 m depth contour;
- Plan 2021 surveys of seabed habitat to document benthic conditions in representative nearshore and offshore sites along the 250 km-long selected parallel interconnector route options from near the shoreline at Waratah Bay in Victoria (ML zero) to near the shoreline at Heybridge in Tasmania (ML 254,000);
- Survey selected (representative) sites along each subsea alignment using available geotechnical and geophysical information to plan the survey sites;
- Use available data or acoustic sounders to identify bottom features prior to towing cameras;
- Use towed underwater camera techniques, in conjunction with position fixing and logging GPS, to record seabed at selected sites, including systematically located sites where seabed was interpreted as sand or continuous reef, rocky outcrops or potential;
- Systematically compile position, depth, site and corresponding camera images; and
- Provide a technical report on the distribution and condition of seabed habitats and associated marine biological assemblages along the subsea alignments and adjacent seabed.

1.3 This report

This technical report will be used by others to assess the implications of project impact pathways on a range of marine environmental values, consider appropriate environmental mitigation measures and prepare the formal documents including marine ecological descriptions for wider distribution and reading.

This report describes the seabed habitats and associated communities along the alignments as assessed from spatially documented underwater high-definition (HD) images collected during the towed underwater camera surveys in January and February 2019 and August and November 2021. The results of 2019 and 2021 seabed habitat towed underwater camera surveys are integrated into this single report.

The main section presents the sites and survey procedures, describes the seabed and benthic community at each nearshore location and offshore location, and identifies and discusses potential benthic ecological sensitivities along the routes.

Technical details of survey sites, seabed surface physical characteristics and images of the seabed at all sites are listed in Appendix A to this report.

1.4 Key information Sources

Key sources of information used in the planning and conduct of the towed underwater camera surveys in Tasmanian, Commonwealth and include:

- Seamap Australia - a national seafloor habitat classification scheme. Institute for Marine and Antarctic Studies (IMAS), University of Tasmania (UTAS)https://seamapaustralia.org;
- CoastKit Victoria (CoastKit, 2023) - A central repository for Victorian marine and coastal scientific projects and datasets: https://mapshare.vic.gov.au/coastkit/;
- Fugro 2020. Project Marinus – Marine Engineering Geophysical Survey – Integrated Report. Bass Strait. Report to Tasmanian Networks Pty Ltd. Fugro Australia Marine Pty Ltd. Perth Australia;
- Tetra Tech Coffey -
    - General information on project
    - Scope requirements
    - Bathymetric data along alignments collected by Fugro;
- Commercial bathymetric information Garmin, Navionics;
- Publications and reports listed in Section 9 References.

1.5 Survey sequence

The sequence of towed camera surveys and geophysical surveys at project marine locations is summarised in Table 1-1

Table 1-1. Key survey dates, locations and reporting

Survey activity	Location	Date	Report
Towed camera	Cam River, Tas	Jan 2019	CEE 2021
Towed camera	Heybridge, Tas	Jan 2019	CEE 2021
Towed camera	Waratah Bay, Vic	Feb 2019	CEE 2021
Geophysical, bathymetry	Heybridge to Waratah Bay	Mar-Apr 2019	Fugro 2020
Geotechnical	Heybridge to Waratah Bay	May-Jun 2019	Fugro 2020
Geophysical survey	Waratah Bay new alignment	Sept 2023	Data only
Towed underwater camera	Heybridge, Tas	Aug 2021	This report
Towed underwater camera	Bass Strait offshore	Aug 2021	This report
Towed underwater camera	Waratah Bay, Vic	Nov 2021	This report

1.6 Assumptions and limitations

The towed underwater camera surveys were designed, implemented and reported on the assumption that the information provided by MLPL was correct and current at the time of its original use by CEE.

It is assumed that readers of this technical document will understand the position of this specialist technical document that reports the results of towed underwater camera surveys of seabed habitat character in the context of (1) the time series of the development of the project (2), the larger overarching framework of the Project including the environmental impact assessment process and (3) other marine technical studies.

The quality of underwater image collection is primarily limited by underwater visibility. This is naturally variable over the annual cycle of seasons.

The amount of information that can collected at sea is limited by weather conditions, which are naturally variable in the short term (days to weeks) and over the annual cycle of seasons. Timing of the surveys was generally determined by Project directives.

The results of the surveys are presented as seabed character descriptions at the positions that the images were collected. Further spatial extrapolation of the seabed character will be made by others, based correlation modelling of seabed depth and habitat character with larger scale mapped seabed bathymetry (e.g., multibeam) and physical characterisation (e.g. side-scan sonar).

Targeted inspections for evidence of anthropogenic seabed disturbance were not included in the scope of this study.

1.7 Acknowledgements

Surveys were designed and implemented by CEE, with valued survey and data compilation support from Marine Solutions Tasmania and vessels from:

- Marine Solutions Tasmania in both 2019 and 2021 Tasmanian nearshore and offshore surveys, and:
- Wilsons Promontory Cruises (Pennicott Wilderness Journeys) for 2021 Waratah Bay and Victorian offshore survey.

2 Survey Locations

The Marinus Link subsea cable extends northward from Heybridge on the north coast of Tasmania across Bass Strait to Waratah Bay in Victoria (Figure 1-1). Previous activities such as cable installations, (telecommunications cable shown in Figure 2-1), gas pipeline installations and commercial fishing have found that the seabed in the central part of Bass Strait is relatively flat and featureless. This was confirmed by the Fugro geophysical and seabed characterisation survey (Fugro 2020).

2.1 State Waters

The alignment was chosen by the project to avoid large-scale rock outcrops associated the Wilsons Promontory and the eastern Bass Strait islands and is the most direct and shortest route between suitable landfalls either side of Bass Strait. The alignment passes through Tasmanian and Victorian State Waters that extend 3 nautical miles (5.56 km) from the state low water lines. Tasmanian state waters include the Eastern Bass Strait islands of Rodondo and Moncoeur Islands which lie 10 km south of Wilsons Promontory. Hence the border between Tasmania and Victoria south of Wilsons Promontory is an east-west line that runs through Boundary Islet in the Hogan Group (Figure 2-6, Figure 2-8).

2.2 Seabed habitat survey site selection

The project configuration and design have been developed based on a wide range of information and investigations on the terrestrial and marine environments. Refinements to the terrestrial routes and additional information on the physical characteristics of the seabed along the preferred corridor resulted in further refinement of the project alignment through to 2022.

Marine ecological seabed habitat surveys were planned and implemented at two stages of the project: the 2019 initial nearshore seabed habitat investigations (5 m to around 30 m water depth) during initial undersea cable location options development and assessment, and; the 2021 nearshore and offshore seabed habitat investigations along the then-selected cable alignment. The final 7 km of the subsea cable alignment in Waratah Bay was adjusted in July 2022 to be about 2 km to the west of the original alignment.

2.2.1 2019 Nearshore Tasmania and Victoria cable alignments

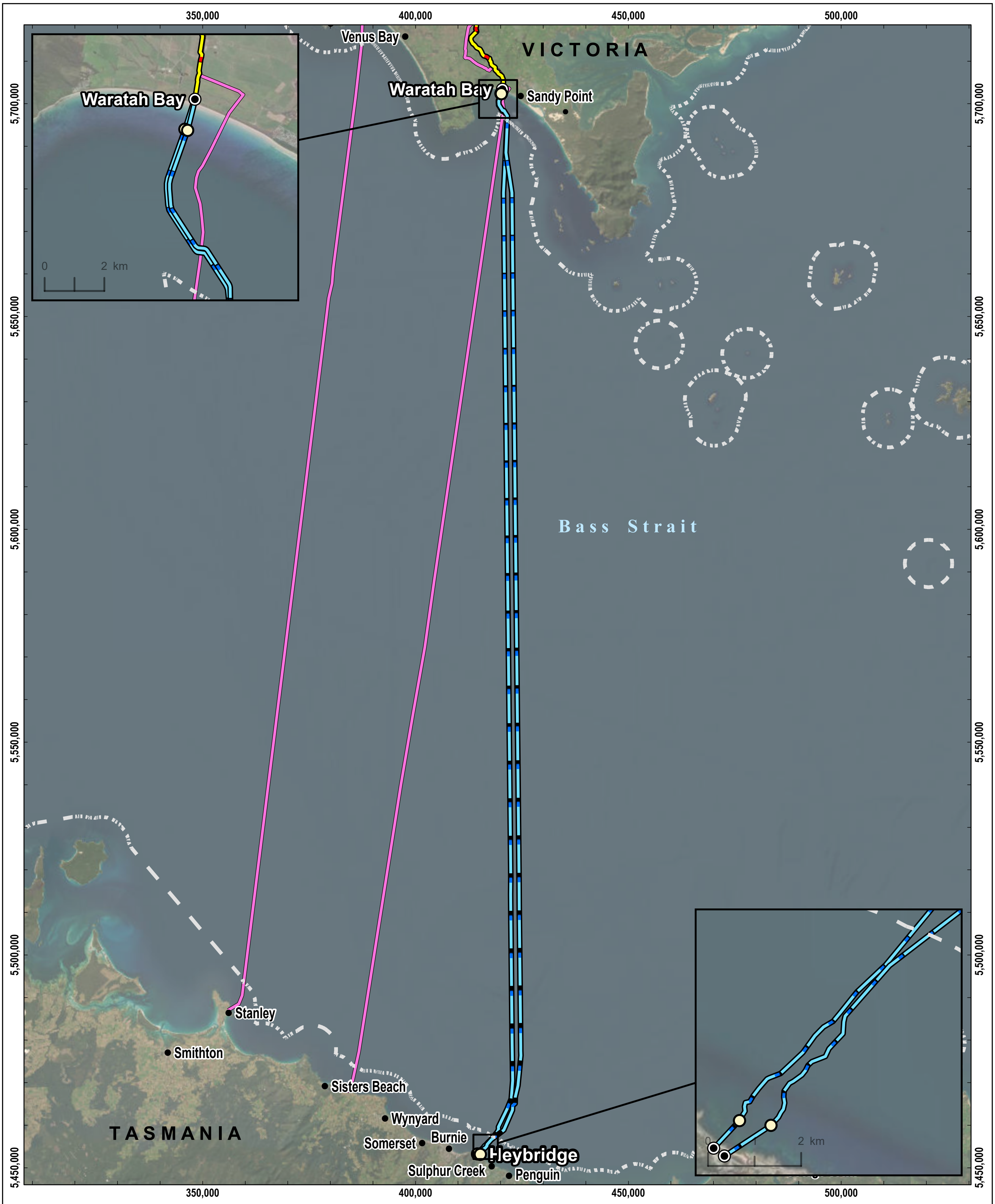
The initial marine cable alignments defined by TasNetworks were based on likely practical locations for the submarine cables to cross the shoreline to connect with land-based transmission infrastructure. Tetra Tech Coffey provided CEE with GIS layers for the proposed alignments in the Tasmanian and Victorian nearshore zones.

The 2019 seabed habitat survey sites were arranged within the investigation corridor from near the shoreline to around the 40 m depth contour offshore of the Tasmanian and Victorian coastline. The site positions were further informed by mapped habitats presented in Seamap Australia (Lucieer *et al* 2017) and CoastKit (DELWP 2018) and features interpreted from Google Earth.

The results of the 2019 survey were reported to TasNetworks (CEE 2021) to inform further evaluation of preferred alignments identified in 2020-21.

2.2.2 2021 Survey site selection

A preferred Marinus Link alignment was developed by Marinus Link Pty Ltd, formerly TasNetworks, in 2021 with assistance of the detailed geophysical survey reported by Fugro (2020). The detailed geophysical survey was fundamental to mapping the physical seabed characteristics required to identify alignments for practical installation of the undersea cables. It was also fundamental in providing detailed full-alignment-length documentation of the physical, seabed biological habitats along the alignment (Figure 2-2 and Figure 2-3).



LEGEND

- HDD exit point
- Landfall
- Limit of State Coastal Waters (3nm)

Proposed route

- HVDC subsea cable
- Underground HVDC cable
- Existing Telstra Cable

MARINUS LINK

15 0 15 km

SCALE **1:1,250,000**

PAGE SIZE: **A4**

PROJECTION: **GDA2020 MGA Zone 55**

SOURCE
Proposed route from Tetra Tech Coffey.
Imagery from ESRI Online.

MARINUS LINK PTY LTD

MARINUS LINK
EIS/EES

FIGURE 2-1

Marinus Link alignment across Bass Strait

TETRA TECH COFFEY

DATE: **16.05.24** PROJECT: **754-MELEN215878ML** FILE: **215878ML_CEE_EIS_F002.1**

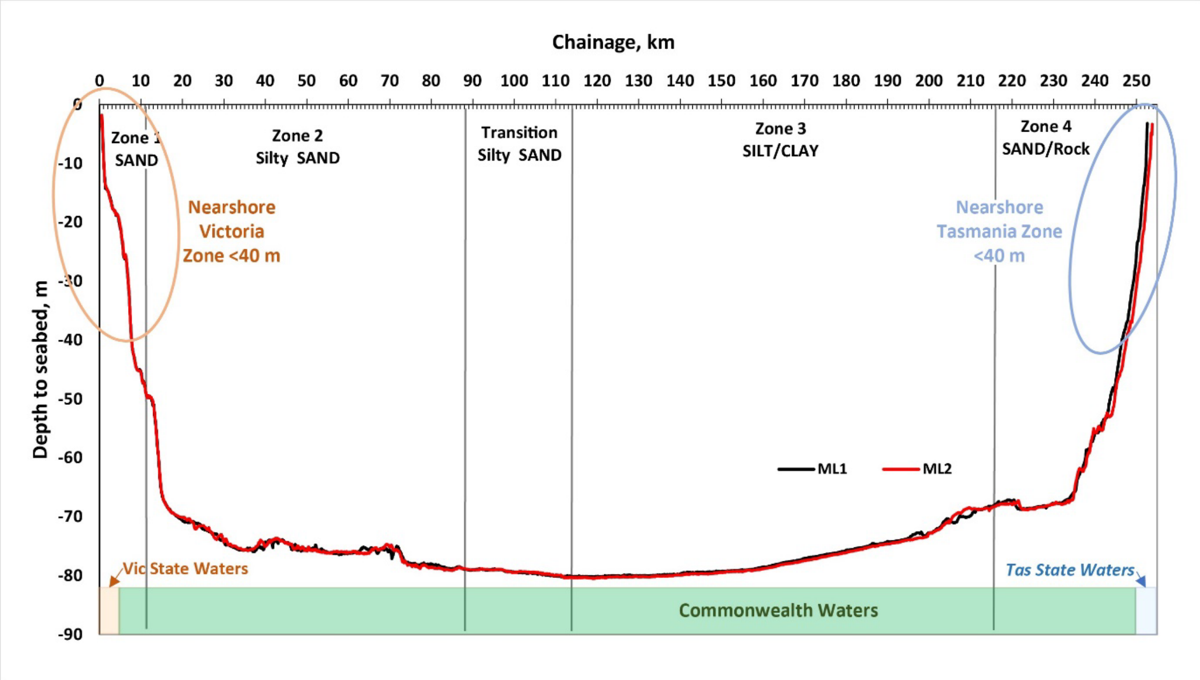


Figure 2-2. Seabed profile along Marinus Link subsea alignment
(Source data: Fugro 2020)

The identified marine route comprises two alignments from Heybridge and Waratah Bay to emerge at two points at about the 12 m depth contour offshore from each shoreline (Figure 1-1). The alignments of the two circuits are initially separated by approximately 800 m at Heybridge and 100 m at Waratah Bay. The cables separate to parallel routes generally 2,000 m apart at about 5 km from around offshore at the Heybridge end and around 20 km offshore at the Waratah Bay end. The alignment was selected to pass across seabed of unconsolidated sediment and avoid rock outcrops as far as practicable.

The project geophysical survey adopted a marine cable alignment distance terminology commencing with chainage zero at the Waratah Bay connection of the terrestrial cable with the marine cables (Figure 2-2). The western link alignment chainage (in metres) was prefixed with “ML1”, and the parallel eastern chainage prefixed with “ML2”. The alignment descriptions in this report commence from Tasmania at Heybridge ML1 253,100 and ML2 254,300 (Figure 2-2).

The sites for the nearshore seabed towed camera surveys in 2021 at Heybridge and Waratah Bay were positioned to supplement the seabed and biological characteristics documented in the 2019 surveys but were informed by the greater detail of seabed composition mapped by the 2020 geophysical survey. Detailed topographical maps of the nearshore Heybridge and Waratah Bay cable routes were presented in the geophysical report as shown in Figure 2-3, below. These maps informed the position of the towed camera survey sites in those areas.

Differences in the composition of the unconsolidated sediments on the seabed were apparent as depths changed along the alignment and as the seabed became more sheltered from ocean swell closer to the Tasmanian coastline. The sites for the 2021 offshore seabed towed camera surveys along the offshore alignments were positioned to describe the general seabed and biological characteristics interpreted from the depth profiles and the geophysical survey features (Figure 2-3) provided in the geophysical report (Fugro 2020).

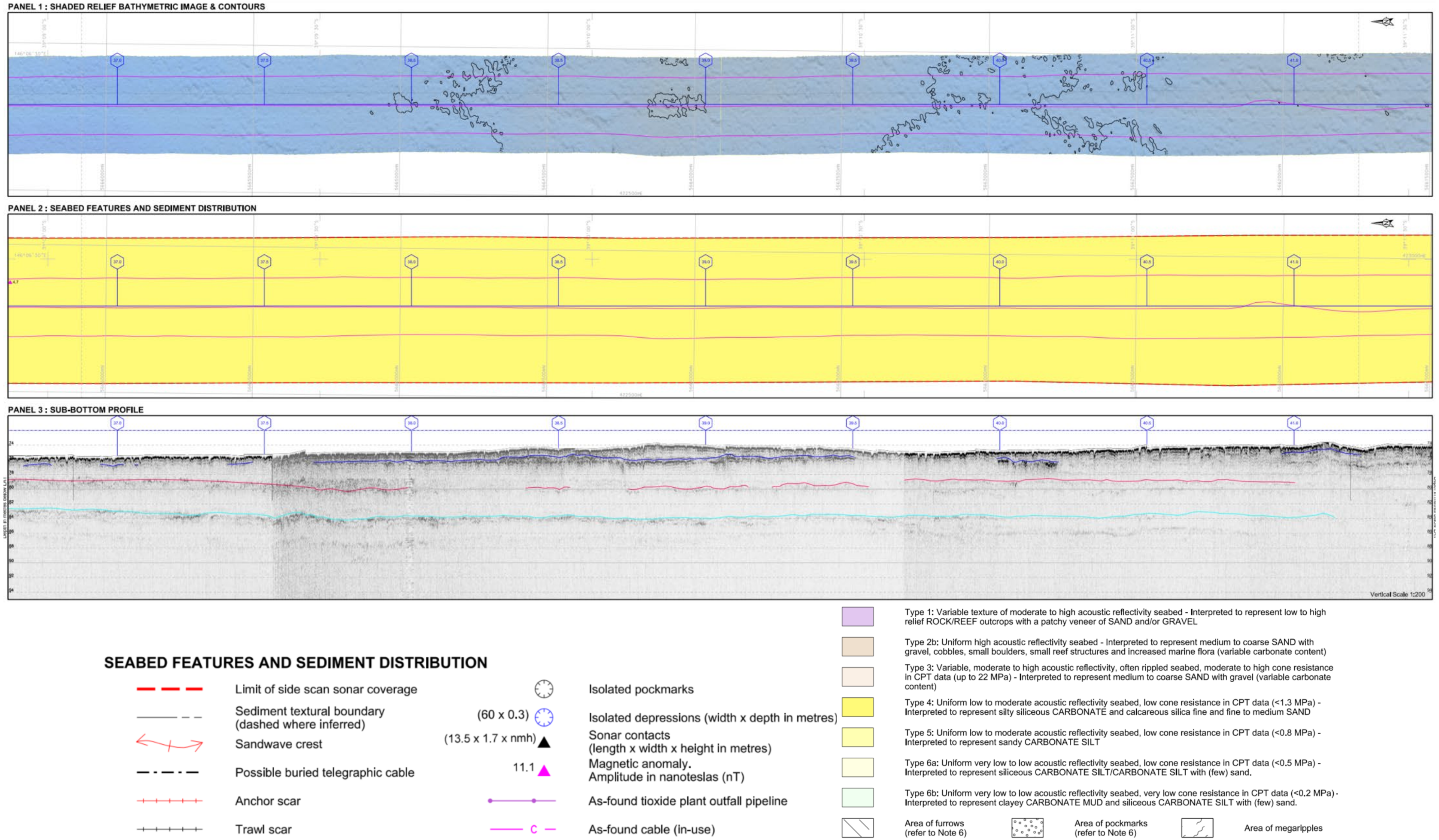
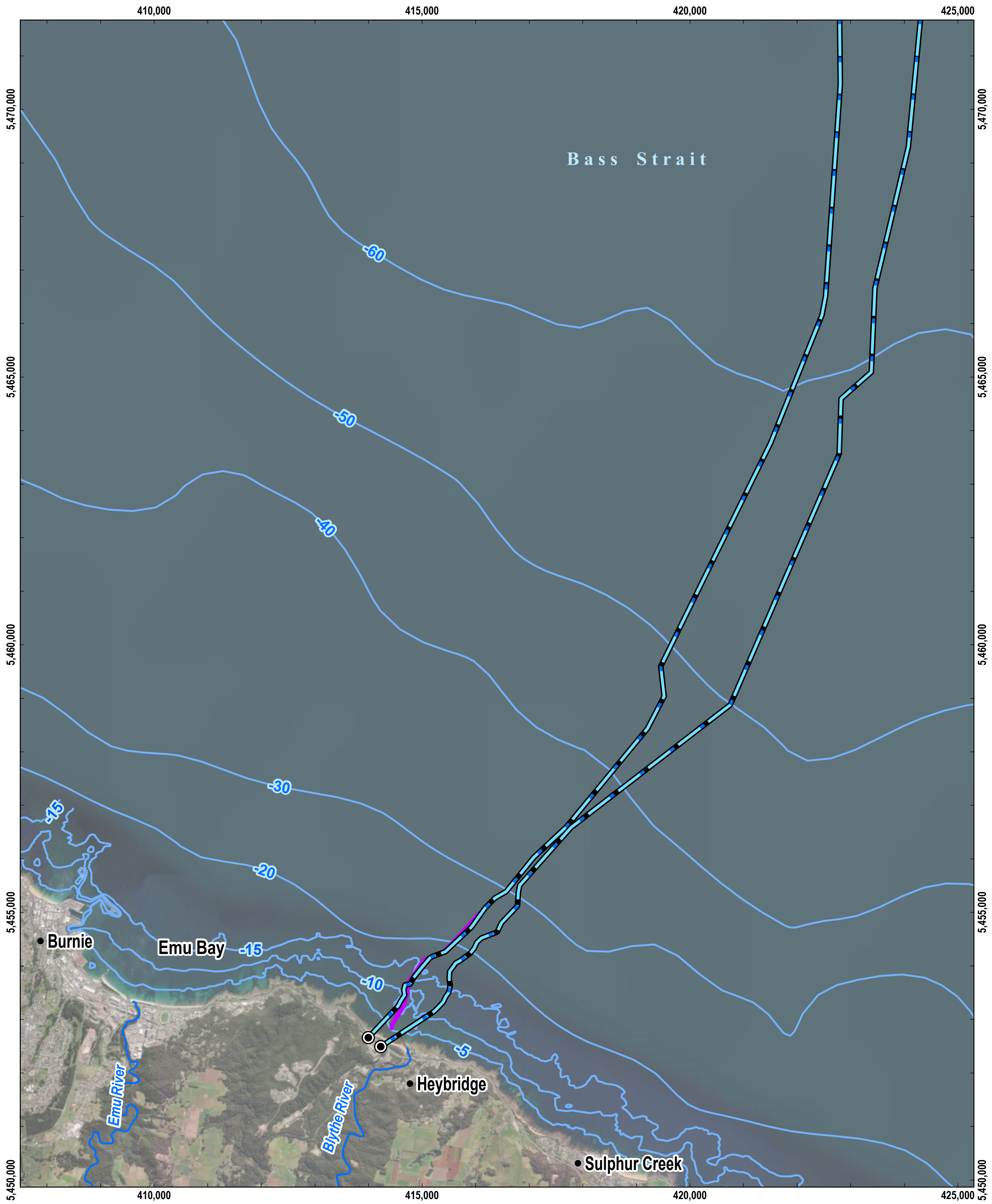


Figure 2-3. Example of geophysical seabed characteristics from KP 36.5 to 41.5
(Source: Fugro 2020)

2.3 Heybridge

Heybridge is located east of Burnie and Emu Bay on the central northern coast of Tasmania. The Heybridge location is relatively sheltered from direct ocean swell but is exposed to seasonally strong northerly winds across Bass Strait.

The subsea alignment initially extends north-easterly from the rocky shore and follows two palaeochannels passing by rocky outcrops associated with Round Hill between Emu Bay and Heybridge to around the 35 m depth contour before the seabed flattens (Figure 2-4). The alignments separate to become parallel at the 50 m depth contour. The alignment avoids rocky outcrops at around the 60 m depth contour and then follows a true north-south alignment at around 20 km offshore (ML 232,000).



LEGEND

- Landfall
- Proposed HVDC subsea cable
- Former tioxide plant outfall pipeline
- Bathymetry contours (m)
- Major watercourse

MARINUS LINK

SCALE **1:100,000**

PAGE SIZE: **A4**

PROJECTION: **GDA2020 MGA Zone 55**

SOURCE
Proposed route from Tetra Tech Coffey.
LGA boundaries from VICMAP.
Imagery from ESRI Online.

MARINUS LINK PTY LTD

MARINUS LINK
EIS/EES

FIGURE 2-4

Heybridge locality

TETRA TECH COFFEY

DATE: **16.05.24** PROJECT: **754-MELEN215878ML** FILE: **215878ML_CEE_EIS_F002.4**

Heybridge is situated in the centre of the Integrated Marine and Coastal Regionalisation of Australia (IMCRA) Boags Mesoscale Bioregion, which extends 180 km east and 110 km west of the cable landfall (Figure 2-5). The Boags Bioregion benthic habitats are characterised by marine ecological communities that are generally similar to each other, but can be distinguished from the adjacent five Mesoscale Bioregions (Figure 2-5).

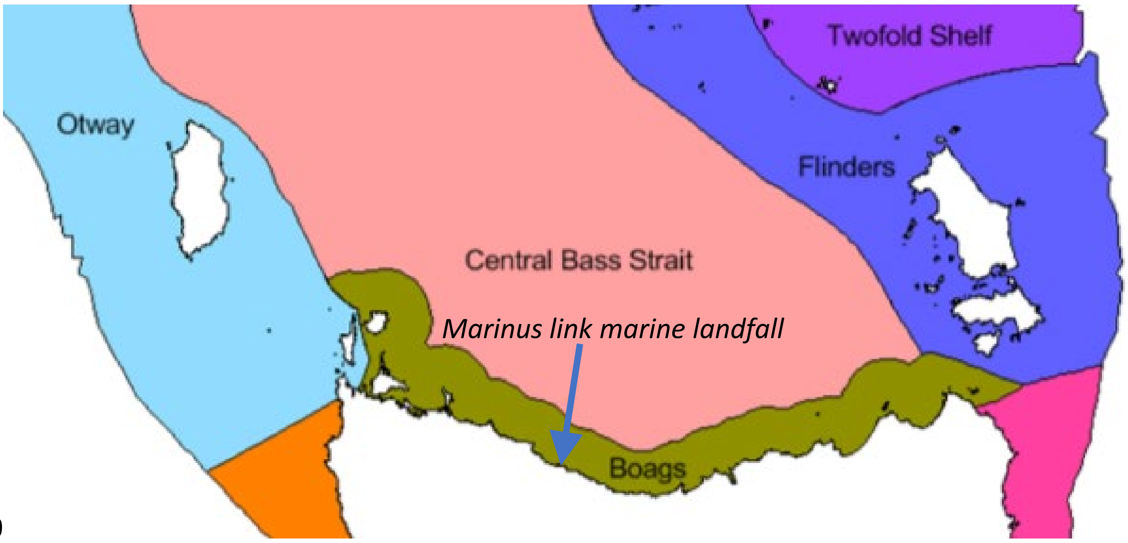


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Figure 2-5. Boags Bioregion, North Tasmania
(Source: IMCRA 1998)

2.4 Central Bass Strait alignment sites (more than 40 m water depth)

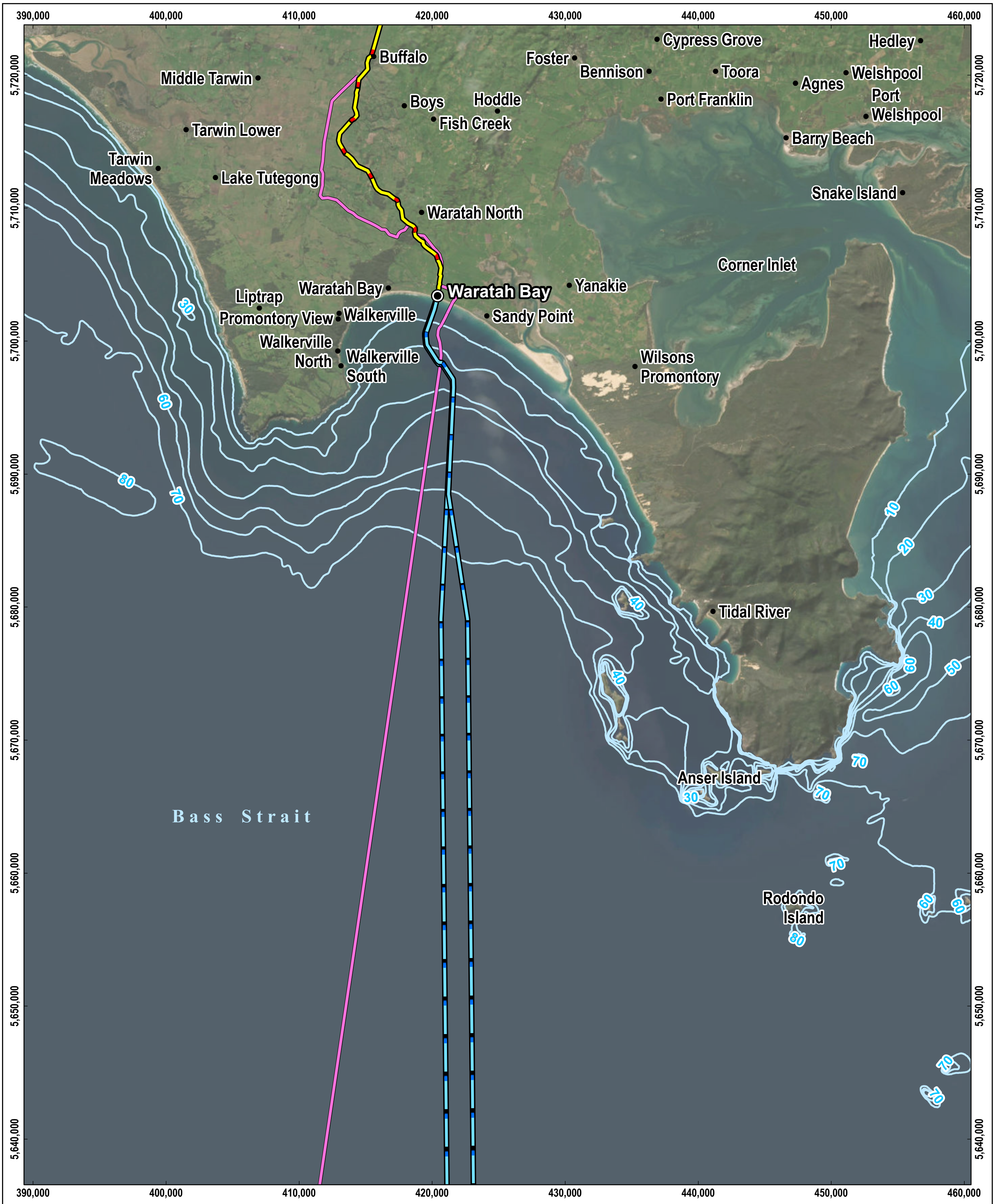
The Central Bass Strait sites are those along the alignment at depths greater than 40 m from around 40 m offshore from Heybridge to Waratah Bay. The alignment was chosen to avoid rock outcrops and passes over unconsolidated sediments over this entire section of the route. The alignment is located within the Central Bass Strait Bioregion. The boundary of this bioregion is around the 50 m depth contour and the maximum depth is about 80 m (IMCRA 1998). Hence, 240 km of the cable alignment is located within the 60,000 km^2 Central Bass Strait marine mesobioregion. A key difference between the Central Bass Strait and the adjacent bioregions is the scarceness of rocky reef in Central Bass Strait bioregion. The alignment has been chosen to avoid any of the rocky outcrops that may occur along the route in central Bass Strait.

2.5 Waratah Bay

Waratah Bay is a sandy bay located between Wilsons Promontory and Cape Liptrap. The route heads southwards offshore from Wilsons Promontory and the Glennie Group of islands. The marine cable route crosses the Tasmanian - Victorian maritime boundary at 39^{O}12'S, just over 40 km south of its shoreline connection at Waratah Bay.

Waratah Bay is a relatively open embayment on Bass Strait. It is exposed to south-westerly ocean swell and winds but is sheltered from easterly weather. Waratah Bay marks the boundary between the National IMCRA Mesoscale Flinders Bioregion to the east and the Central Victorian Bioregion to the west (Figure 2-7). The same boundary separates the Victorian Wilsons Promontory West Bioregion to the east and the Cape Liptrap Bioregion to the west.

The waters offshore from Venus Bay are part of the Central Bass Strait National Bioregion (Figure 2-8). These bioregion benthic habitats are characterised by marine ecological communities that are generally similar to each other, but can be distinguished from the adjacent Bioregions on wave exposure, water mass character and reef community characteristics.



LEGEND

- Landfall

Proposed route

- HVDC subsea cable
- Underground HVDC cable
- Existing Telstra Cable
- Bathymetry contour (m)

MARINUS LINK

4 0 4 km

SCALE 1:400,000

PAGE SIZE: A4

PROJECTION: GDA2020 MGA Zone 55

SOURCE

Proposed route from Tetra Tech Coffey.
LGA boundaries from VICMAP.
Imagery from ESRI Online.

MARINUS LINK PTY LTD

MARINUS LINK
EIS/EES

FIGURE 2-6

Waratah Bay locality

TETRA TECH COFFEY

DATE: 16.05.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CEE_EIS_F002.6

SAVED BY: HELEN.JUNKOVICH 16.05.24 5:33 PM

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Figure 2-7. National Mesoscale Bioregions at Waratah Bay
(Source: CoastKit DELWP)

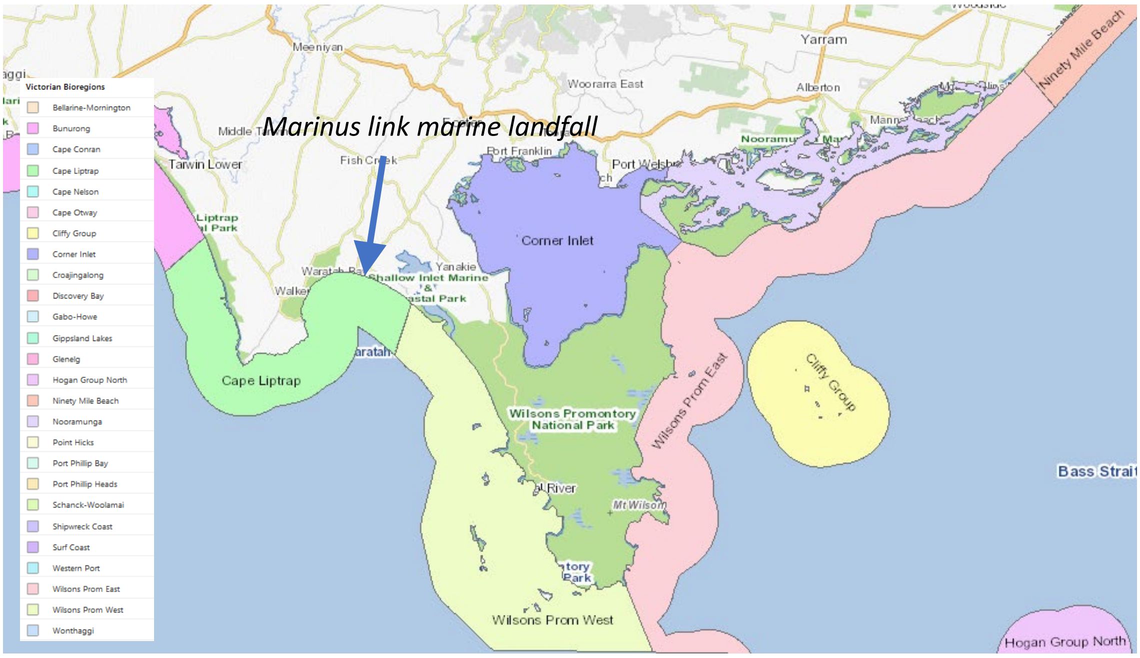


Figure 2-8. Victorian Bioregions at Waratah Bay
(Source: CoastKit)

3 Seabed survey and assessment procedure

The surveys used CEE's and Marine Solutions' towed underwater camera equipment. The equipment is purpose built for marine environmental surveys and comprised:

- A ballasted tow-fish fitted with two cameras, including:
  - A high-definition CCTV camera linked to the surface via a tether and communication cable
  - An autonomous time-lapse, still image camera with a wide-angle lens.
- A surface unit consisting of a screen to view the seabed in real-time and a digital video recorder.

The CCTV camera mounted on the tow-fish with real-time transmission of images to the survey vessel was used to maintain the tow-fish at the optimal height above the seabed for the purpose of the survey. The CCTV video live footage was used for navigation and making observations, but video records were not used for the analysis (see below).

Autonomous high-definition cameras with good low light and auto-white balance sensors (Sony) and wide angle, underwater lenses were configured to take still images every 2 seconds (time-lapse mode). Recording was started at the surface upon deployment and stopped at the surface upon retrieval. The high-definition images from this camera provide detail required for analysis of seabed composition and identification of associated biota. The still images were used for the analysis of seabed habitat.

The survey aimed to recorded still-images along 50 to 100 m transects at each site.

The survey vessel navigated to each site using GPS waypoints and/or the vessel depth sounder. Once in position, the camera equipment was lowered to just above the seabed. The survey vessel was allowed to drift with prevailing currents and wind to cover a 50 to 100 m transect. Minimal propulsion was used to maintain the speed of the camera above the seabed at or below 1 km/h. Where a site aimed to document a habitat boundary, the vessel was positioned and navigated to ensure the transect crossed the boundary.

Electronic and hard-copy data were recorded for each towed camera transect including:

- High resolution images from the 11 megapixel still camera
- A waypoint for the position and time of the start of each transect (hand-held GPS, accuracy ±5 m, WGS 84)
- Trackpoints giving a position every 10 seconds along each transect (hand-held GPS, accuracy ±5 m, WGS 84)
- Depth directly from vessel sounder (unadjusted for tide or waves) at 30 second intervals along each transect (vessel GPS, WGS 84)
- Start/stop times
- Descriptions of habitats and biota on the seabed and other seabed features were recorded ion field sheets by personnel in the field.

3.1 Visual Data Characterisation and Mapping

Fugro geophysical mapping of the cable alignment options in 2020 included multibeam depth records as well as side scan and sub-bottom mapping of seabed composition (Fugro 2020). Fugro charts and bathymetric data corresponding to chainage positions along alignments ML1 and ML2 were referenced for planning and reporting of the 2021 nearshore and offshore seabed habitat surveys. The National Seamap Australia GIS was used to plan 2019 surveys, which included Tasmanian and Victorian marine environments. Victorian DELWP CoastKit seabed and biological categories are available on Seamap and were referenced in planning 2019 surveys in Victoria.

Camera ‘still’ images provide best resolution imagery of the seabed and are used in this report to illustrate the seabed and biota at each site. Times of each digital image metadata were matched with each nearest trackpoint record. The trackpoint records for each transect used as points for characterisation/classification of habitats using GIS. Each trackpoint was assigned a seabed composition and biological classification based on the Seamap Australia systematic hierarchical classification.

Seamap descriptors are compatible with marine environment and ecological community characterisations used in Australia (Butler et al. 2017). Classifications were determined from the still images recorded at and near that point during the survey. General definitions of substrate classification are provided in Table 3-1. Soft and intermediate seabeds comprise loose material that may be mobilised by wave action are considered to be unconsolidated seabed. Tight-packed cobble or boulders that are unlikely to be mobilised by wave action, together with rocky reef are considered to be consolidated seabed. Terms used in the seabed and habitat descriptions in this report reference the geophysical report descriptions (Fugro 2020) and more commonly used ecological descriptors (community, assemblage, genus, species) to differentiate biological and habitat characteristics.

Table 3-1. Seabed physical descriptors

Seabed physical classifications	
Silt and Clay <0.0625 mm	Soft substrate
Sand: grain size 0.0625 to 2.0 mm	Soft substrate
Shell: broken shell visible in sand	Soft substrate
Granule: 2 mm to 4 mm	Intermediate
Pebble: 4 mm to 64 mm	Intermediate
Cobble: 64 mm to 256 mm	Hard substrate
Boulder: 256 mm to 4000 mm	Hard substrate
Reef (rocky reef): broken rock and bedrock	Hard substrate

Comparison with existing seabed and biological classifications has been made for sites where National Seamap Australia and Victorian CoastKit data were available. National Australia-wide and CoastKit classification data were compiled for each site using GIS.

3.1.1 Field measurements

The accuracy of GPS positions fix was monitored by cross-checking planned positions with position shown on two independent GPSs during the survey and confirming accuracies were ±5 m. The position of the tow-fish above the seabed was monitored by the camera operator to ensure the tow-fish was kept at the optimum position. The horizontal position of the towfish was maintained within 5 m backtrack of the tow vessel by controlling vessel speed and towfish weighting.

The cameras used had wide angle lenses and best imagery was obtained when the camera was around 1 to 1.5 m above the seabed (depending on water clarity) and tow speed was less than 1.5 km/h. If the camera went above the desired height, above the seabed the resolution of the imagery was reduced by interference from particles in the water or ambient light. However, this was minimised by constantly monitoring the video feed on the boat and adjusting the camera height accordingly.

Towed camera surveys are planned for daylight hours. This allows for a wide field of camera view and provides for the greatest personnel safety and work efficiency. Previous experience in Bass Strait has shown sufficient natural light on the seabed allows for adequate identification of seabed habitat and ecological community general characteristics, with a wide field of view.

Artificial lighting was used in August 2021, when overcast skies and low ambient light resulted in reduced ambient light on the seabed. Artificial lighting provided images of suitable quality for identification of seabed habitat and associated ecological community general characteristics, with reduced field of view.

Still images from the camera recordings were reviewed regularly when the camera was at the surface to check that adequate quality imagery was being obtained.

3.1.2 Data Analysis

GPS data were saved as GPX files for use in GIS. Extracted trackpoint data for each transect were cross checked between the handheld GPS and vessel GPS, and with the coordinates of the planned survey sites.

Fugro geophysical mapping of the cable alignment options in 2020 included multibeam depth records as well as side scan and sub-bottom mapping of seabed composition (Fugro 2020).

Direct reference to measured water depth from Chart Datum is used to describe ecological communities at locations and sites in this report, rather than biological community composition without a fixed datum or numerical scale. Distances are referenced to Fugro's Marinus Link cable chainage origins at Waratah Bay.

