Volume 2

Appendix B. Contaminated Land and Acid Sulfate Soils Impact Assessment

Marinus Link

Contaminated Land and Acid Sulfate Soils Impact Assessment – Heybridge Converter Station, Tasmania

Tetra Tech Coffey Pty Ltd

05 December 2024

Reference: 754-MELEN215878ML_Sub_CSASS-Tas_R01

MARINUS LINK

Contaminated Land and Acid Sulfate Soils Assessment – Heybridge Converter Station, Tasmania

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05 December 2024

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Certified Environmental Practitioner (Site Contamination) report verification

I have reviewed and can confirm that all works and actions conducted to support this environmental assessment have been undertaken in general accordance with the National Environment Protection (Assessment of Site Contamination) Measure, 1999 as amended 2013, except where noted in this report.

Bryden Tiddy

Principal Environmental Scientist

Restriction on Disclosure and Use of Data

Statement of Limitations for the Contaminated Land and Acid Sulfate Soils Assessment of the Marinus Link project (Heybridge Converter Station) is provided in Appendix A.

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EXECUTIVE SUMMARY

Marinus Link Pty Ltd (MLPL) contracted Tetra Tech Coffey Pty Ltd (Tetra Tech Coffey) to conduct an environmental impact assessment for Marinus Link, the proposed construction of a high-voltage direct current electricity interconnector between Tasmania and Victoria. This report presents the assessment of the Tasmanian component of Marinus Link, covering the Heybridge converter station and shore crossing area (to a distance of 3 nautical miles).

The objective of this assessment was to identify the potential for contamination and/or acid sulfate soils (ASS) to be present at the study area and to assess the risks and residual impacts to the environment and human health posed by the potential contamination. This assessment included a review of previous site investigations and publicly available information, as well as sampling and analysis of soil and surface water within the study area for contaminants of potential concern that may potentially cause impacts to human health or the environment.

This contaminated land and ASS impact assessment identified four potential hazards with a low to high risk of causing impacts to the environment without the application of additional controls (including three potential hazards to the environment arising from contamination) including:

1. Management of excavated soils – including contaminated soils and asbestos (moderate risk),
2. ASS (moderate risk), and
3. Management of routine construction and operational impacts (low risk).

Management and mitigation measures have been developed for each of the identified potential environmental hazards, detailing the measures to be applied to manage potential impacts to the environment through construction and operation of Marinus Link. These management and mitigation measures are considered appropriate for the purposes of managing the potential risks to human health or the environment, in accordance with the environmental values to be protected for ambient air, land and water should they be implemented appropriately. With the implementation of the following areas for environmental management, the risk of impacts to human health and environment is reduced to Moderate to Very low:

- Manage excavated soils: Develop a contaminated land management plan that includes testing soils prior to excavation to confirm their contamination status and how to manage them (disposal, remediation etc) to mitigate potential impacts to environment (CL01. This also includes specific assessment for asbestos and ASS in soils and details how they will be managed. This reduces the risk of impact to the environment from moderate to low.
- ASS: Develop an ASS management controls (as a part of the contaminated land management plan) that includes requirements to test the soils at the site to confirm the extent of ASS to be disturbed, and how to manage potential impacts to the environment such as via acid neutralisation, avoidance or limiting groundwater dewatering (CL02). This reduces the risk of impact to the environment from moderate to low.
- Manage routine construction and operational impacts: Develop an environmental management plan for construction and operation phases to manage potential risks from construction activities (CL04). This reduces the risk of impact to the environment from low to very low.

The assessment of potential impacts to the environment proposed by the project have the potential to cause potentially unacceptable impacts to human health or the environment. However, the application of the management and mitigation measures, are considered to reduce the potential impacts to the environment to acceptable levels and would ensure that the site is acceptable for commercial or industrial land uses (as defined in the NEPM).

ACRONYMS AND ABBREVIATIONS

Acronyms/ Abbreviations	Definition	Acronyms/ Abbreviations	Definition
ACM	Asbestos Containing Material	HVAC	High Voltage Alternative Current
ADWG	Australian Drinking Water Guidelines	HVDC	High-Voltage Direct Current
AFFF	Aqueous Film-Forming Foam	LOR	Limit Of Reporting
AHD	Australian Height Datum	km	Kilometres
ANZG	Australian And New Zealand Guidelines for Fresh And Marine Water Quality	kV	Kilovolt
AS	Australian Standard	Lo	Oonah (Burnie) Formation
ASRIS	Australian Soil Resource Information System	Lob	Oonah Formation
ASS	Acid Sulfate Soils	MLPL	Marinus Link Pty Ltd
BTEXN	benzene, toluene, ethylbenzene, xylene and naphthalene	MW	Megawatt
CEC	Cation exchange capacity	NATA	National Association of Testing Authorities
CEMP	Construction Environmental Management Plan	NEM	National Electricity Market
COPC	Contaminants Of Potential Concern	NEMP	National Environmental Management Plan
CSM	Conceptual Site Model	NEPC	National Environment Protection Council
CrS	Chromium Reducible Suite	NEPM (ASC)	National Environment Protection (Assessment of Site Contamination) Measure 1999 (As Amended In 2013)
Cwlth	Commonwealth of Australia	NOA	Naturally occurring asbestos
DCCEEW	Department of Climate Change, Energy, Environment and Water	NZS	New Zealand Standard
DEWLP	Department of Environment, Water, Land and Planning	NHMRC	National Health and Medical Research Council
DGV	Default guideline value	nSv/hr	NanoSievert per hour
DPIPWE	Department of Primary Industries, Parks, Water and the Environment	NOA	Naturally Occurring Asbestos
DTP	Department of Transport and Planning	NWTD	North West Transmission Developments
EC	Electrical Conductivity	NORM	Naturally Occurring Radioactive Material

Acronyms/ Abbreviations	Definition	Acronyms/ Abbreviations	Definition
EPBC Act	Environment Protection and Biodiversity Conservation Act	OC	Organic Carbon
EIL	Ecological Investigation Level	OCP	Organochlorine Pesticides
EEA	Environment Effects Act	OPP	Organophosphate Pesticides
EES	Environment Effects Statement	PAH	polycyclic aromatic hydrocarbons
EIS	Environmental Impact Statement	PCB	Polychlorinated biphenyls
EMPCA	Environmental Management and Pollution Control Act	PEV	Protected Environmental Value
EP Act	Environment Protection Act	PFAS	Per- and Poly- fluoroalkyl Substances
EPA	Environmental Protection Authority	PPE	Personal Protective Equipment
ERS	Environment Reference Standard	QA	Quality Assurance
ESL	Ecological Screening Level	QC	Quality Control
FSANZ	Food Services Australia and New Zealand	Qhbd	Cenozoic Cover Sequences
GED	General Environmental Duty	Qhwr	Quaternary Deposits - Littoral
HDD	Horizontal Directional Drilling	Qpsa	Quaternary Deposits - Aeolian
GV-high	Guideline Value - high	SPOCAS	Suspension Peroxide Oxidation Combined Acidity Sulfur
HIL	Health Investigation Level	TRH	Total Recoverable Hydrocarbons
HSL	Health Screening Level	TDS	Total Dissolved Solids

1. INTRODUCTION

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

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

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

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

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

This report has been prepared for the Tasmanian jurisdiction as part of the two EISs being prepared for the project.

1.1 PURPOSE OF THIS REPORT

This study presents the results of the investigation into the potential for contamination and acid sulfate soil (ASS) to be present within the Tasmanian component of the project area.

The purpose of the study was to:

- Address the evaluation objectives outlined in the separate EIS guidelines prepared by the Tasmanian EPA and DCCEEW
- Investigate the potential for contamination and ASS to be present within the study area;
- Where potential contamination or ASS was identified, complete an appraisal of the risks to human health or the environment that may be posed by the potential contamination or ASS for the construction, operation and decommissioning of project infrastructure;
- Develop mitigation measures for the project to avoid or manage project risks and impacts; and,
- Evaluate residual risks and impacts of the project once mitigation has been implemented.

1.2 PROJECT OVERVIEW

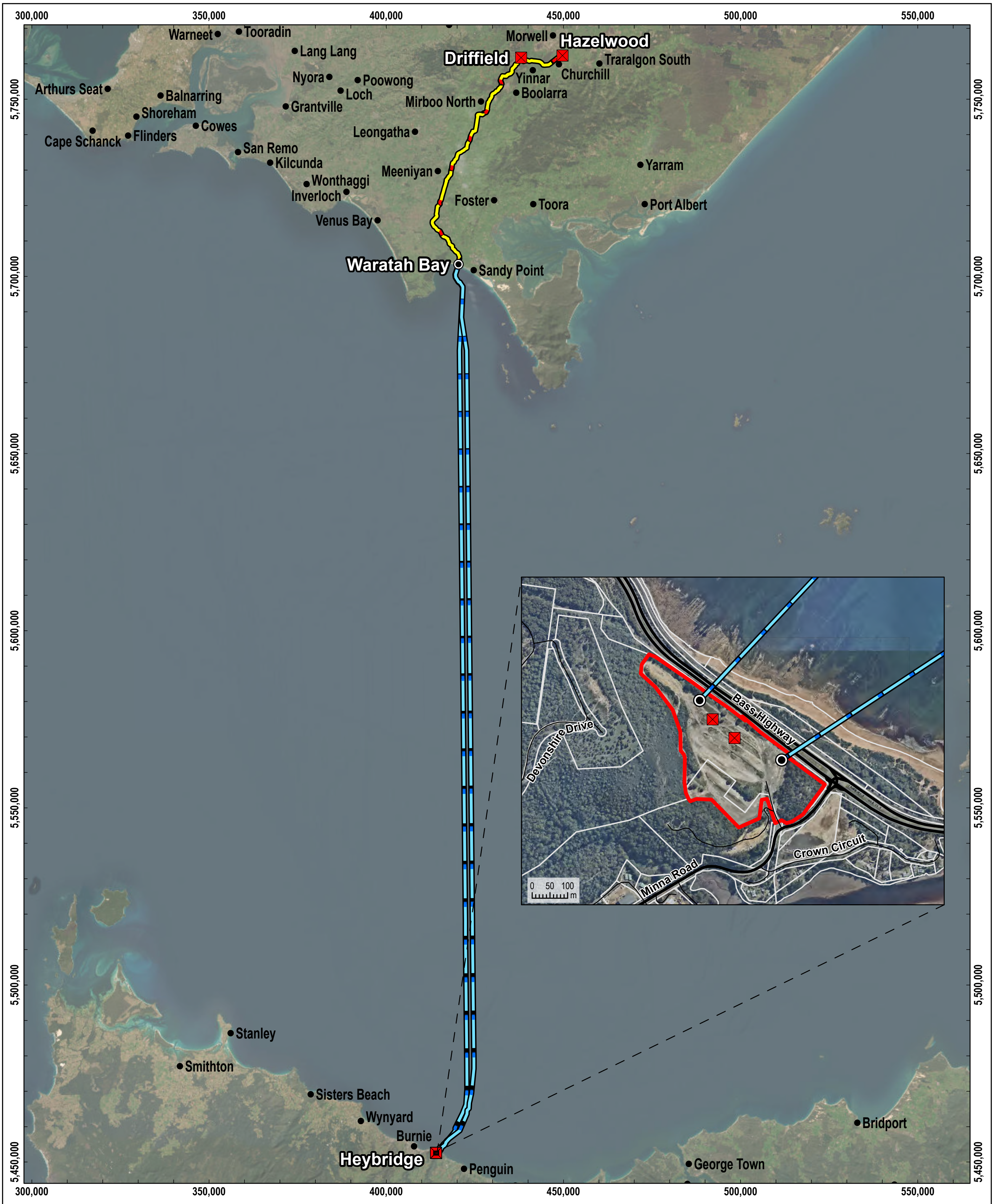
The project is a proposed 1500-megawatt (MW) HVDC electricity interconnector between Heybridge in northwest Tasmania and the Latrobe Valley in Victoria (Figure 1). The project is proposed to provide a second link between the Tasmanian renewable energy resources and the Victorian electricity grids enabling 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. The project 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. The project 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.



LEGEND

- Landfall
- Converter station

Proposed route

- HVDC subsea cable
- Underground HVDC cable
- Heybridge converter station site boundary

MARINUS LINK

0 15 30 km

SCALE 1:1,500,000

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PROJECTION: GDA2020 MGA Zone 55

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

MARINUS LINK PTY LTD

MARINUS LINK
CSASS TASMANIA

FIGURE 1

General site figure

TETRA TECH COFFEY

DATE:17.03.23 PROJECT:754-MELEN215878ML FILE:215878ML_CSASS_TAS_F001_GIS

1.3 ASSESSMENT CONTEXT

Land can be contaminated from anthropogenic activities or naturally occurring due to potential ASS.

Disturbance of contaminated land due to project activities has the potential to pose risks to the environment and human health during construction/operational maintenance, or through unsuitable conditions for the proposed project land-use. Disturbance of existing contamination may lead to:

- Health risks to workers or site users/occupiers;
- Impacts to ecological receptors;
- Risk to the integrity of structures;
- Lead to pollution events if disturbance increases contamination runoff or leaching to groundwater.

ASS or acid sulfate rock are characterised as containing metal sulfide minerals that oxidise when exposed to air and can result in the release of sulfuric acid in runoff from the soil/rock or acidification of groundwater. The acidic conditions can cause corrosion of metal and concrete that is in direct contact with the acidic soil or water. The acid can also cause direct harm to terrestrial or aquatic flora or fauna via low pH and acid scalding, as well as contribute to the release of metals at concentrations that may be toxic to plants and aquatic animals. The generation of ASS can be attributed to development activities including excavation of large volumes of soil, extracting or lowering groundwater, coastal or inshore dredging and filling land over potential ASS.

This assessment provides an overview of the portions of the study area considered to have an increased risk of encountering contamination, wastes or potential ASS that may be disturbed by the project. The report discusses the risks and residual impacts to the project and relevant receptors to inform the development of management and mitigation measures to avoid or reduce or manage risks and impacts.

2. ASSESSMENT GUIDELINES

This section outlines the assessment guidelines relevant to contaminated land and ASS and the linkages to other technical assessments completed for the project. Two EISs are being prepared to address the EIS guidelines published by EPA Tasmania for the converter station and shore crossing.

2.1 EPA TASMANIA GUIDELINES

EPA Tasmania have published two sets of guidelines (September 2022) for the preparation of an EIS for the project converter station and shore crossing. A separate set of guidelines have been prepared for each of these project components.

- *Environmental Impact Statement Guidelines Marinus Link Pty Ltd Converter Station for Marinus Link*, September 2022, Environment Protection Authority Tasmania (Tas converter station EIS guidelines)
- *Environmental Impact Statement Guidelines Marinus Link Pty Ltd Shore Crossing for Marinus Link*, September 2022, Environment Protection Authority Tasmania (Tas shore crossing EIS guidelines)

Table 2-1 summarises the relevant sections of the EIS assessment guidelines being addressed as part of this assessment.

Table 2-1: Tasmanian EIS Assessment guidelines addressed

Converter station		Shore Crossing		Report Section
S 5.2	A description of the general physical characteristics of the site/route and surrounding area, including topography, local climate, geology, geomorphology, soils (including erodibility and acid sulfate soils), vegetation, fauna, groundwater and surface drainage (including waterways, lakes, wetlands, coastal areas etc).	S 9.2	A description of the general physical characteristics of the site/route and surrounding area, including topography, local climate, geology, geomorphology, soils (including erodibility, potential contamination, and acid sulfate soils), vegetation, fauna, groundwater and surface drainage (including waterways, lakes, wetlands, coastal areas etc), and seabed characteristics.	Section 6
S 6.1	Potentially contaminated material.	S 10.2	Potentially contaminated material and ASS.	Section 8
S 6.2	Terrestrial natural values.	S 10.1	Terrestrial natural values	Section 8
S 6.4	Water quality (surface and groundwater)	S 10.5	Water quality (surface and groundwater)	Section 8
-		S 10.3	Marine natural values	Section 8
-		S 10.4	Marine water quality	Section 8
S 6.5	Air Quality	-		Section 8
S 6.6	Waste Management	S 10.8	Waste Management	Section 8

2.2 LINKAGES TO OTHER TECHNICAL STUDIES

This report is informed by or informs other Tasmanian technical assessments outlined in Table 2-2.

Table 2-2: Technical studies

Technical study	Relevance to this assessment
Heybridge Groundwater impact assessment (Tetra Tech Coffey, 2024)	Provided the hydrogeological setting for baseline characterisation
Tasmania surface water impact assessment (Alluvium, 2024)	Provided the hydrology setting for baseline characterisation
Terrestrial geomorphology & soils (Environmental GeoSurveys, 2024)	Provided the geomorphology and geological setting for baseline characterisation
Marine Ecology and Resource Use Impact Assessment (EnviroGulf, 2024)	Assessed the potential impacts from contaminated seabed sediment disturbance and included controls for managing impacts.

3. LEGISLATION, POLICY AND GUIDELINES

3.1 ENVIRONMENTAL MANAGEMENT AND POLLUTION CONTROL ACT 1994

The responsibility for the management of contaminated land is shared by the Tasmanian EPA and local Councils under EMPCA.

If a site poses a known or potential unacceptable risk to human health and/or the environment, or environmental harm is likely to occur, the Director of EPA may issue a Part 5A Notice (an investigation notice, a remediation notice, a site management notice or an environment protection notice) on a person(s), which can include an individual or a company.

3.2 NATIONAL ENVIRONMENT PROTECTION (ASSESSMENT OF SITE CONTAMINATION) MEASURE

National Environment Protection Measures (NEPMs) are statutory instruments that specify national standards for a variety of environmental issues. In Tasmania, the *National Environment Protection Council (Tasmania) Act* 1995 references the *National Environment Protection (Assessment of Site Contamination) Measure 1999* (amended 2013).

In Tasmania, NEPMs are State Policies in accordance with section 12A of the *State Policies and Projects Act 1993*.

3.3 STATE POLICY ON WATER QUALITY MANAGEMENT (1997)

The State Policy on Water Quality Management (1997) provides a framework to manage water quality for all Tasmanian surface waters. Section 7.1 of the policy states that *"Water quality objectives may be set for surface waters and groundwaters in Tasmania by determining which of the following protected environmental values (PEVs) should apply to each body of water"*:

- A – Protection of aquatic ecosystems
- B – Recreational water quality and aesthetics
- C – Raw water for town drinking water supply
- D – Raw water for homestead supply
- E – Agricultural water uses (including irrigation, stock watering)
- F – Industrial water supply

The policy requires that PEVs be set for all Tasmanian surface waters. The policy also sets PEVs for groundwater based on those values that are likely to be possible based on the reported level of total dissolved solids (TDS).

This study does not include the investigation of groundwater but considers the potential for contamination of the land (natural or anthropogenic) that may impact on surface water or groundwater quality at or near the study area.

The policy also includes guidance on the management of contamination in Tasmania. It states that:

> "*Where a point source of pollution might cause environmental nuisance or material or serious environmental harm, limits should be set on the permissible concentrations and/or loads of pollutants which may be present in discharges to waters from point sources of pollution, and these limits be implemented through permits, authorisations, economic measures, or other instruments as appropriate*." (Clause 16.1)

"*Emissions from diffuse sources of pollution should be reduced and managed through the development and implementation of best practice environmental management, and so as not to prejudice the achievement of water quality objectives*" (Clause 30.1)

3.4 ACID SULFATE SOILS AND ROCK

There is no specific acid sulfate legislation in Tasmania. However, control of related impacts may come under the "general environmental duty" section of EMPCA, where: "A person must take such steps as are practicable or reasonable to prevent or minimise environmental harm or environmental nuisance caused, or likely to be caused, by an activity conducted by that person."

The *State Coastal Policy 1996 (as amended 2009)* also may cover acid sulfate management, as it aims to protect the intrinsic value of coastal areas and support sustainable use of coastal areas.

The Department of Primary Industries, Parks, Water and the Environment (DPIPWE) *Tasmanian Acid Sulfate Soil Management Guidelines* (DPIPWE 2009) present the recommended approach to assessment and management for ASS in Tasmania.

4. PROJECT DESCRIPTION

4.1 OVERVIEW

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

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

- HVAC switching station and HVAC-HVDC converter station at Heybridge in Tasmania. This is where the project will connect to the North West Tasmania transmission network being augmented and upgraded by the North West Transmission Developments (NWTD).
- Shore crossing in Tasmania adjacent to the converter station.
- Subsea cable across Bass Strait from Heybridge in Tasmania to Waratah Bay in Victoria.

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

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

This assessment is focused on the Tasmanian terrestrial and shore crossing section of the project. This report will inform the two EISs being prepared to assess the project’s potential environmental effects in accordance with the legislative requirements of the Tasmanian government (Figure 2).

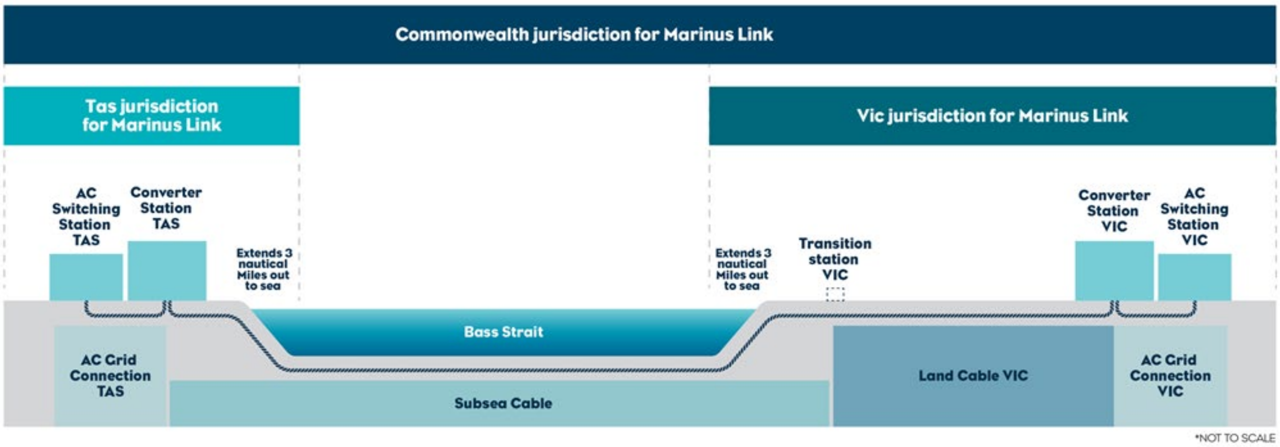


Figure 2: Project components considered under applicable jurisdictions (Marinus Link Pty Ltd 2022).

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

4.2 CONSTRUCTION

A description of elements of the project during the construction phase that have the potential to impact on environmental values considered within this impact assessment are summarised below.

- **Shore crossing** – horizontal directional drilling (HDD)
- **Converter station** – site preparation, earthworks and civil works

These activities can impact on environmental values through mechanisms such as:

- Localised leaks of oils, fuels and chemicals from plant and equipment on site such as containers, batteries, vehicles, underground services or tanks (i.e., fuel or septic) that may present a risk to human health, ecological receptors (terrestrial flora or fauna), or an aesthetic impairment, causing degradation of environment.
- Areas of contamination/ wastes (natural or anthropogenic) uncovered during project development that result in exposure to human or ecological receptors and result in health effects or ecological damage.
- Disturbance of potential ASS that may cause degradation to flora and/or fauna due to acidic runoff.
- Removal of contaminated infrastructure that results in impacts to ecological or human receptors.

4.3 OPERATION

Ground-disturbing works are not anticipated during the standard operation of the project infrastructure. The following operational project activities have been considered:

- Accidental spills and leaks of transformer oil, battery fluids, and diesel fuel stored in above ground tanks.
- Accidental spills of fuels, oils or chemicals onsite during maintenance activities.

4.4 DECOMISSIONING

The operational lifespan of the project is a minimum 40 years. At this time the project will be either decommissioned or upgraded to extend its operational lifespan.

Decommissioning will be planned and carried out in accordance with regulatory requirements at the time. A decommissioning plan in accordance with approvals conditions will be prepared prior to planned end of service and decommissioning of the project.

Requirements at the time will determine the scope of decommissioning activities and impacts. The key objective of decommissioning is to leave a safe, stable and non-polluting environment.

In the event that the project is decommissioned, all above-ground infrastructure will be removed, the site rehabilitated.

Decommissioning activities required to meet the objective will include, as a minimum, removal of above ground buildings and structures. Remediation of any contamination and reinstatement and rehabilitation of the site will be undertaken to provide a self-supporting landform suitable for the end land use, which is assumed to be industrial land.

Decommissioning and demolition of project infrastructure will implement the waste management hierarchy principles being avoid, minimise, reuse, recycle and appropriately dispose. Waste management will accord with applicable legislation at the time.

Decommissioning activities may include recovery of land and subsea cables. The conduits and shore crossing ducts will be left in-situ as removal may cause significant environmental impact. Subsea cables will be recovered by water jetting or removal of rock mattresses or armouring to free the cables from the seabed.

A decommissioning plan will be prepared to outline how activities will be undertaken, and potential impacts managed.

5. ASSESSMENT METHOD

5.1 STUDY AREA

The study area is located in Heybridge, Tasmania, (as displayed in Figure 3) and is the planned location of a converter station and switching station that will allow the connection of the project subsea cable to the Tasmanian transmission network. The study area also includes the shore-crossing and areas where cable conduits will be installed via HDD boring to a distance of 3 nautical miles off-shore.

The Heybridge converter station site is the former site of a Tioxide factory that ceased operation in 1996, with associated infrastructure being demolished in 1998. The history of the site is detailed in section 6.5.1.

5.2 ASSESSMENT OBJECTIVES

The objectives of the contaminated land and ASS study for the project in Tasmania are to:

- Identify areas of contaminated land or ASS within the study area (including offshore areas where contaminated sediments may be present).
- Assess potential impacts from construction, operation and decommissioning of the project related to contaminated land or ASS and identify management and mitigations measures and potential avoidance or management measures.
- Outline of future management plan requirements (e.g., CEMP or ASS management plan).
- Perform a preliminary waste classification.
- Address the contaminated land code of the Tasmanian Planning Scheme.

5.3 SCOPE OF WORK

To meet the objectives of the assessment, the following scope of works was completed to inform this assessment.

5.3.1 Desktop assessment

The desktop assessment included review of publicly available information (including aerial photographs, maps, plans, registers and other information) to establish the potential sources of contamination within the study area.

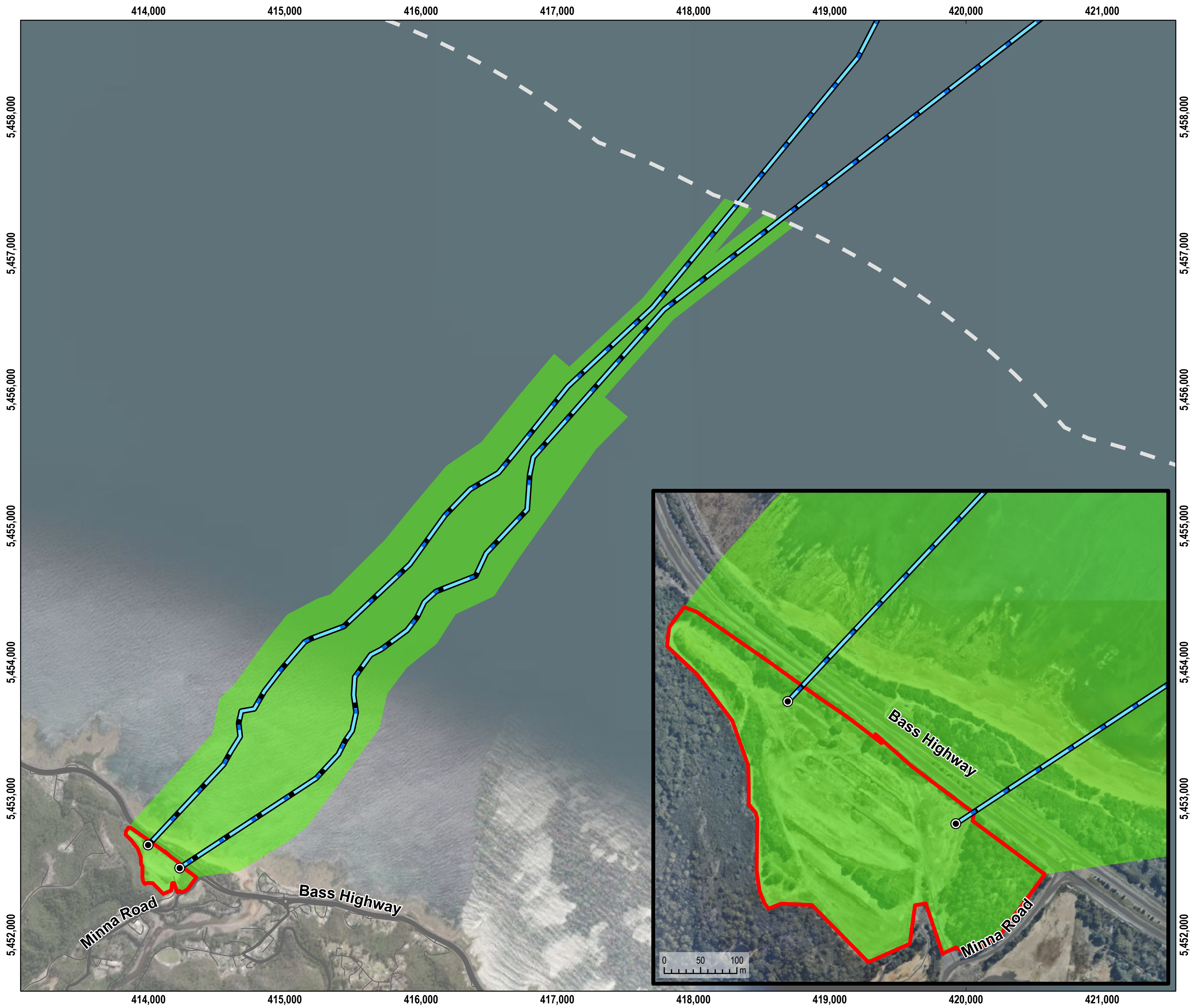
Identification of portions of the study area with a potential of either natural or anthropogenically sourced contamination to be present.

Several reports have been prepared for the study area that provide details as to the nature and extent of contamination and ASS and were reviewed in the preparation of this report. The reports reviewed included:

- WCC (2007a) Site Contamination Assessment, Former Tioxide Factory site, Heybridge (the “Front site”), William C. Cromer, 6 June 2007
- WCC (2007b) Follow-up Site Contamination Assessment, Bullant Ridge, at the former Tioxide Factory site, Heybridge, William C. Cromer, 14 July 2007
- ES&D (2020) Due Diligence, Former Tioxide factory site – Heybridge, V4, Environmental Service & Design, 30 October 2020

- pitt&sherry (2007a) Former Tioxide Australia Pty Ltd, Ocean Outfall Tunnel Assessment Report, pitt&sherry, August 2007
- Synnot & Wilkinson (1996a) Tioxide Australia Soil Contamination Assessment Report, Burnie, Tasmania, May 1996
- Synnot & Wilkinson (1996b) Tioxide Australia, Draft 2, Environmental Decommissioning and Rehabilitation Plan, May 1996
- Synnot & Wilkinson (1997) Tioxide Australia Pty Ltd, 1996 Marine Survey Report, September 1997
- pitt&sherry (2020) Heybridge Converter Station, Environmental Review of Due Diligence Report, Rev A, pitt&sherry, 16 November 2020
- SA Radiation (2020) Heybridge Tioxide Site Radiation Survey, SA Radiation, 1 December 2020
- GBG (2022) Project Marinus – Heybridge Land Remediation Geophysical Investigation, GBG Group, 15 March 2022
- Jacobs (2022a) Ground Conditions Factual Report, Project Marinus – Heybridge Converter Station Ground Investigation, Rev A, Jacobs, 1 April 2022
- Jacobs (2022b) Heybridge Converter Station – Geotechnical Interpretive Report, Project Marinus – Heybridge Converter Station Geotechnical Site Investigation, Rev A, Jacobs, 24 May 2022)
- Tetra Tech Coffey (2022) Marinus Link, Tioxide sediment analysis report, Rev A, Tetra Tech Coffey, 28 July 2022
- IPM (2022) Marinus Link, Marinus Link Development Site, Bass Highway, Heybridge, TAS 7316 Site Surface Asbestos Inspection Report, IPM Consulting Services, October 2022
- pitt&sherry (2022) Marinus Link – Contamination and Acid Sulfate Soils Desktop Review Findings for the Tasmanian Component, dated 19 December 2022
- Marine Solutions (2024) HVDC Cable Crossing of Tioxide Outfall, Summary of Works, August 2024.

The details of the review of these reports are provided in Appendix B, and the summary of the findings of the review provided in Section 6.5. The information from these reports was utilised to identify the potential sources (including the nature and extent) of contamination within the study area and identify areas where additional sampling and analysis was required in order to inform the risk assessment for the study.



MARINUS LINK

LEGEND

Landfall

Proposed route

HVDC subsea cable

Heybridge converter station site boundary

Survey area

Major road

Minor road

Limit of State Coastal Waters (3nm)

Source:
Routes from Tetra Tech Coffey.
Roads and watercourses from DPIPWE.
Limit of Coastal Waters from Geoscience Australia.
Imagery from NearMap (8 March 2022) & ESRI Online.

N

0 400 800 m

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

MARINUS LINK PTY LTD

MARINUS LINK HEYBRIDGE
GROUNDWATER IMPACT ASSESSMENT REPORT

FIGURE 3

Study Area

TETRA TECH COFFEY

DATE: 26.04.23 PROJECT: 754-MELEN215878ML FILE: 215878ML_CSASS_TAS_F002_GIS

5.3.2 Targeted study area assessment

As several areas of potential contamination were identified that had not been assessed, targeted assessment of specific sources of contamination was undertaken within the Heybridge converter station site. The works included:

- Completion of a site walkover of the targeted areas to visually confirm the potential presence or absence of contamination or contaminating activities where access was available.
- Targeted soil assessment of areas that had not previously been investigated and had a potential to contain contamination or ASS that may either cause an impact if disturbed or may require additional management during construction including the collection and analysis of soil samples for contamination and ASS analysis.
- Targeted surface water sampling from onsite stormwater detention ponds and drains.

5.3.3 Risk assessment

On completion of the desktop and targeted study area assessments the following scope of works was completed:

- Review of the outcomes of the baseline assessment to verify appropriate interpretation of the desktop and field data and its alignment with regulatory guidance.
- Preparation of a conceptual site model (CSM) to identify the nature and extent of contamination and ASS within the study area (the sources of contamination), the potential receptors that may be exposed to or impacted by disturbance of the contamination/ASS, and the pathways by which receptors may be exposed. Where a pathway for exposure is not present, the potential for impacts to receptors does not exist. The CSM has been prepared in accordance with guidance in the NEPM and is an important step in characterising the potential for contamination/ASS to impact on receptors as it identifies the exposure pathways which are present and guides the development of potential management and mitigation measures that generally either:
  - interrupt or minimise the exposure pathway,
  - remove the source; or
  - remove the receptor (where this is practicable).

  Further discussion of the CSM is provided in Section 6.6.5.
- Assessment of potential risks to the environment values (human and ecological receptors) from existing contamination (natural or anthropogenic) identified within the study area, including potential risks that may arise during construction, operation and decommissioning of the project.
- Identification of management and mitigation measures to reduce the potential risks to the environment from any potential contamination identified by the assessment.

5.3.4 Cumulative impact assessment

The EIS guidelines includes requirements for the assessment of cumulative impacts. Cumulative impacts result from incremental impacts caused by multiple projects occurring at similar times and within proximity to each other.

To identify possible projects that could result in cumulative impacts, the International Finance Corporation (IFC) guidelines on cumulative impacts have been adopted. The IFC guidelines (IFC, 2013) define cumulative impacts as those that 'result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones.'

The approach for identifying projects for assessment of cumulative impacts considers:

- Temporal boundary: the timing of the relative construction, operation and decommissioning of other existing developments and/or approved developments that coincides (partially or entirely) with Marinus Link.
- Spatial boundary: the location, scale and nature of the other approved or committed projects expected to occur in the same area of influence as Marinus Link. The area of influence is defined as the spatial extent of the impacts a project is expected to have.

Proposed and reasonably foreseeable projects were identified based on their potential to credibly contribute to cumulative impacts due to their temporal and spatial boundaries. Projects were identified based on publicly available information at the time of assessment. The projects considered for cumulative impact assessment across Tasmania and in Bass Strait are summarised in the below table.

Table 5-1: Summary of potential cumulative impact assessment projects

Project	Distance from site
North West Transmission Developments (NWTD)	Adjoins Heybridge site to the south and extends over 100 km to the southeast and southwest of the site.
Robbins Island Renewable Energy Park	Approximately 90 km to the west
Jim’s Plain Renewable Energy Park	Approximately 85 km to the west
Robbins Island Road to Hampshire Transmission Line	Approximately 25 km to the south and west
Bass Highway upgrades between Deloraine and Devonport	Approximately 35km to the east
Bass Highway upgrades between Cooee and Wynard	Approximately 10 km to the west
Hellyer Windfarm	Approximately 50 km to the west
Table Cape Luxury Resort	Approximately 24 km to the west
Youngmans Road Quarry	Approximately 45 km to the south-east
Port Latta Windfarm	Approximately 55 km to the west
Port of Burnie Shiploader Upgrade	Approximately 6 km to the west
Quaylink – Devonport East Redevelopment.	Approximately 35 km to the east

Cumulative impacts from contamination or ASS associated with the above list of projects would be highly localised to the areas where the individual projects disturb potential contamination or ASS. It is unlikely that contamination or ASS that may be disturbed associated with the above projects would result in impacts that may overlap with the potential impacts from this project (due to the distances involved, and the generally localised areas that impact may occur) with the exception of parts of the NWTD project that interfaces with the Heybridge site. Cumulative impacts that may occur that are relevant to the study area may include local residential or commercial redevelopments of land surrounding the site, or upgrades to the Bass Highway or rail line in the vicinity of the site. However, the magnitude of impacts from these potential projects will be minor due to the limited footprints of these projects, and low potential of contamination being present, or ASS being disturbed.

The NWTD project will include the installation of several overhead transmission towers to the south of the study area in close proximity to several former landfills and potential ASS associated with the Blythe River estuary. However, the proposed siting of the overhead towers and any associated ground disturbance is a reasonable distance from potential landfills and no ASS is mapped as being present in the vicinity of the NWTD transmission corridor to the south of the study area. The proposed siting and elevation of the transmission towers (above the valley floor) is also such that they would be unlikely to interact with groundwater during drilling in any significant way that may result in impacts from contaminated land or ASS.

Any disturbance of potential contamination or ASS would be limited to the excavation of tower footprints (with any contaminated soils either re-used or disposed in accordance with EPA bulletin 105) and the scale of such disturbances are such that any potential impacts would be manageable and result in low to very low impacts to the environment.

The existing former offshore Tioxide pipeline and outfall tunnel that extend from the Converter Station site offshore have been considered in this study and whether disturbance of the pipeline or the outfall tunnel may result in potential impacts to the environment.

5.4 SOIL AND SURFACE WATER ASSESSMENT METHOD

Based on the outcome of the desktop assessment (refer to Section 6.5), sampling of soils (for ASS), stockpiles and surface water was undertaken within the study area to provide additional data to inform the risk assessment. This section describes the method applied for the soils and surface water sampling.

5.4.1 ASS sampling

The Tasmanian Acid Sulfate Soil Management Guidelines (DPIPWE, 2009) provides guidance on the approach to undertaking assessment and management of ASS in Tasmania. The guidelines describe a seven-step process for managing potential ASS on project sites. A summary of the steps, and their relevance to the methodology for assessing ASS within the study area is provided in Table 5-2.

Table 5-2: Summary of seven-step methodology for managing ASS impacts (DPIPWE, 2009)

Step	Criteria	Comments
1	Project is below 20 m above Australian Height Datum (m AHD) or will disturb ground below 20 m AHD	The majority of the study area is below 20 m AHD
2	Project likely to disturb >100 m^3 of material	The project will disturb more than 100 m^3 of soils
3	Check DPIPWE or Australian Soil Resource Information System (ASRIS) map	Project is within area mapped as having a low probability of ASS present (5-70% chance)
4	Project in area predicted to contain low or high amounts of ASS: Conduct desktop risk assessment	The project will likely disturb ASS (if present). Redesign of project may allow avoidance of, but still some ASS likely to be disturbed.
5	Undertake site investigation to determine presence, depth and extent of ASS materials	Due to meeting the triggers for steps 1 to 4, a site investigation is required including field sampling and laboratory analysis
6	Conduct field sampling and laboratory analysis	
7	Develop ASS Management Plan to minimise environmental harm	To be developed once full project disturbance has been quantified in detailed design.

The assessment of the potential for ASS to be present has been designed using previously collected data (Jacobs 2022a) and the guidance provided in the DPIPWE (2009) guidelines. The guidelines recommends that soils are sampled at a rate of two locations per hectare (ha) for sites with an area above 4 ha. The area of the site (where construction activities may result in disturbance of ASS if present) is approximately 5 ha, which the guidelines recommend sampling from at least 10 locations to identify the potential presence of ASS.

Jacobs (2022a) undertook soil sampling at five locations across the broader converter station site, with acid sulfate field testing, and laboratory analysis undertaken.

Soil sampling was completed at an additional eight test-pit locations along the northern boundary of the study area to assess for the presence of ASS, as displayed in Figure 4. The locations were spaced at 50-metre intervals along the northern boundary of the site as it was considered that this area was more likely to contain undisturbed soil profiles (as opposed to the other areas where factory demolition may have disturbed the deeper soil profile), and it was assumed that this area was more likely to have shallower groundwater (and containing submerged soils).

Given that the northern boundary was closer to the coastline, this was a factor in locating the samples at this location. The locations also allowed for appraising potential ASS in the areas where the HDD will occur.

Each sampling test-pit was excavated to a depth of 1.5 m below the ground surface. Whilst deeper sampling may have provided additional data as to the potential depth of ASS, soil instability and the potential for test-pit collapse limited sampling depths to 1.5 m.

5.4.1.1 Applicable guidelines

There is no specific acid sulfate legislation in Tasmania. However, control of related impacts may come under the "general environmental duty" section of EMPCA, where: "*A person must take such steps as are practicable or reasonable to prevent or minimise environmental harm or environmental nuisance caused, or likely to be caused, by an activity conducted by that person.*"

The State Coastal Policy 1996 (as amended 2009) also may cover acid sulfate management, as it aims to protect the intrinsic value of coastal areas and support sustainable use of coastal areas.

The Tasmanian Acid Sulfate Soil Management Guidelines (DPIPWE 2009) present the recommended approach to assessment and management for ASS in Tasmania.

Other guidelines and standards for sample collection and analysis include the following:

- ASC NEPM (1999) National Environment Protection (Assessment of Site Contamination) Measure (1999) as amended 2013 (NEPM (ASC)).
- ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines
- EPHC & NRMMC 2011, National guidance for the management of acid sulfate soils in inland aquatic ecosystems, Environment Protection and Heritage Council and the Natural Resource Management Ministerial Council, Canberra

5.4.1.2 Assessment criteria

Assessment criteria for the investigation of ASS within the study area had been adopted from the Tasmanian Acid Sulfate Soil Management Guidelines (DPIPWE 2009) which presents the recommended approach to assessment and management for ASS in Tasmania.

5.4.1.3 Sampling methodology

The field ASS assessment methodology is summarised in Table 5-4. Sampling locations are shown in Figure 4. Location details of the sampling points are provided in the table below.

Table 5-3: Summary of sampling locations

Test Pit Location	Easting*	Northing*	Depth (m bgs)
HEY1	413938	5452704	1.5
HEY2	413983	5452669	1.5
HEY3	414032	5452644	1.5
HEY4	414103	5452596	1.5
HEY5	414152	5452564	1.5
HEY6	414196	5452532	1.5
HEY7	414231	5452454	1.5
HEY8	414205	5452514	1.4

Notes
* - The accuracy of locations is approximately +/- 15m due to the limitations of the hand-held GPS used to measure locations.

MARINUS LINK

LEGEND

- ASS sample location

Proposed route

- HVDC subsea cable
- Heybridge converter station site boundary
- Major road
- Minor road
- Cadastre

SOURCE
Proposed route and sampling locations from Tetra Tech Coffey.
Roads and cadastre from DPIPWE.
Imagery from Nearmap (08/03/2022).

N

0 30 60 m

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PAGE SIZE: **A4**
PROJECTION: **GDA2020 MGA Zone 55**

MARINUS LINK PTY LTD

MARINUS LINK
CSASS TASMANIA

FIGURE 4

Acid Sulfate Soil (ASS) Sample Locations

TETRA TECH COFFEY

DATE: **03.09.24** PROJECT: **754-MELEN215878ML** FILE: **215878ML_CSASS_TAS_F004_GIS**

Table 5-4: ASS Sampling Methodology

Activity	Details
Soil Sampling	Soil samples were collected at depths of 0-0.1m (surface) and half-metre intervals or changes in lithology throughout the test-pits. An excavator was used to collect samples at the nominated depths at each location. Upon collection samples were immediately sealed within laboratory supplied snap lock bags and had the air squeezed out from each sample. Samples were then frozen to minimise potential effects of oxidation. Soil sampling locations were installed in the areas where ASS was most likely to occur, as well from locations spread across the converter station site. The adequacy was considered appropriate as it include coverage across the site. The sampling frequency included collecting and analysing samples from multiple depths throughout the sampling locations. The sampling locations provide a reasonable indication of the potential extent of ASS that may be encountered at the site to inform potential impacts to the environment.
Soil Screening	During sampling, soils were assessed for visual and olfactory indications of potential contamination, including observations of vegetation distress, water-logged soils and extraneous material. Details of these observations are recorded by samplers in field logs provided in Appendix D.
Decontamination	Soil samples were collected directly from the excavator bucket whilst wearing disposable nitrile gloves to avoid cross-contamination between samples. The method for sampling involved the excavator collecting a largely undisturbed 'chunk' of soil from the wall or base of the test-pit, and then splitting the soil sample open to collect soil that had not come into contact with the excavator bucket. As such, decontamination of sampling equipment was not required.
Sample Preservation	Samples were placed in laboratory supplied snap lock bags. Samples were stored on ice (<4ºC) in an ice box while on site and were frozen (below -18°C) within six hours of collection. Samples were refrigerated while in transit to the selected laboratories.
Sample Analysis	Samples were submitted to National Association of Testing Authorities, Australia (NATA) accredited laboratories Eurofins and ALS (inter-laboratory duplicates only) for all specified analysis. A copy of the NATA Analytical reports is provided in Appendix F.

5.4.1.4 Analytical suite

Potential ASS samples were submitted for the following analysis:

- Chromium Reducible Suite (CrS) - 14 samples.
- ASS field test – 21 samples.

5.4.2 Soil stockpile sampling

In 2022, pitt&sherry (2022) undertook an inspection of the Converter Station site and identified up to nine soil stockpiles on the site. During the field inspections undertaken as a part of this study, the location of the pitt&sherry stockpiles and other potential soil stockpiles was undertaken.

Several soil mounds are present on the site and sampling of the soil mounds was undertaken to identify if the soils were potentially contaminated.

Some of the soil mounds area elongated, particularly along the northern boundary of the site and appear to have been installed as a visual barrier to the site. Several other larger soil mounds were observed at isolated locations on the site. Many small mounds of soils (generally less than 1 m^3) were present in areas to assist with water drainage, or from onsite road forming. These smaller soil mounds were not included in sampling and considered to be part of the site soil surface.

The larger soil mounds along the northern boundary and at isolated locations across the site were designated as ‘stockpiles’, to differentiate between the large and small soil mounds.

A summary of the approximate volumes of the stockpiles, and the sampling undertaken is provided in the table below.

Table 5-5: Stockpile sampling densities

Stockpile ID	Description	Volume (m3)	Samples (collected / suggested by Bulletin 105)
SP1	Soil stockpile SP1 from the pitt&sherry report was located on the south-western side of the site and did not appear to be present on site, and the location comprised a slightly elevated area of soil that appeared to have been cut into on its southern side for the former rail-siding and appeared to align approximately with the original site surface. Consequently, this area of soil was not sampled.	N/A	-
SP2	Located on the northern boundary, near the western side of the site. Dimensions were approximately 70 m long by 6 m wide, by up to 2.5 m high.	525	3 / 21
SP3	Located on the northern boundary, near the western side of the site. Dimensions were approximately 50 m long by 5 m wide, by up to 2 m high. Eastern portion not sampled due to being in a mapped former asbestos area.	250	1 / 10
SP4	Soil stockpile SP4 from the pitt&sherry report was located to the north of SP5 in the central western portion of the site. During inspection, the soil stockpile could not be differentiated from the surrounding soils and appeared to be a very slightly elevated (<0.2 m) soil mound. Consequently, this area of soil was not sampled.	N/A	-
SP5	Located in central eastern portion. Approx 16 m long, by 5 m wide, by 1 m high	40	3 / 2
SP6	Soil stockpile SP6 from the pitt&sherry report was located in the northern central portion of the site. During inspection, the soil stockpile could not be identified. Consequently, this area of soil was not sampled.	N/A	-
SP7	Soil stockpile SP7 from the pitt&sherry report was located to the south of the site and appeared to be a mound of soil that was representative of the original site surface and not a soil stockpile. Consequently, this area of soil was not sampled.	N/A	-
SP8	Located on northern boundary. Approx 15 m long, by 3 m wide, by 1.5 m high	34	2 / 2
SP9	Located on northern boundary – eastern end. Approx 55 m long, by 11 m wide, with the western end approximately 3 m high, and the eastern end approximately 2 m high.	770	4 / 31
SP10	Located adjacent the former rail siding in the southern portion of the site. Approximately 30 m long, by 3 m wide, by 2 m high.	90	3 / 4

The sampling densities for some stockpiles was below the ‘general sampling density rule’ of one sample per 25 m^3 for homogeneous soils included in EPA information bulletin No. 105. However, the bulletin notes that the number of samples required for adequate classification of soil is *dependent on the volume of material, the estimated standard deviation of contamination concentrations, and the estimated average concentration*. Consequently, additional sampling of some stockpiles will be required to inform the classification of the soils should they require offsite disposal. The sampling undertaken provided a preliminary indication of the contamination status of the soils in the stockpiles to assess the potential risks to the environment.

5.4.2.1 Applicable guidelines

Applicable guidelines and standards for sample collection and analysis include the following:

- ASC NEPM (1999) National Environment Protection (Assessment of Site Contamination) Measure (1999) as amended 2013 (NEPM (ASC)).
- ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines
- Tasmanian Government (2020) Environmental Management and Pollution Control (Waste Management) Regulations 2020.
- EPA Tasmania (2018) Information Bulletin No. 105, Classification and Management of Contaminated Soil for Disposal.

5.4.2.2 Assessment criteria

Based on the current land use and proposed use of the study area, contaminant screening criteria is sourced from:

Preliminary Waste Classification

- EPA Tasmania (2018) Information Bulletin No. 105, Classification and Management of Contaminated Soil for Disposal.

On-site Retention

- NEPM (ASC) for human health for soils and sediment:
  - Health Investigation Guidelines (HIL) D – Commercial/Industrial use for human health impact for soils and sediments
  - Health Screening Levels (HSL) D for Vapour Intrusion – Commercial/Industrial use for human health impact (sand – 0-1 m)
  - Ecological Investigation Guidelines (EIL) for terrestrial ecological impact for soils and sediments in terrestrial settings
  - Ecological Screening Levels (ESLs) for terrestrial ecological impact for soils and sediments in terrestrial settings
  - Table 1B(7) TRH Management Limits for Commercial/Industrial use (coarse soil)

In the absence of site-specific data, the following values have been conservatively adopted to calculate EILs for copper, nickel, chromium (III) and zinc:

- Cation exchange capacity (CEC): 5 cmol/kg dwt
- Organic carbon (OC) content: 1%
- Clay: 10%

The lowest pH value reported as part of this investigation (4.4 for sample HEY7_0.9-1.1) has also been used to calculate EILs.

5.4.2.3 Stockpile sampling methodology

The stockpile sampling methodology is summarised in Table 5-6. Sampling locations are shown in Figure 5.

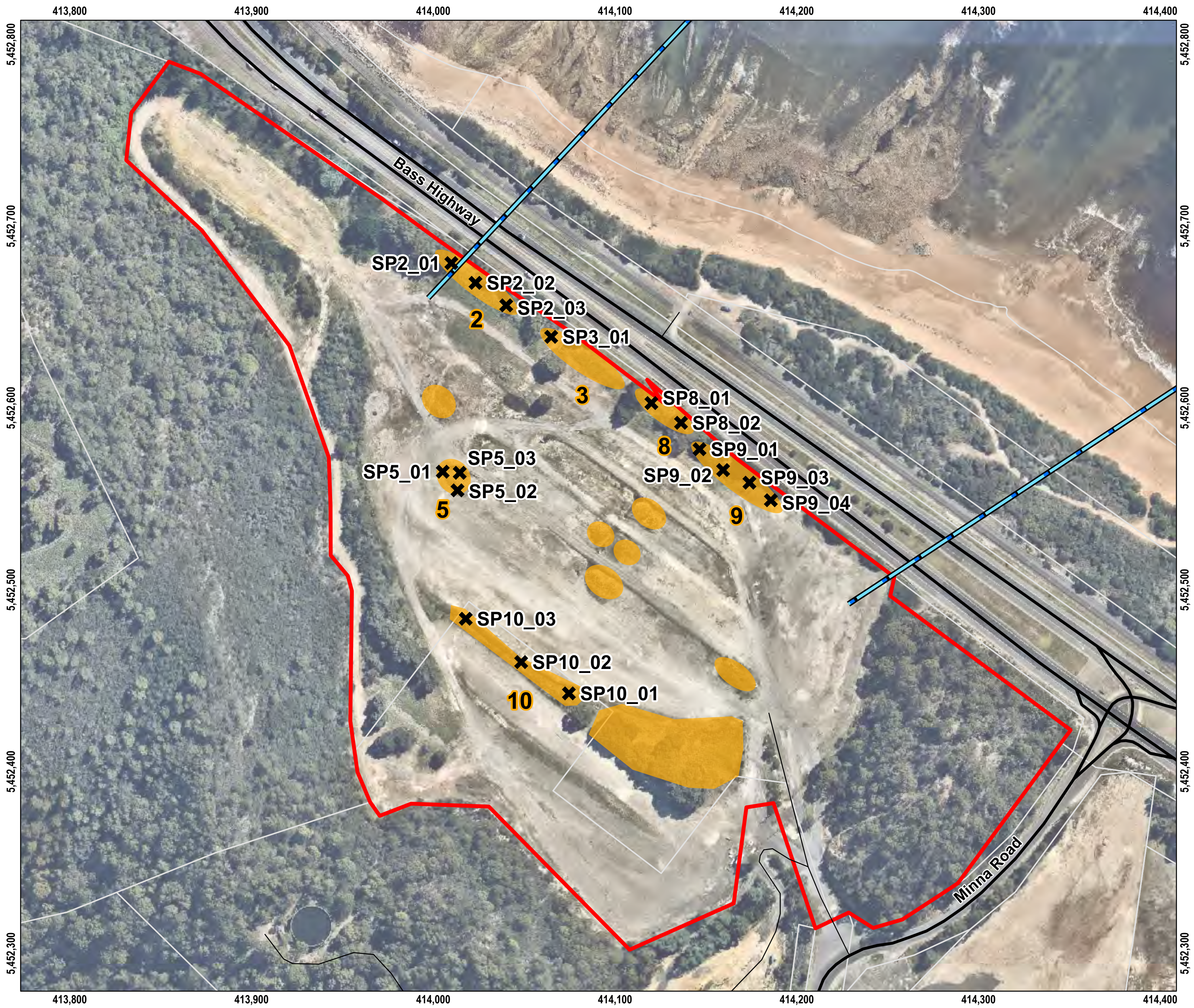
Table 5-6: Stockpile Sampling Methodology

Activity	Details
Stockpile Sampling	Samples were collected from six soil stockpiles. Samples were collected at depths of approximately 0.2m below the surface of the stockpile. Samples from stockpiles along the northern boundary of the site (stockpiles 2, 3, 8 and 9) were collected using an excavator. Samples from stockpiles 5 and 10 were collected by hand directly into laboratory supplied containers.
Soil Screening	During sampling, soils were assessed for visual and olfactory indications of potential contamination, including observations of extraneous material. Details of these observations are recorded by samplers in field logs provided in Appendix E.
Decontamination Procedure	Soil samples were collected directly from the excavator bucket whilst wearing disposable nitrile gloves to avoid cross-contamination between samples. As such, decontamination of sampling equipment was not required.
Sample Preservation	Samples were placed in laboratory supplied jars. Samples were stored on ice (<4°C) in an ice box while on site and were frozen (below -8°C) within six hours of collection. Samples were refrigerated while in transit to the selected laboratories.
Sample Analysis	Samples were submitted to National Association of Testing Authorities, Australia (NATA) accredited laboratories Eurofins and ALS (inter-laboratory duplicates only) for all specified analysis. A copy of the NATA analytical reports is provided in Appendix F.

5.4.2.4 Analytical suite

Stockpile samples were submitted to NATA accredited laboratories for the following analysis:

- Total Recoverable Hydrocarbons (TRH), benzene, toluene, ethylbenzene, xylene and naphthalene (BTEXN), polycyclic aromatic hydrocarbons (PAH) and metals (As, Cd, Cr, Cu, Ni, Pb, Hg) – 12 samples.
- Tas EPA 105 Screen – 4 samples.