Habitat types and associated biological communities identified from imagery were classified using Seamap' hierarchical national system of Butler et al. (2017). Habitat descriptions for Waratah Bay are referenced to DEECA's Victorian Biotope Atlas Habitat Classifications (CoastKit, 2023 and Mazor et al, 2023).

Species and taxonomic identifications were made based on analyst training and experience. CEE biologists have decades of experience along the central north coast of Tasmania and the central Victorian Coast, as well as experience in deeper seabed communities along cable and pipeline routes in central and eastern Bass Strait. This experience informed the interpretation of the seabed images in descriptions of biological communities along the alignments provided in this report.

3.1.3 Consistency with Tasmanian guidelines for natural values surveys – estuarine and marine development proposals

The survey methods used are consistent with the Tasmanian EPA guidelines for natural values surveys – estuarine and marine development proposals (DPIPWE, 2020) where relevant to the benthic habitat characterisation scope of work. The guidelines state that at its most basic level, marine natural values surveys should include an underwater video survey (informed by a desktop assessment), mapping of the bathymetric profile across the site, and identification of seabed characteristics and habitat profile. This is consistent with the approach taken for the current study, noting that the bathymetric survey was conducted under a separate study (Fugro, 2020). The current study also adopted good practice scientific techniques by qualified personnel, with the spatial extent and temporal currency of the survey results being appropriate - core requirements of the guidelines.

4 2021 Survey sites and characteristics

Table 4-1 provides a summary of the number of sites, distance range offshore and depth range for the seabed surveys in 2019 and 2021. As discussed above the results of the 2019 have been previously reported (CEE 2021)

The sites surveyed from the Tasmanian coast at Heybridge to Waratah Bay in Victoria in 2021 are listed in Table 4-2 by chainage and water depth. The survey observations are discussed and illustrated in following sections of this report. Images from all sites are provided in Appendix A to this report.

Table 4-1. Summary of site data for 2019 and 2021 surveys in Tasmania and Victoria

Year	State waters	Start location	Total sites	Distance range from shore	Depth	
					Min	Max
2019	Tasmania	Heybridge	33	1 to 6.5 km	7 m	43 m
2019	Tasmania	Others*	57	0.2 to 11.5 km	3 m	40 m
2021	Tasmania	Heybridge	39	0.8 to 184 km	9 m	80 m
2019	Victoria	Waratah	28	0.5 to 7.5 km	6 m	42 m
2021	Victoria	Waratah	25	0.7 to 70 km	8 m	74 m

*See CEE 2021

Table 4-2. Site list and seabed habitat summary Marinus Link cable alignments 2021
(The table is sorted by depth and distance from Heybridge to Waratah Bay)

Site (m)	Depth (m)	Description
ML2 253300	9	Reef and patchy sand. Mixed invertebrates. Coralline algae dominate reef.
ML1 252300	10	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef.
ML2 253000	11	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef.
ML2 252,800	12	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef.
ML1 252,000	13	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef.
ML1 251,700	14	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef. Tioxide pipeline visible
ML2 252,500	15	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef.
ML1 251,300	17	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef. Tioxide pipeline visible
ML2 252,000	18	Reef and cobble. Mixed invertebrates. Coralline algae dominate reef.
ML1 251,000	20	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef
ML2 251,500	22	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef.
ML1 250,500	23	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef
ML1 250,000	25	Reef and sand gutters. Coralline algae dominated reef
ML2 251,000	26	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef.
ML2 250,000	31	Reef and sand. Mixed invertebrates.
ML1 249,000	31	Reef. Mixed invertebrates
ML2 240,500	55	Silt/Clay. High mixed invertebrates. Scarce erect Eunicid worm tubes. Sparse burrows
ML2 240,000	56	Silt/Clay. Moderate mixed invertebrates. Scarce erect Eunicid worm tubes. Moderate burrows
ML1 240,000	56	Silt/Clay. Moderate mixed invertebrates. Scarce erect Eunicid worm tubes. Moderate burrows
ML2 239,500	56	Silt/Clay. High mixed invertebrates. Scarce erect Eunicid worm tubes. Moderate burrows
ML2 239,000	57	Silt/Clay. Moderate mixed invertebrates. Scarce erect Eunicid worm tubes. Moderate burrows
ML2 238,700	59	Silt/Clay. High mixed invertebrates. Scarce erect Eunicid worm tubes. Sparse burrows. Spider crab sighted
ML2 238,500	59	Silt/Clay. Moderate mixed invertebrates. Moderate burrows. Spider crab sighted
ML2 238,000	60	Silt/Clay. Moderate mixed invertebrates. Moderate burrows.
ML1 238,000	59	Silt/Clay. Sparse mixed invertebrates. Scarce erect Eunicid worm tubes. Moderate burrows.

Site (m)	Depth (m)	Description
ML2 230,000	68	Silt/Clay. Moderate mixed invertebrates. Sparse erect Eunicid worm tubes. Moderate burrows
ML1 230,000	68	Silt/Clay. Very sparse mixed invertebrates. Sparse erect Eunicid worm tubes. Abundant burrows.
ML2 210,000	69	Silt/Clay. Sparse mixed invertebrates. Moderate burrows.
ML1 210,000	70	Silt/Clay. Very sparse mixed invertebrates. High burrows.
ML2 180,900	76	Silt/Clay. Sparse mixed invertebrates. Moderate burrows.
ML1 180,000	76	Silt/Clay. Very sparse mixed invertebrates. Moderate burrows.
ML2 140,000	80	Silt/Clay. Sparse mixed invertebrates. Moderate burrows.
ML1 140,000	80	Silt/Clay. Sparse mixed invertebrates. Moderate burrows.
ML2 120,000	80	Silty Sand. Sparse mixed invertebrates. Moderate burrows.
ML1 120,000	80	Silty Sand. Sparse mixed invertebrates. Sparse to moderate burrows. Sea cumber sighted
ML2 100,000	79	Silty Sand. Sparse mixed invertebrates. Moderate burrows.
ML1 100,000	79	Silty Sand. Moderate mixed invertebrates. Sparse to moderate burrows
ML2 700,00	75	Silty Sand. Sparse mixed invertebrates. Moderate burrows.
ML1 700,00	75	Silty Sand. Moderate mixed invertebrates
ML2 40,000	74	Silty Sand. Scarce erect Eunicid worm tubes.
ML1 40,000	74	Silty Sand. Scarce erect Eunicid worm tubes.
ML2 20,000	71	Silty sand. Scarce erect Eunicid worm tubes.
ML1 20,000	71	Silty sand. Scarce erect Eunicid worm tubes.
ML 10,000	45	Sand and silt. Sparse erect Eunicid worm tubes.
ML 8,000	42	Sand and silt. Sparse to moderate erect Eunicid worm tubes.
ML 7,000	31	Sand with ripples. Sparse macro algae. Solitary seagrass. Sparse to moderate visible infauna. Scarce sea pens. Spider crabs sighted.
ML 6,300	26	Sand with ripples. Sparse macro algae. Sparse to moderate visible infauna. Scarce sea pens. Spider crabs sighted
ML 6,000	26	Sand with ripples. Sparse macro algae. Sparse to moderate visible infauna. Scarce sea pens. Spider crabs sighted
ML 5,000	21	Sand, shell, and cobble. Sparse macro algae. Scarce invertebrates. Scarce sea pens.
ML 4,300	19	Rippled sand with sparse cobble and shell. Sparse invertebrates. Scarce seagrass. Scarce sea pens.

Site (m)	Depth (m)	Description
ML 4,000	19	Sand, cobble, and sparse shell. Sparse to moderate macro algae. Sparse invertebrates. Sparse seagrass
ML 3,700	18	Sand with cobble and shell patches. Sparse to moderate seagrass. Moderate macro algae cover. Sparse invertebrates
ML 3,500	18	Sand and Cobble with patchy reef. Moderate invertebrate and macro algae cover. Sparse seagrass patches.
ML 3,000	17	Sand with ripples. Section of rock, cobble, and shell reef. Sparse to moderate seagrass. Sparse drift algae. Scarce sea pens. Bioturbation (sediments disturbed by biological activity) absent or sparse.
ML 2,500	16	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae. Sparse sea pens. Bioturbation absent or sparse.
ML 2,000	15	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae. No obvious visible epifauna. Scarce sea pens. Bioturbation absent or sparse.
ML 1,700	14	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae. No obvious visible epifauna. Scarce sea pens. Bioturbation absent or sparse.
ML 1,400	14	Sand with ripples. Patchy shell. Sparse seagrass. Sparse drift algae. No obvious visible epifauna. Bioturbation absent or sparse.
SF5	14	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae. Scarce sea pens.
SF3	13	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae. Band of dark sand shell and reef with mixed invertebrates
SF4	13	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae. Band of reef with mixed invertebrates
ML 1,100	10	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae. No obvious visible epifauna. Bioturbation absent or sparse.
SF2	10	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae. Band of dark sand and shell
SF1	8.5	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae

5 Heybridge

Heybridge is located on the mouth of the Blythe River on a rocky coastline on the central north coast of Tasmania, just east of Burnie on Emu Bay. The adopted alignment of the marine cables from the north coast of Tasmania is aligned to avoid rocky outcrops at this shoreline that become covered by unconsolidated silty sediments at around 15 km offshore. The cable routes from the shoreline directionally drilled bores emergences are aligned to follow sandy channels through extensive rocky reefs that characterise the nearshore environment to around 4 km offshore. The western cable (ML1) follows the same sandy channel that is also occupied by the abandoned waste outfall pipeline from the former Tioxide Australia plant (Figure 2-4).

Examination of the Seamap Australia's seabed habitats for the Heybridge area (Figure 5-1) shows that much of the seabed to approximately 3 km offshore of the central-north Tasmanian coast comprises rock reef. The relief of the reefs varies along the coast, generally reflecting the nature of the shoreline topography, which continues downward into the sea. The continuity of the rocky reef is disrupted frequently by areas of fine to coarse mobile sand and cobble, with larger expanses of cobble occupying some areas, such as Emu Bay.

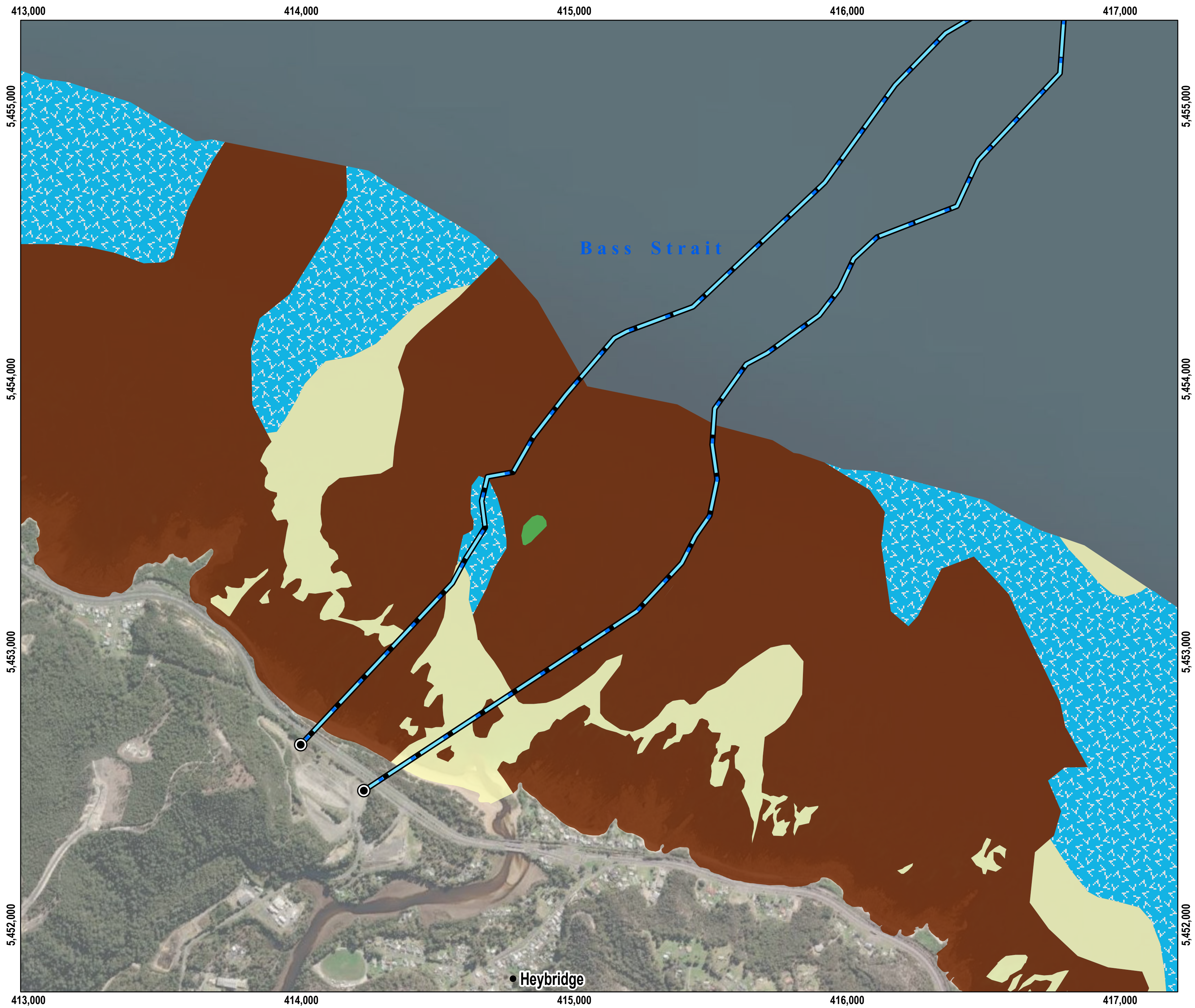
The seabed features map interpreted from the 2020 geophysical survey (Figure 5-2) shows that the seabed over the Marinus Link approach to Heybridge comprises extensive rock reef outcropping with sand gutters (palaeochannels), areas of cobble and nearshore sand; which is consistent with findings of the 2019 CEE seabed habitat survey and the Seamap Australia seabed habitat maps of the same area.

The Fugro geophysical survey outputs were used to position the Marinus Link cable routes to follow sand filled palaeochannels that meander through the reef (Figure 5-2). The figure shows that western cable (ML1) follows the same sandy palaeochannel that is occupied by abandoned Tioxide Australia waste-outfall pipelines.

5.1 Heybridge survey sites (ML1 252,300 to ML1 249,000)

The 2019 seabed habitat survey of the Heybridge area was planned and implemented before the 2020 geophysical survey and cable routes had been finalised. Hence the 2019 survey sites covered a relatively wide area offshore from the proposed landfall site (Figure 5-2). The positions of the alignments and reef shown in Figure 5-2 informed the positions of sites for targeted investigation in the 2021 towed underwater camera seabed survey across Bass Strait, including the nearshore area at Heybridge.

The positions of CEE's 2019 and 2021 survey sites relative to the Marinus Link alignments are shown in Figure 5-3.



MARINUS LINK

LEGEND

- Landfall
- Proposed HVDC subsea cable

Seamap habitats

- Reef
- Cobble
- Sand
- Seagrass

SOURCE
Proposed route from Tetra Tech Coffey.
Seamap habitats from Lucieer et al (2017).
Imagery from ESRI Online.

0 200 400 m

SCALE **1:20,000**
PAGE SIZE: **A4**
PROJECTION: **GDA2020 MGA Zone 55**

MARINUS LINK PTY LTD

MARINUS LINK
EIS/EES

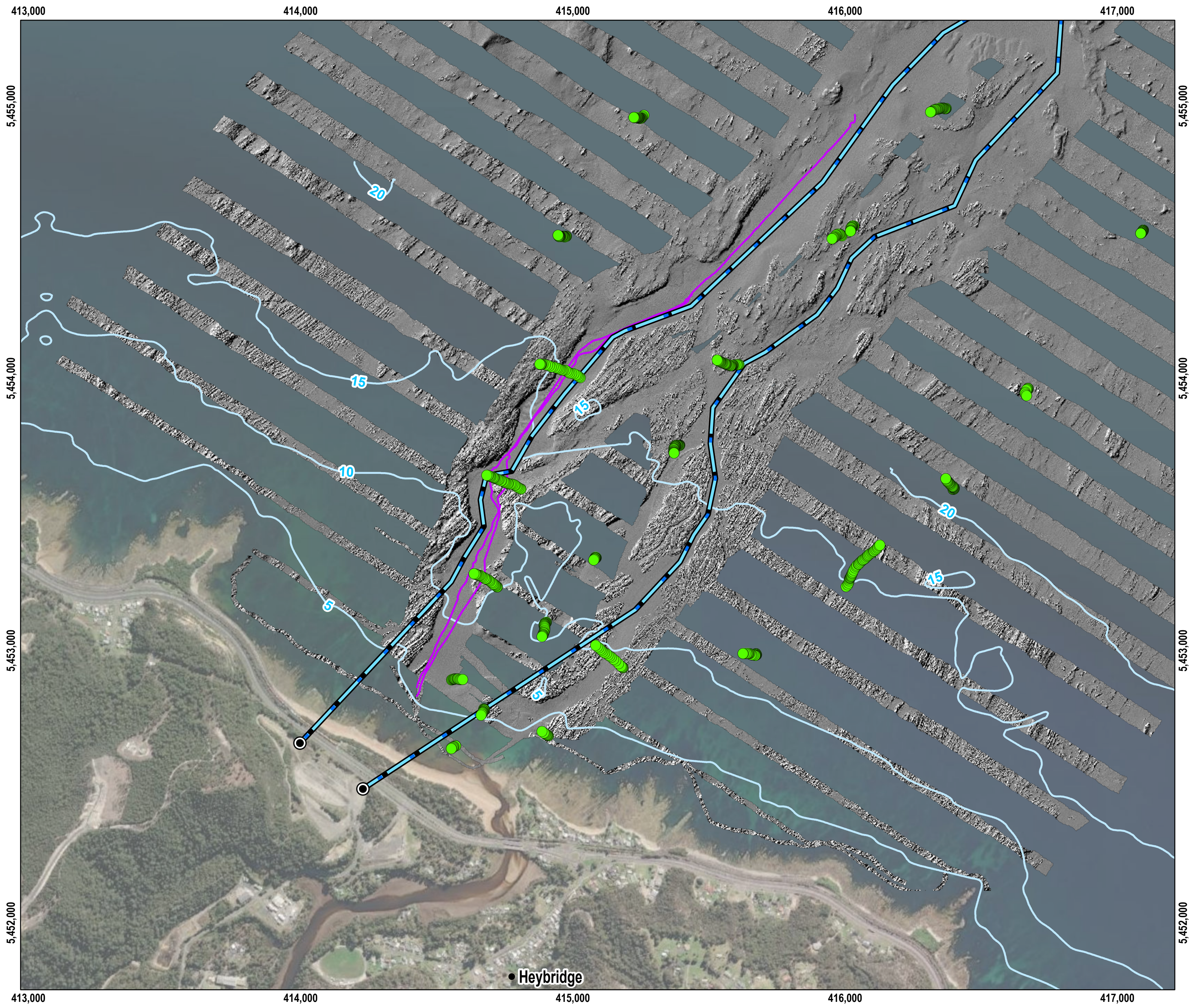
FIGURE 5-1

Seamap Australia mapped habitats in Heybridge area

TETRA TECH COFFEY

DATE: 16.05.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CEE_EIS_F005.1

DOC REFERENCE: \\TT.LOCAL\COFS\772\GIS\215878_MELEN_TASNETWORKS_PROJECTMARINUS\GIS\MXD_APRX\215878ML_CEE_EIS\215878ML_CEE_EIS_F001_F010.APRX LAYOUT:215878ML_CEE_EIS_F005.1_1 SAVED BY: HELEN.UNKOVICH 16.05.24 4:43 PM



MARINUS LINK

LEGEND

- CEE 2019 survey underwater image site
- Landfall
- Proposed HVDC subsea cable
- Former tioxide plant outfall pipeline
- Bathymetry (m)

SOURCE
Proposed route from Tetra Tech Coffey.
Underwater survey sites from CEE.
Bathymetry and tioxide pipeline from Fugro. (2020).
Imagery from ESRI Online.

0 200 400 m

SCALE 1:20,000
PAGE SIZE: A4
PROJECTION: GDA2020 MGA Zone 55

MARINUS LINK PTY LTD

MARINUS LINK
EIS/EES

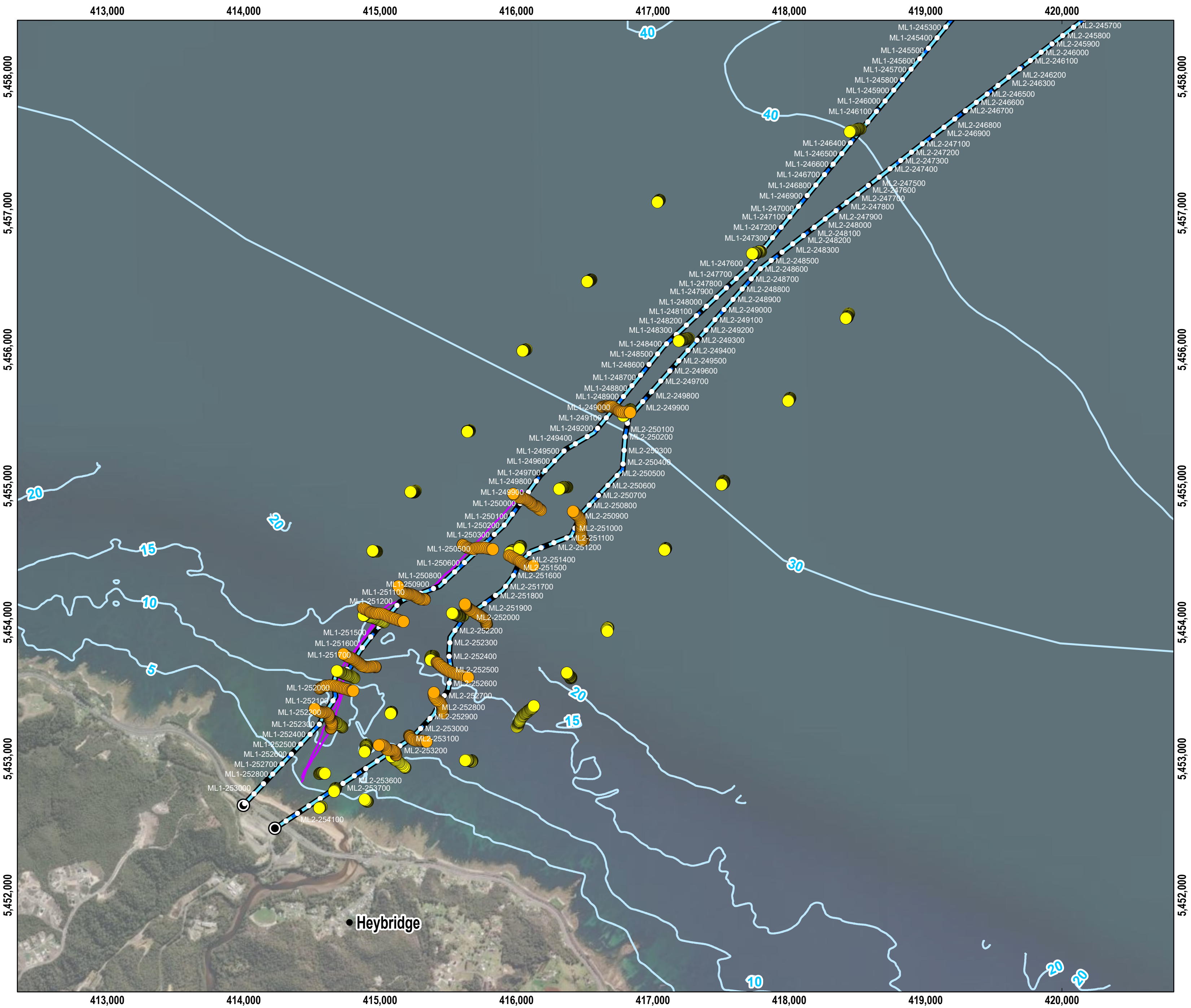
FIGURE 5-2

Heybridge seabed composition interpreted from geophysical survey

TETRA TECH COFFEY

DATE: 16.05.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CEE_EIS_F005.2

DOC REFERENCE: \\TT.LOCAL\COFS\772\GIS\215878_MELEN_TASNETWORKS_PROJECTMARINUS\TASNETWORKSPROJECTMARINUSGIS\MXD_APRX\215878ML_CEE_EIS\215878ML_CEE_EIS_F001_F010.APRX LAYOUT:215878ML_CEE_EIS_F005.2_1 SAVED BY: HELEN.UNKOVICH 16.05.24 4:43 PM



MARINUS LINK

LEGEND

- 2021 seabed survey sites
- 2019 seabed survey sites
- Landfall
- Proposed HVDC subsea cable
- Former tioxide plant outfall pipeline
- Bathymetry (m)

SOURCE
Proposed route from Tetra Tech Coffey.
Underwater survey sites from CEE.
Bathymetry and tioxide pipeline from Fugro. (2020).
Imagery from ESRI Online.

0 400 800 m

SCALE **1:40,000**
PAGE SIZE: **A4**
PROJECTION: **GDA2020 MGA Zone 55**

MARINUS LINK PTY LTD

MARINUS LINK
EIS/EES

FIGURE 5-3

Towed camera survey site positions 2019 and 2021 surveys

TETRA TECH COFFEY

DATE: 16.05.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CEE_EIS_F005.3

5.2 Seabed Habitats

Seabed habitat composition was interpreted from the photographic records from both the January 2019 survey reported previously (CEE 2019) and the subsequent survey in 2021. To meet project timeframes, the Tasmanian and Central Bass Strait towed camera survey was conducted in August 2021. Sea and underwater visibility conditions were marginal at the time of the survey and seabed descriptors at Heybridge in August 2021 were consequently more granular than the previous 2019 survey.

Figure 5-4 shows the distribution of seabed habitat categories at sites surveyed in 2019 and 2021 as well as the Seamap Australia habitat distributions and Figure 5-5 shows the geophysical mapping of the bathymetry.

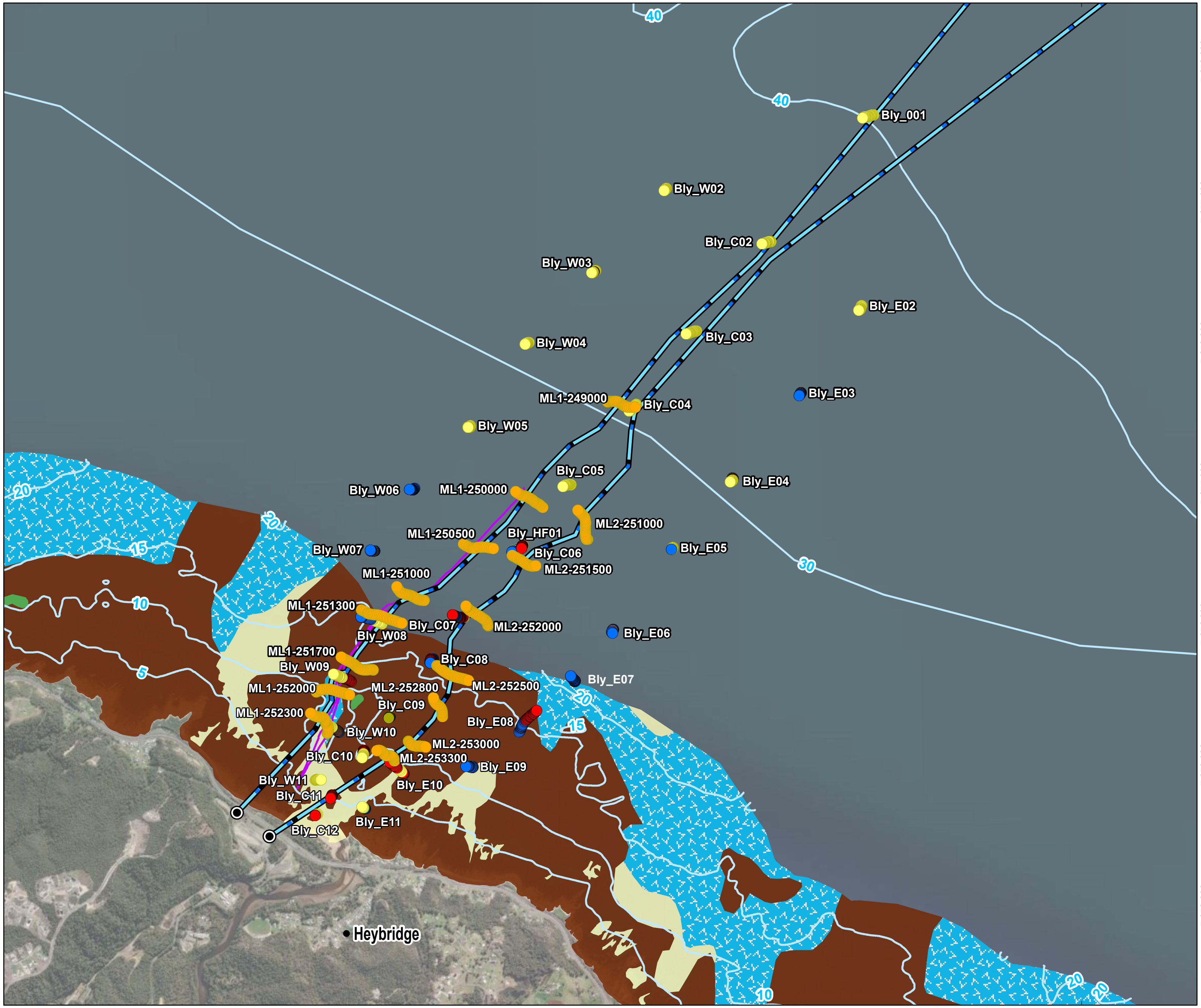
Figure 5-2 and Figure 5-4 show:

- The geophysical survey provides the most detailed distribution map of physical seabed characteristics of the seafloor offshore from Heybridge and along the Marinus Link alignment, as discussed previously.
- The Seamap seabed characteristics provide a broadscale representation of the predominant seabed habitats within discernible boundaries at a larger spatial scale than the geophysical survey.
- The 2019 towed camera survey results demonstrate the characteristics of the finer scale variation in seabed topography apparent in the geophysical survey output.
- The 2021 towed camera survey results demonstrate the characteristics at a similar scale to those in the Seamap, but extend the descriptions of seabed characteristics on the alignment further offshore than the Seamap geographic boundary.

The assembled information indicates four intermingled habitats along the cable alignments within around 4 km of the shoreline at Heybridge:

- Rock reef habitat
- Cobble habitat
- Sand and sand gutter habitat
- Seagrass

The biological assemblages associated with these habitats are described in the next section.



MARINUS LINK

LEGEND

Substrates

- Reef with sand gutters
- Reef
- Sand
- Cobble
- Boulder
- Gravel
- Pebble
- Landfall
- Proposed HVDC subsea cable
- Former tioxide plant outfall pipeline
- Bathymetry (m)

Seamap habitats

- Reef
- Cobble
- Sand
- Seagrass

SOURCE
Proposed route from Tetra Tech Coffey.
Underwater survey sites from CEE.
Seamap habitats from Lucieer et al (2017).
Imagery from ESRI Online.

0 400 800 m

SCALE **1:40,000**
PAGE SIZE: **A4**
PROJECTION: **GDA2020 MGA Zone 55**

MARINUS LINK PTY LTD

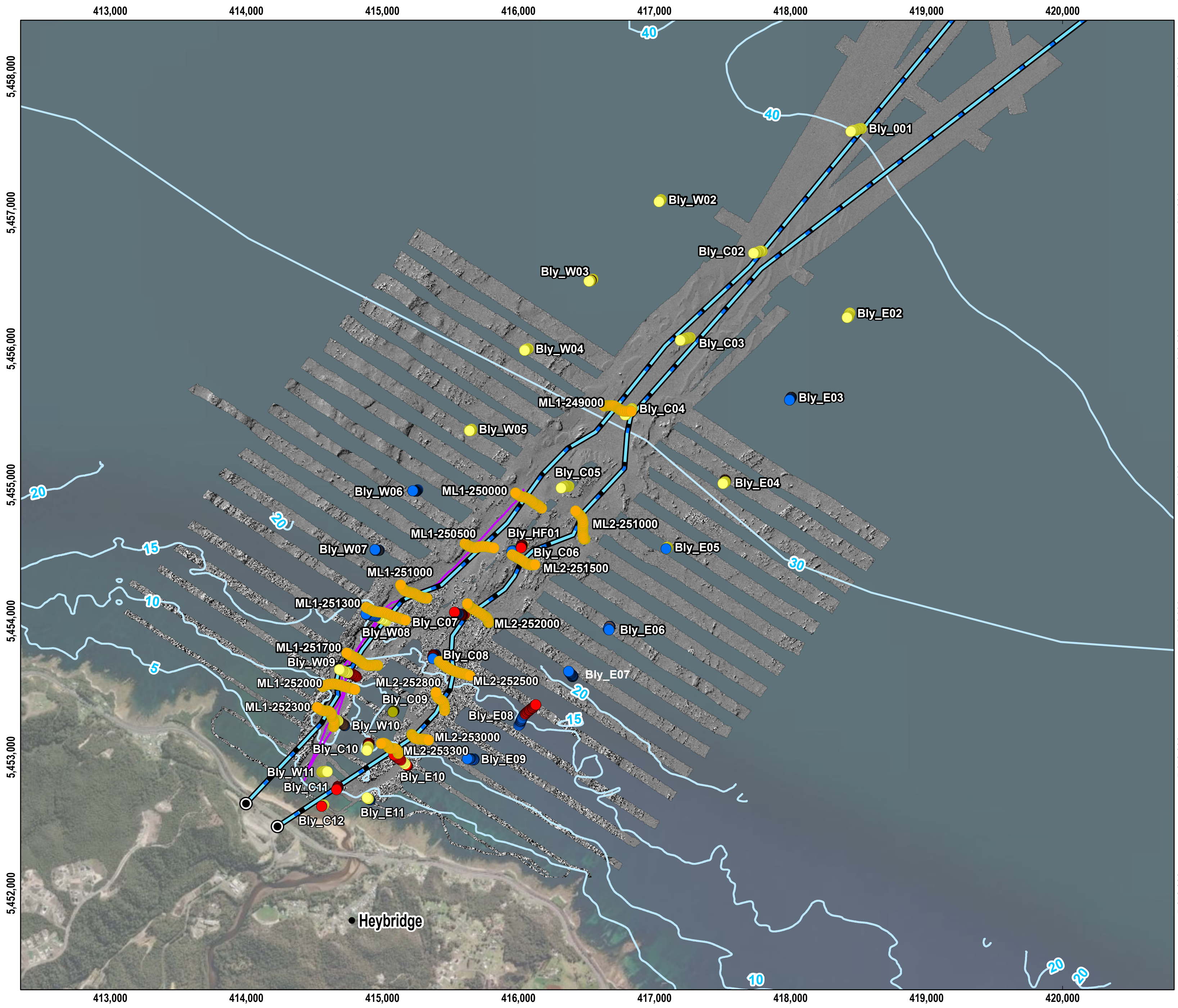
MARINUS LINK
EIS/EES

FIGURE 5-4

Seabed habitats at Heybridge 2019 and 2021

TETRA TECH COFFEY

DATE: 16.05.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CEE_EIS_F005.4



MARINUS LINK

LEGEND

Substrates

- Reef and sand gutters
- Reef
- Sand
- Cobble
- Boulder
- Gravel
- Pebble
- Landfall
- Proposed HVDC subsea cable
- Former tioxide plant outfall pipeline
- Bathymetry (m)

SOURCE
Proposed route from Tetra Tech Coffey.
Underwater survey sites from CEE.
Bathymetry and tioxide pipeline from Fugro. (2020).
Imagery from ESRI Online.

0 400 800 m

SCALE **1:40,000**
PAGE SIZE: **A4**
PROJECTION: **GDA2020 MGA Zone 55**

MARINUS LINK PTY LTD

MARINUS LINK
EIS/EES

FIGURE 5-5

Seabed habitats at Heybridge
Fugro background, 2019 and 2021

TETRA TECH COFFEY

DATE: **16.05.24** PROJECT: **754-MELEN215878ML** FILE: **215878ML_CEE_EIS_F005.5**

DOC REFERENCE: \\TT.LOCAL\COFS\772\GIS\GIS\215878_MELEN_TASNETWORKS_PROJECTMARINUS\GIS\TASNETWORKS\PROJECTMARINUS\GIS\MXD_APRX\215878ML_CEE_EIS\215878ML_CEE_EIS_F001_F010.APRX LAYOUT:215878ML_CEE_EIS_F005.5_1 SAVED BY: HELEN.UNKOVICH 16.05.24 4:56 PM

5.2.1 Rock reef and cobble habitat

The reef habitats at Heybridge (Figure 5-4) comprise variable high relief and dissected rock outcrops nearshore, with progressively lower relief above the general seabed with distance offshore. These solid surfaces provide for attachment of macroalgae and sessile invertebrates, which are consistent with IMCRA descriptions (Edgar et al 1995).

The images from video tows on reef habitat from 4 m to 16 m water depth in January 2019 and August 2021 (Figure 5-6 to Figure 5-11)confirm that larger, longer-lived macroalgae such as larger brown algae *Cystophora* spp, *Acrocarpia* and *Ecklonia radiata* were present at 4 m but not at 13 m or greater. This indicates that these species are restricted to shallower depths due to reduced light availability such as increased turbidity and shorter daylength over winter.

There is sufficient light penetration through the water column for reefs (and cobble) up to 30 m to be characterised by seasonal or short-lived (ephemeral) ephemeral green and red filamentous macroalgae and the green alga *Caulerpa* spp at times of the year with sufficient daylength.

Prolific seasonal (spring to autumn) algal growth on rock reefs in this area may obscure smaller mobile invertebrates such as sea urchins, sea stars, crabs, nudibranchs and snails and encrusting sponges, bryozoans and soft coral *Erythropodium hicksoni*. The same rock reefs are generally devoid of filamentous algae during winter and the reefs are characterised by encrusting coralline algae, solitary ascidians and the sponge/alga *Thamnoclonium dichotomum*. Cobble may be quite bare over winter except for patches of coralline red algae.

The sets of images below show a stark difference between the summer and winter biological communities of the reefs (Figure 5-8 to Figure 5-11). The summer assemblage at each of the depths is more diverse and denser compared to August 2021 which clearly shows a significant decrease at each of the depths.

The biodiversity of reef communities at a more local level, such as the reefs along the Marinus Link alignment, is likely to vary according to the topographic relief and complexity (rugosity) of the habitats provided by the rock formations. Areas of dissected, high-relief reef with complex crevices and overhangs provide more diverse habitats for marine biota, especially fish, invertebrates and kelps; than areas of flat, low-relief bedrock or cobble. These areas have been effectively avoided along the alignment by placing the alignment along the flat, sand-filled channels between rock reef outcrops.

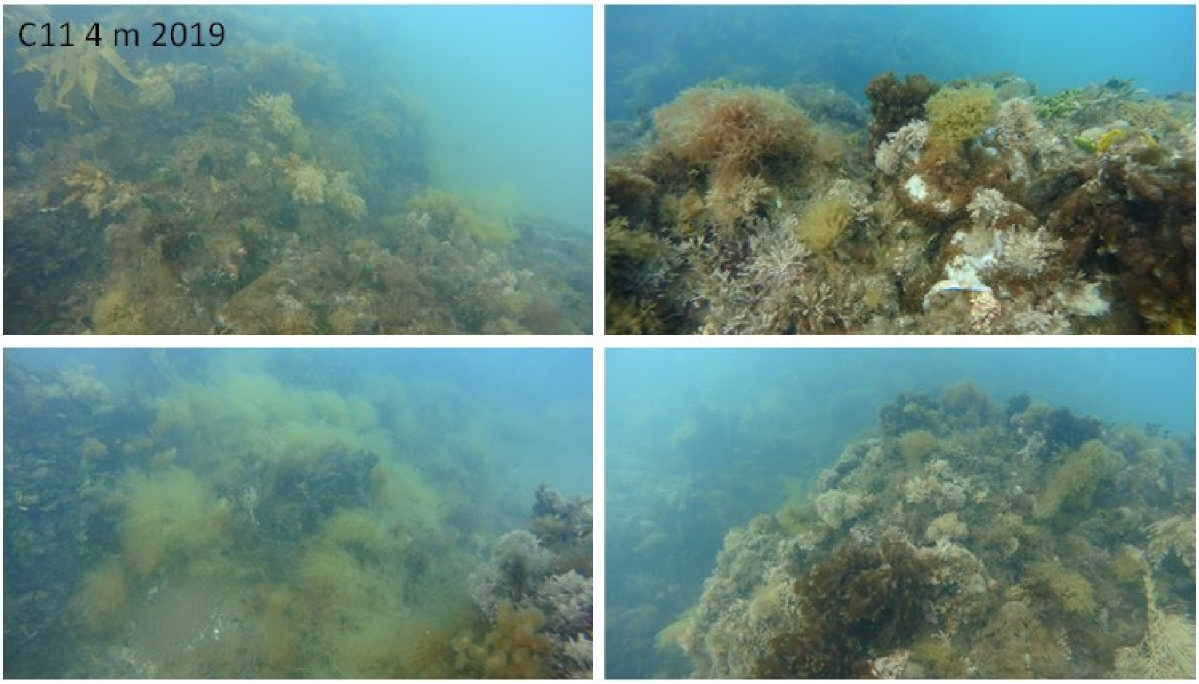


Figure 5-6. Rock reef and cobble habitat, 4 m depth, January, 2019

Figure 5-7. Rock reef and cobble habitat, ~10 m depth Jan 2019 (top) and Aug 2021 (bottom)

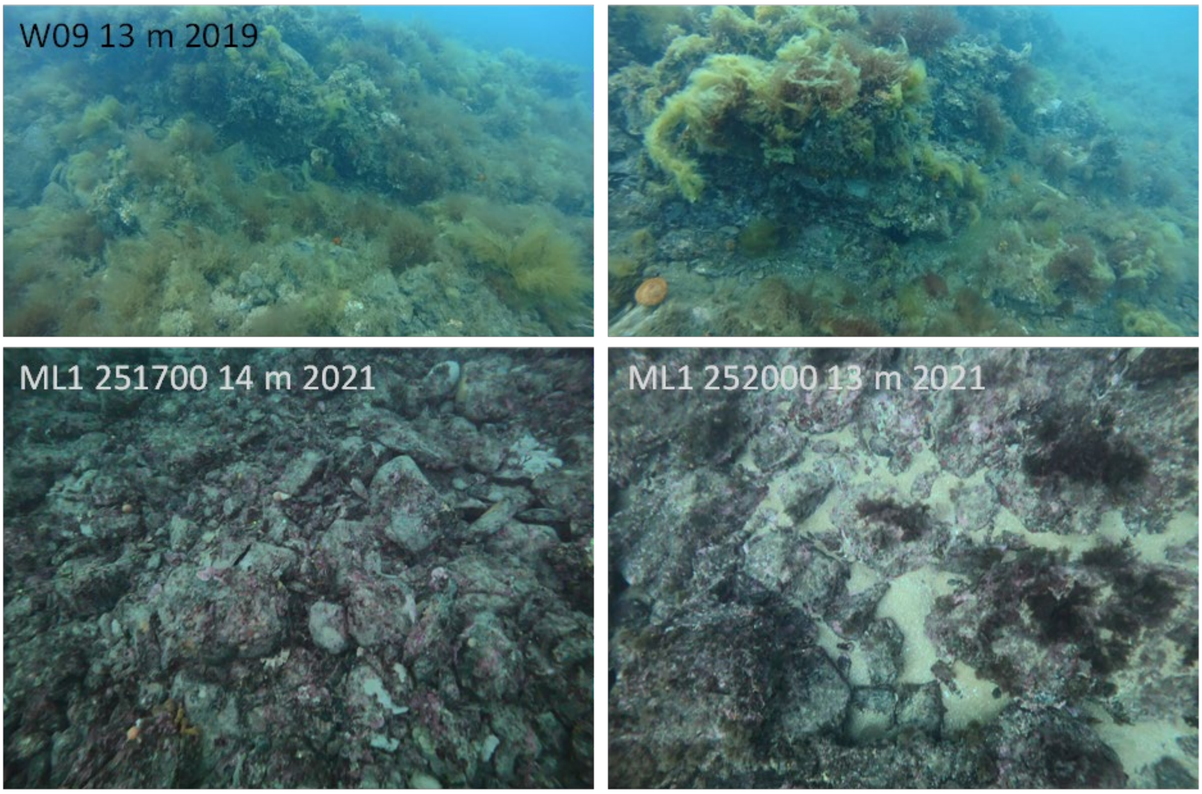


Figure 5-8. Rock reef and cobble habitat, ~13 m depth Jan 2019 (top) and Aug 2021 (bottom)

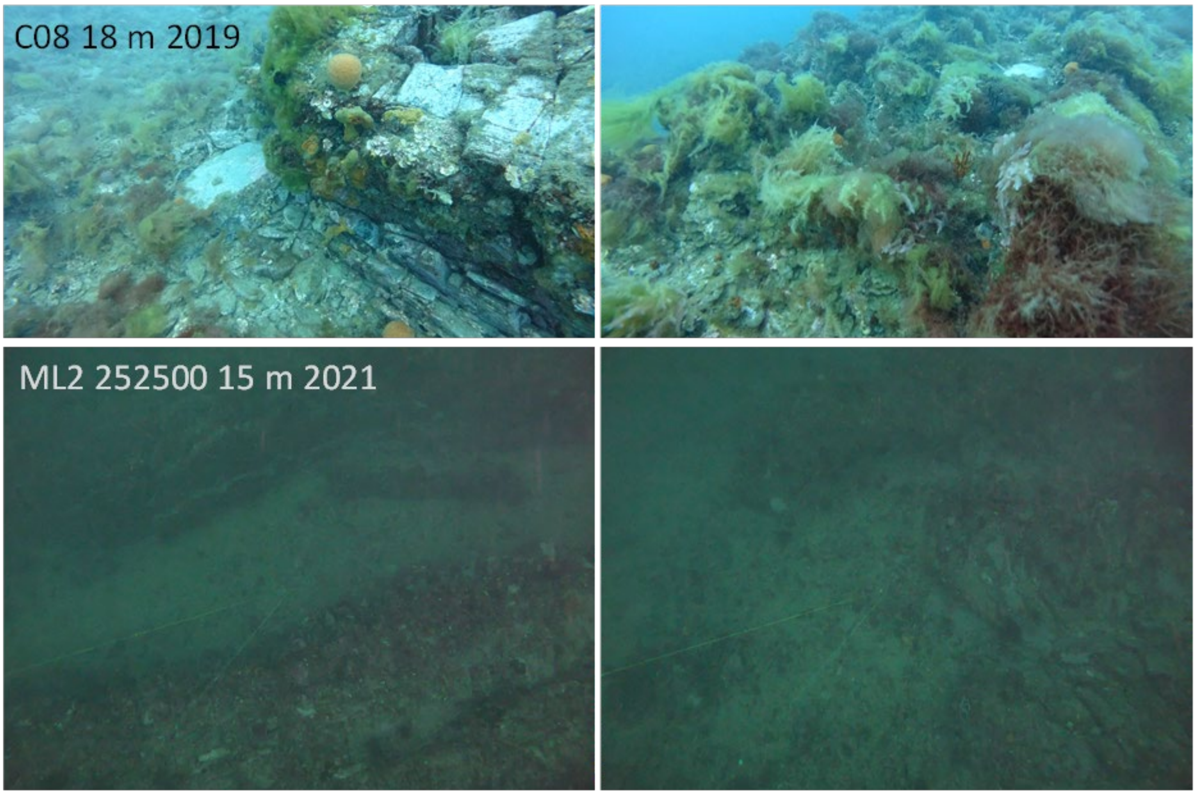


Figure 5-9. Rock reef and cobble habitat, ~16 m depth Jan 2019 (top) and Aug 2021 (bottom)

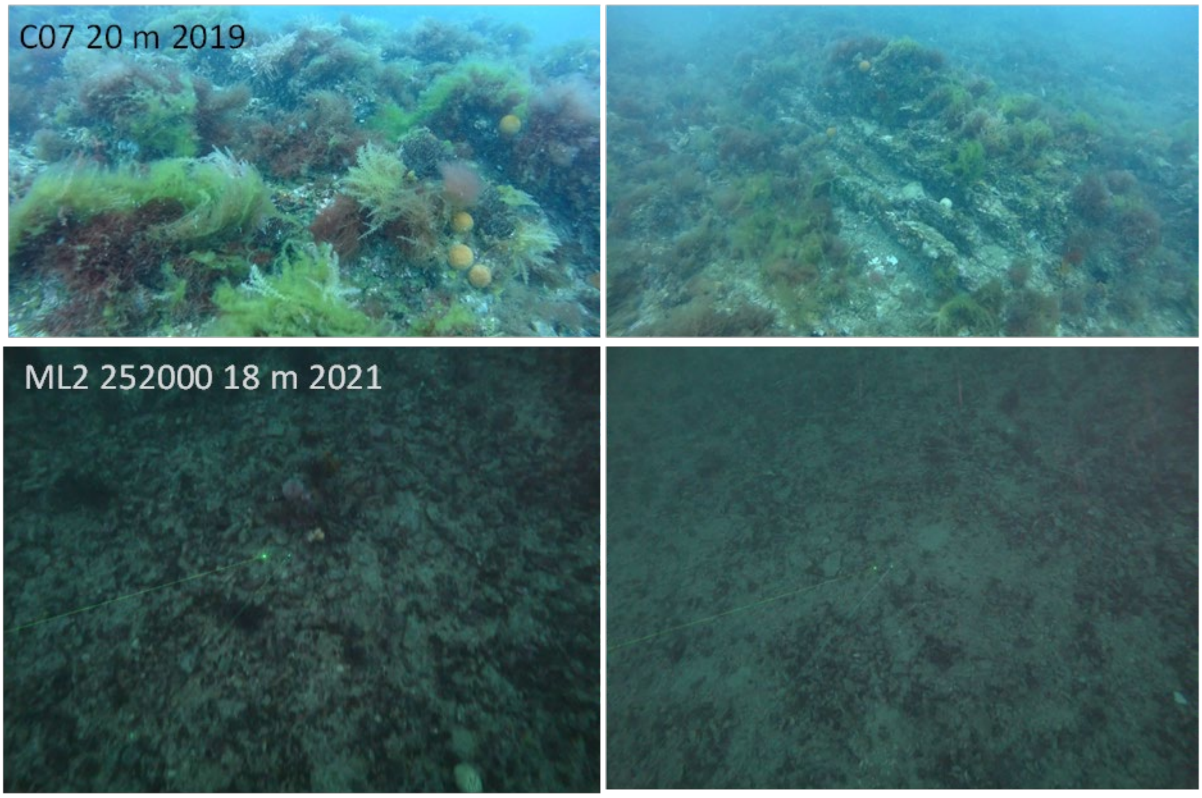


Figure 5-10. Rock reef and cobble habitat, ~20 m depth Jan 2019 (top) and Aug 2021 (bottom)

Figure 5-11. Rock reef and cobble habitat, ~24 m depth Jan 2019 (top) and Aug 2021 (bottom)

5.2.2 Sand and gutter seabed habitat

Seamap, aerial images and the 2020 Fugro geophysical survey results demonstrate that the seabed along the Marinus Link alignment offshore from Heybridge comprises a mosaic of reef of varying relief, expanses of cobble and areas of sand. Images of the sandy seabed including the disused Tioxide pipeline in this area is shown in Figure 5-12 and Figure 5-13.

The two Marinus Link alignments (Western cable ML1, Eastern Cable ML2) were carefully determined to emerge from their directionally-drilled boreholes into sand offshore from Heybridge. The cable routes then follow a series of sand gutters that weave through the rock and cobble outcrops to a distance around 3 km offshore, before they converge around 4 km offshore at ML1 249,000 and ML2 250,000.

The images show that the sand along the routes is medium to coarse sand with shell material. The presence of strong sand waves illustrates the effect of storm waves on the seabed in the region. There was no biota visible on the seabed in the August 2021 images or the corresponding sites from the 2019 survey.

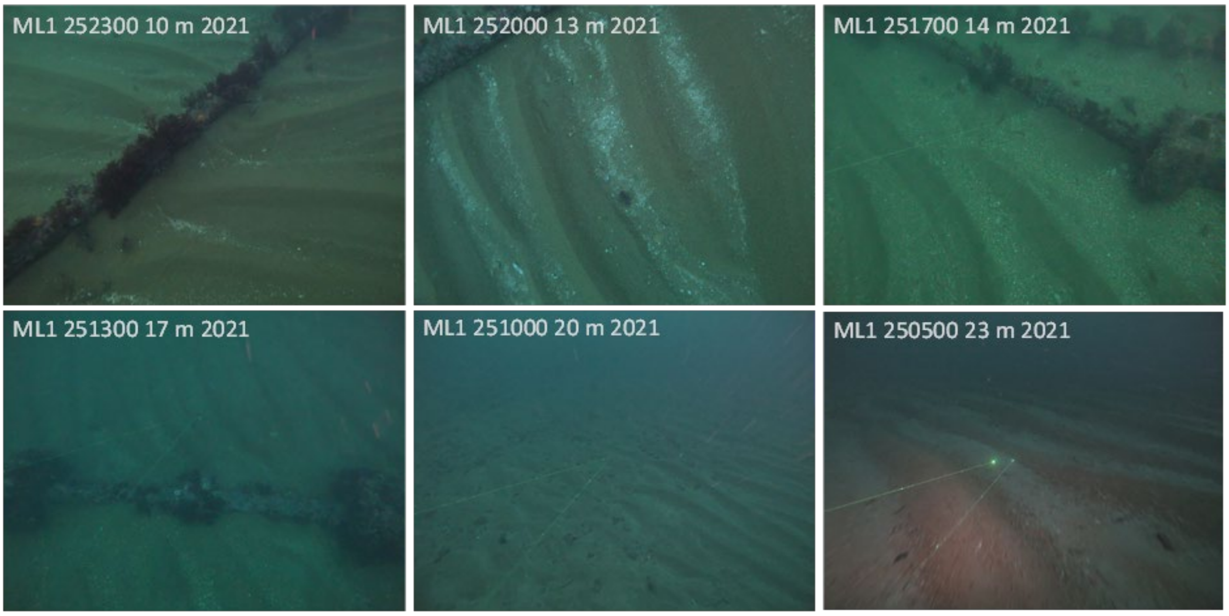


Figure 5-12. Nearshore sand seabed Heybridge alignment ML1

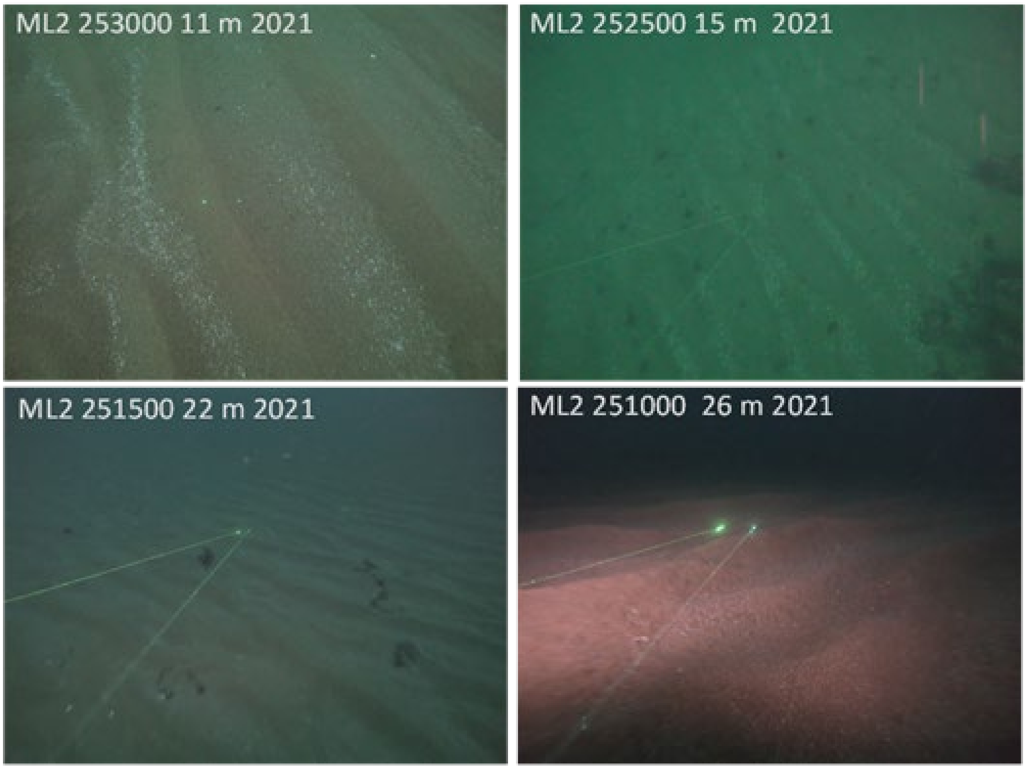


Figure 5-13. Nearshore sand seabed Heybridge alignment ML2

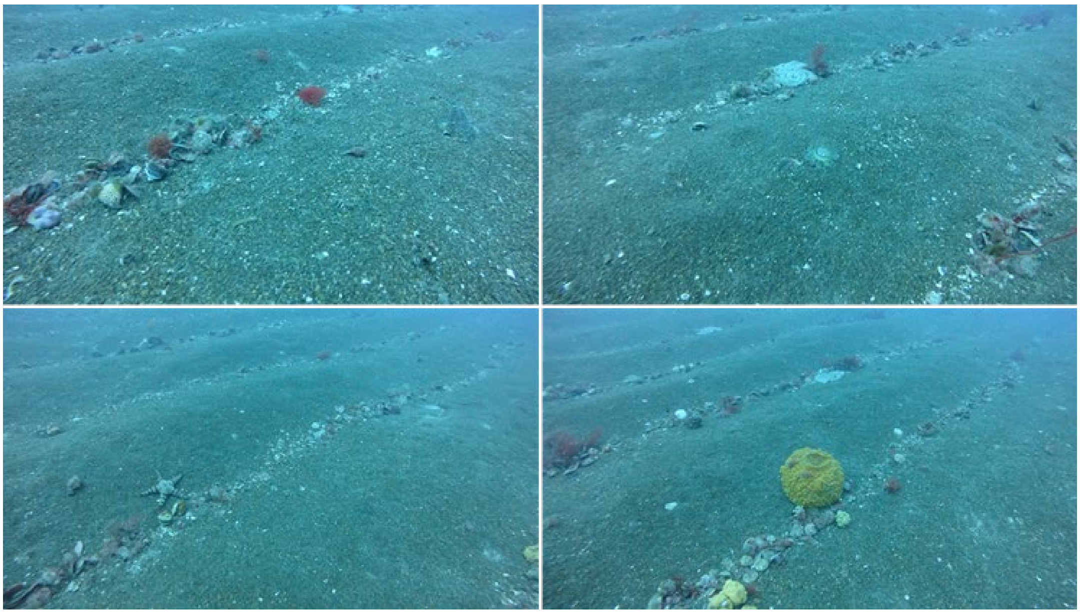
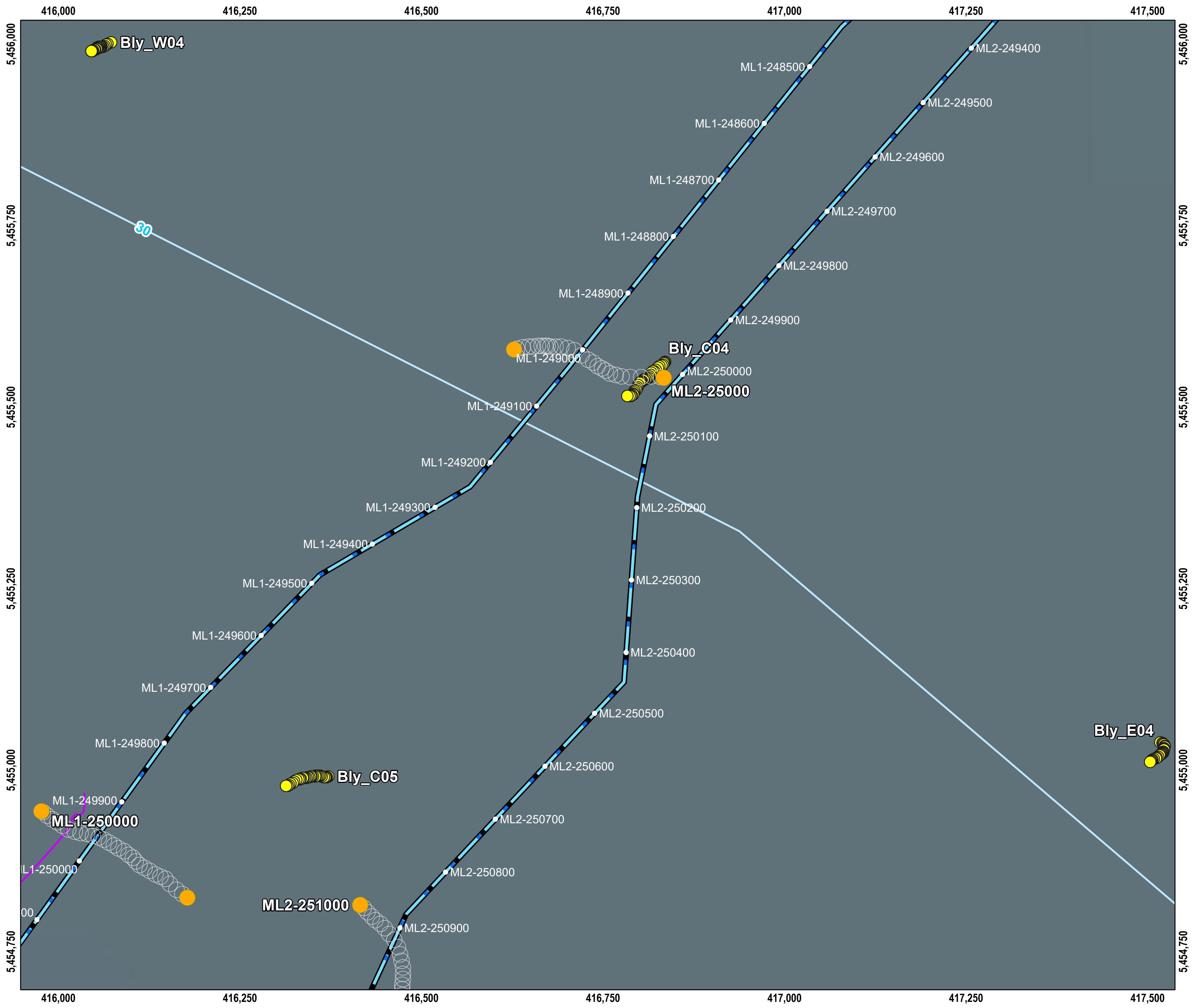


Figure 5-14. Seabed at ML2 250,000 (C 04 2019, 25 m)



MARINUS LINK

LEGEND

- 2019 seabed survey sites

2021 seabed survey sites

- Waypoint
- Track
- Proposed HVDC subsea cable
- Former tioxide plant outfall pipeline

SOURCE
Proposed route from Tetra Tech Coffey.
Underwater survey sites from CEE.
Bathymetry and tioxide pipeline from Fugro. (2020).
Imagery from ESRI Online.

0 75 150 m

SCALE 1:7,500
PAGE SIZE: A4
PROJECTION: GDA2020 MGA Zone 55

MARINUS LINK PTY LTD

MARINUS LINK
EIS/EES

FIGURE 5-15

Camera tows at ML2 250 000 in 2019 and 2021

TETRA TECH COFFEY

DATE: 16.05.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CEE_EIS_F005.15

Figure 5-15 shows that images of the seabed at around ML2 250,500 were taken in 2019 (Site Bly_C04) and 2021 (Site ML2 250,000). Images of 2019 tow are shown in Figure 5-14 and the western end of the 2021 tow are shown in Figure 5-16. The water depth at these sites was 31 m. The images are clearest from the 2019 survey, which show the same sand-waves noted at the sites closer to shore. Whereas the seabed at adjacent site 'ML1 250,000' in 2021 was cobble. Sea conditions during the 2021 August survey prevented better imagery at this site, but it is apparent that there may be some areas patches of rubble among sand at this location.

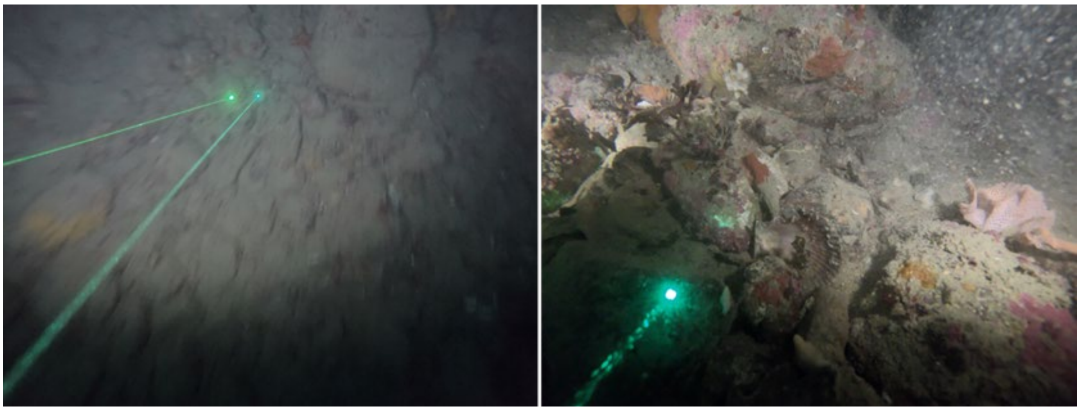


Figure 5-16 Seabed at ML1 249,000 (2021)

5.2.3 Tioxide pipeline

The nearshore section of the western alignment from emergence at ML 252,300 follows the same series of sand gutters through the reef outcrops as the disused Tioxide waste discharge pipelines that terminate at ML1 249,900. Hence the western cable follows the same route as the disused pipelines for approximately 2,400 m. Parts of the pipelines are visible in Figure 5-12, including a section of two pipes merging at ML 251,700.

The pipeline at January 2019 survey sites W08 (ML1 251,380), W09 (ML 251,850) and W10 (ML1 252,250) are shown in Figure 5-17 and Figure 5-18. The images show the medium to coarse sand waves at sites W08 and W09. The pipeline in the images at W10 is located on the lower edge of a rock outcrop at this location (middle picture), with sand further to the west of the pipeline (photo at right of series).

The biological assemblage on the disused outfall pipeline shows the nature of marine biological growth that may colonise the external iron casing of a transmission cable laid across the seabed in this area of the north coast. Comparison of the biological growth on the pipeline in Figure 5-17 and Figure 5-18 compared to the lack of macroalgae in Figure 5-12 illustrates the seasonality of the biological growth in this region, which is also described for the Basslink cable at Five Mile Bluff located 80 km east of Heybridge (CEE 2021, Sherwood et al 2016).

Figure 5-17. Disused Tioxide pipeline, Jan 2019
ML1 251,380, ML 251,850 and ML 252,250,

Figure 5-18. Disused Tioxide pipeline at Blythe River, January 2019
Left: Site W09, (12-13 m depth), Right: W08 (15-16 m depth)

The outfall pipeline discharged rust-red ferro sulphate waste residues until closure of the Tioxide Plant in 1996. Sites C05, C06, W05 and W06 are 500 m to 1,000 m from the discharge point from the old outfall. Representative images of the seabed at each of these sites are shown in Figure 5-19. The video and images from these sites show no evidence of residual material on the seabed. The seabed at each of these sites showed evidence of frequent mobilisation by waves and currents and comprised sand, shell and cobble substrates.

After more than 20 years of oceanographic processes (since tioxide waste discharge ceased) there is no longer any visual evidence of the residues.

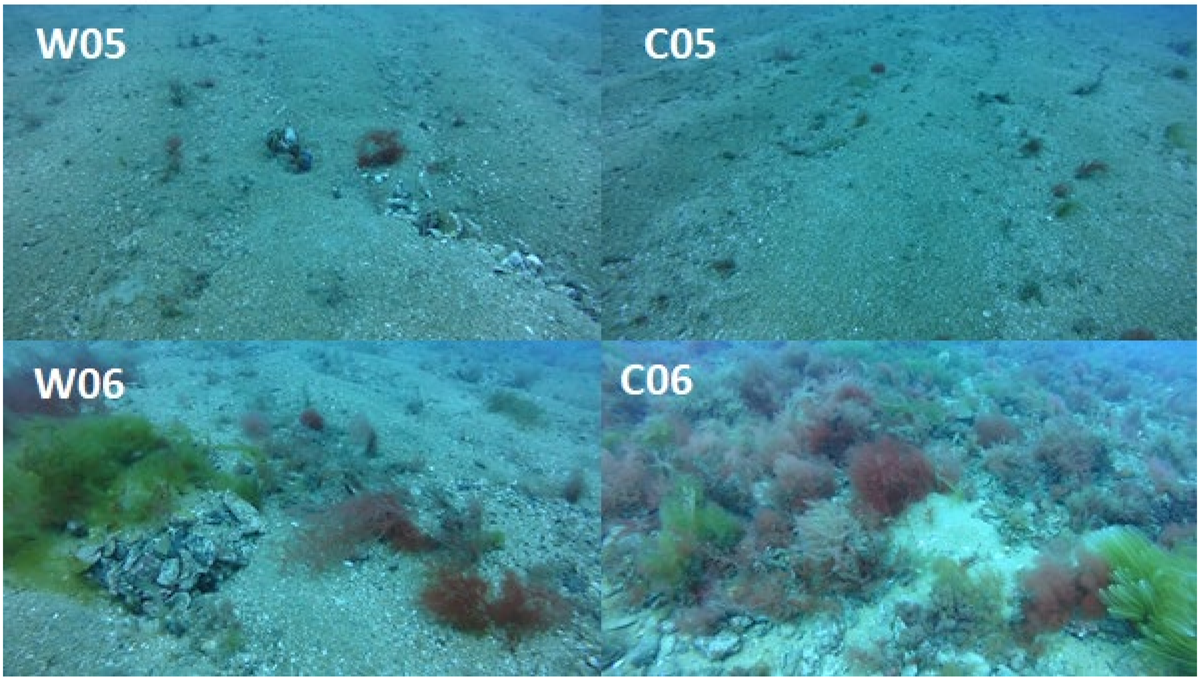


Figure 5-19. Seabed images at sites nearest decommissioned Tioxide outfall

5.2.4 Seagrass

There was no seagrass at any of the Heybridge survey sites surveyed in 2019 and 2021, including 2019 sites W09, C09 and W10, which were located within 150 m of a small area of seabed that was mapped as seagrass in Seamap (Figure 5-4). It is possible that the Seamap mapped seagrass (Figure 5-20) was a small, isolated patch of *Amphibolis antarctica* seagrass, which is distributed on cobble and broken reef seabed close to shore along the north coast. However, Figure 5-20 shows that the water depth at the isolated patch offshore from Heybridge was around 13 m, where available light may limit seagrass. It is possible that the marine vegetation at was the macroalga *Caulerpa* which is common on reefs and cobble at similar depths along the north coast. *Heterozostera tasmanica* is found in clearer waters to the west, such as Sisters Beach, where it grows on fine sand seabed.

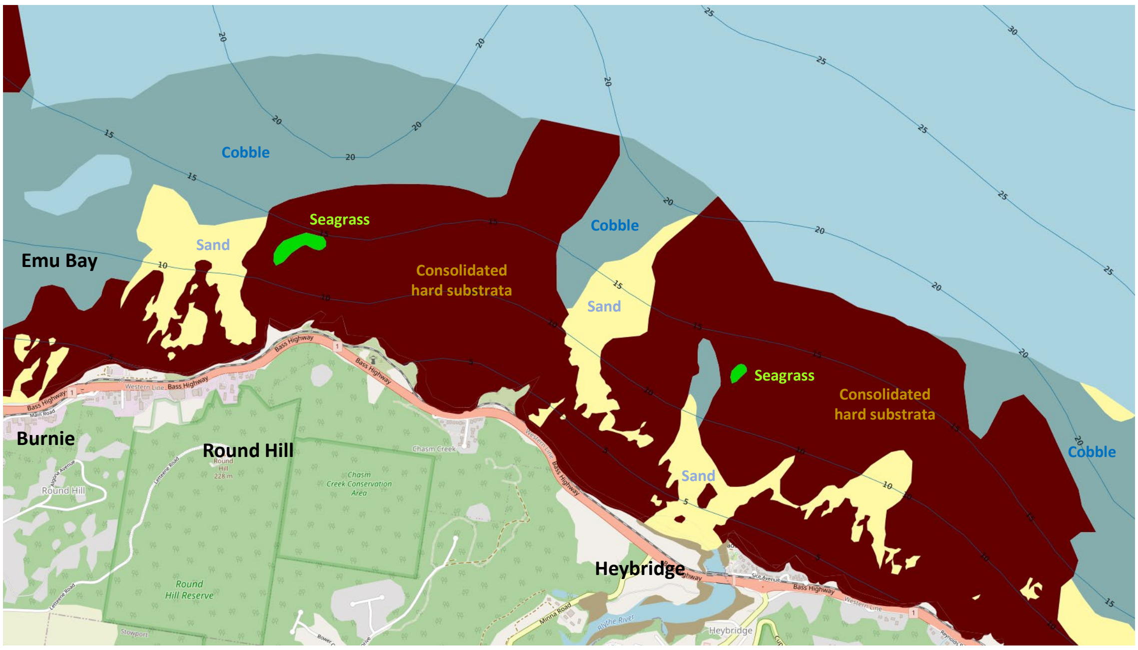


Figure 5-20. Seamap Australia habitat and seagrass distribution at Heybridge
https://seamapaustralia.org/map/# May 2023

5.3 Biological characteristics of benthic habitats at Heybridge

The original characterisation of the marine community of Tasmania's north coast Boags Bioregion including species lists is provided in Edgar et al. (1992). Marine communities of the reefs have been observed in this area during studies of wastewater discharges from the sewage treatment plants at Round Hill (Burnie), Pardoe (Devonport), Boat Harbour and Sisters Beach and former paper mills in Emu Bay (Burnie) and Wesley Vale (Devonport) by CEE marine biologists over the past three decades. These surveys, as well as the Marinus Link surveys, describe the associated habitats with rock reef habitat, cobble habitat, sand and sand gutter habitat and seagrass habitat along the Marinus Link alignments near the Heybridge landfall.

5.4 Summary of Heybridge Seabed Habitat and Community

The Marinus Link alignments within around 4 km of the shoreline at Heybridge follow sand gutters that weave through the extensive rocky outcrops that characterise the nearshore seabed on this part of central northern Tasmanian coast.

The sandy seabed at sites shallower than 30 m depth comprises relatively bare, mobile medium to coarse sand and shell, with no associated biota visible during the 2019 and 2021 surveys. The troughs of the seabed habitat at sites deeper than about 30 m contained unattached biota including doughboy scallops and predatory seastars as well as sparsely distributed solitary anemones, scallops and flathead.

The reef biological community showed strong seasonal differences between the January 2019 survey and the August 2021 survey. The reefs during summer supported a range of invertebrates and macroalgae. Filamentous ephemeral green and red macroalgae (seaweeds) dominated the reefs in summer. Larger long-lived brown algae (*Cystophora* and *Ecklonia*) were restricted to depths less than around 5 m. Invertebrates were more abundant in images from sites over 20 m. This contrasted strongly with the community in winter, when most filamentous seaweeds were absent and the reefs were characterised by bare rock with some encrusting coralline red algae, encrusting invertebrates and solitary ascidians.

The strong seasonality is likely to be a consequence of light availability to the marine algae that dominate the reefs. Low light due to turbidity from runoff, low sun angle and less daylight combine to result in dormancy of the nearshore marine community over winter.

No seagrasses were observed at any survey sites offshore from Heybridge.

6 Central Bass Strait alignment, > 6 km offshore

6.1 Bass Strait Survey Sites

A total of 32 sites were surveyed on the subsea alignments by towed underwater camera at sites greater 40 m depth and further than 6 km offshore across Bass Strait from ML 250,000 to ML 8,000 in 2021. This section describes the seabed from ML 250,000, which is the crossover at Heybridge Section in Tasmania (see Section 5.2.2) to the Waratah Section at ML 8,000.

The locations of the 2021 sites are shown across Bass Strait in Figure 6-1, and a cross-section of Bass Strait is shown in Figure 6-2. The location and depths of the sites are listed in Table 6-1. The camera was towed from one link alignment to the next at ML 8,000 and ML10,000 locations, where the alignments were 80 m apart. Cameras were towed across the seabed for approximately 100 m at most other sites. A map of the Bass Strait section is provided in Figure 6-1 while Figure 6-2 provides a cross section of the chainage to show depth. The dots on the cross section show the major KPs.

LEGEND

- 2021 seabed survey sites
- Landfall

Proposed route (2021)

- HVDC subsea cable
- Underground HVDC cable

MARINUS LINK

15 0 15 km

SCALE **1:1,250,000**

PAGE SIZE: **A4**

PROJECTION: **GDA2020 MGA Zone 55**

SOURCE

Proposed route from Tetra Tech Coffey.

Seabed survey sites from CEE (2021).

Imagery from ESRI Online.

MARINUS LINK PTY LTD

MARINUS LINK

EIS/EES

FIGURE 6-1

Location of seabed survey sites greater than 40 m depth across Bass Strait

TETRA TECH COFFEY

DATE: **16.05.24** PROJECT: **754-MELEN215878ML** FILE: **215878ML_CEE_EIS_F006.1**

DOC REFERENCE: \\TT.LOCAL\COFS\772\GIS\GIS\215878_MELEN_TASNETWORKS_PROJECTMARINUS\GIS\MXD_APRX\215878ML_CEE_EIS\215878ML_CEE_EIS_F011_F020.APRX LAYOUT:215878ML_CEE_EIS_F006.1_1 SAVED BY: HELEN.UNKOVICH 16.05.24 4:51 PM

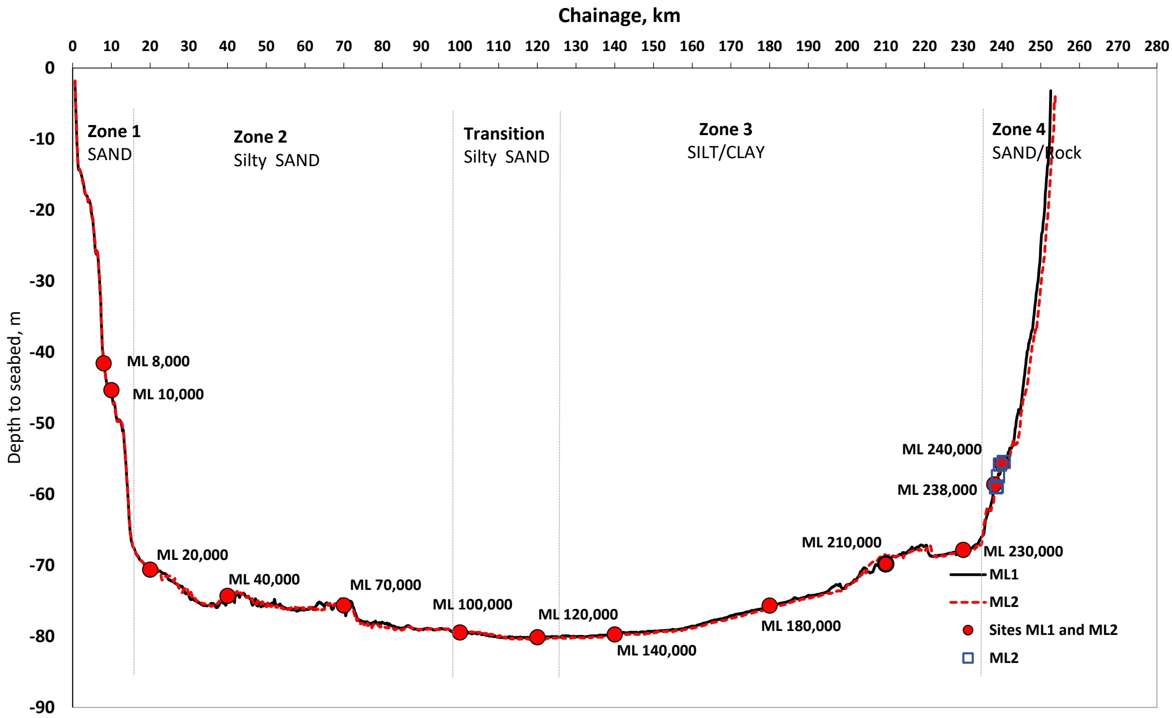


Figure 6-2. Seabed depth at sites greater than 40 m depth across Bass Strait

Table 6-1. Position and depth of towed camera sites

Post_Name	Easting	Northing	Depth, m	Date surveyed
ML1-240,000	421205	5463158	55.7	27 Aug 2021
ML1-210,000	422573	5492886	69.8	27 Aug 2021
ML1-238,000	421997	5464993	58.6	27 Aug 2021
ML1-230,000	422780	5472887	67.8	27 Aug 2021
ML1-180,000	422334	5522885	75.7	26 Aug 2021
ML1-140,000	421906	5562882	79.2	26 Aug 2021
ML1-120,000	421692	5582881	80.1	26 Aug 2021
ML1-100,000	421477	5602880	79.4	26 Aug 2021
ML1-70,000	421156	5632878	75.6	26 Aug 2021
ML1-40,000	420835	5662876	74.3	24 Nov 2021
ML1-20,000	420852	5682871	70.6	24 Nov 2021
ML1-10,000	421359	5692858	45.3	24 Nov 2021
ML1-8,000	421461	5694855	41.6	24 Nov 2021
ML2-240,500	422485	5462876	55.5	27 Aug 2021
ML2-240,000	422684	5463335	55.6	27 Aug 2021
ML2-239,500	422793	5463814	55.8	27 Aug 2021
ML2-239,000	422811	5464313	57.5	27 Aug 2021
ML2-238,700	422832	5464608	58.9	27 Aug 2021
ML2-238,500	422982	5464740	59.0	27 Aug 2021
ML2-238,000	423357	5465071	60.0	27 Aug 2021
ML2-230,000	424422	5472969	67.7	27 Aug 2021
ML2-210,000	424573	5492953	68.6	27 Aug 2021
ML2-180,900	424274	5522052	75.8	27 Aug 2021
ML2-140,000	423854	5562949	79.9	26 Aug 2021
ML2-120,000	423649	5582948	80.4	26 Aug 2021
ML2-100,000	423443	5602947	79.4	26 Aug 2021
ML2-70,000	421156	5632878	75.2	26 Aug 2021
ML2-40,000	422827	5662944	75.1	24 Nov 2021
ML2-20,00	422082	5682899	70.1	24 Nov 2021
ML2-10,000	421435	5692831	45.5	24 Nov 2021
ML2-8,000	421527	5694828	41.6	24 Nov 2021

6.2 Seabed Habitat and Biological Characteristics

The physical factors of seabed composition, water depth and wave turbulence and latitude are strong influences on the nature of the associated biological community. There were no rock outcrops on the Bass Strait alignment camera tows; therefore, the biological community at all sites was characterised as soft seabed assemblages.

The composition of the soft seabed varied with depth across Bass Strait due to decreased wave action on the seabed as water depth increased. The nature of the biological assemblages correspondingly varied with depth. The biological assemblages along the cable alignment are described in terms of the five zones of seabed character identified (Figure 6-2) in the preceding sections.

6.2.1 ML 250,000 to ML 249,000 (water depth 25 m to 41 m, C04 to C001 2019)

The seabed along this section of the alignment showed decreasing influence of wave action on the seabed. No seagrass was present at any sites which is expected due to the depth. One individual sea pen of *Sarcoptilus grandis* was observed.

The seabed at 31 m water depth (ML 2 250,000 or 2019 site C04) showed distinct medium- to coarse-grained sand waves. Shell and other organic material including living and empty doughboy scallops had accumulated in the sand wave troughs (Figure 6-3). Eleven arm seastars, *Coscinasterias muricata*, were observed feeding on the scallops and this species is likely responsible for the many still-joined dead shells in the images. Observed doughboy scallops at this site were unattached to the seabed. Other biota observed on the medium to coarse sands at this site included solitary anemones and sand flathead fish.