MARINUS LINK

LEGEND

- ✖ Soil stockpile sample
- Stockpile

Proposed route

- HVDC subsea cable
- Major road
- Minor road
- Cadastre

SOURCE
Proposed route and sampling locations from Tetra Tech Coffey.
Roads and cadastre from DPIPWE.
Imagery from Nearmap (08/03/2022).

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MARINUS LINK PTY LTD

MARINUS LINK
CSASS TASMANIA

FIGURE 5

Soil Stockpile Locations

TETRA TECH COFFEY

DATE: 03.09.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CSASS_TAS_F005_GIS

5.4.3 Surface water sampling

Surface water runoff was observed to flow north off the Heybridge converter station site to Tioxide Beach via subsurface stormwater drains and into Bass Strait. The contamination status of surface water at the converter station site has not been previously assessed as there has been no surface water present during previous investigation. It was considered that sampling the current surface water drainage system will provide an indication of the current baseline condition of surface water on the site. It is likely that excavation proposed during the construction of the site may result in contamination to surface water, and the baseline condition of surface water was established to allow comparison.

Surface water sampling was completed from the stormwater drain within the converter station site and at the stormwater drain outlet on Tioxide Beach. The effluent tunnel that emerges on the eastern end of Tioxide was blocked and did not appear to be flowing.

5.4.3.1 Applicable guidelines

Applicable guidelines and standards for sample collection and analysis include the following:

- ASC NEPM (1999) National Environment Protection (Assessment of Site Contamination) Measure (1999) as amended 2013 (NEPM (ASC)).
- ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

5.4.3.2 Assessment criteria

Based on the current land use and proposed use of the study area, contaminant screening criteria is sourced from:

- ANZG 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

5.4.3.3 Surface water sampling methodology

The surface water sampling methodology is summarised in **Table 5-7**. Sampling locations are shown in Figure 6.

Table 5-7: Surface Water Sampling Methodology

Activity	Details
Surface Water Sampling	Samples were collected from two surface water locations (HEY-SW1 and HEY-SW2-Alt). Both samples were collected using dedicated sterilized sampling bottles or syringes, avoiding collection of any surface material.
Surface Water Screening	During sampling, surface waters were assessed for visual and olfactory indications of potential contamination. Details of these observations are recorded by samplers in field logs provided in Appendix E.
Decontamination Procedure	Surface water samples were collected using dedicated sterilized sampling bottles or syringes whilst wearing disposable nitrile gloves to avoid cross-contamination between samples. As such, decontamination of sampling equipment was not required.
Sample Preservation	Samples were collected in laboratory supplied bottles. Samples were stored on ice (<4°C) in an ice box while on site and were frozen (below -8°C) within six hours of collection. Samples were refrigerated while in transit to the selected laboratories.

Activity	Details
Sample Analysis	Samples were submitted to National Association of Testing Authorities, Australia (NATA) accredited laboratories Eurofins and ALS (inter-laboratory duplicates only) for all specified analysis. A copy of the NATA analytical reports is provided in Appendix F.

5.4.3.4 Analytical suite

Surface water samples were submitted to NATA accredited laboratories for the following analysis:

- Metals (As, Cd, Cr, Cu, Ni, Pb, Hg, Ag, Sn, Mo, Se, Zn) Cr^{6+}
- Total recoverable hydrocarbons (TRH)
- PAH
- Phenols
- OCP
- PCB
- VOCs
- Vinyl chloride

MARINUS LINK

LEGEND

Surface water sample

Proposed route

HVDC subsea cable

Heybridge converter station site boundary

Major road

Minor road

Cadastre

SOURCE
Proposed route and sampling locations from Tetra Tech Coffey.
Roads and cadastre from DPIPWE.
Imagery from Nearmap (08/03/2022).

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CSASS TASMANIA

FIGURE 6

Surface Water Sample Locations

TETRA TECH COFFEY

DATE: 03.09.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CSASS_TAS_F006_GIS

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5.5 RISK ASSESSMENT METHOD

A qualitative environmental risk analysis has been conducted for the study area to assist in identifying the controls required to avoid and if this is not possible, reduce risks and to identify issues of concern for other technical studies to consider both during the impact assessment stage, and for future design phases.

The risk assessment was focussed on potential risks to environmental receptors including construction and maintenance workers at the site, potential ecological receptors including flora and fauna and potential risks to groundwater or surface water from contamination disturbance that may occur during construction.

The risk analysis has been based on the risk-based approach from the Australian/New Zealand Standard for risk management (AS/NZS IS0 31000:2018).

The assessment of potential risks was based on the likelihood of the impact to the environment (health or ecological) occurring and the potential consequences (i.e., measure of severity should this occur). The descriptors used to classify the likelihood and consequence are detailed in Table 5-8. Assessment specific consequences have been developed that allow for comparison of analytical results and exceedances of screening criteria and are included in Table 5-8.

The level of risk was then determined by combining the likelihood and consequence to rank the potential risk as very high, high, moderate, low or very low according to the risk evaluation matrix in Table 5-9.

Table 5-8: Descriptors used to classify likelihood and consequence

Descriptor	Description
Likelihood	
Almost certain	A hazard, event and pathway exist, and harm has occurred in similar environments and circumstances elsewhere and is expected to occur more than once over the duration of the project activity, project phase or project life.
Likely	A hazard, event and pathway exist, and harm has occurred in similar environments and circumstances elsewhere and is likely to occur at least once over the duration of the project activity, project phase or project life.
Possible	A hazard, event and pathway exist, and harm has occurred in similar environments and circumstances elsewhere and may occur over the duration of the project activity, project phase or project life.
Unlikely	A hazard, event and pathway exist, and harm has occurred in similar environments and circumstances elsewhere but is unlikely to occur over the duration of the project activity, project phase or project life.
Rare	A hazard, event and pathway are theoretically possible on this project and has occurred once elsewhere, but not anticipated over the duration of the project activity, project phase or project life.
Consequence	
Severe	In-situ concentrations of contaminants in soils exceeds NEPM Health Investigation Levels (HILs) / Health Screening Levels (HSLs) and presents an immediate risk to the health of persons accessing the project site. Mitigation measures to manage major impacts are likely to be extensive or complex, requiring a high level of resources and may involve regulatory intervention.
Major	The disturbance of in-situ contamination with concentrations that exceed NEPM HILs / HSLs; Ecological Investigation Levels (EILs) / Ecological Screening Levels (ESLs); or ANZG (2018) sediment upper guideline values (GV-high) and potentially present an acute risk to the health of persons accessing the project site, or which result in the mobilisation of the contaminants within the immediate environment and is sufficient to cause adverse impacts to the local environment and long-term impacts in the receiving environment. Careful management or avoidance can mitigate adverse effects.

Descriptor	Description
Moderate	The disturbance of soil containing environmentally significant levels of one or more contaminants with concentrations that exceed screening criteria for ecological receptors (NEPM ESL / EIL and/or ANZG GV-high); human health (HSLs / HILs), which results in the mobilisation of the contaminants within the immediate environment, which is sufficient to cause adverse impacts to the local environment and long-term impacts in the receiving environment. Appropriate management measures can mitigate the potential impacts.
Minor	The disturbance of soil containing environmentally significant levels of one or more contaminants with concentrations exceeding screening criteria for ecological receptors (NEPM ESL / EIL and/or ANZG default guideline values - DGV) and highly sensitive human receptors (nominally HIL / HSL A), but are below screening criteria for commercial / industrial land uses (nominally HIL / HSL D), which is sufficient to cause adverse impacts to the local environment and impacts in the receiving environment. Appropriate management measures can mitigate the potential impacts.
Negligible	The disturbance of soil containing isolated occurrences of environmentally significant levels of a contaminant (i.e. exceeding EIL / ESL and/or ANZG DGV, but not HSL / HIL), which may result in mobilisation of small amounts of contaminants within the immediate receiving environment. Degradation of the greater receiving environment (being areas outside of the study area) is unlikely with no measurable degradation to the local receiving environment. Monitoring of potential impact may be an appropriate response rather than implementation of mitigation measures.

Table 5-9: Risk evaluation matrix

		Likelihood				
		Rare	Unlikely	Possible	Likely	Almost certain
Consequence	Negligible	Very low	Very low	Very low	Low	Moderate
	Minor	Very low	Low	Low	Moderate	Moderate
	Moderate	Low	Low	Moderate	High	High
	Major	Low	Moderate	High	Very high	Very high
	Severe	Moderate	High	Very high	Very high	Very high

5.6 ASSUMPTIONS AND LIMITATIONS

The following assumptions and limitations have been made during the assessment:

- As a conservative measure, we have assumed that any potential source of contamination within the investigation area may be disturbed by the project regardless of the construction methodology or proximity to final disturbance areas.
- The demolition of factory buildings on the site was undertaken in the mid-1990s, however remnants of footings (such as concrete blocks and bricks) are present in some areas of the site which have limited the sampling of soils in some isolated locations. Generally the footings have comprised pier or rim footings that are not continuous, and previous sampling locations may have had to be moved from design grids to allow sampling of soils from some of the factory areas. Sampling undertaken across the site as a part of Cromer (2007a), Synnot & Wilkinson (1996), Tioxide (1997, & 1998) and ES&D (2020) has been completed across the former factory areas and identified the contamination as detailed in this report. However, there is a possibility that some soil sampling locations met with refusal on concrete blocks or bricks in the former factory area and were not able to be sampled below the concrete/bricks. As locations which were met with refusal were not documented within any of the reports as data gaps, we have assumed that alternative adjacent locations were sampled. Any potential data gaps from refusal on concrete blocks or bricks are considered to represent only a very small portion of the site that may not have been sampled. A site inspection and sampling program of soil disturbance areas is required during the pre-construction phase to confirm the nature and extent of contamination in these locations (if any). The exact location of concrete blocks or bricks that have not been able to be

assessed is not directly noted in any report other than the reports noting that “footings have made it difficult to sample soils in some areas”.

- We have assumed that potential ASS is present beneath the shore area to the low-tide line based on the results of on-shore and off-shore testing, that there are limited sediments overlying the rocky seabed in the near shore area, and the inability to undertake soil/sediment testing in the intertidal zone and near-offshore areas.
- We have assumed that the effluent tunnel was decommissioned in-situ, with the effluent pipeline and all tunnel materials retained in the approximate location of the effluent tunnel alignment. We have also assumed that any contamination that may have been present either in the tunnel or pipeline are still present on the site.
- The converter station site is a former factory site and covered with varying thickness of fill. As detailed in the *Heybridge Foundations and Construction – Technical Memo* (Jacobs 2024), the majority of the fill soils will be geotechnically unsuitable for constructing foundations for the proposed converter station site. On the basis that the filling on the site was unsuitable for construction, the memo made a conservative assumption that the entire thickness of filling from the development area on the site will require excavation and removal from the site. This was because the fill soils were unlikely to be suitable for geotechnical fill if reused. The thickness of fill ranged between approximately 1 to 2.5 m and equated to approximately 62,200 m^3 across the site. For the purposes of this assessment, we have assumed that all filling will be required to be managed, and how it will be managed will be documented in a waste management plan.

6. EXISTING CONDITIONS

This section describes the existing conditions and values within the study area based on the information obtained from the intrusive site works and review of previous site investigation reports (listed in Table 2-2).

The objective is to document all values that could be affected by the project and to provide context to explain what the baseline conditions mean and why they are important.

The assessment of contaminated land and ASS existing conditions considered the following features:

- Land use (Section 6.1)
- Topography (Section 6.2)
- Regional geology (including ASS and naturally occurring asbestos (NOA)) (Section 6.3)
- Hydrogeology (Section 6.4)
- Site history and previous reports (Section 6.5)
- Summary of previous contamination assessment report findings (Section 6.5.2
- Results of targeted sampling (Section 6.6)

6.1 LAND USE

According to the NRE Tasmania ListMap, the land tenure of the proposed converter station site is listed as Private Freehold and is classified as Rural (zone 20) under the Burnie Local Provisions Schedule. The site is currently vacant, largely undeveloped, with sparse grasses and gravel hardstands occupying the majority of the site. Minimal vegetation currently exists on the site.

Historically, the Heybridge converter station site was used as a paint pigment factory by Tioxide Australia. The factory commenced operation in 1949 the factory was demolished by 1998.

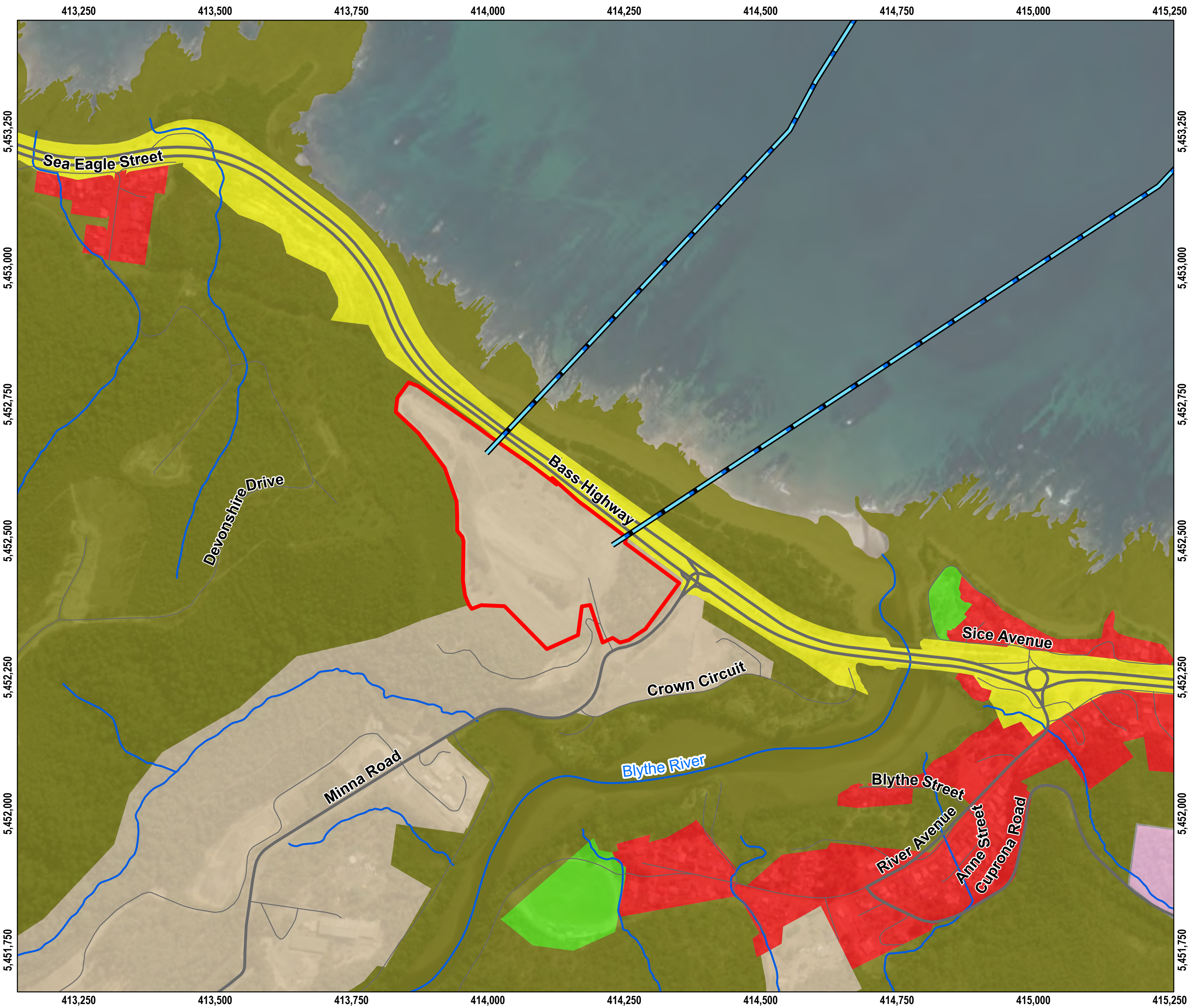
Rehabilitation activities were reported to have commenced immediately following the site’s closure in 1996; the details of the remediation completed, and the current contamination status of the site is unknown.

The land surrounding the proposed development site is largely unsealed, vacant and comprises of native forest, bushlands and habitats associated with the Blythe River located approximately 240 m to the southeast (Figure 6). The north of the study area is bordered by a sealed highway (Bass Highway) which separates the proposed redevelopment site from the Bass Strait shore front (approximately 100 m north). A small number of residential properties are located to the west and south, with a small rural town located along Blythe River to the southeast.

Surrounding land within the study area is zoned for the following uses (shown on Figure 7):

- Further areas of Rural Living (Zone 11) to the south with an associated Priority Vegetation Area overlay,
- Landscape Conservation (Zone 22), Environmental Management (Zone 23) to the north, south and west.
- Areas of General Residential (Zone 8) and Recreation (Zone 28) follow the right bank of Blythe River estuary and are mostly positioned outside of the study area.

No agricultural land exists within the study area.



MARINUS LINK

LEGEND

Proposed route
- HVDC subsea cable
- Heybridge converter station site boundary

Planning zones
- General Residential
- Rural Living
- Rural
- Landscape Conservation
- Environmental Management
- Utilities
- Recreation
- Watercourse
- Major road
- Minor road

Source:
Routes from Tetra Tech Coffey.
Roads, watercourses and planning zones from DPIPWE.
Imagery from NearMap (8 March 2022).

0 100 200 m

SCALE **1:10,000**
PAGE SIZE: **A4**
PROJECTION: **GDA2020 MGA Zone 55**

MARINUS LINK PTY LTD

MARINUS LINK HEYBRIDGE
GROUNDWATER IMPACT ASSESSMENT REPORT

FIGURE 7

Surrounding land use and topography

TETRA TECH COFFEY

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6.2 TOPOGRAPHY

The surface elevation of the land-based study area ranges from 0 to approximately 25 m above Australian height datum (AHD) with the land sloping from the southern portion of the converter station site down towards the shore. Higher topographic elevations are present on the larger land parcel at the eastern and western ends (up to 40 m AHD); however these areas are outside of the project disturbance footprint associated with potential contaminated land or ASS impacts.

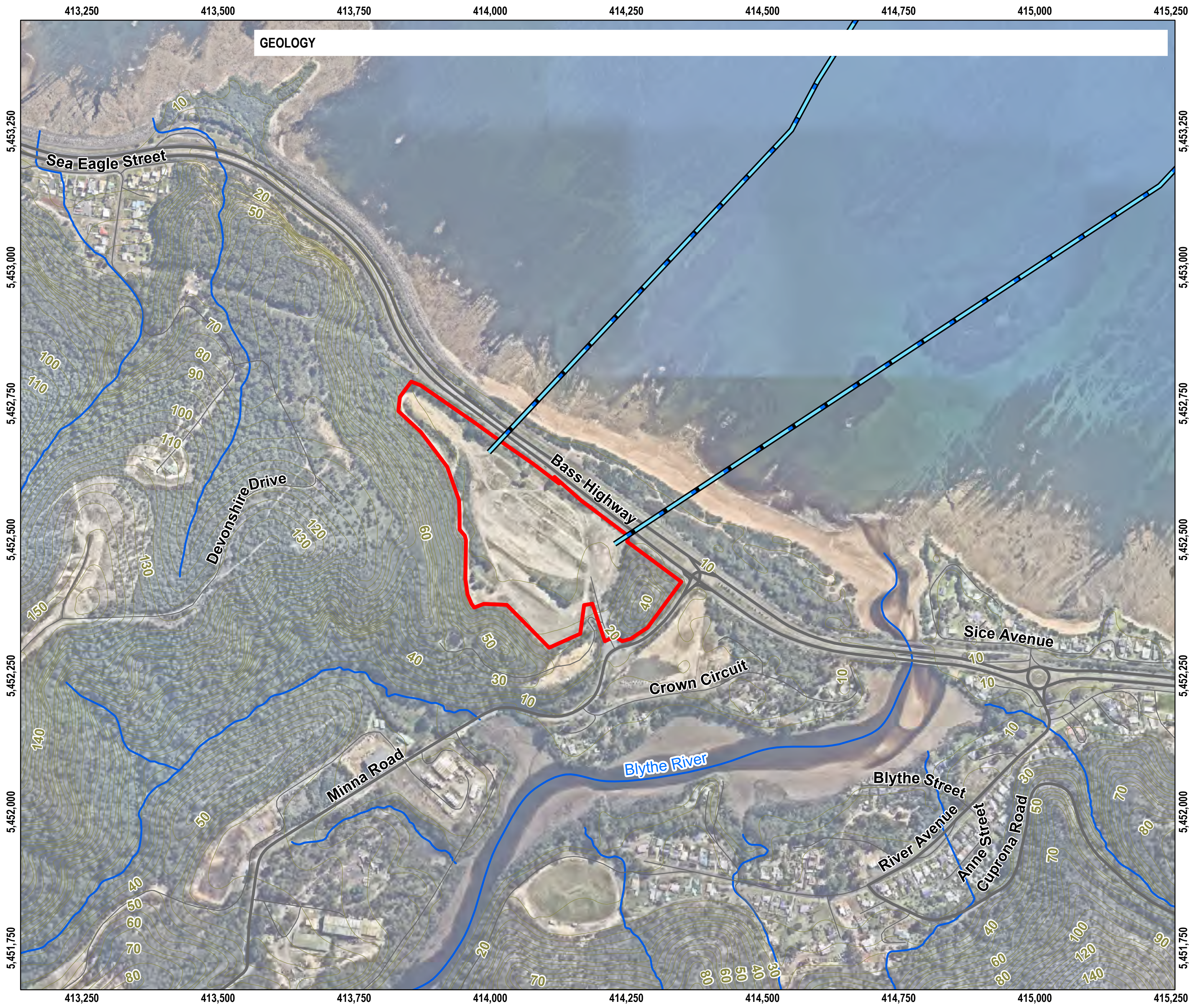
6.3 REGIONAL GEOLOGY

6.3.1 Geological units

The site is located within the Sheffield Element, which is one of several Precambrian aged geological blocks in the north of Tasmania. The site is mapped as being underlain by more modern Quaternary deposits of aeolian sand, and river and marine gravels, sand and clays, which are expected to overly the Precambrian aged Burnie and Oonah Formation (Po, Lo) bedrock of the Sheffield Element. This formation is comprised of pale grey coloured interbedded mudstone, sandstone and siltstone, and is expected to include an upper weathered horizon.

The more recent Quaternary sands, gravels and clays are deposited in the lower elevation embayment of the outcropping Burnie and Oonah Formation bedrock, which extends across the Bass Highway to the coastal landside landfall zone. The bedrock outcrops where the topography rises steeply around the site to the west, south and east. Interbedded Tertiary basalts are present in the region but expected to be absent from the study area.

Figure 8 shows the regional geology.



MARINUS LINK

LEGEND

Proposed route
- HVDC subsea cable
- Heybridge converter station site boundary
- Watercourse
- Major road
- Minor road
- Elevation contours (5m interval)

Source:
Routes from Tetra Tech Coffey.
Geology from MRT.
Roads and watercourses from DPIPWE.
Imagery from NearMap (8 March 2022).

0 100 200 m

SCALE **1:10,000**
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PROJECTION: **GDA2020 MGA Zone 55**

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MARINUS LINK HEYBRIDGE
GROUNDWATER IMPACT ASSESSMENT REPORT

FIGURE 8

Regional geology

TETRA TECH COFFEY

DATE: 03.09.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CSASS_TAS_F008_GIS

The Mineral Resources Tasmania (2012) digital geological atlas map (sheet 4045) Burnie and the Tasmanian Government Department of State Growth (2017) geological map of Northwest Tasmania (1:25,000) indicate that the study area is underlain by the geological units listed below in Table 6-1.

Table 6-1: Geological units

Geological Unit	Symbol	Age	Description	Location
Quaternary Deposits - Aeolian	Qpsa	Quaternary (Pleistocene)	Older aeolian sand of coastal plain.	Covers the majority of the study area.
Quaternary Deposits - Littoral	Qhwr	Quaternary (Holocene)	Sand of stabilised longitudinal beach ridges.	North of study area along sand dunes.
Cenozoic Cover Sequences	Qhbd	Quaternary (Holocene)	Beach sand, sand dunes and beach gravel.	North of study area along beach.
Oonah (Burnie) Formation	Lo	Neo-Proterozoic	Quartzwacke turbidite sequence of sandstone, siltstone and well bedded black slaty mudstone.	South and west of study area as well as north of Tioxide beach.
Oonah Formation	Lob	Proterozoic	Albite dolerite, metabasalt.	North of Tioxide beach.

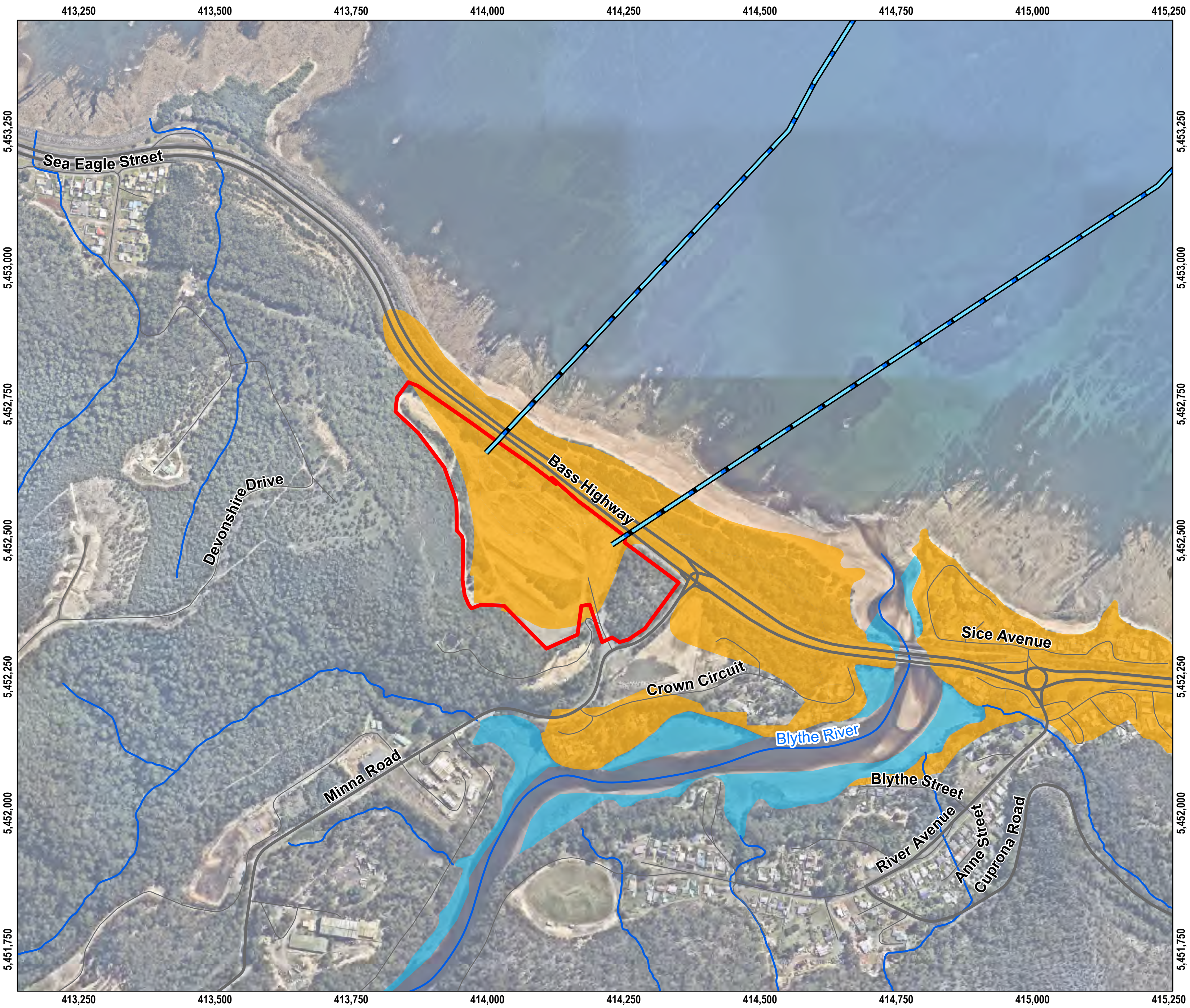
6.3.2 Acid sulfate soils

ASS containing metal sulphides can be present within highly mineralised areas of Tasmania, particularly where oxidation of these metal sulphides takes place. This can be through:

- Hydrothermal alteration of metal sulphide-containing rocks and soils; and,
- Microbial decomposition of organic matter in water-logged soils and sediments containing metal sulphides (usually pyrite).

According to the National Acid Sulfate Soils Atlas there is a low probability (6-70%) that ASS exist within the study area. Given the proximity to areas of high probability (greater than 70%) of ASS being present and proximity to the coast, intrusive ASS testing works were completed at the site and detailed in Section 5.4.1.

Figure 9 shows the probability of ASS.



MARINUS LINK

LEGEND

Proposed route

- HVDC subsea cable
- Heybridge converter station site boundary
- Watercourse
- Major road
- Minor road

Coastal Acid Sulfate Soils (0 - 20 m AHD)

- Low probability (5-70%)

Marine acid sulfate soils

- High (>70%) Intertidal

Source:
Routes from Tetra Tech Coffey.
ASS from Resource Management and Conservation.
Roads and watercourses from DPIPWE.
Imagery from NearMap (8 March 2022).

0 100 200 m

SCALE **1:10,000**
PAGE SIZE: **A4**
PROJECTION: **GDA2020 MGA Zone 55**

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MARINUS LINK HEYBRIDGE GROUNDWATER IMPACT ASSESSMENT REPORT

FIGURE 9

ASS Probability

TETRA TECH COFFEY

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6.3.3 Naturally occurring asbestos

NOA is generally encountered within basement rocks and ultramafic (such as serpentinites) volcanic rocks. As there are no known ultramafic rocks intersecting the site it is considered that the likelihood of encountering NOA within the study area is very low.

6.4 HYDROGEOLOGY

The Oonah Formation fractured rock (sandstone and siltstone) aquifer is the primary aquifer at the study area with groundwater previously encountered at depths of 1 to 3 mbgl (Jacobs, 2022a).

TDS values recorded for groundwater samples historically collected at the study area ranged from 700 to 1,300 mg/L (Cromer, 2007) while Jacobs (2022a) reported electrical conductivity (EC) between 213 and 615 µS/cm in groundwater sampled from test pits at the site. Groundwater was inferred to flow to the north (Bass Strait) as shown in Figure 10.

Further details of the hydrogeology are provided in the Groundwater Impact Assessment report (Tetra Tech Coffey 2024).

MARINUS LINK

LEGEND

- Boreholes
- Directional flow
- Groundwater contours (m AHD)
- Major road
- Minor road
- Elevation contours (5m interval)

Proposed route

- HVDC subsea cable
- Heybridge converter station site boundary

Source:
Routes from Tetra Tech Coffey.
Roads from DPIPWE.
Imagery from NearMap (8 March 2022).

0 30 60 m

SCALE 1:3,000
PAGE SIZE: A4
PROJECTION: GDA2020 MGA Zone 55

MARINUS LINK PTY LTD

MARINUS LINK HEYBRIDGE
GROUNDWATER IMPACT ASSESSMENT REPORT

FIGURE 10

Inferred groundwater contour plan

TETRA TECH COFFEY

DATE: 03.09.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_CSASS_TAS_F010_GIS

6.5 SITE HISTORY AND PREVIOUS REPORTS

6.5.1 Historical site use

Historically, the proposed converter site was used as a paint pigment factory by Tioxide Australia (formerly known as Australian Titan Products [pre-1972]), which is a subsidiary of British Titan Products Ltd England. The factory commenced operation in 1949 and produced up to 35,000 tons of paint pigment (titanium dioxide) per year. Economic factors caused closure of the plant in 1996, and the factory was subsequently demolished by 1998. Titanium dioxide pigments were produced at the factory from ilmenite mined in the Capel area in Western Australia.

Titanium dioxide is a non-toxic white pigment used in products ranging from paint, plastics, printing ink, paper, flooring, cement products, wall coverings, cosmetics, ceramics, rubber and textiles. The Heybridge site was chosen because of the availability of sulfuric acid, cheap electricity, local coal, water and access to the deep-water port of Burnie. The location of the site also facilitated the direct discharge of effluent into Bass Strait. While it is unknown what volume or types of waste were discharged, the Heybridge factory was subjected to criticism for the discolouration of the ocean and coast. It is understood that iron salts effluent (ferro sulfates) generated during operations were responsible for causing significant discolouration (red) of the sea water and beach sands, which extended more than a kilometre along the coast. Following the 1973 State Government Environmental Protection Act, Tioxide Australia invested in reducing the volume of waste being discharged to Bass Strait.

Demolition of the factory was completed in 1998 however concrete footings and reinforcement, as well as deleterious materials (building rubble), were noted as still being present by Jacobs (2022b).

There is known contamination present within the study area that is associated with the former Tioxide factory, including naturally occurring radioactive materials (NORM). NORM, consisting of uranium (U238), thorium (Th232) and their decay products, occur at various concentrations in the titanium ore used at the site. U238 and Th232 become concentrated as titanium ore is processed, resulting in levels that can exceed regulatory exemption levels in waste materials such as mineral sludges, dusts and sands (Jacobs, 2022a). Radiation investigation completed at the site is summarised in section 6.5.2.5.

Most recently the site was used as a lumber yard between 2015 and 2022.

A review of EPA Tasmania's list of regulated premises shows that the converter station site is not the subject of any EPA issued notices.

One regulated premise is located within 500m of the converter station comprising the Ixom Operations – Minna Road Chemical Plant. This site is approximately 300m to the south of the converter station site and is listed as having a 1A2 Chemical works – manufacture Permit, which also include an Environment Protection Notice (EPN).

6.5.2 Summary of previous investigations

This section provides a summary of the findings of the review of the previous environment assessments undertaken at the site and separated into the relevant contaminated media or contamination type. The details of the reviews are provided in Appendix B.

6.5.2.1 Soil Contamination

The key findings regarding the contamination status of the soil within the study area reported by previous investigations include the following:

- A grid-based soil investigation was completed by WCC (2007a) and identified concentrations of lead at one test pit and hydrocarbons in shallow groundwater at two separate test pits. However, these locations were further investigated by ES&D (2020) and determined to be very localised, and the contaminant concentrations were below commercial/industrial screening criteria (NEPM HIL/HSL D). Hydrocarbons were also reported in a similar area by Jacobs (2022a).
- Jacobs (2022a) excavated nine test pits to a maximum depth of 3 m bgs and submitted a total of 13 primary samples for laboratory analysis.
- No visual or olfactory indicators of contamination were observed at the sample locations completed by Jacobs (2022a).
- Natural soils (weathered clays and siltstone) were encountered at depths ranging from 0.3 – 1.5 mbgl (Jacobs, 2022a).
- Results reported for samples collected by Jacobs (2022a) were all below adopted health, ecological and management limit guideline values for commercial/industrial use.
- The majority of results reported for the samples collected by Jacobs (2022a) were below EPA Tasmania IB105, Table 2, Fill Material (Level 1) Max Total Concentrations with the exception of arsenic (23 mg/kg – one sample only), manganese (1,640 mg/kg – one sample only), nickel (84 mg/kg – one sample only), zinc (230 mg/kg – one sample only) and TPH fraction C_{10}-C_{36} sum of total (1,050 mg/kg – one sample only).
- ES&D noted that surface soil that built up during the use of the site as a lumber yard was scraped and stockpiled along the northern site boundary, adjacent to the Bass Highway.
- WC (2007a) and GBG (2022) noted that there are concrete slabs, footings and piles remaining across a significant amount of the site which made the investigation of these areas difficult.

The reported findings from previous site investigations indicate that levels of contamination within the soil on the converter station site are unlikely to present an unacceptable risk to human health or ecological receptors based on the proposed commercial/industrial site use. However, it is noted that the contamination status of soil underlying the remaining foundations of the former Tioxide factory have not been assessed. Previous investigations also suggest that, should shallow fill soils within the study area require excavation and offsite disposal, there are potential for contaminants (metals and hydrocarbons) to be at concentrations that exceed EPA Tasmania IB105 Level 1 (fill material) criteria but are below the Level 2 (low level contaminated soil) criteria.

6.5.2.2 Effluent Tunnel and Pipeline

The eastern portion of the converter station site formerly contained an effluent tunnel that ran from the factory area, beneath the Bass Highway, the railway line and the dune areas before emerging on Tioxide Beach. The tunnel is understood to have comprised a concrete structure approximately 200 m long, 1.2 m wide and 2.2 m high, and was covered with approximately 2 m of cover soils. Where the tunnel passed beneath the Bass Highway, it comprised a 600 mm diameter concrete pipe.

To the north of the Bass Highway, the tunnel comprised a similar box-like structure to the onsite tunnel and passed beneath the rail line and the dune systems. The northern-most 29 m of the tunnel had been more recently been replaced (i.e. recent in 2007) with a box-culvert type of structure (pitt&sherry, 2007).

The southern end of the tunnel was installed into competent rock. During tunnel inspections (*ibid*), water approximately 600 mm deep was present in the tunnel and was assumed to be from groundwater or surface water infiltration.

A 300 mm diameter stainless steel pipe was laid within the tunnel to transport effluent, and that at the northern end of the tunnel (where it emerged on the beach) the pipeline continued, buried beneath the sand of the beach and shore crossing for approximately 250 m. The pipeline extended approximately 3 km offshore and ended in a diffuser to distribute the effluent (*ibid*). Whilst all historic reports only note a single pipeline that is buried from the Beach entrance of the effluent tunnel to some distance offshore, later reports (CEE, 2022), notes that two pipelines extend offshore approximately 3 km.

It is inferred that the tunnel portion that is on the converter station was decommissioned in 2008. This is based on the preferred approach recommended to manage the integrity of the tunnel in the pitt&sherry (2007) tunnel inspection report. This report recommended removing the overburden, removing the concrete top to the tunnel, removing the existing pipe (if possible) or crushing the pipeline within the tunnel on the site, crushing the walls of the tunnel into the tunnel floor, placing the roof of the tunnel into the tunnel void, backfilling the remaining tunnel void with self-compacting crushed rock, and then reinstating the overburden (if uncontaminated). The report also recommended filling the 600 mm diameter culvert under Bass highway with concrete, and also filling the older section of the tunnel under the railway line and dunes (up to the newer box-culvert section) with concrete. The plan in the report did not indicate if the pipeline where it left the converter station site was to be removed or retained within the tunnel.

No reports or records regarding the completion of the tunnel works were available for review (from either the EPA or other sources) which documented the remediation and/or validation of the tunnel or pipeline. However, an aerial photograph from January 2008 appears to show that the tunnel had been uncovered, with two stockpiles of overburden either side of the tunnel alignment (Figure 11).

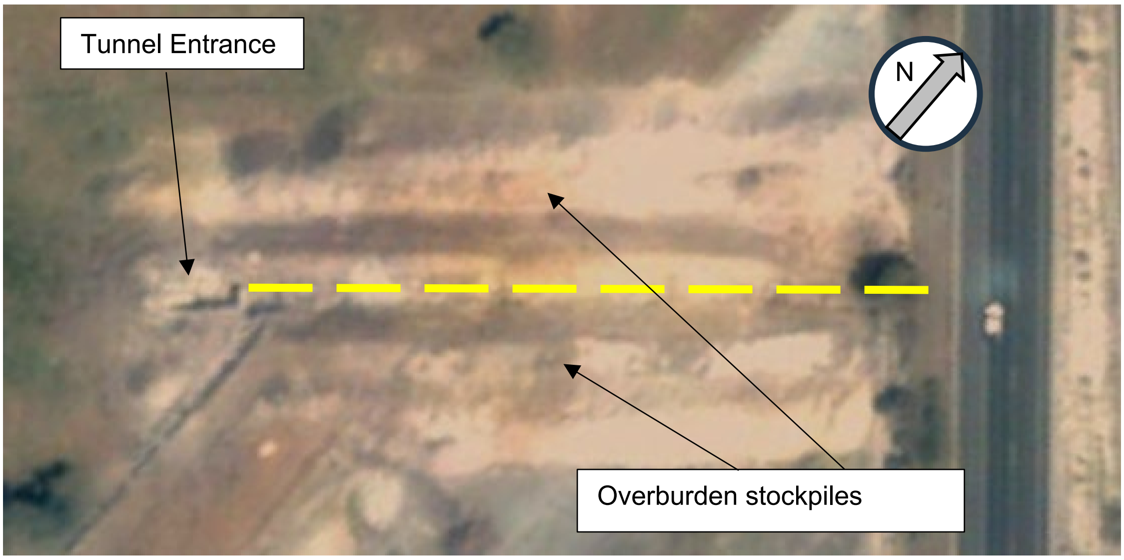

Figure 11: Aerial photograph from 2008 showing tunnel exposure (tunnel in yellow)

Subsequent aerial photographs in 2011 show a disturbed area where the tunnel was, and the former entrance shaft was no longer visible on the site.

As there are no reports available for review of the removal and/or testing of contamination around the tunnel, as a conservative measure it is assumed (based on the reviews of the reports provided and consistent with the absence of remediation or validation reports or approvals) that the tunnel was decommissioned and retained in-situ as crushed concrete and/or crushed rock backfill, and the condition of any residual sediments or scale within the tunnel or pipeline are unknown, but still present in the inferred tunnel alignment.

The offshore effluent pipelines were inferred to be buried at the shore crossing to a distance of approximately 250 m offshore (based on CEE, 2022), and they currently extend approximately 3 km offshore. The condition of the connection between the effluent tunnel beach entrance and the offshore portion of the pipelines is unknown.

The HVDC cable crossing study (Marine Solutions, 2024) identified that in the area where the proposed sub-sea cable will cross the pipelines that the pipelines:

- Were in good condition with no observable holes.
- Were constructed from lengths of pipe that were bolted together and anchored to the seabed via steel banding bolted to rock outcrops, or via concrete collars at regular intervals.
- No asbestos or asbestos fibres were present in samples collected from flange gaskets used to seal the pipe joins.
- The concentrations of potential contaminants from sediment inside and outside the pipeline were all below the sediment default guideline values (DGVs), or below the laboratory reporting limits (LOR). The sediment concentrations inside the pipeline were generally lower than those outside from the seabed, with the exception of titanium and manganese, which were marginally higher from sediments within the pipeline.

Consequently, based on the results of the Marine Solutions (2024) study, the pipeline, if disturbed during cable crossing works (in the area planned for the cable crossing), is unlikely to result in disturbance of contaminated sediment that may impact on the environment.

6.5.2.3 Acid Sulfate Soils

Limited investigation into the potential presence of ASS has previously been conducted at the study area. Relevant findings include:

- Swamp deposits and a hydrogen sulfide odour (potentially indicative of ASS) were identified by WCC (2007a) in 35 of 62 test pits completed at depths of up to 1.5 mbgl from across the converter station site, noting that no deeper samples were collected.
- ASS field testing was conducted by Jacobs (2022a) on soil samples from five locations on the converter station site. Results of the ASS field testing demonstrated strong evidence that ASS is present at the site with large pH reductions reported for each sample during field testing.
- Samples from five locations from the converter station site were submitted by Jacobs (2022a) for laboratory SPOCAS analysis to confirm the potential for ASS to be present in the study area. Two samples reported minor exceedances of the net acidity action criteria (0.03 %S / 15 mol.H^+/tonne). However, Jacobs noted that the values that exceeded the criteria may have been overestimated due to the reporting method extracting organic sulfur, leading to potential interference to some of the analytical methods.
- The soil profile on the site comprised fill or disturbed natural soils to depths of between 1 and 2.5 min the ASS sampling locations, with potential ASS identified at two locations:
  - TP01-0.5m, with a net acidity of 0.096 %S in gravelly sand fill in the former factory area, and
  - BH04-2.0, with a net acidity of 0.035 %S in wet clayey gravels in the former factory area.
- ASS testing of 26 sediment sampling from the sea bed at 14 locations confirmed that there were no actual ASS within the sediments, and whilst the analysis indicated that there was a potential for acid to be generated if the sediments were oxidised, the acid-neutralising capacity exceeded the acid generation by several orders of magnitude, and the net acidity was below the adopted screening criteria and laboratory reporting limits (<0.02 %S / <10 mole H^+/tonne). This indicated that the offshore sediments were unlikely to be acid generating and will not require specific management.

The reported results of ASS sampling and analysis completed by Jacobs (2022a) indicate that ASS is potentially present within the study area. However, due to the potential interference of some analytical methods, the results presented by Jacobs (2022a) are not considered sufficient for the purposes of assessing the possible impacts that may arise during construction, operation or decommissioning works planned for the study area. Consequently, additional targeted ASS assessment was required, and the details of the additional assessment are provided in Section 6.6.

6.5.2.4 Soil stockpiles

No investigations into the contamination status of soil stockpiles at the study area have previously been conducted. Consequently, additional targeted assessment of soil stockpiles within the Heybridge Converter station site was warranted and the details of the additional assessment are provided in Section 6.6.

6.5.2.5 Naturally Occurring Radioactive Material (NORM)

NORM assessment has previously been completed at the site by SA Radiation (2020), pitt&sherry (2020) and Jacobs (2022a). In order to assess for NORM, radiation readings were recorded across the site and during test pit excavation and borehole advancement across the converter station site. The measured results ranged from 43 to 115 nSv/hr. The adopted screening level for NORM was two times the background radiation levels. Background locations comprised three sites: one at a sports oval in Burnie (approximately 4km to the west), one at the eastern end of Tioxide beach (approximately 400 m from the site), and one site upstream and to the east of the Blyth River. Background readings were in the range 41 and 73 nSv/hr, and were used to establish a background screening level of 146 nSv/hr.
The highest recording of 115 nSv/hr was measured within a test pit at a depth of 1.0 mbgl.

Based on the reported results of the assessment completed by previous consultants, it is considered unlikely that NORM is present within the study area at levels that will impact on the proposed development of the site.

6.5.2.6 Groundwater quality

The investigation of groundwater quality underlying the study area has been limited, with samples collected from test pits where groundwater has been encountered during previous soil assessments, and from the previous installation of 5 groundwater wells across the converter station site. A summary of the findings of the groundwater assessment include:

- Groundwater was encountered by Jacobs (2022a) at approximately 1 to 3 mbgl across the converter station site.
- A total of five groundwater samples were collected by Jacobs (2022a) and submitted for laboratory analysis.
- Analytes for the groundwater samples collected by Jacobs (2022a) were reported to be below adopted criteria with the exception of cobalt (all samples), copper (three samples) and zinc (all samples). PFAS concentrations were reported in three wells but were below the adopted screening criteria for marine ecosystems (95% species protection) and also for other water uses.
- Field parameters recorded by Jacobs (2022a) indicated that the groundwater was mildly acidic with an oxidising potential.
- WCC (2007a) reported that shallow groundwater encountered during test pit excavation was locally contaminated with TPH (>C_{10}) and traces of volatiles at two locations.

The groundwater results reported by Jacobs (2022a) and WCC (2007a) indicate that there are minor concentrations of metals in groundwater that exceed the adopted marine water screening criteria but that there is unlikely to be groundwater contamination at the study area that impacts on the proposed development.

6.5.2.7 Surface water

No investigations into the contamination status of surface water within the converter station site, including runoff and water contained in the onsite stormwater pond, have previously been undertaken. Consequently, additional targeted surface water assessment was required, and the details of the additional assessment are provided in Section 6.6.

6.5.2.8 Sediment

Sampling of offshore sediment was completed in 2022 as part of the marine geotechnical and geophysical surveys. Sediment samples were compared against the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZ, 2018) for sediment guidelines. Two levels of screening criteria were applied (Tetra Tech Coffey, 2022) including:

- Default guideline values (DGVs), which indicate the concentrations below which there is a low risk of biological effects occurring.
- Upper guideline values (GV-high), which provide an indication of concentrations at which toxicity related effects will be expected.

The results of the metals analysis showed that some samples contained concentrations of metals that exceeded the Default Guideline Values for sediment quality, but the majority did not exceed the upper guideline values at which point benthic toxicity effects are likely to be observed.

Concentrations of arsenic exceed the DGV at most locations, with a median value of 24.5 mg/kg and a 95% upper confidence limit of 39.7 mg/kg across the entire dataset. This indicates that the arsenic may be naturally elevated in sediments in the area. Elevated concentrations of arsenic above the upper-guideline (GV-high) value were detected at SED-E5 at depths of 0.4-0.6m and 0.8-1.0m with concentrations of 103 and 108 mg/kg, respectively. The arsenic at depth at this location may represent a potential risk to benthic species if disturbed in this area and will require management in accordance with the requirements included in the Marine ecology and resource use report.

Concentrations of chromium were also elevated at locations SED-E5 and SED-W5 above the DGV for sediments. However, as the concentrations were below the adopted upper-guideline values, it is considered that localised effects on benthic biota may potentially be observed, but more investigation will be needed to confirm the relevance. The elevated concentrations of chromium were observed at the 0.4-0.6m depth, with shallower samples reporting lower concentrations.

Concentrations of nickel were observed in some locations above the DGV sediment criteria, with two locations (SED-E5 and SED-W5) reporting concentrations above the upper-guideline values. Given the location of these samples coincides with the elevated arsenic and chromium concentrations, the sediments in this area may potentially result in observable toxic effects on benthic biota if disturbed.

In general, the shallow sediment samples reported lower concentrations of metals, which likely represents fresh sediments that have been deposited over the last 20 years. Patterns in metals concentrations with depth were generally not observed in the sampling locations closer to the shore (i.e., sites E1, E2, E3, and W1), with no clear pattern in metals concentration changes with depth. This may partially be attributable to the shallow rock depth at some of these locations meaning that an aged sediment profile was not present to be sampled.

At the furthest location from shore (the E5/W5 sampling points) a marked change in metals concentrations with depth was observed, with concentrations of most metals (aluminium, arsenic, chromium, iron, nickel, vanadium and titanium) all increasing in concentration with depth.

This location, based on the increased metals (in particular iron and titanium) may represent an area where former effluent from the processing of titanium oxides has increased metals concentrations, but has more recently been covered by sediments more representative of natural sediments from the area.

It will typically be expected that metals concentrations in the <63µm fraction will be higher than in the whole <2,000 µm due to the higher surface area for metal binding per unit weight. The appraisal of fine (<63 µm) versus coarse (<2,000 µm) sediment metals concentrations did not show significant differences between the fractions indicating no significant preference for metals adsorption to the sediments.

The Marine Ecology and Resource Use Impact Assessment (EnviroGulf, 2024) assessed the potential impacts to the environment that may arise from the disturbance of contaminated sediments in the nearshore area and concluded that the risks to marine ecosystems were low, and that application of management and mitigation measures (as documented in the EnviroGulf, 2024 report) would reduce the potential risks to very low. The potential impacts from the metals contamination in offshore sediments has not been considered further in this report.

6.6 TARGETED SOIL AND SURFACE WATER SAMPLING

Based on the results of the review of previous reports prepared for the study area, a data gap in terms of characterising surface water quality on the site, soil stockpile contamination status and the potential for ASS to be present at the site was identified.

Additional targeted sampling of site surface water, soil stockpiles, and soils for ASS testing was conducted on 8 March 2023 to assess the impact of potentially contaminating activities on stockpiled soil and surface water runoff at the study area, as well as the presence of ASS. The results of the sampling works are detailed in the following sections.

6.6.1 ASS sampling results

Sampling for ASS was undertaken at eight locations along the northern boundary of the Heybridge converter station site. The results of the sampling are summarised below.

6.6.1.1 Field observations

As part of the sampling works conducted, field observations were made to identify indicators of potential soil impacts or contamination such as vegetation distress, water-logged soils or disturbed earth. A summary of these observations is provided in Table 6-2.

Table 6-2: Field Observations – soil sampling

Test Pit Location	mBGL	Observations
HEY1	0.0- 0.4	Fill: Brown-grey sandy clay with gravels and debris (brick and wood pieces)
	0.4-0.9	Natural: Dark grey clayey sand with black and white mottling with gravels
	0.9-1.4	Natural: Dark grey clayey gravels with sand
	1.4-1.5+	Natural: Pale grey gravelly clay with coarse sand and quartz pebbles. A sulfur-like odour was noted at 1.4 mbgl.

Test Pit Location	mBGL	Observations
HEY2	0-0.2	Fill: Sandy clay fill with gravels
	0.2-0.4	Fill: Clay fill with rootlets and charcoal fragments
	0.4-1.5+	Natural: Dark brown clay.
HEY3	0-0.3	Fill: Dark brown sandy clay fill with gravels and brick fragments
	0.3-1.45	Natural: Grey sand
	1.45-1.5	Natural: Oxidised red-brown cemented sand
HEY4	0-0.8	Fill: Sandy clay fill with boulders and debris (bricks, wood and concrete)
	0.8-1.5+	Natural: Dark grey sand with shell fragments.
HEY5	0-0.5	Fill: Yellow sandy clay fill with gravels, with concrete pieces, wire and plastic fragments
	0.5-1.5+	Fill: Yellow sandy clay fill with gravels
HEY6	0-0.1	Fill: Shallow dark brown sandy clay
	0.1-1.5+	Natural: Sandy clay with mudstone and quartz gravels.
HEY7	0-0.9	FILL: Yellow-grey clayey sand with gravels and boulders.
	0.9-1.5+	FILL: Pale grey clay with boulders, gravels and wood fragments.
HEY8	0-0.16	Fill: Clayey sand
	0.16-0.9	Natural: Clayey sand with boulders, gravels and pebbles,
	0.9-1.3	Natural: Yellow sandy clay with orange mottling and boulders
	1.4	Refusal on boulders

Field notes recorded during sampling are presented in Appendix E.

6.6.1.2 Analytical results

A total of 21 soil samples were analysed using the ASS field test methodology (by the NATA accredited laboratory). The ASS field testing is a quick method for appraising the potential for soils to be ASS containing and is used to guide furthermore specific ASS testing at the laboratory. The Method involved mixing two 5-gram sub-samples of soil in de-ionised water (pH-F) and 30% hydrogen peroxide (pH-Fox) and recording the reaction rates and the pH of each sample. The reaction rates range between no reaction (1) to vigorous reaction with heat or gas generation (4).

In order to evaluate the potential ASS impacts, the analytical results have been compared against the below screening criteria (based on Vic EPA Publication 655.1- Acid Sulfate Soil and Rock).

Table 6-3: Summary of ASS field test screening criteria

Hazard	pHF	pHFOX	Change in pH
None	>5	>5	< 2
Low	>5	>5	>2
Moderate		3 – 5	>2
High		<3	>2

Notes:
pH_F – indicates the existing pH of the soil in the field.
pH_{FOX} - measure of soil pH after rapid oxidation with hydrogen peroxide

Screening criteria for reaction rates have not been included in the above table as reaction rates can be affected by other compounds or materials within the sample (such as levels of organic carbon).

The results of the field pH test (conducted before and after oxidation using pHF and pHFOX respectively) and reaction rates (as compared with the screening criteria in Table 6-3 above) is presented in Table 6-5 below (and in Appendix C). Where field test results indicated an elevated risk of ASS (potential or actual) to be present, additional analysis of the samples via CrS testing was undertaken. The results of the CrS testing have also been included in the table below with 18 mol.H^+/t being the adopted screening criteria.

Table 6-4: Results of acid sulfate soil testing

Soil Sample ID	pH_F	pH_{FOX}	Change in pH	Reaction Rate	Actual Acidity (mol H+/t)	Net Acidity (mol H+/t)
HEY1_0.0-0.2	5.8	3.1	2.7	3.0	-	-
HEY1_0.4-0.7	6.4	4.2	2.2	4.0	-	-
HEY1_0.9-1.0	-	-	-	-	7.2	11
HEY1_1.4-1.5	-	-	-	-	7.8	15
HEY2_0.0-0.2	5.6	4.1	1.5	4.0	-	-
HEY2_0.6-0.7	5.6	3.1	2.5	4.0	-	-
HEY2_1.4-1.5	-	-		-	41	46
HEY3_0.0-0.2	7.5	4.8	2.7	4.0	-	-
HEY3_0.9-1.0	-	-	-	-	4.8	<10
HEY3_1.4-1.5	-	-	-	-	3.2	<10
HEY4_0.0-0.2	8.3	5.3	3	4.0	-	-
HEY4_0.4-0.5 (A)	7.9	4.8	3.1	4.0	-	-
HEY4_0.9-1.0	-	-	-	-	<2	<10
HEY4_1.4-1.5	-	-	-	-	<2	<10
HEY5_0.0-0.2	9.1	6.9	2.2	4.0	-	-
HEY5_0.4-0.5	8.0	5.8	2.2	3.0	-	-
HEY5_0.9-1.0	7.2	5.2	2	3.0	-	-
HEY5_1.4-1.5	6.3	4.9	1.4	3.0	-	-
HEY6_0.0-0.3	6.5	4.0	2.5	3.0	-	-
HEY6_0.4-0.5	5.5	2.5	3	3.0	22	27
HEY6_0.9-1.0	5.5	3.1	2.4	3.0	-	-
HEY6_1.4-1.5	-	-	-	-	11	11
HEY7_0.0-0.2	6.1	2.8	3.3	3.0	-	-
HEY7_0.5-0.6	6.1	3.0	3.1	3.0	-	-
HEY7_0.9-1.0	4.4	3.0	1.4	3.0	48	85
HEY7_1.4-1.5	-	-	-	-	42	67
HEY8_0.0-0.3	6.1	2.8	3.3	4.0	-	-
HEY8_0.4-0.5	5.1	2.9	2.2	3.0	2.7	<10
HEY8_0.6-0.7	5.3	2.9	2.4	3.0	-	-
HEY8_0.9-1.0	4.8	2.9	1.9	3.0	6.0	13
HEY8_1.3-1.4	-	-	-	-	24	30

The measured pH_F (or acidity) and pH_{FOX} of both the fill and natural soil samples collected from the site do not suggest the presence of actual ASS. However, the change in pH and the reaction rate suggest that potential ASS may be present in both the fill and natural soils.