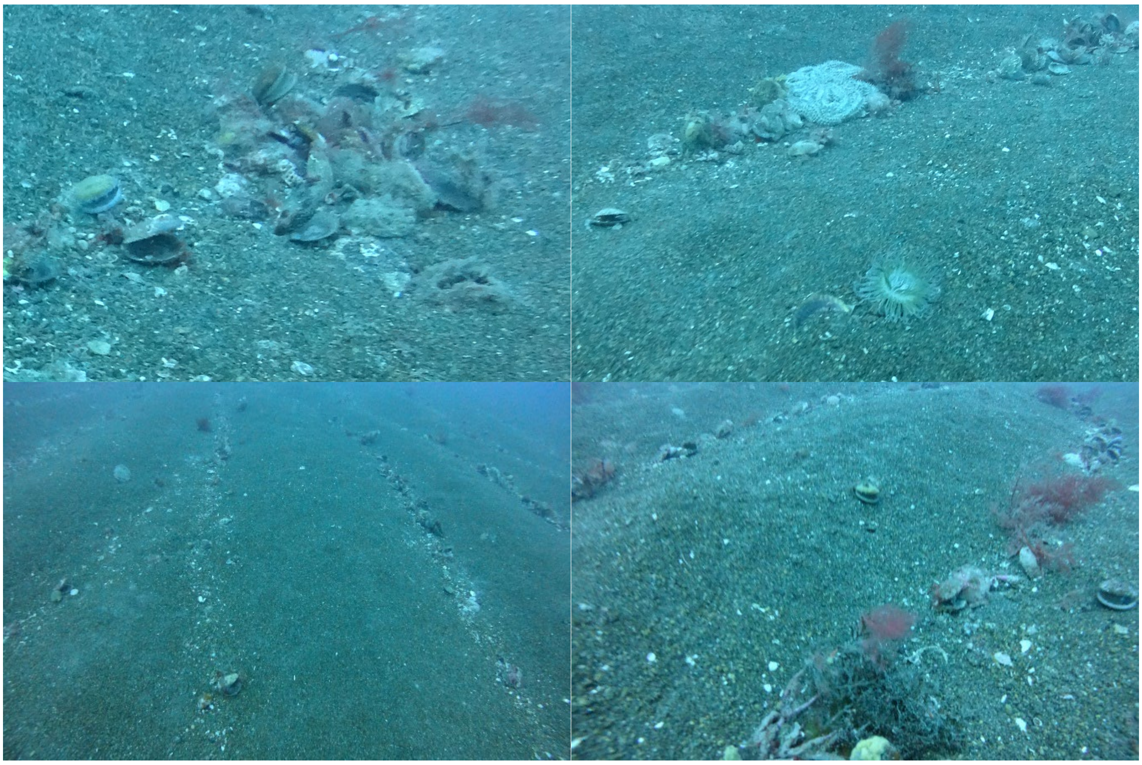


Figure 6-3. Biota on sand seabed at depth 25 m depth (2019 site C04)

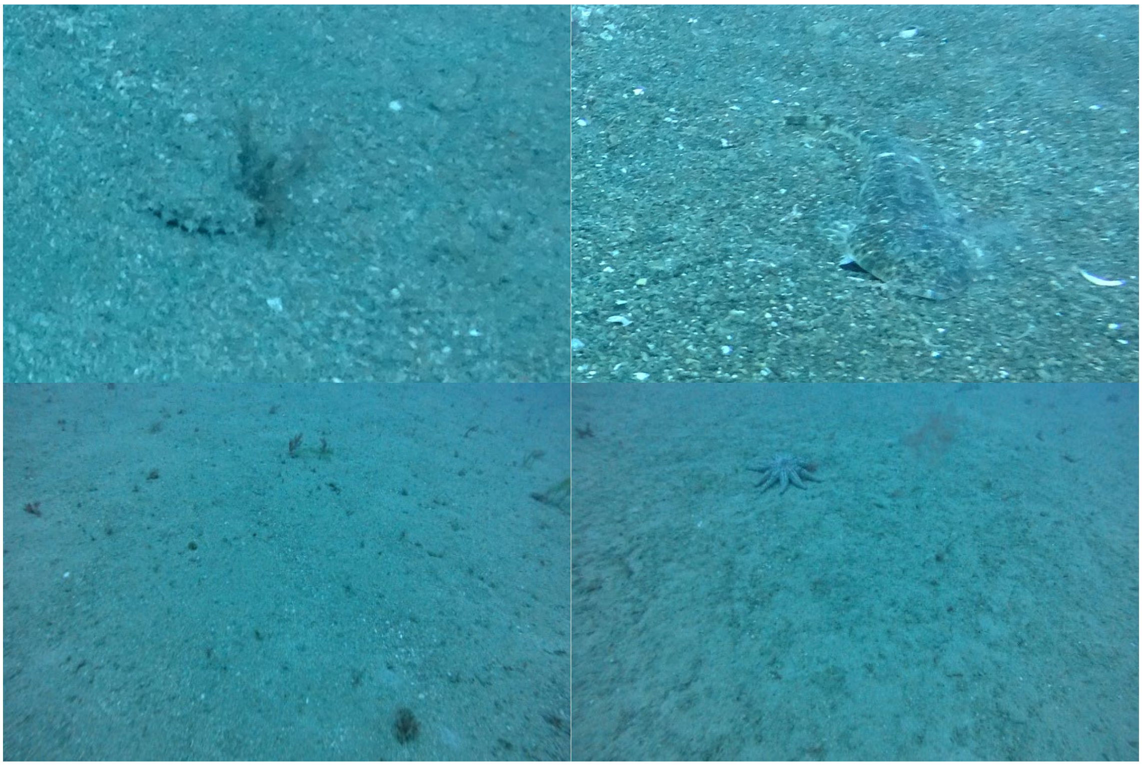


Figure 6-4. Seabed biological community 35 m (2019 site C03)

The seabed at 35 m water depth (ML 2 249,300 or 2019 site C03) was notably finer and flatter than the 31 m site, with substantially lower shell content. Epibiota were sparse including doughboy scallops commercial scallops, eleven arm seastar *Coscinasterias muricata.* The small, stalked bryozoan *Lanceopora smeatoni* appears as small black shapes was present. The green alga *Caulerpa longifolia* was present in low abundance. Doughboy scallops were sparsely scattered over the seabed, while commercial scallops were present but scarce. (Figure 6-3).

The seabed at 38 m depth (between ML1 247,300 or 2019 survey site C02) comprised finer sand and less shell than the shallower sites and the seabed was relatively flat with low undulations rather than the distinct sand waves evident at the shallower sites. The small, stalked bryozoan *Lanceopora smeatoni* appears as small black shapes was more common than the 35 m site. The green alga *Caulerpa longifolia* was present in low abundance. Doughboy scallops were sparsely scattered over the seabed, while commercial scallops were present but scarce.

Figure 6-5. Seabed biological community 38 m (2019 site C02)

The seabed at 41 m water depth corresponding to ML 246,200 (2019 survey site Bly 001) was characterised by a flat sandy seabed with no obvious burrow mounds (Figure 6-6). Visible epibiota were sparse. The small, stalked bryozoan *Lanceopora smeatoni* was present in higher abundance than the shallower sites Figure 6-6. The colour of these invertebrates is actually red, but they appear black without artificial light in the image because red light is removed by the water column. Other biota included the green alga *Caulerpa longifolia* and sparsely distributed commercial (*Pecten fumatus*) and doughboy (*Chlamys asperrima*) scallops. A school of small pelagic fish (possibly juvenile mackerel or Australian snapper) followed the camera at this site.

Figure 6-6. Seabed biological community 41 m (Site C01, 2019)

6.2.2 ML 240,500 to ML 238,000 (water depth 55 m to 60 m)

Figure 6-7 shows the seabed at 55 m to 60 m water depth. The seabed along this section of the alignment was relatively flat, with distinct low sparsely distributed mounds and burrow holes and increasing amounts of mixed sponge/bryozoan assemblages scattered over the otherwise bare seabed. Encrusted eunicid worm tubes were present.

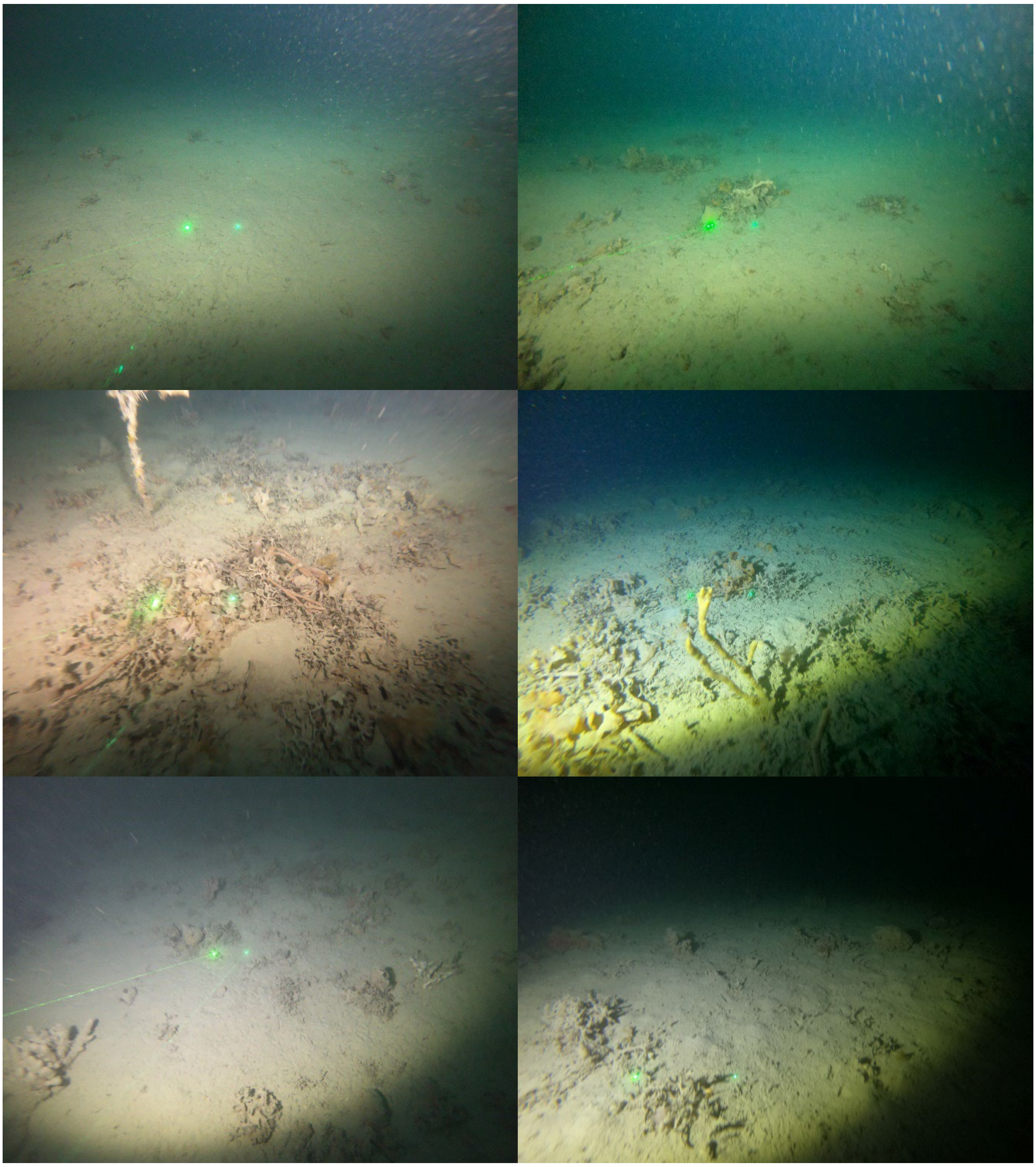


Figure 6-7. Seabed biological community ML 240,500 to 238,000

6.2.3 ML 230,000 to ML 180,000 (water depth 68 m to 76 m)

The seabed ML 230,000 to ML 180,000 was characterised by silt with abundant mounds of burrowing biota (Figure 6-8). The seabed in images from these sites was otherwise bare except for the re-appearance of sparsely distributed overgrown worm tubes at ML 230,000, together with a slender branched soft coral (octocoralline), which can be seen with extended tentacles in Figure 6-9.

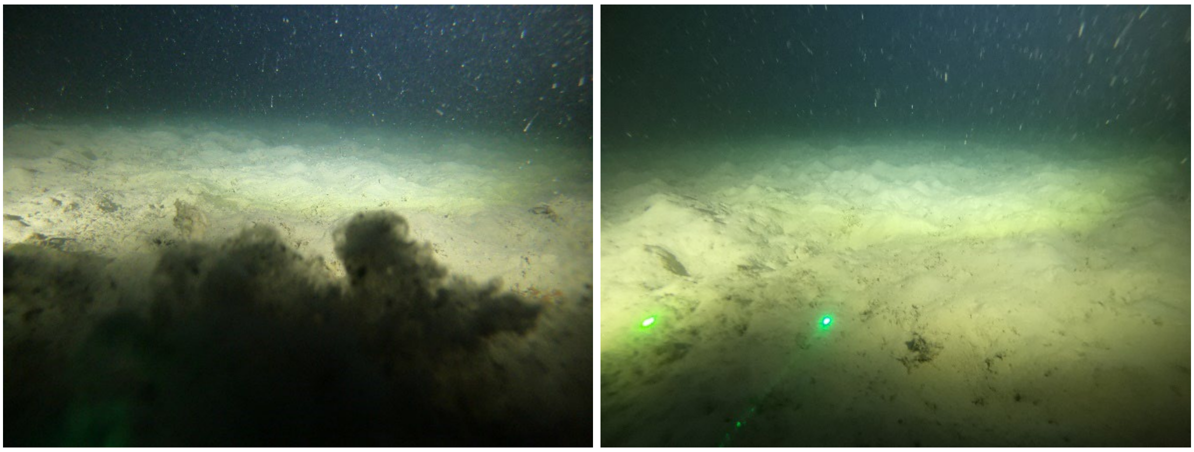


Figure 6-8. ML 230,000 to ML 180,000 Typical seabed of burrow mounds

Figure 6-9. ML 230,000 Encrusted eunicid worm tubes and soft coral (right)

6.2.4 ML 140,000 to ML 100,000 (water depth ~80 m)

The seabed along this section of the alignment was fine silt with mounds, dimples and open holes from biological activity below the seabed surface. Thin opaque worm tubes (possibly Orbiniid) were abundant in some patches at ML 100,000. Epibiota at these three sites were scarce, with individual sponges or small patches of mixed invertebrates including sponges, bryozoans, ascidians and branching soft corals scattered over the otherwise bare seabed surface (Figure 6-10).

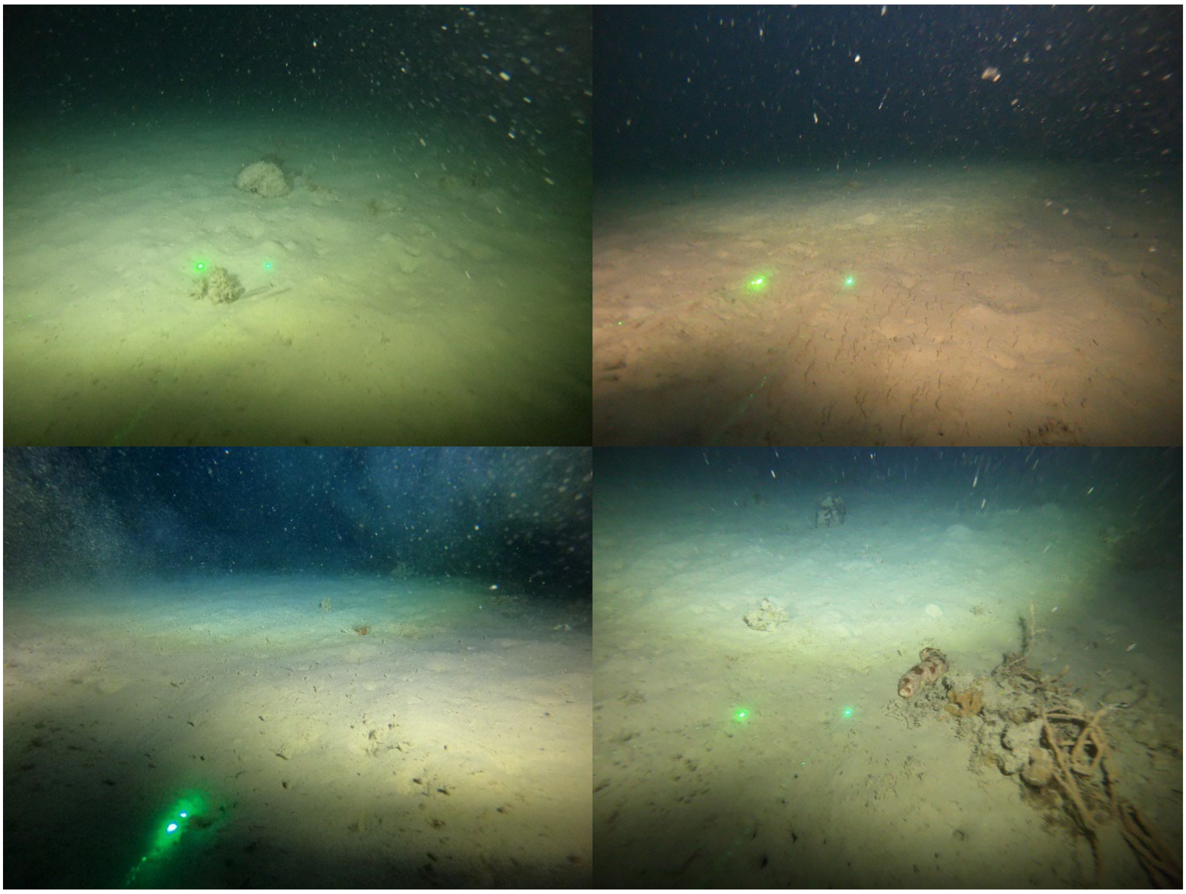


Figure 6-10. Seabed community at ML 140,000 to ML 100,000

6.2.5 ML 70,000 and ML 40,000 (water depth ~75 m)

The seabed along this section of the alignment was flat, compacted silty sand. Eunicid worm tubes were absent at ML 70,000 and scarce at ML 40,000. The seabed community at ML 40,000 (Figure 6-11) included patches of small opaque worm tube openings likely to represent the presence of Eunicidae or Onuphidae polychaete worms below the seabed surface. Unidentifiable low growth over the seabed probably represented early growth of encrusting or colonial invertebrates such as sponges, bryozoans and hydroids. The small, stalked hydroid *Lanceopora smeatoni* were present individually and in small patches. Small mounds representing actively burrowing biota were present but sparsely distributed.

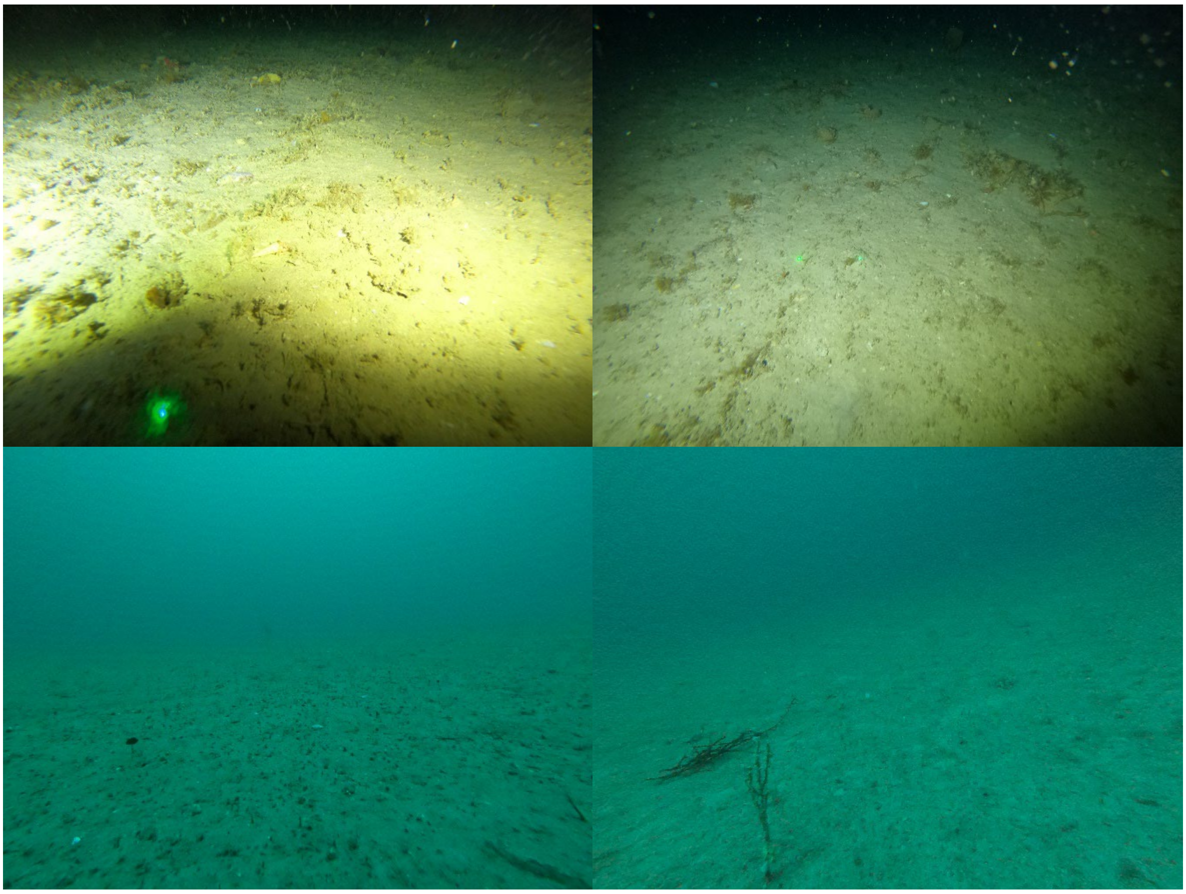


Figure 6-11. Seabed community at ML 70,000 (top) and ML 40,000 (bottom)

The seabed invertebrate community present in its early form at ML 40,000 appears to have developed into larger colonies and individuals at ML 70,000 (Figure 6-11). Worm tubes were not visible in images.

6.2.6 ML 20,000 to ML 8,000 (water depth 70 m to 40 m)

The seabed along this section of the alignment comprised flat fine sand, with no seagrass, no sea pens and relatively little surface bioturbation indicative of burrowing infauna.

The notable biological feature of the seabed was the presence of sparsely distributed erect invertebrate colonies (Figure 6-12). This feature is likely to be the erect branched tube of a colony of Eunicid worms (Dr Robin Wilson, Museums of Victoria, *pers comm*). The tube may outlast the worm (or worms) themselves and provide a solid surface for attachment of other invertebrates such as sponges. These appeared to be most abundant at ML 8,000 (depth 42 m) with numbers appearing to decrease as depth increased to 74 m at ML 40,000. They appeared to be absent from the seabed from sites at ML 210,000 (depth 69 m) to ML 70,000 (depth 75 m) before reappearing at ML 230,000 (depth 69 m), 22 km offshore from Burnie in Tasmania. This feature appears similar to the “intermediate bushy sponge” reported in the South-East Shelf Survey (Bax and Williams 2001) and worm tube colonies identified in North Arm of Western Port (CEE 2021).

Figure 6-12. Overgrown Eunicid worm tubes: ML 20,000; ML10,000; and ML 8,000

6.3 Summary of Central Bass Strait Alignment

The Bass Strait section of the alignment from ML 250,000 m to ML 8,000 m and depths from around 25 m to a maximum of 80.5 m water depth at around ML119,000 m comprised fine sands to silts as mapped in the geophysical survey. Images of the seabed showed scarce epibiota along most of the alignment.

At 31 m water depth (ML1 250,000) the seabed showed strong medium- to coarse-grained sand waves. Shell and other organic material including living and empty doughboy scallops had accumulated in the sand wave troughs. Eleven-arm seastars *Coscinasterias muricata* were observed feeding on the scallops and was likely responsible for the many still-joined dead shells in the troughs. Other biota observed on the medium to coarse sands of this habitat included solitary anemones and sand flathead fish.

From 35 m to 38 m depth (ML1 248,300 to 247,400 m), the seabed showed some wave created undulations and progressively fewer shell fragments. Small burrow mounds were visible. *Lanceopora smeatoni* and *Caulerpa longifolia* were sparse. Doughboy scallops were sparsely scattered over the seabed, while commercial scallops were present but scarce. At 41 m depth (ML1 246,300) stalked bryozoans *Lanceopora smeatoni*, green algae *Caulerpa longifolia* were more abundant and doughboy and commercial scallops were scarce.

The seabed comprised of soft silt which was relatively flat from ML 240,000 m to ML 230,000 m (~68 m depth). Then from ML 230,000 m to ML 180,000 m (76 m depth) the sub-seabed biological activity was pronounced as abundant mounds up to around 8 cm high. The seabed surface was dimpled with burrowing biota activity from ML 180,000 m to ML 100,000 m (~80 m depth) and then became relatively flat again from ML 100,000 m to ML 70,000 m (75 m depth). Patches of entwining sponge, bryozoan and ascidians, eunicid worm tube stalks and solitary sponges became sparsely distributed over the seabed.

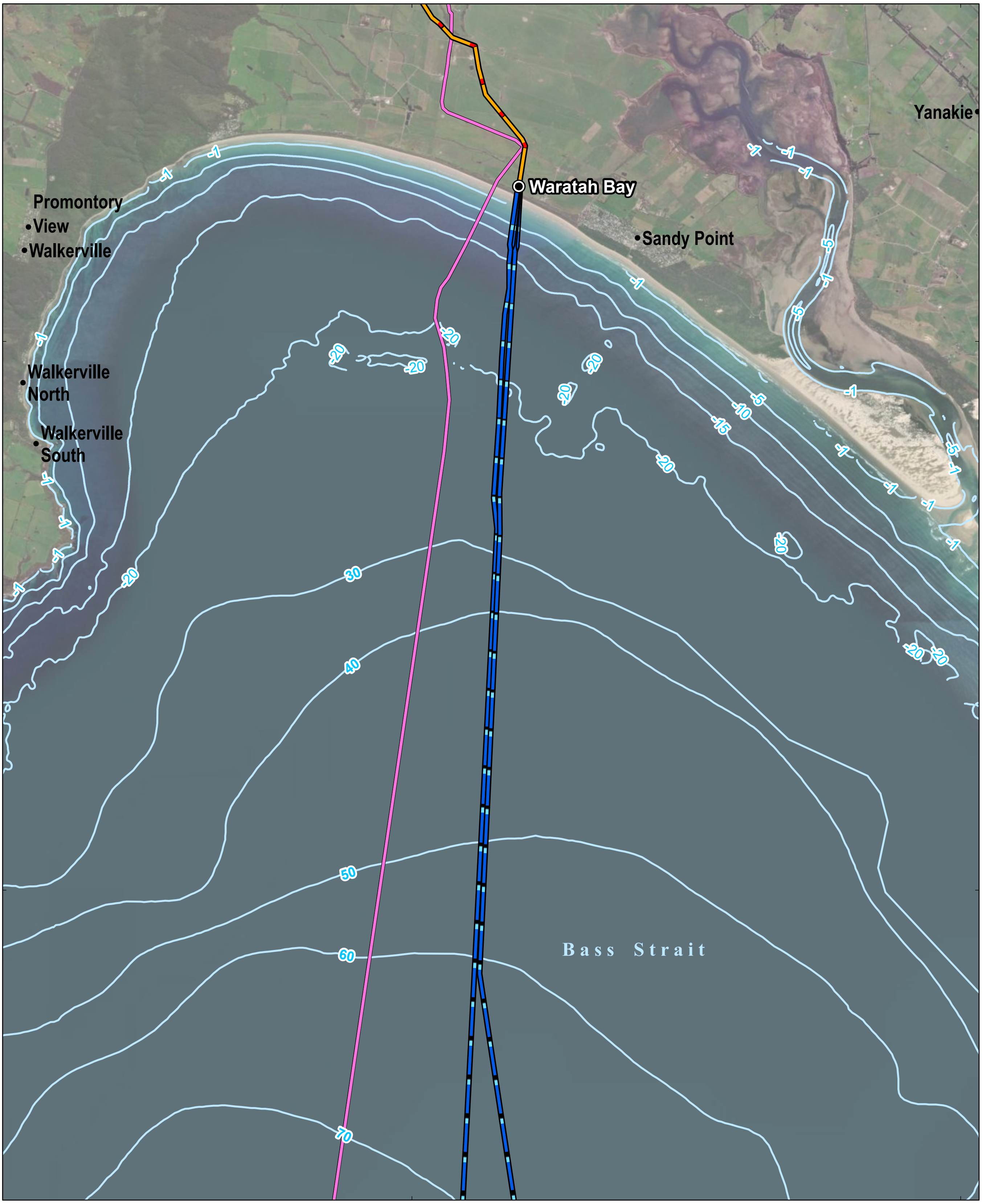
Colonial Eunicid worm tubes stalks protruded as sparsely distributed erect solitary 40 cm high stalks from the seabed at depths between around 40 m and 70 m on either side of Bass Strait. Sponges and other epibiota were scarce at depth greater than about 72 m between ML 200,000 m and ML 30,000 m.

7 Waratah Bay

Waratah Bay is a sandy bay located between rock promontories - Cape Liptrap to the west and Wilson Promontory to the east - and open to Bass Strait to the south. The Marinus Link alignments from the junction point at Heybridge to the junction point at Waratah Bay were chosen by the project in 2021 to avoid identified seabed features, such as rock reefs, as far as practical.

The seabed investigations described in this section were based on the 2021 alignment (Figure 7-1).

The nearshore alignment within 6 km of shore was modified in August 2022 due to landside considerations (Figure 7-2). The marine seabed habitats implications of the 2022 alignment are addressed in Section 7.4.



LEGEND

Landfall

Proposed route (2021)

HVDC subsea cable

Underground HVDC cable

Existing Telstra Cable

SCALE 1:100,000

PAGE SIZE: A4

PROJECTION: GDA2020 MGA Zone 55

SOURCE
Proposed route from Tetra Tech Coffey.
Imagery from ESRI Online.

MARINUS LINK PTY LTD

MARINUS LINK
EIS/EES

FIGURE 7-1

Marinus Link Waratah Bay subsea cable alignment 2021

DATE: 16.05.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CEE_EIS_F007.1

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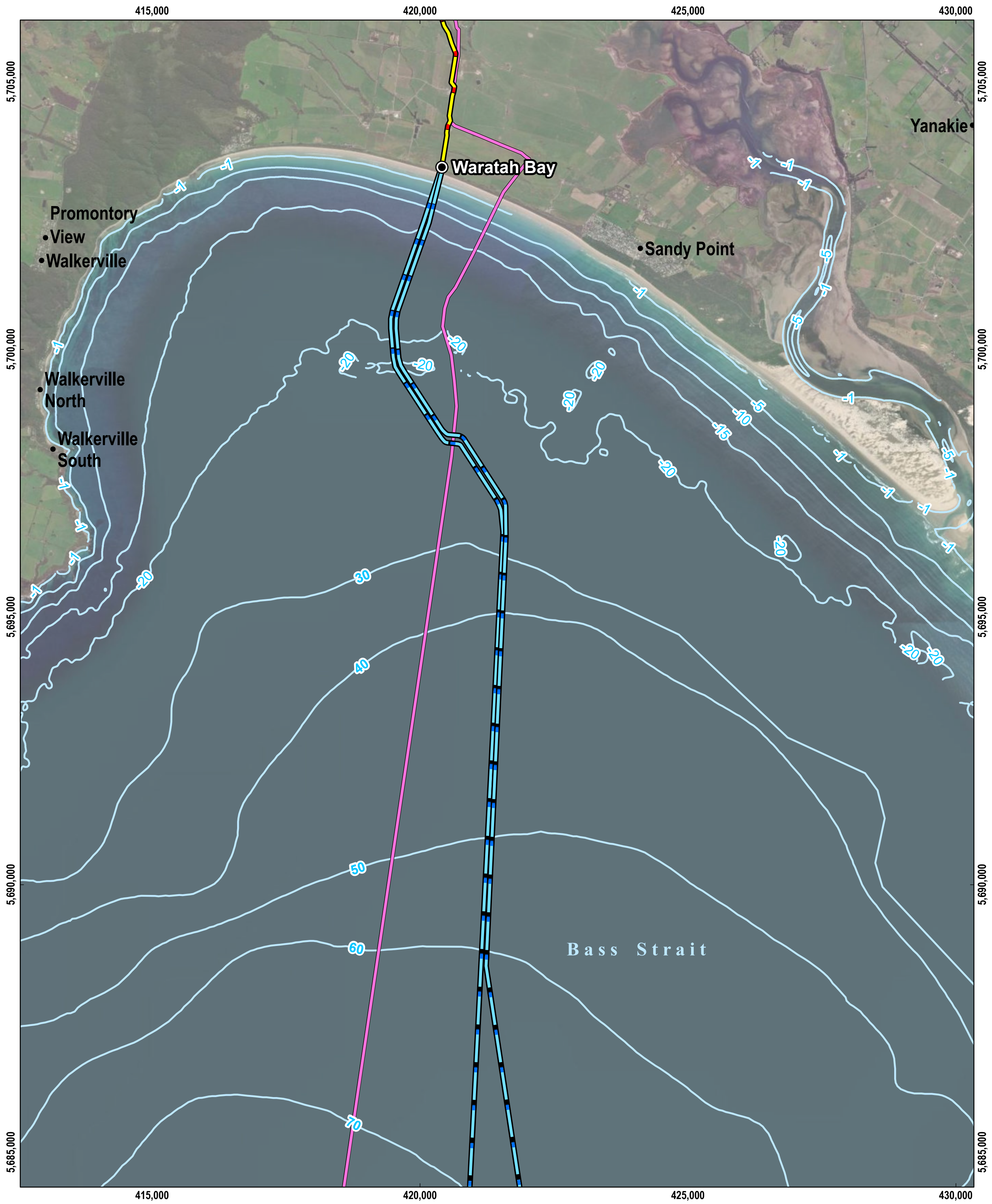
DOC REFERENCE: \\TT.LOCAL\COFS\772\GIS\215878_MELEN_TASNETWORKS_PROJECTMARINUS\GIS\MXD_APRX\215878ML_CEE_EIS\215878ML_CEE_EIS_F011_F020.APRX LAYOUT:215878ML_CEE_EIS_F007.1_1



LEGEND

Landfall

Proposed route

HVDC subsea cable

Underground HVDC cable

Existing Telstra Cable

MARINUS LINK

SCALE 1:100,000
PAGE SIZE: A4
PROJECTION: GDA2020 MGA Zone 55

SOURCE
Proposed route from Tetra Tech Coffey.
Imagery from ESRI Online.

MARINUS LINK PTY LTD

MARINUS LINK
EIS/EES

FIGURE 7-2

Marinus Link Waratah Bay subsea cable alignment August 2022

TETRA TECH COFFEY

DATE: 16.05.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CEE_EIS_F007.2

The seabed profile along the Waratah 2021 subsea cable routes (Figure 7-3) shows an initial, steep increase in depth from 7 m to 15 m over the first 500 to 600 m of the section (gradient 1:70), followed by gently-sloping, flat seabed from 15 m to 25 m over approximately 4 km (gradient of 1 in 400). A longshore trough occurs 5.8 to 5.9 km offshore, followed by a relatively steep increase in depth from 30 m to 42 m over the last 1,000 m of the offshore section (gradient of 1 in 80).

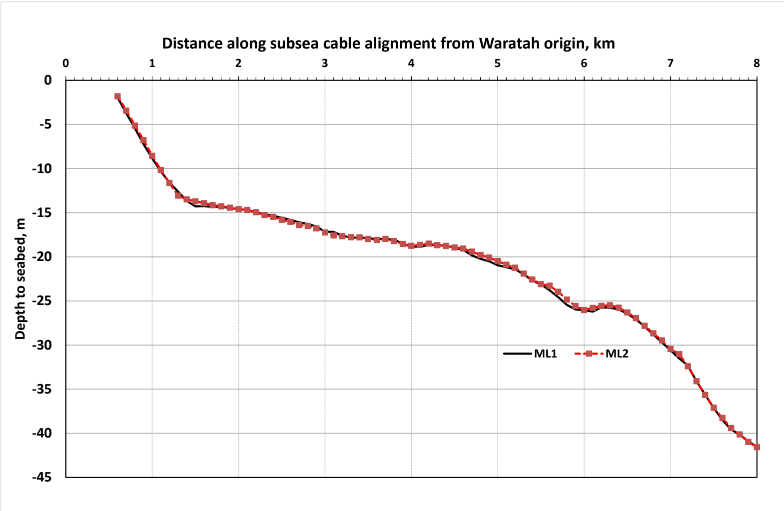
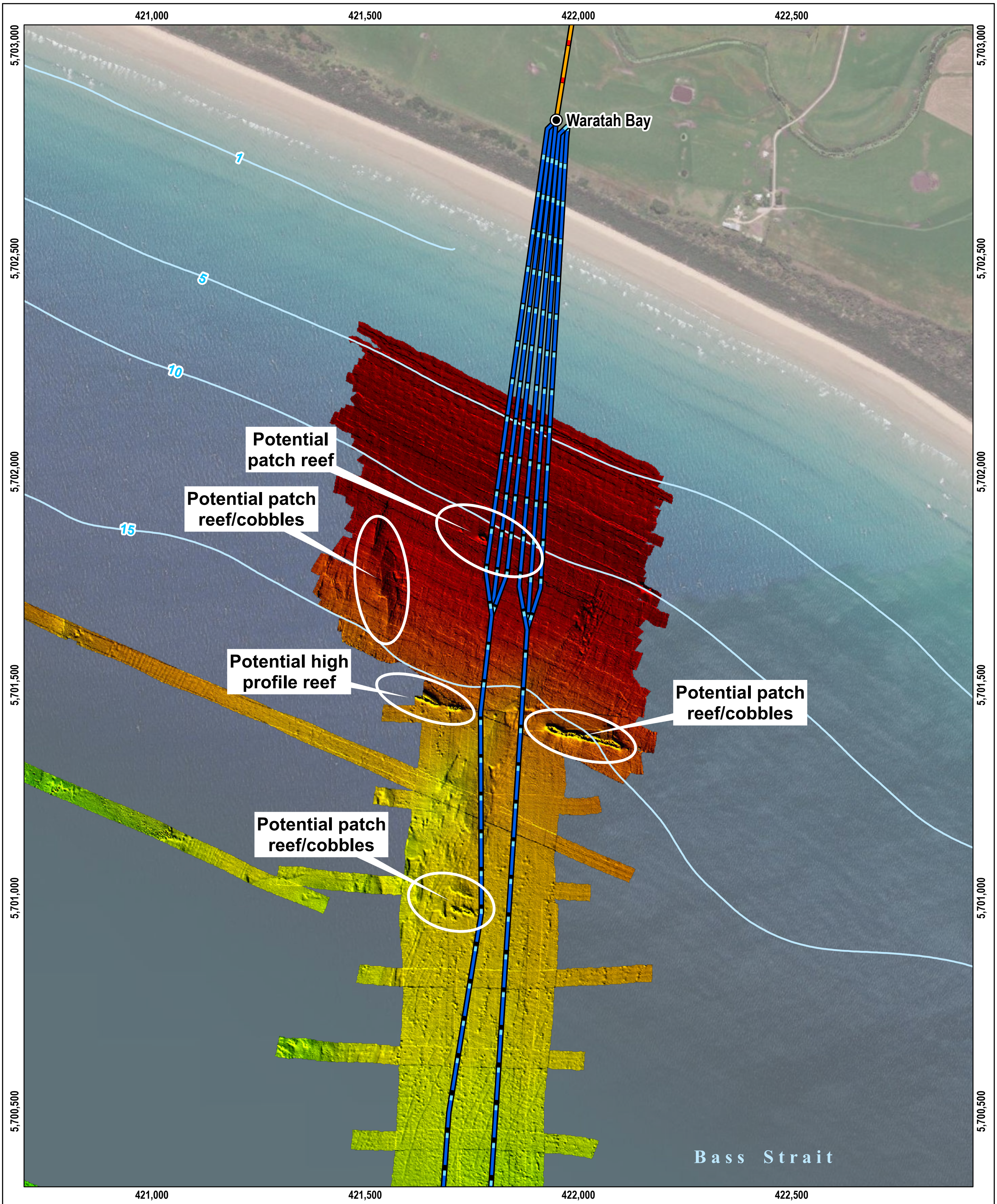


Figure 7-3. Seabed profile along Waratah Bay route
(Source: data Fugro 2020)

Side scan and multi-beam survey data show that the seabed over most of the alignments comprises sand (Figure 7-4). The Fugro 2020 geophysical data identified isolated seabed features from the geophysical survey that were distinct from the surrounding sandy seabed. These features were targeted in CEE's 2021 towed underwater camera seabed survey.



LEGEND

- Landfall

Proposed route (2021)

- HVDC subsea cable
- Underground HVDC cable
- Bathymetry (m)

MARINUS LINK

SCALE 1:12,500 (125 0 125 m)
PAGE SIZE: A4
PROJECTION: GDA2020 MGA Zone 55

SOURCE
Proposed route from Tetra Tech Coffey.
Bathymetry from Fugro (2020).
Imagery from ESRI Online.

MARINUS LINK PTY LTD
MARINUS LINK
EIS/EES

FIGURE 7-4

Waratah Bay seabed composition from 2020 geophysical survey

TETRA TECH COFFEY

DATE: 16.05.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CEE_EIS_F007.4

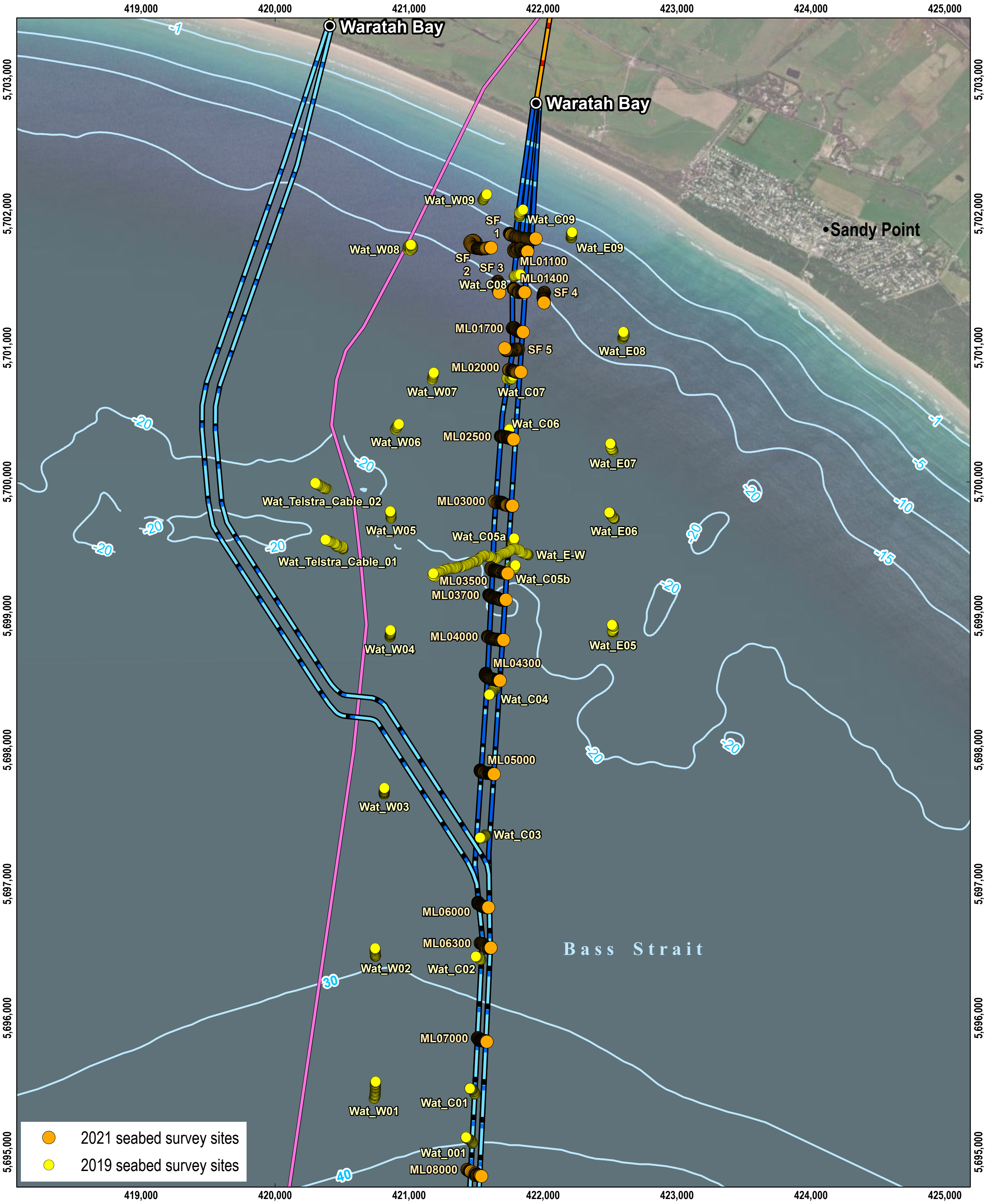
7.1 Waratah Bay survey sites (ML 0 to 8,000 m)

The positions of the 2019 and November 2021 survey sites relative to the Marinus Link 2021 and 2022 alignments and the existing telecommunications cable are shown in Figure 7-5. The paired 2021 sites represent the start and end points of continuous tows across both cable routes, or across features identified in the 2020 geophysical survey. The 2021 survey included 20 sites along the 2021 alignment to 8 km offshore (Figure 7-5).

7.2 Seabed Habitat

The Fugro seabed map (Figure 7-4) and data report outputs (Figure 7-6 and Figure 7-7) show that the seabed in Waratah Bay mostly comprise of fine to medium sands to approximately 3 km offshore, grading to medium to coarse rippled sand with areas of cobble and cobble unconsolidated sediments from 3 km to 8 km offshore. Several small patches of reef and broken reef of cobble were detected within 2 km of shore.

Figure 7-8 shows the characteristics of the seabed habitat based on towed underwater camera records at the 2019 and 2021 CEE survey sites. The seabed habitat in each image along the towed underwater camera tracks was allocated a broad category of predominantly sand, coarse unconsolidated material or rock reef. Each of these categories and their variation across the 2019 and 2021 survey sites is discussed below. Appendix A includes photographic examples of the seabed at all survey sites.



LEGEND

- Landfall

Proposed route

- HVDC subsea cable
- Underground HVDC cable

Proposed route (2021)

- HVDC subsea cable
- Underground HVDC cable
- Existing Telstra Cable
- Bathymetry (m)

MARINUS LINK

SCALE 1:40,000
PAGE SIZE: A4
PROJECTION: GDA2020 MGA Zone 55

SOURCE
Proposed route from Tetra Tech Coffey.
Seabed survey locations from CEE.
Imagery from ESRI Online.

MARINUS LINK PTY LTD

MARINUS LINK
EIS/EES

FIGURE 7-5

Waratah Bay seabed towed camera survey sites 2019 and 2021

TETRA TECH COFFEY

DATE: 16.05.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CEE_EIS_F007.5

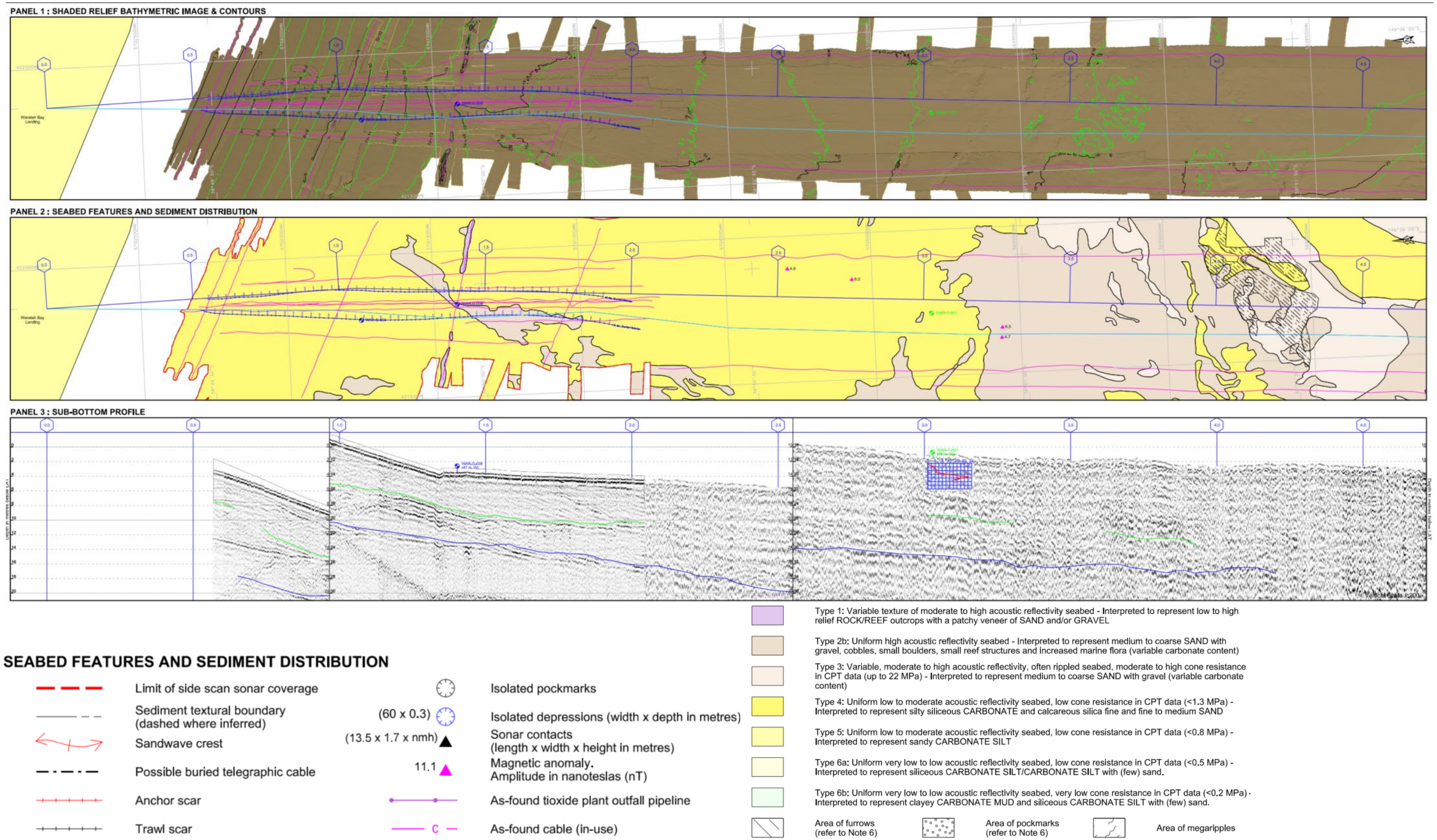


Figure 7-6. Geophysical analysis of seabed, ML 0 to 4,500 Waratah Bay
(From Fugro 2020)

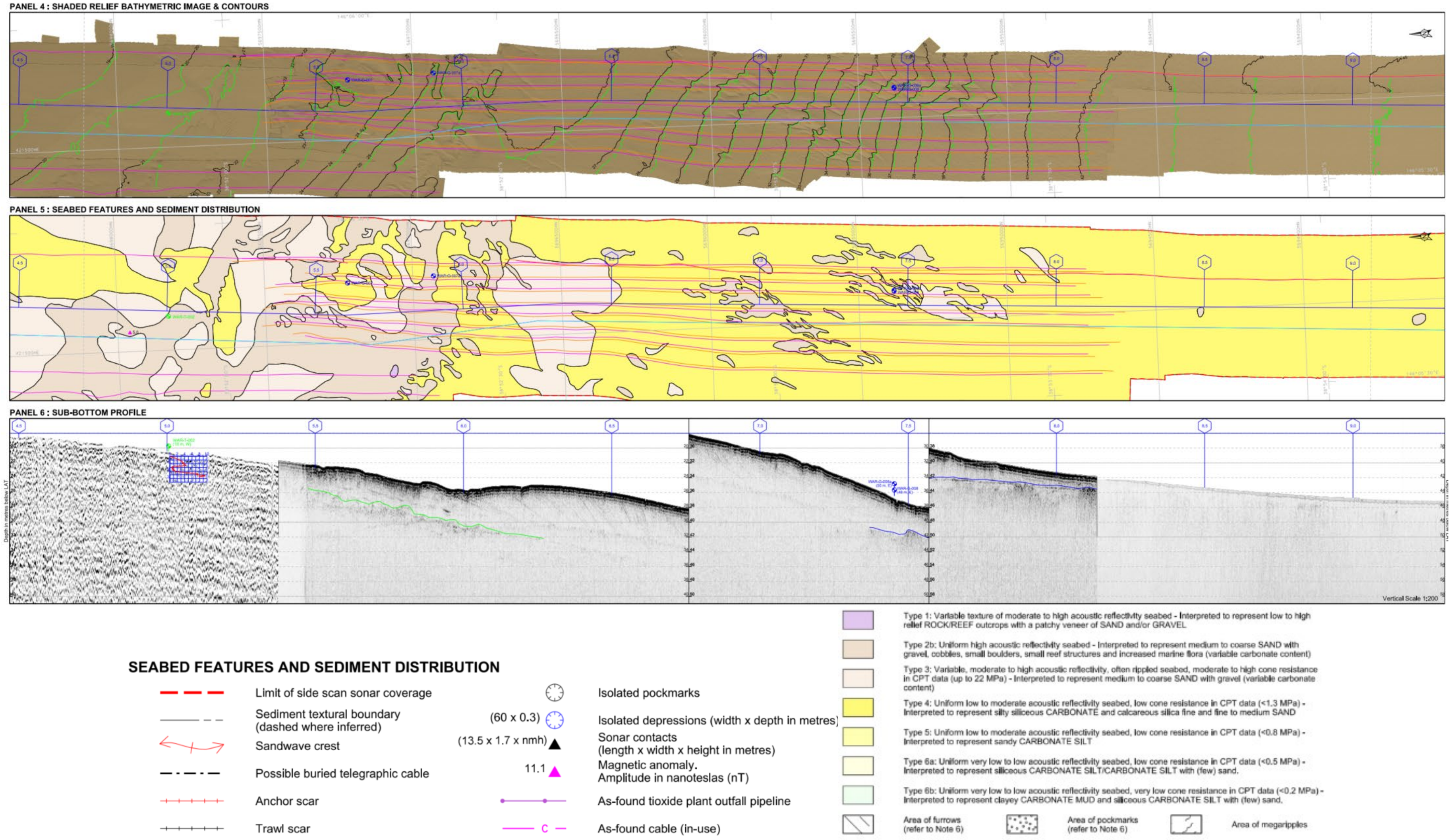
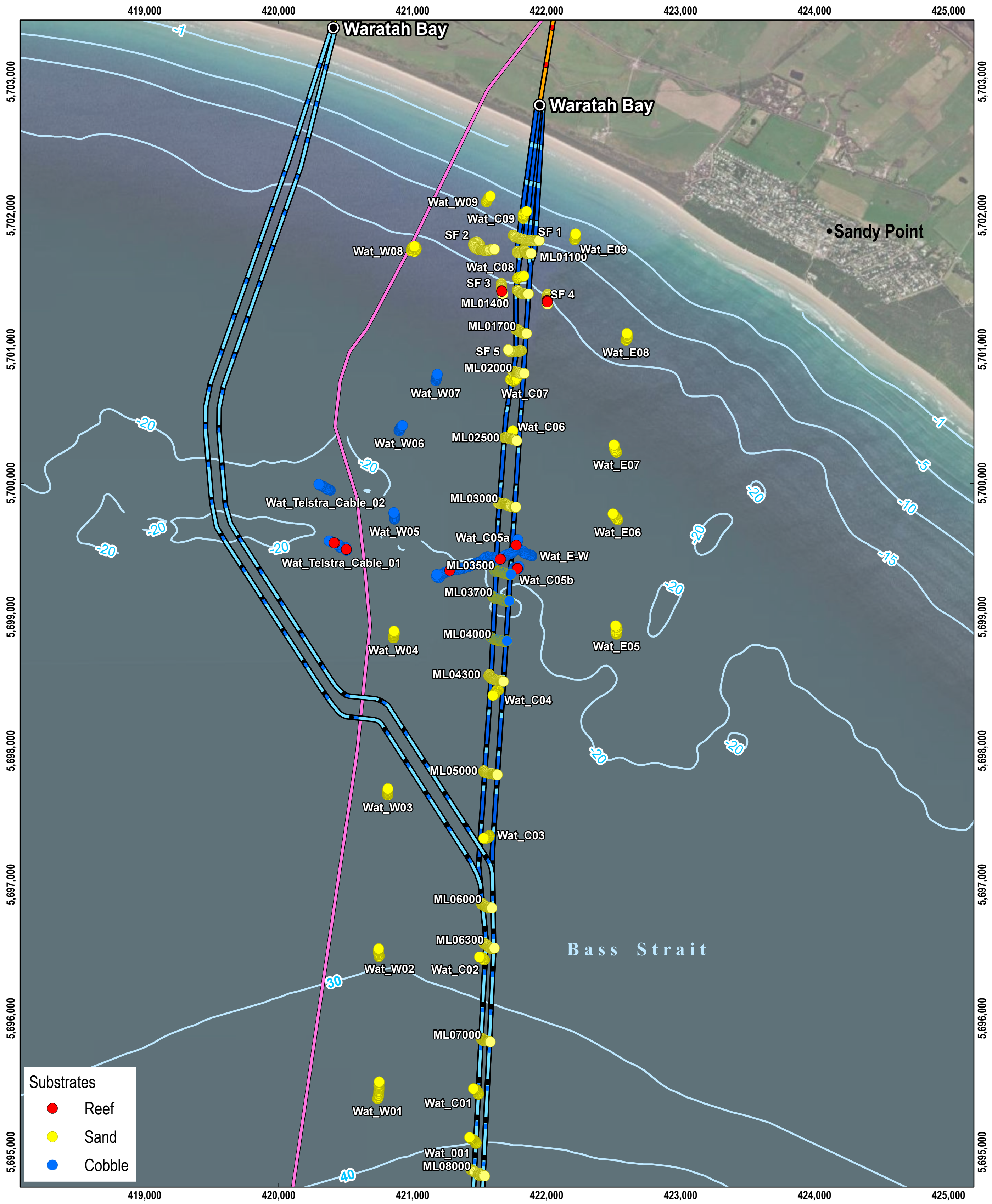


Figure 7-7. Geophysical analysis of seabed, ML 4,500 to 9,000 Waratah Bay
(From Fugro 2020)



LEGEND

- Landfall

Proposed route

- HVDC subsea cable
- Underground HVDC cable

Proposed route (2021)

- HVDC subsea cable
- Underground HVDC cable
- Existing Telstra Cable

MARINUS LINK

400 0 400 m

SCALE 1:40,000

PAGE SIZE: A4

PROJECTION: GDA2020 MGA Zone 55

SOURCE
Proposed route from Tetra Tech Coffey.
Seabed survey sites from CEE.
Imagery from ESRI Online.

MARINUS LINK PTY LTD

MARINUS LINK
EIS/EES

FIGURE 7-8

Seabed habitat at Waratah Bay 2019 and 2021 survey sites

TETRA TECH COFFEY

DATE: 16.05.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CEE_EIS_F007.8

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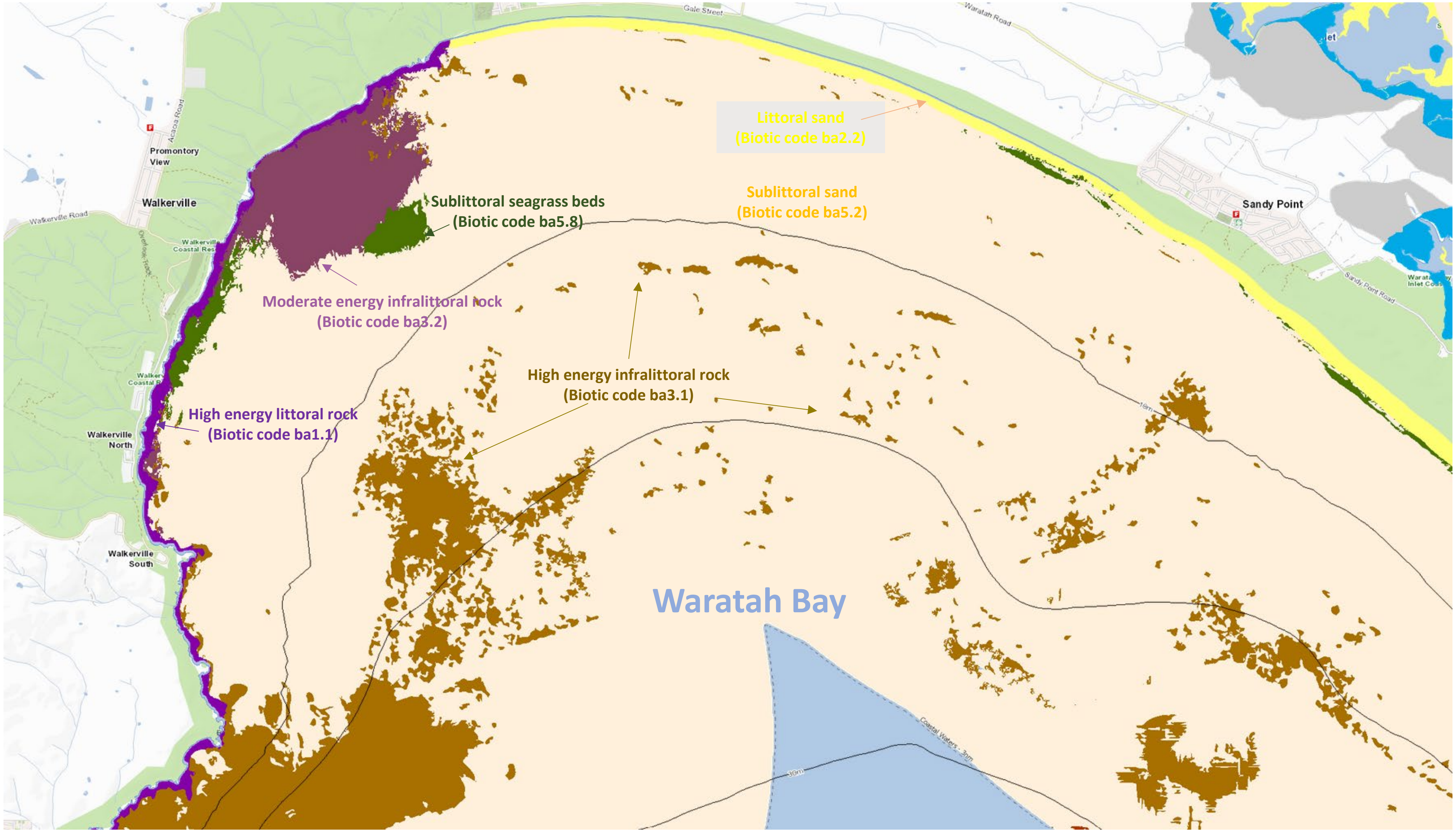


Figure 7-9. CoastKit 2023 mapped seabed habitat classification Waratah Bay 2023

Map base DEECA https://mapshare.vic.gov.au/coastkit/; habitat classification labels added for this report

7.2.1 Sand seabed habitats

Sand seabed habitat at sites surveyed in 2019 and 2021 from the shoreline to 9 km offshore varied from fine to medium sands with varying quantities of shell (Figure 7-8). Most sites surveyed included a proportion of sand ranging from around 5 percent to 100 percent sand. Seabed habitats mapped on DEECA's CoastKit in 2023 are shown in Figure 7-9. Figure 7-10 shows photographic examples of predominantly sand seabed at CEE survey sites from 6 m at the closest nearshore site (Wat C09, 2019) to around 40 m depth at 8 km offshore (ML 8,000, 2021 survey). This habitat corresponds to DEECA CoastKit "Sublittoral sand" (Biotic Code ba5.2) as shown in Figure 7-9.

The images show that surface features of the sand seabed change with depth and corresponding change in wave energy. Sand ripples were most pronounced on the seabed from 5 m to 15 m water depth. Undulations were visibly present on the seabed to around 26 m water depth.

Camera tows between ML1 7,000 and ML2 7,000 in 30 m water showed notable difference in texture between the sites, from distinct wave in pattern on one part of the tow to low, smooth undulations on another part.

The presence of scattered small, individual macroalgae on otherwise bare sand at water depth greater than 30 m (e.g., photo ML 7,400) indicate the presence of exposed shell material suitable for attachment of ephemeral seaweeds.

Oceanographic processes act on the seabed act on the seabed texture and result in differences in seabed texture which causes differences in the natural distribution of visible seabed epibiota and burrowing infauna at a similar spatial scale.

7.2.2 Cobble seabed habitat

Coarser unconsolidated sediments were observed mixed with sands at many sites. Coarse material ranged from pebbles to rounded cobble or angular rubble up to around 20 cm across. This material has been termed 'cobble' for the purposes of this report. Figure 7-8 shows that patches of seabed characterised by coarser unconsolidated sediments occur in the vicinity of the alignment to almost 4 km offshore and appear mostly between 3 km and 4 km along the alignment (Figure 7-8). Comparison of the distribution of this seabed character with the CoastKit habitat distributions shown in Figure 7-9 indicate that larger patches of 'cobble' may be intermediate between DEECA CoastKit "Sublittoral sand" (Biotic Code ba5.2) and "High energy infralittoral rock" (Biotic Code ba3.7). Photographic examples of coarse, unconsolidated seabed at CEE survey sites within 4 km offshore are shown in Figure 7-11.

Examination of the photographic record along the camera tow tracks across cobble seabed showed the composition of the seabed varied between tows and along individual tows. Cobble was densest at Site Wat W07 (2019), with continuous, medium-sized cobble cover of the seabed.

Tows across the Marinus Link alignment between KP 3,300 and 3,500 (sites Wat CO5a and Wat_EW) showed that the seabed included dense cobble and reef, with patches of sand and sparse to moderate cobble.

The imagery from the tows across the Marinus Link alignment from KP 3,500 to KP 4,000 showed that the amount of cobble among sand decreased as the distance offshore increased. The seabed from KP 4,300 was sand with very sparsely scattered individual cobbles or pebbles to KP 5,000.

The seabed at ML 8,000 was fine sand with irregular flat plates that appeared to be consolidated sand scattered irregularly across the seabed. The absence of biological growth on these objects indicated that they may move during storms.

Figure 7-10. Examples of sandy seabed features from shore to 8,000 (2021)
(Differences in blue and green colour and resolution result from different cameras
blue = Sony camera; Green = GoPro camera)

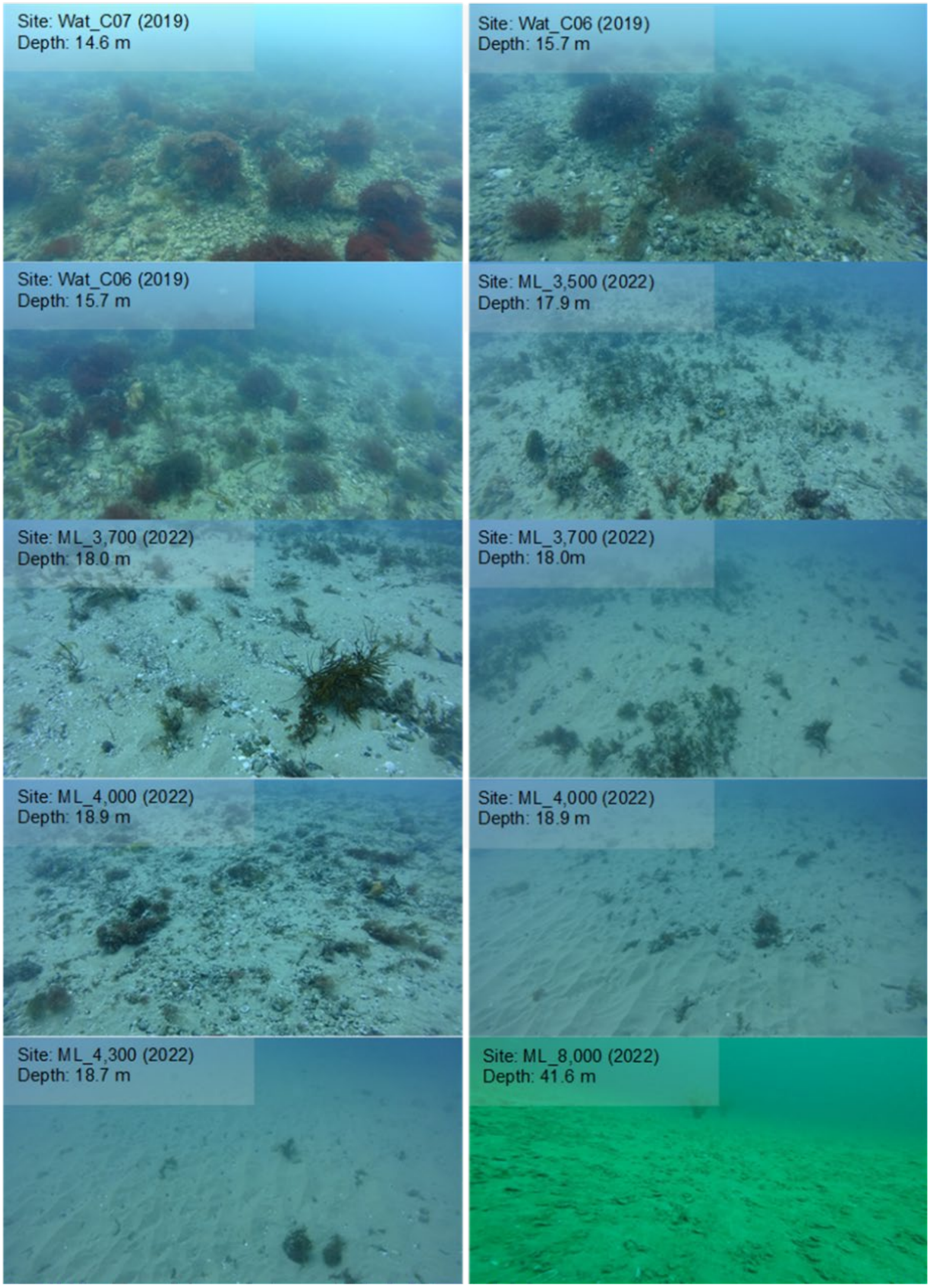
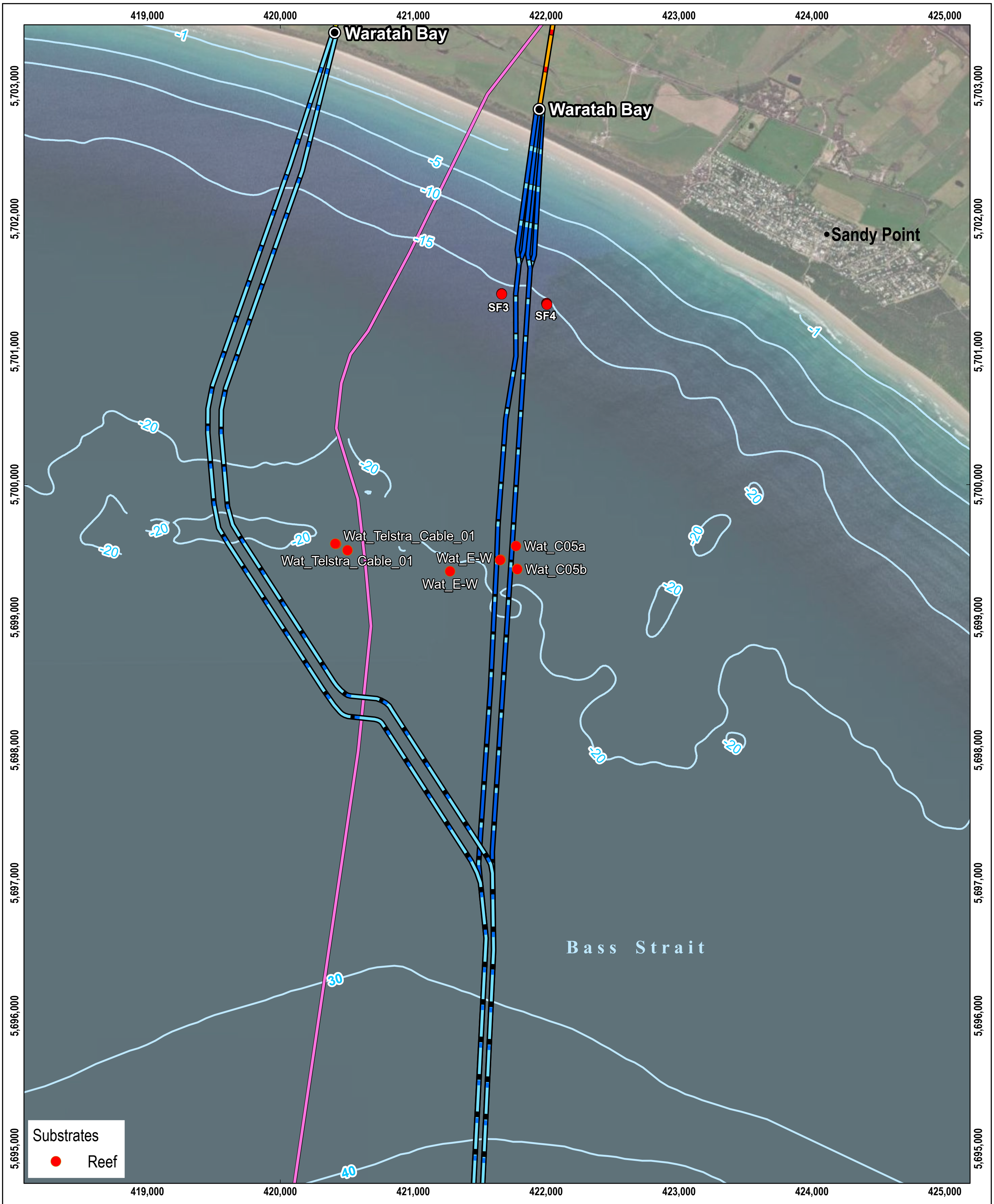


Figure 7-11. Examples of coarse sediments, shoreline to ML 8,000



LEGEND

- Landfall

Proposed route

- HVDC subsea cable
- Underground HVDC cable

Proposed route (2021)

- HVDC subsea cable
- Underground HVDC cable
- Existing Telstra Cable
- Bathymetry (m)

MARINUS LINK

400 0 400 m

SCALE 1:40,000

PAGE SIZE: A4

PROJECTION: GDA2020 MGA Zone 55

SOURCE

Proposed route from Tetra Tech Coffey.

Seabed survey sites from CEE.

Imagery from ESRI Online.

MARINUS LINK PTY LTD

MARINUS LINK

EIS/EES

FIGURE 7-12

Location of rock reef outcrops at Waratah Bay sites 2019 and 2021

TETRA TECH COFFEY

DATE: 16.05.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CEE_EIS_F007.12

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7.2.3 Rock habitat

Patches of larger rocks (up to 1.2 m high) and low-relief bedrock were recorded among areas of rubble found along the Marinus Link alignment in the 2021 survey, shown as red dots in Figure 7-12. Rock was present at site SF3 on the western side at ML 1,400 while a combination of cobble, sand, shell and rock was found on the eastern side at SF4 (Figure 7-13).

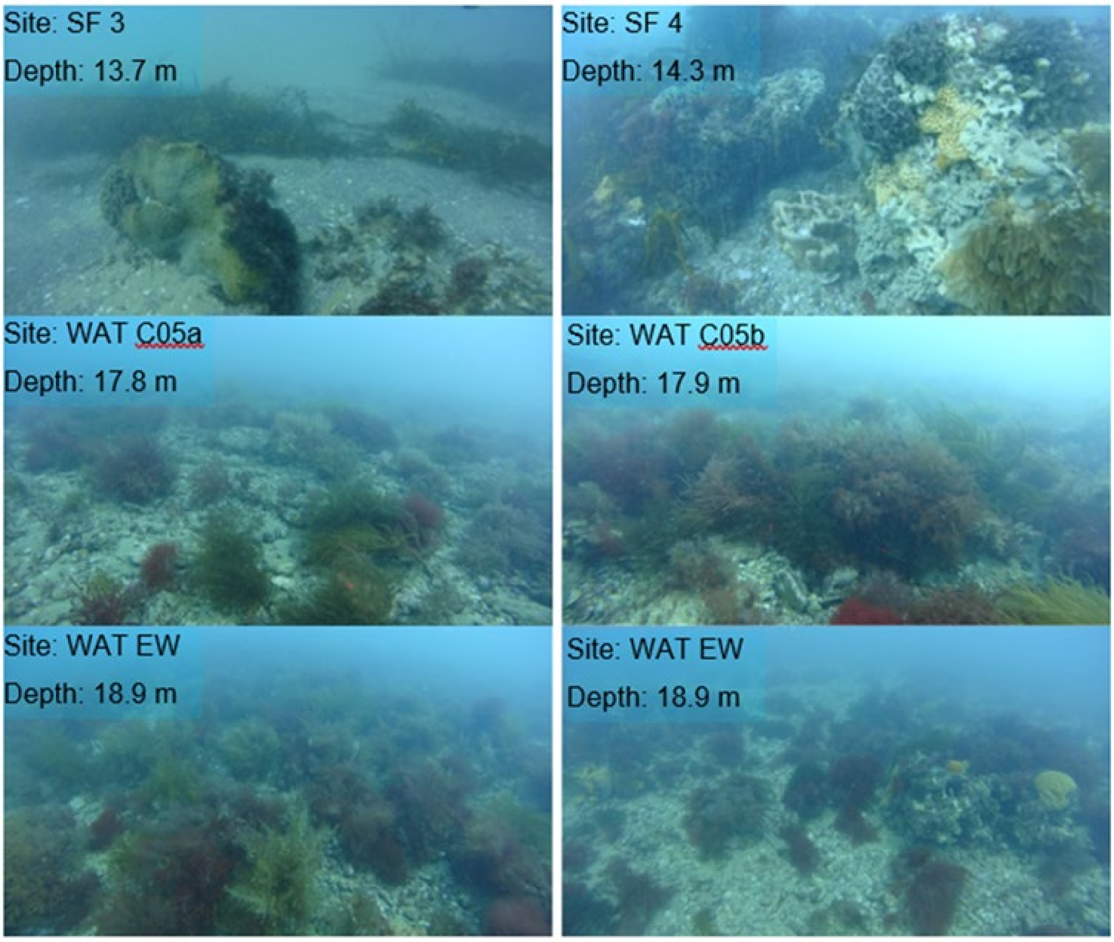
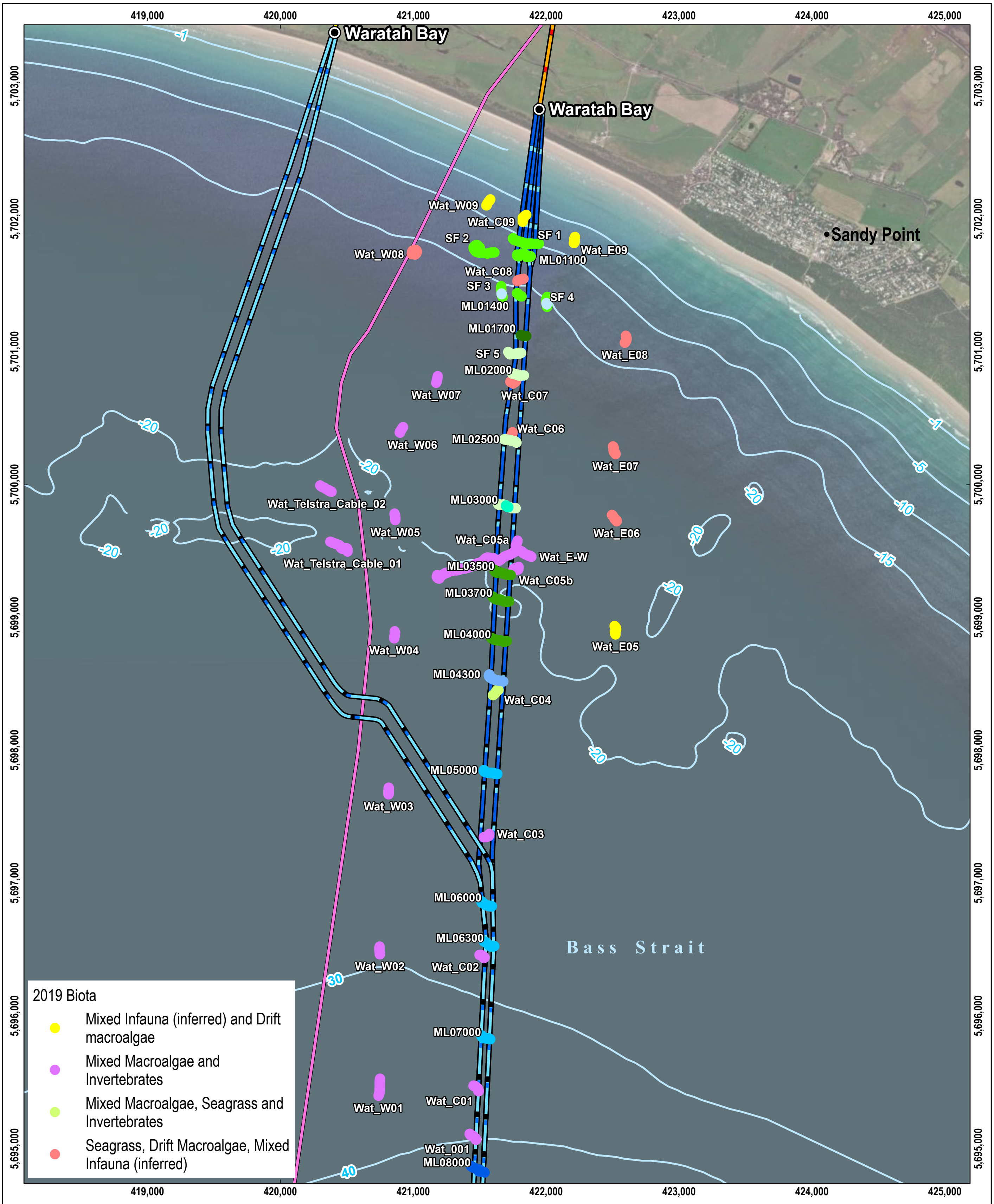


Figure 7-13. Rock reef along Marinus Link alignment in Waratah Bay

Further south, rock and cobble 'reef' occurred with coarse unconsolidated seabed on and around the alignments from ML 3,200 to 3,700 (sites CO5a, CO5b, Wat EW). Patches of broken rock and bedrock were estimated at around 10 m to 50 m in extent, rising up to 1.5 m above the cobble. Low-lying bedrock was present at around eight sites, but most of the rock could not be distinguished due to biological growth of large sponges and macroalgae over the rock entire surface (Figure 7-13). This rocky habitat corresponds to DEECA CoastKit "High Energy Infralittoral rock" (Biotic Code ba3.1.) as shown in Figure 7-9.

7.3 Biological Characteristics

As discussed in the previous section, the seabed along the Marinus Link cable alignment through Waratah Bay slopes from the shoreline to a water depth of around 40 m at 8 km offshore. The biological communities along the depth profile comprise burrowing animals (infauna) associated with bare unconsolidated sediments, animals that live on the surface of the sandy seabed (soft seabed epifauna), seagrasses that grow on the sediments and cobble, and the seaweeds and animals that grow on the rock and cobble reefs. The distribution of these broad groups of biota in Waratah Bay is discussed in the following sections.



LEGEND

- Landfall

Proposed route

- HVDC subsea cable
- Underground HVDC cable

Proposed route (2021)

- HVDC subsea cable
- Underground HVDC cable
- Existing Telstra Cable

MARINUS LINK

SCALE 1:40,000
PAGE SIZE: A4
PROJECTION: GDA2020 MGA Zone 55

SOURCE
Proposed route from Tetra Tech Coffey.
Seabed survey sites from CEE.
Imagery from ESRI Online.

MARINUS LINK PTY LTD

MARINUS LINK
EIS/EES

FIGURE 7-14

Seabed biological characteristics at 2019 and 2021 survey sites

TETRA TECH COFFEY

DATE: 16.05.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CEE_EIS_F007.14

7.3.1 Soft seabed epifauna

Examination of the photographs from the soft seabed sites showed a seabed mostly bare of sedentary animals, such as seastars, scallops or snails (gastropods). The absence of these epifauna may be due to the wave action in Waratah Bay and the regular disturbance of the seabed sediments and any unattached biota living on the seabed. Three solitary spider crabs were observed: one on tow ML 6,000 at 26 m depth (Figure 7-15); another on tow ML 6,300 at 26 m depth; and the other on tow ML 7,000 at 31 m depth.

The notable exception to the relative absence of epifauna on the soft seabed was the ‘sea pen’ *(Pseudogorgia godeffroyi)*. This soft octocoral, related to gorgonians and sea whips, extends its foot into the sand to maintain position and feeds using rows of short tentacles extending along each side of a central ribbon-like axis.

Figure 7-15. Spider crab Leptomithrax gaimardii
Site ML 6,000, 26 m depth 2021

Figure 7-16. *Pseudogorgia godeffroyi* in Waratah Bay, November 2021

Pseudogorgia godeffroyi were sparsely distributed as patches or individuals over the seabed in both the 2019 and 2021 surveys along the sandy seabed of the alignment from 14 m depth at ML 1,700 to 31 m depth at ML 7,000. They were observed also in patches of sparse to moderate *Heterozostera tasmanica* seagrass. *P. godeffroyi* was absent from Waratah Bay sites deeper than 31 m. Figure 7-16 shows *P. godeffroyi* in Waratah Bay in 2019.

Pseudogorgia godeffroyi is a ribbon or blade-like, soft octocoral. It is typically sparsely distributed and inconspicuous and unlikely to be scientifically collected by mechanical grab. Individuals are observed lying loosely on the seabed while attached by a basal foot, giving the appearance of a fragment of drifting organic material lying on the seabed. *Pseudogorgia godeffroyi* may be difficult to distinguish from marine vegetation detritus and other dislodged organic debris.

The geographic distribution of *Pseudogorgia godeffroyi* is documented from South Australia and Victoria. Bayer, Grasshoff and Verseveldt (1982) stated the geographic range of *Pseudogorgia godeffroyi* from near Lakes Entrance (Victoria) to Pearson Island (SA) between 30 and 64 m depth. *Pseudogorgia godeffroyi* was recorded by the National Museum of Victoria on two occasions in 1982 among seagrasses at 13 m depth from Norman Bay on western Wilsons Promontory (Wilson et al 1983). Those records are about 35 km south-southeast of sites CEE's 2019 and 2021 records in Waratah Bay. This species is not protected or listed under Victorian regulation.

7.3.2 Seabed infauna

Seabed infauna typically comprise a range of burrowing invertebrate animals including burrowing worms (polychaete worms), various shrimps, brittle stars and small burrowing clams (bivalves). The abundance and diversity of the infauna community varies at a large scale according to bioregional factors, large scale topographical features and organic inputs. In Waratah Bay, the abundance and diversity of the infauna community is likely to vary with the size and the mobility of the sediments.

Diver inspections of the seabed at Venus Bay during seabed sampling revealed no obvious bioturbation or burrow entrances as indication of infauna presence. Hence, the visible absence of bioturbation on the Waratah Bay seabed during the Marinus Link's surveys is considered typical for the bioregion where ocean swell regularly disturbs the seabed surface, and does not indicate a total absence of infauna.