Based on field observations and initial ASS field test results, fourteen selected samples were submitted for laboratory analysis using the chromium reducible sulfur (CrS) suite analytical method to assess acid production potential and net acidity for comparison to the texture-based action criteria in the Tasmanian Acid Sulfate Soil Management Guidelines (DPIPWE 2009). Relevant criteria are also dependent on the volume of material to be disturbed and are grouped as disturbances between 100 to 1000 tonnes, and greater than 1000 tonnes. Given that the scale of the soil disturbance is not yet known, we have adopted the more conservative screening criteria (disturbances greater than 1000t) to appraise potential risks. The net acidity result was determined according to acid base accounting for both the sulfur and acid trails which takes into account existing acidity, potential acidity and the acid neutralising capacity of the soil (as appropriate).

The reported analytical results for the ASS samples collected as part of this assessment are displayed in Table 1, Appendix C, and are summarised below in Table 6-5. Laboratory documentation is presented in Appendix F.

Table 6-5: Summary of ASS analysis – samples exceeding action criteria

Location / Depth (m)	Soil type	Net Acidity	
		Acid Trail (moles H^+ / tonne)	Sulfur Trail (% S w/w)
HEY2_1.4-1.5	Clay	46	0.07
HEY6_0.4-0.5	FILL: Sandy Clay	27	0.04
HEY7_0.9-1.0	FILL: Clay	85	0.14
HEY7_1.4-1.5	FILL: Clay	67	0.11
HEY8_1.3-1.4	Sandy Clay	30	0.05

The reported analytical results confirm that potential ASS are present at the northwest and southeast ends of the site in the vicinity of the planned HVDC subsea cable end points, as depicted in Figure 4. At location HEY2 in the northwest part of the site potential ASS was encountered at a depth of 1.4 mbgs while at the southeast end of the site it was encountered at depths ranging from 0.4 mbgs at location HEY6 to the maximum excavation depth of 1.5 mbgs at location HEY7.

The extent of ASS is not consistent across the site, and some units have neutralising capacity to mitigate potential acid generation. However, the analysis for ASS in the Jacobs (2022a) and this report identified that the grey to black clays, with or without gravels, were associated with potential ASS, and were likely to be encountered at a depth of 1 to 1.5 m below the ground surface, although up to 0.5 m deeper on the southern side of the converter station site due to higher elevations in this area. The centre of the former factory area may also contain acidic conditions in soils from either ASS or former acid leaks from the factory processes.

6.6.2 Stockpile sampling results

Sampling of the stockpiles on the Heybridge converter station site was undertaken and the results of the sampling are summarised below.

6.6.2.1 Field observations

As part of the sampling works conducted, field observations were made to identify indicators of potential soil impacts or contamination such as odours, staining or the presence of extraneous material. A summary of these observations is provided in Table 6-6.

Table 6-6: Field Observations – stockpile sampling

Stockpile Location	Samples Collected	Observations
SP2	3 *(SP2_01-03)*	Sandy clay with gravels and some extraneous material (plastic, clay pipe, concrete pieces, glass fragments). Organic odour noted.
SP3	1 *(SP3_01)*	Dark brown sandy clay with brick fragments. Eastern part of stockpile not sampled as it was considered to be within a designated asbestos area.
SP5	3 *(SP5_01-03)*	Sandy clay with gravels and wood fragments.
SP8	2 *(SP8_01-02)*	Sandy clay with gravels. No extraneous material observed.
SP9	4 *(SP9_01-04)*	Sandy clay with gravels. Organic odour and white staining noted at sample location SP9_01. Eastern part of stockpile (includes sample locations SP9_01 and SP9_02) was observed to be dark brown and contained a significant amount of wood chips – suspected to be more recently placed than western part of stockpile.
SP10	3 *(SP10_01-03)*	Sandy clay with wood, brick and concrete fragments.

It is noted that other stockpiles were present onsite (as shown in Figure 5) however, due to their small size and volume, sampling of these stockpiles was not completed. Field notes recorded during sampling are presented in Appendix E.

6.6.3 Surface water sampling results

Sampling of surface water at the Heybridge converter station site and foreshore was undertaken. The results of the sampling are summarised below.

6.6.3.1 Field observations

Surface water was observed onsite in man-made drainage channels adjacent to tracks running south-east to north-west, with culverts feeding the water under the tracks and ultimately under the Bass Highway to the drainage outlet (HEY-SW2-Alt) at Tioxide beach. Little to no vegetation was present along the tracks, while low scrubby vegetation was observed around the drains.

The surface water displayed no visual or olfactory evidence of chemical contamination at the time of sampling.

The observations noted at each surface water sample location are summarised below in Table 6-7.

Table 6-7: Field Observations – surface water sampling

Sample Location	Location Type	Observations
HEY-SW1	Stormwater drain outlet to Tioxide Beach	No apparent odour. Clear with green algae.
HEY-SW2-Alt	Onsite drainage channel alongside site tracks	Slightly cloudy – brown. No odour.

Field notes recorded during sampling are presented in Appendix E.

6.6.3.2 Analytical results

The reported analytical results for the surface water samples collected as part of this assessment are displayed in Table 4, Appendix C. Laboratory documentation is presented in Appendix F.

The copper concentrations reported for both surface water samples collected as part of the assessment (HEY_SW1 and HEY_SW2) exceed the adopted marine and freshwater assessment criteria. The reported concentrations of zinc in both samples are above the adopted freshwater assessment criteria. The adopted marine assessment criteria is also exceeded by the zinc concentration reported for sample HEY_SW2.

Concentrations of arsenic (sample HEY_SW2), nickel (both samples) and some petroleum hydrocarbons (sample HEY_SW1) were also reported above the laboratory limit of reporting (LOR), but below the adopted screening criteria. All other analytes were reported at concentrations below the laboratory LOR.

The surface water criteria exceedances are summarised below in Table 6-8.

Table 6-8: Surface Water criteria exceedances

Analyte	Reported Concentration Range (mg/L)	ANZECC 2000 Recreational water quality and aesthetics	ANZG (2018) Freshwater 95% toxicant DGVs	ANZG (2018) Marine water 95% toxicant DGVs	Locations Exceeding Criteria
Copper	0.003	1	0.0014	0.0013	HEY_SW1 & HEY_SW2
Zinc	0.012 – 0.067	5	0.008	0.015	HEY_SW1 & HEY_SW2

Shading denotes analytical results that exceeded the adopted site criteria.

6.6.4 Data quality assessment

Tetra Tech Coffey has completed a review of the Quality Assurance (QA) steps and Quality Control (QC) results, according to the following documents.

- NEPC, National Environment Protection (Assessment of Site Contamination) Measure, National Environment Protection Council (1999).
- US EPA Guidance on Environmental Data Verification and Data Validation (2002).
- US EPA Contract Laboratory Program for Organic (1999) and Inorganic (2002) Data Review.

This included examining holding times, laboratory accreditation, sample preservation methods, a review of field QC sample results and a review of laboratory QC sample results. To validate the accuracy and validity of primary soil sampling results, a range of field and laboratory QC samples were collected and assessed during the assessment.

A summary of the reported QC analytical results and data validation report is provided in Appendix G.

NATA certified laboratory certificates of analysis are provided in Appendix F.

Overall, it was considered that the field and laboratory quality procedures and results are acceptable for the purposes of interpreting and verifying the findings of the assessment.

6.6.5 Stockpile classification

A comparison of the reported analytical results for the stockpile samples collected as part of this assessment against the waste classification criteria listed in EPA Tasmania Information Bulletin No. 105 is displayed in Table 2, Appendix C. Laboratory documentation is presented in Appendix F.

Several stockpile samples reported concentrations of some metals exceeding 'fill material (level 1)' criteria. The elevated analyte concentrations reported for each stockpile sampled as part of the assessment and the subsequent preliminary classification are summarised below in Table 6-9.

The concentrations reported for all other analytes were below detectable limits, with the exception of some hydrocarbon fractions which were reported above the laboratory limit of reporting (LOR) in several samples.

Table 6-9: Preliminary stockpile classification

Stockpile	Analyte Exceeding Fill Material Criteria	Samples	Maximum Concentration (mg/kg)	Preliminary Classification
Stockpile 2	Chromium (III+VI)	SP2_01 - 03	280	Low Level Contaminated Soil (Level 2)
	Copper	SP2_02	170	
	Mercury	SP2_02	6.7	
	Nickel	SP2_01 - 03	110	
Stockpile 3	Chromium (III+VI)	SP3_01	87	Low Level Contaminated Soil (Level 2)
	Mercury	SP3_01	9.8	
Stockpile 5	Lead	SP5_02	380	Low Level Contaminated Soil (Level 2)
Stockpile 8	Chromium (III+VI)	SP8_02	63	Low Level Contaminated Soil (Level 2)
	Nickel	SP8_02	94	
Stockpile 9	Chromium (III+VI)	SP9_01 & SP9_02	67	Low Level Contaminated Soil (Level 2)
Stockpile 10	Chromium (III+VI)	SP10_01 & SP10_03	84	Low Level Contaminated Soil (Level 2)
	Nickel	SP10_03	73	
	Zinc	SP10_03	400	

On-site retention

The reported stockpile sample results have been compared against the adopted human health and ecological assessment criteria to indicate if the stockpiled material is appropriate to be retained onsite for reuse. The reported analytical results are compared against the adopted criteria in Table 3, Appendix C.

Concentrations of copper (sample SP2_02), nickel (SP2_01-03, SP8_02, SP10_03) and zinc (SP10_03) were reported above the adopted Ecological Investigation Levels (EILs). It is noted that the EILs for copper, nickel and zinc were calculated using conservative criteria in the absence of site-specific data.

All other analytes were reported to be below the adopted assessment criteria. It is noted that some TPH/TRH fractions were reported to be above the laboratory LOR in several stockpile samples.

The stockpile human health and ecological criteria exceedances are summarised below in Table 6-10.

Table 6-10: Stockpile human health and ecological criteria exceedances

Analyte	Reported Concentration Range (mg/kg)	NEPM (2013) Table 1B(5) EILs - Comm/Ind	Locations Exceeding Criteria	Stockpiles Impacted
Copper	<5 - 170	90	SP2_02	Stockpile 2
Nickel	<5 - 110	65	SP2_01-03, SP8_02, SP10_03	Stockpiles 2, 8 and 10
Zinc	8.6 - 400	190	SP10_03	Stockpile 10

The reported stockpile results indicate that, should the stockpiled material be retained and reused onsite, it is unlikely to present an unacceptable health risk to maintenance and construction workers who are exposed to the soil. The reuse of the soils withing stockpiles 2, 8 and 10 may result in impacts to sensitive ecological receptors and any retention of these stockpiles will require additional investigation to determine likely effects to receptors in their final re-use location.

7. CONCEPTUAL SITE MODEL

This section provides a summary of the conceptual site model (including the nature and extent of contamination within the study area) and appraises the potential risks to receptors from contamination.

Based on the review of previous environmental site investigations and publicly available relevant environmental and historical information, and targeted sampling undertaken as a part of this assessment, potential sources of contamination and their associated contaminants of concern which may have impacted the soil, sediments, surface water and groundwater within the study area have been summarised in Table 7-1.

Table 7-1: Summary of potential sources of contamination

Sources of Contamination	Associated Contaminants of Potential Concern
Former Tioxide factory	Metals, petroleum hydrocarbons, asbestos, low pH, NORM
Lumber yard	Petroleum hydrocarbons
Potential ASS	Acid generation (low pH), metals

7.1 NATURE AND EXTENT OF CONTAMINATION (SOURCES)

The primary sources of contamination (as summarised in Table 7-1) are no longer present on the converter station site (with the exception of potential ASS), however, secondary sources of contamination remain on the converter station site, and within the study area.

7.1.1 Soil impacts

Soil contamination associated with the former Tioxide factory have largely been remediated to levels commensurate with the industrial land use. However, isolated locations of contamination still remain within the converter station site including metals in fill soils across the site, with concentrations of copper, nickel, lead and zinc above the adopted NEPM EILs calculated for the site, as well as one location with lead above the adopted NEPM HIL-D.

There is also the potential that hydrocarbon contamination may be present in soils at the converter station site above NEPM management limits or health screening levels based on the historic impacts identified in soils. Recent testing has not identified any locations on the converter station site with concentrations of hydrocarbons above the adopted screening criteria.

Asbestos containing materials are also present within fill soils and soil stockpiles on the converter station site with several areas reporting ACM presence that will potentially present an unacceptable hazard to human health via the inhalation of fibres. A plan showing the areas where asbestos containing materials have previously been identified and removed is presented as Figure 12. The asbestos materials (where identified) were visually removed, however no validation sampling of the residual soils (in accordance with the NEPM) has been undertaken and there is a potential that fragments of asbestos containing materials remain within fill soils on the site.

Low pH soils (less than 4 pH units) are also present beneath some areas of the converter station site, where acid leakages from the plant have resulted in reduced pH. The low pH soils are generally contained to the central section of the converter station site.

The converter station site is underlain by a varying thickness of fill soils, ranging from approximately 0.3 to greater than 2 m in some locations. The average fill thickness across the converter station site was approximately 0.7 m, based on test-pitting undertaken since the demolition and rehabilitation of the factory. The extent of fill has also not been well characterised in the former factory areas where buried concrete blocks and bricks / rubble have limited the ability to extend boreholes to depth.

Given the highly heterogeneous nature of the fill soils on the converter station site, there is a potential that areas of contamination are present in soils at depth, including hydrocarbon contamination, metal contamination, acidic soils and asbestos containing materials at concentrations that could pose a potential impact to the health of site users or environmental receptors both on the converter station site, and in within the greater study area where contamination may be mobilised (such as via airborne or surface water transport) if disturbed.

The condition of the former effluent tunnel is also unknown, and contaminated soils may be present in and around this structure. The condition of the materials around the tunnel (whether still present or decommissioned) is unknown. However, based on the proposed decommissioning plan (pitt&sherry 2007), it is possible that the former tunnel could act as a preferential pathway for contaminant migration from the site to Bass Strait, or saline intrusion onto the site during any dewatering activities.

Soil stockpiles are also present on various areas of the converter station site and whilst the soils in the stockpiles are unlikely to present an unacceptable risk to human health or environmental receptors, should they require offsite disposal they may be classified as low-level contaminated soils (Level 2) in accordance with Tasmanian EPA Bulletin 105.

Radioactivity testing undertaken across the converter station site and within test pits indicated that the measured radioactivity was within background levels for the area.

PFAS testing for soils did not report any concentrations above the adopted screening criteria or laboratory limits of reporting.

Areas of soils at the site potentially contain hydrocarbon odours. The majority of hydrocarbon impacts were removed during the factory decommissioning and remediation works undertaken and validated as being below the adopted industrial land-use screening criteria. However, some residual hydrocarbons may remain in soils (either around former remediation areas or in unidentified areas on the converter station site) that may be odorous and present an aesthetic impact to receptors if disturbed.

The conservative assumption that all fill soils will require removing from the site as a part of the project will remove the majority of any potential contamination remaining within the fill soils at the site. Review of the previous data (WWC, 2007a) noted that soil sampling was undertaken on an approximate 30 m grid across the entire former factory site at 62 locations and identified elevated concentrations of arsenic, cobalt, chromium, mercury, manganese, nickel, lead and zinc above the Level 1 (fill material) screening criteria. The locations of the Level 1 (fill material) exceedances were across the centre and south of the converter station site (where fill has been assumed to require removal) and within the top 0.5 m of soils. One location in the centre of the former factory area also contained a concentration of manganese (6,469 mg/kg) that exceeded the Level 2 (low level contaminated soils) criteria.
A statistical appraisal of the soil manganese results indicated the following:

- The shallow fill soils reported a 95% UCL of 1,911 mg/kg, and
- The entire soil data set reported a 95% UCL of 611 mg/kg.

The statistical evaluation would classify the soils (from a manganese perspective) as Level 2 (low level contaminated soils)

The distribution of impacts throughout the soil profile indicates that whilst the top 0.5 m of soils contains the majority of Level 2 (low level contaminated soil) with deeper soils generally comprising Level 1, isolated locations – particularly in the factory areas - contain deeper contamination (up to 1 m below ground levels) that would classify these isolated locations as Level 2 (low level contaminated soil).

On the basis that the upper 0.5 m of soils on the converter station site are predominantly Level 2 (low level contaminated soils), with some deeper areas, the following estimate of the approximate volumes of waste soils in the fill soils to be disturbed has been provided. The estimates in the table are based on the assumption of the top 0.5 m of fill soils are Level 2 (low level contaminated soil), and a further 25% of deeper fills soils are also Level 2 (low level contaminated soil). The table also assumes that the remaining deeper fill soils would be classified as Level 1 (fill material) for the purposes of off-site disposal.

Table 7-2: Estimates of waste soil categories for disposal

Soil category	Estimated volume (m^3)
Level 1 (fill material)	37,200
Level 2 (low level contaminated soil)	34,300
Level 3 (contaminated soil)	0
Level 4 (contaminated soil for remediation)	0
Totals	**62,200**

MARINUS LINK

LEGEND

- Landfall

Proposed route

- HVDC subsea cable
- Heybridge converter station site boundary
- Major road
- Minor road
- Areas where ACM debris was identified and removed from site (approx. locations only)

Source:
Routes from Tetra Tech Coffey.
Asbestos areas digitised from IPM Consulting and Pitt & Sherry reports.
Roads from DPIPWE.
Imagery from NearMap (8 March 2022).

0 30 60 m

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PROJECTION: **GDA2020 MGA Zone 55**

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GROUNDWATER IMPACT ASSESSMENT REPORT

FIGURE 12

Plan of known asbestos contamination

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DATE: **03.09.24** PROJECT: **754-MELEN215878ML** FILE: **215878ML_CSASS_TAS_F012_GIS**

7.1.2 Surface water impacts

Surface water testing from the drain and pond on the converter station site indicated that the surface water contained concentrations of copper and zinc above the adopted screening criteria for protection of fresh and marine water (ANZG 2018 – DGVs for 95% species protection). Given that the converter station site drains and ponds are man-made structures, a lower level of protection of freshwater species could be adopted – as these will be classified as highly-disturbed systems (or may not even qualify as surface water requiring protection given that it is in a pipeline and storage detention basin). However, as the surface water from the converter station site discharges directly to the marine environment, the 95% marine criteria have been adopted for appraising potential impacts to water quality.

The concentrations of copper and zinc are marginally above the adopted screening criteria and could present a potential risk to marine receptors. However, as the surface water flowing from the converter station site is ephemeral (in that it only flows during rainfall events), the impacts to marine receptors are likely to be minimal, as the exposure duration for assessing impacts to aquatic biota is based on continual exposure, and not periodic exposure. Consequently, the surface water quality within the study area is not considered to impact on ecological receptors within the marine environment.

The concentrations of potential contaminants at the converter station site were all below the screening criteria for protection of human health (primary contact recreation and potable water supply).

7.1.3 Groundwater impacts

Groundwater at the converter station site is present at depths ranging between approximately 0.5 m to 3 m below the ground surface (based on recent studies). Groundwater contaminant testing has shown that groundwater is generally not impacted by contamination originating from the converter station site.

The groundwater is mildly acidic (pH approximately 6.5), and contains concentrations of cobalt, copper and zinc in excess of the adopted marine water ecosystem protection criteria. The metals concentrations in groundwater are widespread across the converter station site, do not appear to be associated with any particular point source, and maybe reflective of background water quality in the area. No background water testing has been undertaken to confirm if the concentration of metals are naturally occurring, however given the widespread nature of the impacts, and that zinc and cobalt are not associated with any anthropogenic activities on the converter station site, it is likely that the concentrations are naturally occurring.

Localised areas of hydrocarbon impacts in groundwater were reported during test pit sampling (WCC 2007a). However, the concentrations are likely to be limited to the areas where they were previously identified and not widespread across the converter station site.

The groundwater from the converter station site discharges to the ocean at Tioxide beach and there is a potential that the concentrations of metals in groundwater may impact on marine receptors.

Testing of groundwater for PFAS identified concentrations of PFOS, PFOA and PFHxS above the laboratory reporting limits, although all concentrations were below the adopted screening criteria for protection of human health and marine aquatic ecosystems.

7.1.4 Sediment and offshore impacts

Offshore sediment sampling indicated that whilst metals in sediments were present, they were generally below the adopted default guideline value (DGV) levels and likely to be naturally occurring across the majority of the sampling areas. However, concentrations of arsenic, nickel and chromium were elevated at the furthest sampling points from the shore (SED-W5 and SED-E5), with concentrations above the DGV (As, Cr, Ni and Ag), and also above the Upper guideline value (As and Ni). The increased concentrations of metals in sediments at these locations is potentially a result of metal rich effluent discharged to this area from the Tioxide factory (via the effluent pipeline). These locations also show higher concentrations of iron, aluminium and titanium compared to locations closer to the shore, which also suggests that the metals may be from the former factory.

The effluent pipeline (in the area where the cable is proposed to cross the pipeline) is not considered to be a potential source of contamination, with sediments in and around the pipeline containing concentrations of potential contaminants below the sediment DGVs.

For the majority of the pipeline length, the sediments surrounding the pipeline are not considered to be contaminated. However, based on sediment sampling near the outlet of the effluent pipe, it is likely that sediments in the vicinity of the pipe outlets are contaminated with metals.

7.1.5 Potential ASS

ASS testing undertaken at the converter station site has shown that potential ASS are present at the converter station site at depths from approximately 0.5 m below the ground surface, but that it is not continuous across the converter station site. The lack of continuity across the converter station site is likely due to historic disturbance of the soil profile during factory construction and demolition.

The conservative assumption that all fill soils will require removing from the site as a part of the project will result in disturbance of large volumes of potential ASS. The extent of ASS or PASS at the site is not well characterised as the distribution is not contiguous across the site. The ASS sampling undertaken across the centre and south of the converter station site identified potential ASS presence in grey to black clays (with or without gravels) at depths of 1 to 1.5 m below the ground surface (up to 2 m on the southern side of the converter station site). The centre of the former factory area may also contain acidic conditions in soils from either ASS or former acid leaks from the factory processes. These soils and the associated potential ASS are likely to be disturbed where fill soils are removed (as assumed in Section 5.6). The potential oxidation and generation of acid from these soils will require management and/or treatment to mitigation potential impacts to the environment.

On the basis that a thickness of 0.5 m of soils (generally at depths of between 1 and 1.5 m below the ground) on the converter station site are potential ASS, the following estimate of the approximate volumes of potential ASS that may be disturbed has been provided. It is noted that the extent of ASS across the site is not contiguous, but that thicknesses may be greater than 0.5 m in some areas. Consequently, we have conservatively adopted a thickness of potential ASS of 0.5 m extends across the entire disturbance area for the purposes of assessing potential impacts.

On this basis, approximately 37,200 m^3 of ASS may be disturbed. The actual acidity of the potential ASS ranged from < 2 to 48 mol H^+/tonne, and reported liming rates ranged between < 1 to 5.6 kg per tonne.

Whilst sampling for ASS between the converter station site and the shoreline has not been undertaken, it has been assumed that a layer of potential ASS is present in this area. Depending on the depth that the HDD conduits are drilled, potential ASS may be intercepted in this area. However, it is likely that if the conduits are drilled deeper (i.e., within the basement rock), potential ASS is less likely to be intercepted. Off-shore ASS testing indicated that the sediments were not potential ASS as they had sufficient acid-neutralising capacity to limit the generation of acid.

The extent of potential ASS likely extends across the converter station site, across the beach to the low tide line. The transition between potential ASS soils and offshore non-ASS sediments is not well defined. However, rock platforms with limited sediments extend to at least 200 m offshore and it has been assumed that the rock platforms do not contain any potential ASS. Consequently, we have assumed that the potential ASS soils extend to the low-tide line at Tioxide Beach.

The disturbance of ASS may also result in generation of localised sulfidic odours.

7.2 POTENTIAL EXPOSURE PATHWAYS

The main exposure pathways that could be considered likely during the construction, operation and decommissioning phases include:

- Human Health Exposure Pathways
  - Dermal contact with contaminated soil/sediments
  - Incidental ingestion of soil/sediments
  - Inhalation of soil derived dusts (including asbestos fibres)
  - Volatilisation of contaminants leading to inhalation
  - Incidental ingestion or dermal contact with contaminated surface water (including marine surface water) or groundwater
- Ecological Exposure Pathways
  - Ingestion of soil by, or direct toxicity to, soil invertebrates
  - Uptake and accumulation by, or direct toxicity to terrestrial plants
  - Incidental ingestion of soil by fauna foraging
  - Ingestion of sediment by, or direct toxicity to benthic biota
  - Uptake and accumulation by, or direct toxicity to contaminated sediment by benthic biota
  - Migration of contamination via surface run-off resulting in direct contact with contaminated water and/or sediment by aquatic organisms in receiving surface waters
  - Leaching of contamination in soil to groundwater resulting in impacts to groundwater dependent ecosystems

7.2.1 Potential receptors

The following key current site-specific receptors have been identified in vicinity of the study area:

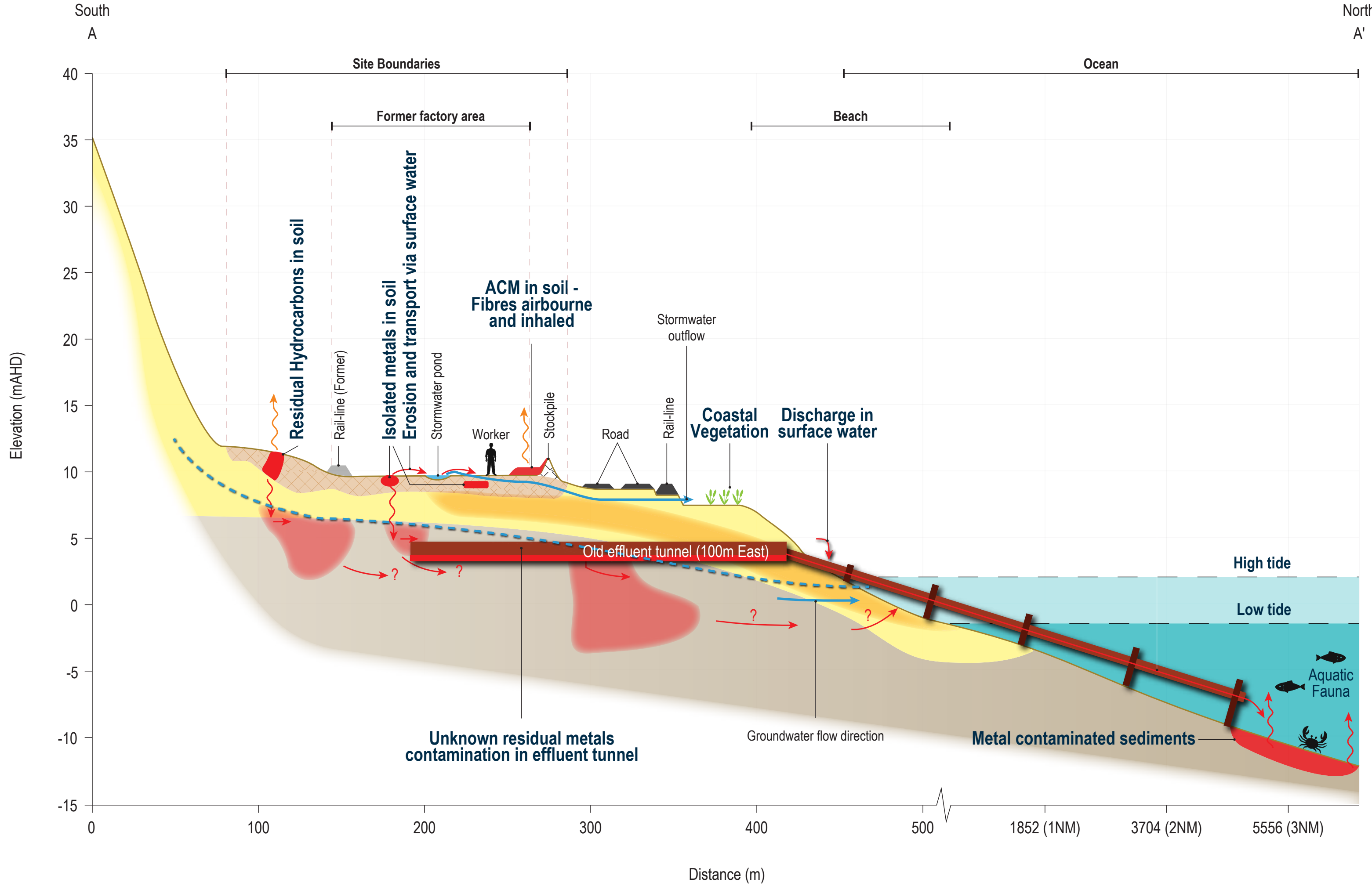
- Human Health Receptors
  - Persons using the facility currently or in the future that may come into contact with contaminated soil and/or groundwater or be exposed to airborne contamination, or vapours that emit into indoor or outdoor areas; and
  - Construction and maintenance workers conducting works at the site in the event they come into contact with contaminated soil and/or groundwater or are exposed to airborne contamination, or vapours that emit into indoor or outdoor areas.
  - Construction or maintenance workers that may come into contact with contaminated sediments when working offshore
  - Recreational users of impacted surface waterbodies.
- Ecological Receptors
  - Terrestrial fauna that may come into contact with onsite surface water bodies
  - Terrestrial flora that may update contaminated groundwater or surface water

- Terrestrial flora and fauna that may come into contact with contaminated or low pH soils
- Marine biota that is exposed to contaminated groundwater or surface that has discharged from the site
- Marine biota that is exposed to contaminated sediments on the seabed that are disturbed by construction, maintenance or decommissioning.

7.2.2 Summary of conceptual site model

Based on the review of previous environmental site investigations and publicly available relevant environmental and historical information, potential sources of contamination within the study area that may impact on receptors were identified. A plan of the site conceptual model is presented as Figure 13. The key contamination issues within the study area include:

- Fill soils on the Heybridge converter station site with heterogeneously distributed contamination including metals (lead, copper, nickel, chromium and zinc), petroleum hydrocarbons and ACM that potentially cause an impact to human health or ecological receptors. Where these soils are disturbed or surplus to requirements, they have the potential to impact on receptors. If the soils are removed from the site, they have the potential to cause environmental or health impacts if not managed appropriately.
- Based on the long history of mineral processing, the demolition undertaken at the site and the highly heterogeneous distribution of contamination in soils at the Heybridge converter station site, contamination may be encountered outside of areas previously identified or remediated (i.e. former effluent tunnel).
- Contaminated groundwater discharging to surface water (onsite and the offsite marine environment) that may result in impacts to sensitive ecological receptors.
- Potential ASS within soils at the converter station site and between the converter station and the low-tide line that if disturbed or dewatered may result in generation of acid that impacts on human health, built structures, terrestrial or aquatic biota, or cultural heritage artefacts.
- Contaminated sediments approximately 5km offshore that may impact on benthic biota if disturbed (addressed in the Marine Ecology and Resource Use Impact Assessment (EnviroGulf, 2024)).



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LEGEND

- Fill
- Sand
- Potential acid sulfate soils
- Quartz-wacke
- Effluent piping
- Leaching/groundwater transport plume
- Volatilisation
- Leaching
- Potential Migration
- Groundwater

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FIGURE 13

Conceptual site model

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8. RISK ASSESSMENT

The following sections present the contaminated land and ASS risk assessment for the construction, operation and decommissioning of the project.

Based on the outcomes of the conceptual site model and contamination assessment (Section 7), five potential hazards have been identified as having a risk of causing impacts to the environment without the application of additional controls:

1. Management of excavated soils,
2. ASS,
3. ACM debris, and
4. Management of routine construction and operational impacts.

These four hazards and the associated risks are detailed below. The contaminated sediments in the offshore area have been considered in the Marine Ecology and Resource Use Impact Assessment (EnviroGulf, 2024) report.

Each potential impact is discussed with an assessment of risk likelihood and consequence provided. A summary table of risk to human health and ecological receptors have been provided (Table 8-4).

8.1 MANAGEMENT OF EXCAVATED AND SURPLUS SOIL

The assessment of the study area has identified that, shallow fill soils within the converter station portion of the study area that require excavation and/or offsite disposal, there are potential for contaminants (metals and hydrocarbons) to be at concentrations that may cause impact to human health or the environment if not managed appropriately.

These potential impacts are associated with disturbance of contamination that leads to either impacts to human health of site construction and maintenance workers via inhalation, dermal contact or incidental ingestion of contaminated soils. The likelihood of adverse effects to human health from disturbance of contaminated soils at the site is low as there are only limited and isolated occurrences of contaminants that exceed the adopted health screening criteria (NEPM HIL-D), and the known impacts are generally outside of the planned areas of disturbance. Generally, disturbance of soils at the converter station site is unlikely to result in impacts to human health and the soils are not considered to be contaminated (such that they require remediation or offsite disposal) – noting the presence of asbestos that requires specific remediation and management.

Residual soil stockpiles on the converter station site are unlikely to result in an adverse impact to human health as the potential contaminants within the stockpiles are below the adopted health screening criteria. Some of the fill and stockpiles soils at the converter station may also contain asbestos containing materials that could impact on human health. The risks from asbestos are considered separately in Section 8.3.

Metals contamination (primarily arsenic, copper, nickel and zinc) in soils and soil stockpiles on the converter station site may potentially impact on ecological receptors on the converter station site, however the extent of contaminated soil that exceeds the adopted NEPM EILs is limited, and it is likely that the majority of the areas of the converter station site will be maintained as a hardstand, which is unlikely to support ecological receptors. Removing fill soils from the site that are contaminated with metals that exceed the NEPM EILs, or retention of contaminated soils beneath areas of hardstand or pavement could reduce the potential impacts to ecological receptors. Additional testing of natural surface soils in the area of the site may also provide relevant background data that can be utilised to better characterise the potential risks to native ecological receptors (flora and fauna).

The former effluent tunnel that is under the eastern part of the site has not been assessed for potential contamination (including contaminated sediments). The tunnel is considered to have been decommissioned in the converter station site, but what was used to backfill the tunnel void is unknown, and if any material (sediment, contaminated construction materials etc.,) is to be removed from the tunnel area, it is to be tested for contamination and managed accordingly.

The construction phase will generate soils from the construction of footings for site infrastructure and from horizontal boring that will require management. Based on the current design estimates, it is likely that approximately 62,200 m^3 of fill will be required to be excavated and managed. Where any excavated fill is geotechnically suitable for reuse and if the spoil is contaminated and retained on the converter station site to address the principles of the EMPCA waste hierarchy, then the operation and decommissioning phase of the project has the potential to generate contaminated soils that will require management.

Improper handling and stockpiling of excavated soils can result in impacts to air quality from dust emanation or surface water quality via stormwater run-off and sedimentation. Any stockpiles of ‘contaminated’ material must be contained to limit the potential for migration of contamination through dust dispersion, leaching, or stormwater run-off. Controls for all stockpiles should be documented within the project contaminated land management plan to be prepared as part of the project’s Construction Environmental Management Plan (CL-01).

Where localised impacts from contamination or ASS are identified (CL-01) soils excavated from these areas will require separate management. Contaminated soil may present a risk to human health or the environment via leaching of contamination to groundwater or surface water, or ingestion/inhalation from dust or volatile contamination.

Surplus soils generated during site works that require offsite disposal must be classified and managed in accordance with EPA Tasmania (2018) Information Bulletin No. 105, *Classification and Management of Contaminated Soil for Disposal*.

Where soils are classified as *‘contaminated soil’* (level 3) or ‘*contaminated soil for remediation*’ (level 4), these soils are to be managed in accordance with the EP Regulations and only transported to a premises authorised by EPA to accept such wastes. No soils to date on the Converter Station site have reported concentrations of contaminants that would classify them as Level 3 or Level 4 wastes.

Should the soils be classified as ‘*low level contaminated soil’* (Level 2), the project may apply to EPA for a permit to retain the soils within the project site. It is estimated that approximately 34,400 m^3 of the estimated 62,200 m^3 of fill soils that may require removing from the site may be classified as Level 2 (low level contaminated soil).

Given the historical use of the site, there is a potential that ground disturbance in the study area may uncover areas of waste, stained or odorous soil, asbestos containing materials or other potential areas of contamination. Such finds could impact on the health of site users (construction and maintenance workers) or environmental receptors (including terrestrial flora and fauna, as well as surface water ecosystems should contamination disturbance at the location result in discharge to surface water bodies – including the marine environment).

In order to address the potential risks to the environment from unexpected contamination finds an unexpected finds protocol is to be incorporated into the contaminated land management plan.

Soils on the site may also contain hydrocarbon or sulfidic odours which may pose an aesthetic risk to site users or surrounding receptors. Soils that are odorous must be managed to minimise odour via the design of odour controls relevant to the potential impacts identified (if any). Controls may take the form of odour suppressants, odour capture and treatment, avoidance or other relevant measures to mitigate impacts.

The application of the suggested management and mitigation measures for managing contaminated soils will reduce the potential risks to human health and the environment from Moderate to Low.

Table 8-1: Management and mitigation measures: management of soil

ID	Management and mitigation measure
CL01	Manage excavated soil, contaminated soils and potential risks to the environment due to contamination during construction.

8.2 ACID SULFATE SOILS CAUSING DEGRADATION TO FLORA AND/OR FAUNA IF DISTURBED

The disturbance of ASS has the potential to result in oxidation of sulfidic minerals within the soils and create acid, which can leach metals, degrade constructed project elements or cause degradation to the environment including terrestrial and aquatic flora and fauna, or result in generation of sulfidic odours. The generation of sulfidic odours from exposed ASS are typically highly localised to the areas where ASS are stored, and given the distance to the neared sensitive receptor, impacts are expected to be negligible. Mitigation measures for managing any generation of potential sulfidic odours from any ASS that may be disturbed are included in management and mitigations measures CL01 and CL02.

Soil sampling and analysis completed during this (and prior) assessments confirmed the presence of ASS within the study area that may be disturbed if all fill soils are removed from the site (as assumed in Section 5.6).

Any ASS disturbed during the planned site works should be managed in accordance with the *Tasmanian Acid Sulfate Soil Management Guidelines* (DPIPWE 2009).

The disturbance of potential ASS during the construction, operation or decommissioning phases has the potential to result in a Moderate impact to the environment.

Management measures (for example but not limited to): minimising length of time soils are exposed, covering stockpiles to prevent infiltration of water, bunding of stockpiles to prevent runoff should be implemented for the project to reduce the risk of environmental impact occurring as a result of disturbance of ASS on the project, will reduce the risks of environmental impact from ‘moderate’ to ‘low’. These measures should also include:

- Managing dewatering to limit the generation of acid from oxidation of submerged potential ASS
- Managing drilling cuttings during the HDD drilling through potential ASS.
- Designing settlement loading to manage the submerging of potential oxidised ASS above the water table.

Further ASS testing and assessment is required to inform detailed design and prior to construction so that it can be managed during the construction phase. The approach should be addressed within the contaminated land management plan (appended to the construction environmental management plan (CEMP)) and implemented prior to and during construction.

Management of ASS during operation and decommissioning is limited to managing excavated soils (as per CL-01).

The application of the suggested environmental performance requirements for managing potential ASS within the study area will reduce the potential risks to human health and the environment from Moderate to Low.

The following management and mitigation measure is proposed to minimise the risk of potential impacts.

Table 8-2: Management and mitigation measures: ASS causing degradation to flora and/or fauna if disturbed.

ID	Management and mitigation measure
CL02	Develop and implement acid sulfate soils (ASS) management controls during construction

8.3 EXPOSURE TO ASBESTOS FIBRES

ACM debris has been identified on the ground surface (and visually removed from the surface where observed) at the converter station site and is also likely contained within fill material. A plan of the locations of known asbestos contamination is presented in Figure 12. This figure shows the known contamination; however it is likely that it is present in fill soils across the site. The condition of the ACM is such that it is susceptible to degradation and fibre release and has the potential to impact on human health (site construction and maintenance workers) and terrestrial fauna should the asbestos fibres become airborne and respirable.

The extent of ACM contaminated fill is not known at the site, although several areas where it is present have been identified. It is recommended that additional testing of the extent of asbestos within the fill soils at the site is undertaken (in accordance with the methodologies included in the NEPM), to characterise the nature and extent of ACM within soils (CL-01).

Following completion of the characterisation of the extent of ACM in soils, a remediation design is to be developed and included in the CEMP to manage disturbance of soils and the associated potential impacts to human health. All areas of the site where disturbance of soils are planned and have the potential to contain ACM, these should be remediated to mitigate the potential impacts to the health of site construction and maintenance workers.

The potential exposure to asbestos fibres by human receptors is to be managed during the construction, operational and decommissioning phases of the project through the development and implementation of asbestos management controls within the CEMP.

The application of the suggested management and mitigation measures for managing asbestos and ACM within the study area (as required by mitigation measure CL01) will reduce the potential risks to human health and the environment from Moderate to Low.

8.4 MANAGEMENT OF ROUTINE CONSTRUCTION AND OPERATIONAL IMPACTS

There are a range of potential impacts to the environment or human health that are common to most construction sites, and which are routinely addressed by well-established standard operating procedures or guidelines in the construction industry. Examples of these potential impacts considered to be low to very low risk where managed during construction and operation include (but are not limited to):

- Contamination of near surface soils from storage, transportation, and use of small volumes of chemicals, fuels, and other materials
- Impacts associated with use of subsurface construction materials (sealants, grouts, adhesives etc.)
- Impacts associated with infrastructure construction including roads, drainage areas, concreting, drilling etc.

- Impacts from contaminated drilling fluids
- Impacts from spills or leaks from vehicles, storage tanks, and underground infrastructure.
- Impacts from removal of historic infrastructure (including old pipelines, footings etc).

These impacts are to be managed during the construction, operational and decommissioning phases of the project via the development and implementation of project Construction Environmental Management Plans for the Construction, Operation and Decommissioning phases. Management and mitigation measure CL01 includes requirements for managing these potential impacts during construction, and the proposed management and mitigation measure CL03) is specific for managing these potential impacts during operation.

The application of the suggested management and mitigation measures for managing routine construction and operational impacts will reduce the potential risks to human health and the environment from Low to Very Low.

Table 8-3: Management and mitigation measures: management of routine construction and operational impacts

ID	Management and mitigation measure
CL03	Develop and implement measures to manage potential contamination impacts in operation

8.5 RISK ASSESSMENT SUMMARY

Table 8-4 presents a summary of the risk assessment evaluation undertaken for the project.

Table 8-4: Risk assessment summary

Affected value	Potential risk of harm	Project phase	Standard controls	Initial risk assessment			Environmental performance requirement	Residual risk assessment		
				Likelihood	Consequence	Risk		Likelihood	Consequence	Risk
Human health/ ecological receptors	Excavated soils (including contaminated soils) may present a risk to human health or ecological receptors if not contained causing degradation of environment or hazards to health	Construction, operation and decommissioning	Excavated soils are managed to limit erosion via wind or surface water via wetting, stormwater controls, bunding and/or covering.	Unlikely	Major	Moderate	A contaminated land management plan is to be developed and implemented to ensure contaminated soils are managed to reduce impacts to the environment (CL01).	Rare	Moderate	Low
Human health/ ecological receptors	Construction/ operational activities lead to generation of contaminated wastes, spills or leaks that may cause a risk to human health or ecological receptors if not contained causing degradation of environment or hazards to health	Construction & Operation	Standard industry practice for managing hazards associated with handling chemicals, wastes, and undertaking underground excavations	Possible	Minor	Low	Implement an environmental management plan during construction and operation that includes controls for managing such hazards (CL01 & CL03).	Rare	Minor	Very Low
Ecological receptors	ASS may cause degradation to flora and/or fauna if disturbed	Construction, operation and decommissioning	Prior to ground disturbance, confirm the location and extent of ASS in relation to the planned locations of site infrastructure	Possible	Moderate	Moderate	ASS management controls are to be developed (as a part of the contaminated land management plan) to characterise the extent of ASS to be disturbed by the project and include measures to prevent oxidation or treatment of ASS (CL02).	Rare	Moderate	Low
Human health	Exposure of asbestos fibres from ACM in soil to human receptors during construction, operation or decommissioning	Construction, operation and decommissioning	Inspection and removal of ACM debris from site surface by appropriately qualified contractors prior to the commencement of construction works	Possible	Moderate	Moderate	Undertake ACM in soil assessment and remediate areas that will be disturbed. Asbestos management controls are to be developed (as a part of the contaminated land management plan) to characterise the extent of asbestos in soils prior to excavations commencing, and include the required controls, and management measures to remediate or manage any asbestos during construction, operation and decommissioning (CL01).	Rare	Moderate	Low

9. INSPECTION AND MONITORING

As detailed above, the risk assessment has identified five key hazards that present potential risks to human health or the environment. Of those four, three will require ongoing management to reduce the risk of potential impacts during construction, operation and/or decommissioning.

To demonstrate that the recommended management and mitigation measures are effective, monitoring is often implemented. The details of an inspection and monitoring program should be documented in the environmental management plan. Inspection or monitoring requirements for standard construction and waste management practices have not been prepared, such as testing spoil for onsite retention/offsite disposal, testing if treated ASS prior to reuse or offsite disposal, reporting of waste disposal as required for contaminated soils/asbestos containing materials, reporting associated with implementing a management plan, periodic monitoring of stormwater/sediment controls etc. No specific monitoring (beyond normal construction monitoring) has been recommended.

10. MANAGEMENT AND MITIGATION MEASURES

The recommended management and mitigation measures to reduce the risks to very low to low (as detailed in Section 8), are summarised in Table 10-1.

A decommissioning plan will be prepared to outline how activities will be undertaken, and potential impacts managed, including due to contamination, addressing the items outlined in the below mitigation measures. The requirements for the decommissioning management plan are outlined in the EIS.

The management and mitigation measures have also been developed with consideration of industry standards and relevant legislation, guidelines and policies. Management and mitigation measures from the groundwater assessment are also relevant to the management of ASS at the Heybridge converter station site.

Table 10-1: Management and mitigation measures

ID	Management and mitigation measures
CL01	**Manage excavated soil, contaminated soils and potential risks to the environment due to contamination during construction.**
CL01-1	Undertake a detailed site investigation for the site (in accordance with guidance from the NEPM(ASC) - including as a minimum schedules B1 and B2) to define the nature and extent of potential contamination in soils (including asbestos and ASS).
CL01-2	Identify options to manage surplus soils in accordance with the waste hierarchy.
CL01-3	Sample and classify all soils surplus to project requirements in accordance with EPA Tasmania's *Information Bulletin 105 – Classification and Management of Contaminated Soil for Disposal,* Australian Standards AS4482.1 (2005) and AS4482.2 (1999), and *Tasmanian Acid Sulfate Soil Management Guidelines* (DPIPWE 2009) to identify the waste classification of the soils.
CL01-4	Any waste soils that are classified as Level 1 (fill material), must be responsibly managed and disposed to a site where the soils do not result in impacts to the environment, or result in pollution (as defined in the EMPCA), which may include disposal to a Solid Inert (Category A) Landfill. Level 1 soils may be reused on the site.
CL01-5	Any waste soils that are classified as Level 2 (low level contaminated soil) and surplus to project requirements are likely to be Controlled Wastes (depending on contaminants) and require disposal to a Category B (Putrescible Landfill). There are opportunities for Level 2 soils to be reused on the site, depending on the nature of the contamination and how they are proposed to be used. The reuse of Level 2 soils on the site will be assessed on a case-by-case basis in consultation with EPA.
CL01-6	Testing to date has not identified any Level 3 or Level 4 Contaminated Soils. If any are identified during redevelopment, they are to be managed in accordance with the EMPCA and *Information Bulletin 105.*
CL01-7	All transport of contaminated soils must be undertaken only by a waste transport business holding a current relevant approval for the particular waste type (issued under the EMPCA).
CL01-8	Any temporary storage of soils (including material produced via trenchless construction methods) must: • Be stored in appropriately sited stockpiles away from surface drainage lines • With bunding • Depending on the nature of the contamination in the material to be stockpiled, on a lined or impermeable surface • Have surface covering if odourous • Be sprayed during periods of dry weather with water or suitable dust suppressant
CL01-9	Any asbestos containing materials identified must be removed from the site by an appropriately qualified and licensed removalist.
CL01-10	Develop an unexpected finds protocol for contamination, asbestos and odour management of excavated soils.
CL01-11	Develop and implement contingency and emergency response procedures to manage fuel, chemical or contamination spills

ID	Management and mitigation measures
CL01-12	Manage all contaminated materials, chemicals, fuels and hazardous materials to mitigate potential environmental harm via: • All dangerous goods or environmentally hazardous materials will be stored in appropriately bunded containers within the construction compound, in accordance with relevant Australian Standards and state regulations. • Fuel storage on site during construction will be via tankers (between 20,000 L and 50,000 L in size) that will be parked in bunded hardstands within the construction compound, or temporary containerised, self-bunded, above-ground fuel storage systems. Machinery and equipment will then either be refuelled within the compound or in situ via a refuelling truck, which will have on board spill kits and temporary bunding equipment. • Hydrocarbon and chemical spill kits will be stored within the construction compound(s) and wherever dangerous goods and environmentally hazardous materials are used throughout the project area.
CL01-13	The construction contractor will maintain records of waste soil volumes generated, disposal locations, including disposal facility receipts.
CL02	**Develop and implement acid sulfate soils (ASS) management controls during construction**
CL02-1	Design excavation and soil disturbance works (including HDD conduits between the site and shoreline) to avoid ASS where practicable.
CL02-2	ASS risk and management will be addressed through the development of an ASS Management Plan in accordance with the *Tasmanian Acid Sulfate Soil Management Guidelines 2015* (DPIPWE, 2015c). The ASS Management Plan will form part of the CEMP for the Project and will be submitted to the EPA for approval prior to construction.

CL02-3	Where disturbance of ASS cannot be avoided, develop management measures to reduce the potential impact from ASS in accordance with the *Tasmanian Acid Sulfate Soil Management Guidelines* (DPIPWE 2009) and the *National Acid Sulfate Soils Guidance* (DAWR 2018) as follows:
	• Design excavations or site loadings to ensure that changes in groundwater levels (from dewatering or displacement of soils) do not result in acid generation. Where changes to groundwater levels cannot be avoided, design ASS treatment methods to limit generation or neutralise acid.
	• Design HDD cutting and drilling fluid retention systems to allow testing for potential acidic or ASS conditions in HDD returns and allow diversion for treatment.
	• Design and appropriately locate ASS stockpile areas to avoid and otherwise minimise impacts from acid generation including lining, covering and runoff collection to prevent release of acid.
	• Where ASS is identified and disturbed, it must be treated to ensure neutralisation of potential acid generation. Treatment (via liming) is to be at the rates identified during the further ASS assessment to be undertaken in the proposed DSI for mitigation measure CL01-1. Any treatment must be designed with consideration of Tasmanian regulations and guidance and include sufficient neutralising capacity to mitigate acid generation.
	• Manage any odours that may be generated during handling of potential ASS via covering, application of odour suppressant or other appropriate measure.
	• Prevent oxidation of disturbed ASS so far as reasonably practicable via:
	  ○ Scheduling works to limit exposure of ASS to oxidising conditions
	  ○ Ensure ASS or acid sulfate rock is not retained in on-site stockpiles for long periods (i.e. greater than 48 hours) without treatment
	  ○ Designing and implement ASS treatment to neutralise ASS prior to other management measures applied.
	• Identify suitable sites for re-use, management or disposal of ASS and acid sulfate rock that may be generated by the project

CL03	**Develop and implement measures to manage potential contamination impacts in operation**
CL03-1	Fuel storage on site during operation will be in above-ground fuel storage tanks on an impermeable concrete surface (with bunding) designed in accordance with Australian Standard AS1940 *The storage and handling of flammable and combustible liquids*. Fuel deliveries will be via tankers will be parked in designated refuelling areas which will be designed to contain any potential spills. The fuel storage areas and refuelling areas will contain spill kits and temporary bunding equipment.
CL03-2	Develop and implement contingency and emergency response procedures to manage fuel, chemical or contamination spills.

ID	Management and mitigation measures
CL03-3	Manage all contaminated materials, chemicals, fuels and hazardous materials to mitigate potential environmental harm via: • All dangerous goods, environmentally hazardous materials or fuels will be stored in appropriately bunded containers at the site, in accordance with relevant Australian Standards and state regulations. • Fuel and chemical spill kits will be maintained within close proximity to dangerous goods, hazardous materials or fuel storage areas.

11. CONCLUSION

The contaminated land and ASS impact assessment undertaken for the Heybridge converter station and nearshore area identified four potential hazards with a low to high risk of causing impacts to the environment without the application of additional controls including:

1. Management of excavated soils (including contaminated soils and asbestos contamination)
2. ASS, and
3. Management of routine construction and operational impacts.

The potential management measures that may be applied to ensure compliance with the nominated management and mitigation measures include:

Manage contaminated soils – Undertake testing of soils prior to commencing excavation works to confirm the contamination status of soils (including the nature and extent of asbestos and ASS) prior to disturbance, so that appropriate management controls can be applied to ensure impacts to the environment are mitigated. Management measures may include offsite disposal of contaminated soils or remediation and reuse. Odour management may also be required to be implemented depending on whether odorous soils are encountered. Application of an odour suppressant may be suitable for managing risks to air quality from contamination related odours. The asbestos testing to be undertaken across the Heybridge converter station site should confirm the nature and extent of asbestos in soils. Management of asbestos containing materials in soils at the converter station site may include excavation and disposal from site, abatement (physical removal of asbestos containing materials from soils) and reuse or capping with a barrier.

ASS - Undertake testing of proposed excavation areas for potential ASS to confirm the extent of ASS to be disturbed, and how impacts from any identified ASS may be managed to limit impacts to the environment. Management measures include ASS neutralisation on site, avoiding disturbing ASS, managing groundwater dewatering to reduce ASS generation. Excavated ASS may generate sulfidic odours that can be managed via the application of standard ASS management measures (e.g. neutralisation, odour suppressant application).

The assessment of potential impacts to the environment proposed by the project have the potential to cause potentially unacceptable impacts to human health or the environment. However the application of the management and mitigation measures are considered to reduce the potential impacts to the environment to acceptable levels and would ensure that the site is acceptable for commercial or industrial land uses (as defined in the NEPM).

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Appendix C. Terrestrial Ecology Impact Assessment

C.1 Terrestrial Ecology Impact Assessment

C.2 Terrestrial Ecology Impact Assessment Addendum

Marinus Link Heybridge Converter Station

Terrestrial ecology baseline and impact assessment

May 2024

Prepared by Hydro-Electric Corporation ABN48 072 377 158

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Document information

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Executive summary

This report presents a baseline characterisation of ecological values within the Marinus Link Heybridge converter station and shoreline crossing areas based on available data resources and the results of field surveys. This report also presents an impact assessment that considers the potential impact of the project on those ecological values and whether there is likely to be a significant impact on Matters of National Environmental Significance (MNES) protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and/or species protected under the Tasmanian *Threatened Species Protection Act 1995* (TSP Act) or vegetation communities protected under the *Nature Conservation Act 200*2 (NC Act).

The baseline assessment identified:

- The presence of three native vegetation communities, one of which is listed under the NC Act.
    - *Eucalyptus amygdalina* coastal forest and woodland (DAC) –NC Act listed – on the shoreline crossing
    - Coastal scrub (SSC), on the shoreline crossing
    - *Eucalyptus viminalis–Eucalyptus globulus* coastal forest and woodland (DVC), on the converter station site
- The potential presence of five EPBC Act listed fauna species
    - Tasmanian devil (*Sarcophilus harrisii*)
    - Spotted tail quoll (*Dasyurus maculatus* subsp*. maculatus*)
    - Tasmanian wedge-tailed eagle (*Aquila audax* subsp. *fleayi*)
    - White-throated needletail (*Hirundapus caudacutus*)
    - Fork-tailed swift (*Apus pacificus*)
- The potential presence of one NC Act listed fauna species
    - White bellied sea-eagle (*Haliaeetus leucogaster)*

The significance assessment considers the sensitivity of a value and magnitude of impact. This approach assesses the sensitivity of an environmental value by considering its conservation status, intactness, uniqueness or rarity, sensitivity to change and replacement potential.

The impact assessment found that the significance of the pre-mitigation impact to the vegetation communities and most fauna species was low. This low impact assessment is primarily determined by the negligible magnitude of impact to most of the above native vegetation communities and threatened species at this site.

The only species assessed as being potentially impacted at a moderate significance level, following the implementation of EPRs, were Tasmanian devils (*Sarcophilus harrisii*) and spotted-tailed quolls (*Dasyurus maculatus* subsp*. maculatus*). Tasmanian devils and spotted-tailed quolls are highly sensitive to roadkill risk, given that vehicle strikes are often lethal and both species frequently are attracted to foraging on carcasses of other roadkill species. The magnitude of roadkill impact due to construction activities was assessed as minor, prior to the implementation of mitigation measures to comply with EPRs. However, with implementation of measures to comply with the Environmental Performance Requirements (EPRs), the residual magnitude of roadkill impacts will be reduced to negligible, and the significance of the impact on devils and quolls will be low.

The significance of the impact due to the construction and operation of the Heybridge converter station and shoreline crossing is therefore low. The recommended EPRs will minimise impacts to ecological values through:

- Minimising vegetation removal and disturbance during construction
- Implementing vegetation protection measures during construction
- Implementing measures to protect fauna during construction
- Implementing measures to protect raptors during construction
- Implementing vegetation protection measures during operation
- Implementing measures to protect raptors during operation.

This assessment found that any impacts from the project on threatened ecological communities, threatened flora or threatened fauna species at the either the converter station or the shore crossing will be reduced to manageable levels.