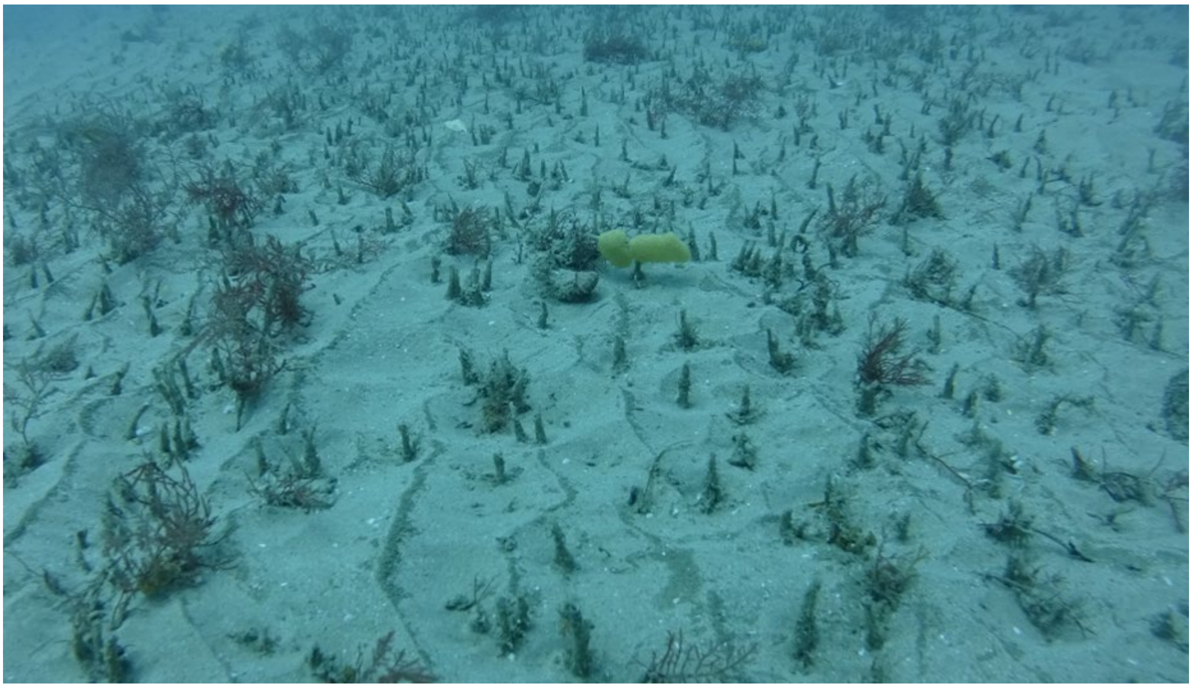


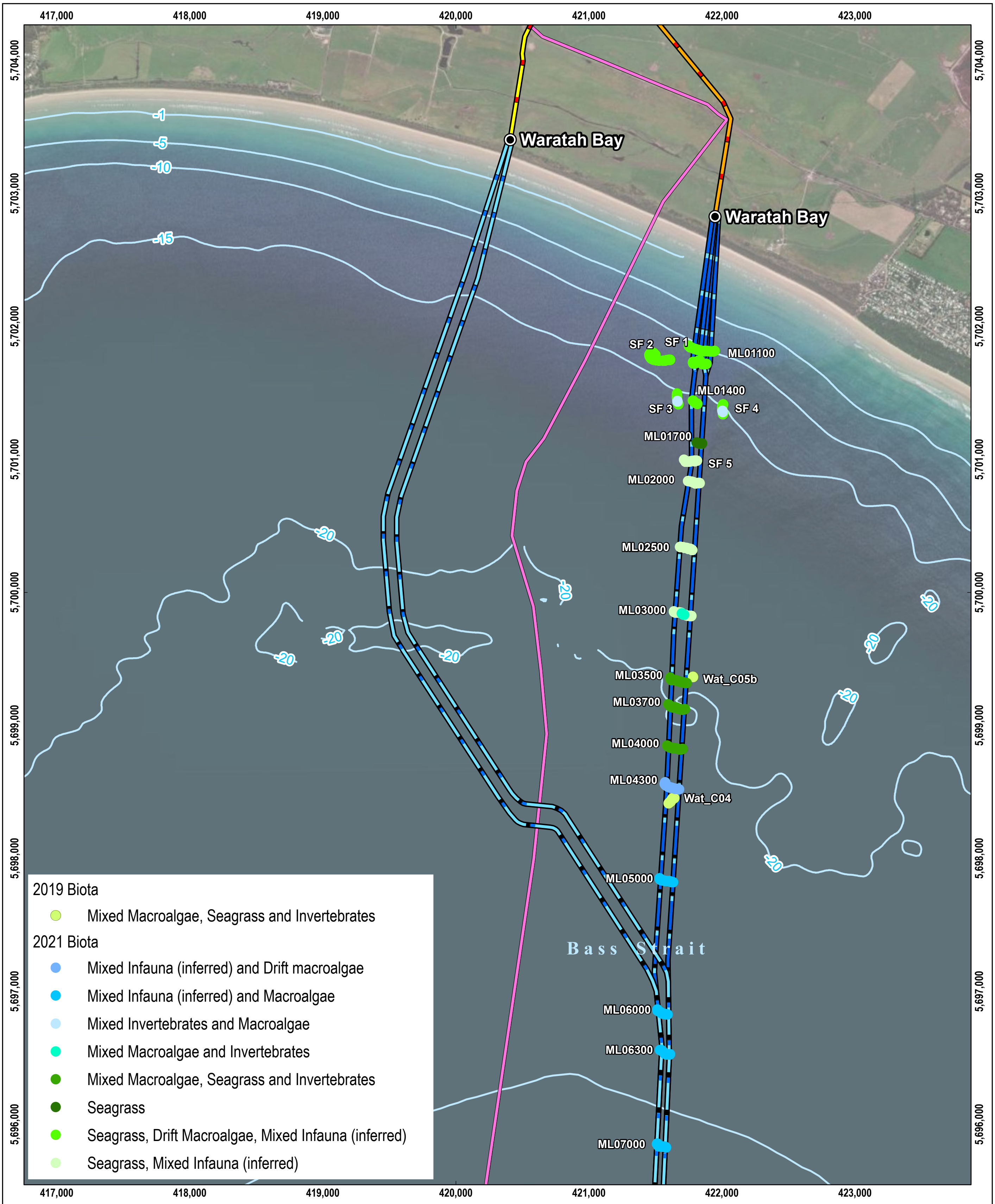
Figure 7-17. Numerous worm tubes at ML 6,000
(Yellow object is a small sponge)

The soft seabed along the route comprises fine to medium and coarse sands, which are common in the Central Victorian and Wilsons Promontory Bioregions and the Victorian Wilsons Promontory West, Cape Liptrap and Bunurong Biounits. Examination of the photographs showed no obvious bioturbation or burrow entrances as indication of infauna presence. Results from the video tows in 2019 and 2021 show that there was inferred infauna mixed with other biology at sites ranging from ML 4,000 to ML 7,000. Most of these were inferred infauna mixed with macroalgae. Figure 7-17 shows worm tubes which were clearly evident on the seabed on a video tow at ML 6,000. The identity of the worms inhabiting these tubes is unknown but are probably from the Family Eunicidae or possibly Onuphidae (Dr Robin Wilson, Museums of Victoria *pers comm*).

It is expected that the infauna community of the fine sands in Waratah Bay are likely to be similar to those with similar wave exposure and depth throughout the Victorian Wilsons Promontory West and Cape Liptrap Biounits, and the biounits adjacent to them in the Central Victorian Bioregion.

7.3.3 Seagrass

Two species of seagrasses were recorded at many of the sites along the cable route in Waratah Bay sites: the leafy seagrass *Amphibolis antarctica* and the southern Australian seagrass *Heterozostera tasmanica*. The results of surveys for seagrass in Waratah Bay are shown in Figure 7-18. Seagrass habitat corresponds to DEECA CoastKit “Sublittoral seagrass beds” (Biotic Code ba5.8) as shown in Figure 7-9. Biotic Code ba5.8 may include a variety of around six seagrass species in Victoria, with most species having different environmental requirements.



LEGEND

- Landfall

Proposed route

- HVDC subsea cable
- Underground HVDC cable

Proposed route (2021)

- HVDC subsea cable
- Underground HVDC cable
- Existing Telstra Cable
- Bathymetry (m)

MARINUS LINK

400 0 400 m

SCALE 1:40,000

PAGE SIZE: A4

PROJECTION: GDA2020 MGA Zone 55

SOURCE
Proposed route from Tetra Tech Coffey.
Seabed survey sites from CEE.
Imagery from ESRI Online.

MARINUS LINK PTY LTD

MARINUS LINK
EIS/EES

FIGURE 7-18

Sites with seagrass in Waratah Bay 2021

TETRA TECH COFFEY

DATE: 16.05.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CEE_EIS_F007.18

Amphibolis antarctica was found in patches among seaweeds at rubbly sites from around 14 m to 18 m depth. It did not form extensive meadows. This species of seagrass is widespread on semi-exposed cobble seabed along the Victorian coastline east of Wilsons Promontory and westward to Carnarvon in WA. It is common around the Bass Strait Islands and the north coast of Tasmania and is not listed as threatened.

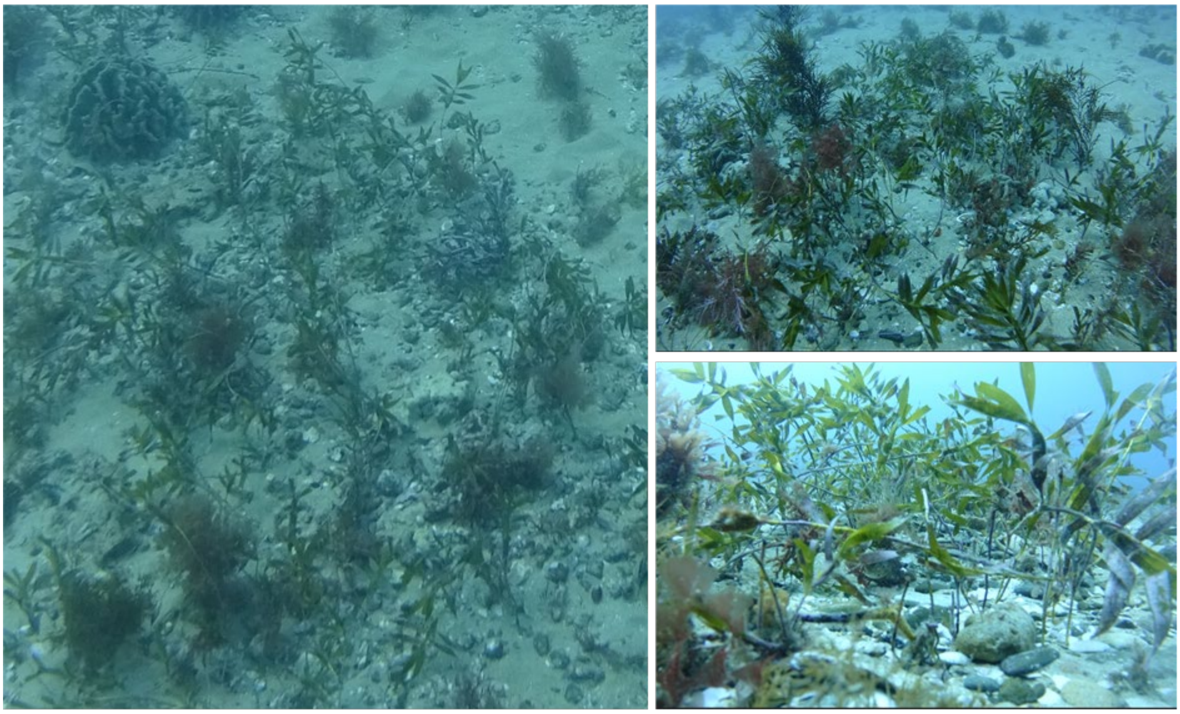


Figure 7-19. *Amphibolis antarctica* seagrass at Waratah Bay, November 2022

Heterozostera tasmanica was common on the fine, clean sandy seabed of Waratah Bay from 10 m to 15 m depth, and on sand amongst cobble and reef areas (Figure 7-20). It became sparser as depth increased and was absent from sites with coarser sediment (e.g., ML 6,300). A single plant was recorded at ML 7,000 at 31 m depth.

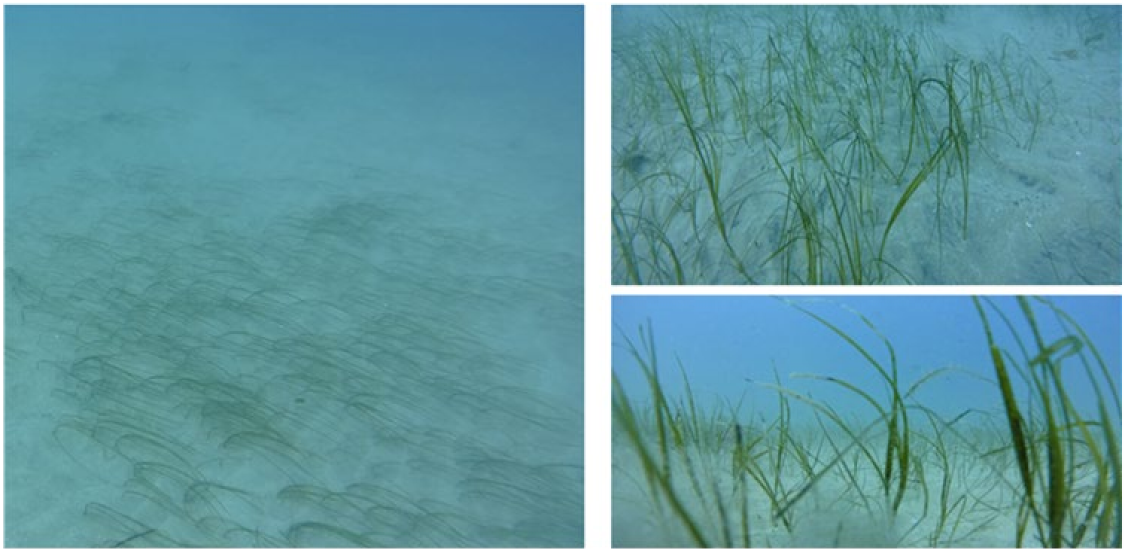


Figure 7-20. *Heterozostera tasmanica* at ML 1100, Waratah Bay 2021

Heterozostera tasmanica (G.Martens ex Asch. Hartog), along with *Heterozostera nigricaulis* (Kuo 2005) were recently listed (October 2021) as threatened species and in danger of extinction on Victoria's Flora and Fauna Guarantee Act 1988 Threatened Species List. These two seagrasses grow subtidally, except in rare cases where *Heterozostera nigricaulis* may occupy the lower intertidal. *Heterozostera nigricaulis* was not seen in the camera tow surveys and is unlikely to occur in this environment.

7.3.4 Cobble and reef biota

The distribution and physical nature of cobble and reef habitats of Waratah Bay are discussed in Section 6.2. These habitats are mostly located between 10 m to 20 m water depth (ML 2,000 to ML 5,000). Boundaries between these habitats are indistinct, and the associated attached biota are generally similar biota over the depth range and between the outcrops. They were characterised by a macroalgal (seaweed) flora with patches of *Amphibolis antarctica* and *Heterozostera tasmanica* seagrasses and an invertebrate fauna characterised by sponges of various sizes.

The macroalgal community comprised small to medium sized red, green and brown algae. The red (a diverse range of ephemeral foliose species including *Plocamium*, *Dasya*, *Pterocladia*) and green algae (notably species of *Caulerpa*) are relatively short-lived. The brown algae were relatively sparse and included various Dictyotales species and some Fucales general. The largest brown algae present were small individuals of *Cystophora*.

Large brown, long-lived kelps such as common *Ecklonia radiata* and *Phyllospora comosa* and species of *Cystophora* were notably absent from the rock surfaces of the reefs. These species would usually be expected to inhabit reefs at this depth. Large sponges were present on the reefs instead, which is unusual at these depths. The reason for the lack of kelp and unexpected composition of the community in this area may be a combination of the low relief of the rocks relative to the surrounding sand seabed and the high wave energy in the Bay.

Close examination of macroalgae on the small, isolated reef at site SF4 ('SF' stands for 'special feature', which is a term adopted by the authors as a site ID in order to ensure consistency with a previous Fugro report), located east of ML1,400 showed the *Ecklonia radiata* and *Phyllospora comosa* along the reef/sand boundary were decaying individuals that were not attached to the rock reef (Figure 7-21). The main part of this small patch reef was characterised by large sponges and ephemeral red and green algae like the other reefs.

Figure 7-21. Drifting kelp plants accumulating along reef edge at Site S4

The presence of the drift algae at site S4 is further evidence of the accumulation and transport of dislodged marine vegetation across the sandy seabed at Waratah Bay. This phenomenon is not unusual and is often seen when it accumulates as heavy, decaying deposits of kelps along the shoreline. It may also be seen in aerial images of the seabed and may be confused with attached vegetation such as seagrass beds or reefs as discussed in the previous Project Marinus marine benthic survey report (CEE 2019).

The biota of the reefs on or close to the alignment are likely to be recruited from the more substantial reefs of Cape Liptrap along the western side of Waratah Bay (Figure 7-22) as well as the Marine Protected Areas of Wilsons and Promontory to the east.

7.4 2022 Waratah Bay Re-alignment

The 2019 and 2021 seabed habitat investigations focussed on the Marinus Link alignment options at those times. As noted previously, the subsea cable alignment termination point at Waratah Bay was relocated up to approximately 2 km west of the 2021 termination point due to landward route considerations, with consequent realignment of 7 km of the nearshore subsea cable alignment as shown in Figure 7-22.

Figure 7-22 shows the reef and cobble habitat mapped by CEE in 2019 and 2021 and the position of reef (“Infralittoral reef and other hard substrata”, CoastKit 2023) and sand extent mapped from aerial images and other inspections compiled by DELWP on CoastKit. The figure shows that the 2022 subsea cable alignment avoids areas of reef and cobble mapped by CEE in 2019 and 2021. However, the latest 2023 CoastKit map of seabed habitat characteristics based on digital elevation models (DEM) using Lidar (Light detection and ranging) depth data shows small patches of reef (or possibly rubble) scattered reef through much of Waratah Bay. There are minor discrepancies between the distribution of the reef/rubble *documented* in the towed video surveys and those *modelled* in Coastkit, but these patches are very small in area at the scale of the bay or bioregion.

Seabed and associated ecological community mapping models such as CoastKit Victoria, Seamap Australia and bioregional categorisation such as IMCRA 'map' the extent of seabed character or marine community characteristics based over large areas based on the reasonable assumption of continuity or correlation of those characteristics with physical factors, such as water depth, seabed composition, water temperature and others.

In September 2023, the geophysical characteristics of the new alignment in Waratah Bay were surveyed by XOCEAN. The survey included multibeam echosounder (MBES) bathymetry and backscatter of seabed reflectivity. No underwater imagery was collected.

Figure 7-23 presents the multibeam echosounder bathymetry from the XOCEAN survey. The bathymetry from the original alignment is included for comparison. The eastern side of the 2023 survey area overlaps marine ecological survey sites previously surveyed and mapped by CEE in 2019 and 2021 as shown in Figure 7-8.

The 2023 MBES and backscatter data showed that the new alignment traverses predominantly sand, with patches of hard rock. Figure 7-23 shows that this seabed character is the same as the original alignment, with the same rocky outcrops tending east-west in extent around 3 km offshore across both Marinus alignments and the Telstra cable alignment. Figure 7-23 shows that the alignment appears to bypass the larger rock outcrops.

These outcropping features were surveyed by CEE along the original alignment at sites CO5, Wat EW, and near the Telstra cable at site Wat_Telstra_Cable_01 (see Figure 7-8). Site Wat_Telstra_Cable_01 is in the area surveyed by the XOCEAN bathymetry where the hard surface is visible.

The comparison of the 2023 geophysical outputs with CEE's 2019 and 2021 towed underwater camera surveys shows that the seabed habitat categories are consistently scattered across the original and new Marinus alignments in Waratah Bay. The 2019 and 2021 imagery identified the hard substrate features surveyed in 2023 to comprise rock reef and cobble, with coarse unconsolidated sediments (see Figure 7-8 and section 7.2). In some areas, patches of low-lying bedrock were present and estimated to be at around 10 to 50 m in extent and rising up to about 1.5 m above the cobble. The corresponding biota at the rock reef and cobble patches comprised mixed macroalgae and invertebrates.

Given the continuation of the physical seabed conditions across the original and new alignments, there will also be ecological continuity across these areas. It is therefore expected that the characteristics of the sand seabed habitat and associated biota (sparse epibiota of seagrass between 10 to 15 m and seapens between about 10 to 30 m depth) along the 2022 alignment will follow the same depth related patterns as those on the same habitats described elsewhere in Waratah Bay including along the original alignment. Similarly, any patches of rock reef and cobble that occur along the 2022 alignment will provide habitat for the same biological communities (i.e., mixed macroalgae and invertebrates) as those described on the reefs and cobble surveyed elsewhere in Waratah Bay including along the original alignment.

CoastKit shows that rock habitat is extensive along the western shore of Waratah Bay and extends around Cape Liptrap to the southwest of Waratah Bay. Any reef and cobble habitat ecological communities that occur along the 2022 alignment will be representative of the larger area of the Cape Liptrap and West Wilsons Promontory Victorian Marine Bioregions.

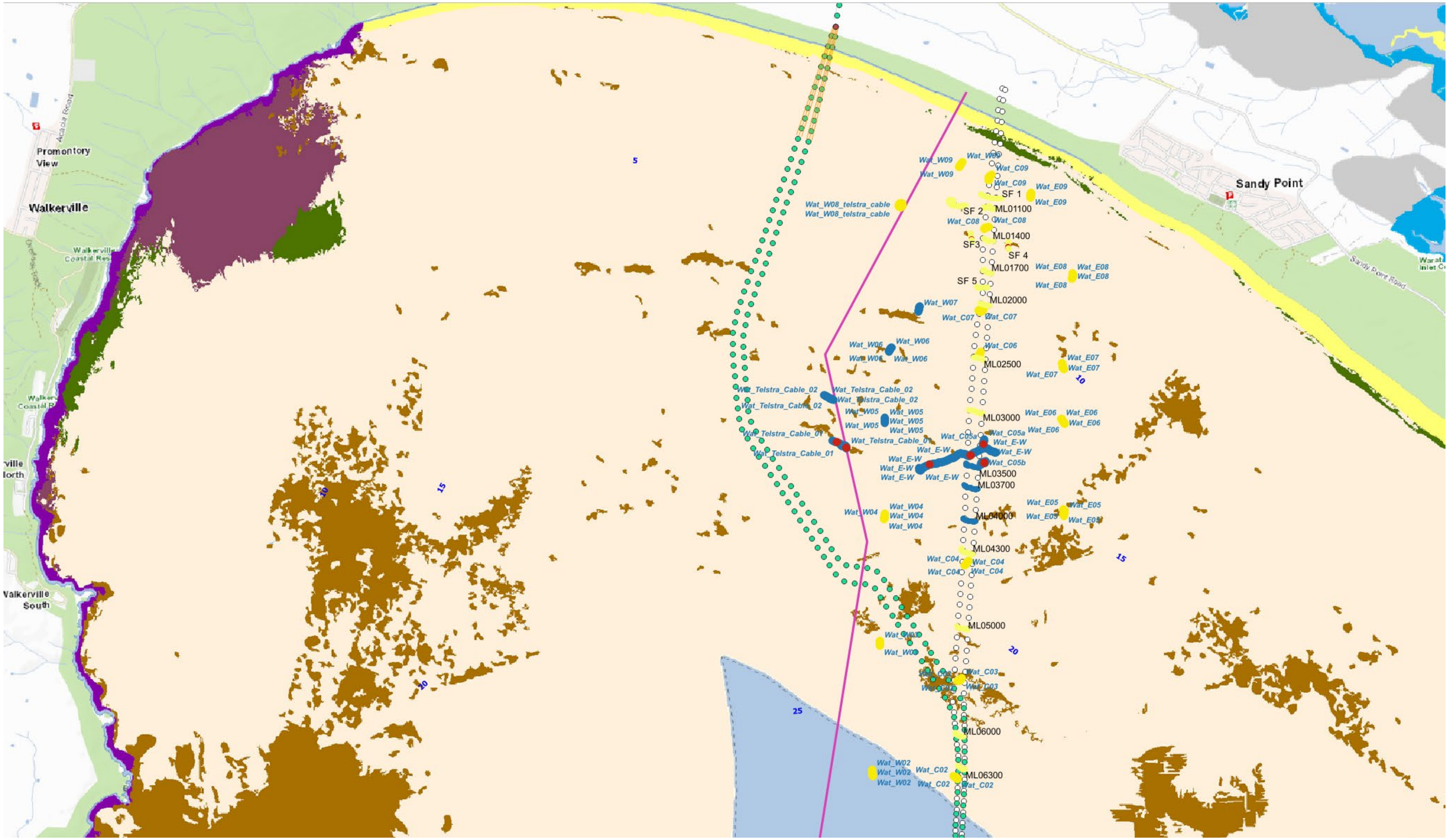
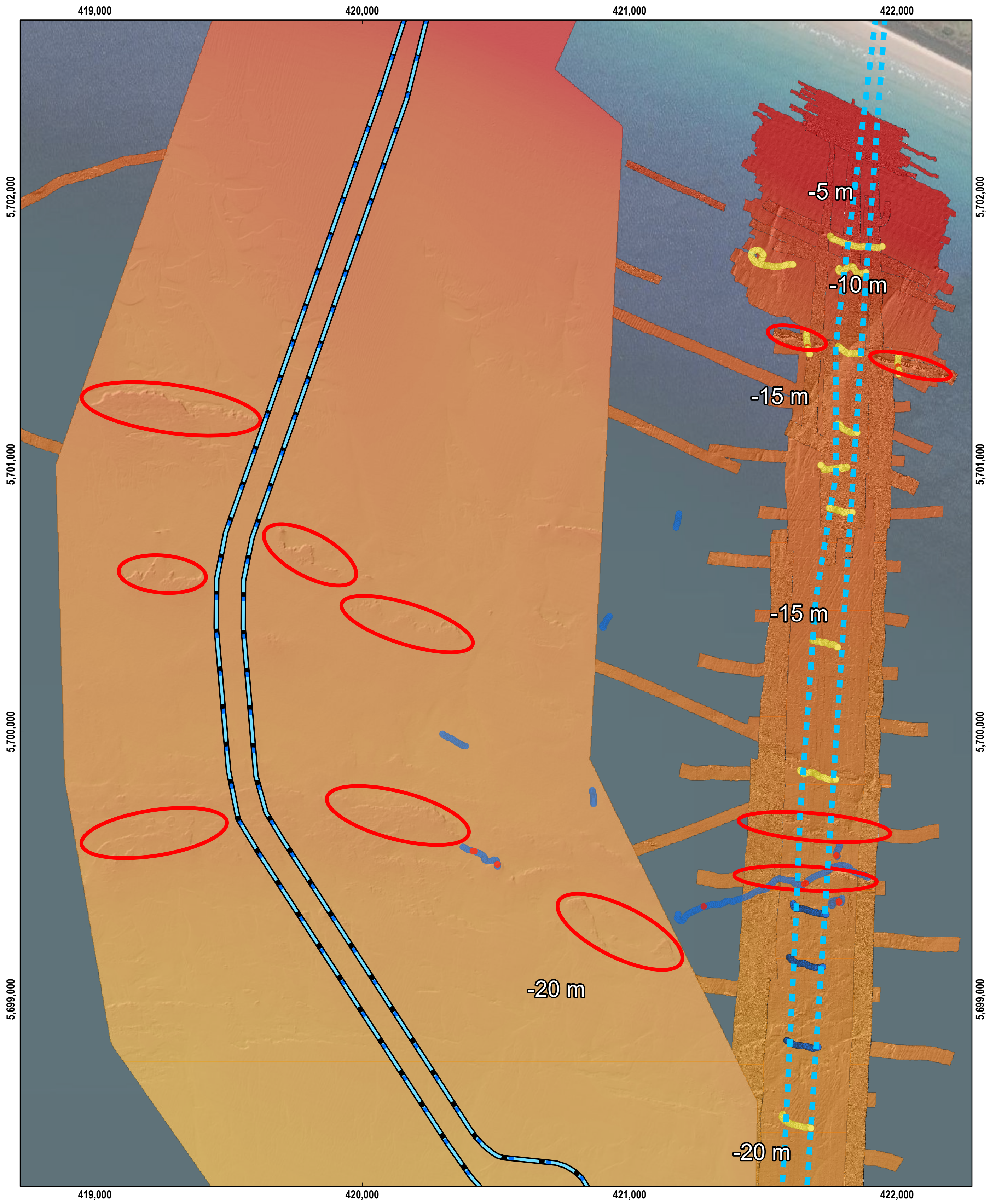


Figure 7-22. Waratah Bay subsea cable alignments and seabed habitats, 2023
(Yellow area represents sand. Black depth contours are imbedded on CoastKit shaped file)



LEGEND

Seabed characterisation

- Reef
- Cobble
- Sand

Proposed route

- HVDC subsea cable
- Previous subsea cable
- Rocky outcrop

MARINUS LINK

200 0 200 m

N

SCALE 1:20,000

PAGE SIZE: A4

PROJECTION: GDA2020 MGA Zone 55

SOURCE
Proposed routes from Tetra Tech Coffey.
Seabed characterisation from CEE (2021).
2023 bathymetry from XOcean.
2019/2020 bathymetry from Fugro.
Imagery from ESRI Online.

MARINUS LINK PTY LTD

MARINUS LINK
EIS/EES

FIGURE 7-23

Comparison of MBES bathymetry between the current and original alignments

TETRA TECH COFFEY

DATE: 16.05.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CEE_EIS_F007.23

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7.5 Summary of Waratah Bay Seabed Habitat and Community

The Waratah Bay segment of the 2021 subsea cable routes extends from ML 400 to ML 8,000 through the boundary area of the Central Victoria and Flinders Bioregions. The 2019 and 2021 towed underwater camera investigations and 2020 geophysical survey (Fugro 2020) showed that the physical characteristics of the Bay comprised mostly of sand from around ML 400 (the edge of the beach) to ML 2,900 along the alignment with a small amount of shell mixed with the sand between ML 1,100 and ML 1,400.

Survey sites west of the 2021 alignment showed some cobble between ML 2,000 and ML 3,300. At around ML 3,300 cobble was more prominent and was found along the alignment mixed with sand up to around ML 5,000. Surveys showed that at around ML 3,300 there was also a line of rocky reef extending east to west across the alignment.

The seagrass *Heterozostera tasmanica* was present in patches of low to moderate abundance on the sand at depth range from 10 m to 15 m (ML 1,000 to ML 4,400) and was present as sparse patches and individuals to depths of 31 m. This seagrass is widespread in similar patchy or sparse form, in suitable habitat and wave climate on the open coast of Victoria east of Wilsons Promontory along the Victorian coast through to the west of South Australia and along the north and east coasts of Tasmania. The sea pen *Pseudogorgia godeffroyi* was present as scattered individuals to moderate density among *H tasmanica* and on the bare sand from 10 m depth to around 31 m depth.

Infauna burrow entrances together with drifting macroalgae were visible at around ML 700 at several sites. The sandy seabed was relatively bare of infauna burrows to ML 4,000. Infauna burrows and sparse macroalgae were visible from ML 4,000 to ML 8,000 where burrows were present.

The cobble habitat at around 15 m and 18 m was characterised by sponges and ephemeral, filamentous red, filamentous green algae*, the* green alga *Caulerpa* spp and the seagrass *Amphibolis antarctica*. The larger rock was characterised by sponges and ephemeral (seasonal) seaweeds.

Attached kelps were absent from the rock reef on the alignments. Unattached drifting kelps, including *Ecklonia radiata,* were observed accumulated along the reef edges in places. Accumulations of macroalgae drifting across the seabed may result in misidentification of nearshore reef, macroalgae and seagrass from aerial imagery. More substantial and extensive rock reefs occur on the western shore or Waratah Bay and around Cape Liptrap to the west of the cable alignment.

8 Seabed Habitat and Biological Communities Summary

The Marinus Link subsea cable routes were defined in 2021 on the basis of available information and geophysical information collected in 2020 (CEE 2021, Fugro 2020). The cable routes were selected to avoid rocky seabed. The seabed along the 250 km route from 4 km offshore from Tasmania through a maximum depth of 80.5 m to Waratah Bay comprised sand and silt with different physical characteristics determined by depth and wave exposure and depths along the route. The alignment passes through, or close to four marine meso-scale bioregions: Central Victoria; Flinders; Central Bass Strait and Boags Bioregions. The marine biological characteristics along the alignment showed characteristic changes corresponding to the seabed physical characteristics, depth, wave action on the seabed character and bioregion.

High-definition geophysical mapping from the Tasmanian shore, across Bass Strait to the Victorian shoreline was used to ensure the cables passed over unconsolidated sediments and avoided passing over rock as much as possible. The cable alignments from the shoreline of the north Tasmanian coast were guided along a series of sand gutters (palaeochannels). The sandy seabed of the sand gutters through the nearshore reef from the shore to 4 km offshore at Heybridge comprised coarse to medium sands, with pronounced sand waves that resulted from wind driven waves from Bass Strait. The regularly disturbed sands nearshore were largely bare of marine biota.

The reef community around the cable alignments at Heybridge was characterised by macroalgae and invertebrates common to the Tasmanian central north coast Boags Bioregion. Larger long-lived brown algae (*Cystophora, Acrocarpia* and *Ecklonia*) were restricted to depths less than around 5 m. Filamentous ephemeral green and red macroalgae (seaweeds) dominated the reefs in summer from the shoreline to 30 m depth. This contrasted strongly with the community in winter, when most filamentous algae were absent and the reefs were characterised by bare rock with some encrusting coralline red algae, encrusting invertebrates and solitary ascidians. The strong seasonality is likely to be a consequence of light availability to the marine algae that dominate the reefs. Low light due to turbidity from runoff, low sun angle, less daylight and temperature difference combine to result in dormancy of the nearshore marine community over winter. No seagrasses were observed at any survey sites offshore from Heybridge.

The sandy seabed offshore from the reef comprised coarse to medium sands, with pronounced sand waves that resulted from wind driven waves. At 33 m water depth (ML 249,600) the seabed showed strong medium- to coarse-grained sand waves. Accumulation in the sand wave troughs included shall and doughboy scallops and Eleven-arm seastars *Coscinasterias muricata* were observed feeding on the scallops. Other biota observed on the medium to coarse sands of this habitat included solitary anemones and sand flathead fish.

From 35 m to 38 m depth (ML 249,000 to 248,000), the seabed showed wave created undulations rather than distinct sand waves and progressively fewer shell fragments. Small burrow mounds were visible. *Lanceopora smeatoni* and *Caulerpa longifolia* were less abundant. Doughboy scallops were sparsely scattered over the seabed, while commercial scallops were present but scarce. The cable alignment avoided rocky outcrops to around 40 km offshore from the Tasmanian coast.

The seabed in the Central Bass Strait Bioregion was relatively flat from ML 240,000 m to ML 230,000 m (~68 m depth) and comprised of soft silt. Sub-seabed biological activity became evident as pronounced, abundant mounds up to around 8 cm high from ML 230,000 m to ML 180,000 m (76 m depth). The seabed surface was dimpled with burrowing biota activity from ML 180,000 m to ML 100,000 m (~80 m depth) and then became relatively flat again from ML 100,000 m to ML 70,000 m (75 m depth). Patches of entwining sponge, bryozoan and ascidians, eunicid worm tube stalks and solitary sponges became sparsely distributed over the seabed. Colonial Eunicid worm tubes stalks protruded as sparsely distributed erect solitary 40-cm-high stalks from the seabed at depths between around 40 m and 70 m on either side of Bass Strait.

The Waratah Bay segment of the 2021 subsea cable routes extends from ML 400 to ML 8,000 through the boundary area of the Central Victoria and Flinders Bioregions. The 2019 and 2021 towed underwater camera investigations and 2020 geophysical survey (Fugro 2020) showed that the physical characteristics of Waratah Bay comprised mostly of sand from around ML 400 (the edge of the beach) to ML 2,900 along the alignment with a small amount of shell mixed with the sand between ML 1,100 and ML 1,400.

The seagrass *Heterozostera tasmanica* was present in patches of low to moderate abundance on the sand at depth range from 10 m to 15 m (ML 1,000 to ML 4,400) and was present as sparse patches and individuals to depths of 31 m. *Heterozostera tasmanica* is listed as Endangered on the Flora and Fauna Guarantee Act Threatened List June 2022. This seagrass is widespread in similar patchy or sparse form, in suitable habitat and wave climate on the open coast of Victoria east of Wilsons Promontory along the Victorian coast through to the west of South Australia and along the north and east coasts of Tasmania (CEE 2013, Waycott et al 2014, Wilson et al 1983). It was the only marine species observed with threatened status.

No other biological assemblages or species that could be considered particularly sensitive to the proposed project due to having a restricted range or restricted habitat availability, particular sensitivity to project activities and/or special conservation significance were identified at any of the survey sites along the subsea alignments.

The sea pen *Pseudogorgia godeffroyi* was present as scattered individuals to moderate density on the bare sand and among the *H tasmanica* from 10 m depth to around 31 m depth. There were few other epibiota on the sand seabed.

Areas of cobble and some patches or rock are scattered on the otherwise sandy seabed on and to the west of 2021 alignment and east of the 2022 alignment. The cobble habitat at around 15 m and 18 m was characterised by sponges and ephemeral, filamentous red, filamentous green algae*, the* green alga *Caulerpa* spp and the seagrass *Amphibolis antarctica*. The larger rock was characterised by sponges and ephemeral (seasonal) seaweeds.

Attached kelps were absent from the rock reef on the alignments at Waratah Bay. Unattached drifting kelps, including *Ecklonia radiata,* were observed accumulated along the reef edges in places. Accumulations of macroalgae drifting across the seabed may result in misidentification of nearshore reef, macroalgae and seagrass from aerial imagery. More substantial and extensive rock reefs occur on the western shore or Waratah Bay and around Cape Liptrap to the west of the cable alignment.

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Appendix A

Report to: Tetra Tech Coffey

Marinus Link

Marine Benthic Habitat Characterisation

Appendix A

2021 Towed Camera Images

May 2024

Marinus Link

Marine Benthic Habitat Characterisation

2021 Towed Camera Image Appendix

1 About this Image Appendix

Underwater camera surveys of the seabed habitats and associated marine biological conditions along the Marinus Link alignments were commissioned in 2021. These surveys documented seabed habitat and associated marine biological conditions along the defined preferred alignments close to the Tasmanian and Victorian shore crossings and along the alignments across central Bass Strait.

The methods used followed those described for the 2019 towed camera surveys of initial nearshore subsea cable alignment options and are described in the main report (CEE 2022).

The 2021 seabed habitat surveys were guided by the seabed descriptions and maps provided in the Fugro 2020 geophysical survey report (Fugro, 2020). The 2021 seabed habitat survey sites were planned to provide representative images of seabed habitat and associated biological communities along the chosen alignments at features identified in the geophysical survey report along and nearby the alignment.

The 2021 towed underwater camera images presented in this report were collected during two surveys:

i. 39 sites were surveyed nearshore and offshore in Tasmanian waters from ML1 252,000 to ML1 70,000 by Marine Solutions Tasmania in August 2021
ii. 25 sites were surveyed from ML1 40,000 to ML 1,000 by CEE offshore from the Victorian coastline in November 2021

Section 2 of this Appendix provides 2021 alignment chainage, water depth, and seabed summary description for all tows.

Section 3 provides images of representative seabed character from each 2021 camera tow chainage sorted from Tasmania to Victoria.

2 2021 Camera tow chainages, water depth and seabed description

KPs (m)	Depth (m)	Description
ML2 253,300	9	Reef and patchy sand. Mixed invertebrates. Coralline algae dominate reef.
ML1 252,300	10	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef.
ML2 253,000	11	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef.
ML2 252,800	12	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef.
ML1 252,000	13	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef.
ML1 251,700	14	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef. Trioxane line visible.
ML2 252,500	15	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef.
ML1 251,300	17	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef. Trioxane line visible.
ML2 252,000	18	Reef and cobble. Mixed invertebrates. Coralline algae dominate reef.
ML1 251,000	20	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef
ML2 251,500	22	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef.
ML1 250,500	23	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef.
ML1 250,000	25	Reef and sand gutters. Coralline algae dominated reef.
ML2 251,000	26	Reef and sand gutters. Mixed invertebrates. Coralline algae dominate reef.
ML2 250,000	31	Reef and sand. Mixed invertebrates.
ML1 249,000	31	Reef. Mixed invertebrates.
ML2 240,500	55	Silt/Clay. High mixed invertebrates. Scarce erect Eunicid worm tubes. Sparse burrows.
ML2 240,000	56	Silt/Clay. Moderate mixed invertebrates. Scarce erect Eunicid worm tubes. Moderate burrows.
ML1 240,000	56	Silt/Clay. Moderate mixed invertebrates. Scarce erect Eunicid worm tubes. Moderate burrows.
ML2 239,500	56	Silt/Clay. High mixed invertebrates. Scarce erect Eunicid worm tubes. Moderate burrows.
ML2 239,000	57	Silt/Clay. Moderate mixed invertebrates. Scarce erect Eunicid worm tubes. Moderate burrows.
ML2 238,700	59	Silt/Clay. High mixed invertebrates. Scarce erect Eunicid worm tubes. Sparse burrows. Spider crab sighted.
ML2 238,500	59	Silt/Clay. Moderate mixed invertebrates. Moderate burrows. Spider crab sighted.
ML2 238,000	60	Silt/Clay. Moderate mixed invertebrates. Moderate burrows.
ML1 238,000	59	Silt/Clay. Sparse mixed invertebrates. Scarce erect Eunicid worm tubes. Moderate burrows.
ML2 230,000	68	Silt/Clay. Moderate mixed invertebrates. Sparse erect Eunicid worm tubes. Moderate burrows.
ML1 230,000	68	Silt/Clay. Very sparse mixed invertebrates. Sparse erect Eunicid worm tubes. Abundant burrows.
ML2 210,000	69	Silt/Clay. Sparse mixed invertebrates. Moderate burrows.
ML1 210,000	70	Silt/Clay. Very sparse mixed invertebrates. High burrows.
ML2 180,900	76	Silt/Clay. Sparse mixed invertebrates. Moderate burrows.
ML1 180,000	76	Silt/Clay. Very sparse mixed invertebrates. Moderate burrows.
ML2 140,000	80	Silt/Clay. Sparse mixed invertebrates. Moderate burrows.
ML1 140,000	80	Silt/Clay. Sparse mixed invertebrates. Moderate burrows.
ML2 120,000	80	Silty Sand. Sparse mixed invertebrates. Moderate burrows.

KPs (m)	Depth (m)	Description
ML1 120,000	80	Silty Sand. Sparse mixed invertebrates. Sparse to moderate burrows. Sea cumber sighted.
ML2 100,000	79	Silty Sand. Sparse mixed invertebrates. Moderate burrows.
ML1 100,000	79	Silty Sand. Moderate mixed invertebrates. Sparse to moderate burrows.
ML2 70,000	75	Silty Sand. Sparse mixed invertebrates. Moderate burrows.
ML1 70,000	75	Silty Sand. Moderate mixed invertebrates.
ML2 40,000	74	Silty Sand. Scarce erect Eunicid worm tubes.
ML1 40,000	74	Silty Sand. Scarce erect Eunicid worm tubes.
ML2 20,000	71	Silty sand. Scarce erect Eunicid worm tubes.
ML1 20,000	71	Silty sand. Scarce erect Eunicid worm tubes.
ML 10,000	45	Sand and silt. Sparse erect Eunicid worm tubes.
ML 8,000	42	Sand and silt. Sparse to moderate erect Eunicid worm tubes.
ML 7,000	31	Sand with ripples. Sparse macro algae. Sparse to moderate visible infauna. Scarce sea pens. Spider crabs sighted.
ML 6,300	26	Sand with ripples. Sparse macro algae. Sparse to moderate visible infauna. Scarce sea pens. Spider crabs sighted.
ML 6,000	26	Sand with ripples. Sparse macro algae. Sparse to moderate visible infauna. Scarce sea pens. Spider crabs sighted.
ML 5,000	21	Sand, shell, and cobble. Sparse macro algae. Scarce invertebrates. Scarce sea pens.
ML 4,300	19	Rippled sand with sparse cobble and shell. Sparse invertebrates. Scarce seagrass. Scarce sea pens.
ML 4,000	19	Sand, cobble, and sparse shell. Sparse to moderate macro algae. Sparse invertebrates. Sparse seagrass.
ML 3,700	18	Sand with cobble and shell patches. Sparse to moderate seagrass. Moderate macro algae cover. Sparse invertebrates.
ML 3,500	18	Sand and Cobble with patchy reef. Moderate invertebrate and macro algae cover. Sparse seagrass patches.
ML 3,000	17	Sand with ripples. Section of rock, cobble, and shell reef. Sparse to moderate seagrass. Sparse drift algae. Scarce sea pens. Bioturbation absent or sparse.
ML 2,500	16	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae. Sparse sea pens. Bioturbation absent or sparse.
ML 2,000	15	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae. No obvious visible epifauna. Scarce sea pens. Bioturbation absent or sparse.
ML 1,700	14	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae. No obvious visible epifauna. Scarce sea pens. Bioturbation absent or sparse.
ML 1,400	14	Sand with ripples. Patchy shell. Sparse seagrass. Sparse drift algae. No obvious visible epifauna. Bioturbation absent or sparse.
SF5	14	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae. Scarce sea pens.
SF3	13	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae. Band of dark sand shell and reef with mixed invertebrates.
SF4	13	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae. Band of reef with mixed invertebrates.
ML 1,100	10	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae. No obvious visible epifauna. Bioturbation absent or sparse.
SF2	10	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae. Band of dark sand and shell.
SF1	8.5	Sand with ripples. Sparse to moderate seagrass. Sparse drift algae.