Glossary and Abbreviations

CEMP	Construction Environmental Management Plan
EFOS	Environmental Field Observation System
EPA Tas	Environmental Protection Agency Tasmania
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPRs	Environmental Performance Requirements
GIS	gas insulated switchgear
HDD	horizontal directional drills
HVAC	high voltage alternating current
HVDC	high voltage direct current
MNES	Matters of Environmental Significance
NC Act	*Nature Conservation Act 2002*
NEM	National Electricity Market
NVA	Natural Values Atlas
PMST	Protected Matters Search Tool
SF_6	Sulfur hexafluoride
TSP Act	*Threatened Species Protection Act 1995*

1. Introduction

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

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

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

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

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

This report has been prepared by Entura for the Tasmanian jurisdiction to support both the Tasmanian EISs and the EIS/EES being prepared for the project.

1.1 Purpose of this report

Marinus Link Pty Ltd (MLPL) is proposing the development of a second Bass Strait electricity interconnector, known as Marinus Link. Entura has been engaged by Tetra Tech Coffey Pty Ltd (Tetra Tech Coffey) on behalf of MLPL to undertake an assessment of the terrestrial ecological values of the proposed converter station at Heybridge and shore crossing sites. This report presents a baseline characterisation of ecological values within the study area based on available data resources and the results of field surveys. The impact assessment considers the potential impact of the project on those ecological values and whether there is likely to be a significant impact on Matters of National Environmental Significance (MNES) protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and/or species protected under the Tasmanian *Threatened Species Protection Act 1995* (TSP Act) or vegetation communities protected under the *Nature Conservation Act 2002* (NC Act).

1.2 Project overview

The project is a proposed 1500-megawatt (MW) HVDC electricity interconnector between Heybridge in North West Tasmania (Figure 1.1) and the Latrobe Valley in Victoria.

The project 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 National Electricity Market (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. The project 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. The project is expected to facilitate the reduction in greenhouse gas emissions at a state and national level.

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

Figure 1.1: Heybridge converter station overview

1.2.1 Tasmanian converter station

Two converter stations and a high voltage alternating current (HVAC) switching station will be located near the coast at Heybridge, on the site of the former titanium dioxide plant. The site and all components located on it will be referred to as the Heybridge converter station site.

The subsea cables will connect directly into the two converter stations, which are connected to the HVAC switching station that facilitates the project connecting to the Tasmanian 220 kV HVAC network. The high-voltage direct current (HVDC) voltage will be either ±320 kV or ±400 kV.

The development footprint of the converter stations and associated HVAC switching station is expected to be 280m by 220m. A preliminary overview is set out in Figure 1.1 and a preliminary general layout is set out in Figure 1.2. The site will have internal access roads that will be sealed.

The Heybridge converter station will comprise the following key components and equipment:

- Overhead steel lattice gantries on which the HVAC 220 kV transmission lines (connection to Tasmanian transmission network) will terminate.
- HVAC 220 kV AC switching station with gas insulated switchgear (GIS). Sulfur hexafluoride (SF_6) gas will be used in the switchgear. A building will enclose the GIS equipment.
- HVAC 220 kV filter banks, assumed to be housed within a building, however there is potential for open air depending on the visual impacts.
- Converter transformers and coolers. The transformers will be housed in bunds designed in accordance with applicable Australian standards. A spare transformer (without transformer oil) will be stored adjacent to the western transformer bays.
- Main building that will include a phase reactor hall, a valve hall and an HVDC hall. The three halls are separate areas in the one building.
  - HVAC phase reactor hall containing valve reactors.
  - Valve hall containing the converter modules and valves.
  - HVDC hall with HVDC reactors and HVDC land cable terminations.
- Two-storey service and control building containing system control, protection and data acquisition equipment, station services such as UPS systems with batteries, fire suppression systems, control room and amenities.
- Spare parts buildings and workshop (common to both converter stations).
- Telecoms building for purposes of providing control systems for the project and commercial telecoms services where there is available capacity (common to both converter stations).
- Firefighting systems including 1,000,000 L (estimated) fire water tank.
- Stormwater drainage system. Potentially contaminated water from bunded areas will be directed to and collected in a gross pollutant trap or triple interceptor trap which will be periodically pumped out by a licensed wastewater disposal contractor. Clean surface water runoff and overflow from the traps will discharge to a form of water sensitive urban design (e.g., swale drain), before discharge to the ocean via the existing site drainage culvert.

- Greywater and sewerage will be managed through a septic tank. The site will also have underground oil separator tanks. Security fencing will be weldmesh, 3.25m high, with barbed wire on top section. Onsite temporary fuel storage for backup generators.
- Two 1500 kVA diesel generators with above ground fuel storage of 5000L (sufficient for 8 hours at full load), (2500 L diesel per converter).
- Building materials: roof and walls will be a standard sheet steel construction; however, alternatives may include adding insulating panels or pre-cast concrete tilt panels if required for acoustic attenuation.

The phase reactor hall, valve hall and HVDC hall will have maximum dimensions (based on ±400 kV design) of approximately 70m wide, 90m long and 27m high, as indicated in Figure 1.2. The attached control and auxiliaries building will be approximately 40m long by 25m wide by 10m high. The GIS switching station building will be a portal frame building approximately 49 m long, 16 m wide and 10m high.

1.2.2 Tasmanian landfall and shore crossing

The shore crossing area extends from the Bass Strait shoreline, under the Bass Highway and Western Line Railway, to the Heybridge converter station site, as shown in Figure 1.2.

The shore crossing is west of the Blythe River mouth, in the vicinity of the former titanium dioxide plant outfall pipeline.

The shore crossing will be comprised of six horizontal directional drills (HDD). This will consist of two cable bundles each requiring three drills (for two power and one fibre optic cable). Each HDD will be drilled from one of two pads located within the Heybridge converter station site. Three ducts will be installed from each of the two drill pads. The crossings will be drilled under the Bass Highway and Western Line which are adjacent to the proposed converter site. The HDD rigs will be located within the Heybridge site and drill out along the subsea cable route alignment. The HDD bores will extend approximately 1 km offshore and end in approximately 10m water depth. The subsea cables will be pulled from the cable laying vessel to the converter station HDD drill pads.

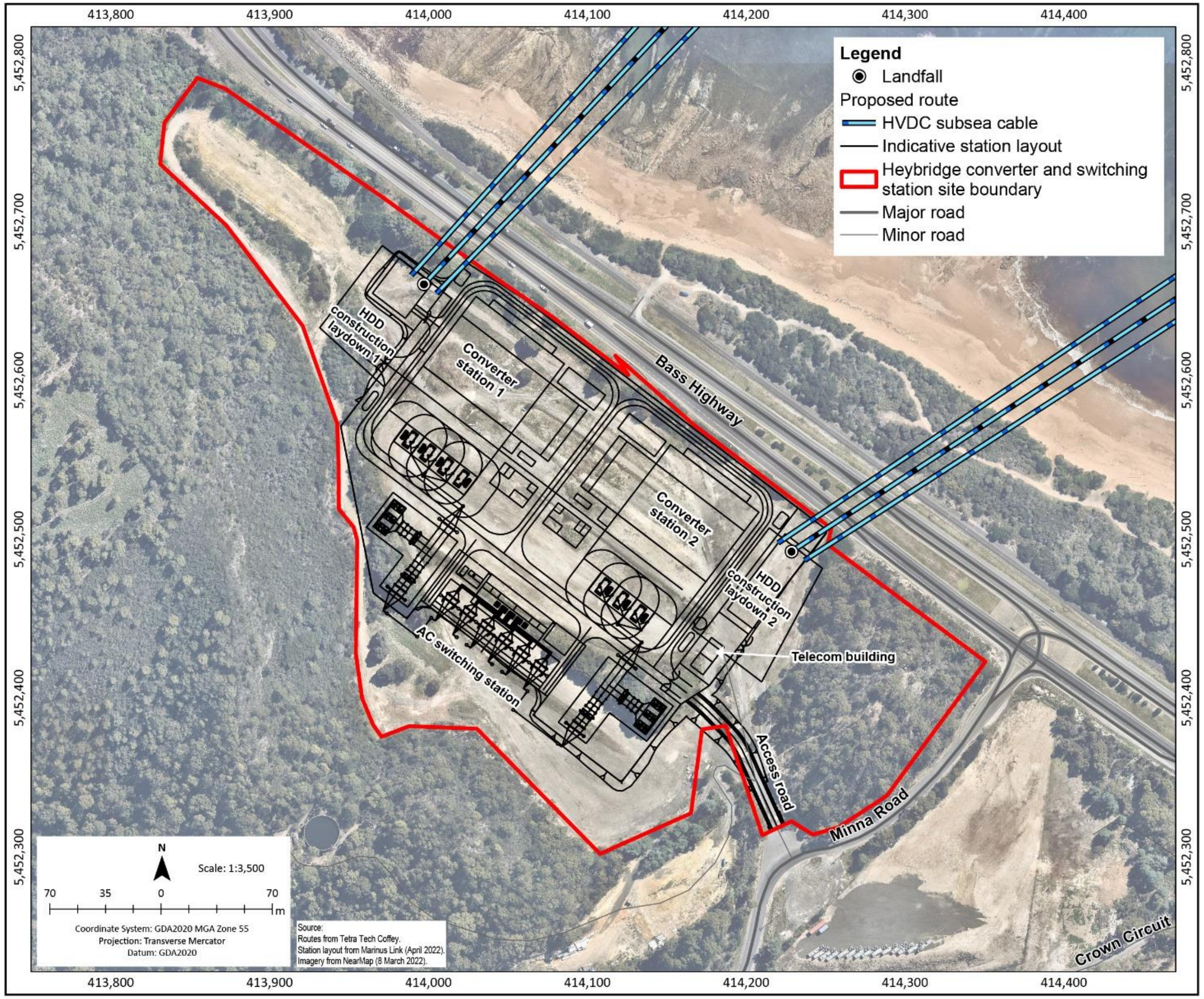

Figure 1.2: Converter station site preliminary general layout.

1.3 Assessment context

This report assesses the likely impacts of the project on threatened flora, fauna and ecological communities. It is a requirement to undertake this assessment , as the project has the potential to have impacts on flora, fauna and ecological communities that are listed as threatened under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and/or on flora and fauna species protected under the Tasmanian *Threatened Species Protection Act 1995* (TSP Act) or vegetation communities protected under the *Nature Conservation Act 200*2 (NC Act).

In the event that this assessment identifies that the project will result in the taking or disturbance to a threatened species listed under the TSP Act 'A 'permit to take is likely to be required. Under the TSP Act a person must not knowingly kill, injure or collect a listed species without a permit. Similarly, a person must not disturb a listed species on land subject to an interim protection order or subject to a land management agreement without a permit. It is also an offense under TSP Act to disturb wildlife on reserved land under the *National Parks and Reserves Management Regulation 2019*.

If a native vegetation community listed under the NC Act is impacted, then usually a Forest Practices Plan (FPP) is required. However, there are exemptions under the *Forest Practices Regulations 2017* including for the construction of electrical infrastructure (Regulation4 (l)). In the event that a threatened species or community listed under the EPBC Act is assessed as likely to be significantly impacted, mitigation measures and/or offsets may be an approval requirement.

The field surveys targeted flora and fauna species listed under the TSP Act which were identified as likely to occur within the survey area so that potential impacts could be assessed.

2. Assessment guidelines

This section outlines the assessment guidelines relevant to terrestrial ecology and the linkages to other EIS/EES technical assessments. Two EISs are being prepared to address the Tasmanian EPA requirements for the Heybridge converter station and shore crossing. A separate EIS/EES is being prepared to address the requirements of DTP and DCCEEW.

This report has been prepared by Entura for the Tasmanian jurisdiction to support both the Tasmanian EISs and the EIS/EES being prepared for the project.

2.1 Commonwealth

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

The guidelines relevant to the terrestrial ecology stated in Section 5.5 for terrestrial impacts:

'The EIS must include an assessment of the potential direct and indirect impacts to listed and threatened species and communities arising from the terrestrial components of the project, particularly native vegetation clearance for the onshore converter station. The following will be required:

- *identify and characterise threatened species and ecological communities present within terrestrial environments of the project, supported by maps and survey work;*
- *determine the total amount of vegetation likely to be removed during construction and the potential impacts on protected matters, including the presence of hollow bearing trees…and other critical habitat features within vegetation proposed for removal; and*
- *details of the extent, intensity, and duration of potential impacts of the action on the identified threatened species and/or ecological communities*.'

2.2 Tasmania

The EPA Tasmania has published two sets of guidelines (September 2022) for the preparation of an EIS for the Marinus Link converter station and shore crossing. A separate set of guidelines has been prepared for each of these project components. The sections relevant to the terrestrial ecology assessment are included in Table 2.1: .

Table 2.1: EIS guidelines issued by EPA Tasmania relevant to this terrestrial ecology assessment

EIS guideline section	Key issue detail	Reference in this report
Existing Environment		
CS[#] Section 6.2 SC[Σ] Section 10.1	Specify and map known records of species and their habitat, with particular reference to rare and threatened species, communities, and habitats, including those listed under the relevant Schedules of the Commonwealth EPBC Act and the Tasmanian Threatened Species Protection Act 1995 (TSP Act) and Tasmanian Nature Conservation Act 2002 (NC Act).	5.1, 6.4, 6.5, 6.6, 0
CS Section 6.2 SC Section 10.1	Undertake and provide the results of a current natural values survey for the site.	5, 6, 7
CS Section 6.2 SC Section 10.1	Identify any known occurrences of species of conservation significance, threatened fauna species or flora species or potential habitat in the vicinity of the proposal footprint, or potentially impacted offsite, including aquatic species and shorebirds.	6.3, 6.4, 6.5, 0
CS Section 6.2 SC Section 10.1	Identify areas or habitats of conservation significance, including designated conservation areas, areas relating to the requirements of international treaties (e.g., Japan-Australia and China-Australia Migratory Bird Agreements (JAMBA/CAMBA) and Ramsar (wetlands) Convention).	6, 7
CS Section 6.2 SC Section 10.1	Specify and map known sites of geoconservation significance or natural processes (such as fluvial or coastal features), including sites of geoconservation significance listed on the Tasmanian Geoconservation Database.	6.1
CS Section 6.2 SC Section 10.1	Demonstrate that any surveys comply with requirements in *Guidelines for Terrestrial Natural Values Surveys*.	5
CS Section 6.2 SC Section 10.1	Identify any environmental weed species present on or near the site.	6.8
CS Section 6.2 SC Section 10.1	Describe natural processes of particular importance for the maintenance of the existing environment (e.g., fire, flooding, etc).	N/A (see 6.4.1, 6.4.2)
CS Section 6.2 SC Section 10.1	Provide all results in a natural values assessment, undertaken by a suitably qualified person.	6, 7
SC Section 9.2	Any existing conservation reserves located on or within 500 metres of the site/route.	N/A (see 6.2)
SC Section 9.2	Information on species, sites or areas of landscape, aesthetic, wilderness, scientific or otherwise special conservation significance which may be affected by the proposal. Relevant information resources include the LIST and Natural Values Atlas	6
Potential impacts		
CS Section 6.2 SC Section 10.1	Describe potential impacts of construction and operation of the proposal on flora, vegetation communities and habitat, with particular reference to rare and threatened species, communities, and habitats, including those listed under the relevant Schedules of the TSP Act and NC Act.	8.1, 8.2

EIS guideline section	Key issue detail	Reference in this report
CS Section 6.2 SC Section 10.1	Describe potential impacts of construction and operation of the proposal on fauna, including impacts on species, communities, and habitats. Provide details of impacts to rare and threatened species, migratory species, communities, and habitats, including those listed under the relevant Schedules of the TSP Act and NC Act.	8.1, 8.2
CS Section 6.2	In discussion of impacts on flora and fauna, including consideration of: • Habitat clearance and disturbance • Activity causing potential disturbance (e.g., movement) • Noise and vibration emissions • Lighting and vehicle movements (including roadkill) • Mobilised contaminated material or sediment	8
SC Section 10.1	In discussion of impacts on flora and fauna, including consideration of: • Habitat clearance and disturbance • Activity causing potential disturbance (e.g., movement) • Noise and vibration emissions • Lighting and vehicle movements (including roadkill) • Mobilised contaminated material or sediment • The potential for the proposed works to result in subsidence and resultant impact on shorebird habitat above and adjacent to the drill holes.	6.1, 8
CS Section 6.2 SC Section 10.1	Discuss impacts on existing conservation reserves which may be affected by the proposal, with reference to the management objectives of the reserve(s) and the reserve management plan(s) (if any).	N/A (see 6.2)
CS Section 6.2 SC Section 10.1	Discuss impacts on other species, sites or areas of special conservation significance, including areas of wilderness or scientific value.	8
CS Section 6.2 SC Section 10.1	Discuss the potential introduction or spread of pests, weeds and plant and animal diseases as a result of construction and operation of the proposal. Information about controlling the introduction and spread of weeds and the development of weed and disease management plans can be found in Section 4 of the NRE (2015) *Weed and Disease Planning and Hygiene Guidelines - Preventing the spread of weeds and diseases in Tasmania.*	8.6, 8.7
CS Section 6.2 SC Section 10.1	Discuss impacts on sites of geoconservation significance or natural processes (such as fluvial or coastal features), including sites of geoconservation significance listed on the Tasmanian Geoconservation Database.	N/A (see 6.1)
CS Section 6.2	In consideration of all issues, discuss any potential for cumulative impact with the proposed Heybridge shore crossing for Marinus Link.	8.4

EIS guideline section	Key issue detail	Reference in this report
SC Section 10.1	In consideration of all issues, discuss any potential for cumulative impact with the proposed Heybridge converter station for Marinus Link.	8.4
Avoidance and mitigation measures		
CS Section 6.2 SC Section 10.1	Describe management measures to mitigate adverse impacts to threatened fauna, flora and vegetation communities and other natural values where they cannot be avoided.	8
SC Section 10.1	It is noted that the shore crossings will be drilled continuously over 24 hours, 7 days a week to ensure borehole stability. It is important that illumination of the site at night is minimised as this can disorient seabirds and shorebirds. If there is to be any form of additional night-time lighting associated with the construction area for safety (or other) reasons, the illumination should be kept to a minimum and red light should be used. It is recommended that the guidance principles outlined in the Commonwealth National Light Pollution Guidelines for Wildlife be considered for incorporation into the lighting design, in particular those specified in Appendix A (Best Practice Lighting Design).	8.1.3.1, 8.1.3.2, 8.7
CS Section 6.2 SC Section 10.1	Where impacts cannot be avoided, present proposed measures to mitigate and/or compensate adverse impacts on biodiversity and nature conservation values.	8
CS Section 6.2 SC Section 10.1	Develop a plan to control the spread of weeds, pests and diseases and ensure that weeds present at the impact site are properly managed.	8.1
CS Section 6.2 SC Section 10.1	Discuss rehabilitation of disturbed areas following the completion of construction activities and cessation of the activity, including any proposed seed collection and progressive rehabilitation programme.	8.1, 8.3, 8.5
CS Section 6.2 SC Section 10.1	Provide a conclusion regarding the significance of likely impacts on natural values.	8.6, 9
Requirements for surveys		
CS Section 6.2 SC Section 10.1	Any flora and fauna surveys must, as a minimum, comply with the requirements of the document Guidelines for Terrestrial Natural Values Surveys published by the Department of Natural Resources	5

CS = Converter station EIS guidelines; Σ SC = Shore crossing EIS guidelines

2.3 Victoria

The Victorian component of the project is being assessed in accordance with the EES Scoping Requirements approved by the Minister for Planning (February, 2023). This assessment is documented in a separate report [Eco Logical Australia, 2023. Terrestrial Ecology Impact Assessment – Marinus Link].

2.4 Linkages to other reports

The Tasmanian terrestrial ecology report describes the baseline conditions at the Heybridge converter station site and the shore crossing of the undersea cable to the converter station. It also assesses the impacts of the terrestrial ecology within the survey area. The Tasmanian terrestrial ecology report together with the Victorian terrestrial ecology report characterise the baseline condition of the terrestrial ecological values within the project footprint and assesses the impacts on them. They also describe the Environmental Performance Requirements (EPRs) set out the environmental outcomes that must be achieved during design, construction, operation and decommissioning of the project which will minimise impacts and the risk of harm to the terrestrial ecology values.

This report is informed by the technical assessments outlined in Table 2.2.

Table 2.2: Reports with relevance to this report

Technical assessment	Relevance to this assessment
Marinus Link Project Environmental Impact Statement (Tasmania) Technical Report – Traffic & Transport (Stantec, 2023)	Characterisation of traffic movements to and from site
Geomorphology Technical Report produced by Environmental GeoSurveys Pty Ltd and A.S. Miner Geotechnical Pty Ltd (2023)	Characterisation of expected impacts on geomorphology and soils
North Barker (2022). North West Transmission Upgrades Project – Viewshed Analysis Active Eagle Nests 21/22 Season. Report written for Tetra Tech Coffey, Northwest Transmission Developments, 13 January 2022.	Utilises raptor searches undertaken on behalf of TasNetworks for the North West Transmission Development project. The search area also covers the necessary area for the Heybridge Converter Station. Permission has been provided by TasNetworks for use in this assessment.

3. Legislation, policy and guidelines

This section describes the Australian Government and Tasmanian Government legislation that protects threatened species and ecological communities that will apply to the proposed Heybridge converter station project and landfall and shore crossing.

3.1 Commonwealth

3.1.1 *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)

The EPBC Act is Australian Government legislation that protects Matters of Environmental Significance (MNES). The EPBC Act provides for Commonwealth involvement in the assessment and approval of proposed actions that could have an impact on an MNES.

MNES include:

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

A proponent who proposes to take an action that will have or is likely to have a significant impact on MNES must refer that action to the Minister for assessment. The Minister determines whether the activity can proceed with no further assessment by the Australian Government, or whether it will be a controlled action for which assessment is required.

3.2 Tasmania

3.2.1 Threatened Species Protection Act 1995

Under the Tasmanian Threatened Species Protection Act 1995 (TSP Act) a person must not knowingly kill, injure or collect a listed species without a permit. Similarly, a person must not disturb a listed species on land subject to an interim protection order or subject to a land management agreement without a permit. It is also an offense under TSP Act to disturb wildlife on reserved land under the *National Parks and Reserves Management Regulation 2019*.

The field surveys targeted flora and fauna species listed under the TSP Act which were identified as likely to occur within the survey area so that potential impacts could be assessed.

3.2.2 Nature Conservation Act 2002

The Nature Conservation Act 2002 (NC Act) provides for the conservation and protection of the fauna, flora and geological diversity in Tasmania and for the declaration of national parks and other reserved land.

Schedule 3A of the NC Act lists the native vegetation communities in Tasmania that are threatened. Communities listed under the NC Act are protected from clearance and conversion under the *Forest Practices Act* 1985 and are also afforded higher levels of protection under some local government planning schemes). Clearing or conversion of listed threatened vegetation communities usually requires the preparation and certification of a Forest Practices Plan (FPP). However, Regulation 4 (l) of the *Forest Practices Regulations 2017* describes the circumstances in which a forest practices plan is not required:

> <u>*Regulation 4 (l)*</u>
>
> *The harvesting of timber or the clearing of trees on any land, or the clearance and conversion of a threatened native vegetation community on any land, to enable the construction and maintenance of electricity infrastructure, if –*
>
> *(i) there is an easement on the land that enables the electricity infrastructure to be constructed or used, or, if there is no such easement, if the owner of the land consents to the construction or maintenance of the electricity infrastructure on the land; and*
>
> *(ii) the clearance and conversion is undertaken in accordance with an environmental management system endorsed by the Forest Practices Authority.*

Therefore, a Forest Practices Plan will not be required if listed threatened communities were affected by the proposed Heybridge substation.

3.2.3 Weed Management Act 1999 and Biosecurity Act 2019

The *Weed Management Act 1999* consists of sections relating to the declaration, management, compliance requirements, and powers of inspectors appointed under the Act. It is essential that declared weeds within the project area are identified and measures to comply with EPRs are implemented to prevent their spread through construction, operation and maintenance of the site. This report identifies declared weeds within the project area and EPRs that will inform measures to reduce project-related impacts.

Note that the *Biosecurity Act 2019* has superseded seven separate pieces of legislation, including the *Weed Management Act 1999*. The recently passed Biosecurity Regulations 2022 will allow for the full implementation of the *Biosecurity Act 2019*, following repeal of the *Weed Management Act*. It is understood that in relation to weed management, the major regulatory tool under the *Weed Management Act 1999* – the Statutory Management Plans – will be replaced by Biosecurity Management Plans under the *Biosecurity Act 2022*. It is understood the content of these plans will be identical to the current Statutory Management Plans.

4. Project description

4.1 Overview

The project is proposed to be implemented as two 750 MW circuits to meet transmission network operation requirements in Tasmania and Victoria. Each 750 MW circuit will comprise two power cables and a fibre-optic communications cable bundled together in Bass Strait and laid in a horizontal arrangement on land. The two 750MW circuits would be installed in two stages with the western circuit being laid first as part of stage one, and the eastern cable in stage 2.

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

- HVAC switching station and HVAC-HVDC converter station at Heybridge in Tasmania. This is where the project will connect to the North West Tasmania transmission network being augmented and upgraded by the North West Transmission Developments (NWTD).
- Shore crossing in Tasmania adjacent to the converter station.
- Subsea cable across Bass Strait from Heybridge in Tasmania to Waratah Bay in Victoria.

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

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

This assessment is focused on the Tasmanian terrestrial and shore crossing section of the project. This report will inform the two EISs being prepared to assess the project's potential environmental effects in accordance with the legislative requirements of the Tasmanian government (Figure 4.1).

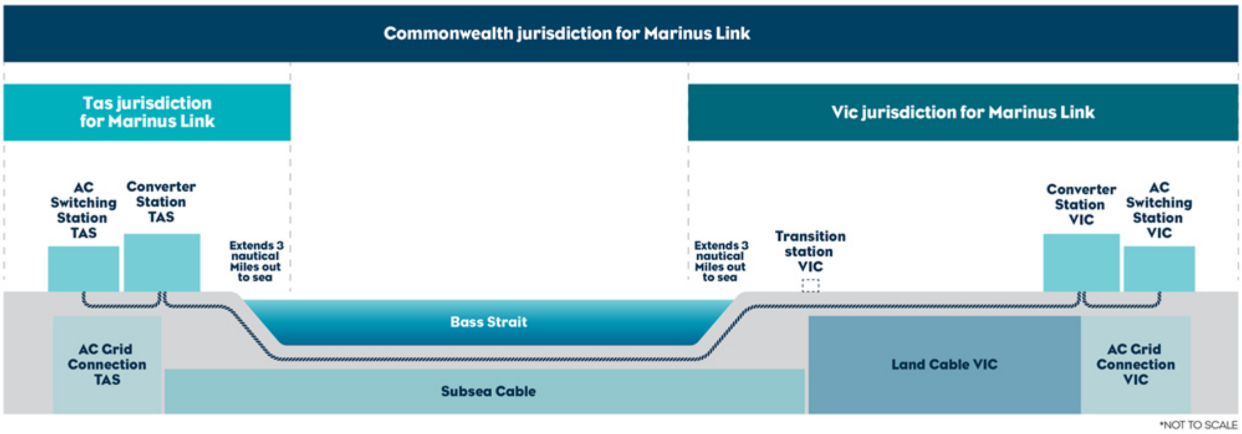

Figure 4.1: Project components considered under applicable jurisdictions (MLPL 2022, Consultation Plan).

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

4.2 Construction

The construction activities for the Heybridge converter station and shoreline crossing that are of relevance to the assessment of impacts to terrestrial ecological values include:

- Vegetation and habitat clearing for the construction of the substation and shore crossing

It is planned that an area of up to 6.5 ha will be required on the converter station site for the two the converter stations, switching station, HDD drill pads and laydown, with some clearing of modified vegetation types that is on site. The clearing of the native vegetation in the south east portion of the converter station site (Figure 5.2) will be avoided.

- No clearing of vegetation will occur on the shoreline crossing site, with HDD proposed to occur from the Heybridge converter station site and progressing underneath the road and shoreline. Construction work times and traffic movements
  - The majority of heavy vehicle and worker traffic movements will occur at the start and end of the working day (Stantec 2023). Transport movements for the period of the year between October and March will for the most part occur during daylight hours. However, during the shorter days between April and September, it will be likely for worker and heavy vehicle transport, to and from site, to occur at or just after dawn and just before or at dusk.
  - HDD for the shore crossings will be drilled continuously over 24-hours /7 days a week to ensure borehole stability, for a period of 8-12 months. Some night-time traffic at shift changes is likely.

4.3 Operation

The project will operate 24 hours per day, 365 days per year over an anticipated minimum 40-year operational lifespan.

Operation and maintenance activities include:

- Routine inspections of the land cable easement for potential operational and maintenance issues, including:
  - Unauthorised activities and structures.
  - Land stability.
  - Rehabilitation issues.
  - Weed infestations resulting from construction activities.
  - Cover at watercourse crossings.
- Periodic inspection of the subsea cable routes by remotely operated vehicles.
- Remote monitoring of shipping activity near the subsea cables for potential anchoring issues.
- Servicing, testing and repair of the subsea and land cables and converter stations equipment and infrastructure including scheduled minor and major outages.

5. Assessment method

5.1 Survey area

The terrestrial ecology survey area was defined by the property boundary of the Heybridge converter station site and the location of the shore crossings, which extends from the converter station site, under the Bass Highway and Western Line railway to Bass Strait (Figure 5.1). Note that survey area was extended to 2 km around the converter station site to identify any potential eagle nests (wedge-tailed eagle and white-bellied sea-eagle) that may be affected by the proposed Heybridge substation.

The converter station survey area is 10 ha in area and is a previously cleared industrial site that is highly disturbed. Within the 10-ha converter station site, approximately 6.5 ha are required for the two converter stations, the switching station, construction HDD and laydown areas.

The shore crossing survey area is 6.5 ha, and it is primarily comprised of the beach and coastal vegetation between the Bass Highway and the sea; this beach and coastal vegetation extends from the Blythe River mouth in the east to the rocky headland to the north approximately 700 m (Figure 5.2). Note that the shore crossing will be horizontally directionally drilled underground from the converter station to a location the offshore, and there will be no above ground disturbance at the shore crossing.

5.2 Database and literature review

A desktop review was completed to identify ecological values that may occur within the study area and to gather associated supporting information.

- Database and literature sources reviewed as part of this work were:
- Natural Values Atlas (NVA)
- EPBC Act Protected Matters Search Tool (PMST)
- TASVEG 4 mapping
- Threatened Native Vegetation Communities (TNVC 2020) mapping (DPIPWE 2021) derived from TASVEG 3, TASVEG 4 and previous TNVC 2014 maps
- Tasmanian Geoconservation database
- Publicly available aerial imagery, including current and historical images from Google Earth™ and Environmental Systems Research Institute (ESRI)

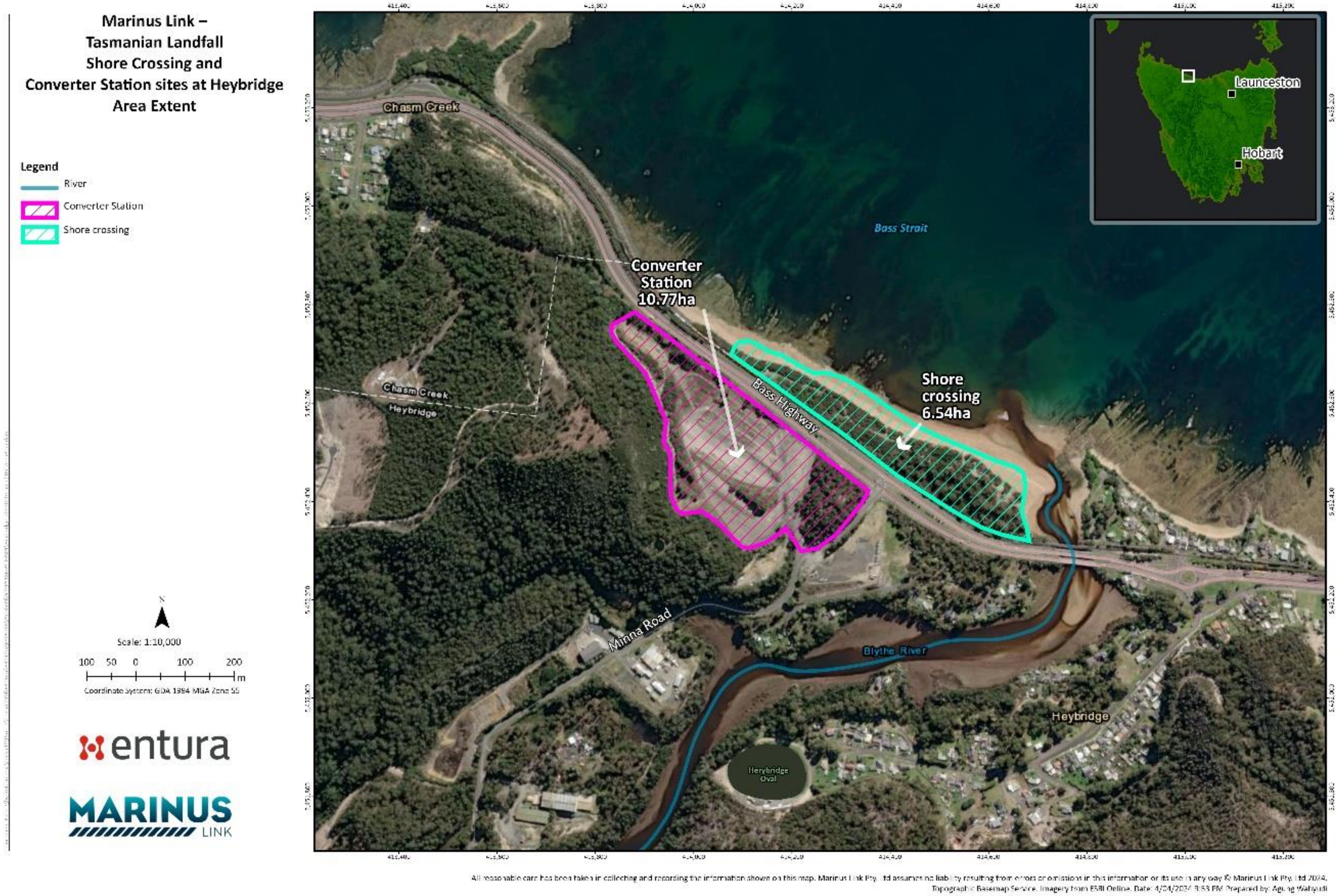

Figure 5.1: Converter station survey area and shore crossing survey area.

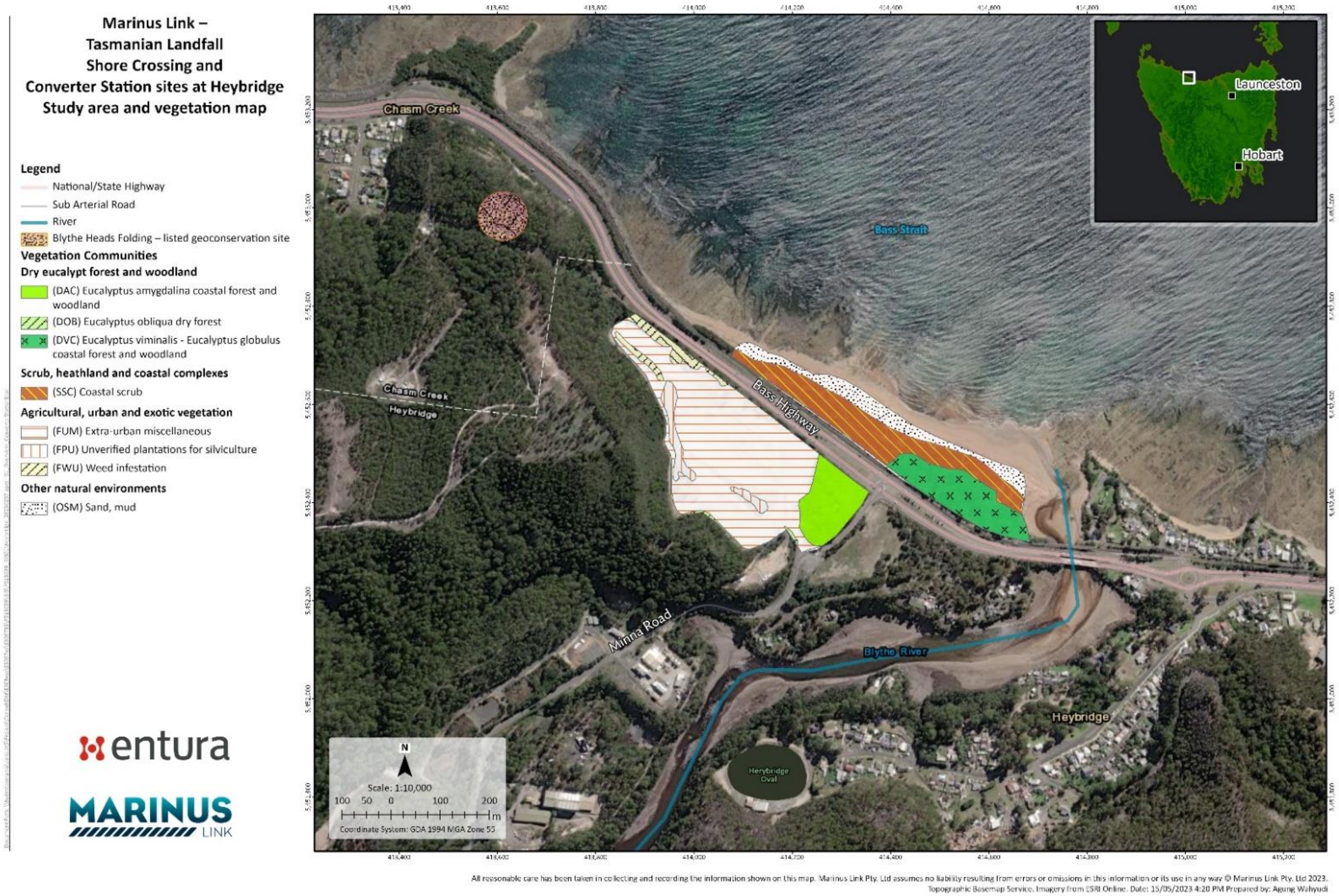

Figure 5.2: Map of study area, vegetation communities and nearest site of geoconservation significance

5.3 Field surveys

A field survey of the converter station site and the shore crossing was undertaken between 17 -18 January 2023. There had been a previous localised terrestrial ecology survey of geotechnical sites both within the converter station and at the shore crossing on 12 February 2021. There had also been two previous surveys of the shore crossing site targeting little penguins between 21 - 23 November 2018, 3 February 2022 and January 2023.

The field surveys included:

- The verification and mapping of the vegetation communities present within the converter station or shore crossing survey areas.
- The identification of vegetation communities listed as threatened under the NC Act and ecological communities listed under the EPBC Act, if present. Where encountered the complete extent of threatened vegetation and/or ecological communities was surveyed and mapped, even where it extended outside of the survey areas.
- Searching for flora species listed under the TSP Act (Tas) and EPBC Act (Commonwealth) in potential habitat and in the vicinity of known locations that were identified in the desktop survey.
- The recording of declared weeds listed on the schedules of the superseded *Weed Management Act 1999* (Tas) and listed as part of the Biosecurity Regulations 2022 under the *Biosecurity Act 2019*.
- The identification and assessment of potential habitat for fauna species listed as threatened under the TSP Act and EPBC Act.

Searches for evidence of little penguins inhabiting the shore, including searches for burrows. The vegetation, flora and fauna surveys were undertaken in a manner that is consistent with the Guidelines for Natural Values Surveys - Terrestrial Development Proposals (Natural and Cultural Heritage Division 2015).

5.4 Flora surveys

The field surveys used a meandering method to undertake flora surveys within the survey area. A meandering search method involves walking over the survey area in a random manner and recording all flora species encountered. The flora survey covered the converter station site and the shore crossing area with adequate walkovers to confirm absence of species and suitable habitat (but see section 5.7 for an explanation of the limitations of the survey method and of the assumptions underlying the survey method). The flora survey targeted habitats and vegetation communities that were likely to support threatened species. All species of flora encountered during the survey were recorded on a computer tablet with GPS capability using Entura’s EFOS (Environmental Field Observation System) which records data using fields that are consistent with Tasmania’s Natural Values Atlas (NVA).

In addition, all mapped TASVEG communities within the converter station and shoreline crossing survey areas were verified during the flora survey which included recording characteristic flora species and their cover abundance where required to determine the vegetation community.

5.5 Fauna surveys

Important fauna habitat components were also recorded during the survey where encountered (e.g. important habitat trees, rock outcrops suitable for Tasmanian devil and spotted-tailed quolls). Indirect evidence of the presence of threatened fauna was also recorded using EFOS where encountered (e.g. scats, diggings, burrows, shelters). No fauna capture surveys were undertaken during the surveys, however the information gathered in relation to indirect evidence and identification of suitable habitats are included in this report.

A search for Tasmanian devil and spotted-tailed quoll dens within the survey area was also undertaken in a manner that is consistent with the DPIPWE Survey Guidelines and Management Advice for Development Proposals that May Impact on the Tasmanian Devil (Natural and Cultural Heritage Division 2015b). This involved the survey team of two people targeting likely den sites and also looking for scats in accordance with the 'Survey guidelines for Australia's threatened mammals' (Commonwealth of Australia 2011).

An eagle nest survey was undertaken by North Barker in April 2022 for the Remaining NWTD project (Appendix D) in accordance with the FPA *Technical Note No. 1 for eagle nest searching* (FPA 2014), and also in accordance with the *Survey guidelines for Australia's threatened birds* (Commonwealth of Australia 2010). Raptor nest identification was based on a database search within a 1 km search radius and subsequent February 2023 aerial surveys within 1 km and 2 km radius of the NWTD route's operational area, which also included the converter station and shoreline crossings (North Barker 2022; see Figure 5.3). The surveys were conducted from the air by helicopter using a search area of 2 km either side of the proposed alignment, which included the area around the converter station and shore crossing with a team of three ecologists, of which at least two were experienced in aerial and ground-based eagle nest surveying and identification of suitable habitat (North Barker 2022; see Figure 5.3). There are plans to undertake annual surveys prior to construction as part of the TasNetworks NWTD project which will also cover the area around the Heybridge Converter Station, and may be utilised in agreement with TasNetworks.

The previous surveys (21-23 November 2018 and 3 February 2022) of the shore crossing were undertaken by Entura to target little penguins (*Eudyptula minor*), as colonies are known to be scattered along the north coast including east of Leith at the eastern end of Lillico beach, and between Sulphur Creek and Somerset in the vicinity of the Heybridge crossing point (NVA data). A survey was undertaken to search for penguin burrows at the crossing point west of the Blythe River mouth. Little penguins feed during the day and return to their burrows and mates at dusk. Consequently, evening surveys were also undertaken on 21 and 22 November 2018 at the shore crossing area, to identify if any little penguins returned to their burrows at dusk. Subsequent searches for burrows and evidence of penguins were also undertaken on 3 February 2022 and 18 January 2023.

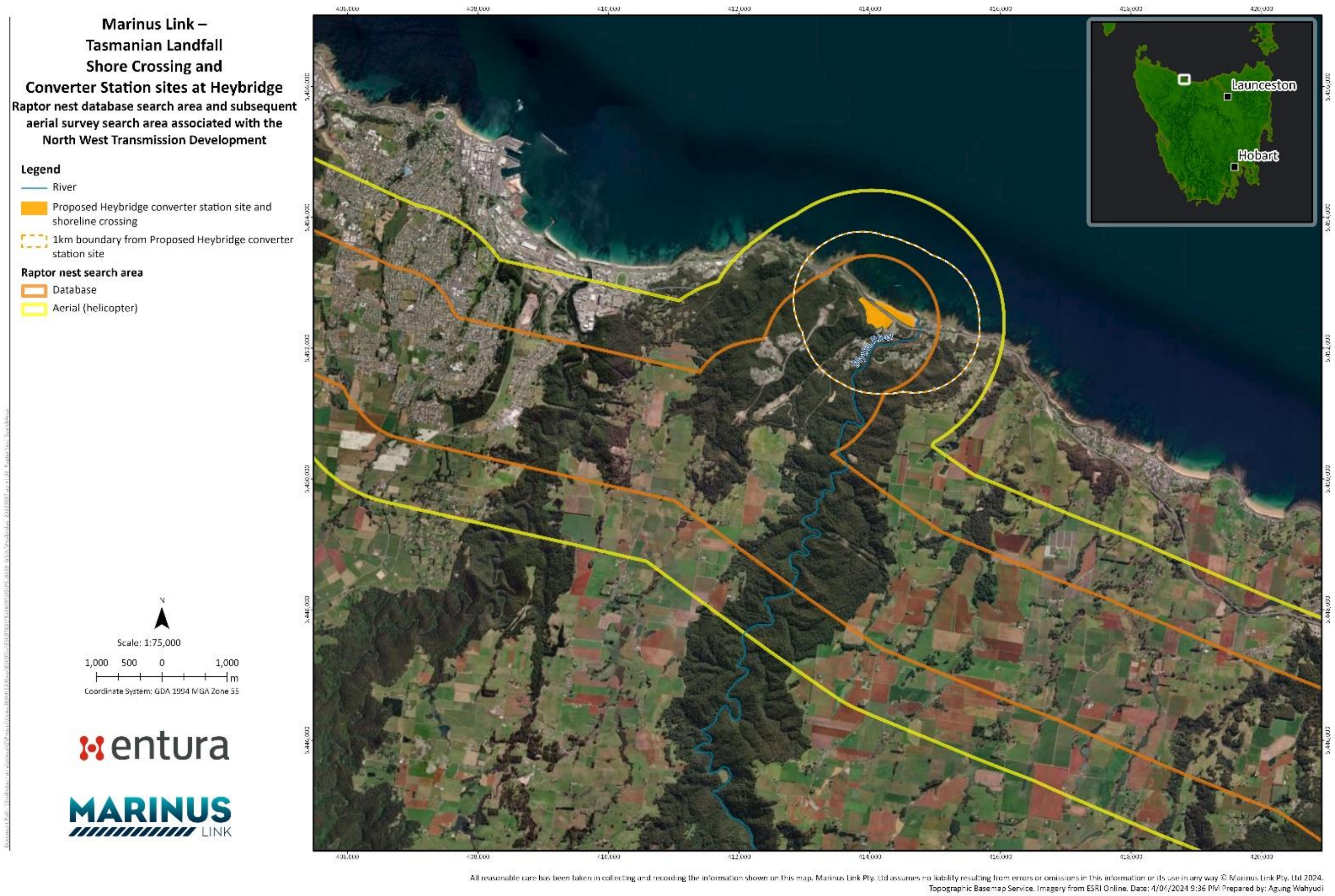

Figure 5.3: Raptor nest database search area and subsequent aerial raptor nest search area associated with the North West Transmission Development, undertaken by North Barker Ecosystem Services

5.6 Analysis and impact assessment

The baseline characterisation and impact assessment comprised the following steps:

- A likelihood of occurrence assessment to determine which ecological values are considered likely to occur within 5 km of the survey area. In some instances, ecological values identified in the 5 km radius study areas will occur in habitats significantly different from those in which the project is located and therefore can be excluded from further consideration (e.g. species occurring on floodplains when considering a project situated within foothills). This informed the likelihood of whether these ecological values were considered likely to occur within the survey area, and therefore at risk of impact.
- A field survey across both the converter station and the shore crossing area undertaken in January 2023 to verify the vegetation communities, fauna habitats and flora species.
- An ecological impact assessment of those values identified as occurring or likely to occur within the survey area from the baseline characterisation. The impact assessment considered impacts to ecological values in the absence of any further mitigation.

5.6.1 Likelihood of occurrence

The likelihood of occurrence is a determination of the potential for threatened flora, fauna or ecological communities to be present and for threatened fauna to make use of the survey area. The likelihoods of occurrence ranking of species' or ecological communities within the survey area was determined by assessing:

- information collated through the database, literature review and field surveys; and
- species habitat requirements (including surrounding habitat connectivity).

Based on these assessments the species or ecological community was determined as one of the following:

- Known to occur: the species/ecological community has been recorded (NVA or field surveys) in the survey area.
- May occur: the species/ecological community has been recorded on the NVA in the study area and suitable species habitat exists or could exist in the survey area following detailed ecological studies.
- Unlikely to occur: there are no species/ecological community records on the NVA in the study area and/or suitable species habitat does not exist in or adjacent to the survey area.
- Does not occur or absent: the species/community potential distribution identified by the PMST includes the study area but there are no records on the NVA in the study area.

The likelihood of occurrence of threatened flora and fauna species listed under the EPBC Act and TSP Act were assessed using a 5 km search radius from the converter station site on the PMST and NVA databases. The likelihood for threatened flora species was recorded as 'known to occur' if it was recorded on site during the ecology field surveys or if there were NVA records from within the survey area.

If the species was not recorded in the survey area during the ecology field surveys but there were NVA records within the study area and suitable habitat was present in the survey area and it was within the species known range, they were assessed as 'may occur'. If there was no suitable habitat present within the survey area they were assessed as 'unlikely to occur' instead of 'absent' under a conservative approach.

Restrictions to construction activities are triggered within a 1 km line-of-sight of an active raptor nest during breeding seasons to minimise disturbance to breeding raptors, as per the *Threatened Tasmanian Eagles Recovery Plan 2006-2010* and the Environment Protection Authority's *Guide to Eagle Nest Searching and Nest Activity Checks*, Version 1 Records of raptor nests were therefore assessed within a 1 km search radius from the converter station site. The assessment of likelihood of occurrence of threatened raptor species under the TSP Act or EPBC Act including *Aquila audax* subsp. *fleayi* (Tasmanian wedge-tailed eagle), *Accipiter novaehollandiae* (grey goshawk) and *Haliaeetus leucogaster* (white-bellied sea-eagle) were only assessed as 'known to occur' if there is a known nest within the survey area.

5.6.2 Impact assessment

An impact assessment has been undertaken for threatened vegetation and threatened flora and fauna species determined as occurring or likely to occur within the survey area.

Conservation advice, recovery plans and relevant Tasmanian Government guidelines have also informed the impact assessment including the Natural Heritage Strategy for Tasmania (DPIPWE 2013) and the Threatened Species Strategy for Tasmania (DPIPWE 2020). These guidelines include:

- Conservation Advice for *Leucochrysum albicans* subsp. *tricolor* (Hoary Sunray)
- *Hirundapus caudacutus* (White-throated Needletail) Conservation Advice (2019).
- Recovery Plan for the Giant Freshwater Crayfish (*Astacopsis gouldi*) (2017).
- *Engaeus yabbimunna* (Burnie burrowing crayfish) – Advice to the Minister for the Environment and Heritage from the Threatened Species Scientific Committee (TSSC) on Amendments to the List of Threatened Species under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Available from: https://www.dcceew.gov.au/environment/biodiversity/threatened/conservation-advices/engaeus-yabbimunna Accessed Wed, 20 Jul 2022.
- *Haliaeetus leucogaster* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat .
- National Recovery Plan for the Spotted-tailed Quoll *Dasyurus maculatus* (2016).
- *Conservation Advice for* Numenius madagascariensis *(eastern curlew)*. Department of the Environment, Canberra. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/847-conservation-advice.pdf
- *Draft Referral guideline for 14 birds listed as migratory species under the EPBC Act* (2015b)
- *Acanthornis magnus* subsp. *greeniana* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat .
- *Apus pacificus* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat.

- *Calidris acuminata* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat .
- *Calidris ferruginea* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat
- *Calidris melanotos* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat
- *Gallinago hardwickii* in Species Profile and Threats Database, Department of the Environment, Canberra. Available from: http://www.environment.gov.au/sprat
- Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species. (2017)
- Tasmanian *Recovery Plan for the Giant Freshwater Crayfish (Astacopsis gouldi)* (2017).
- Approved Conservation Advice for *Perameles gunnii* (Eastern Barred Bandicoot, Tasmania)
- Significant impact guidelines for 36 migratory shorebird species – Migratory species
- Conservation Advice for *Sarcophilus harrisii* (Tasmanian Devil, 2009)
- Approved Conservation Advice for *Tyto novaehollandiae castanops* (Tasmanian Masked Owl, 2010)
- Tasmanian Burrowing Crayfish Group Recovery Plan 2001-2005.
- *Identifying Tasmanian devil and spotted-tailed quoll habitat,* Fauna Technical Note No. 10. Forest Practices Authority
- *Identifying masked owl habitat*. Fauna Technical Note No. 17, Forest Practices Authority
- *Forest Practices Code.* Forest Practices Authority
- *Eagle nest searching, activity checking and nest management.* Fauna Technical Note No. 1 (Version 4.0), Forest Practices Authority
- Survey Guidelines and Management Advice for Development Proposals that may impact on the Tasmanian Devil (*Sarcophilus harrisii*). Tasmanian Department of Natural Resources and Environment.
- Conservation of Tasmanian Plant Species & Communities threatened by *Phytophthora.* Strategic Regional Plan for Tasmania. Technical Report 03/03
- Listing Statement for *Caladenia caudata* (tailed spider-orchid, 2014)
- Threatened Species and Marine Section (2014b). Listing Statement for *Tetratheca 26iliate* (northern pinkbells), Department of Primary Industries, Parks, Water and Environment, Tasmania.
- Threatened Species Scientific Committee (2015). Conservation Advice *Dasyurus viverrinus* (eastern quoll). Department of the Environment and Energy, Canberra.
- Threatened Species Scientific Committee (2016). Conservation Advice *Lathamus discolor* swift parrot. Department of the Environment, Canberra.
- Threatened Species Scientific Committee (2017). Conservation Advice *Astacopsis gouldi* (giant freshwater crayfish, Tasmanian giant freshwater lobster). Department of the Environment and Energy, Canberra.
- *Threatened Tasmanian Eagles Recovery Plan 2006-2010*. Threatened Species Section of the Tasmanian Department of Natural Resources and Environment (2006).

- Listing Statement for *Baumea gunnii* (slender twigsedge). Threatened Species Section of the Tasmanian Department of Natural Resources and Environment (2016).
- National Recovery Plan for the Tasmanian Giant Freshwater Crayfish (*Astacopsis gouldi*). Threatened Species Section of the Tasmanian Department of Natural Resources and Environment (2006).
- Listing Statement for *Ceyx azureus* subsp. *diemenensis* (Azure Kingfisher). Threatened Species Section of the Tasmanian Department of Natural Resources and Environment (2006).
- Notesheet for *Leucochrysum albicans* subsp. *triclor* (grassland paperdaisy). Threatened Species Section of the Tasmanian Department of Natural Resources and Environment (2006).
- Listing Statement for *Senecio psilocarpus* (swamp fireweed). Threatened Species Section of the Tasmanian Department of Natural Resources and Environment (2011).
- Notesheet for *Pomaderris phylicifolia* subsp*. ericoides* (revolute narrowleaf dogwood) and *Pomaderris phylicifolia* subsp*. phylicifolia* (narrowleaf dogwood). Threatened Species Section of the Tasmanian Department of Natural Resources and Environment (2017).
- *Accipiter novaehollandiae* (Grey Goshawk): Species Management Profile for Tasmania's Threatened Species Link. Accessed on 10/2/2021.
- Aquila audax subsp. fleayi (Tasmanian Wedge-tailed Eagle): Species Management Profile for Tasmania's Threatened Species Link. Threatened Species Section of the Tasmanian Department of Natural Resources and Environment (2021).
- Listing statement for *Caladenia patersonii* (Paterson's spider orchid). Threatened Species Section of the Tasmanian Department of Natural Resources and Environment (2001).
- Listing statement for *Persicaria decipiens* (slender knotweed) Threatened Species Section of the Tasmanian Department of Natural Resources and Environment (2003).

The assessment determined the likelihood of impacts occurring to the threatened ecological communities, and flora and fauna species listed under the EPBC Act using the thresholds and criteria defined under the significant impact guidelines for the EPBC Act (Department of the Environment 2013). Impacts to threatened flora and fauna listed under the TSP Act were assessed using the information provided in species listing statements and technical notes and the requirements of the TSP Act. Impacts to state listed vegetation communities under the NC Act were assessed using the Tasmanian Threatened Native Vegetation Communities descriptions.

The impact assessment was carried out based on the project description in Section 4 with no additional mitigation implemented, other than those avoidance measures indicated in the project description. EPRs proposed to mitigate the potential impacts identified to threatened species and ecological communities are consistent with Australian Government documents including conservation advice and recovery plans considered in the impact assessment, therefore no residual impacts for these species or communities are likely.

The assessment of impacts on those threatened ecological communities and species listed under Tasmanian and Australian Government legislation was carried out using:

- the results of the desktop assessment of the likelihood of occurrence of threatened species and ecological communities
- the results of the 2023 field survey
- the 2018 and 2022 targeted penguin surveys

- technical experience and understanding of the distribution and ecology of the species and communities and their sensitivity to disturbance.

The impact thresholds that are outlined in the EPBC Significant impact guidelines 1.1- Matters of National Environmental Significance Environment Protection and Biodiversity Conservation Act 1999' (Department of the Environment 2013) that include specific guidelines which have been prepared for listed species and communities, if required, were then used to assess the impacts without mitigation. The assessment of the degree of impact without mitigation on State listed species was assessed using the information on the current status and extent of populations, the sensitivity of a species to impacts and the current threats provided in listing statements and technical notes and with regard to regulatory requirements.

Impacts on other natural values including conservation reserves and species with special conservation significance that may occur in the project area have been assessed using a significance-based method by considering the sensitivity of a value and magnitude of impact. This method was used to assess the significance of impacts on ecological values in the absence of statutory, nationally, internationally or industry accepted criteria for assessing significance. This approach assesses the sensitivity of an environmental value by considering its conservation status, intactness, uniqueness or rarity, sensitivity to change and replacement potential. The sensitivity (Table 5.1) and magnitude (Table 5.2) criteria, and impact significance matrix used for the impact assessment for other environmental values were used where appropriate and are described in the three tables below. The significance of each impact was assessed based on the combination of the sensitivity of a value and the magnitude of the impact; the significance matrix is shown in Table 5.3.

Cumulative impacts of other proposed developments and impacts of the project to ecosystem resilience are considered in section 8.4.

Table 5.1: Sensitivity criteria

Sensitivity level	Criteria
Very high sensitivity	The environmental value is listed on a recognised or statutory state, national or international register as being of conservation significance (e.g., listed as a Matter of National Environmental Significance under the EPBC Act).
	The environmental value is intact and retains its intrinsic value.
	It is unique. It is isolated to the affected system/area which is poorly represented in the region, territory, country or the world.
	It is fragile and predominantly unaffected by threatening processes. Small changes would lead to substantial changes to the prescribed value.
	It is not widely distributed throughout the system/area and consequently would be difficult or impossible to replace.
High sensitivity	The environmental value is listed on a recognised or statutory state or national conservation significance (e.g., listed as a Matter of National Environmental Significance under the EPBC Act).
	The environmental value is relatively intact and retains most of its intrinsic value.
	It is locally unique to the environment in which it occurs, with few regionally available alternatives.

	It is predominantly unaffected by threatening processes. Small changes would lead to changes to the prescribed value.
	It is not widely distributed throughout the system/area and consequently recovery potential would be limited.
Moderate sensitivity	The environmental value is recorded as being important at a regional level, and may have been nominated for listing on recognised or statutory registers (e.g., nominated for listing as a Matter of National Environmental Significance under the EPBC Act).
	The environmental value is in a moderate to good condition despite it being exposed to threatening processes. It retains many of its intrinsic characteristics and structural elements.
	It is relatively well represented in the systems/areas in which it occurs but its abundance and distribution are limited by threatening processes.
	Threatening processes have reduced the environmental value's resilience to change. Consequently, changes resulting from project activities may lead to degradation of the prescribed value.
	Replacement of unavoidable losses is possible due to its abundance and distribution.
Low sensitivity	The environmental value is not listed nor nominated for listing on a recognised or statutory state or national conservation significance.
	The environmental value is in a moderate to poor condition and is exposed to threatening processes. It does not retain many of its intrinsic characteristics and structural elements.
	It is relatively well represented in the systems/areas in which it occurs, and its abundance and distribution are not limited by threatening processes.
	The environmental value is not sensitive to threatening processes, or threatening processes have already degraded the environmental value's condition, such that changes resulting from project activities are unlikely to lead to further degradation of the prescribed value.
	Replacement of unavoidable losses is possible due to its abundance and distribution.

Table 5.2: Magnitude criteria definitions.

Magnitude level	Criteria
Severe	An impact on an environmental value (ecological community, species population or ecosystem) that extends beyond the operational area and adjacent area to the surrounding area and is evident with respect to natural variability. Viability of environmental value substantially reduced resulting in a highly modified ecological community or severely depleted species population or ecosystem. Effects are long term (>20 years) and affect the viability of an ecological community or ecosystem at the regional level or result in a permanently reduced species population.
Major	An impact on an environmental value (ecological community, species population or ecosystem) that extends beyond the operational area to the adjacent area and is readily detectable with respect to natural variability. Viability of environmental value reduced resulting in a modified ecological community or depleted species population or ecosystem. Effects are longer term (10 to 20 years) and affect the viability of an ecological community or ecosystem at the local level or result in the displacement of a local population.
Moderate	An impact on an environmental value (ecological community, local species population or ecosystem) that extends beyond the operational area to the adjacent area and is detectable with respect to natural variability. Limited reduction in viability of environmental value resulting in partially modified ecological community or locally depleted species population. Effects are medium term (5 to 10 years) with recovery of a partially modified ecological community or species population or ecosystem expected within that timeframe.
Minor	A localised impact on an environmental value (ecological community or individuals) that is short term (<5 years) and does not extend beyond the operational area. Reduction in viability of ecological community, species or ecosystem unlikely. Full recovery expected within that timeframe.
Negligible	A localised impact on an environmental value (ecological community or individuals) that is temporary or short term (< 1 year) and does not extend beyond the operational area. Effects on the ecological community, species or ecosystem are unlikely to be detectable with full recovery expected.

Table 5.3: Matrix for the assessment of significance of impacts

	Sensitivity of environmental value			
Magnitude of impact	**Very High**	**High**	**Moderate**	**Low**
Severe	Major	Major	Major	High
Major	Major	Major	High	Moderate
Moderate	High	High	Moderate	Low
Minor	Moderate	Moderate	Low	Low
Negligible	Moderate	Low	Low	Low

5.6.3 Cumulative impact assessment

The EIS guidelines and EES scoping requirements both include requirements for the assessment of cumulative impacts. Cumulative impacts result from incremental impacts caused by multiple projects occurring at similar times and within proximity to each other.

To identify possible projects that could result in cumulative impacts, the International Finance Corporation (IFC) guidelines on cumulative impacts have been adopted. The IFC guidelines (IFC, 2013) define cumulative impacts as those that 'result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones.'

The approach for identifying projects for assessment of cumulative impacts considers:

- Temporal boundary: the timing of the relative construction, operation and decommissioning of other existing developments and/or approved developments that coincides (partially or entirely) with the project.
- Spatial boundary: the location, scale and nature of the other approved or committed projects are expected to occur in the same area of influence as Marinus Link. The area of influence is defined at the spatial extent of the impacts a project is expected to have.

Proposed and reasonably foreseeable projects were identified based on their potential to credibly contribute to cumulative impacts due their temporal and spatial boundaries (See Appendix E). Projects were identified based on publicly available information at the time of assessment. The projects considered for cumulative impact assessment across Tasmania, Bass Strait and Victoria are:

- The Remaining North West Transmission Developments component of the North West Transmission Developments[1] (see Figure 5.4).
- Guilford Windfarm
- Robbins Island Renewable Energy Park
- Jim's Plain Renewable Energy Park
- Robbins Island Road to Hampshire Transmission Line
- Bass Highway upgrades between Deloraine and Devonport
- Bass Highway upgrades between Cooee and Wynard
- Hellyer Windfarm
- Western Plains Wind Farm
- Cethana PHES
- Table Cape Luxury Resort
- Youngmans Road Quarry
- Port Latta Windfarm
- Port of Burnie Shiploader Upgrade
- Quaylink – Devonport East Redevelopment.

[1] Note that the Staverton to Hampshire Hills 220 kV overhead transmission line (OHTL) and upgrades to the existing OHTLs between Sheffield and Staverton are being assessed separately from the Remaining North West Transmission Developments; the two components comprise the North West Transmission Developments. The Staverton to Hampshire Hills component is not within proximity to the Heybridge Converter Station to be considered as a potential contributor to cumulative impacts.

The Remaining North West Transmission Developments component of the North West Transmission Developments was considered relevant to this assessment based on the potential for cumulative impacts associated with construction activities.

Figure 5.4: Location of the two North West Transmission Development components in relation to the location of the Heybridge converter station and shore crossing.

5.7 Limitations and assumptions

The terrestrial ecology impact assessment is based on desktop and field verified information that was obtained through field surveys undertaken in 2023 along with previous surveys undertaken for penguin presence in 2018 and 2022. However, it is possible that not all flora species that occur across the site were recorded in the survey because of varying flowering times and seasonality of occurrence. In particular, short lived annuals and lilies that may be present at the site may have been missed because they were not able to be identified (they were not flowering) or they were not evident at the time of survey (they were annual plants that had died back or not emerged at the time of survey). None of the species (grasses and short-lived annual plants) that had the potential to be present were listed threatened species. The survey is therefore considered adequate to identify listed threatened species and communities at the site because there were no listed threatened annual flora species that were identified as potentially occurring at the site.

The impact assessment in this report considered potential impacts on listed threatened species and communities based on the assumption that mitigation measures, beyond avoidance measures already used in the project, were not in place. The residual impact assessment then assumed the successful implementation of proposed mitigation measures.

6. Baseline characterisation

6.1 Geomorphological considerations

The Tasmanian Geoconservation Database is an inventory of geodiversity features, processes and systems of conservation significance. There are no geoconservation features in the study area (Tasmanian Geoconservation Database; Environmental GeoSurveys Pty Ltd and A.S. Miner Geotechnical Pty Ltd. 2023). However, there is a listed localised site located approximately 400 m to the north west of the converter station: the Blythe Heads Folding (Figure 5.2) and the significance statement notes that this site is a 'Notable example' of this type of feature (Tasmanian Geoconservation Database). The Blythe Heads Folding will not be impacted by project activities given its distance from the converter station site and the shoreline crossing.

The Geomorphology Technical Report produced by Environmental GeoSurveys Pty Ltd and A.S. Miner Geotechnical Pty Ltd (ESG, 2023) details the fluvial and coastal processes that will be relevant to this coastal site adjacent to the Blythe River and estuary over a "decadal time scale." These processes include "riverine flood and channel dynamics" and "potential erosion and inundation consequences of sea-level rise." The geomorphology report (2023) assesses the overall sensitivity of the converter station site to the processes of riverine flood, coastal erosion and vulnerability, and coastal recession as "non-sensitive."

The converter station site's overall sensitivity to "vegetation Loss/ removal," however, is assessed as "sensitive" from a technical geomorphological perspective (ESG,2023). That is, removal of the "extant vegetation," i.e., the patch of *Eucalyptus amygdalina* coastal forest and woodland (DAC), could "promote instability and erosivity" on that eastern elevated area of the converter station site. This potential impact will be avoided by not clearing this area of verified *Eucalyptus amygdalina* coastal forest and woodland.

The risk of subsidence or collapse of the sand, coastal scrub, and modified land overlying the tunnels (as a result of the sub-surface cable tunnels created by the horizontal directional drilling (HDD) was assessed as part of the Geomorphology Technical Report (ESG,). This potential impact was assessed as primarily relevant during HDD operations, when "ground vibration" may cause "soil movement through ground subsidence" and potentially even "collapse of the surface into the borehole." The risk of subsidence or collapse during HDD operations may be "exacerbated by management or mechanical error and be related to location of the borehole in relation to the surface, drill fluids, migration of water and obstructions and encountered by the drill head." The geomorphology report states that "appropriate conduct of HDD and monitoring to avoid/minimise instability of tunnel and overlying materials is required to reduce the risk of subsidence" and therefore to avoid/minimise impacts of HDD operations on the sand and coastal scrub overlying the tunnel routes.

There is a continued risk of subsidence or collapse of the materials overlying the cable tunnels during cable stringing, during the project's operational phase, and potentially during decommissioning when the cables are removed. This potential impact can be mitigated through the implementation of the following EPRs listed in the geomorphological report (ESG,2023):

- "Develop and implement an **inspection program of ground conditions along the surface HDD alignment** during and following construction to confirm if ground movement or changes in surface conditions is occurring during construction and operation."

- "Develop and implement a **plan for addressing any ground movement identified through the inspection program** which could affect the HDD construction and stability of the surrounding area. Separate plans may be prepared for construction and operation."

Ultimately, the geomorphology report (ESG,2023))) concludes that "implementation of appropriate management measures to comply with EPRs would ensure minimal impact [of HDD to create the tunnels for the cables], and as such no significant residual impacts have been identified in this study, assuming appropriate design, operational protocols and longer-term management actions." Therefore, no residual impacts on the sand and coastal scrub overlying the tunnel routes are expected[2].

6.2 Conservation reserves

There are no conservation reserves within 500 m of the project site. The nearest conservation reserve is the Blythe River Conservation Reserve. This is located 570 m from the south eastern boundary of the site, on the opposite side of the Blythe River.

6.3 Land management agreements and interim protection orders

There are no land management agreements or interim protection orders associated with the project site.

6.4 Vegetation communities

This section provides a baseline characterisation of ecological values within the converter station site and the shore crossing. The converter station survey area was 10.8 ha and was comprised of 1.5 ha of native vegetation and 9.3 ha of modified land, namely cleared land (8.2 ha), with smaller areas of tree plantings (0.6 ha) and weeds (0.5 ha). The shore crossing survey area was 6.5 ha and included 2 ha of native forest, 3 ha of native scrub and 1.5 ha of sandy beach. Note the vegetation discussed in this section is referred to using the three lettered mapping units under TASVEG 4.0 Vegetation Communities (DPIPWE 2020).

6.4.1 Converter Station

The area of native vegetation within the converter station operational area is 1.5 ha of *Eucalyptus amygdalina* coastal forest and woodland (DAC). The remainder of the converter station site (9.3 ha) is comprised of modified communities including extra-urban miscellaneous (FUM), other plantations (FPU) and weed infestation (FWU).

Eucalyptus amygdalina **coastal forest and woodland (DAC)**

This vegetation community occurs as a remnant patch on an elevated area in the south-east corner of the converter station site (Figure 6.1, Figure 5.2). The *Eucalyptus amygdalina* coastal forest and woodland occurs on infertile siliceous soils in coastal and sub-coastal areas of northern and eastern

[2] Given this assessment, no impact is expected on shorebirds that might use this coastal area. The listed shorebird species *Limosa lapponica baueri* (Nunivak bar-tailed godwit) and *Numenius madagascariensis* (eastern curlew) were identified as potentially occurring near the survey area by the Protected Matters Search Tool (PMST). However, the likelihood of occurrence for both species was assessed as "Absent" based on there being no records on Natural Values Atlas database within 5 km of the survey area (Appendix A.1).

Tasmania (Kitchener and Harris 2013). At the site, *Eucalyptus amygdalina* (black peppermint) formed the dominant canopy species to approximately 8 to 10 m with the occasional *E. obliqua* (stringybark tree). The tree layer was comprised of small relatively young trees with no hollow development. The understorey was dominated by a shrub layer of 1 to 2 m height which included *Acacia terminalis* (sunshine wattle), *Leptospermum scoparium* (common teatree), *Allocasuarina zephyrea* (western sheoak), *Leucopogon parviflorus* (coast beardheath), *Banksia marginata* (*silver banksia*), *Leptomeria drupacea* (erect currantbush) and *Exocarpos cupressiformis* (cherry ballart). There were scattered low shrubs including *Epacris impressa* (common heath), *Leucopogon collinus* (white beardheath), *Dillwynia sericea* (showy parrotpea). Herbs, sedges and native grasses were sparsely present and included *Stylidium graminifolium* (triggerplant), *Gonocarpus tetragynus* (common raspwort), *Rytidosperma* species (wallaby grass), *Lomandra longifolia* (sagg), and *Lepidosperma laterale* (variable swordsedge).

There is 1.5 ha of *Eucalyptus amygdalina* coastal forest and woodland within the converter station site (Figure 5.2). *Eucalyptus amygdalina* coastal forest and woodland is not listed as threatened under the *Nature Conservation Act 2002*. This community is quite common and widespread in Woolnorth bioregion with over 23,000 ha (Forest Practices Authority Annual Report, 2021–22). There are no specific natural processes (e.g. fire, flood) important for the maintenance of this native vegetation community.

Figure 6.1: *Eucalyptus amygdalina* coastal forest and woodland (DAC)

Extra-urban miscellaneous (FUM)

Apart from the remnant of *Eucalyptus amygdalina* coastal forest and woodland the rest of the site has been cleared for past industrial uses including a titanium dioxide plant which was decommissioned and removed, and its subsequent use as a log storage area (Figure 5.2). The surface of the urban miscellaneous component is either gravelled or has a cover of introduced pasture grasses and herbs (Figure 6.2).

Figure 6.2: Extra-urban miscellaneous (FUM)

Other plantations other (FPU)

There are two patches of planted native trees within the site one is comprised of *Eucalyptus regnans* (mountain ash) and *Acacia melanoxylon* (blackwood) (Figure 6.3, Figure 5.2). The other is mostly *Acacia melanoxylon* with some *Banksia marginata* which may be regenerating naturally. There were other shrubs present which may also have been regenerating naturally including *Pomaderris elliptica* (yellow dogwood) and *Leptospermum scoparium*. The ground fern *Pteridium esculentum* (bracken) was also commonly present.

Figure 6.3: Other plantation (FPU)

Weed infestation (FWU)

There are patches of weed infestation around the far western boundary of the converter station site (Figure 6.4,Figure 6.5). The introduced mainland species *Kunzea ericoides (*burgan*)* and the introduced shrub *Psoralea pinnata* (blue butterfly bush) along with the native *Acacia longiflora* (coast teatree) were three dominant species present. Other tree and shrub species present included *Buddleja davidii* (butterfly bush) and *Metrosideros excelsa* (pōhutukawa), *Populus alba* (white poplar) and *Pinus radiata* (Monterey pine). Common introduced herbs included *Euphorbia peplus* (petty spurge), *Cirsium vulgare* (spear thistle) and *Conyza* species (fleabane) which was abundant in bare areas (Figure 6.4).

Figure 6.4: Weed infestation (FWU)

Figure 6.5: Weed infestation (FWU)

6.4.2 Shore crossing

The vegetation at the shore crossing is comprised of a narrow coastal strip of native vegetation up to 120 m wide growing on a sandy beach. Two native vegetation communities at the shore crossing area are coastal scrub (SSC) and *Eucalyptus viminalis–Eucalyptus globulus* coastal forest and woodland (DVC; listed as threatened under the *Nature Conservation Act 2002*) were present at the shore crossing site (Figure 5.2).

Coastal scrub (SSC)

Coastal scrub generally occurs on consolidated dunes, sand sheets and rocky headlands close to the coast (Kitchener and Harris 2013). The coastal scrub at the shore crossing is growing on a sand sheet that extends from the Blyther River mouth to the north west where it meets a rocky headland (Figure 5.2). This vegetation community is characterised by the presence of a relatively diverse tall shrub/small tree layer to a height of 2 to 3 m comprised of *Acacia longifolia*, *Allocasuarina verticillata* (drooping sheoak), *Leptospermum laevigatum* (coast teatree), *Leptospermum scoparium*, *Banksia marginata* and *Acacia dealbata* (silver wattle) (Figure 6.6). The dominant feature of the shrub layer was the sprawling coastal shrub *Tetragonia implexicoma* (bower spinach). Other shrubs that were commonly present were *Correa alba* (white correa), *Rhagodia candolleana* (coastal saltbush), *Leucopogon parviflorus* and *Myoporum insulare* (common boobyalla). The spreading herb *Carpobrotus rossii* (native pigface) was commonly present as was the introduced erect herb *Euphorbia paralias* (sea spurge) which grew at the interface of the coastal scrub and the beach. The native grasses *Spinifex sericeous* (beach spinifex), *Poa labillardierei* (silver tussock) and *Austrostipa* species (spear grass) were also present as were the introduced grasses *Dactylus glomerata* (cocksfoot) and *Ammophila arenaria* (marram grass).

There is 3 ha of coastal scrub at the shore crossing. Coastal scrub is not listed as threatened under the NC Act. There is approximately 14,000 ha of this community across Tasmania. There are no specific natural processes (e.g. fire, flood) important for the maintenance of this native vegetation community.

Figure 6.6: Coastal scrub (SSC)

***Eucalyptus viminalis–Eucalyptus globulus* coastal forest and woodland (DVC)**

Eucalyptus viminalis (white gum)–*Eucalyptus globulus* (Tasmanian blue gum) coastal forest and woodland occurs on coastal and near coastal areas on sandy soils. The 2 ha patch of forest was located at the south eastern end of the shore crossing area near the Blythe River mouth (Figure 5.2). *Eucalyptus viminalis* was the dominant tree species to 20 m high. *Eucalyptus amygdalina* and *E. obliqua* were also present as minor components of the canopy layer (Figure 6.7). The tree canopy layer trees appeared to be older regrowth trees with no obvious hollow development. There were no *Eucalyptus globulus* trees present in the vegetation community. Note that the north west coast is outside the natural range of *Eucalyptus globulus*. *Acacia melanoxylon* was present as a sub-canopy tree along with *Exocarpos cupressiformis* and *Banksia marginata*. The shrub layer included *Goodenia ovata* (hop native-primrose), *Cassinia aculeata* (dollybush), *Aotus ericoides* (golden pea) and *Olearia lirata* (forest daisybush). The understorey was dominated by the ground fern *Pteridium esculentum*. The native graminoid *Lepidosperma concavum* (sand sword sedge) was also commonly present. Other graminoids present were *Lomandra longifolia* and *Dianella revoluta* (spreading flaxlily). The native grasses *Poa labillardierei* and *Rytidosperma* species were sparsely present as were the native herbs *Acaena novae-zelandiae* (buzzy), *Senecio linearifolius* (fireweed groundsel) and *Senecio pinnatifolius* (coast groundsel).

There is 2 ha of *Eucalyptus viminalis–Eucalyptus globulus* coastal forest and woodland at the shore crossing. *Eucalyptus viminalis–Eucalyptus globulus* coastal forest is listed as threatened under the *Nature Conservation Act 2002*. There 9.6 ha of this community in the Woolnorth bioregion (Forest Practices Authority Annual Report 2021–22). There are no specific natural processes (e.g. fire, flood) important for the maintenance of this native vegetation community.

Figure 6.7: *Eucalyptus viminalis–Eucalyptus globulus* coastal forest and woodland (DVC)

6.5 Threatened ecological communities

The PMST identified two terrestrial ecological communities that are listed as critically endangered under the EPBC Act as potentially occurring within 5 km of the survey area:

- Tasmanian Forests and Woodlands dominated by black gum or Brookers gum (*Eucalyptus ovata / E. brookeriana*).
- Tasmanian white gum (*Eucalyptus viminalis*) wet forest.

Neither of the two terrestrial ecological communities Tasmanian Forests and Woodlands dominated by black gum or Brookers gum (*Eucalyptus ovata / E. brookeriana*; listed as critically endangered under the EPBC Act) and Tasmanian white gum (*Eucalyptus viminalis*; listed as critically endangered under the EPBC Act) wet forest were recorded within the survey area.

As noted above, the *Eucalyptus viminalis–Eucalyptus globulus* coastal forest community, which occurs at the south eastern end of the shore crossing area adjacent to the Blythe River, is listed as threatened under the NC Act.

6.6 Threatened fauna

6.6.1 EPBC Act listed species

6.6.1.1 Threatened fauna

No threatened fauna species listed under the EPBC Act have been recorded within the survey area. However, the Tasmanian devil (*Sarcophilus harrisii*; listed as endangered under both the EPBC Act and TSP Act) and the spotted-tailed quoll (*Dasyurus maculatus* subsp. *maculatus*; the Tasmanian population of which is listed as vulnerable under the EPBC Act and as rare under the TSP Act) have previously been recorded adjacent to the site (see Appendix A.1), as incidences of roadkill. These species may forage over both the converter station site and the shore crossing, but there is no suitable denning habitat for either species and limited habitat for prey species such as small and medium sized mammals (e.g. *Trichosurus vulpecula*, brush-tailed possum). Thus, these species are unlikely to reside permanently at either site. The shore crossing area is also separated from the native forest to the south by the Bass Highway. This would limit access to the shore area by both Tasmanian devils and spotted-tailed quolls and is less likely to be used by either species. Both the Tasmanian devil and spotted-tailed quoll are highly sensitive to roadkill risk.

There is also one eagle nest recorded on the NVA located over 1.6 km to the west of the converter station (nest # 1323; see Figure 6.8). It is listed as an eagle nest of indeterminate eagle species nests (i.e. wedge-tailed eagle or white-bellied sea-eagle). This nest could not be found in the eagle nest survey undertaken in April 2022 (North Barker 2022). The nest was last observed in 2006 (NVA data) and is now considered to be absent. The next nearest confirmed wedge-tailed eagle nest (nest # 2573) is recorded on the NVA and is 1.7 km to the south of the survey area. Nest #2573 was most recently recorded on 1 April 2022 (NVA data). The wedge-tailed eagle (*Aquila audax* subsp. *fleayi*; listed as endangered under both the EPBC Act and TSP Act) may occasionally overfly the site given that they have large home ranges.

The white-throated needletail (*Hirundapus caudacutus*; listed as vulnerable under the EPBC Act) was also identified as potentially occurring within the survey area namely because it is an aerial species which can occur over coastal areas. The white-throated needletail is a summer visitor to Australia including Tasmania from its breeding grounds in Asia. It is almost exclusively aerial within its Australian distribution and can occur over most types of habitats, most often found above wooded areas including open forests and rainforest. This species may land and roosting habitat can be important. This species prefers to land in areas with tall trees that are well spaced.

There are no records on the NVA within 5 km of the survey area but may occur flying over the site on occasions during the summer months.

6.6.1.2 Listed migratory species

One species, listed as migratory under the EPBC Act, was identified as potentially occurring within the survey area is the fork-tailed swift (*Apus pacificus*; listed as both a marine and migratory species under the EPBC Act). Similar to the white-throated needletail, the fork-tailed swift is migratory species which visits Tasmania during the summer months. It is also an aerial species which rarely comes to land and occurs over wide range of open habitats. Although there are no NVA records within 5 km of proposed route, the species still could potentially occur flying over the site on occasions during the summer months.

6.6.2 TSP Act listed species

One species, listed under the TSP Act, was identified as potentially occurring within the survey area, the white-bellied sea-eagle (*Haliaeetus leucogaster*; listed as vulnerable under the TSP Act). The eagle nest is also mentioned above under the EPBC Act listed species (Section 6.6.1.1), is recorded on the NVA as nest #1323. This nest is located over 1.6 km to the west of the converter station and is listed as an eagle nest of indeterminate species (see Figure 6.8). Note that this nest could also have been used by the white-bellied sea-eagle. As stated above, this nest was unable to be found in the eagle nest survey undertaken in April 2022 (North Barker 2022) and was last observed in 2006 (NVA data). Nest #1323 is now considered to be absent. The nearest known white-bellied sea-eagle nest (nest # 2273) is located on the Emu River, 4.8 km to the south west, and was most recently recorded in February 2023 (NVA data).

6.6.3 Other fauna species

There were no observations during field surveys of little penguin (*Eudyptula minor*; a listed marine species under the EPBC Act) burrows or individuals at the Heybridge shore crossing point.

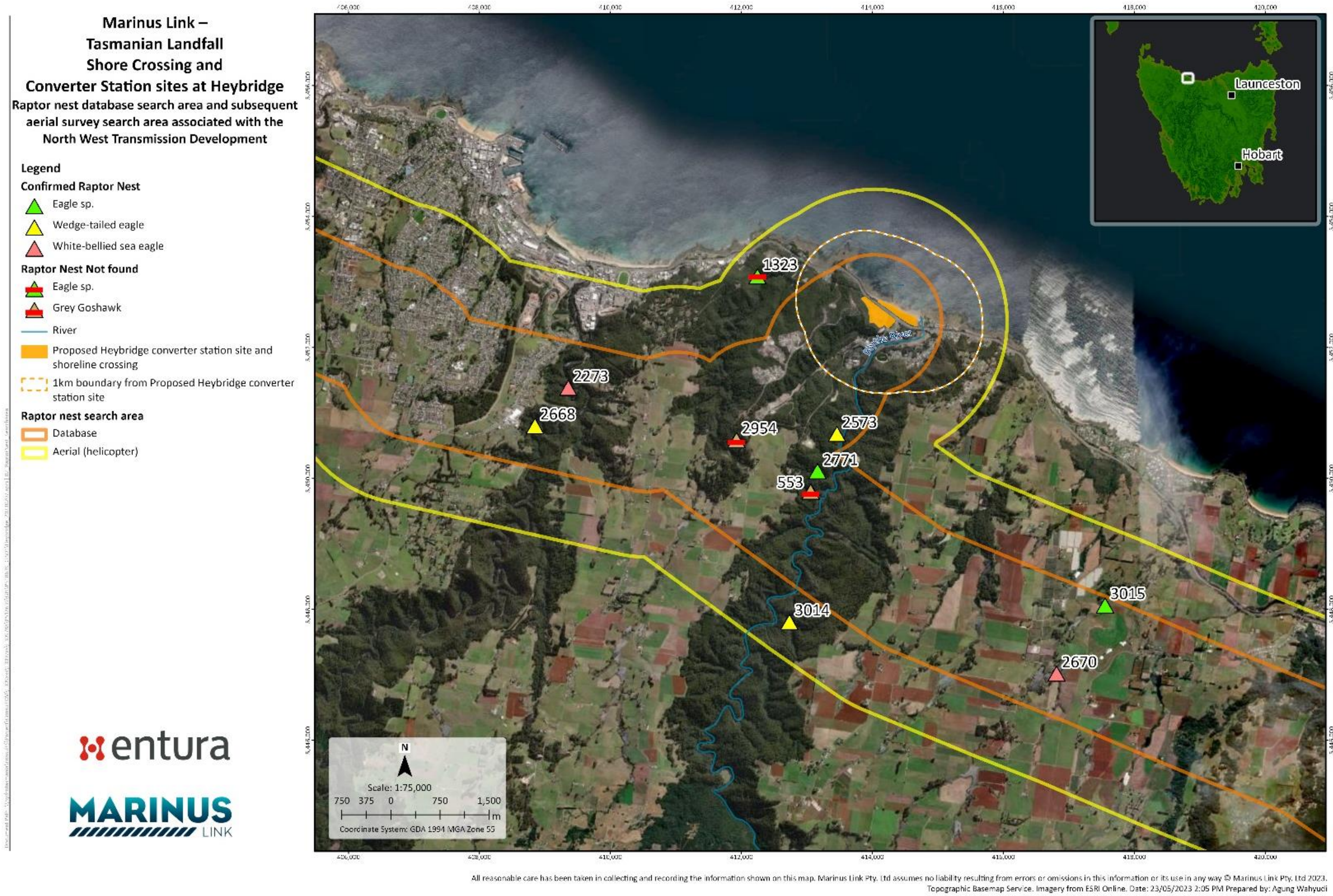

Figure 6.8: Raptor nests in the vicinity of the Heybridge Converter Station as identified by review of NVA data and recent nest searches undertaken for the North West Transmission Developments. Nest search area indicated overlaps with the 1 km boundary of the site.

6.7 Threatened flora

6.7.1 EPBC Act listed species

No threatened flora species were identified as potentially occurring within the converter station site or the shore crossing. Three flora species were identified in the baseline assessment within the survey area through the PMST tool or with records on the NVA. These species were *Caladenia caudata* (tailed spider orchid; listed as vulnerable under the EPBC Act), *Leucochrysum albicans* var. *tricolo*r (hoary sunray; listed as Endangered under the EPBC Act) and *Senecio psilocarpus* (swamp fireweed; listed as vulnerable under the EPBC Act),).

However, a review of the current range and habitat requirements found that they were either absent, i.e. they were outside of their known range and had no NVA records within 5 km; or unlikely to occur because of the absence of suitable habitat within the survey area. A complete list of threatened flora species and their likelihood of occurrence is provided in (see Appendix A.2).

6.7.2 TSP Act listed species

No threatened flora species were identified as potentially occurring within the converter station site or the shore crossing. Eight flora species listed as threatened under the TSP Act were identified as potentially occurring in the study area in the baseline assessment through records on the NVA. These species were *Baumea gunnii* (slender twigsedge), *Caladenia patersonii* (Paterson's spider-orchid), *Caladenia pusilla* (tiny fingers), *Persicaria decipiens* (slender waterpepper), *Tetratheca ciliate* (northern pinkbells), *Caladenia caudata* (tailed spider orchid), *Leucochrysum albicans* var. *tricolo*r (hoary sunray) and *Senecio psilocarpus* (swamp fireweed).

However, a review of the current range and habitat requirements found that they were either absent, i.e. they were outside of their known range and had no NVA records within 5 km; or unlikely to occur because of the absence of suitable habitat within the survey area. A complete list of threatened flora species and their likelihood of occurrence is provided in (see Appendix A.2).

6.8 Weeds and diseases

6.8.1 Declared weeds

A total of 44 introduced flora species were recorded within the survey area (see Appendix B). Seven of these are declared weeds under the *Weed Management Act 1999* (TAS) and *Biosecurity Act 2019*. Four of these declared weeds occurred at the shore crossing:

- *Chrysanthemoides monilifera* subsp. *monilifera* (boneseed): Two plants were recorded in the coastal scrub (SSC) community.
- *Rubus fruticosus* aggregate (blackberry): was recorded across the coastal scrub community.
- *Senecio jacobaea* (ragwort): One plant recorded within the coastal scrub community.
- *Ulex europaeus* (gorse): Three plants recorded within the coastal scrub community.

Three declared weed species were encountered within the converter station site:

- *Cirsium arvense* var. *arvense* (Californian thistle): a number of small patches were observed across the site.
- *Cortaderia species* (pampas grass): five plants were recorded along the southern boundary of the site, however they were not flowering at the time of the survey so the species could not be confirmed.
- *Erica lusitanica* (Spanish heath): 10 plants were recorded adjacent the eastern most end of the other plantation community.

The survey area is within the Burnie Local Government Area. The management objectives for declared weeds are identified in the Statutory Weed Management plans and are defined for each weed by whether the weeds are identified as Zone A or Zone B within each municipality. The objective of weed management for Zone A species within the municipality is to 'Implement integrated control program for eradication and prevent future occurrences.' The objective of weed management for Zone B species within the municipality is 'Containment within municipal boundaries, protection of specified areas within municipal boundaries, prevention of spread to Zone A municipalities.' The relevant management zone for each of the declared weed species is shown in Table 6.1

Under the *Biosecurity Ac*t 2019 it is a requirement to fulfill the General Biosecurity Duty. With respect to weeds, this requires that actions are taken to prevent the introduction or spread of weeds in accordance with Statutory Weed Management plans or Biosecurity Plans.

Table 6.1: Principal management objectives in Statutory Weed Management Plans for declared weeds recorded within the survey area

Species	Common name	Burnie
Rubus fruticosus aggregate	Blackberry	Zone B
Chrysanthemoides monilifera subsp. *monilifera*	Boneseed	Zone B
Cirsium arvense var. arvense	California thistle	Zone B
Ulex europaeus	Gorse	Zone B
Cortaderia species	Pampas grass	Zone A
Senecio jacobaea	Ragwort	Zone A
Erica lusitanica	Spanish heath	TBC[3]

6.8.2 *Phytophthora cinnamomi*

Commonly known as root rot or dieback, *Phytophthora cinnamomi* is a soil-borne fungal pathogen that invades the roots of plants and starves them of nutrients and water. It is generally spread by the transportation of soil on vehicles, construction machinery and walking boots. Soils that are more favourable for the spread of *Phytophthora* are generally the low nutrient types that support healthy communities. The vegetation types most affected in Tasmania are heathland, moorland and dry sclerophyll forest.

[3] TBC – pending confirmation as Statutory Weed Management Plan was not available on the NRE website at the time of writing. In the absence of a Statutory Weed Management Plan for this species, it is recommended conservatively treating Burnie municipality as being Zone A in relation to the control of *Erica lusitanica*

There are native vegetation communities within the survey area that are potentially susceptible to *Phytophthora.* The *Eucalyptus amygdalina* coastal forest and woodland (shown in Figure 5.2) is considered highly susceptible to *Phytophthora* (Schahinger et. al. 2003). Whereas the coastal scrub and the *Eucalyptus viminalis–Eucalyptus globulus* coastal forest are considered to have variable or moderate susceptibility (Schahinger et. al. 2003). There are no *Phytophthora cinnamomi* records on the NVA within 5 km of the survey area although there are two records from 1984 just over 5 km away. No symptoms of infection (i.e. dieback in susceptible species) were recorded during field surveys.

7. Ecological values and sensitivity

7.1 Ecological communities

Three native vegetation communities were recorded at the converter station or shore crossing site: *Eucalyptus amygdalina* coastal forest and woodland (DAC), coastal scrub (SSC), *Eucalyptus viminalis–Eucalyptus globulus* coastal forest and woodland (DVC). None of these communities are listed under the EPBC Act. However, the *Eucalyptus viminalis–Eucalyptus globulus* coastal forest and woodland (DVC) which was recorded within the shore crossing survey area is listed as threatened under the NC Act. This community occurs as small remnants across eastern and northern Tasmania and all patches would be considered important for the conservation of the community; thus it would have high sensitivity.

7.2 Flora

No flora species listed under the TSP Act or EPBC Act have been recorded at the converter station nor at the shore crossing site.

7.3 Fauna

Six threatened fauna species were identified as potentially occurring at the converter station and shore crossing area (Table 7.1). Two of these are bird species listed as threatened under the EPBC Act; the fork-tailed swift (*Apus pacificus*) and white-throated needletail (*Hirundapus caudacutus*). Both are aerial species which may fly over the site but will not use the site, as they do not come to land. As listed species, they have high sensitivity to disturbance from the activities associated with the construction and operation of the converter station and shore crossing.

Two other bird species, the Tasmanian wedge-tailed eagle (*Aquila audax* subsp. *fleayi*) and the white-bellied sea-eagle (*Haliaeetus leucogaster*) were identified as potentially occasionally overflying the site as they have been sighted within 5 km of the converter station and shore crossing. There are no known eagle nests within 1 km of the survey area and the nearest eagle nest is over 1.5 km but has not been verified as present since 2006. Therefore, it is unlikely that the construction and operation of the converter station and shore crossing will disturb breeding birds. However, as listed species both of these have high sensitivity.

Two mammal species – the Tasmanian devil (*Sarcophilus harrisii*) and spotted-tailed quoll (*Dasyurus maculatus* subsp. *maculatus*) – may occasionally pass over the converter station and shore crossing site and will be unlikely to be affected by activities associated with the construction and operation of the converter station and shore crossing site. However, roadkill has been identified as a major threat to Tasmanian devils and spotted-tailed quolls, with records of roadkill carcasses of both of these species from the Bass Highway and Minna Road. As listed species both have high sensitivity to impacts.

Tasmanian devils and spotted-tail quolls are most susceptible to road mortality at “night-time”, between the period one hour before dusk to one hour after sunrise. Construction activities and associated traffic movements for the most part will involve morning traffic (7 am) arriving at site during the period just after sunrise. While most traffic leaving site (4 pm) will be during daylight hours. However, during the shorter days in April to September there will be potential for heavy vehicle and worker transport movements to site to occur at dawn and dusk periods, when there is potential for animal activity (see section 8.1.3). In addition, the horizontal directional drilling for the shore crossing will progress 24 hours a day, seven days a week until the drilling is completed and may also involve transport movements between dusk and dawn.

Table 7.1: Fauna species sensitivity

Species name	Common name	Sensitivity	Sensitivity rationale
Sarcophilus harrisii	Tasmanian devil	High	Listed species No important habitat components on sites (den) Potential to use site; known previous observations of carcasses on Minna Rd and Bass Hwy nearby, and therefore roadkill risk Frequently are attracted to foraging on carcasses of other roadkill species Vehicle strikes are often lethal
Dasyurus maculatus subsp. *maculatus*	Spotted-tailed quoll	High	Listed species No important habitat components Potential to use site; known previous observations of carcasses on Minna Rd and Bass Hwy nearby, and therefore roadkill risk Frequently are attracted to foraging on carcasses of other roadkill species Vehicle strikes are often lethal
Apus pacificus	fork-tailed swift	High	Aerial species that may occur over survey area but will not use survey area Listed species
Aquila audax subsp. fleayi	Tasmanian wedge-tailed eagle	High	No nest currently within 1 km of site. No disturbance to breeding birds. Listed species
Haliaeetus leucogaster	white-bellied sea-eagle	High	No nest currently within 1 km of site. Listed species
Hirundapus caudacutus	white-throated needletail	High	Primarily aerial species that may occur over survey area but will not use survey area Listed species

8. Impact assessment

8.1 Construction

This section describes pathways for potential impacts to terrestrial ecological values as a result of the construction at the converter station site and the shoreline crossing are covered in this section. These provide an outline of the ecological value, the significance of the impact to the value and Environmental Performance Requirements (EPRs) that are recommended for implementation to limit the impact to these. The assessment of the significance of the impact for each of the terrestrial ecological values is summarised in Table 8.4. Note that there are no sites of geoconservation significance within the study area (Figure 5.2).

8.1.1 Native vegetation communities

There are areas of native vegetation located on the converter station and shore crossing sites. These include:

- On the converter station site, an area of 1.5 ha of *Eucalyptus amygdalina* coastal forest and woodland community (DAC)
- On the shore crossing, 3 ha of coastal scrub vegetation community (SSC) and 2 ha of the NC Act listed *Eucalyptus viminalis–Eucalyptus globulus* coastal forest and woodland vegetation community (DVC).

8.1.1.1 Impact pathway and significance

Disturbance to both of the above vegetation communities is avoided as part of the project description, and therefore there is no impact pathway and no impacts to these. No triggers under either the NC Act or EPBC Act are activated, as there are no threatened vegetation communities impacted. The following details the project plans to preserve native vegetation communities, and also identifies potential threats to these from construction activity. The project will avoid impacts to native vegetation through implementation measures to comply with EPRs (detailed in Table 8.5). These measures will be documented in the CEMP .

The current project plan in relation to the disturbance of these vegetation communities indicates the following:

- The *Eucalyptus viminalis–Eucalyptus globulus* coastal forest and woodland (DVC) at the shore crossing site will not be impacted as the cable will be connected to the converter station by horizontal direct drilling from the converter site to the sea, underneath the shoreline. The HDD for the HDVC subsea cable will not be drilled underneath the *Eucalyptus viminalis–Eucalyptus globulus* coastal forest and woodland and therefore will not impact this State-listed community. Zero hectares of the *Eucalyptus viminalis–Eucalyptus globulus* coastal forest and woodland (DVC) are expected to be cleared.
- Zero hectares of the coastal scrub (SSC) are expected to be cleared.
- The *Eucalyptus amygdalina* coastal forest and woodland community at the converter station site is not part of the construction footprint or planned to be cleared. Zero hectares of the *Eucalyptus amygdalina* coastal forest and woodland (DAC) will be cleared.

- The potential to transport of weeds and diseases (*Phytophthora*) to/from site poses risks to the existing native vegetation community, particularly vectors such as construction vehicles. Specifically, the *Eucalyptus amygdalina* coastal forest and woodland community on the converter station site is very susceptible to *Phytophthora* infection.
- The depth at which the HDD will pass under the shoreline will exceed 10 m and will be well below the vegetation root zone.

The project's EPRs (Table 8.5) below aim to preserve native vegetation, avoiding native vegetation clearing, while also preventing the introduction or spread of weeds, pests and pathogens in compliance with the Biosecurity Regulations 2022 and the *Biosecurity Act 2019*. It will be important to ensure that mitigation measures are developed and incorporated into the design and construction in order to meet the EPRs. The following mitigation measures are recommended measures to comply with EPRs (Table 8.5):

- Continue to use areas of existing disturbance (i.e. the currently cleared areas) to access and construct infrastructure to eliminate disturbance to native vegetation, where practicable.
- Flag and/or fence-off areas of native vegetation to be preserved.
- If hazard trees are located within areas of native vegetation to be preserved, these hazard trees should be clearly identified and marked for removal. Hazard trees include dead or dying trees, and trees with obvious externally visible defects, at high risk of failure in foreseeable weather conditions, and upon failure may provide safety risks during construction.
- Felling hazard trees into the open area on site to avoid damage to adjacent vegetation, where safe to do so. Where unsafe, fell tree and leave in-situ.
- Avoid movement of vehicles and machinery through native vegetation.
- Implement a Hot Work Process in consultation with TasFire that (as a minimum) to reduce risk of bushfire ignition.
    - Requires weather conditions and fire risk to be monitored.
    - Prohibits hot work on total fire ban days.
    - Permits hot work in cleared areas only.
    - Requires appropriate fire suppression equipment at site.
    - Requires monitoring of works for sparks that might ignite vegetation.
- If necessary to clear native vegetation, do so in a manner that allows fauna to disperse into adjacent native vegetation.
- Induct contractors and employees in the identification of weeds, specifically declared weeds.
- Induct contractors and employees in the identification of plant pathogens including dieback.
- Provide onsite vehicle hygiene training and implement a vehicle clean-down checklist that includes the requirements outlined in the Weed and Disease Planning and Hygiene Guidelines - Preventing the spread of weeds and diseases in Tasmania (DPIPWE 2015).
- Identify, map, demarcate and treat/eradicate weed infestations.
- Work from clean sites to weed infested sites, if weed infested sites cannot be avoided. Clearly identify access routes.
- Avoid working in weed infested sites while in seed, if weed infested sites cannot be avoided.

- Follow quarantine notices or directions from relevant authorities for the control of declared weeds, considering the General Biosecurity Duty.
- Do not drive through weed infestations without implementing appropriate or recommended biosecurity procedures.
- Wash down vehicles, plant and equipment and boots prior to entering and on leaving declared weed infested areas in accordance with the *Weed and Disease Planning and Hygiene Guidelines - Preventing the spread of weeds and diseases in Tasmania* (DPIPWE 2015) and in accordance with the Biosecurity Regulations 2022 under the *Biosecurity Act 2019*.

8.1.1.2 Environment Performance Requirements

The following EPRs are proposed to protect native vegetation communities from clearing and introduction of weeds, pests or pathogens.

EPR ECO1: Minimise vegetation removal and implement vegetation protection measures

1. To inform the project design, develop and implement measures to avoid and otherwise minimise to the extent practicable impacts on native vegetation. The design must avoid the eucalyptus woodland vegetation in the northeast corner of the site.
2. Prior to commencement of project works, develop a vegetation management plan to avoid and otherwise minimise impacts to vegetation, covering as a minimum:
   (a) Identification of areas of important flora and fauna habitat to be protected during construction.
   (b) Fencing protected areas and no-go zones to prevent access during construction.
   (c) Pre-construction site assessment to confirm that vegetation and trees to be retained have been adequately protected from impact.
   (d) Vegetation clearing controls and protection measures.
   (e) Implementation of appropriate measures to manage the risk of spread and introduction of weeds and pathogens during construction.
   (f) Procedures if unexpected threatened species are identified.

The vegetation management plan must be a sub plan of the CEMP and implemented during construction.

EPR ECO4: Operational implementation of vegetation protection measures

1. As part of the OEMP, develop a vegetation management plan for operations to avoid and otherwise minimise impacts that covers:
   (a) Demarcation of areas of important flora and fauna habitat to be protected during normal maintenance and operations.
   (b) Implementation of appropriate measures to manage the risk of spread and introduction of weeds and pathogens during normal maintenance and operations.

The vegetation management plan must be a sub plan to the OEMP and implemented in operation.

8.1.2 Flora

There are no flora species listed under either the TSP Act or the EPBC Act located on site. With the absence of any protected flora there will be no impact to protected floral values.

8.1.3 Fauna - Tasmanian devils and spotted-tailed quolls

Threatened fauna which have the potential to be impacted are Tasmanian devils and spotted-tailed quolls.

The EPBC listed mammals Tasmanian devil (*Sarcophilus harrisii*) and spotted-tailed quoll (*Dasyurus maculatus* subsp*. maculatus*) may occasionally pass over and exist in the vicinity of the converter station and shore crossing site. Whilst there are no previous records or observations during the survey of suitable denning habitat in the vicinity of the sites, there is the possibility of roadkill from road traffic movements between dusk and dawn, and there have been a small number of nearby records of roadkill of both species on Minna Road (one spotted-tailed quoll, one Tasmanian devil) and the Bass Highway (one Tasmanian devil).

8.1.3.1 Impact pathway and significance

The EPBC significant impact criteria for the Tasmanian devil and spotted-tail quoll were used in the assessment of impacts to these species. The criteria are included in Appendix C.

The *Survey Guidelines and Management Advice for Development Proposals that May Impact on the Tasmanian Devil* (Natural and Cultural Heritage Division 2015b) propose that where there is increased night-time road use (between one hour before dusk and one hour after dawn) that a traffic impact assessment is undertaken and is used in conjunction with assessments of the local Tasmanian devil population information from both desktop and survey data to determine if there is a potential for a substantial impact (i.e. predicted >10% increase in deaths due to roadkill). Note that guidelines to be released will redefine the night-time period to one hour before sunrise to one hour after sunrise, and this is used here in determining the quantum of increase in night-time traffic. The traffic impact assessment and assessment of increase in roadkill of the local Tasmanian devil population is provided below.

Construction and associated traffic movements are planned to occur at the beginning and end of each working day, which will be at 7 am and 4 pm (Stantec 2023). The majority of heavy vehicle and worker traffic movements will occur at these times (Stantec 2023). Some of these movements will be considered night-time movements occurring in periods one hour after sunrise or one hour before sunset (Table 8.1). Most night-time movements will occur in the morning transit to site (at 7 am) with 288 days annually having sunrises after 6 am.

Transport movements occurring in the evening from the construction site will mostly be considered daylight movements; however, there are 39 days a year when sunsets occur before 5 pm, when both morning and evening movements will occur at night-time during mid-winter. There will also be 77 days each year when neither the morning or evening movements will occur during night-time. Therefore, in this assessment, a typical day has been estimated as having one period per day when all heavy vehicle and worker transport traffic movements will occur at “night-time”.

Table 8.1: No. of days and proportion of year when timing of vehicle movements at 7 am and 4 pm will be considered night-time movements (i.e. sunrises after 6 am or sunsets before 5 pm). Calculations from Geoscience Australia data for 2023.

Morning		**Evening**	
Sunrises after 6 am (annual number)	**Sunrises after 6 am (% of year)**	**Sunsets before 5 pm (annual number)**	**Sunsets before 5 pm (% of year)**
288	**79**	39	**11**

Table 8.2: No. of days per year when heavy vehicle and worker movements occur at day-time or night-time, and estimated daily night-time traffic movements

Worker transit periods timing relative to day-time/night-time	No. of days per year	Daily night-time traffic movements
Two day-time periods (7am and 4 pm)	77	0
One night-time period (7 am) and one day time period (4 pm)	249	210
Two night-time periods (7 am and 4 pm)	39	420

The proposed maximum increase in traffic movements are 30 heavy vehicles and 180 light vehicles movements – a total of 210 movements each in the morning and evening (Stantec 2023). The calculation of the relative increase in night-time traffic volume (estimated as 5 pm-7 am) as a result of construction assumes one transit period per day is typically during night-time occurs (i.e. morning). On this basis, there will be an approximately 2.65-fold increase in night time traffic on Minna Road between the Bass Highway intersection and the entrance to the site. The busier Bass Highway would have an approximate increase night-time traffic of 3.2 % (Table 8.3).

Table 8.3: Night-time increases in vehicle movements to and from site relative to recent traffic measurements.

Measured weekday night-time movements (5pm-7am)	Average additional daily night-time vehicle movements	% increase in night-time traffic
Minna Road		
127	210	165 %
Bass Highway		
6501	210	3.2 %

Traffic movements are also expected to occur at night-time whilst the HDD is being undertaken - as the potential exists for the change-over of operator shifts of the drilling equipment. The number of movements likely to occur in relation to the HDD operation has not been specified, however is assumed by Stantec (2023) to be only ten movements each at 7 am and 7 pm, which would provide only a minor increase in proportion of traffic movements.

Minna Road between the intersection with the Bass Highway and the entrance to the site, has a potential increased risk of roadkill as a result of the level of increase in night-time traffic. This includes the HDD operator vehicle movements that may occur at night, but particularly the 165 % increase in traffic from general worker and heavy vehicle transport movements arriving at site in the morning. As required in the guidelines (Natural and Cultural Heritage Division 2015b), a number of factors have been taken into consideration in assessing the impact on the local population due to roadkill of Tasmanian devils or spotted-tailed quolls. In particular:

- The increase in traffic volume of 165%
- Populations of these species in the area are low, with very few observation records over a 20-year period
- There is a lack of evidence of individuals residing in the surveyed locations (e.g. no scats)
- There is a lack of suitable denning habitat in the vicinity

The length of the section of Minna Road with increased traffic is short; less than 200 m between the Bass Highway and the site entrance. As a consequence of being a short stretch of road the potential to reach high speeds over this distance, especially for heavy vehicles, is considered low. Based on the above information, whilst the potential increase in risk is not easily quantified, it suggests that the risk to the local population of Tasmanian devils and spotted-tailed quolls is likely to be low. However, in order to mitigate the potential for increased risk of roadkill, it is advisable to instigate mitigations proposed below as part of the EPRs.

The Bass Highway has an estimated increase in night-time traffic of 3.2 %. As this is lower than 10 %, the impact of increases in traffic on roadkill are considered to be negligible, and mitigation measures are not considered necessary to satisfy the EPR.

Measures will be developed to comply with EPRs (Section 8.1.3.2, Table 8.5) and documented in the CEMP, to reduce impacts to Tasmanian devils and spotted-tailed quolls on Minna Road, and may include:

- Education on wildlife-vehicle collisions and maintaining low speeds between dusk and dawn as part of inductions and daily toolbox sessions. Operating procedure developed and distributed to all staff with instructions on what to do in the event of a fauna road incident, including injured or orphaned wildlife.
- Monitoring Minna Road daily (between the Bass Highway and the site entrance) for roadkill, with mortalities moved off the road immediately when encountered to limit the likelihood of threatened carnivorous fauna including Tasmanian devils and quolls being attracted to the carrion and the increased risk of road mortality.
- Recording and reporting process for incidents of vehicle strikes and/or roadkill of Tasmanian devils and spotted-tailed quolls on Minna Road between intersection with Bass Highway and the entry to site via the online Natural Resources and Environment Tasmania roadkill report form, which can be accessed at https://nre.tas.gov.au/wildlife-site/Pages/Report a Roadkill Sighting.aspx.
- Reducing the amount of night-time construction traffic with measures compliance with recommended measures such as:
    - Maintain converter station construction hours, where possible, to daylight hours
    - If night-time, dawn or dusk transport to work is required, minimise traffic movements by providing bus services for the majority of the staff during the construction period.

  - Schedule known night-time work (HDD) operator shift changes to coincide, as much as practicable, to daylight hours.

- Design and use lighting in a manner that attempts to employ the use of minimal light for safety on sight and minimises light impacts on surrounding areas, reducing the disturbance to fauna.
- Manage trenching to minimise impacts to fauna through the following recommended measures:
  - Minimising the period that trenches remain open
  - Construction of trenches to allow exit of fauna that may fall into trenches (e.g. ramping at trench ends)
  - Checking trenches each morning for the presence of fauna
  - Having procedures for notification of wildlife rescue organisations, should these be required.

8.1.3.2 Environmental Performance Requirements

The following EPR will be implemented to protect Tasmanian devils, spotted-tailed quolls and other fauna from impact during construction.

EPR ECO2: Implement measures to protect fauna

1. Prior to commencement of project works, develop a fauna management plan to avoid and otherwise minimise impacts to fauna, covering as a minimum:

   (a) Protection measures for Tasmanian devils and spotted-tailed quolls with a focus on construction traffic and awareness regarding roadkill included in site inductions

   (b) Recording and reporting process for incidents of vehicle strikes and/or roadkill of Tasmanian devils and spotted-tailed quolls on Minna Road between intersection with Bass Highway and the entry to site, where vehicles associated with the project will travel, via the online Natural Resources and Environment Tasmania roadkill report form**,** which can be accessed at https://nre.tas.gov.au/wildlife-site/Pages/Report a Roadkill Sighting.aspx. Removing mortalities off the road within a specified distance of site to reduce attracting carnivorous fauna

   (c) Design and utilisation of night lighting to a minimum amount required to safely operate the site and to reduce light pollution and adverse effects to fauna species.

   (d) Trench management procedures to avoid animals entering trenches or being recovered from trenches

   (e) Pre-clearance surveys of construction areas for threatened fauna species prior to vegetation removal and undertaken by a suitably qualified ecologist.

The fauna management plan must be a sub plan of the CEMP and implemented during construction.

8.1.4 Fauna - Raptors

The EPBC listed wedge-tailed eagle (*Aquila audax* subsp. *fleayi*) and the TSP Act listed white-bellied sea-eagle (*Haliaeetus leucogaster)* have no known nest sites within 1 km of the site. The nearest eagle nest is 1.5 km from site, but has not been verified as present since 2006. Individuals of both species may occasionally overfly the site as they have large home ranges.

8.1.4.1 Impact pathway and significance

Both species of raptor are currently unlikely to be impacted by the construction of the converter station and shoreline crossing as there are no known nests within 1 km of the site. However, if a raptor nest is constructed within a distance of 500 m (with or without line-of-sight) or located within 1 km (with line-of-sight) in the period prior to construction, then there is the potential for the project to impact on raptors, as per the *Threatened Tasmanian Eagles Recovery Plan 2006-2010* and the Environment Protection Authority's *Guide to Eagle Nest Searching and Nest Activity Checks*, Version 1.

In order to comply with the EPR (Table 8.5) below, possible mitigation measures to reduce impacts to raptors to both detect nests and reduce impacts in the event of finding nests within a distance of 500 m or within 1 km line-of-sight include:

- Conduct additional nest searches (within 1 km of site) annually until construction is completed, to detect any new nests, to schedule construction and scheduled maintenance (excluding emergency access and repairs) outside of the breeding season.
- Undertake nest searches using the methods outlined in Section 4 of the 'Eagle nest searching, activity checking and nest management' Technical Note (Forest Practices Authority 2023) by a suitably qualified person. Conduct activity checks outside the eagle breeding season (July to January inclusive).

8.1.4.2 Environmental Performance requirements

The following EPR is proposed to protect raptors from impact during construction.