3 2021 Camera tow seabed character images

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	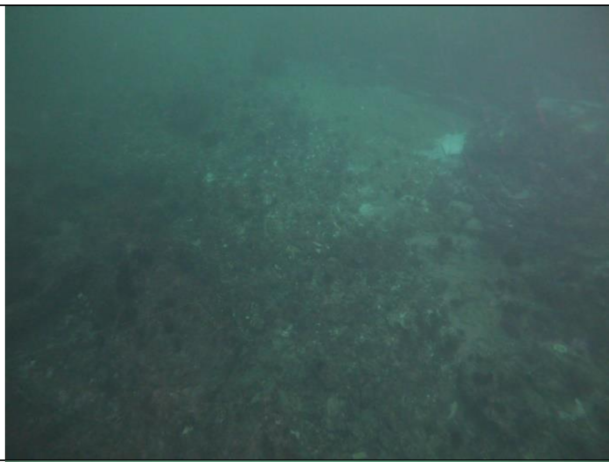
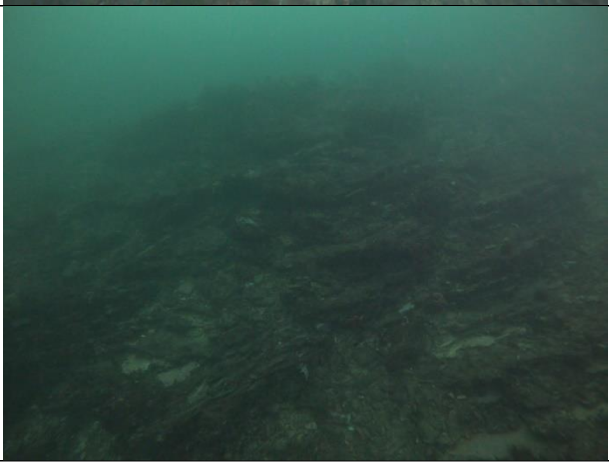	

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	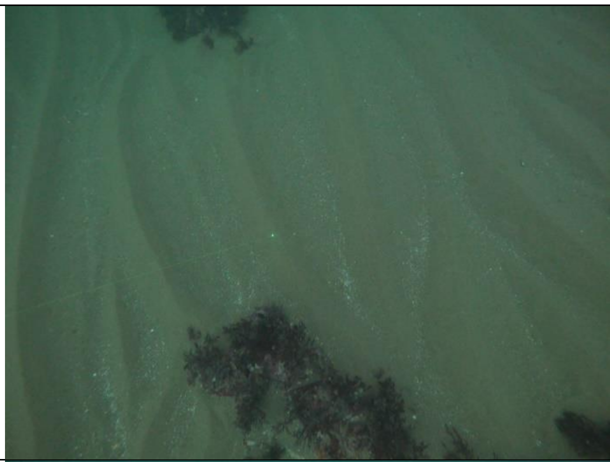
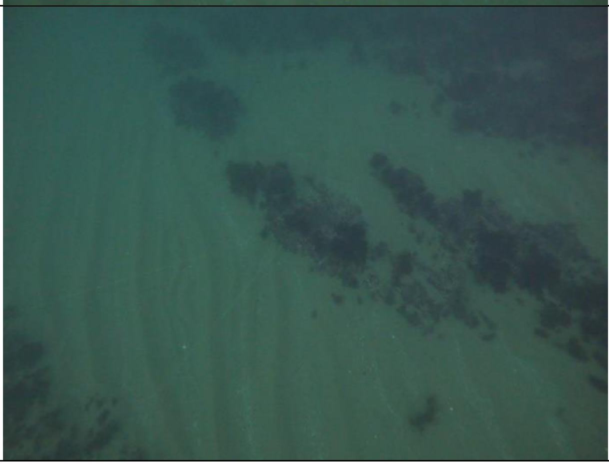	

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	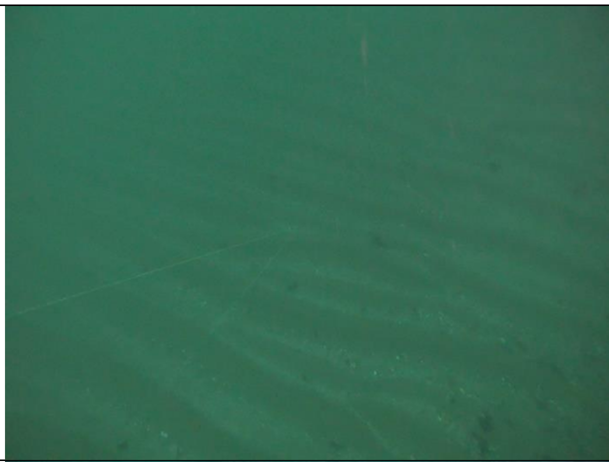
	
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	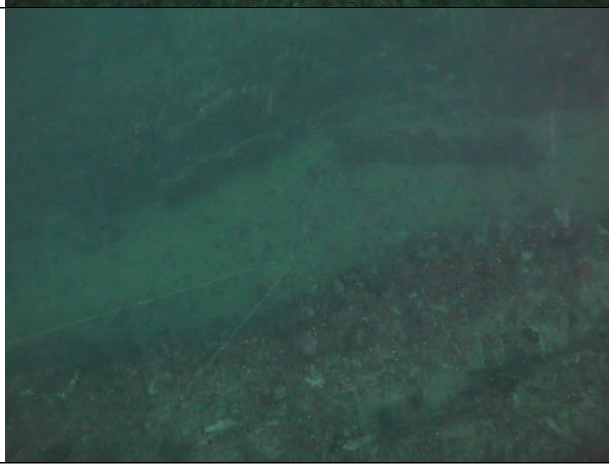

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	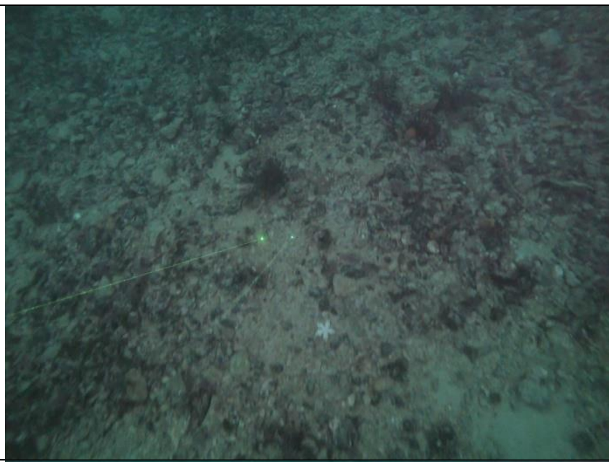
	
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	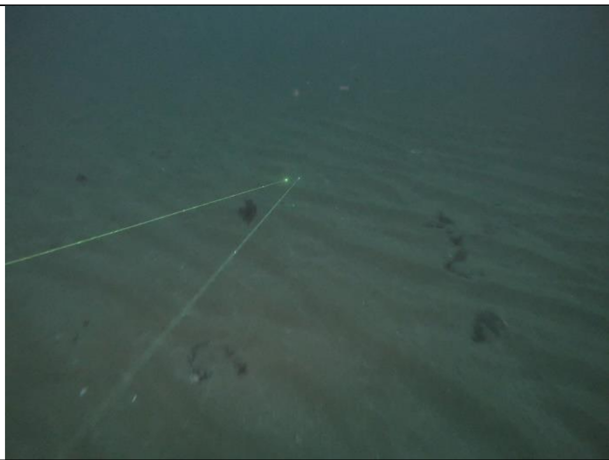
	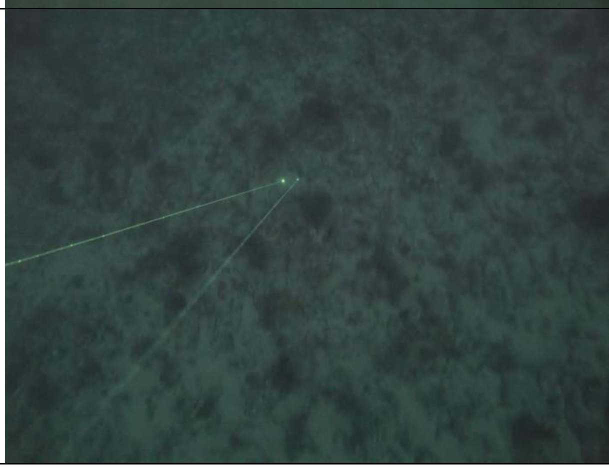

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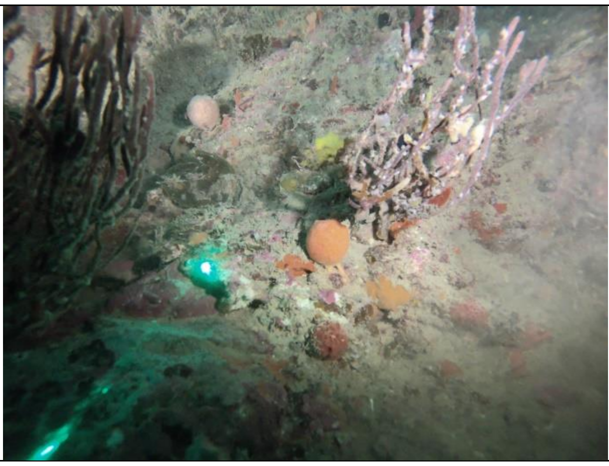	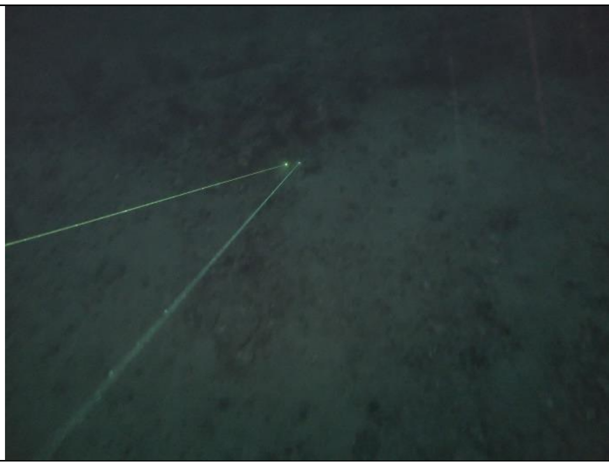
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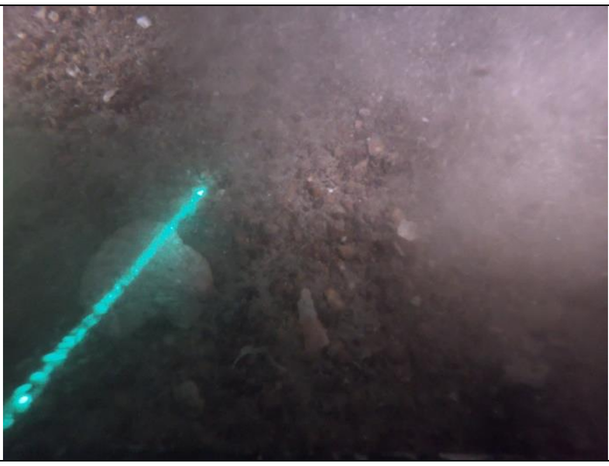	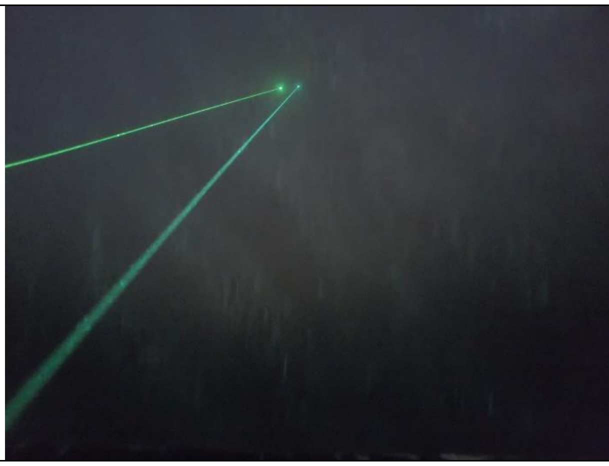
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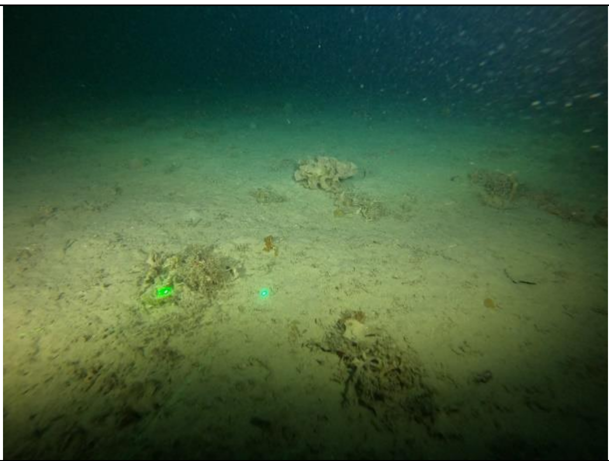	
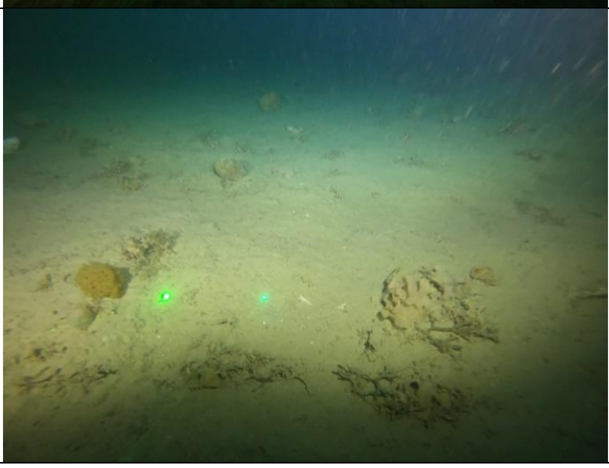	

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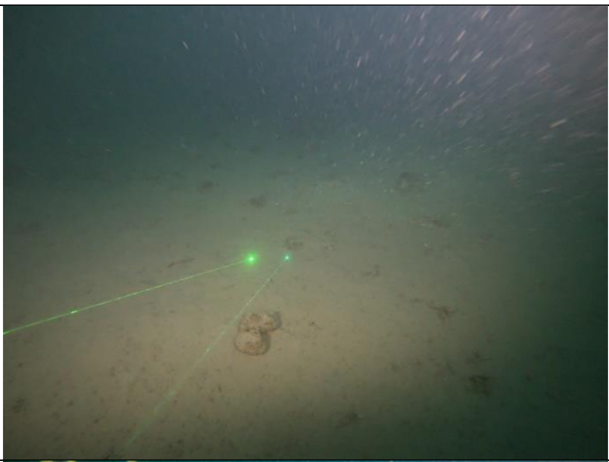	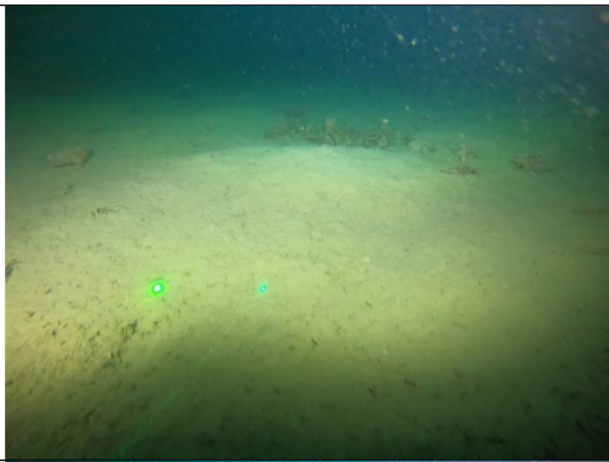
	
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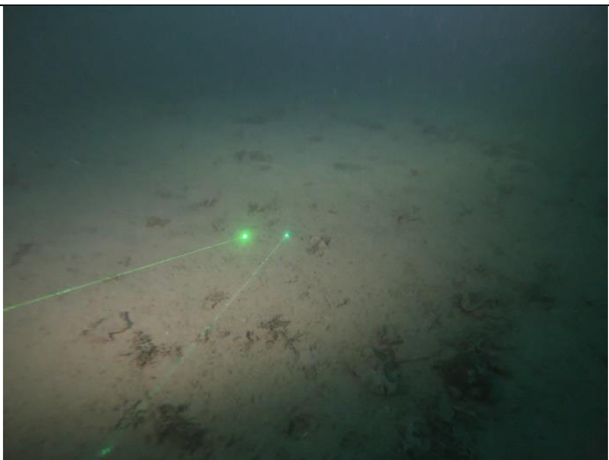	
	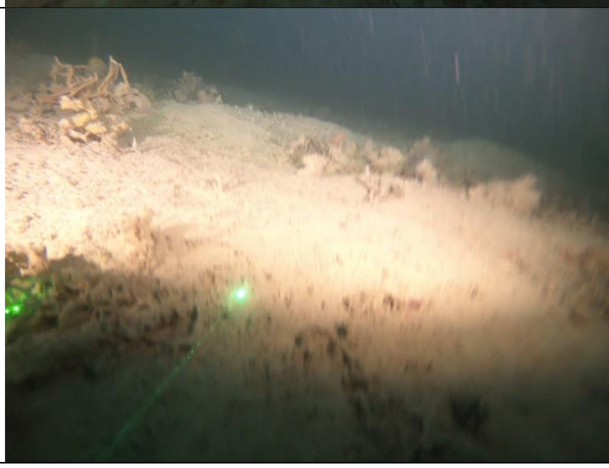

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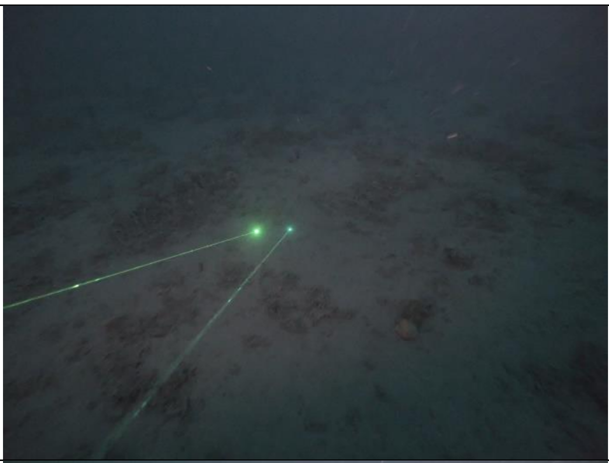	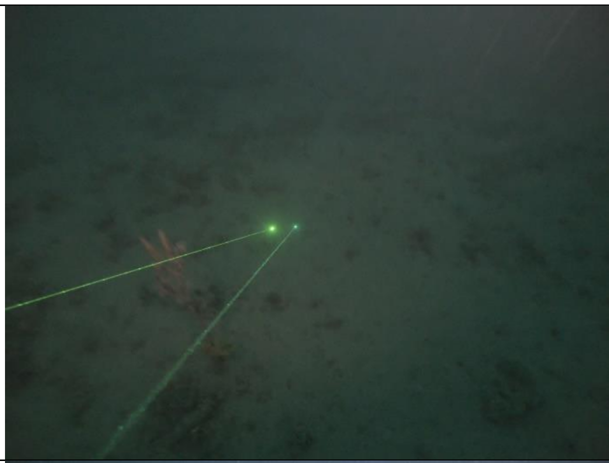
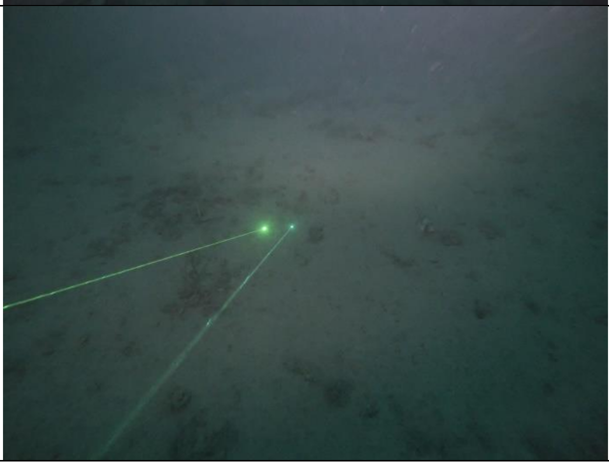	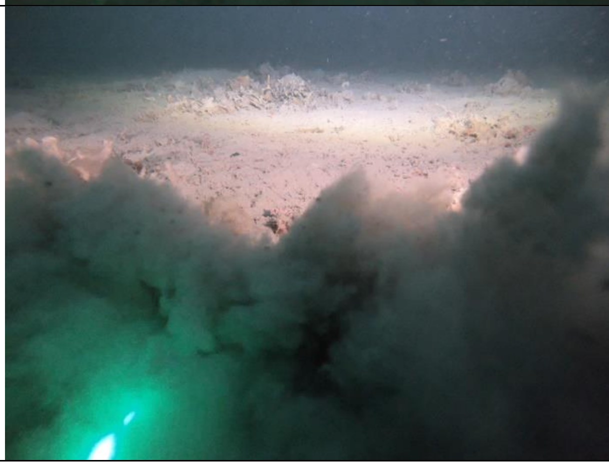
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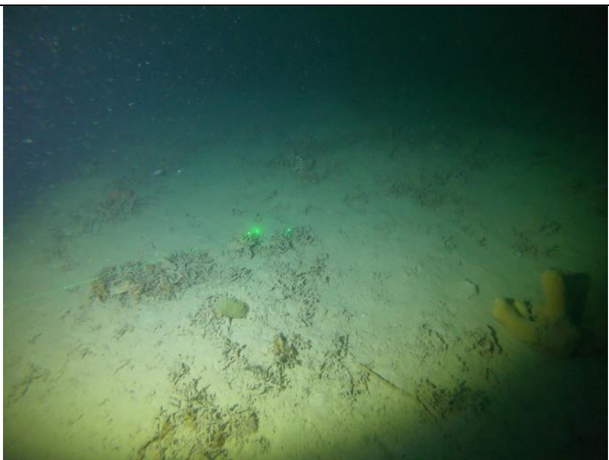	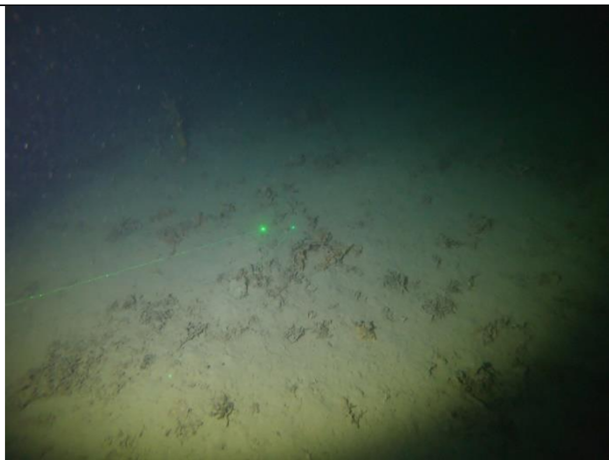
	

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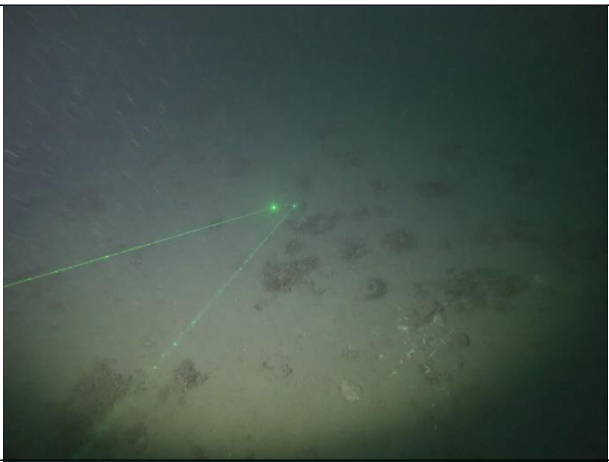	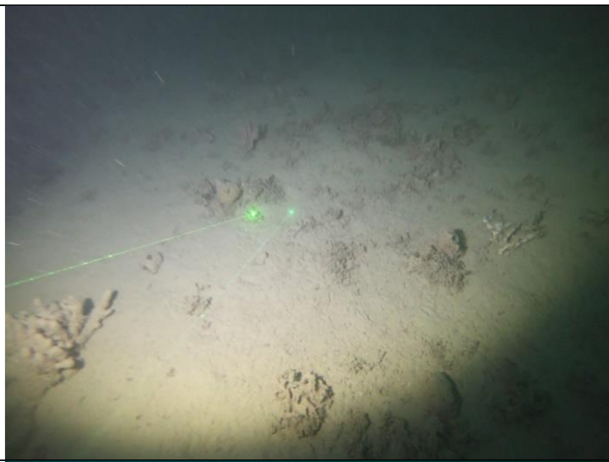
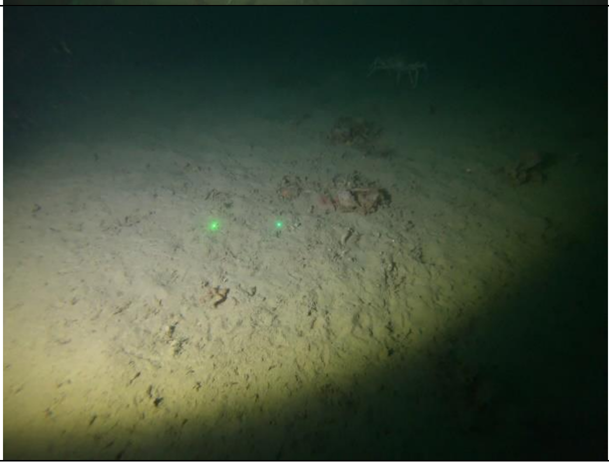	
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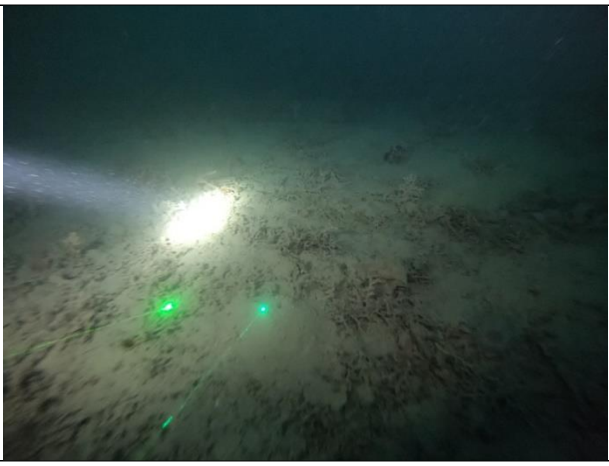	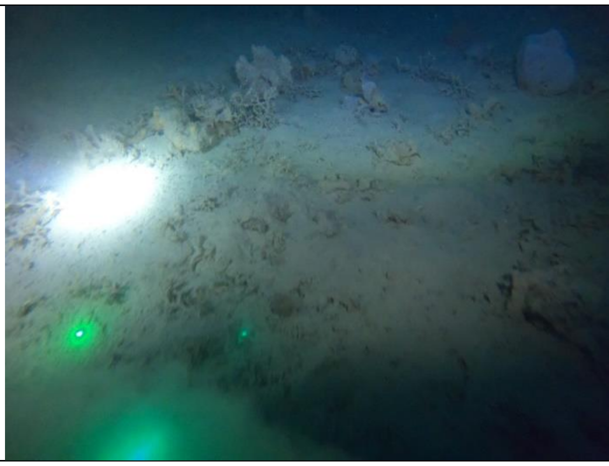

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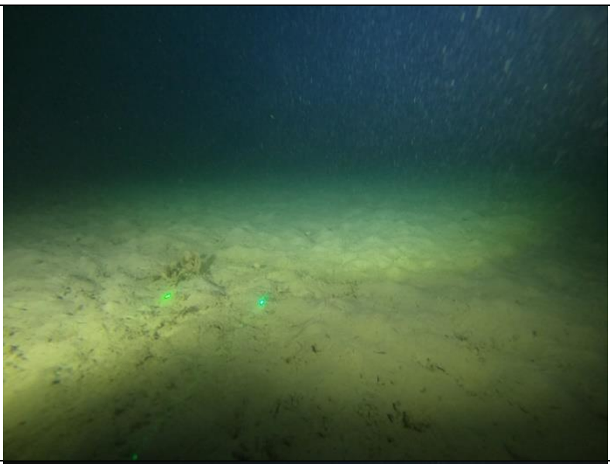	
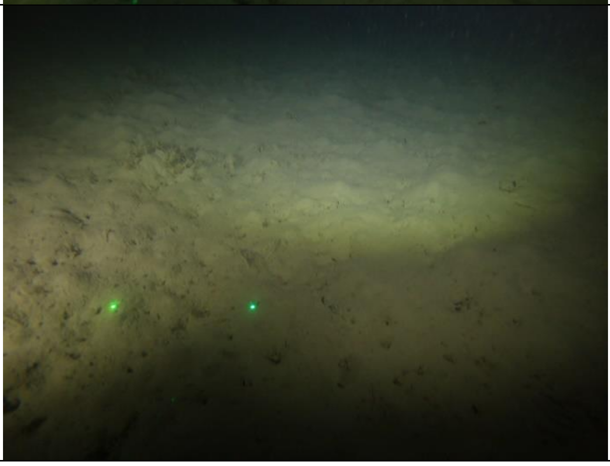	
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	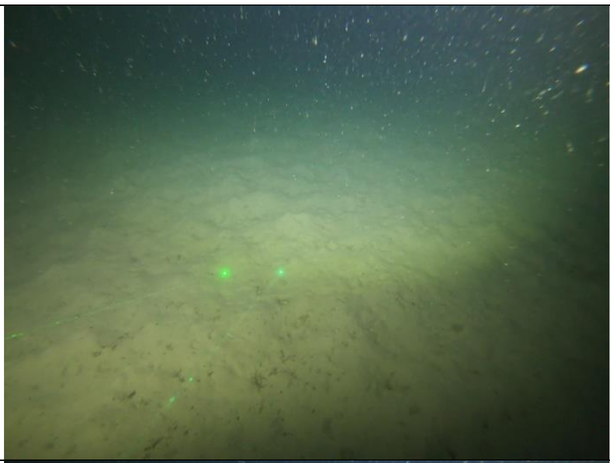
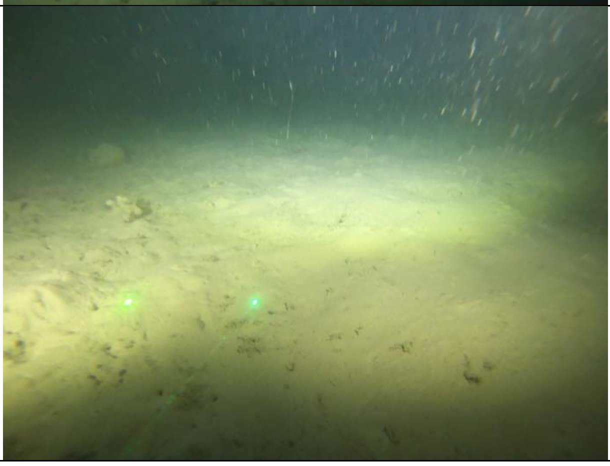	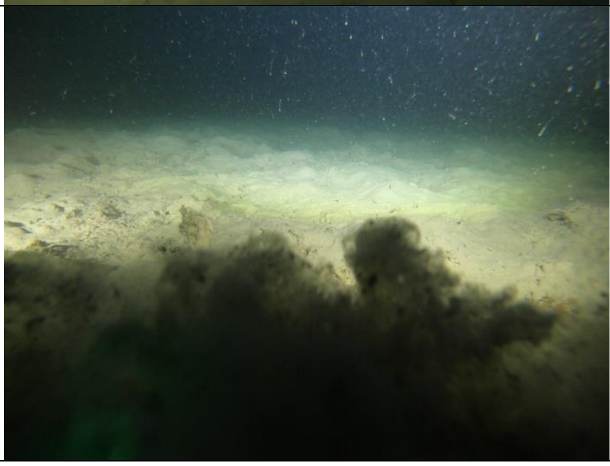

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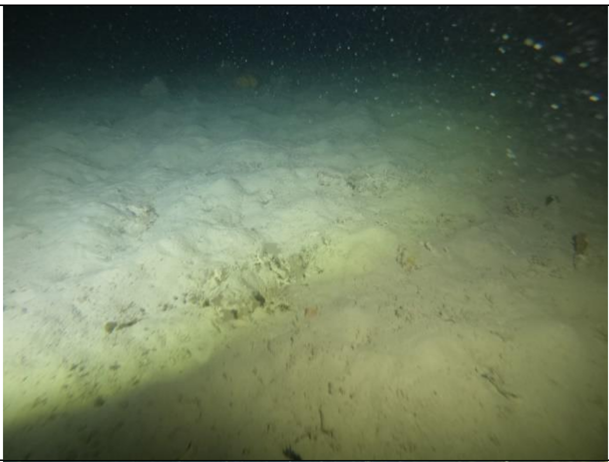	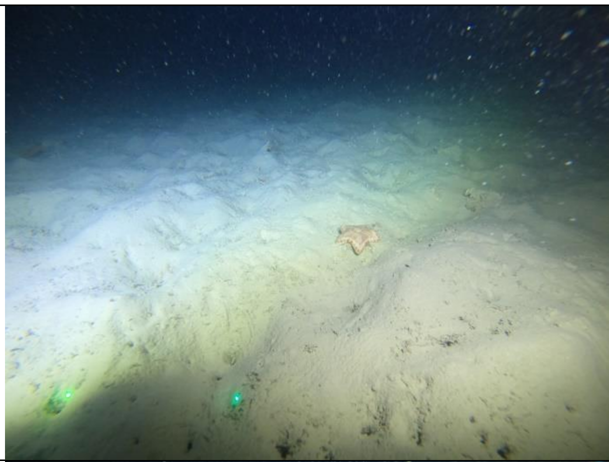
	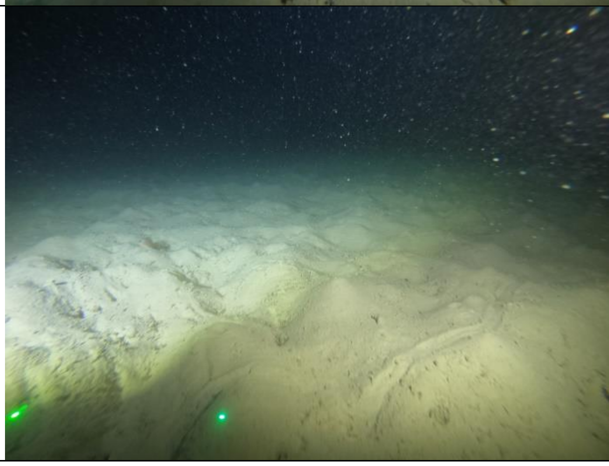
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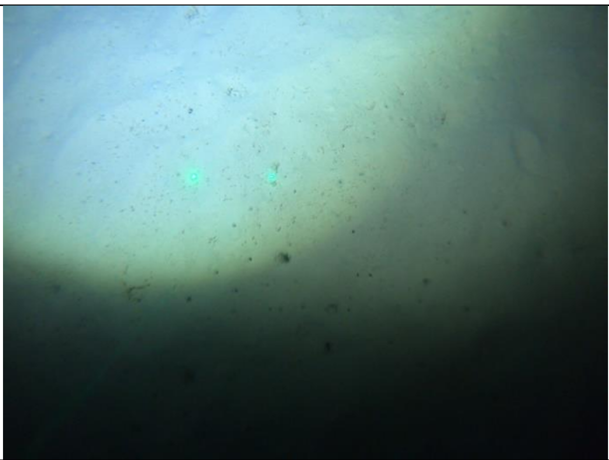	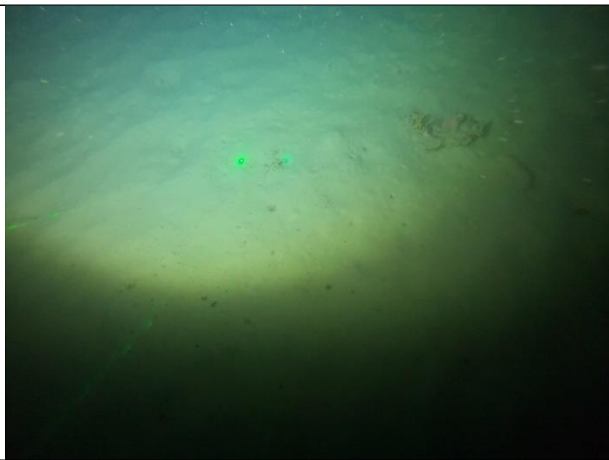
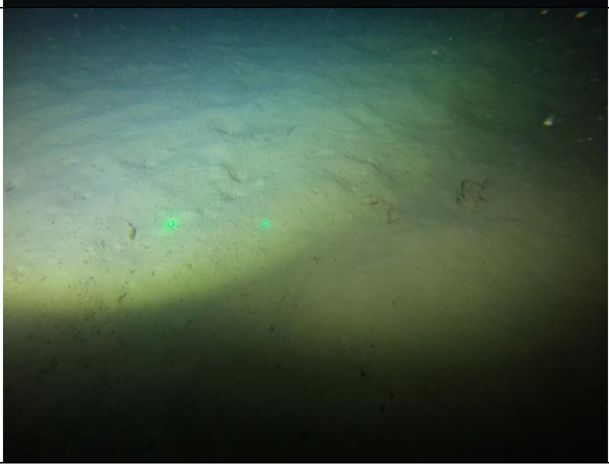	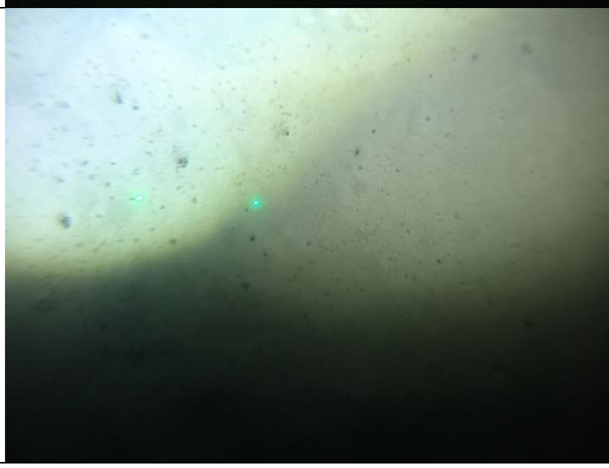

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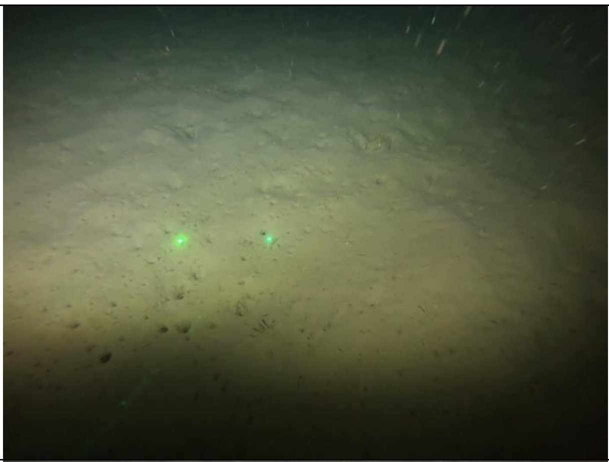	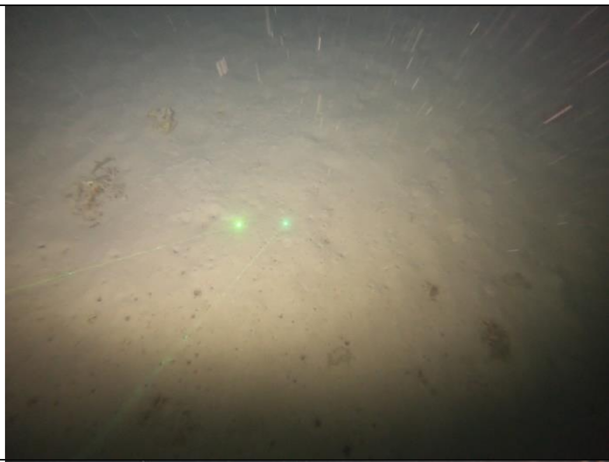
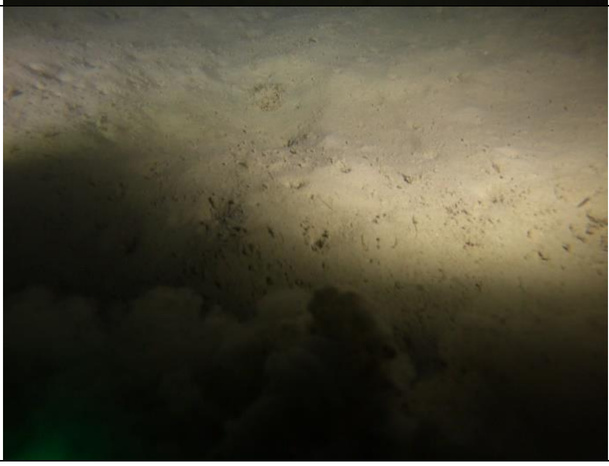	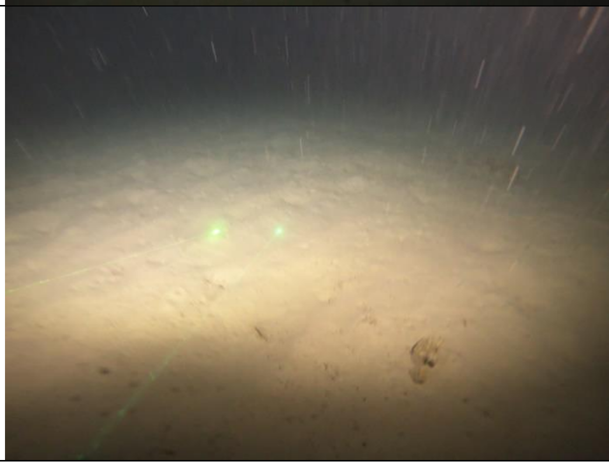
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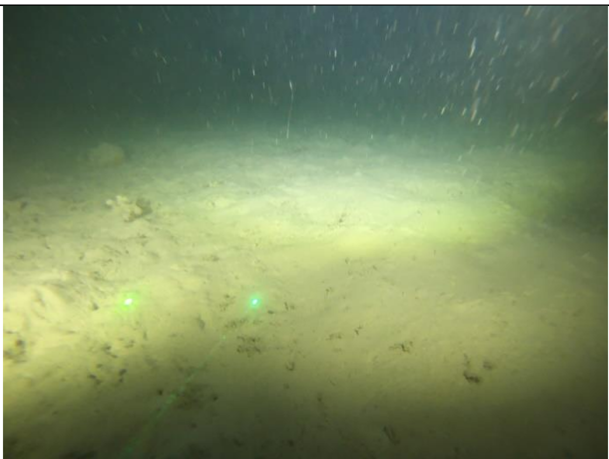	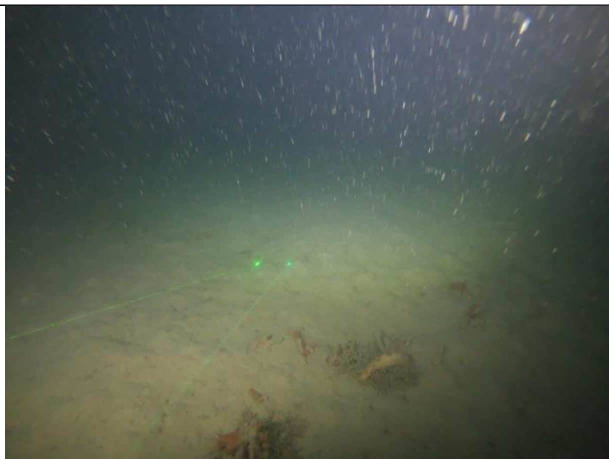
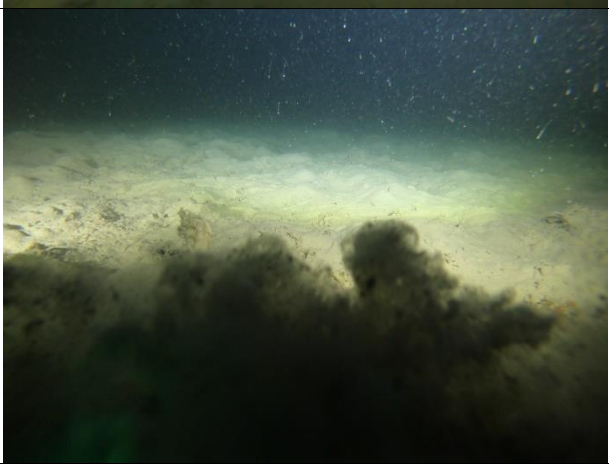	