EPR ECO3: Implement measures to protect raptors

1. Prior to commencement of project works confirm that there are no nests within a distance of 500 m, or within 1 km line-of-sight prior to construction using data collected within one year of construction commencing.
2. Undertake further nest survey if there is no current (within one year) survey of nest presence and to avoid impacts to raptors outside of the breeding season, as per the *Threatened Tasmanian Eagles Recovery Plan 2006-2010* and the Environment Protection Authority's *Guide to Eagle Nest Searching and Nest Activity Checks*, Version 1.
    (a) If a nest is observed within a distance of 500 m, or within 1 km line-of-sight prior to construction the following will be required:
        (i) Avoid project activities within a distance of 500 m, or within 1 km line-of-sight of active eagle nests during breeding season in accordance with guidelines outlined in the FPA Fauna Technical Note No. 1
        (ii) Construction to be deferred until outside of the breeding season if a nest within a distance of 500 m, or within 1 km line-of-sight is determined to be active as per FPA Fauna Technical Note No. 1. All nests are to be treated as active during the breeding season until determined as inactive by a suitable qualified person.

8.1.5 Fauna - Fork-tailed swift and white-throated needletail

Two further bird species listed as threatened under the EPBC Act; the fork-tailed swift (*Apus pacificus*) and white-throated needletail (*Hirundapus caudacutus*) are aerial species. These may fly over the site but will not use the site. While both species are considered aerial species, the white-throated needletail has been known to roost amongst dense foliage and hollows (Corben et al. 1982; Quested 1982; Day 1993; Tarburton 1993, 2015), preferring areas that have widely spaced trees. These two aerial bird species have low sensitivity to disturbance from the activities associated with the construction and operation of the converter station and shore crossing, by virtue of their primarily aerial habit. The small amount of vegetation cleared in relation to the potential for the white-throated needletail roosting trees to be affected, the degree of clearing on site is minimal, and are unlikely to be impacted.

8.1.6 Residual impacts

The pre-mitigated assessments of the impact magnitude to most of the values was considered to be negligible. Only Tasmanian devils and spotted-tailed quolls had pre-mitigated assessment of minor magnitude of impact. The significance of the impacts were considered to be low for most identified ecological communities, flora and fauna species (Table 8.4) on the basis of the matrix that considers both the sensitivity of the value and the magnitude of the potential impact (Section 5.6.2). As a result of the high sensitivity and low magnitude of impact for Tasmanian devils and spotted-tailed quolls, the significance of the impact was assessed as moderate.

Through the implementation of measures to comply with EPRs (Table 8.5), which aim to further reduce the impact, there is an assessed reduction in the potential magnitude of impact to Tasmanian devils and spotted-tailed quolls from minor to negligible.

The magnitude of the residual impact on all identified values due to the construction of the converter station and shore crossing is therefore considered to be negligible and of low significance.

There are a number of mitigation measures expected to be implemented to achieve the EPRs and reduce the residual risk. These include measures to mitigate against:

- Impacts to Tasmanian devils and spotted-tailed quolls (e.g. limiting traffic movements to daylight hours, if night-time work utilise buses to limit traffic)
- Impacts to raptors (e.g. undertake pre-construction nest survey, construction mitigations in the event of finding a nest)
- Ongoing risks related to weed management (e.g. identification and eradication of weeds on site, site hygiene) as well as the appropriate management of native vegetation on site (e.g. avoiding use of areas where native vegetation is present, avoiding removal of vegetation by only removing trees that may be hazardous), in compliance with the Biosecurity Regulations 2022 under the *Biosecurity Act 2019*.

8.2 Operation

8.2.1 Native vegetation communities

There are areas of native vegetation located on the converter site and shore crossing sites. These include:

- On the converter station site, an area of 1.5 ha of *Eucalyptus amygdalina* coastal forest and woodland community (DAC)
- On the shore crossing, 3 ha of coastal scrub vegetation community (SSC) and 2 ha of the NC Act listed *Eucalyptus viminalis–Eucalyptus globulus* coastal forest and woodland vegetation community (DVC)

8.2.1.1 Impact pathway and significance

The native vegetation communities on the sites will be maintained during the operation of the converter station. It will be necessary to manage these to minimise disturbance to these communities and reduce the potential impacts from introduction of weeds, pests and pathogens.

The project's EPRs (Table 8.5) are designed to avoid any disturbance of native vegetation and the introduction of weeds, pests and pathogens. It will be important to ensure that mitigation measures are developed and incorporated into the operation procedures in order to meet the EPRs. Available mitigation measures to satisfy the EPRs may include the following:

- Continue to use areas of existing disturbance (i.e. the currently cleared areas) to access the site to reduce disturbance to native vegetation.
- Avoid clearing by clearly identifying and marking hazard trees outside the currently cleared site. Hazard trees include dead or dying trees, and trees with obvious externally visible defects, at high risk of failure in foreseeable weather conditions, and upon failure may provide safety risks during operation.
- Felling trees into the open area on site to avoid damage to adjacent vegetation, where safe to do so. Where unsafe, fell tree and leave in-situ.
- Implement a Hot Work Process in consultation with TasFire that (as a minimum) to reduce risk of bushfire ignition.
  - Requires weather conditions and fire risk to be monitored.
  - Prohibits hot work on total fire ban days.
  - Permits hot work in cleared areas only.
  - Requires appropriate fire suppression equipment at site.
  - Requires monitoring of works for sparks that might ignite vegetation.
- If necessary to clear native vegetation, do so in a manner that allows fauna to disperse into adjacent native vegetation
- Induct contractors and employees in the identification of weeds, specifically declared weeds.
- Induct contractors and employees in the identification of plant pathogens including dieback.
- Provide onsite vehicle hygiene training and implement a vehicle clean-down checklist that includes the requirements outlined in the Tasmanian Washdown Guidelines for Weed and Disease Control - Machinery, Vehicles and Equipment, Edition 1.
- Identify, map and demarcate weed infestations.
- Treat weeds with appropriate control measures.
- Work from clean sites to weed infested sites, if weed infested sites cannot be avoided. Clearly identify access routes.

- Avoid working in weed infested sites while in seed, if weed infested sites cannot be avoided.
- Follow quarantine notices or directions from relevant authorities or land managers for the control of declared weeds.
- Do not drive through weed infestations without implementing appropriate or recommended biosecurity procedures.
- Wash down vehicles, plant and equipment and boots prior to entering and on leaving declared weed infested areas in accordance with the *Tasmanian Washdown Guidelines for Weed and Disease Control - Machinery, Vehicles and Equipment*, Edition 1 and in accordance with the Biosecurity Regulations 2022 under the *Biosecurity Act 2019*..

8.2.1.2 Environment Performance Requirements

Ensure that as per the construction project description (section 4), that operations do not specifically require clearing of native vegetation on either the converter station site or the shore crossing. The aim of the EPR below (Table 8.5) is to ensure that operational procedures recognise the need to preserve the native vegetation located on site.

EPR ECO4: Operational implementation of vegetation protection measures

1. As part of the OEMP, develop a vegetation management plan for operations to avoid and otherwise minimise impacts that covers:
   (a) Demarcation of areas of important flora and fauna habitat to be protected during normal maintenance and operations.
   (b) Implementation of appropriate measures to manage the risk of spread and introduction of weeds and pathogens during normal maintenance and operations.

The vegetation management plan must be a sub plan to the OEMP and implemented in operation.

8.2.2 Flora

There are no flora listed under either the TSP Act or the EPBC Act located on site. With the absence of any protected flora there will be no impact to protected floral values.

8.2.3 Fauna - Tasmanian Devils and spotted-tailed quolls

The EPBC listed mammals Tasmanian devil (*Sarcophilus harrisii*) and spotted-tailed quoll (*Dasyurus maculatus* subsp*. maculatus*) may occasionally pass over and in the vicinity of the converter station and shore crossing site. Whilst there is no suitable denning habitat in the vicinity of the sites, there is the possibility of roadkill from road traffic movements between dusk and dawn, and there have been a small number of records of roadkill of both species on Minna Road (one quoll, one devil) and the Bass Highway (one devil) nearby. The sensitivity of each of these two carnivore species to the risk of roadkill is high.

8.2.3.1 Impact pathway and significance

As traffic movements are likely to be minimal during operation, it is not expected that there will be an impact from roadkill to these species as a result of operations. Operation and maintenance vehicles entering and exiting the converter station site per day will be a maximum of five light vehicles per day (for operational personnel). On some days, it may be as low as two vehicles per day. In the context of the heavily trafficked Bass Highway, these operational vehicles addition to traffic is negligible. The approximately 250m of Minna Road to be traversed by these vehicles poses a negligible increase on roadkill risk, especially in the context of the regular use of Minna Road by private landfill operator vehicles.

8.2.3.2 Environment Performance Requirements

There will be no requirement for environmental performance requirements during operation.

8.2.4 Fauna - Raptors

The EPBC listed wedge-tailed eagle (*Aquila audax* subsp. *fleayi*) and the TSP Act listed white-bellied sea-eagle (*Haliaeetus leucogaster)* have no known nest sites within 1 km of the site. The nearest eagle nest is over 1.5 km but has not been verified as present since 2006 Individuals of both species may occasionally overfly the site as they have large home ranges

8.2.4.1 Impact pathway and significance

Both species of raptor are currently unlikely to be impacted by the operation of the converter station and shoreline crossing as there are no known nests within 1 km of the site. However, if a raptor nest is constructed within a distance of 500 m, or within 1 km line-of-sight in the period prior to construction, then there is the potential for major operational maintenance activities to impact on raptors.

Measures will be developed to comply with the EPR below. Possible mitigation measures to reduce impacts to raptors to both detect nests and reduce impacts in the event of finding nests within a distance of 500 m, or within 1 km line-of-sight include:

- Nest management may be conducted during the operational phase of the project that includes regular nest searches in the vicinity of the converter station.

8.2.4.2 Environment Performance Requirements

The following EPR is proposed to protect raptors from impact during operation. The intent of this EPR is to ensure that in the event that major operational maintenance activities (which have the potential to disturb raptors) are planned, that appropriate surveys are undertaken to identify nest locations. In addition it identifies requirements for the undertaking of such activities if a nest is nearby.

EPR ECO5: Operational implementation of measures to protect raptors

1. As part of the OEMP, develop a nest management strategy to avoid impacts to raptors during major operational and maintenance activities (e.g. long-term increase in site activity that includes use of crane/s for lifting and replacing large components and equipment)
2. Prior to major operational and maintenance activities, confirm that there are no nests within a distance of 500 m, or within 1 km line-of-sight prior to activities, using data collected within one year prior to the commencement of construction.

3. Undertake a further nest survey if there is no recent (within one year) survey data of nest presence outside of the breeding season as per the *Threatened Tasmanian Eagles Recovery Plan 2006*-2010 and the Environment Protection Authority’s *Guide to Eagle Nest Searching and Nest Activity Checks.*
   (a) If a nest is observed within a distance of 500 m, or within 1 km line-of-sight prior to major operational/maintenance activities the following will be required:
      (i) Avoid major activities within a distance of 500 m, or within 1 km line-of-sight of active eagle nests during breeding season in accordance with guidelines outlined in the FPA Fauna Technical Note No. 1
      (ii) Defer major activities until outside of the breeding season if a nest within 500 m or 1 km line of sight is determined to be active as per FPA Fauna Technical Note No. 1. All nests are to be treated as active during the breeding season until determined as inactive by a suitable qualified person.

8.2.5 Fork-tailed swift and white-throated needletail

Two further bird species listed as threatened under the EPBC Act; the fork-tailed swift (*Apus pacificus*) and white-throated needletail (*Hirundapus caudacutus*) are aerial species. These may fly over the site but will not use the site, as they do not come to land.

8.2.5.1 Impact pathway and significance

Both species are unlikely to be impacted by the operation of the converter station and shoreline crossing.

8.2.5.2 Environment Performance Requirements

There will be no requirement environmental performance requirements during operation.

8.2.6 Residual impacts

The pre-mitigation assessments of impacts were all considered to be low for the ecological communities, flora and fauna. Based on the above implementation of EPRs, which aim to further reduce the impact, there will be no residual impacts due to the operation of the converter station and shore crossing (Table 8.5). There are a number of mitigation measures expected to be implemented to achieve the EPRs and further reduce the residual risk. These include measures to mitigate against ongoing risks related to weed management (e.g., identification and eradication of weeds on site, site hygiene) in accordance with the Biosecurity Regulations 2022 under the *Biosecurity Act 2019*.

A further EPR to protect raptors in the vicinity will require confirmation hat there are no nests within a distance of 500 m of the site boundary, or within 1 km line-of-sight prior to construction using data collected within one year of construction commencing.

8.3 Decommissioning

The operational lifespan of the project is a minimum 40 years. At this time Marinus Link will be either decommissioned or upgraded to extend its operational lifespan. Decommissioning will be planned and carried out in accordance with regulatory requirements at the time. A decommissioning plan in accordance with approvals conditions will be prepared prior to planned end of service and decommissioning of the project. Requirements at the time will determine the scope of decommissioning activities and impacts. The key objective of decommissioning is to leave a safe, stable and non-polluting environment.

In the event that the project is decommissioned, all above-ground infrastructure will be removed and the site rehabilitated. Decommissioning activities required to meet the objective will include, as a minimum, removal of above ground buildings and structures. Remediation of any contamination and reinstatement and rehabilitation of the site will be undertaken to provide a self-supporting landform suitable for the end land use.

Decommissioning and demolition of project infrastructure will implement the waste management hierarchy principles being avoid, minimise, reuse, recycle and appropriately dispose. Waste management will accord with applicable legislation at the time.

Decommissioning activities may include recovery of land and subsea cables. The conduits and shore crossing ducts would be left in-situ as removal may cause significant environmental impact. Subsea cables would be recovered by water jetting or removal of rock mattresses or armouring to free the cables from the seabed.

A decommissioning plan will be prepared to outline how activities would be undertaken and potential impacts managed.

8.4 Cumulative impacts

If mitigation measure are implemented, the project is not expected to impact threatened ecological communities, threatened flora or threatened fauna species at either the converter station or the shore crossing site. However, additional pressure on roadkill risk on the Bass Highway from nearby projects where construction works occur at the same time as construction works for the project may generate residual cumulative impact.

Construction activities for the Remaining North West Transmission Developments[4] are likely to occur in proximity and in similar timeframes to the project, such that the same transportation routes may experience increased traffic due to simultaneous project works. Both projects will result in an increase in vehicle traffic during construction. Twilight and night traffic movements on Minna Road will increase by at least 10 % at times due to construction activities associated with the two projects, and they may approach a 10 % increase on the Bass Highway. Therefore, there is a possibility for cumulative impacts to Tasmanian devils and spotted-tailed quolls, related to roadkill from twilight and night-time traffic movements from construction of both the project and Remaining North West Transmission Developments on these roads. Both species are highly sensitive to roadkill risk.

[4] Note that the Staverton to Hampshire Hills 220 kV overhead transmission line (OHTL) and upgrades to the existing OHTLs between Sheffield and Staverton are being assessed separately from the Remaining North West Transmission Developments; the two components comprise the North West Transmission Developments. The Staverton to Hampshire Hills component is not within sufficient proximity to the Heybridge Converter Station to be considered as a potential contributor to cumulative impacts.

With the application of standard management measures, the Remaining North West Transmission Developments project is unlikely to result in a significant impact or decrease in population of these species. Given the limited extent of roads where the project may contribute to roadkill, and with the application of measures to comply with EPRs, the project is unlikely to contribute to a significant decrease in the population of Tasmanian devil and spotted-tailed quolls in Tasmania when combined with the impacts from the Remaining North West Transmission Developments project.

The other projects identified in section 5.6.3 are not likely to contribute to the impacts expected from the project to the extent that a cumulative residual impact would be expected.

8.5 Inspection, monitoring and review

The implementation of measures to comply with EPRs will be monitored during construction. The program of monitoring and review will be detailed in the CEMP and may include the following measures.

This will include:

- Monitoring during the construction and operation the areas of native vegetation removed, including the reasons for removal (EPR ECO1, EPR ECO4).
- Audit the implementation of procedures in the vegetation management plan (EPR ECO1, EPR ECO4)
- Monitoring and recording of vehicle strikes and roadkill on Minna Road between the Bass Highway intersection and the site entrance during the construction period, to ensure that mitigation measures to minimise roadkill are effective (EPR ECO2).
- Undertake annual nest survey for raptors, to monitor for any newly constructed nests within a distance of 500 m, or within 1 km line-of-sight (EPR ECO3).
- Annually assess (during construction and operation) the need to implement measures (i.e. stop work during breeding season in the event that a new nest within a distance of 500 m, or within 1 km line-of-sight is identified) in regard to raptor nests (EPR ECO3, EPR ECO5), following nest surveys.
- Review the implementation of procedures in the operational nest management strategy (EPR ECO5), particularly in preparation for undertaking of major maintenance activities.

8.6 Summary of impacts

For the construction and operation of the Heybridge converter station and its shoreline crossing, there are a number of ecological values and their significance assessments listed in Table 8.4.

The assessment identified:

- The presence of three native vegetation communities, one of which is listed on the NC Act.
    - *Eucalyptus amygdalina* coastal forest and woodland (DAC) – NC Act listed – on the shoreline crossing
    - Coastal scrub (SSC), on the shoreline crossing
    - *Eucalyptus viminalis–Eucalyptus globulus* coastal forest and woodland (DVC), on the converter station site
- The potential presence of five EPBC Act listed fauna species

    - Tasmanian devil (*Sarcophilus harrisii*)
    - spotted-tailed quoll (*Dasyurus maculatus* subsp. *maculatus*)
    - Tasmanian wedge-tailed eagle (*Aquila audax* subsp. *fleayi*)
    - white-throated needletail (*Hirundapus caudacutus*)
    - fork-tailed swift (*Apus pacificus*).
- The potential presence of one NC Act listed fauna species

    white bellied sea-eagle (*Haliaeetus leucogaster).*

After the implementation of the EPRs, these listed vegetation communities and fauna species were assessed as having low significance of being impacted, with negligible magnitude of impact due to the construction and operation, and consequently a low significance of impact.

The project is not expected to impact threatened ecological communities, threatened flora or threatened fauna species at either the converter station or the shore crossing site.

Table 8.4: Significance assessment summary table

Affected value	Project phase	Impact Assessment			Environmental Performance Requirements	Residual Impact		
		Sensitivity	**Magnitude**	**Significance**		**Sensitivity**	**Magnitude**	**Significance**
Remnant patch *E. amygdalina* coastal forest and woodland 1.5 ha on converter station site	Construction, operation	Low	Negligible	Low	EPR ECO1 EPR ECO4	Low	Negligible	Low
Coastal scrub vegetation community 3 ha at shore crossing	Construction, operation	Low	Negligible	Low	EPR ECO1 EPR ECO4	Low	Negligible	Low
E. viminalis-E.globulus coastal forest and woodland (NC Act listed) 2ha at crossing adjacent to Blythe River mouth	Construction, operation	High	Negligible	Low	EPR ECO1 EPR ECO4	High	Negligible	Low
Tasmanian devils and spotted-tailed quolls	Construction	High	Minor	Moderate	EPR ECO2	High	Negligible	Low
Wedge-tailed eagle	Construction, operation	High	Negligible	Low	EPR ECO3 EPR ECO5	High	Negligible	Low
White bellied sea-eagle	Construction, operation	High	Negligible	Low	EPR ECO3 EPR ECO5	High	Negligible	Low
Fork-tailed swift	Construction, operation	High	Negligible	Low	None required Aerial species	High	Negligible	Low
White-throated needletail	Construction, operation	High	Negligible	Low	None required Primarily aerial, no suitable habitat.	High	Negligible	Low

8.7 Environmental performance requirements

The EPRs discussed above in the impact assessment, are listed in Table 8.5. These EPRs are designed to minimise the impacts of construction and operational activities on the ecological values of the Heybridge converter station site and shoreline crossing areas.

The EPRs have also been developed with consideration of industry standards and relevant legislation, guidelines and policies.

Table 8.5: Summary of EPRs for construction and operation of the Heybridge converter station and shoreline crossing

EPR ID	Environmental Performance Requirement	Project Stage
EPR ECO1	**Minimise vegetation removal and implement and implement vegetation protection measures** 1. To inform the project design, develop and implement measures to avoid and otherwise minimise to the extent practicable impacts on native vegetation. The design must avoid the eucalyptus woodland vegetation in the northeast corner of the site. 2. Prior to commencement of project works, develop a vegetation management plan to avoid and otherwise minimise impacts to vegetation, covering as a minimum: (a) Identification of areas of important flora and fauna habitat to be protected during construction. (b) Fencing protected areas and no-go zones to prevent access during construction. (c) Pre-construction site assessment to confirm that vegetation and trees to be retained have been adequately protected from impact. (d) Vegetation clearing controls and protection measures. (e) Implementation of appropriate measures to manage the risk of spread and introduction of weeds and pathogens during construction. (f) Procedures if unexpected threatened species are identified. The vegetation management plan must be a sub plan of the CEMP and implemented during construction.	Construction
EPR ECO2	**Implement measures to protect fauna** 1. Prior to commencement of project works, develop a fauna management plan to avoid and otherwise minimise impacts to fauna, covering as a minimum: (a) Protection measures for Tasmanian devils and spotted-tail quolls with a focus on construction traffic and awareness regarding roadkill included in site inductions. (b) Recording and reporting process for incidents of vehicle strikes and/or roadkill of Tasmanian devils and spotted-tail quolls on Minna Road between intersection with Bass Highway and the	Construction

EPR ID	Environmental Performance Requirement	Project Stage
	entry to site, where vehicles associated with the project will travel. Reporting of roadkill of Tasmanian devils and spotted-tail quolls to the Department of Natural Resources and Environment Tasmania. Removing mortalities off the road within a specified distance of site to reduce attracting carnivorous fauna. (c) Utilisation of night lighting to a minimum amount required to safely operate the site and to reduce light pollution and adverse effects to fauna species. (d) Management procedures to avoid animals entering trenches or being recovered from trenches and excavated areas. (e) Preclearance surveys of construction areas for threatened fauna species prior to vegetation removal and undertaken by a suitably qualified ecologist. The fauna management plan must be a sub plan of the CEMP and implemented during construction.	
EPR ECO3	**Implement measures to protect raptors** 1. Prior to commencement of project works confirm that there are no nests within a distance of 500 m of the site boundary, or within 1 km line-of-sight prior to construction using data collected within one year of construction commencing. 2. Undertake further nest survey if there is no current (within one year) survey of nest presence and to avoid impacts to raptors outside of the breeding season, as per the *Threatened Tasmanian Eagles Recovery Plan 2006-2010* and the Environment Protection Authority's *Guide to Eagle Nest Searching and Nest Activity Checks*. (a) If a nest is observed within a distance of 500 m of the site boundary, or within 1 km line-of-sight prior to construction the following will be required: **(i)** Avoid project activities within a distance of 500 m, or within 1 km line-of-sight of active eagle nests during breeding season in accordance with guidelines outlined in the FPA Fauna Technical Note No. 1 (ii) Construction to be deferred until outside of the breeding season if a nest within a distance of 500 m, or within 1 km line of sight is determined to be active as per FPA Fauna Technical Note No. 1. All nests are to be treated as active during the breeding season until determined as inactive by a suitable qualified person.	Construction
EPR ECO4	**Operational implementation of vegetation protection measures** 3. As part of the OEMP, develop a vegetation management plan for operations to avoid and otherwise minimise impacts that covers: (a) Demarcation of areas of important flora and fauna habitat to be protected during normal maintenance and operations.	Construction

EPR ID	Environmental Performance Requirement	Project Stage
	(b) Implementation of appropriate measures to manage the risk of spread and introduction of weeds and pathogens during normal maintenance and operations. (i) The vegetation management plan must be a sub plan to the OEMP and implemented in operation.	
EPR ECO5	**Operational implementation of measures to protect raptors** 1. As part of the OEMP, develop a nest management strategy to avoid impacts to raptors during major operational and maintenance activities (e.g. long-term increase in site activity that includes use of crane/s for lifting and replacing large components and equipment) 2. Prior to major operational and maintenance activities, confirm that there are no nests within a distance of 500 m of the site boundary, or within 1 km line-of-sight prior to activities, using data collected within one year prior to the commencement of construction. 3. Undertake a further nest survey if there is no recent (within one year) survey data of nest presence outside of the breeding season, as per the *Threatened Tasmanian Eagles Recovery Plan 2006*-2010 and the Environment Protection Authority's *Guide to Eagle Nest Searching and Nest Activity Checks* (a) If a nest is observed within a distance of 500 m, or within 1 km line-of-sight prior to major operational/maintenance activities the following will be required: (i) Avoid major activities within a distance of 500 m, or within 1 km line of sight of active eagle nests during breeding season in accordance with guidelines outlined in the FPA Fauna Technical Note No. 1 (ii) Defer major activities until outside of the breeding season if a nest within a distance of 500 m, or within 1 km line of sight is determined to be active as per FPA Fauna Technical Note No. 1. All nests are to be treated as active during the breeding season until determined as inactive by a suitable qualified person.	Operation

9. Conclusion

This report presents a baseline characterisation of ecological values within the study area of the Heybridge converter station and shoreline crossing based on available data resources and the results of field surveys. The report also presents an impact assessment that considers the potential impact of the project on those ecological values and whether there is likely to be a significant impact on MNES protected under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), and/or species protected under the Tasmanian *Threatened Species Protection Act 1995* (TSP Act) or vegetation communities protected under the *Nature Conservation Act 2002* (NC Act).

The key values identified as part of this assessment were:

- The presence of three native vegetation communities, one of which is listed on the NC Act.
    - *Eucalyptus amygdalina* coastal forest and woodland (DAC) –NC Act listed – on the shoreline crossing
    - Coastal scrub (SSC), on the shoreline crossing
    - *Eucalyptus viminalis–Eucalyptus globulus* coastal forest and woodland (DVC), on the converter station site
- The potential presence of five EPBC Act listed fauna species
    - Tasmanian devil (*Sarcophilus harrisii*)
    - spotted tail quoll (*Dasyurus maculatus* subsp*. maculatus*)
    - Tasmanian wedge-tailed eagle (*Aquila audax* subsp. *fleayi*)
    - white-throated needletail (*Hirundapus caudacutus*)
    - fork-tailed swift (*Apus pacificus*)
- The potential presence of one NC Act listed fauna species
    - white bellied sea-eagle (*Haliaeetus leucogaster)*

This assessment found that any impacts from the project on threatened ecological communities, threatened flora or threatened fauna species at the either the converter station or the shore crossing site will be manageable. EPRs were developed to further minimise the impacts of this project activity.

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Appendices

A Likelihood of occurrence tables

Table A.1: Terms utilised in Likelihood of occurrence tables

Likelihood of occurrence	TSP Act	EPBC Act
FLORA AND FAUNA AND VEGETATION COMMUNITIES **Known to occur (K)** - the species/ecological community has been recorded in the survey area. **May occur (M)** - the species/ecological community has been recorded in the study area and suitable species habitat exists or could exist in the survey area following detailed ecological studies. **Unlikely to occur (U)** - the species/ecological community has not been recorded in the study area and/or suitable species habitat does not exist in or adjacent to the survey area. **Does not occur or absent (A)** - the species/community potential distribution includes the study area but has never been recorded in or adjacent to the study area.	**x:** Extinct **en:** Endangered **vu:** Vulnerable **r:** Rare	**EX:** Extinct **CR:** Critically endangered **EN:** Endangered **VU:** Vulnerable **CD:** Conservation dependent **MiW**: Migratory wetland species **MiT:** Migratory terrestrial species **MiM**: Migratory marine birds **Mar:** Marine birds

A.1 Listed fauna

Table A.2: Listed fauna likelihood of occurrence for the converter station and shore crossing

Scientific name	Common name	TSP Act	EPBC Act	EPBC Migratory/Marine	Count (sum)	Last record	Source	Likelihood of Occurrence	Habitat	Rationale
Terrestrial/non-marine species										
Accipiter novaehollandiae	grey goshawk	en			71	04/10/2021	NVA	A	A medium sized white goshawk that inhabits wet forest, mixed forest and swamp forest, particularly where blackwood is present generally below 600 m (Threatened Species Section 2021). The species nests in mature wet forest, usually in the vicinity of a watercourse.	There are no known nests within 1 km of the converter station or shore crossing.
Actitis hypoleucos	common sandpiper			Mi W	0	N/A	PMST	A	A small sandpiper of 19–21 cm in length with a wingspan of 32–35 cm found along all coastlines of Australia and in many areas inland, the common sandpiper is widespread in small numbers. The population when in Australia is concentrated in northern and western Australia (Department of the Environment 2020a)	No NVA records within 5 km of converter station and shore crossing. No suitable coastal wetland habitat within survey area.
Apus pacificus	fork-tailed swift			MiM	0	N/A	PMST	M	Medium-sized swift to 18-21 cm, characterised by a long and deeply forked tail. Almost exclusively aerial, flying from less than 1 m to at least 300 m above ground. In Australia, mostly occur over inland plains, over dry or open habitats, including riparian woodland and teatree swamps, low scrub, heathland or saltmarsh (Department of the Environment 2015b). Department of the Environment 2019a).	There are no NVA records within 5 km of converter station and shore crossing. Aerial species which could occur over the survey area.
Aquila audax subsp. fleayi	Tasmanian wedge-tailed eagle	en	EN		530	08/10/2022	NVA	M	Large brown-black eagle with feathered legs. Occurs across Tasmania in forested habitats. Nesting habitat is large tracts (more than 10 ha) of	There are no known wedge-tailed eagle nests within 1 km of the converter station or shore crossing: The nearest known

Scientific name	Common name	TSP Act	EPBC Act	EPBC Migratory/Marine	Count (sum)	Last record	Source	Likelihood of Occurrence	Habitat	Rationale
									eucalypt or mixed forest (Threatened Species Section 2006).	eagle nest is nest# 1323 which is located over 1.6 km to the west of the converter station. It is listed on the NVA as an eagle nest of indeterminate eagle species nests (i.e. wedge-tailed eagle or white-bellied sea-eagle). This nest could not be found in the 2022 eagle nest survey undertaken by North Barker for the NWTD (North Barker 2022). The nest was last recorded in 2006 (NVA data). The next nearest confirmed wedge-tailed eagle nest (nest # 2573) is recorded on the NVA and is 1.7 km to the south of the survey area. No suitable nesting habitat is at the converter station or shore crossing. May overfly site on occasions.
Astacopsis gouldi	giant freshwater crayfish	vu	VU		30	20/02/2021	NVA	A	A large slow-growing and long-lived freshwater crayfish that can weigh up to 3 kg. The species is endemic to rivers, lakes and streams of northern Tasmania (Threatened Species Scientific Committee 2017).	The closest record to the converter station is over 4 km south in Chasm Creek. No suitable stream habitat in survey area.
Botaurus poiciloptilus	Australasian bittern	en	EN	Mi W	)	N/A	PMST	U	A large (to 76 cm tall), stocky, thick–necked heron–like bird with mottled brown and dark brown to black plumage. Its preferred habitat is freshwater wetlands with tall dense vegetation particularly those dominated by sedges, rushes and reeds.	No suitable wetland habitat within survey area. No NVA records within 5 km.
Calidris acuminata	sharp-tailed sandpiper			Mi W	0	N/A	PMST	A	A small to medium-sized wader, that spends the non-breeding season in Australia. Prefers muddy edges of shallow fresh or brackish waters, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. In Tasmania, they mostly occur in coastal areas in the east from George Town to Hobart, with scattered records on the north-west coast, and west coast from Henty River	No suitable estuarine wetland habitat within the survey area. No NVA records within 5 km of converter station and shore crossing.

Scientific name	Common name	TSP Act	EPBC Act	EPBC Migratory/Marine	Count (sum)	Last record	Source	Likelihood of Occurrence	Habitat	Rationale
									and Port Davey (Department of the Environment 2019b).	
Calidris canutus	red knot		EN	Mi W	0	N/A	PMST	U	A small to medium coastal bird that inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They rarely use inland lakes or swamps. They generally travel through Tasmania from August to September, but does not breed in Australia.	No suitable estuarine wetland habitat within the survey area. No NVA records within 5 km of converter station and shore crossing.
Calidris ferruginea	curlew sandpiper		CR	Mi W	0	N/A	PMST	A	Small, slim sandpiper 18-23 cm long that mainly occur on intertidal mudflats in sheltered coastal areas and around non-tidal swamps, lakes and lagoons near the coast. They are also recorded inland around ephemeral and permanent lakes, dams etc. They mostly occur in eastern Tasmania, but also at several sites in the northwest (Department of the Environment 2019c).	No suitable estuarine wetland habitat within the survey area. No NVA records within 5 km of converter station and shore crossing.
Calidris melanotos	pectoral sandpiper			Mi W	0	N/A	PMST	A	Small to medium-sized sandpiper with a length of 19-24 cm, that occurs in coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. The pectoral sandpiper in Tasmania is very rare, with records existing for Cape Portland, Orielton Lagoon-Sorell, Barilla Bay, Clear Lagoon, Cameron Inlet and Flinders Island (Department of the Environment 2019d).	No suitable estuarine wetland habitat within the survey area. No NVA records within 5 km of converter station and shore crossing.

Scientific name	Common name	TSP Act	EPBC Act	EPBC Migratory/Marine	Count (sum)	Last record	Source	Likelihood of Occurrence	Habitat	Rationale
Ceyx azureus diemenensis	Tasmanian azure kingfisher	en	EN		11	01/01/2009	NVA	A	A small brightly coloured kingfisher with a long slender black bill and red legs (Threatened Species Section 2012b). The head, neck, and back are deep blue and the breast is orange-red. This species inhabits the forested margin of rivers.	Three NVA records from Blythe River adjacent to site from early 2000's. No suitable habitat on site or at shore crossing.
Dasyurus maculatus subsp. maculatus	spotted-tail quoll	r	VU		4	11/02/2020	NVA	M	A medium-sized carnivorous marsupial found in wet forest and coastal habitats across Tasmania (DELWP 2016).	There is a NVA record of a roadkill carcass on Minna Road near the intersection with the Bass Highway on 11/02/2020. No suitable habitat on the converter station site but potentially suitable habitat in the coastal vegetation at the shore crossing.
Dasyurus viverrinus	eastern quoll		EN		1	01/05/1996	NVA	U	A small carnivorous marsupial whose preferred habitat includes inhabits dry grassland and forest mosaics which are bounded by agricultural land (Threatened Species Scientific Committee 2015).	There is one NVA record over 800 m to the east in Heybridge. There is no suitable grassland or agricultural land habitat at the converter station and shore crossing.
Engaeus yabbimunna	Burnie burrowing crayfish	vu	VU		2	08/05/1996	NVA	A	A small grey-blue freshwater crayfish which is less than 10 cm in length (Threatened Species Scientific Committee 2016). They inhabit stream banks and seepages with remnant riparian vegetation within the Burnie area and the area around Mt Hicks and at Ridgeley. They dig burrows that generally intersect the water table so that they can keep moist. They are rarely ever seen outside their burrows (Doran 2000), .	NVA records from Emu River over 4 km west of the converter station. No suitable habitat within survey area.
Galaxiella pusilla	eastern dwarf galaxias	vu	VU		0	N/A	PMST	A	Tiny slender freshwater fish that averages 30-40 mm in length. In Tasmania this species is only known from Flinders Island, Piper-Ringarooma Rivers and Smithton-Burnie Coast. Occurs in slow flowing and still, shallow, permanent and temporary freshwater habitats often containing dense aquatic macrophytes and emergent plants.	No NVA records within 5 km of survey area current known range.

Scientific name	Common name	TSP Act	EPBC Act	EPBC Migratory/Marine	Count (sum)	Last record	Source	Likelihood of Occurrence	Habitat	Rationale
Gallinago hardwickii	Lathams snipe			Mi W	0	N/A	PMST	A	Medium-sized wader 29-33 cm in length and occurs in permanent and ephemeral wetlands up to 2000 m above sea level. May be found in a variety of vegetation types or communities including tussock grasslands with rushes, reeds and sedges, coastal and alpine heathlands, lignum or tea-tree scrub, button-grass plains, alpine herbfields and open forest. This species is widespread in Tasmania, with the Central Plateau supporting large colonies of Latham's snipe (Department of the Environment 2019e).	No suitable wetland habitat within survey area. No NVA records within 5 km from proposed route.
Haliaeetus leucogaster	white-bellied sea-eagle	v		Mar	198	04/02/2022	NVA	M	The White-bellied Sea-eagle is a large raptor that has long, broad wings and a short, wedge-shaped tail. The White-bellied Sea-eagle is distributed along the coastline (including offshore islands) of mainland Australia and Tasmania. In Tasmania, nesting habitat is forest with old-growth eucalypts within 5 km of the coast (nearest coast including shores, bays, inlets and peninsulas), rivers, lakes or farm dams.	There are no known white-bellied sea-eagle nests within 1 km of the converter station or shore crossing: As noted above under the wedge-tailed eagle there is an eagle nest is nest# 1323 which is located over 1.6 km to the west of the converter station. It is listed on the NVA as an eagle nest of indeterminate eagle species nests (i.e. wedge-tailed eagle or white-bellied sea-eagle) and was last recorded in 2006. No suitable nesting habitat is the at the converter station or shore crossing. The nearest known white-bellied sea-eagle nest (nest # 2273) is located on the Emu River, 4.8 km to the south west. May overfly site on occasions.
Hirundapus caudacutus	white-throated needletail		VU	MiT	0	N/A	PMST	M	The White-throated Needletail is a large (20 cm in length and approximately 115–120 g in weight) swift with a thickset, cigar-shaped body, stubby tail and long pointed wings. Migratory species, almost exclusively aerial within its Australian distribution Department of the Environment (2015b). Although they occur over most types of habitats, they are	There are no NVA records within 5 km of converter station and shore crossing. Aerial species which could occur over the survey area. Impact on potential roosting sites negligible.

Scientific name	Common name	TSP Act	EPBC Act	EPBC Migratory/Marine	Count (sum)	Last record	Source	Likelihood of Occurrence	Habitat	Rationale
									probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings. The species is known to roost in live and dead trees (including isolated trees) amongst dense foliage in the canopy or in hollows (Corben et al. 1982; Quested 1982; Day 1993; Tarburton 1993, 2015).They also commonly occur over heathland (Cooper 1971; Learmonth 1951; McFarland 1988). Mainly within Australia during non-breeding season from September to November.	
Lathamus discolor	swift parrot	en	CR		10	09/10/2015	NVA	A	A small bright green parrot with red under the wings and a red face (Threatened Species Scientific Committee 2016). Breeding range (foraging and nesting habitat) is mostly within 10 km of the coast (including shores, bays, inlets or peninsulas) predominantly in eastern and south eastern Tasmania, although there is breeding in some years on the central north and north western coast of Tasmania. Foraging habitat is Eucalyptus globulus dry and wet forest and E. ovata forest. Nesting habitat is forest with large eucalyptus trees with hollows in close proximity to foraging habitat.	The Heybridge converter station site and the shoreline crossing are located within North West Breeding Range of swift parrots. There are two sighting record on the NVA over 700m to the east of the converter Station from 1987 and 2015. There are also 4 records over 1.6 km to the west of the converter Station including one nest record from 2006. There is no suitable priority foraging or nesting habitat at the converter station or the shore crossing.
Limosa lapponica baueri	Nunivak bar-tailed godwit		VU	Mi W	0	N/A	PMST	A	A large migratory shorebird that occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays (Higgins & Davies 1996).	No records on NVA within 5 km of the survey area.
Myiagra cyanoleuca	satin flycatcher			MiT	10	04/02/2018	PMST	U	Glossy blue-black bird with a length around 17.5 cm, a wingspan of 23 cm and a weight of 17 g. Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal	There are records from 10 locations within 5 km of the survey area with the nearest record over 1 km to the south that was recorded in 2016. There is no

Scientific name	Common name	TSP Act	EPBC Act	EPBC Migratory/Marine	Count (sum)	Last record	Source	Likelihood of Occurrence	Habitat	Rationale
									forests, woodlands, mangroves and drier woodlands and open forests (Blakers et al. 1984; Emison et al. 1987; Officer 1969).	suitable habitat present at the converter station or the shore crossing
Numenius madagascariensis	eastern curlew	en	CR	Mi W	0	N/A	PMST	A	The largest migratory shorebird with a characteristic long down-curved bill. During the non-breeding season in Australia, the eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats. Eastern curlews are rarely recorded inland (Department of the Environment 2015).	No records on NVA within 5 km of the survey area.
Perameles gunnii gunnii	eastern barred bandicoot		VU		2	24/04/2001	NVA	A	A small marsupial with long pink nose and large ears and characteristic pale bars across its hindquarters (DEWHA 2008a). Occurs in a range of agricultural habitats across Tasmania where improved pasture is interspersed with patches of native bush.	The nearest NVA record is 4 km to east of Sulphur Creek. There is no potential suitable habitat within the Converter Statom or the shore crossing.
Prototroctes maraena	Australian grayling	vu	VU		26	03/06/1964	NVA	A	Dark green to dark grey fish with silvery sides and a dark mid-lateral stripe to 30 cm. An anadromous species where fish are born in freshwater, then migrate to the ocean as juveniles where they grow into adults before migrating back into freshwater to spawn (Fulton 1990).	Two records from the Blythe River in 1964. No suitable habitat at the converter station and shore crossing.
Sarcophilus harrisii	Tasmanian devil	en	EN		371	29/02/2020	NVA	M	A medium-sized carnivorous marsupial that inhabits forest, woodland and agricultural areas across Tasmania (DEWHA 2009).	There are NVA records of a roadkill carcass on Minna Road from 17/02/2017 and a carcass on the Bass Highway dated 26/12/2018. There is no suitable habitat on the converter station site or at the shore crossing.
Sternula nereis subsp. nereis	Australian fairy tern	vu	VU		4	07/03/2012	NVA	U	A small grey and white tern; 22 to 27 cm in length with long, narrow wings and a bright orange bill (Threatened Species Scientific Committee 2011). Inhabits coasts and offshore islands including	There are two records from the early 1980's with poor position accuracy (18,500 m) within 5 km. No suitable habitat at the converter station may occasionally occur on the spit at the

Scientific name	Common name	TSP Act	EPBC Act	EPBC Migratory/Marine	Count (sum)	Last record	Source	Likelihood of Occurrence	Habitat	Rationale
									beaches, bays, estuaries and lagoons (Higgins and Davies 1996).	mouth of the Blyther River at the southern end of the shore crossing area.
Thinornis cucullatus cucullatus	hooded plover (eastern)		VU		2	17/03/2012	PMST	U	A stocky, medium-sized wading bird about 20 cm long. Both males and females are similar and have a black 'hood' and a white 'collar' across the back of the neck. Occurs around the coast of Tasmania on ocean beaches where they may be observed singly, in pairs, family groups or flocks (Department of the Environment. 2014).	There are two NVA records within 5 km of converter station and shore crossing. However, these are over 4 km away. No birds have been observed at the shore crossing during surveys and the shore crossing provides limited suitable habitat as it is close to residential areas and has high visitation rates including dog walkers which are disturbing to hooded plovers.
Tringa nebularia	Common greenshank			Mi W	0	N/A	PMST	U	Heavily-built wader 30-35 cm in length that is mostly found along the coast in Tasmania from Temma in the northwest to Hobart in the southeast. Found in a variety of inland wetlands and sheltered coastal habitats. The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats (Department of the Environment 2019g).	No suitable estuarine wetland habitat within the survey area. No NVA records within 5 km of converter station and shore crossing.
Tyto novaehollandiae castanops	Tasmanian masked owl	en	VU		2	6/06/2020	NVA	A	A large owl with white disc face that occurs in native forests and woodlands as well as agricultural areas with a mosaic of native vegetation and pasture (DEWHA 2010). Nests in hollows in large old trees.	There are two records from the Emu River over 4.8 km to the south west of the survey area. There is no suitable masked owl habitat at the converter station and shore crossing. No potential nesting trees with no trees occurring > 1m DBH with nest hollows > 15cm dia.
Marine/migratory animals										
Ardenna carneipes	fleshy-footed shearwater			MiM	0	N/A	PMST	A	Marine bird species.	No suitable habitat within survey area.

Scientific name	Common name	TSP Act	EPBC Act	EPBC Migratory/Marine	Count (sum)	Last record	Source	Likelihood of Occurrence	Habitat	Rationale
Ardenna grisea	sooty shearwater			MiM	0	N/A	PMST	A	Marine bird species.	No suitable habitat within survey area.
Balaenoptera musculus	blue whale		EN	MiM	0	N/A	PMST	A	Marine whale species.	No suitable habitat within survey area.
Caperea marginata	pygmy right whale			MiM	0	N/A	PMST	A	Marine whale species.	No suitable habitat within survey area.
Carcharodon carcharias	great white shark		VU	MiM	0	N/A	PMST	A	Marine shark species.	No suitable habitat within survey area.
Chelonia mydas	Green sea turtle	vu	VU	MiM	1	30/06/1959	NVA	A	Marine turtle species.	No suitable habitat within survey area.
Diomedea antipodensis	Antipodean albatross		VU	MiM	0	N/A	PMST	A	Pelagic albatross species.	No suitable habitat within survey area.
Diomedea antipodensis gibsoni	Gibson's albatross		VU		0	N/A	PMST	A	Pelagic albatross species.	No suitable habitat within survey area.
Diomedea epomophora	southern royal albatross		VU	MiM	0	N/A	PMST	A	Pelagic albatross species.	No suitable habitat within survey area.
Diomedea exulans	wandering albatross		VU	MiM	0	N/A	PMST	A	Pelagic albatross species.	No suitable habitat within survey area.
Diomedea sanfordi	northern royal albatross		EN	MiM	0	N/A	PMST	A	Pelagic albatross species.	No suitable habitat within survey area.
Eubalaena australis	southern right whale	en	EN	MiM	4	11/04/2014	NVA	A	Marine whale species.	No suitable habitat within survey area.
Fregetta grallaria grallaria	white-bellied storm-petrel		VU		0	N/A	PMST	A	Marine bird species.	No suitable habitat within survey area.
Galeorhinus galeus	School shark		CD		0	N/A	PMST	A	Marine shark species	No suitable habitat within survey area
Halobaena caerulea	blue petrel	vu	VU		0	N/A	PMST	A	Marine bird species.	No suitable habitat within survey area.
Lagenorhynchus obscurus	dusky dolphin			MiM	0	N/A	PMST	A	Marine dolphin species.	No suitable habitat within survey area.
Lamna nasus	mackerel shark			MiM	0	N/A	PMST	A	Marine shark species.	No suitable habitat within survey area.
Macronectes giganteus	southern giant-petrel	vu	EN	MiM	0	N/A	PMST	A	Pelagic albatross species.	No suitable habitat within survey area.
Macronectes halli	northern giant-petrel		VU	MiM	0	N/A	PMST	A	Pelagic albatross species.	No suitable habitat within survey area.

Scientific name	Common name	TSP Act	EPBC Act	EPBC Migratory/Marine	Count (sum)	Last record	Source	Likelihood of Occurrence	Habitat	Rationale
Megaptera novaeangliae	humpback whale	en	VU	MiM	10	12/11/2017	NVA	A	Marine whale species.	No suitable habitat within survey area.
Mirounga leonina subsp. macquariensis	southern elephant seal	en	VU		4	9/11/2007	NVA	A	Marine seal species.	No suitable habitat within survey area.
Pachyptila turtur subantarctica	fairy prion	en	VU		0	N/A	PMST	A	Marine bird species.	No suitable habitat within survey area.
Phoebetria fusca	sooty albatross		VU	MiM	0	N/A	PMST	A	Pelagic albatross species.	No suitable habitat within survey area.
Pterodroma leucoptera leucoptera	Australian Gould's Petrel		EN	Mar	0	N/A	PMST	A	Small slightly-built petrel about 70 cm in length, and is a pelagic marine species spending much of its time foraging at sea and coming ashore only to breed (Department of the Environment 2019f).	No suitable habitat as species is a pelagic marine species.
Pterodroma mollis	soft-plumaged petrel	en	VU	Mar	0	N/A	PMST	A	Pelagic petrel species that breeds on Maatsuyker Island off southern Tasmania.	No suitable habitat as species is a pelagic marine species.
Thalassarche bulleri	Buller's albatross		VU	MiM	0	N/A	PMST	A	Pelagic albatross species.	No suitable habitat within survey area.
Thalassarche bulleri platei	Pacific albatross		VU		0	N/A	PMST	A	Pelagic albatross species.	No suitable habitat within survey area.
Thalassarche cauta	shy albatross	vu	EN	MiM	78	20/10/2018	NVA	A	Pelagic albatross species.	No suitable habitat within survey area.
Thalassarche chrysostoma	grey-headed albatross		EN	MiM	0	N/A	PMST	A	Pelagic albatross species.	No suitable habitat within survey area.
Thalassarche impavida	Campbell albatross		VU	MiM	0	N/A	PMST	A	Pelagic albatross species.	No suitable habitat within survey area.
Thalassarche melanophris	Black-browed albatross	en	VU	MiM	6	25/10/2013	NVA	A	Pelagic albatross species.	No suitable habitat within survey area.
Thalassarche salvini	Salvin's albatross		VU	MiM	0	N/A	PMST	A	Pelagic albatross species.	No suitable habitat within survey area.
Thalassarche steadi	white-capped albatross		VU	MiM	0	N/A	PMST	A	Pelagic albatross species.	No suitable habitat within survey area.
Thunnus maccoyii	Southern Bluefin Tuna		CD		0	N/A	PMST	A	Marine shark species	No suitable habitat within survey area

A.2 Listed flora

Table A.3: Listed flora likelihood of occurrence for the converter station and shore crossing

Scientific name	Common name	TSP Act	EPBC	No. of records	Last record	Source	Likelihood of Occurrence	Habitat	Rationale
Baumea gunnii	slender twigsedge	r		1	6/07/2009	NVA	A	Perennial sedge to 70 cm that inhabits wet moors, creeks and riverbanks and can extend into poorly-drained sedgy/ grassy forest and woodland (Threatened Species Section 2016a).	One NVA record from east of the Blythe River at Heybridge. No suitable habitat within the survey area.
Caladenia caudata	tailed spider-orchid	vu	VU	0	N/A	PMST	A	A small terrestrial orchid, found mainly in dry heathland and heathy woodland habitats on sandy and loamy soils, in lowland areas of northern, eastern and south-eastern Tasmania (Threatened Species and Marine Section 2014a)..	No NVA records within 5 km of survey area. Converter station and shore crossing are outside of the species' known range. No suitable heathland and heathy woodland habitats on sandy soils within survey area.
Caladenia patersonii	Paterson's spider-orchid	vu		1	12/10/1978	NVA	U	Small orchid up to 35 cm tall with a wiry and densely hairy stem bearing 1-2 flowers. Known to occur in coastal and near coastal areas in the north from south of Marrawah to Bridport. Occurs in low shrubby heathland in moist to well-drained sandy and clay loam (Threatened Species Unit 2001) .	One historic NVA record from southeast of Heybridge. No suitable coastal shrubby heathland habitat within survey area, therefore unlikely to occur.
Caladenia pusilla	tiny fingers	r		2	17/10/1976	NVA	U	Small pink spider orchid to 10 cm tall. Occurs in coastal and near coastal areas in the north west and north east Tasmania and on King Island and Cape Barren Island (Jones et al. 1999). Grows in heathland and open forest often on well-drained sandy soils.	Two historic records; one from near the Cam River and one west of Heybridge. No suitable heathland or open forest habitat on sandy soils within the survey area therefore is unlikely to occur.
Leucochrysum albicans var. tricolor	hoary sunray	en	EN	0	N/A	PMST	A	Perennial herb with greenish-yellow flowers that occurs in the west and on the Central Plateau and the Midlands, mostly on basalt soils in open grassland. Would have originally occupied Eucalyptus pauciflora woodland and tussock grassland, though most of its habitat is now converted to pasture or cropland (Threatened Species Section 2017).	No NVA records within 5 km of survey area. Outside of species known range. No suitable habitat within the survey area.

Scientific name	Common name	TSP Act	EPBC	No. of records	Last record	Source	Likelihood of Occurrence	Habitat	Rationale
Persicaria decipiens	slender waterpepper	vu		20	23/10/2018	NVA	A	An annual or perennial sprawling herb with branched, slender stems that grow up to 60 cm long. Grows locally on the banks of rivers and streams (Threatened Species Unit 2003a).	One record on the NVA from within 5 km of converter station and shore crossing. No suitable present.
Senecio psilocarpus	Swamp fireweed	en	VU	0	N/A	PMST	A	Habitat characteristics for swamp fireweed includes the following elements: swampy habitats including broad valley floors associated with the Midlands river systems (Cressy area), edges of farm dams amongst low-lying grazing/cropping ground (Forth area), herb-rich native grassland in a broad swale between stable sand dunes (Nook Swamps, King Island), adjacent to wetlands in native grassland (Mount William), herbaceous marshland (Dukes Marshes), and low-lying lagoon systems (Flinders Island) (Threatened Species Section 2011).	Outside of known range. No NVA records within 5 km of the Converter station or shoreline crossing.
Tetratheca ciliata	northern pinkbells	r		2	14/09/1892	NVA	A	A slender shrub that in Tasmania with pink flowers that has been recorded from mostly near-coastal sites from Rocky Cape in the north west to the Tomahawk/Boobyalla area in the north east, It grows in heathland or heathy woodland on sandy well-drained soils (Threatened Species and Marine Section 2014b).	Two historic records from 1892 within 5 km of the survey area. There is no suitable heathland or heathy woodland habitat on sandy well-drained soils within the survey area.

B List of flora recorded within the survey area

Key: i – introduced, e – endemic, t – threatened under the Threatened Species Act 1995, D – declared weed under the Weed Management Act 1999.

Species	Preferred common name	Status
DICOTYLEDON		
Apiaceae		
Hydrocotyle hirta	hairy pennywort	
Aizoaceae		
Tetragonia implexicoma	ice-plant	
Amaranthaceae		
Rhagodia candolleana	seaberry saltbush	
Asteraceae		
Arctotheca calendula	cape dandelion	
Cassinia aculeata	dolly bush	
Chrysanthemoides monilifera subsp. monilifera	boneseed	D
Cirsium arvense var. arvense	Californian thistle	D
Cirsium vulgare	spear thistle	i
Conyza sp	fleabane	i
Euchiton involucratus	star cottonleaf	
Euchiton japonicus	common cottonleaf	
Helichrysum luteoalbum	Jersey cudweed	
Hypochaeris radicata	cats ear	i
Leontodon saxatilis	hairy hawkbit	i
Olearia lirata	forest daisybush	
Olearia stellulata	sawleaf daisybush	
Osteospermum fruticosum	shrubby daisybush	i
Senecio jacobaea	ragwort	D
Senecio linearifolius	fireweed groundsel	
Senecio sp.	groundsel	
Sonchus asper	prickly sowthistle	i
Sonchus oleraceus	common sowthistle	i
Campanulaceae		
Wahlenbergia gymnoclada	naked bluebell	
Wahlenbergia sp	bluebells	
Caryophyllaceae		

Species	Preferred common name	Status
Cerastium glomeratum	sticky mouse-ear	i
Moenchia erecta	erect chickweed	i
Polycarpon tetraphyllum	fourleaf allseed	i
Casuarinaceae		
Allocasuarina littoralis	black sheoak	
Allocasuarina verticillata	dropping sheoak	
Allocasuarina zephyrea	western sheoak	e
Cyperaceae		
Cyperus eragrostis	tall flatsedge	i
Crassulaceae		
Crassula sieberiana	Australian stonecrop	
Dilleniaceae		
Hibbertia procumbens	spreading guineaflower	
Hibbertia sericea	silky guinea-flower	
Ericaceae		
Astroloma humifusum	native cranberry	
Epacris impressa	common heath	
Erica lusitanica	Spanish heath	D
Leucopogon collinus	white beardheath	
Leucopogon parviflorus	coast beardheath	
Monotoca glauca	goldey wood	
Euphorbiaceae		
Euphorbia paralias	sea spurge	i
Euphorbia peplus	petty spurge	i
Fabaceae		
Aotus ericoides	golden pea	e
Dillwynia sericea	showy parrotpea	
Goodia lotifolia	golden tip	
Lotus sp.	trefoil	i
Lotus suaveolens	hairy birds-foot trefoil	i
Medicago polymorpha	burr medick	i
Pultenaea gunnii	golden bushpea	
Psoralea pinnata	African scurf-pea	i
Ulex europaeus	gorse	D

Species	Preferred common name	Status
Fumariaceae		
Fumaria muralis subsp. muralis	wall fumitory	i
Gentianaceae		
Centaurium erythraea	common centaury	i
Geraniaceae		
Geranium sp.	cranesbill	
Gleicheniaceae		
Gleichenia microphylla	scrambling coral fern	
Goodeniaceae		
Goodenia ovata	hop native-primrose	
Haloragaceae		
Gonocarpus tetragynus	common raspwort	
Gonocarpus teucrioides	forest raspwort	
Lauraceae		
Cassytha glabella	slender dodderlaurel	
Cassytha melantha	large dodderlaurel	
Mimosaceae		
Acacia dealbata subsp. dealbata	silver wattle	
Acacia longifolia	coast wattle	
Acacia melanoxylon	blackwood	
Acacia mucronata	caterpillar wattle	
Acacia myrtifolia	redstem wattle	
Acacia suaveolens	sweet wattle	
Acacia terminalis	sunshine wattle	
Acacia verticillata	prickly moses	
Myoporaceae		
Myoporum insulare	boobyalla	
Myrtaceae		
Eucalyptus amygdalina	black peppermint	e
Eucalyptus caesia	weeping eucalypt	i
Eucalyptus obliqua	stringybark	
Eucalyptus regnans	giant ash	
Eucalyptus viminalis subsp. viminalis	white gum	
Kunzea ericoides	burgan	i
Leptospermum glaucescens	smoky teatree	e

Species	Preferred common name	Status
Leptospermum laevigatum	coast tea tree	
Leptospermum scoparium	common tea tree	
Melaleuca sp (garden escapees)	garden escapee tea trees	
Metrosideros excelsa	New Zealand Christmas tree	i
Oxalidaceae		
Oxalis exilis	feeble woodsorrel	
Oxalis pes-caprae	African woodsorrel	i
Oxalis sp.	woodsorrel	
Pittosporaceae		
Billardiera heterophylla	bluebell creeper	i
Bursaria spinosa subsp. spinosa	prickly box	
Plantaginaceae		
Plantago coronopus	Buck's-horn plantain	i
Plantago lanceolata	ribwort plantain	i
Primulaceae		
Lysimachia arvensis	scarlet pimpernel	i
Proteaceae		
Banksia marginata	silver banksia	
Hakea salicifolia	willow-leaved hakea	
Hakea sp	ornamental hakeas	i
Rhamnaceae		
Pomaderris apetala subsp. apetala	common dogwood	
Pomaderris elliptica	yellow dogwood	
Rosaceae		
Acaena novae-zelandiae	common buzzy	
Rubus fruticosus aggregate	blackberry	D
Sanguisorba minor	salad burnet	i
Rubiaceae		
Galium aparine	cleavers	i
Galium australe	tangled bedstraw	
Rutaceae		
Correa alba	white correa	
Zieria arborescens subsp. arborescens	stinkwood	
Salicaceae		
Populus sp.	poplar	i

Species	Preferred common name	Status
Santalaceae		
Exocarpos cupressiformis	common native-cherry	
Leptomeria drupacea	erect currantbush	
Solanaceae		
Solanum laciniatum	kangaroo apple	
Solanum nigrum	blackberry nightshade	i
Stylidiaceae		
Stylidium graminifolium	narrowleaf triggerplant	
Thymelaeaceae		
Pimelea linifolia	slender riceflower	
GYMNOSPERMAE		
Pinaceae		
Pinus radiata	radiata pine	i
MONOCOTYLEDON		
Cyperaceae		
Carex appressa	tall sedge	
Carex sp.	sedge	
Lepidosperma concavum	sandhill swordsedge	
Lepidosperma filiforme	common rapiersedge	
Lepidosperma laterale	variable swordsedge	
Iridaceae		
Diplarrena moraea	white iris	
Juncaceae		
Juncus bufonius	toad rush	
Juncus pallidus	pale rush	
Juncus pauciflorus	looseflower rush	
Juncus procerus	tall rush	
Juncus sarophorus	broom rush	
Juncus subsecundus	finger rush	
Liliaceae		
Dianella revoluta	spreading flaxlily	
Orchidaceae		
Microtis sp.	onion-orchid	
Poaceae		
Agrostis capillaris	browntop bent	i

Species	Preferred common name	Status
Agrostis stolonifera	creeping bent	i
Ammophila arenaria subsp. arenaria	marram grass	i
Anthoxanthum odoratum	sweet vernal grass	i
Austrostipa sp	speargrass	
Avena fatua	oat	i
Briza maxima	greater quaking-grass	i
Briza minor	lesser quaking-grass	i
Cortaderia sp.	pampasgrass	D
Dactylis glomerata	cocksfoot	i
Festuca arundinacea	tall fescue	i
Holcus lanatus	Yorkshire fog	i
Hordeum marinum	barleygrass	i
Lachnagrostis filiformis	common blowngrass	
Lolium sp.	ryegrass	i
Microlaena stipoides var. stipoides	weeping grass	
Poa labillardierei	silver tussock grass	
Poa annua	annual meadow grass	
Poa poiformis	coast tussockgrass	
Rytidosperma caespitosum	common wallabygrass	
Rytidosperma sp.	wallabygrass	
Spinifex sericeus'	coastal spinifex	
Xanthorrhoeaceae		
Lomandra longifolia	sagg	
PTERIDOPHYTA		
Dennstaedtiaceae		
Histiopteris incisa	batswing fern	
Pteridium esculentum subsp. esculentum	bracken	
Dryopteridaceae		
Polystichum proliferum	mother shield fern	

C Significant impact criteria for EPBC listed species with moderate sensitivity to the project

C.1 Tasmanian devil - vulnerable species

C.1.1 Significant impact criteria

An action is likely to have a significant impact on a **vulnerable** species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of an important population of a species
- reduce the area of occupancy of an important population
- fragment an existing important population into two or more populations
- adversely affect habitat critical to the survival of a species
- disrupt the breeding cycle of an important population
- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat
- introduce disease that may cause the species to decline, or
- interfere substantially with the recovery of the species.

C.1.2 What is an important population of a species?

- An 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:
- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

C.2 Spotted-tailed Quoll - endangered species

C.2.1 Significant impact criteria

An action is likely to have a significant impact on a **critically endangered** or **endangered** species if there is a real chance or possibility that it will:

- lead to a long-term decrease in the size of a population
- reduce the area of occupancy of the species
- fragment an existing population into two or more populations
- adversely affect habitat critical to the survival of a species

- disrupt the breeding cycle of a population
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat
- introduce disease that may cause the species to decline, or
- interfere with the recovery of the species.

C.2.2 What is a population of a species?

- A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:
- a geographically distinct regional population, or collection of local populations, or
- a population, or collection of local populations, that occurs within a particular bioregion.

C.2.3 What is an invasive species?

- An 'invasive species' is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.

C.2.4 What is habitat critical to the survival of a species or ecological community?

- 'Habitat critical to the survival of a species or ecological community' refers to areas that are necessary:
- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long term evolutionary development, or
- for the reintroduction of populations or recovery of the species or ecological community.

Such habitat may be, but is not limited to: habitat identified in a recovery plan for the species or ecological community as habitat critical for that species or ecological community; and/or habitat listed on the Register of Critical Habitat maintained by the minister under the EPBC Act.

D Eagle nest search report undertaken for TasNetworks for the North West Transmission Developments project, by North Barker (2022)

northbarker
ECOSYSTEM SERVICES

Remaining North-West Transmission Developments
Eagle Nesting Habitat Survey

Balance Report of the North-West Tasmania Strategic Transmission Plan

6th April 2023

Tetra Tech Coffey
on behalf of TasNetworks

COF011

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PROJECT INFORMATION

Project	Remaining North-West Transmission Developments (NWTD)
Location	Hampshire to Poatina
Client	Tetra Tech Coffey
Client Contact	Ben Casillas-Smith (bens@ecoaus.com.au)
NBES Job Code	COF011
NBES Project Manager	Grant Daniels (gdaniels@northbarker.com.au)
NBES Project Summary	Eagle habitat and nest surveys
Reporting	Karen Dick and Erin Harris
Mapping	Eric Hong

DOCUMENT CONTROL

Document Control	Version	Date	Personnel	Position
Version 0.1	Draft- data	03/03/23	Karen Dick Erin Harris	Principal Ecologist Senior Ecologist
Version 0.2	Draft - report	15/03/23	Karen Dick Erin Harris	
Version 0.3	Draft - report	03/04/23	Erin Harris	
Version 0.4	Report reviewed	04/04/2023	Karen Dick	
Version 0.5	Report reviewed	04/04/2023	Grant Daniels	Managing Director
Version 0.6	Report updated with minor edits	06/04/2023	Karen Dick Erin Harris	
Version 1.0	Approved for issue to client	06/04/2023	Grant Daniels	

EXECUTIVE SUMMARY

TasNetworks is proposing a new transmission line route for the northern section of the Remaining North-West Transmission Developments, spanning from Hampshire to Poatina.

As part of the assessment pathway through the *Major Infrastructure Development Approvals Act 1999* (MIDAA), schedule 2, section 6.1.2 of the project assessment criteria specifies that aerial surveys for eagle[1] nests are to be conducted annually until construction.

North Barker Ecosystem Services was commissioned to carry out nest searches within 2 km of the proposed route, with this commission being the fifth consecutive year of aerial surveys for the project.

Prior to the 2023 survey, a total of fifty-nine raptor nests were on record (on the Tasmanian Natural Values Atlas) as present on the proposed alignment from Hampshire to Poatina transmission route (fifty-two eagles and seven Grey Goshawks).

During the 2023 survey, eleven previously unrecorded ('new') eagle nests were found.

One of the previously reported eagle nests (a small nest classified as a remnant) was re-classified as a goshawk nest. With this change included, forty previously recorded eagle nests were relocated (and one Grey Goshawk nest).

Eleven eagle and seven goshawk nests that had been previously recorded were 'not found' or 'not searched for' (due to land access permissions).

Within this group of nests, seven attributed to eagles have met the parameters to be formally declared 'absent' on the NVA, with three of these having fallen and four having not been found over three consecutive aerial surveys.

In total, with the seven absent nests excluded, there are sixty-three raptor nests known within 2 km of the alignment of the remaining NWTD (fifty-five eagles and eight Grey Goshawk).

[1] Tasmanian Wedge-tailed Eagle and White-bellied Sea Eagle

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1. INTRODUCTION AND BACKGROUND

1.1. Introduction

North Barker Ecosystem Services (NBES) was commissioned by Tetra Tech Coffey on behalf of Tasmanian Networks Pty Ltd (TasNetworks) to carry out a survey of nesting habitats of Tasmanian Wedge-tailed Eagle (*Aquila audax fleayi)* and White-bellied Sea Eagle (*Haliaeetus leucogaster)* – referred to collectively as eagles throughout the report. The route covered was from Hampshire to East Cam, East Cam to Sheffield and Sheffield to Poatina, as well as the respective parts of the routes around Heybridge and Kimberley.

The route is part of the broader North-West Transmission Developments (NWTD) proposed by TasNetworks, , which includes a span from Staverton to Hampshire, with the balance of the alignment and the section pertaining to this report referred to as the 'Remaining NWTD' – together these form part of the transmission network proposed to facilitate the North-West Tasmania Strategic Transmission Plan.

1.2. Background to the Remaining North-west Transmission Developments

In 2018, the Australian Energy Market Operator prepared an Integrated System Plan (ISP) for the National Electricity Market that identified the north-west as one of three Renewable Energy Zones in Tasmania. Building on the ISP, TasNetworks has prepared the North-West Tasmania Strategic Transmission Plan, which sets out how the network could be advanced to support development of the north-west.

TasNetworks proposes to develop a series of new double-circuit 220 kilovolt (kV) overhead transmission lines (OHTLs) in north-west Tasmania, upgrade the existing Palmerston, Sheffield and Burnie substations, and construct a new switching station at Hampshire Hills. The project comprises:

- Palmerston–Sheffield OHTL. – A new double circuit 220 kV OHTL between Poatina/Palmerston substation) and Sheffield. The existing single circuit 220 kV OHTL (TL503) between the Palmerston and Sheffield substations will be dismantled.
- Sheffield–Heybridge OHTL and Heybridge–Burnie OHTL – A new double circuit 220 kV OHTL between Sheffield and Burnie substations with a new in-out spur to a proposed switching station at Heybridge (the proposed switching station at Heybridge is not part of this project). The existing single circuit 220 kV OHTL (TL504) between Sheffield and Burnie substations will be dismantled.
- Burnie–East Cam OHTL and East Cam–Hampshire Hills OHTL – A new double circuit 220 kV OHTL from between Burnie substation and a proposed switching station at Hampshire Hills, via East Cam.

Including the above substation upgrades and switching station, the project area for the Remaining NWTD will also include:

- A 60-m-wide operational area required for construction and operation of the new 220 kV OHTLs.
- Access tracks to towers where they extend outside the operational area to join the road network.

- Temporary winch and brake sites that may extend 90 m outside the operational area, (e.g., at bends in the OHTL) for the purpose of conductor stringing.

1.3. Eagle nest searches background

As part of the assessment pathway through the *Major Infrastructure Development Approvals Act 1999* (MIDAA), schedule 2, section 6.1.2 of the project assessment criteria specifies that aerial surveys for eagle nests are to be conducted annually until construction.

This is the fifth consecutive year of project-specific aerial surveys, which commenced in 2019.

The area surveyed for the 2023 survey was approximately 161 km long, with a buffer of 2 km either side of the proposed transmission line alignment.

2. METHODS

2.1. Survey area

The proposed transmission line route was supplied in spatial data to NBES by the client. It consisted of a 90 m corridor for the preferred alignment, which was then buffered by a 2 km wide corridor to give the entire survey area of approximately 66,561 ha (Figure 1).

2.1.1. *Background research and planning*

As an exploratory desktop process, all habitat within this search area was considered against the suitability index of the Forest Practices Authority's (FPA) eagle habitat model[2]. Whilst this model provides guidance for areas of highest eagle nesting potential, it is best-practice to consider all habitat within a survey area when conducting the aerial search, to ensure the model has not misrepresented habitat patches and to establish if nests are present outside of areas mapped as suitable. Within partly modified environments such as the current survey area, marginal habitats can include wildlife habitat clumps and streamside reserves adjacent to forest and agriculture operations. It was thus proposed to search the entire area of habitat to determine habitat suitability[3], and to prioritise nest searches where habitat was suitable.

2.1.2. *Survey team*

The survey was led by NBES Senior Ecologist Erin Harris, who has more than 300 hours of experience searching for eagle nests and a Master's degree in eagle nesting habitat management. Erin was accompanied by a team that included NBES Principal Ecologist and bird specialist Karen Dick, who has 35 years' experience as an ornithologist and has carried out more than 800 hours of raptor surveys. The team also comprised Adam Hardy, who runs Raptor Care NW and has extensive experience of eagles, their nests and habitats, and Laura Cardona, a current PhD candidate studying bird interactions, who has carried out a number of eagle nest searches and eagle utilisation surveys with NBES. Flights were conducted using Helicopter Resources Tasmania, with experienced pilots Damien Hennessy and Hoey Stobart. Damien has been a low-altitude helicopter pilot for a range of surveys and fireground work, and Hoey has many years of experience undertaking eagle nest surveys.

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[2] Forest Practices Authority (2014a)

[3] DEWHA (now DCCEEW) 2010. *Survey effort guide for the Tasmanian Wedge-tailed Eagle within Commonwealth of Australia* in:. Survey guidelines for Australia's threatened birds - Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999, pp 213-214.

2.2. Aerial nest search surveys

Aerial searches were undertaken by helicopter[4] (according to current best practice[5]) between 13th and 23rd February 2023, in mostly fine weather conditions, with generally excellent visibility and predominantly calm conditions. Conditions permitted constant surveying and no weather-induced downtime during the whole survey programme.

The surveys involved slow flying (5-10 knots) above the tree canopy or where possible, below the adjacent canopy level, such as through gullies and river valleys. Transects were flown to ensure complete coverage of the area.

Marginal potential habitat was also checked and transects were also flown over areas of plantations and rainforest to ensure small wildlife habitat clumps and coupes of potential nesting habitat were not missed.

All known nests within the survey area (with locations extracted from the Natural Values Atlas [NVA] database) were visited to verify condition and presence, except for one nest on the border of a no-fly zone.

Any previously reported nest(s) that could not be found were searched for using both their reported position and spatial accuracy as a guide, in addition to surrounding suitable trees and habitat. Further suitable habitat and trees in the broader vicinity of the reported nest position were also checked until it was considered that continued searching was futile.

Once a nest was located, its condition and features were described *in-situ*, including with the assistance of 12 x 50 mm binoculars, to enable observers to remain distant from the nest. Owing to the nature of the task that sometimes involved hovering near the canopy, and potentially presenting risks to local birds and to observers, nest checks were kept as short as possible and only long enough to verify presence and condition. In the case of known nests with existing informative photos and relatively accurate spatial locations, it was not necessary to repeat those tasks. To further reduce potential disturbance, all nest observations were photographed using a high-quality camera setup, with a Canon 5Dmk3 and 100-400mm prime lens and only GPS recorded (using a handheld non-differential GPS, Garmin Map 66s) if the previously reported position had low reported spatial accuracy and had evident scope for improvement.

To support the *in-situ* observations, images of each nest were later examined to further inform the condition assessment of each nest. Characteristics of each nest that were checked to determine its condition included: fresh green leaves, stick tone (brown or grey), whitewash,

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[4] Aerial surveys are considered to be more effective and efficient in large survey areas, as well as tall wet forests, as per the guidelines below – noting this also satisfies schedule 2, section 6.1.2 of the MIDAA criteria.

[5] Forest Practices Authority (2014). *Eagle nest searching, activity checking and nest management*. Fauna Technical Note No. 1. Forest Practices Authority, Hobart.

algal leaching, nest shape (flat-topped or concave bowl), down/feathers, prey remains and bird presence[6].

The integrity of the nest was then assigned a classification of either: prime, viable, derelict or remnant. These factors represent the viability of the nest for breeding and correspond to the spectrum of poor/average/good/excellent used in the Forest Practices Authority's nest activity assessment forms. However, the categories used in this survey relate more to time since use (and likelihood of use in the near future), with prime being used to describe nests considered likely to be active in recent years, and remnant being those the least likely to be active. This is consistent with the definitions applied during past surveys of this location and use of similar viability classes in assessments of these species elsewhere[7].

2.2.1. *Limitations*

Owing to the large size of the project area, it was not possible to check every individual tree, nor to conduct multiple passes of all potentially suitable habitat. Therefore, there is a possibility that nests may have been missed owing to being obscured from view by other trees or dense canopy cover.

In particular, it should be noted that owing to a preference by Grey Goshawks for a dense canopy above the nest site, these nests are generally better checked and searched for from the ground (noting they are not the primary target species in this project with respect to the assessment conditions).

When navigating through different types of vegetation, the height at which observations were made varied with canopy cover and topography (*i.e.* where canopy cover was sparse, observations were taken at a higher altitude where more trees could be observed; conversely, where canopy cover was dense, lower flights under the canopy [where possible] were undertaken, with particular attention given to areas of high habitat suitability).

To minimise the chance of missing a nest, we used three observers and pilots with extensive experience in low-level flying and nest searches. We also utilised parallel transects as far as possible to minimise potential detection gaps, with additional forays into suitable habitat.

Tree and nest heights are estimates only, with the aid of the helicopters altimeter.

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[6] Forest Practices Authority's nest activity assessment forms.

[7] Enviro-Dynamics (2019). Helicopter Eagle Nest Survey in North West Tasmania. Report for TasNetworks, July 2019.

Wiersma, J, Koch, AJ, Livingston, D, Brown, B, Spencer, C, Mooney, N, Munks, S (2009). Eagle Nest Monitoring Project – Year 1 2007–08, Establishing monitoring sites and investigating the relationship between nesting success of the Tasmanian Wedge-tailed Eagle and environmental variables, report to Roaring 40s and the Forest Practices Authority, Forest Practices Authority Scientific Report 8.

Dennis, T.E., Detmar, S.A., Brooks, A.V. and Dennis, H.M. (2011). Distribution and status of White-bellied Sea Eagle, *Haliaeetus leucogaster*, and Eastern Osprey, *Pandion cristatus*, populations in South Australia. *South Australian Ornithologist*, 37 (1).

Cherriman, S.C., Foster, A., Debus, S.J.S. (2009). Supplementary Notes on the Breeding Behaviour of Wedge-tailed Eagles *Aquila audax*. *Australian Field Ornithology*, 26, pp. 142-147.

3. RESULTS

Photographs of all nests observed during the survey are presented in Appendix A.

3.1. Area covered

A total of 1961.98 km was covered, as shown in the flight maps in Figures 2-12 (Appendix B).

3.2. Newly located nests

Eleven previously unrecorded nests were found (Table 1, Figures 2 -12). All new nests, apart from one (which was found at the northern end of the south to north section of the alignment), were found along the east to west section of alignment between East Cam and Poatina and were relatively evenly spaced. One new nest (#3148) is potentially just outside the alignment buffer (by only by 20 m) but is still treated as present within the alignment for the sake of diligence and allowing for any geospatial inaccuracies. Details of the newly located nests can be found in Appendix C, with the Forest Practices Authority's (FPA) nest location form used as a template.

3.3. Relocated nests

Fifty-nine locations of previously reported raptor nests were visited. One remnant eagle nest (#3020) found in the previous year was re-determined during the 2023 survey as a Grey Goshawk nest. Thus, fifty-one eagle and eight Grey Goshawk nests were surveyed for. Forty of the previously known eagle nests and one previously known Grey Goshawk nest were relocated and verified as present (Table 2).

3.4. Previously reported nests not found or not able to be searched for

Eleven previously reported eagle nests and seven previously reported Grey Goshawk nests could not be found (Table 3, and Appendix D).

One of these eagle nests (#2503) was not searched for, as the nest was immediately adjacent to a 'No Fly Zone' and permission to access this nest on-foot could not be obtained from the landholder. As this nest was last seen in 2018, it is assumed that it is still present at this location.

Three of the 'not found' eagle nests (#2771, #2960 and #3022) have evidently fallen, based off photographs of the known nest tree from the previous year. Of these nests, the previous location of nest #2960 has a new nest being built approximately 150 to the NW.

3.5. Absent nests

Of the known nests in the 2023 survey, seven have now met the conditions to be formally treated as absent (Appendix D) and have been excluded from the maps in this report. This is based on: not being relocated during three consecutive aerial and/or ground searches, expert observation where it was known that the nest is now gone, and/or confirmation that a previously reported nest with uncertainty around its status was confirmed as 'not an eagle nest'. These nests will still show on TheLIST under a raptor nest search and will still be listed on the Natural Values Atlas (NVA), although the final entry of these nest will include an 'absent' status if 'include absent records' is included in the NVA search.

Table 1. Nest location details and integrity classifications for newly found/located nests from 2023 survey, in order of date found. WTE = Wedge-tailed Eagle; WBSE = White-bellied Sea Eagle.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
14/02/2023	3144	401287	5450719	Prime	10	Indeterminate[8]	A prime nest with large amounts of brown leaves on top and a slight bowl. The nest is roughly 45 m up a 50 m high *Eucalyptus obliqua* tree. See Plates 1a and 1b and Figure 3.
15/02/2023	3145	421717	5444021	Prime	10	Indeterminate	A large robust nest with a flat top, brown sticks and whitewash on adjacent branches. The nest is roughly 47 m up a 57 m high *E. obliqua.* See Plates 2a and 2b and Figure 5.
16/02/2023	3146	428761	5441072	Viable	10	Indeterminate	A small nest roughly 20 m up a 35 m *E. obliqua.* This nest is hard to see under canopy and has brown sticks and leaves on top but no signs of recent use. See Plate 3 and Figure 5.
17/02/2023	3147	433608	5432624	Prime	10	WBSE	A large nest roughly 26 m up a 35 m high *E. viminalis.* This nest has a flat top, brown leaves and sticks. A juvenile White-bellied Sea Eagle was observed flushing from a nearby tree. See Plates 4a and 4b and Figure 6.

[8] All indeterminate nests are treated as eagle nests if it cannot be determined which of the two Tasmanian eagle species the nest belongs to.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
17/02/2023	3148	442409	5426702	Prime	10	Indeterminate	A large nest roughly 30 m up a dead 36 m *Eucalyptus* tree. This nest has lots of bark lining a nest bowl although the nest doesn't appear to have been used. This nest was found 20 m outside the survey area boundary. See Plates 5a and 5b and Figure 6.
20/02/2023	3149	456528	5417067	Viable	10	Indeterminate	Large nest roughly 41 m up dead 45 m *Eucalyptus* tree. Nest is bleached with loose sticks on top and a slight bowl. See Plates 6a and 6b and Figure 8.
21/02/2023	3150	464078	5408092	Viable	10	Indeterminate	A large nest with deep nest bowl. Sticks loose on top and bleaching. This nest is in 32 m up an exposed 33 m high *E. obliqua.* See Plates 7a and 7b and Figure 9.
21/02/2023	3151	475220	5404715	Viable	10	Indeterminate	A large nest with a nest bowl roughly 28 m up a 35 m high dead *Eucalyptus* tree. Small pieces of down feather present on nest. See Plates 8a and 8b and Figure 10.
21/02/2023	3152	483427	5394802	Remnant	10	Indeterminate	An atypical cluster of nesting material in tree. Sticks large enough for an eagle although the material is loose with no distinct nest shape. The material is 45 m up a 55 m high *E. viminalis.* See Plate 9 and Figure 11.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
21/02/2023	3153	496087	5383187	Viable	10	Indeterminate	A small nest roughly 20 m up a 30 m *E. amygdalina*. Materials on the nest appear loose and bleached. A slight nest bowl is present as well as brown leaves. See Plates 10a and 10b and Figure 11.
22/02/2023	3154	497647	5378353	Viable	10	WBSE	A small newly built nest approximately 160 m to the NE of fallen nest #2960. It is likely this nest is from the same pair of White-bellied Sea Eagles that are attempting to rebuild on the same river line. The nest has lots of new material although at this point it is still loose in structure. The nest is roughly 35 m up a 45 m high *E. viminalis* tree. See Plates 11a and 11b and Figure 11.

Table 2. Nest location details from within the survey area and 2023 integrity classifications. WTE = Wedge-tailed Eagle; WBSE = White-bellied Sea Eagle; GG = Grey Goshawk.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
13/02/2023	2674	393602	5432334	Viable	10	WTE	This nest is obscured under dense canopy. It appears that new material has been added to this nest in the last year, resulting in it sloping less. The nest has a relatively flat top with brown sticks and leaves and is roughly 25 m up 35 m *E. obliqua* tree. A small amount of whitewash is present on adjacent branches. See Plate 12 and Figure 2.
13/02/2023	2675	397357	5435638	Prime	10	WTE	This nest is hard to see nest under tree canopy. At the time of the survey, the nest was occupied by a young fledgling, which was only observed through the camera lens. The helicopter left the vicinity as soon as the fledgling was observed. The nest has a flat top with brown sticks, leaves, lots of whitewash and down, and algal leaching present. The nest is roughly 25 m up a 35m *E. obliqua*. Epiphytes are present on the nest. See Plates 13a&b and Figure 2.
13/02/2023	3007	397441	5436187	Viable	10	WTE	No new material has been added to this nest this year. It doesn't appear to have been recently used. The nest is roughly 28 m up a 35 m dead tree. See Plates 14a&b and Figure 2.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
13/02/2023	1498	398781	5441581	Viable	10	WTE	This nest had not been observed since 2021 due to an aggressive Wedge-tailed Eagle. An eagle was observed during the survey soaring over a nearby ridge, but it showed no aggression towards the helicopter and kept its distance. The nest is still large and has a bowl with new nesting material. See Plate 15 and Figure 2.
13/02/2023	3011	401666	5442489	Viable	50	WBSE	A large robust nest under dense canopy. This nest has a bowl and small amounts of whitewash on adjacent trunk, it doesn't appear to have been recently used. The coordinates for this nest have been updated on the *Natural Values Atlas*. See Plates 16a&b and Figure 2.
13/02/2023	2361	400268	5447522	Prime	10	WTE	This nest has a slight nest bowl, algal leaching, and whitewash around surrounding branches. It is found roughly 30 m up a 33 m tall *E. obliqua*. See Plate 17a&b and Figure 3.
13/02/2023	2678	400493	5448226	Viable	10	WTE	This nest is starting to slope slightly and bleach although still viable. No new brown sticks or leaves have been added. It is close to nest #743, #2772 and #3010. Slight algal leaching is present below the nest. Nest is roughly 25 m up a 35 m tall *E. obliqua.* See Plate 18 and Figure 3.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
13/02/2023	2772	400444	5448346	Viable	10	WTE	Large, old, composted platform. This nest has no sticks left and epiphytes are slowly taking over. Although this nest has no sticks it was active during the 2021/2022 activity assessment with an adult eagle present on the nest. The nest is located roughly 230 m northeast of nest #743 and 120 m north of nest #2678. It is in a roughly 30 m tall *E. amygdalina*, about 15 m up. These nests are likely all within one eagle territory. Two adult Wedge-tailed Eagles were seen circling nearby. See Plates 19a&b and Figure 3.
13/02/2023	743	400295	5448177	Viable	10	WTE	The nest is roughly 25 m up a 35m *E. obliqua* and is robust but bleached with sticks beginning to loosen. Nest is close to nests #2678, #2772 and nest #3010. See Plates 20a&b and Figure 3.
13/02/2023	2957	401333	5446854	Remnant	10	Indeterminate	A very small remnant nest, roughly 10 m up a 30 m tall *E. obliqua*. Nest material is bleached with a relatively flat top. See Plates 21 and Figure 3.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
13/02/2023	3012	399987	5448450	Prime	10	WTE	A large robust nest not too far from the nest clusters of #743, #2678 and #2772. This nest is likely within the same territory as these nests although being in a different gully there is a chance that this nest also belongs to a separate pair of eagles. The nest has a flat top with loose sticks. Nest is roughly 24 m up a 30 m tall *E. obliqua.* See Plate 22 and Figure 3.
14/02/2023	2676	401273	5452373	Prime	10	WTE	The canopy around this nest has grown a lot making it hard to see. The nest appeared to still be in good condition. The nest is Roughly 27 m up a 35 m tall *E. obliqua*. See Plate 23 and Figure 3.
14/02/2023	3013	404232	5451221	Viable	10	Indeterminate	A large robust nest in a dead eucalyptus tree roughly 20 m up. The nest has a slight bowl with whitewash present on adjacent branches and algal leeching under the nest. The nest is mainly all bleached with no new nesting material, although still viable. See Plates 24a&b and Figure 3.
14/02/2023	2669	402398	5454696	Viable	10	WBSE	Very large nest, roughly 15 m up a 25 m *E. obliqua*. Nest has a slight bowl and is bleached. With better clarity, the large branch that was thought to be obstructing the nest last year doesn't in fact obstruct potential use. See Plates 25a&b and Figure 3.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
14/02/2023	891	402490	5454678	Derelict	10	WBSE	This nest is just behind nest #2668 and is situated roughly 20 m up a 22 m dead tree. The sticks on this nest are very loose and bleached. See Plate 26 and Figure 3.
14/02/2023	2668	408846	5450819	Prime	10	WTE	Large robust nest with a flat top and algal leaching down the main trunk. Fresh sticks and brown leaves were present on the nest with down and feathers found in nest. Appears to have been recently used. The nest is roughly 28 m up a 35 m tall *E. obliqua*. See Plates 27a&b and Figure 4.
14/02/2023	2273	409238	5451491	Prime	10	WBSE	Large robust nest with relatively flat top. Nest is roughly 25 m up a 28 m tall *E. obliqua* tree. Whitewash and some new fresh sticks were present. This nest was active in the 2022/2023 breeding season. See Plate 28 and Figure 4.
15/02/2023	2573	413457	5450697	Prime	10	WTE	Large prime nest with a slight bowl, brown sticks and whitewash on adjacent branches. Down feathers present in nest. It is situated 25 m up a 30 m tall *E. obliqua*. See Plates 29a&b and Figure 4.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
15/02/2023	3014	412731	5447825	Prime	10	WTE	A medium nest with a bowl and brown leaves. The nest is roughly 32 m up a 42 m tall *E. obliqua.* Two Wedge-tailed Eagle was seen nearby. See Plate 30 and Figure 4.
15/02/2023	2670	416810	5447036	Prime	10	WBSE	Large robust nest roughly 30 m up a 35 m tall *E. viminalis*. Flat top with loose sticks on top. Whitewash present on adjacent branches. See Plates 31a&b and Figure 4.
15/02/2023	3015	417551	5448077	Viable	10	Indeterminate	This nest has been significantly added to this year and is now a viable nest. The nest is relatively low in an *E. viminalis.*, only 15 m up a 45 m tree. It has a flat, loose top. See Plates 32a&b and Figure 4.
15/02/2023	923	426566	5442534	Viable	10	WTE	Large flat top nest lined mainly with reeds. Down feathers present on nest. The nest is roughly 28 m up a 35 m tall *E. obliqua*. See Plates 33a&b and Figure 5.
15/02/2023	2680	426421	5442200	Viable	10	WTE	Large nest with flat top roughly 25 m up 40 m high *E. viminalis.* Nest appears to have fresh brown sticks on top and algal leaching around the base. See Plates 34a&b and Figure 5.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
16/02/2023	3016	423848	5442013	Prime	10	Indeterminate	A large nest with fresh brown sticks and leaves. Whitewash was present on the nest and adjacent branches as well as algal leaching underneath. This nest is close to nest #3017. Nest roughly 28 m up a 35 m tall *E. obliqua.* See Plates 35a&b and Figure 5.
16/02/2023	3017	423861	5441991	Derelict	10	Indeterminate	A small sloping nest 25 m from nest #3016. It seems to have been a large nest that has now half collapsed on one side. Nest roughly 30 m up a 31 m tall *E. viminalis*. See Plates 35b and Figure 5.
16/02/2023	3018	427641	5438180	Prime	10	Indeterminate	This nest has had a lot of new material added to it and its condition has gone from derelict and degraded to prime. Nest roughly 25 m up a 45 m tall *E. regnans*. It is situated between two plantations. Nest with fresh brown sticks and leaves, whitewash and down feathers present on nest. See Plate 36 and Figure 5.
16/02/2023	3019	432757	5437838	Prime	10	Indeterminate	Large robust nest in valley. This nest appeared likely to have been used recently during the breeding season. A flat top and whitewash present, as well as new fresh sticks and brown leaves. Algal leaching is present on tree trunk. The nest is roughly 25 m high in a 50 m tall *E. regnans*. See Plate 37 and Figure 6.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
17/02/2023	3020	434209	5434667	Remnant	10	GG	This nest was thought to be a small remnant eagle nest. However, a Grey Goshawk was present at the nest during the survey. This change in species has been updated on the *Natural Values Atlas*. The nest has been recently added too with new nesting material and a deep bowl in the centre of the nest. The nest is in a regrowth 25 m tall *E. regnans* roughly 18 m up. See Plates 38a&b and Figure 6.
17/02/2023	3021	437213	5427479	Prime	10	WBSE	Large robust nest with new material and a nest bowl. This nest was previously near nest #3022, which has now fallen. The nest is 25 m up a 30 m tall *E. obliqua*. See Plates 39a&b and Figure 6.
20/02/2023	2958	438667	5430396	Prime	10	WTE	A juvenile Wedge-tailed Eagle was still in the nest during the nest survey and once spotted the helicopter vacated the vicinity immediately. Moderate-sized flat top nest in large fork, roughly 28 m up a 30 m tall *E. viminalis*. Fresh sticks and brown leaves were present with the nest. Whitewash was present on adjacent branches and fresh down on nest. See Plate 40 and Figure 6.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
20/02/2023	3006	443060	5421352	Prime	10	WTE	A prime nest with a flat top and lots of down and whitewash. The nest is approximately 28 m up a 40 m *E. delegatensis*. Two Wedge-tailed Eagles observed near the nest (Table 4). See Plate 41 and Figure 7.
20/02/2023	3008	454901	5417164	Viable	10	Indeterminate	A large nest, roughly 30 m up a 40 m tall *E. obliqua*. The sticks on this nest are loose, with a large branch fallen across the nest centre, noting this fallen branch was there last year. This nest is close to nest #3009. See Plate 42 and Figure 8.
20/02/2023	3009	454689	5416841	Prime	10 m	Indeterminate	This nest is relatively close to nest #3008 and likely in the same territory. This nest is also prime, with loose new nesting material, a slight bowl and a small amount of whitewash. The nest is roughly 26 m up in a 30 m tall *E. delegatensis*. See Plates 43a&b and Figure 8.
21/02/2023	3010	456217	5413457	Viable	10	Indeterminate	A medium-sized nest roughly 27 m up a 30 m tall *E. obliqua*. This nest has new brown sticks and leaves and a nest bowl although the sticks are loose on top. See Plates 44a&b and Figure 8.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
21/02/2023	2682	474914	5404500	Prime	10	WBSE	Large, round, robust nest with a nest bowl with brown sticks and leaves. The nest is roughly 30 m up in 45 m tall *E. viminalis*. See Plates 45a&b and Figure 10.
21/02/2023	3023	479252	5402029	Viable	10	Indeterminate	Small nest in lone paddock tree. The nest has a flat top, few fresh brown sticks, whitewash, down feathers and green leaves in the centre. The nest is roughly 15 m up a 27 m tall *E. ovata*. See Plates 46a&b and Figure 10.
21/02/2023	3024	480882	5397755	Viable	10	WTE	A small nest with a lot of whitewash present on adjacent branches. Nest sloping with flat top. Nest is roughly 17 m up a 25 m tall *E. obliqua*. An adult Wedge-tailed Eagle was observed nearby. See Plate 47 and Figure 10.
21/02/2023	192	483133	5395089	Prime	10	WTE	A very large, deep, mostly bleached nest. A few brown sticks present on top with a slight bowl. Nest roughly 30 m up a 35 m tall dead *E. obliqua.* See Plate 48 and Figure 10.
21/02/2023	1613	497235	5379781	Prime	10	WTE	Large nest in dead exposed tree. Nest has a slight nest bowl and is bleached overall with a few brown leaves lining the bowl. See Plates 49a&b and Figure 12.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
22/02/2023	3025	491328	5391943	Viable	10	Indeterminate	Nest found right on the boundary of a plantation near nest #3026. Nest roughly 14 m up a 20 m tall *E. amygdalina*. Nest is brown with loose sticks on top. See Plates 50a&b and Figure 11.
22/02/2023	3026	491012	5391532	Prime	10	Indeterminate	Large robust nest near nest #3025 in thinned out forest. This nest has a lot of whitewash on adjacent branches and down feather within the nest. The top is flat and compressed. Nest roughly 28 m up 35 m tall *E. amygdalina.* See Plates 50a&b and Figure 11.

Table 3: Nest details of previously reported nests that could not be found or could not be searched for within the 2023 survey (excluding those that have met the parameters to be considered absent[9]. WTE = Wedge-tailed Eagle; WBSE = White-bellied Sea Eagle; GG = Grey Goshawk.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
13/02/2023	1696	399880	5434600	N/A	50	GG	This nest could not be found, even though the habitat patch is thinning out, making observation into the canopy easier.
15/02/2023	553	413055	5449815	N/A	10	GG	A viable nesting tree (*Acacia melanoxylon*) was observed at the purported location, but no nest found. Last recorded in 1985. Due to the nature of Grey Goshawks nesting under dense canopy it is possible that it was missed during the aerial search, although equally possible the tree simply no longer supports a nest.
15/02/2023	1130	489513	5387684	N/A	10	GG	Last recorded in 1985. Due to the nature of Grey Goshawks nesting under dense canopy it is possible that it was missed during the aerial search.
17/02/2023	2705	436613	5430024	N/A	10	GG	Nest hard to see under canopy, appears to be an atypical cluster of sticks in *E. viminalis*. No definitive conclusion on nest classification due to lack of visibility. Nest is roughly 20 m up 25 m tall tree.
17/02/2023	1286	437663	5426827	N/A	30	WTE	This nest could not be found. Last year it was a remnant and hardly recognisable as a nest with only a few sticks remaining.

[9] Nests from the cohort of 'not-found' nests that have now met the parameters to be treated as 'absent' on the NVA can be found in Appendix D.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
17/02/2023	1871	437921	5426026	N/A	10	WTE	This nest could not be found and was last observed on the NVA in 2010 where it was described as a small nest with loose structure that was falling apart. It is likely that this nest has fallen.
21/02/2023	2451	464955	5408790	Viable	10	WTE	Nest hard to see under canopy. This nest could not be found but it is likely still present. The canopy has become very dense.
16/02/2023	2963	429086	5439129	N/A	10	GG	No nest observed although it is likely still present and obscured from view by the tree canopy. This nest was first recorded in 2021 with an adult likely incubating some eggs and is likely still present.
-	2503	457775	5411586	N/A	10	WTE	This nest was not searched for due to restricted access to the site. The property the nest is located on has a strict 'no fly' policy. The landholder also refused ecologists access to the property via a ground search. This nest was found in 2018 and is likely still present. See Figure 8.
22/02/2023	1838	491759	5385228	N/A	10	GG	This goshawk nest was not found, it is purported to be within 25 m of Wedge-tailed Eagle nest #675. This nest was found in 2010 with white feather down and whitewash reportedly present.
22/02/2023	2954	411923	5450603	N/A	10	GG	This nest likely still exists as it was active in October 2021.

Table 4: Incidental raptor observations and minor nests seen on each day of the survey.

Survey date	Wedge-tailed Eagles	White-bellied Sea Eagles	Grey Goshawks	Minor nests seen[10]
13/02/2023	8	0	2	0
14/02/2023	0	2	1	3
15/02/2023	6	0	2	6
16/02/2023	6	1	3	4
17/02/2023	7	1	2	3
20/02/2023	5	0	1	5
21/02/2023	7	1	0	6
22/02/2023	7	0	1	2

[10] Non-raptor species, primarily suspected corvid nests

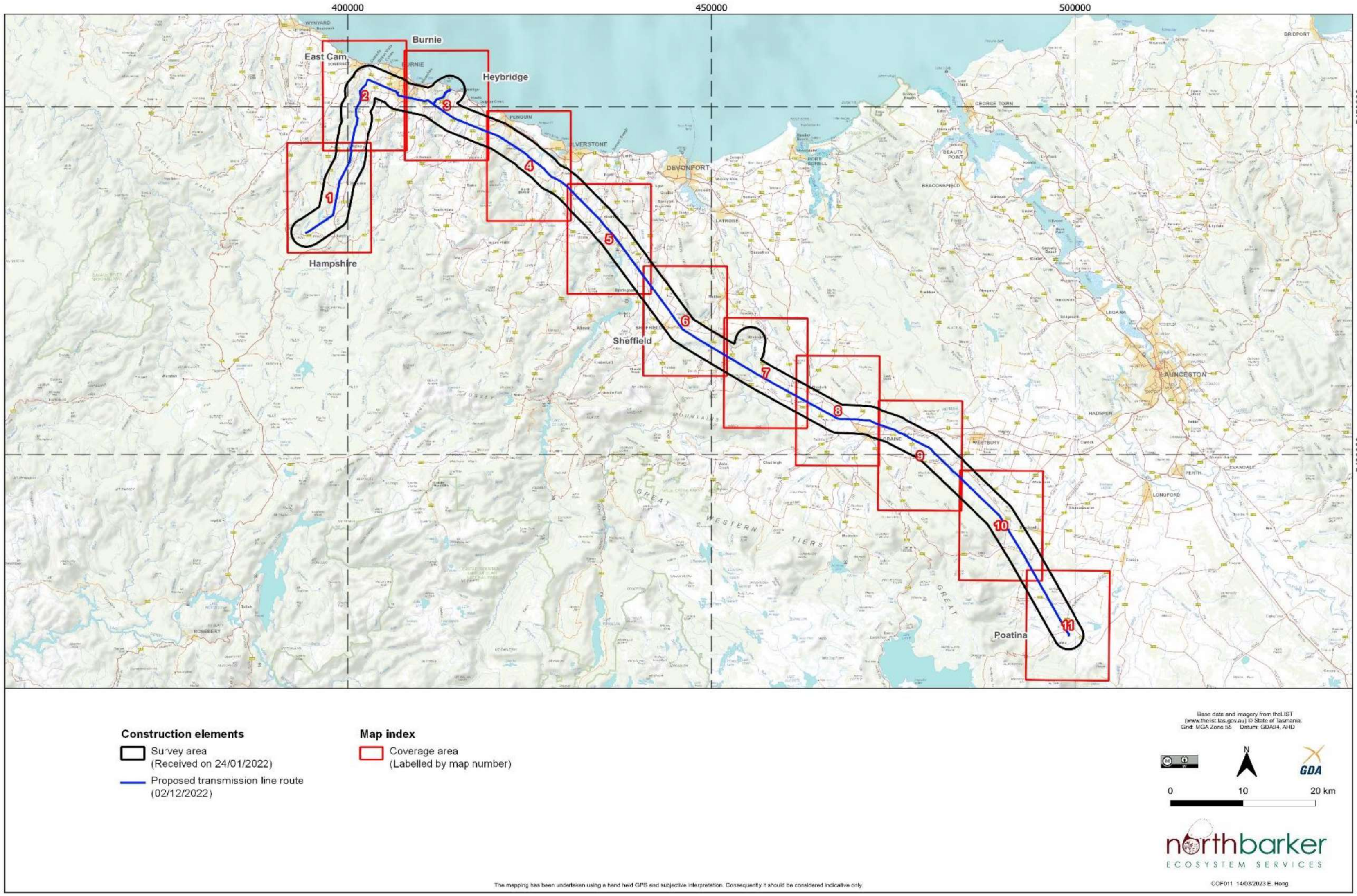

Figure 1: Index map of proposed transmission line route, nest search buffer and individual map sections.

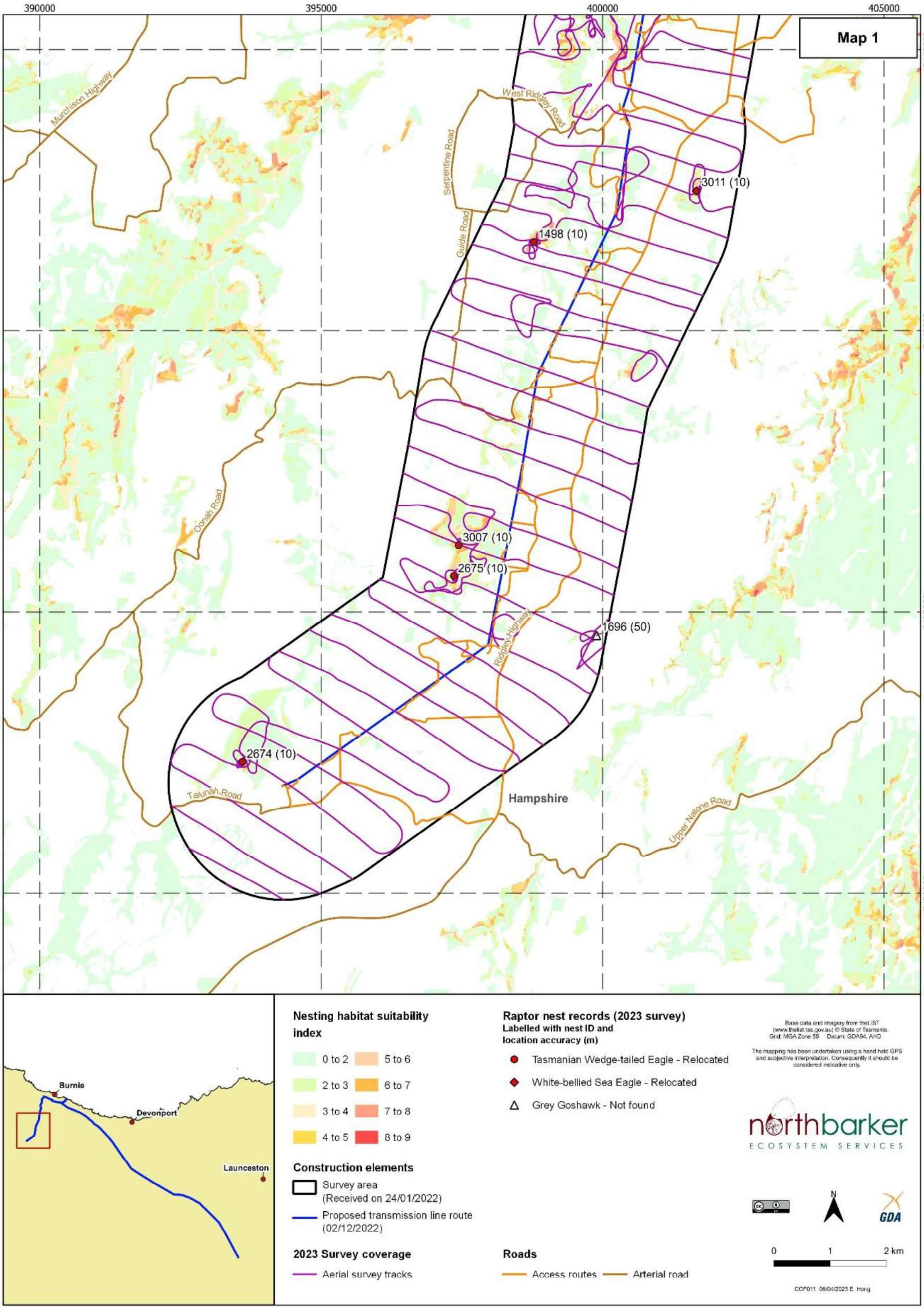

Figure 2: Map 1 – Aerial survey tracks and survey results.

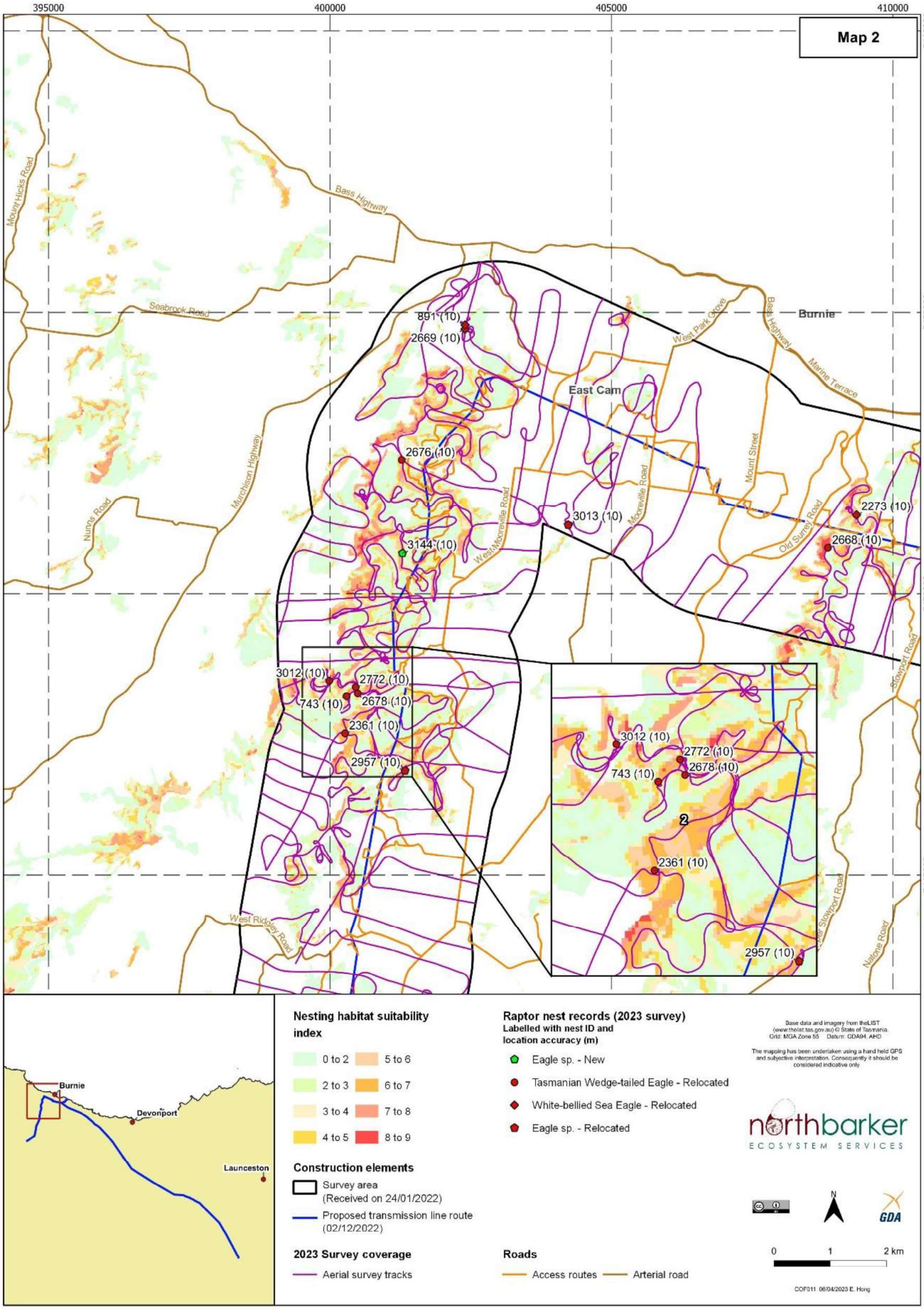

Figure 3: Map 2 - Aerial survey tracks and survey results.

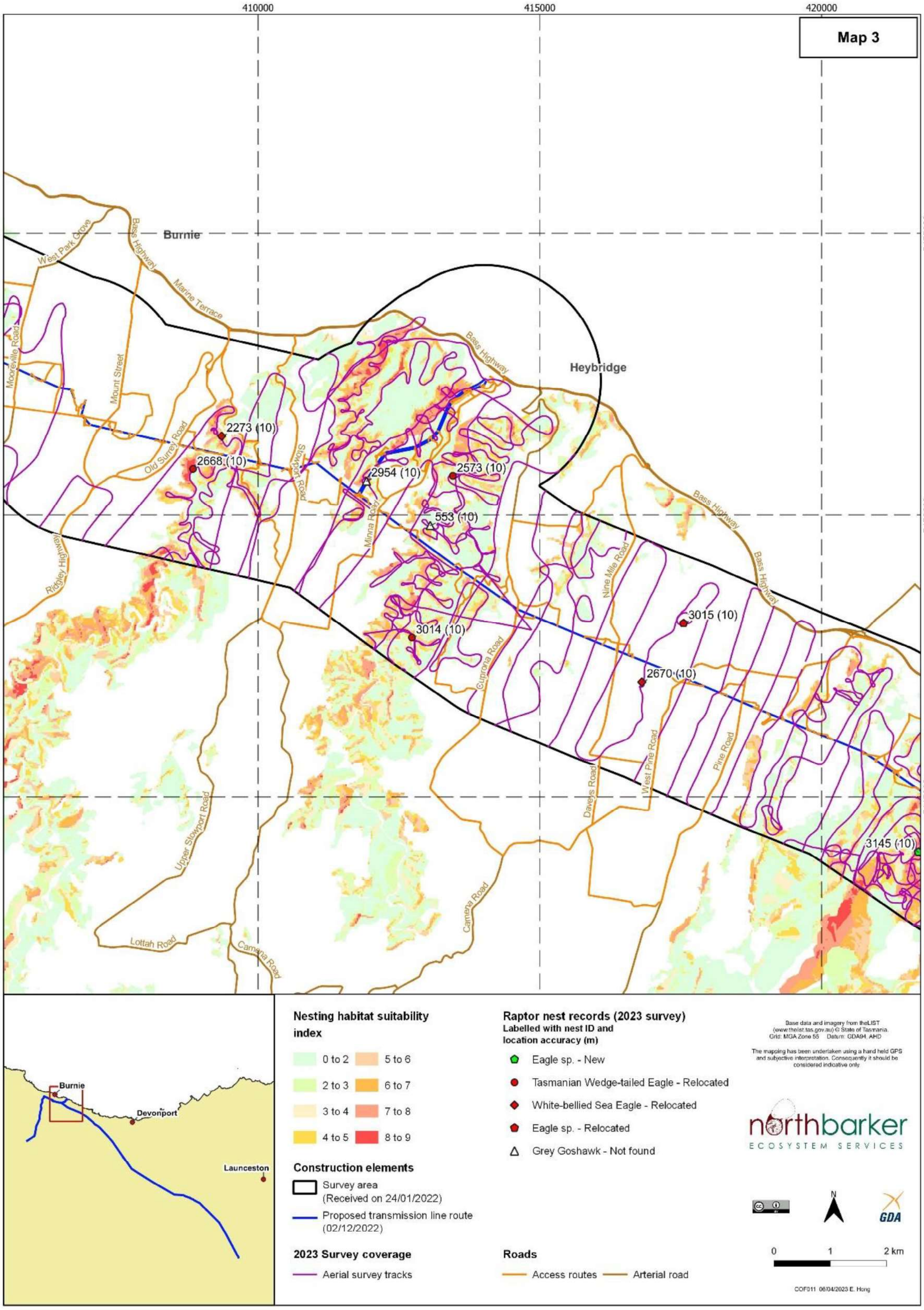

Figure 4: Map 3 - Aerial survey tracks and survey results.

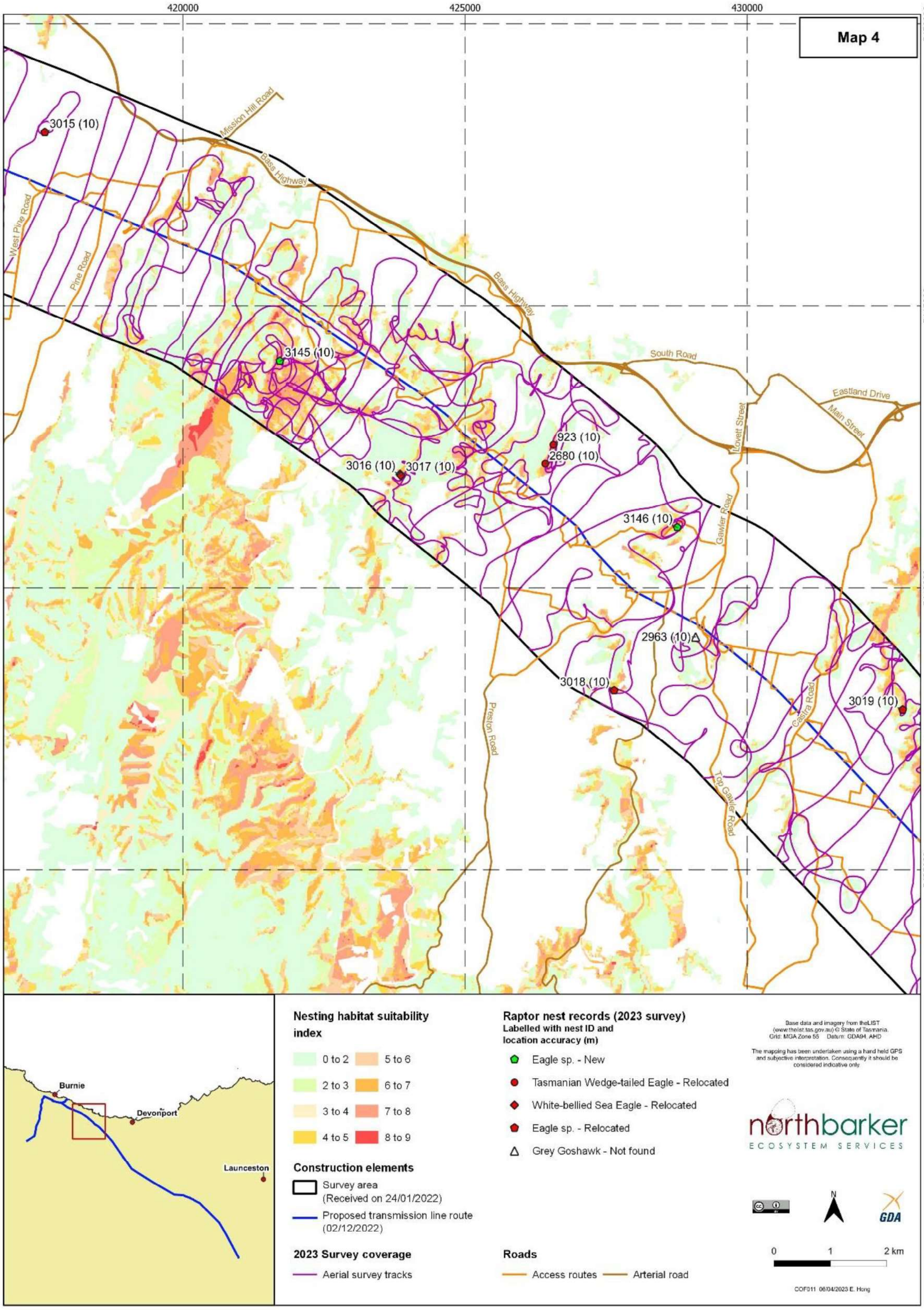

Figure 5: Map 4 - Aerial survey tracks and survey results.