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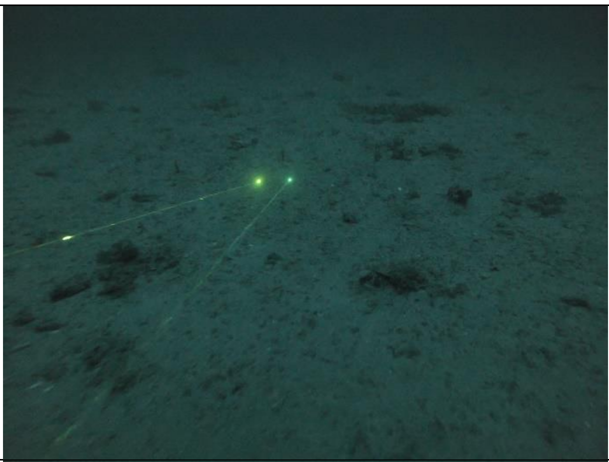	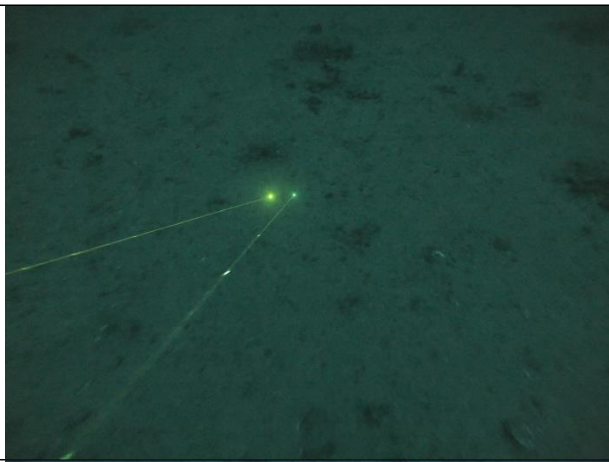
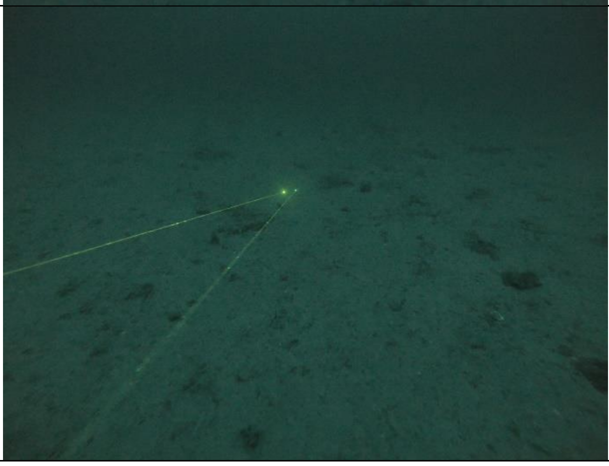	
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	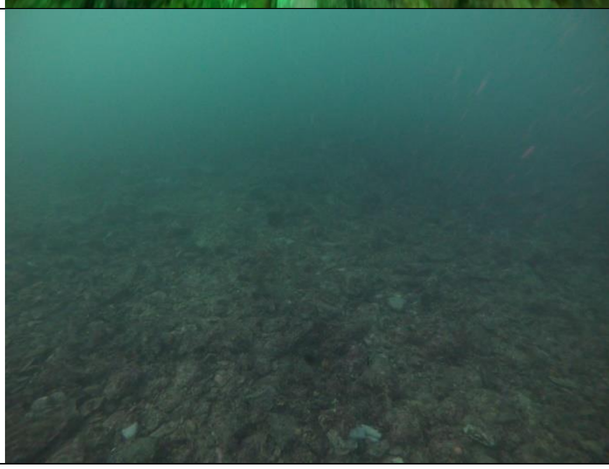

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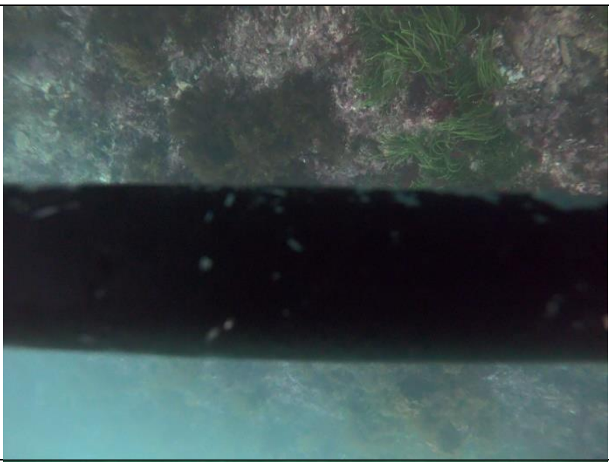
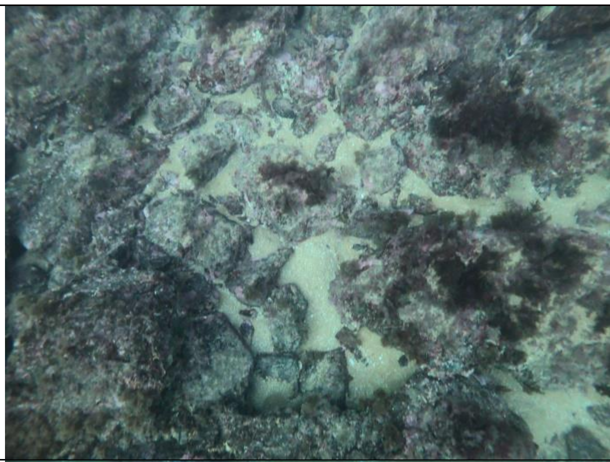
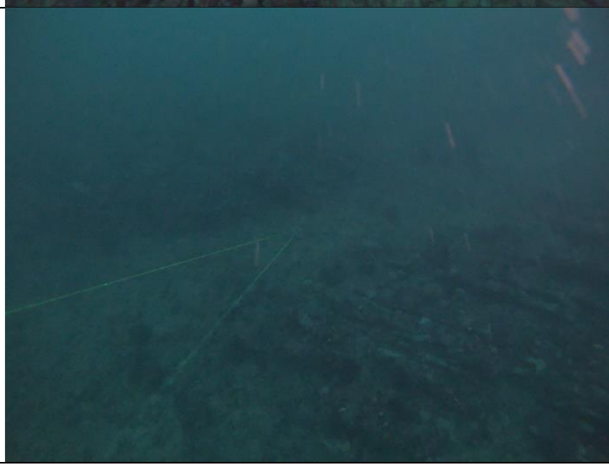
	
	
ML1 251,700	14m
	
	

ML1 251,300	17m
	
c 	
ML1 251,000	20m
	
	

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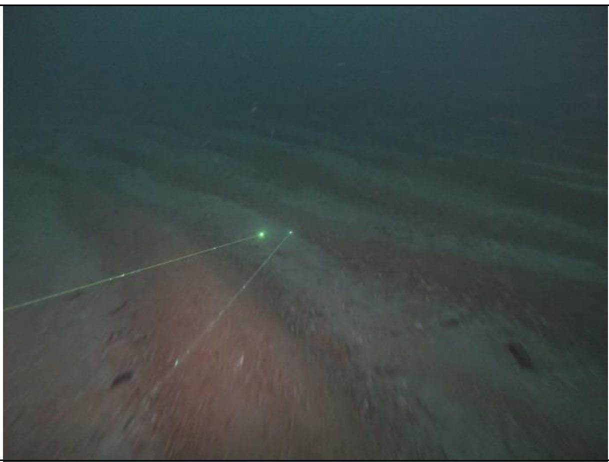	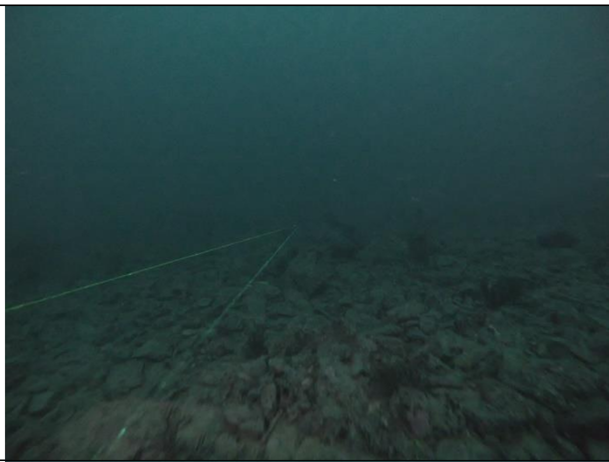
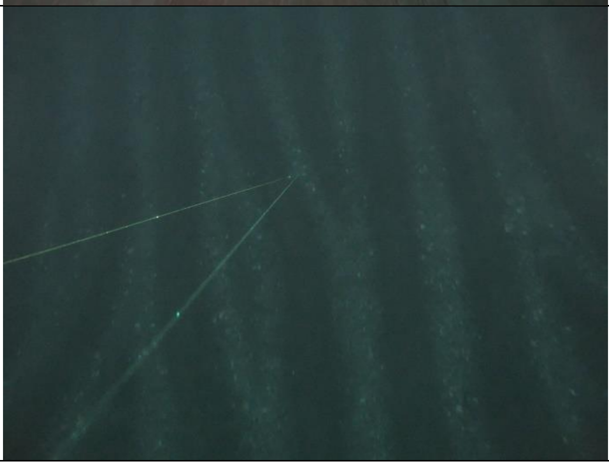	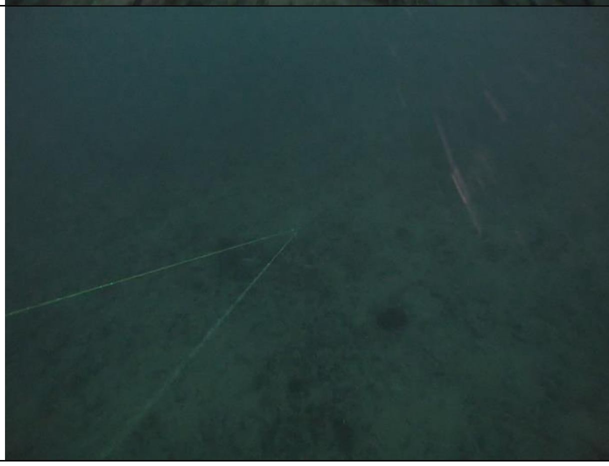
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	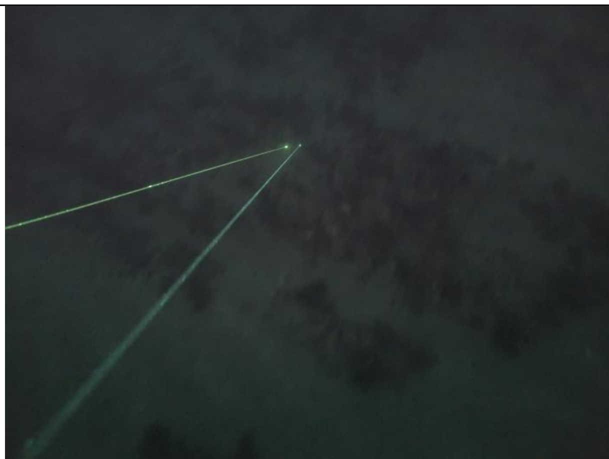
	

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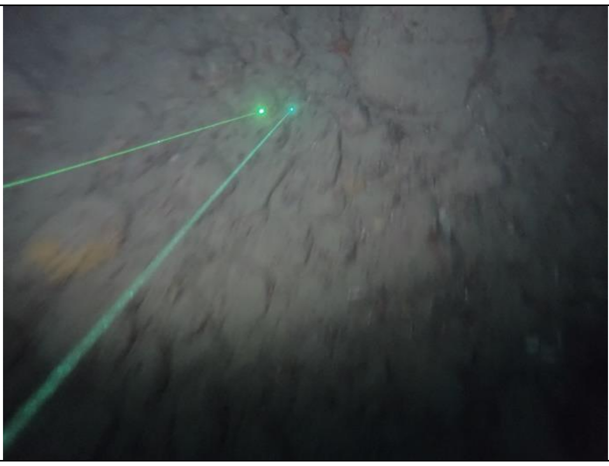	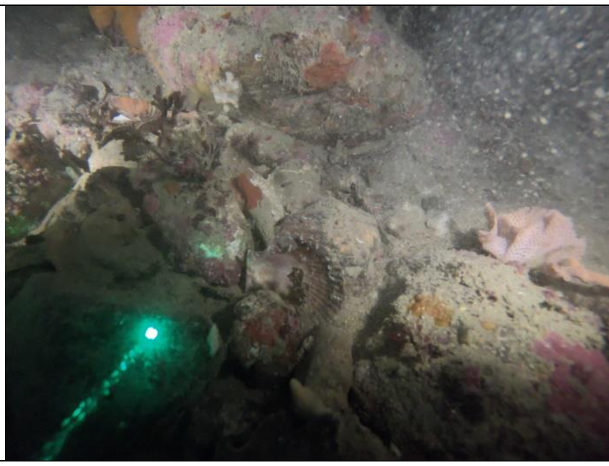
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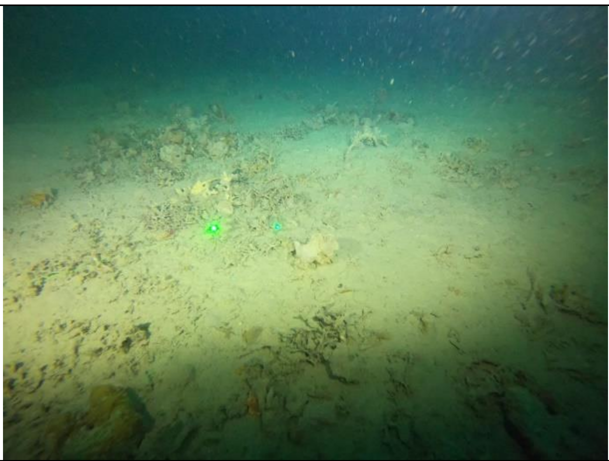	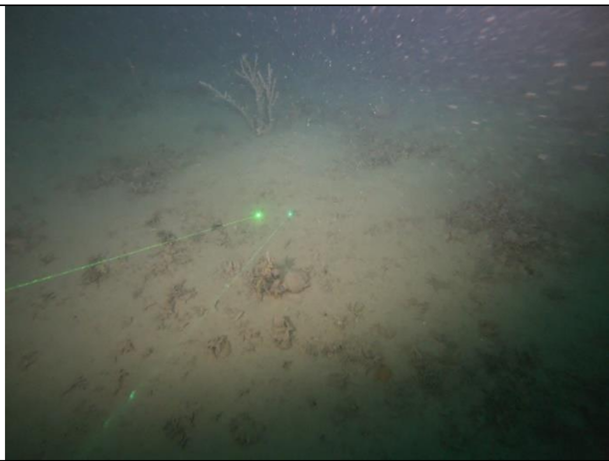
	

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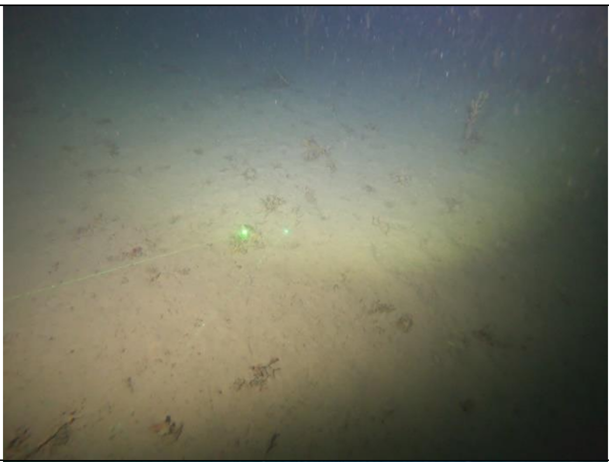	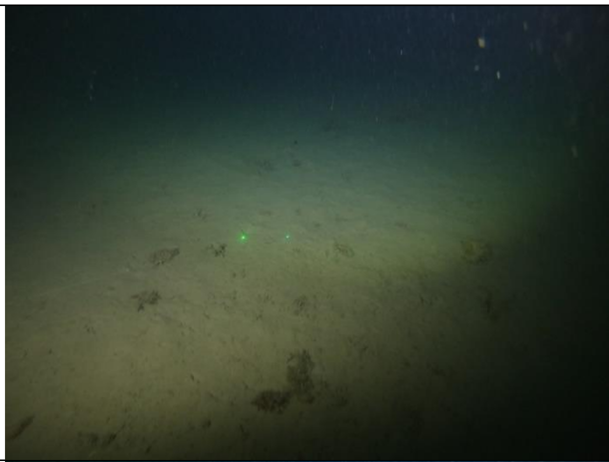
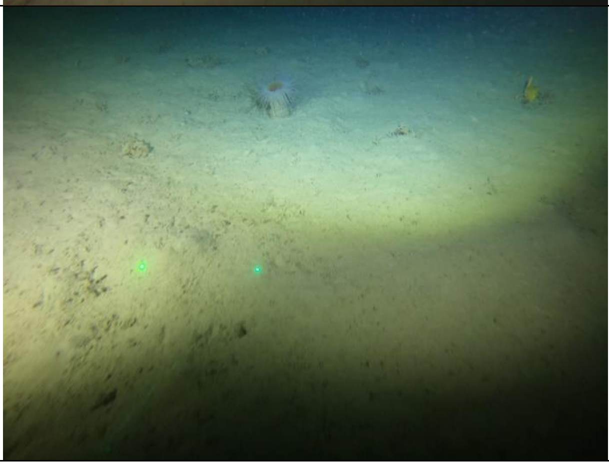	
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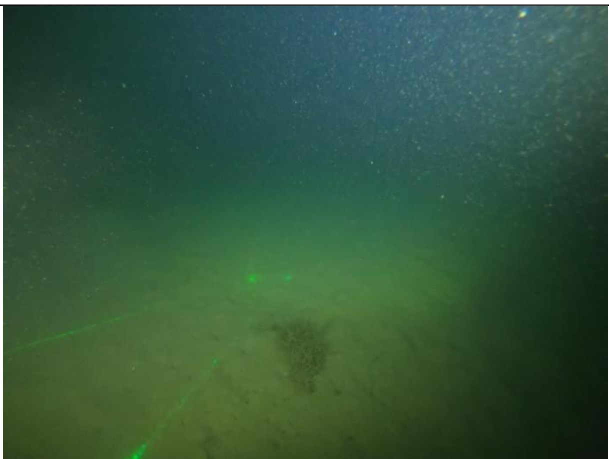
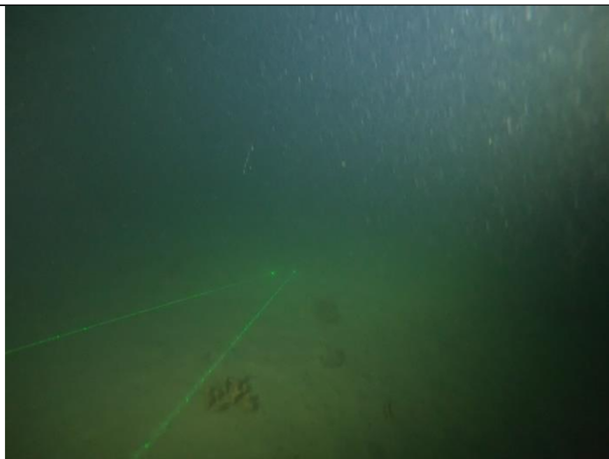
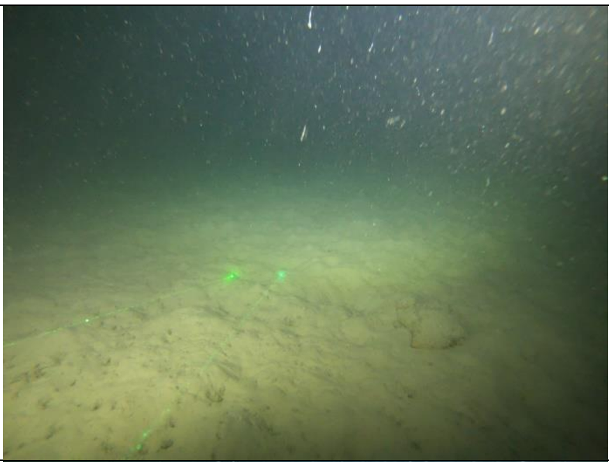
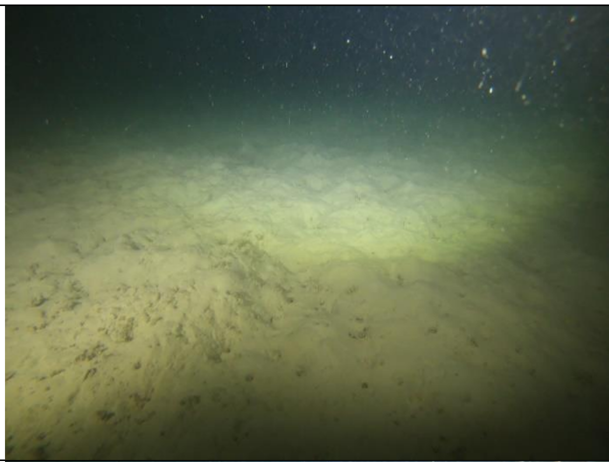
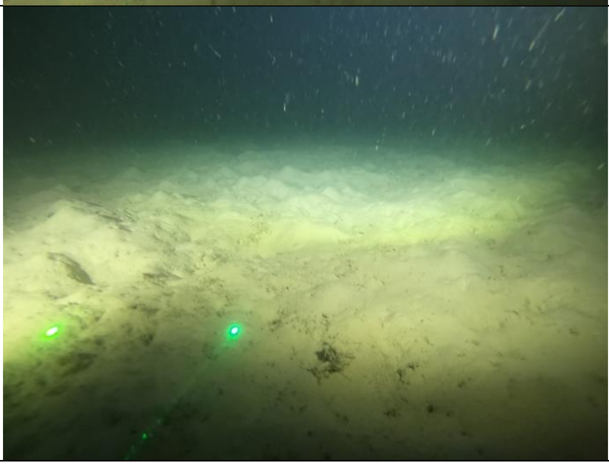
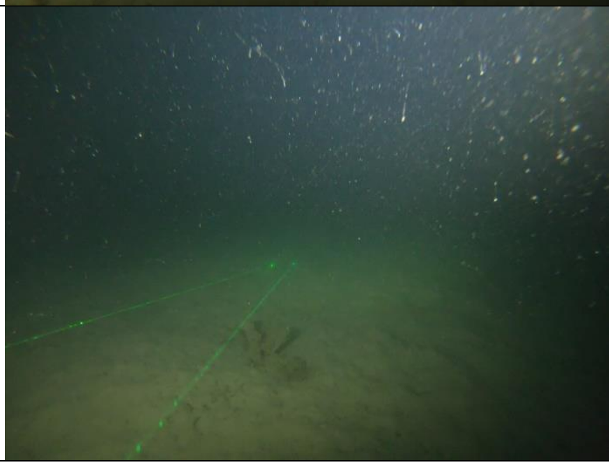
	
	

ML1 210,000	70m
	
	
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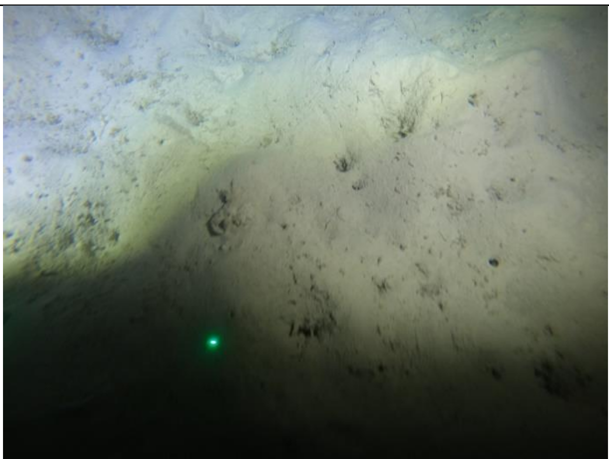	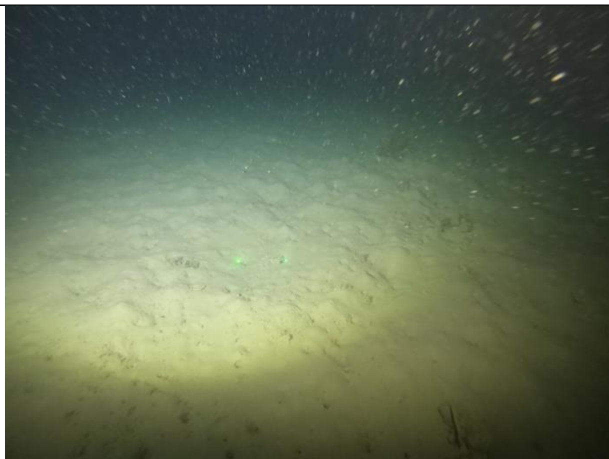
	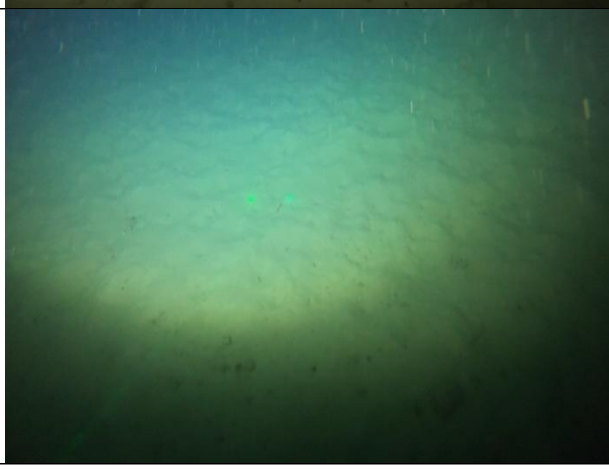

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	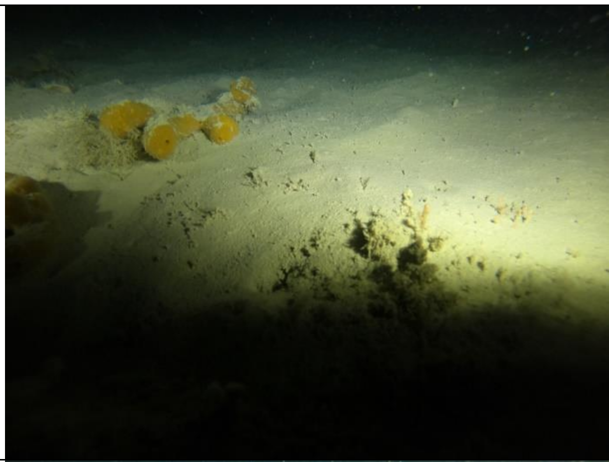
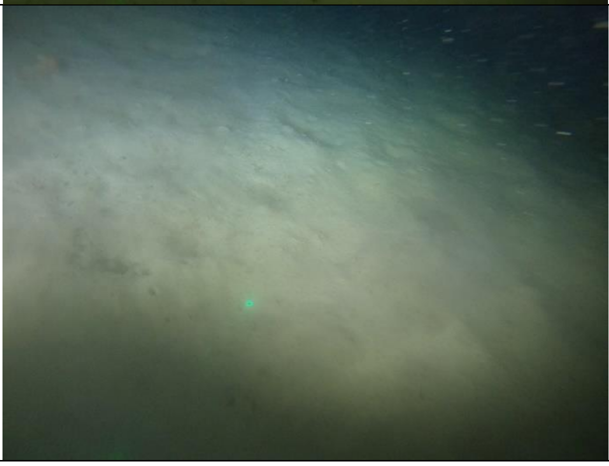	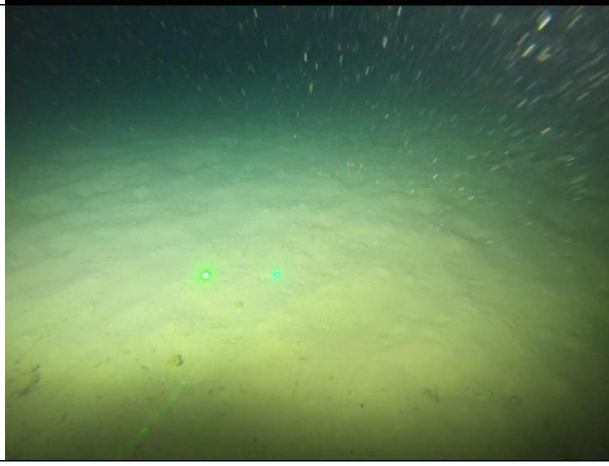
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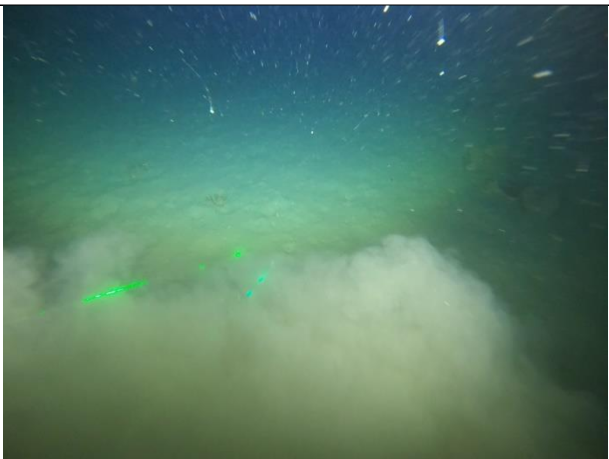	
	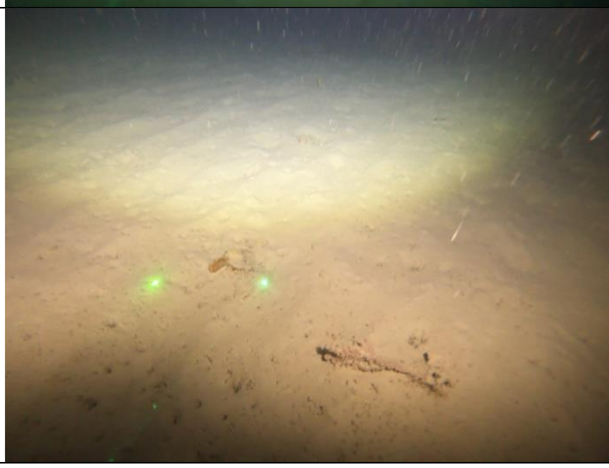

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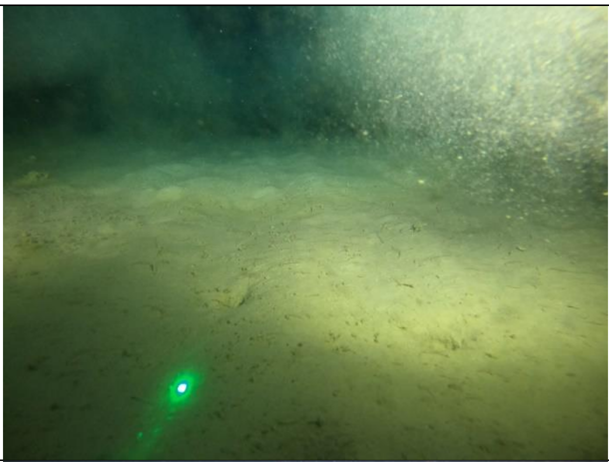	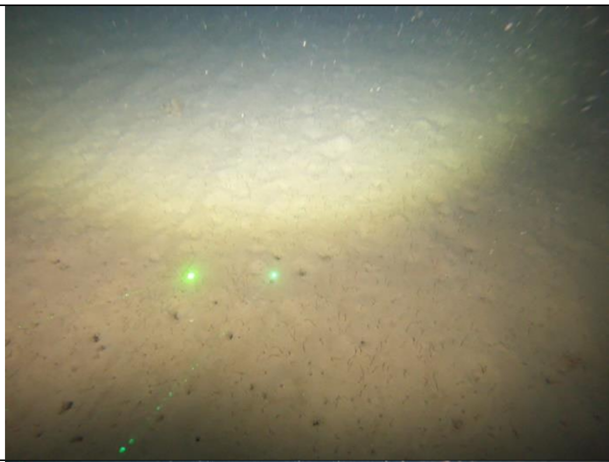
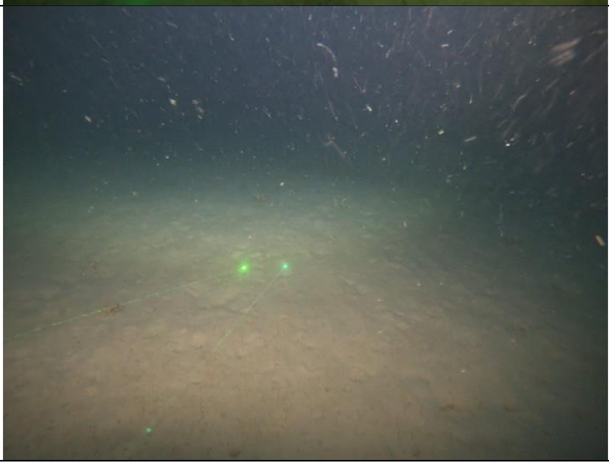	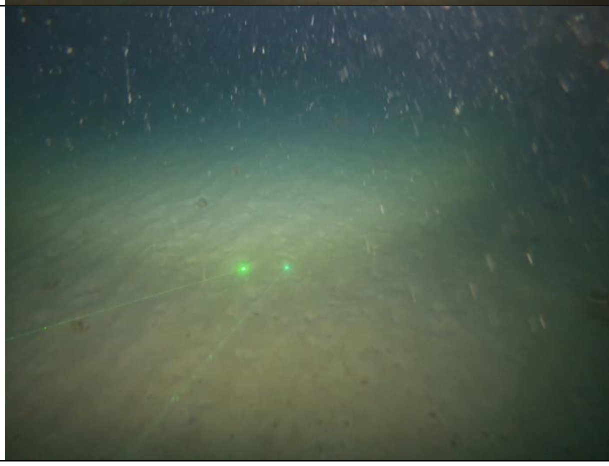
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	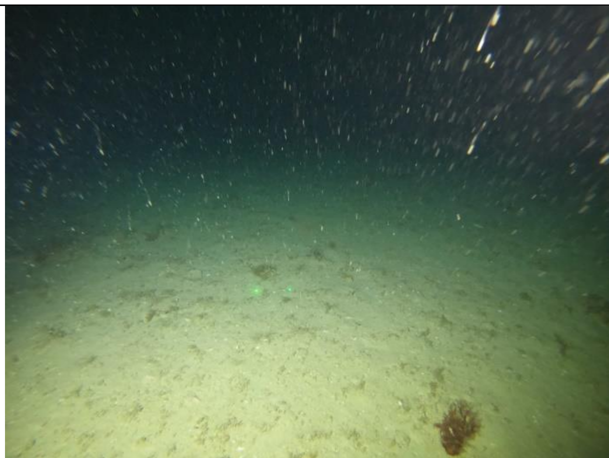
	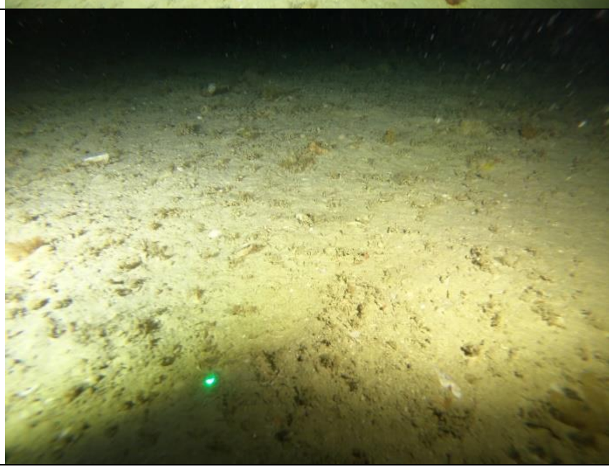

ML2 40,000	74m
	
	
ML1 40,000	74m
	
	

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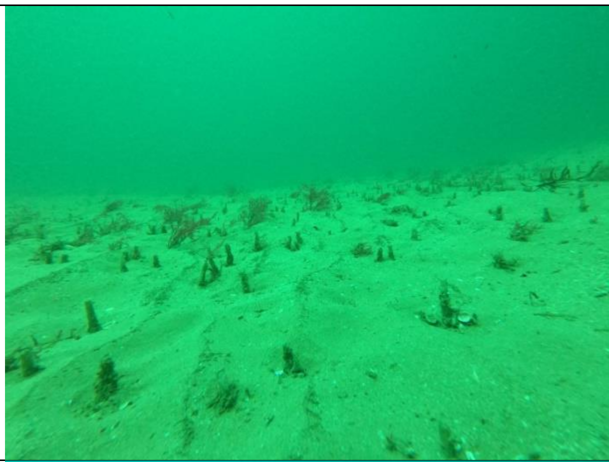
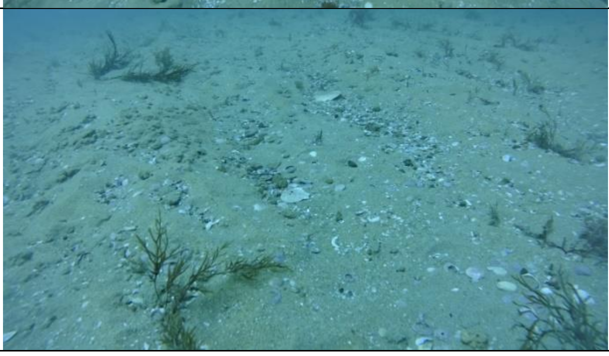
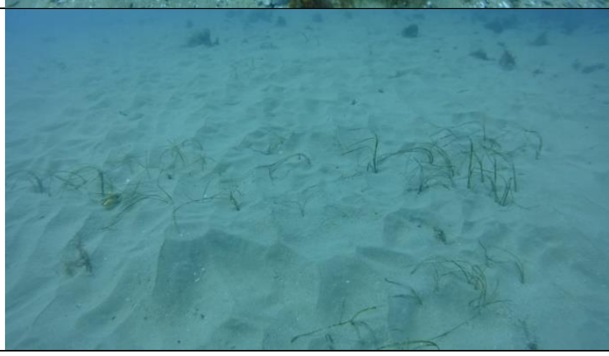
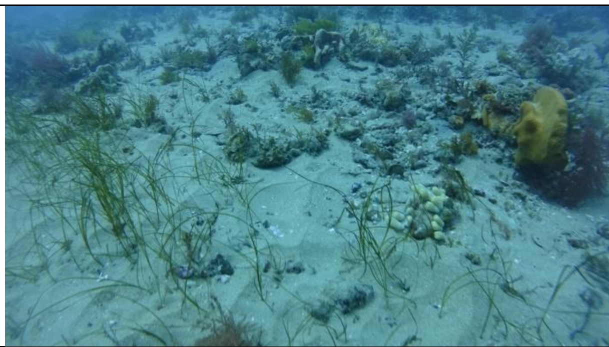
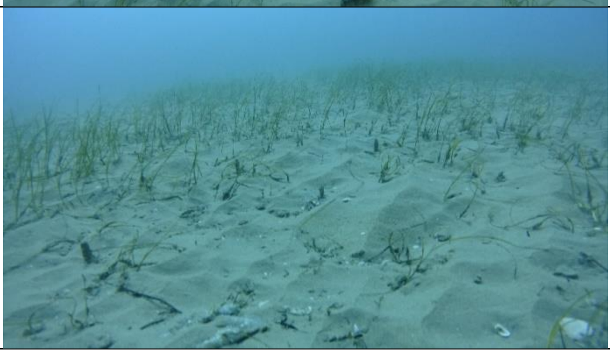
ML 10,000	45m
	
	
ML 8,000	42m
	
	

ML 7,000	31m
	
	
ML 6,300	26m
	
	

ML 6,000	26m
	
	
ML 5,000	21m
	
	

ML 4,300	19m
	
	
ML 4,000	19
	
	

ML 3,700	18m
	
	
ML 3,500	18m
	
	

ML 3,000	17m
	
	
ML 2,500	16m
	
	

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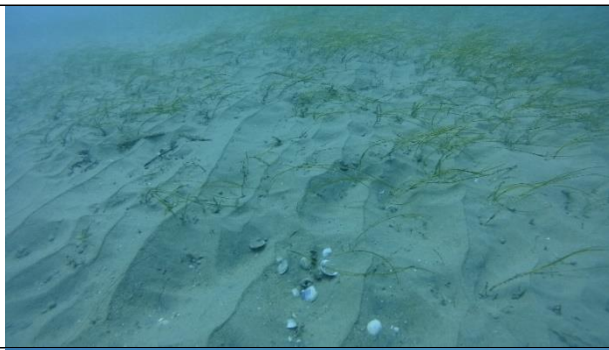
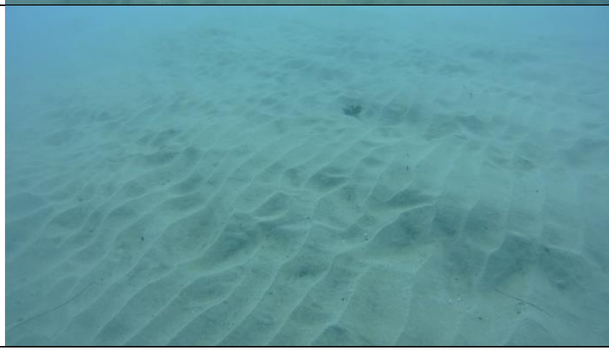
	
	
ML 1,700	14m
	
	

ML 1,400	14m
	
	
ML 1,100	10m
	
	

SF1	
	
	
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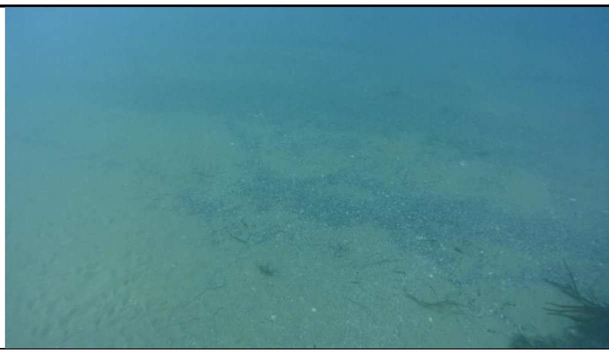
SF3	
	

	
SF4	
	
	
SF5