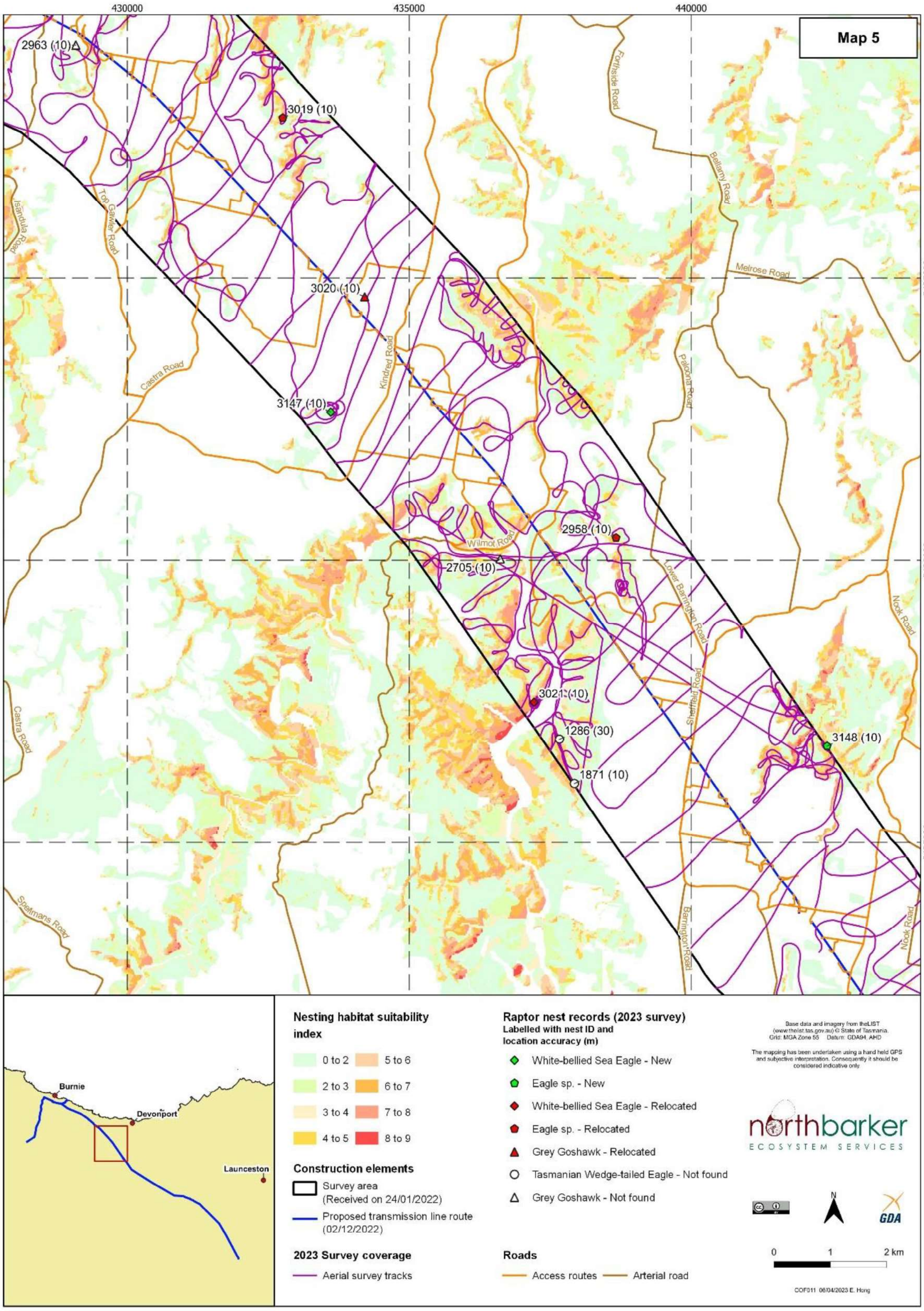

Figure 6: Map 5 - Aerial survey tracks and survey results.

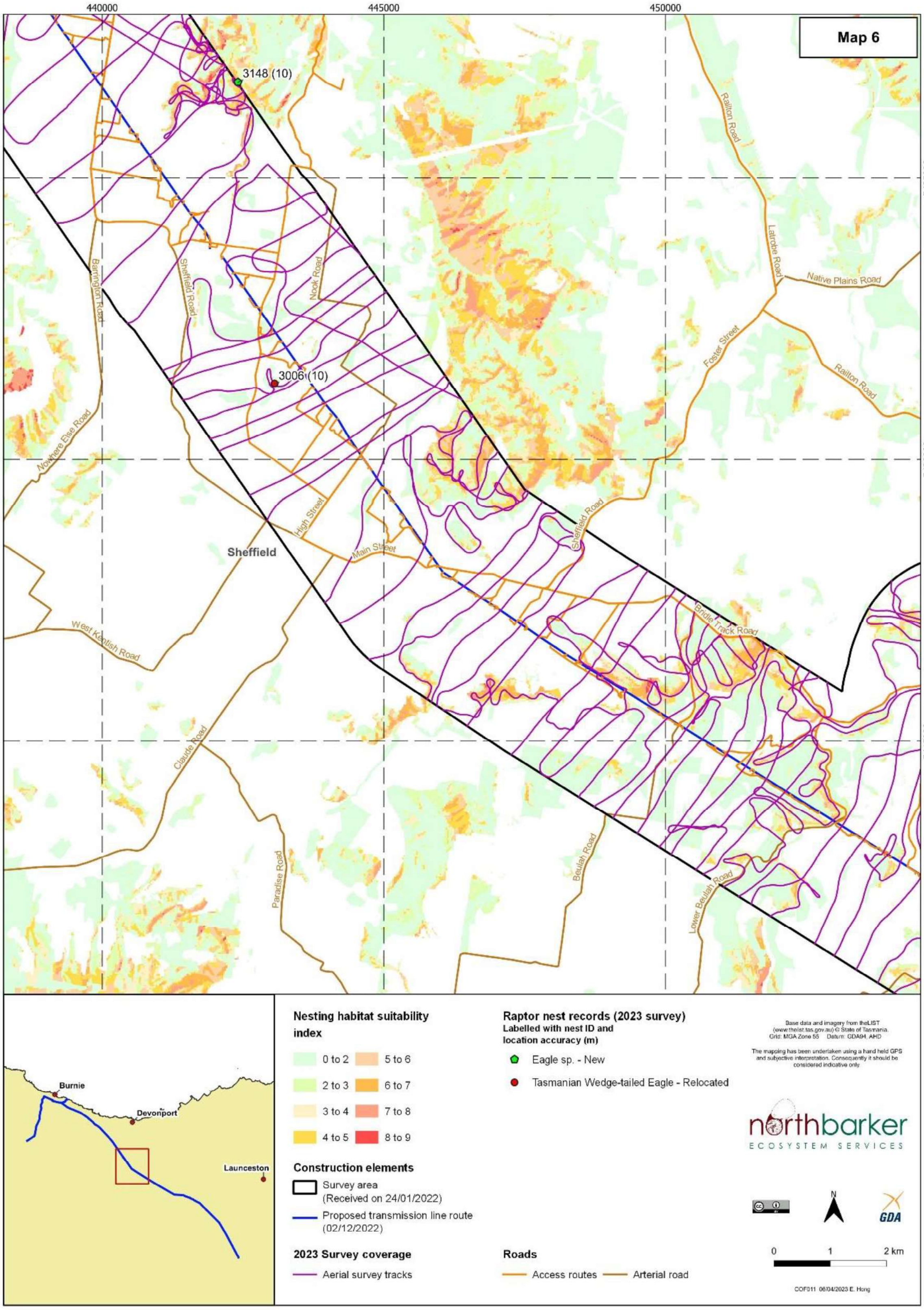

Figure 7: Map 6- Aerial survey tracks and survey results.

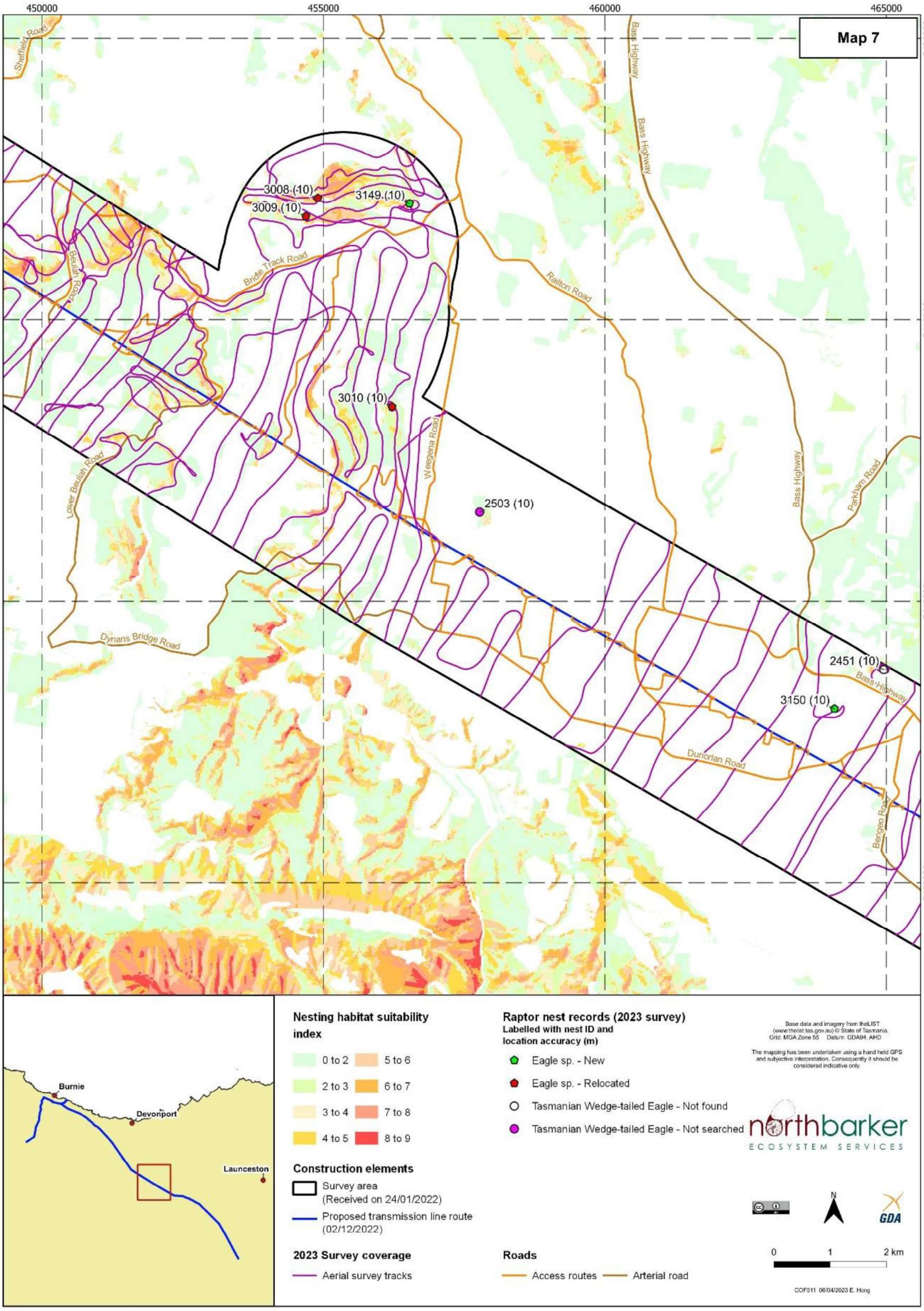

Figure 8: Map 7- Aerial survey tracks and survey results.

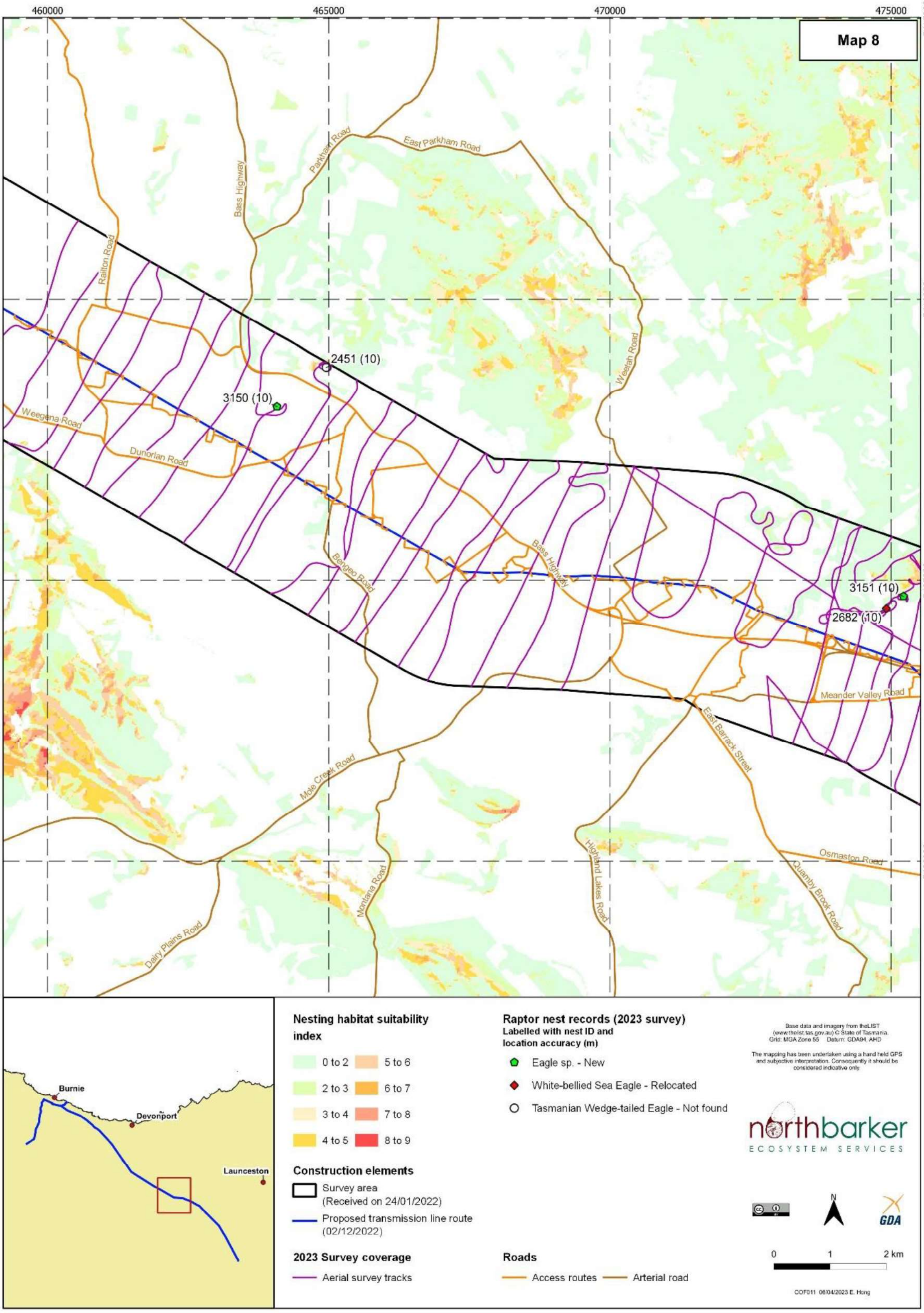

Figure 9: Map 8- Aerial survey tracks and survey results.

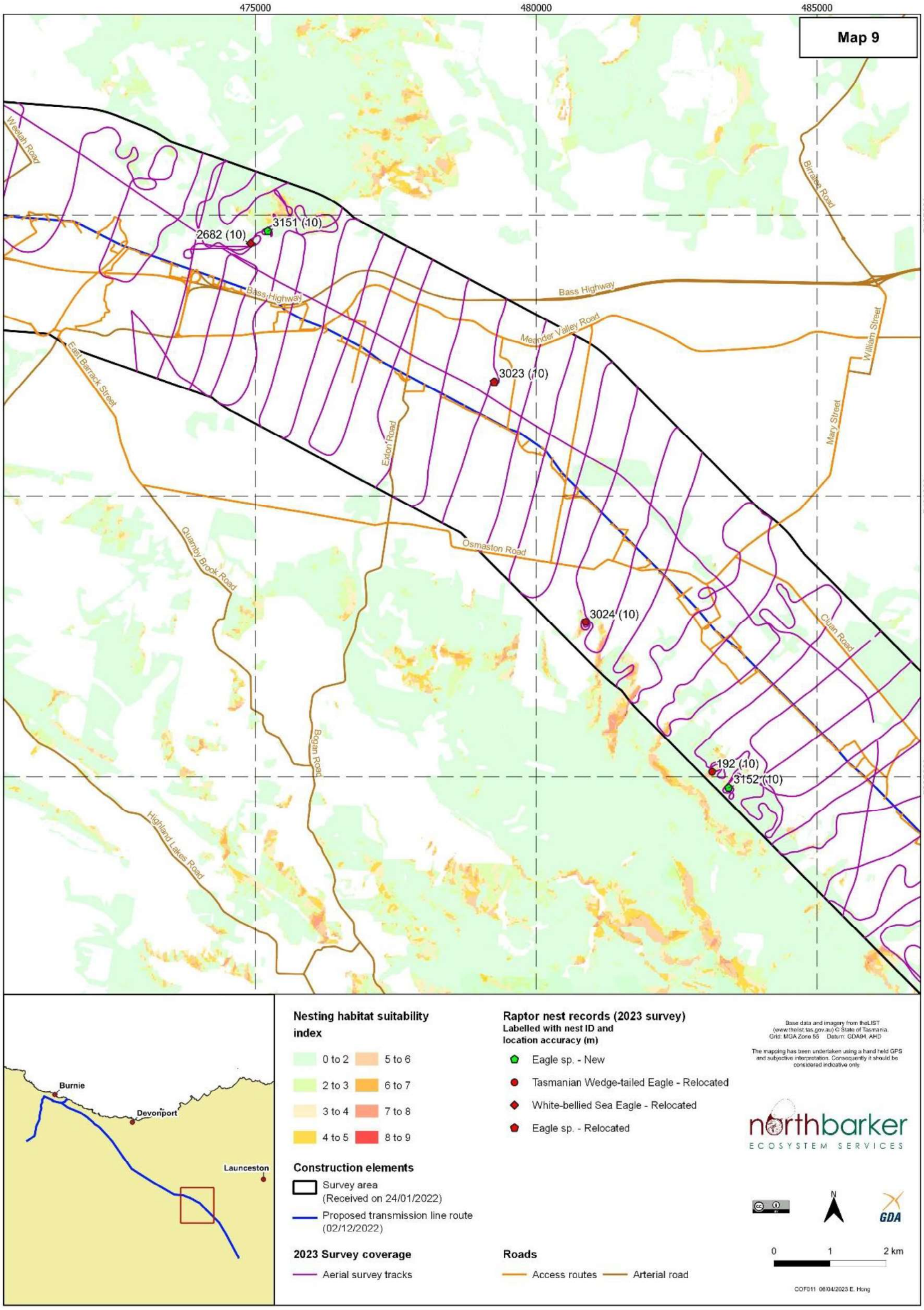

Figure 10: Map 9- Aerial survey tracks and survey results.

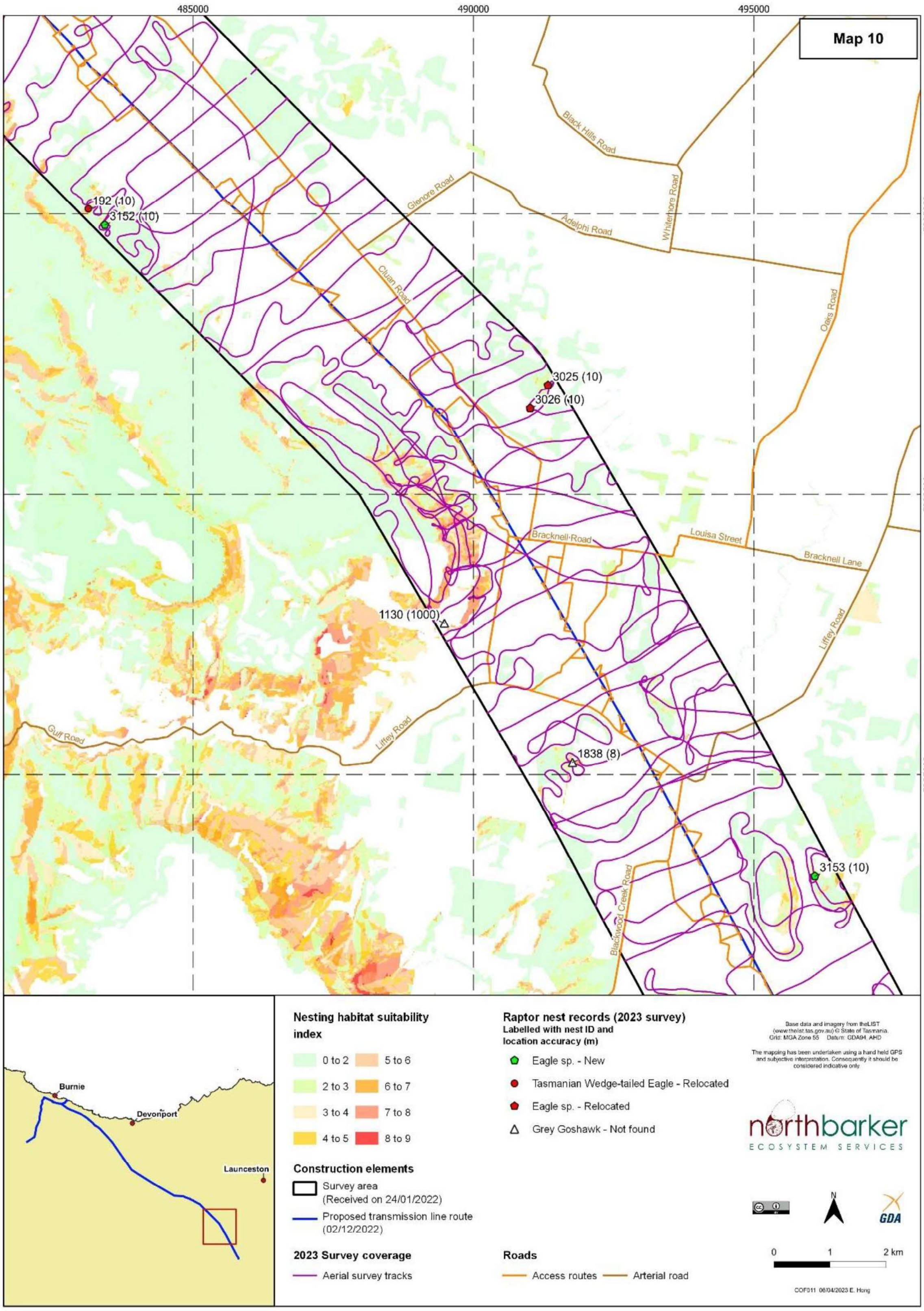

Figure 11: Map 10- Aerial survey tracks and survey results.

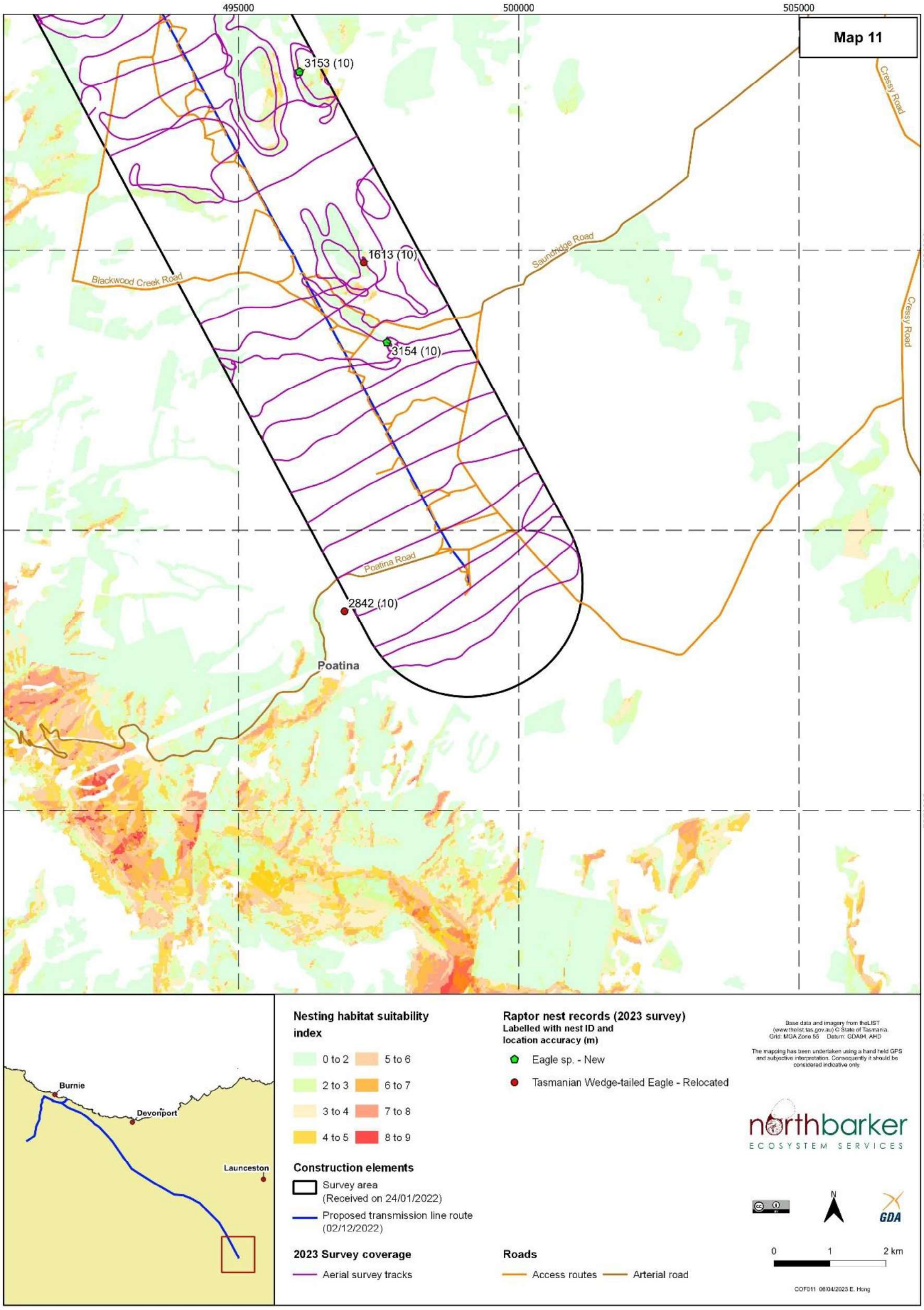

Figure 12: Map 11- Aerial survey tracks and survey results.

4. NEST LOCATIONS RELATIVE TO THE PROPOSED ALIGNMENT

Overall, nests along the entire alignment occurred within a range of habitat types, such as in locations mapped as having relatively high habitat suitable on the FPA's eagle habitat suitability model, such as gullies, river valleys and east facing slopes and locations mapped as having low habitat suitability such as in small native habitat patches surrounded by forestry and/or agricultural land.

Seven of the (fifty-seven) eagle nests[11] are within 500 m direct distance (taking into account potential GPS inaccuracy of 10 m) of the proposed alignment section (Table 5). Of these, seven nests five are currently considered 'prime' (nest #2273, #3144, #2670, #2668, and #2676), one is considered 'viable' (#2680) and one (#2957) is considered a remnant.

An additional eighteen nests are positioned less than 1 km away (Table 5). Of the eighteen nests between 500 m - 1 km, three were newly found nests (#3154, #3150 and #3145) and one of them (#2503) was not searched for but considered likely to remain extant. The remaining thirty-three nests are greater than 1 km from the alignment.

Table 5: Approximate horizontal distances of all extant eagle nests (excluding 'absent' nests) to the potential route alignment, in order of closest to farthest[12].

NVA nest ID	Distance from favourable alignment (m)	Species	Nest Status
2273	318.408	White-bellied Sea Eagle	Relocated
3144	335.144	Eagle sp.	Found
2957	338.887	Eagle sp.	Relocated
2670	356.778	White-bellied Sea Eagle	Relocated
2668	360.655	Wedge-tailed Eagle	Relocated
2676	404.089	Wedge-tailed Eagle	Relocated
2680	503.004	Wedge-tailed Eagle	Relocated
3006	530.626	Wedge-tailed Eagle	Relocated
3023	620.52	Eagle sp.	Relocated
2772	737.958	Wedge-tailed Eagle	Relocated
2573	741.29	Wedge-tailed Eagle	Relocated

[11] Grey Goshawks have not been included as they do not share the same management constraints as eagles.
[12] At the time of this report, these distances have been calculated from the most up to date information, received from the client on the 2nd of December 2022.

NVA nest ID	Distance from favourable alignment (m)	Species	Nest Status
3154	750.165	Eagle sp.	Found
2678	753.653	Wedge-tailed Eagle	Relocated
2682	792.541	White-bellied Sea Eagle	Relocated
2503	806.143	Wedge-tailed Eagle	Not searched, restricted access
2675	826.957	Wedge-tailed Eagle	Relocated
2674	829.004	Wedge-tailed Eagle	Relocated
3007	847.681	Wedge-tailed Eagle	Relocated
923	853.937	Wedge-tailed Eagle	Relocated
3015	885.186	Eagle sp.	Relocated
2361	897.361	Wedge-tailed Eagle	Relocated
3150	912.565	Eagle sp.	Found
3145	922.551	Eagle sp.	Found
743	951.325	Wedge-tailed Eagle	Relocated
2669	962.903	White-bellied Sea Eagle	Relocated
891	1030.968	White-bellied Sea Eagle	Relocated
1613	1063.539	Wedge-tailed Eagle	Relocated
2958	1079.984	Eagle sp.	Relocated
1498	1091.006	Wedge-tailed Eagle	Relocated
3151	1097.617	Eagle sp.	Found
3012	1168.465	Wedge-tailed Eagle	Relocated
675	1191.798	Wedge-tailed Eagle	Not found
3016	1297.703	White-bellied Sea Eagle	Relocated
3017	1300.975	White-bellied Sea Eagle	Relocated
3011	1341.825	White-bellied Sea Eagle	Relocated

NVA nest ID	Distance from favourable alignment (m)	Species	Nest Status
3146	1343.961	Eagle sp.	Found
3026	1376.01	Eagle sp.	Relocated
3019	1380.671	Eagle sp.	Relocated
3014	1479.205	Wedge-tailed Eagle	Relocated
3147	1553.764	White-bellied Sea Eagle	Found
3024	1575.523	Wedge-tailed Eagle	Relocated
1323	1590.38	White-bellied Sea Eagle	Not found
3010	1597.65	Eagle sp.	Relocated
3153	1665.732	Eagle sp.	Found
3018	1725.939	Eagle sp.	Relocated
3021	1783.54	White-bellied Sea Eagle	Relocated
1286	1788.657	Wedge-tailed Eagle	Not found
3025	1856.638	Eagle sp.	Relocated
3152	1861.127	Eagle sp.	Found
192	1867.455	Wedge-tailed Eagle	Relocated
3013	1868.336	Eagle sp.	Relocated
2451	1950.43	Wedge-tailed Eagle	Not found
1871	2020.931	Wedge-tailed Eagle	Not found
3148	2032.666	Eagle sp.	Found
3008	3665.011	Eagle sp.	Relocated
3009	4052.249	Eagle sp.	Relocated
3149	4829.171	Eagle sp.	Found

5. DISCUSSION

An aerial search for eagle nests and potential nesting habitat was conducted within 2 km of the proposed transmission line routes from Hampshire to East Cam, East Cam to Sheffield and Sheffield to Poatina/Palmerston substation in northwest Tasmania. This survey was the fifth consecutive annual project-specific survey for the Hampshire to East Cam route. The works undertaken were based on the best practice methodology for eagle nest searches[13]and in a manner that meets the MIDAA planning criteria for the proposal.

Of the fifty-nine previously known raptor nests surveyed in 2023, forty-one were classified as present, either by being relocated or considered likely to be extant (one nest that could not be surveyed due to landholder restrictions) – within these forty-one raptor nests, forty are attributed as eagle nests and one a Grey Goshawk.

Eighteen previously reported nests were 'not found' (eleven eagle nests and seven Grey Goshawk); of the eleven 'not found' eagle nests, seven have now meet the conditions to be formally treated as 'absent' on the NVA.

Eleven new nests were located during the 2023 survey. Details of the nests found, such as their condition and features, were documented to allow for monitoring nest changes over time, including potentially throughout the operational lifespan of this project.

Combining the 2023 survey results with past observations and excluding absent nests, a total of sixty-three raptor nests (fifty-seven eagle and eight Grey Goshawk) are known from the entire alignment (encompassing the Hampshire to Poatina/Palmerston substation route and the respective parts of the routes around Heybridge and Kimberly). Nineteen eagle nests previously known from within the area will still show up on the NVA and TheLIST raptor nest layers, although they can now be considered 'absent' (notwithstanding that the locations may support another nest in the future, but meaning annual breeding season constraints need not be applicable to a nest no longer present).

Disturbances from development are known to have a negative effect on breeding eagle species, particularly the Tasmanian Wedge-tailed Eagle, so provisions are made within the MIDAA criteria for works to minimise the risk of disturbance to breeding birds. Eagle breeding season constraints are typically applied between the 1st of July and 31st of January (but in some years are extended into February to capture late breeding events). Constraints typically include cessation of activities such as vegetation clearing, roading, and development of infrastructure within 500 m or 1 km line-of-sight of nests that are confirmed as active or not definitively inactive. Activity assessments are undertaken annually around October and November – within each season a nest must be assumed to be active until determined to be otherwise (*i.e.* the annual constraint period always applies from 1st of July until [if] an activity assessment determines the nest is inactive that season). Thus, the updated distribution of nests within the area around the alignment can be used to inform the proponent of potential constraints in the upcoming breeding season for 2023/24.

[13] Forest Practices Authority 2014 Fauna Technical Note No. 1: Eagle nest searching, activity checking and nest management.

APPENDIX A: Photographs of recorded nests

Plate 1a: Nest ID #3144

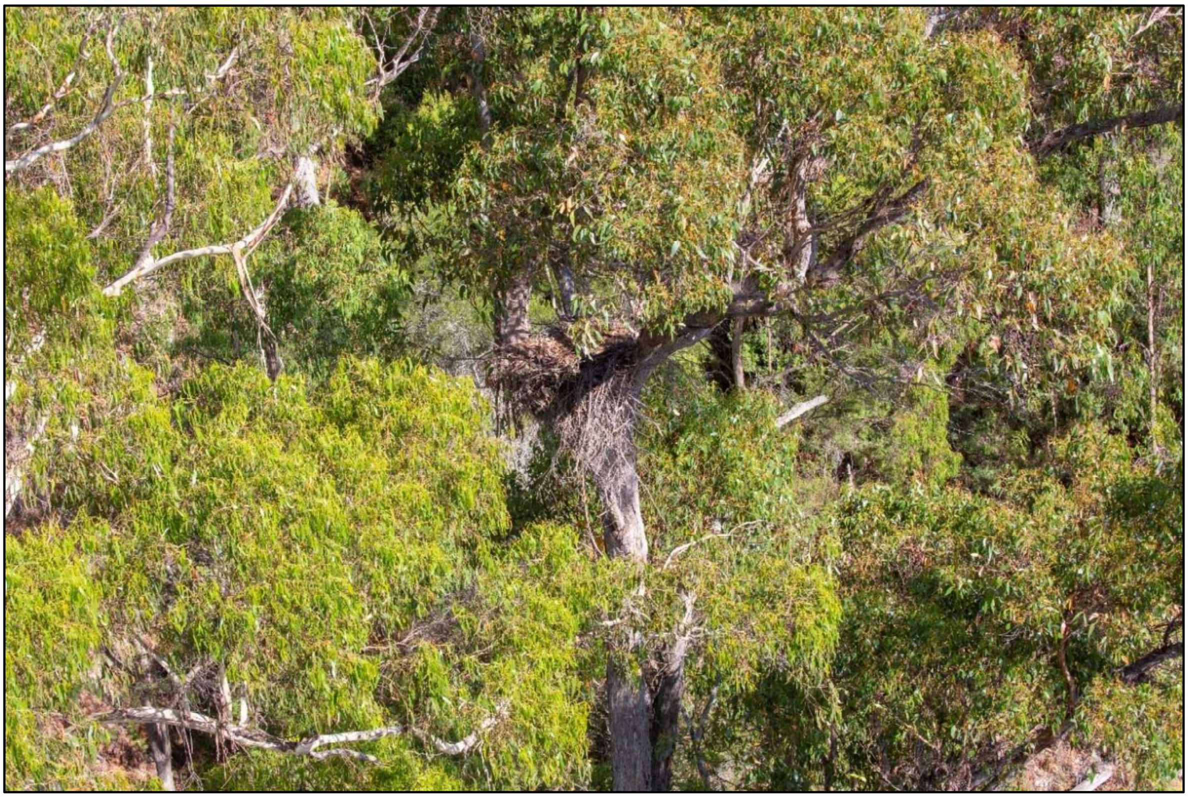

Plate1b: Nest ID #3144

Plate 2a: Nest ID #3145

Plate 2b: Nest ID #3145

Plate 3: Nest ID #3146

Plate 4a: Nest ID #3147

Plate 4b: Nest ID #3147

Plate 5a: Nest ID #3148

Plate 5b: Nest ID #3148

Plate 6a: Nest ID #3149

Plate 6b: Nest ID #3149

Plate 7a: Nest ID #3150

Plate 7b: Nest ID #3150

Plate 8a: Nest ID #3151

Plate 8b: Nest ID #3151

Plate 9: Nest ID #3152

Plate 10a: Nest ID #3153

Plate 10b: Nest ID #3153

Plate 11a: Nest ID #3154

Plate 11b: Nest ID #3154

Plate 12: Nest ID #2674

Plate 13a: Nest ID #2675

Plate 13b: Nest ID #2675

Plate 14a: Nest ID #3007

Plate 14b: Nest ID #3007

Plate 15: Nest ID #1498

Plate 16a: Nest ID #3011

Plate 16b: Nest ID #3011

Plate 17a: Nest ID #2361

Plate 17b: Nest ID #2361

Plate 18: Nest ID #2678

Plate 19a: Nest ID #2772

Plate 19b: Nest ID #2772

Plate 20a: Nest ID #743

Plate 20b: Nest ID #743

Plate 21: Nest ID #2957 (photo from 2022)

Plate 22a: Nest ID #3012

Plate 22b: Nest ID #3012

Plate 23: Nest ID #2676

Plate 24a: Nest ID #3013

Plate 24b: Nest ID #3013

Plate 25a: Nest ID #2669

Plate 25b: Nest ID #2669

Plate 26: Nest ID #891

Plate 27a: Nest ID #2668

Plate 27b: Nest ID #2668

Plate 28: Nest ID #2273

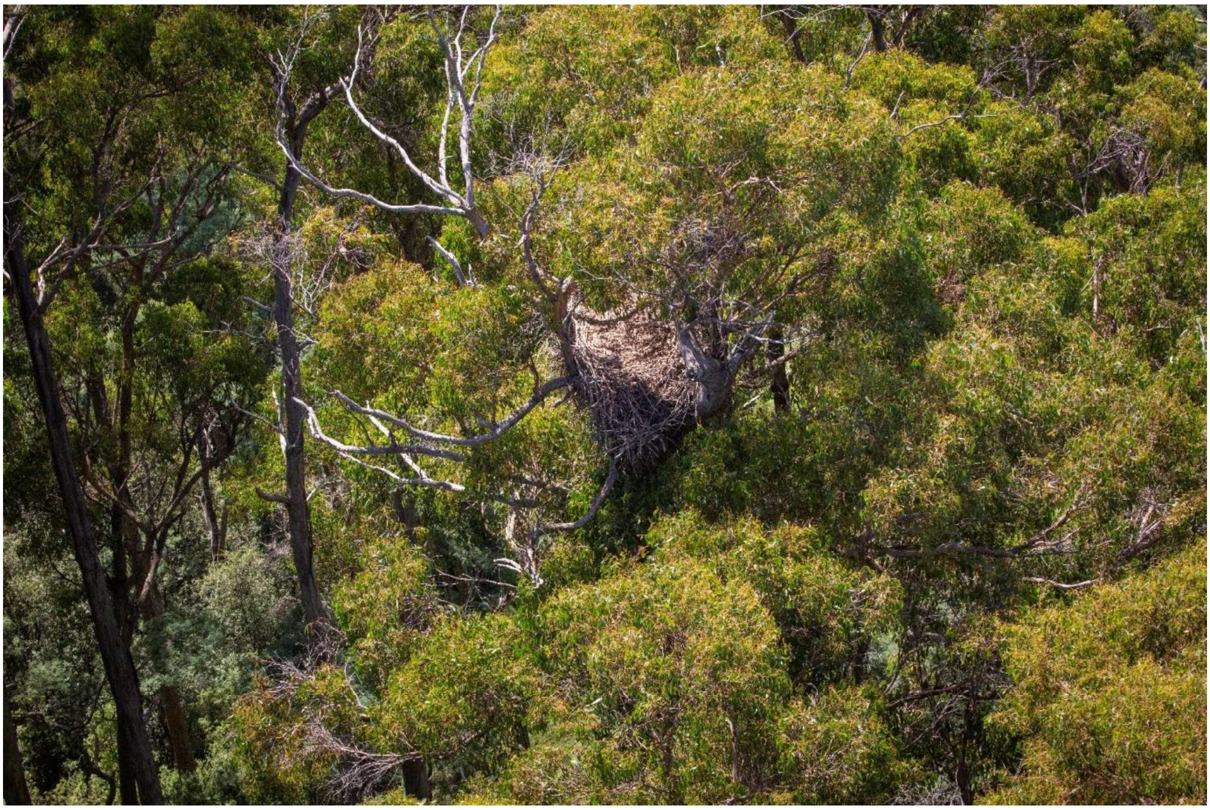

Plate 29a: Nest ID #2573

Plate 29b: Nest ID #2573

Plate 30: Nest ID #3014

Plate 31a: Nest ID #2670

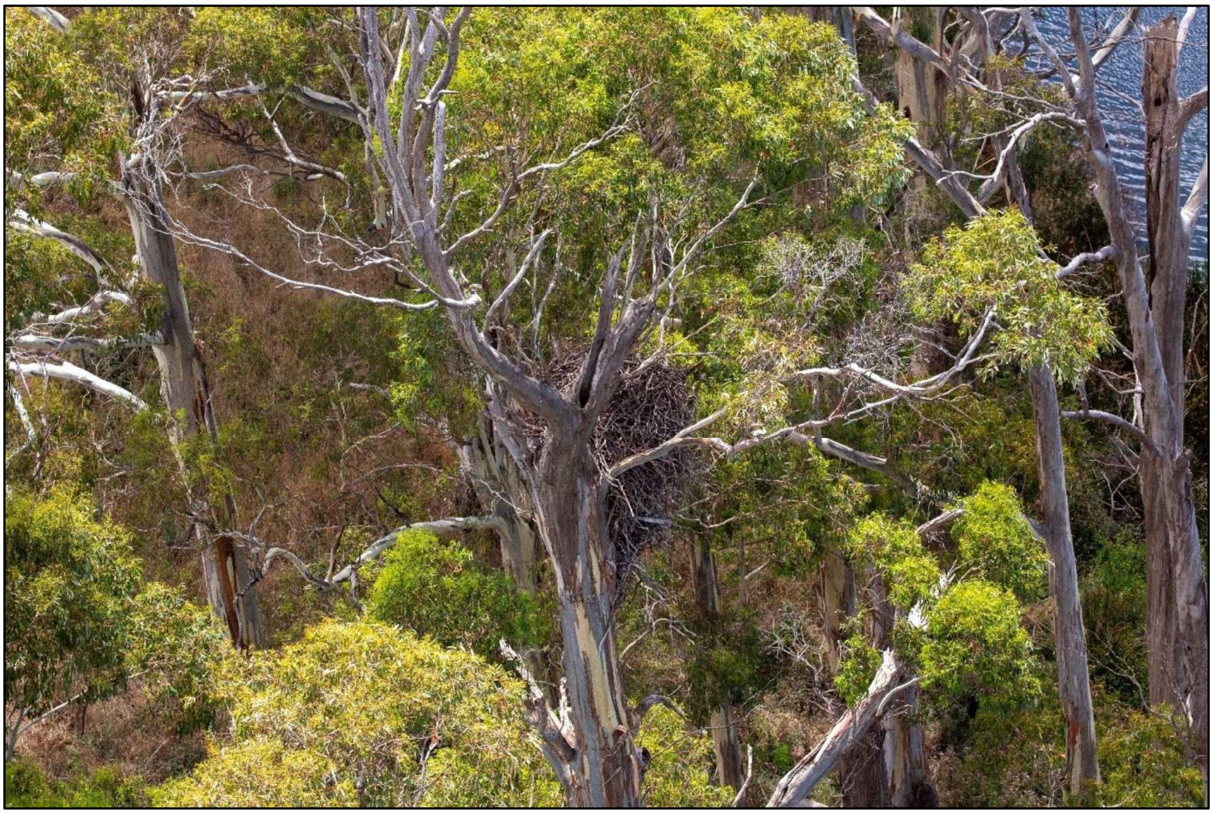

Plate 31b: Nest ID #2670

Plate 32a: Nest ID #3015

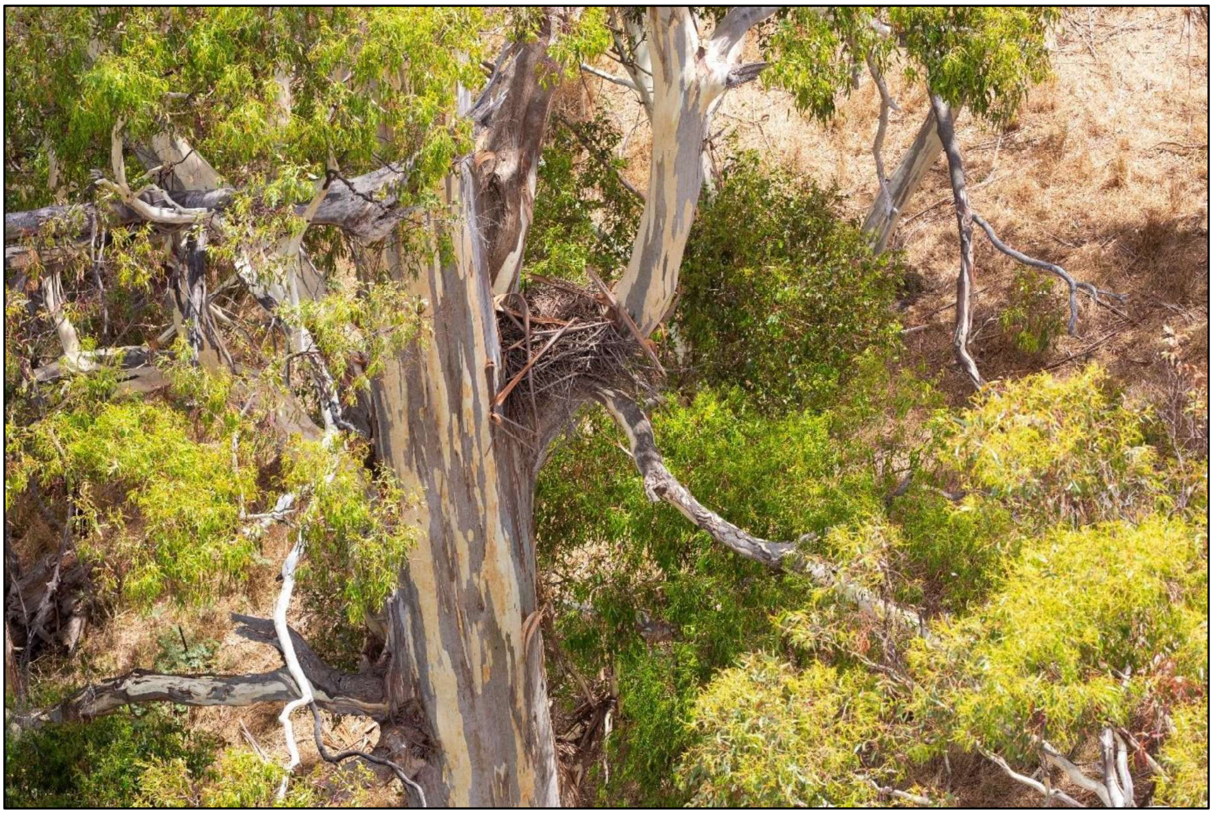

Plate 32b: Nest ID #3015

Plate 33a: Nest ID #923

Plate 33b: Nest ID #923

Plate 34a: Nest ID #2680

Plate 34b: Nest ID #2680

Plate 35a: Nest ID #3016

Plate 35b: Nest ID #3016 and 3017

Plate 36: Nest ID #3018

Plate 37: Nest ID #3019

Plate 38a: Nest ID #3020

Plate 38b: Nest ID #3020

Plate 39a: Nest ID #3021

Plate 39b: Nest ID #3021

Plate 40: Nest ID #2958

Plate 41: Nest ID #3006

Plate 42: Nest ID #3008

Plate 43a: Nest ID #3009

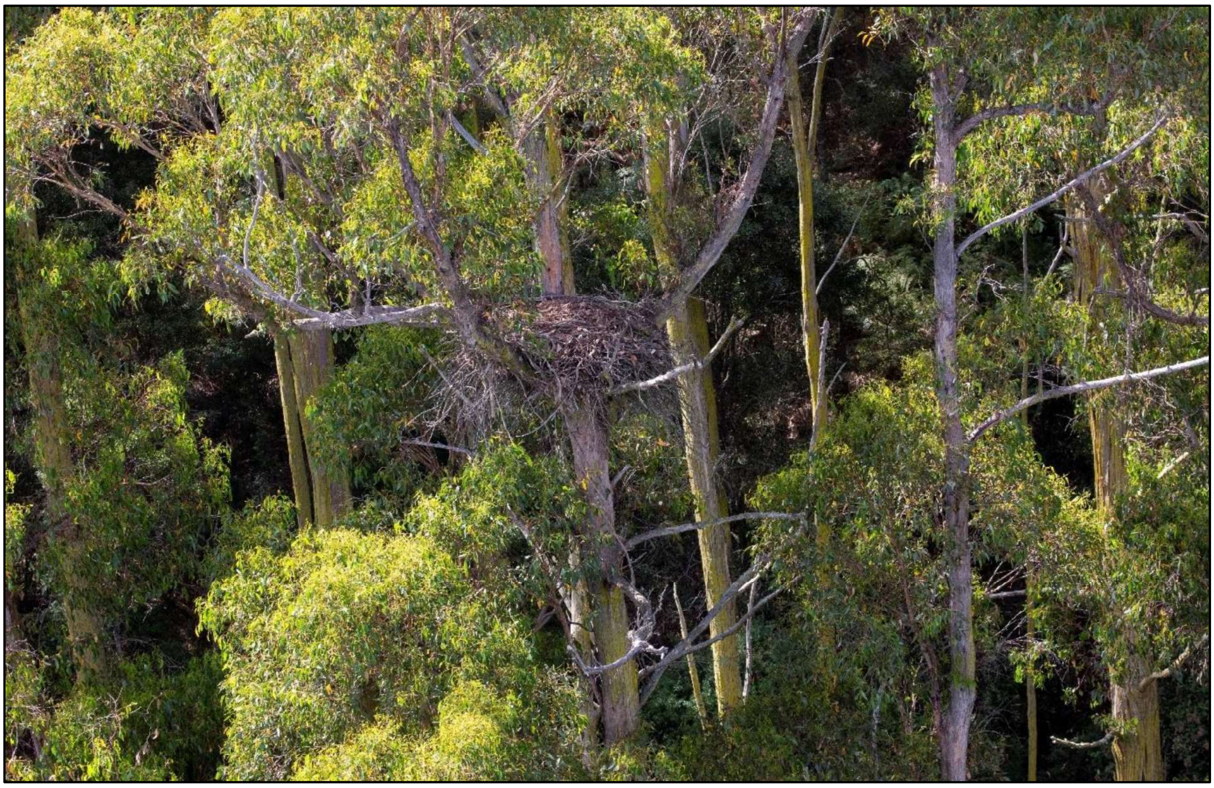

Plate 43b: Nest ID #3009

Plate 44a: Nest ID #3010

Plate 44b: Nest ID #3010

Plate 45a: Nest ID #2682

Plate 45b: Nest ID #2682

Plate 46a: Nest ID #3023

Plate 46b: Nest ID #3023

Plate 47: Nest ID #3024

Plate 48: Nest ID #192

Plate 49a: Nest ID #1613

Plate 49a: Nest ID #1613

Plate 50a: Nest ID #3025

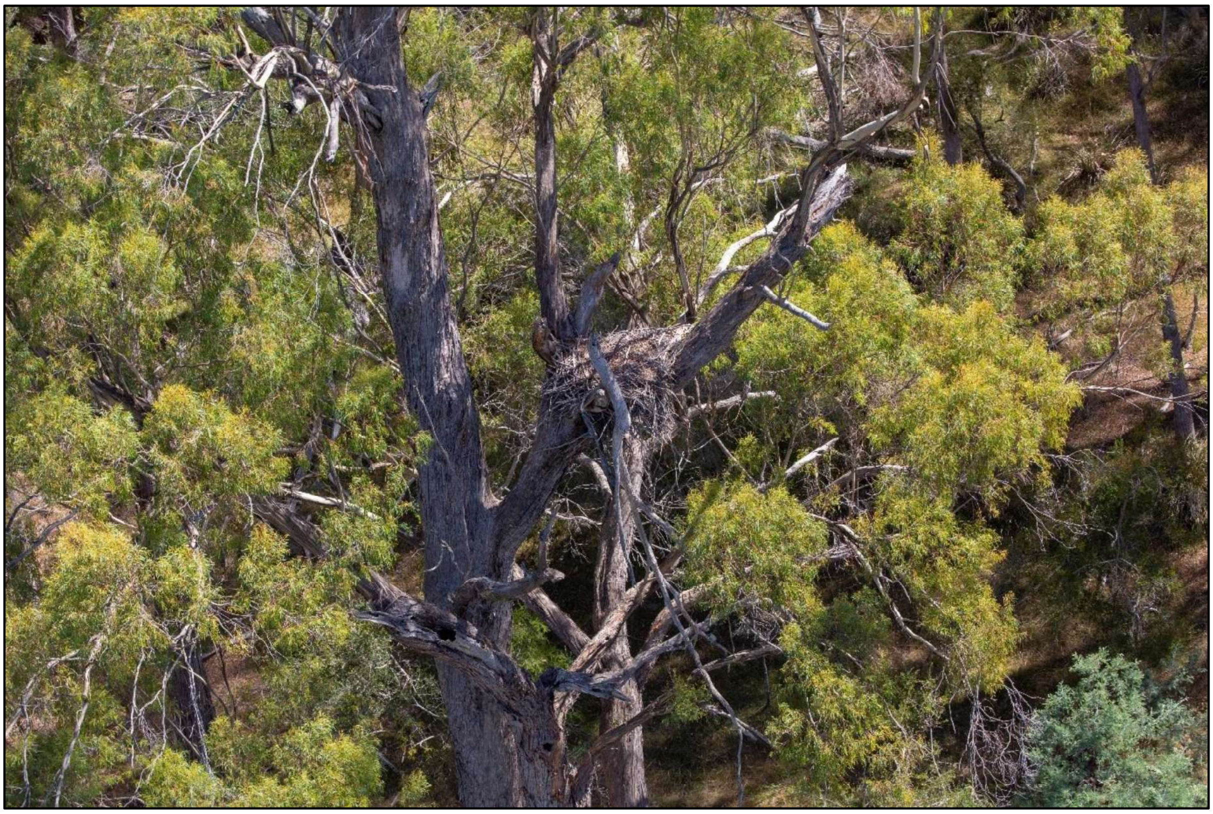

Plate 50 b: Nest ID #3025

Plate 51a: Nest ID #3026

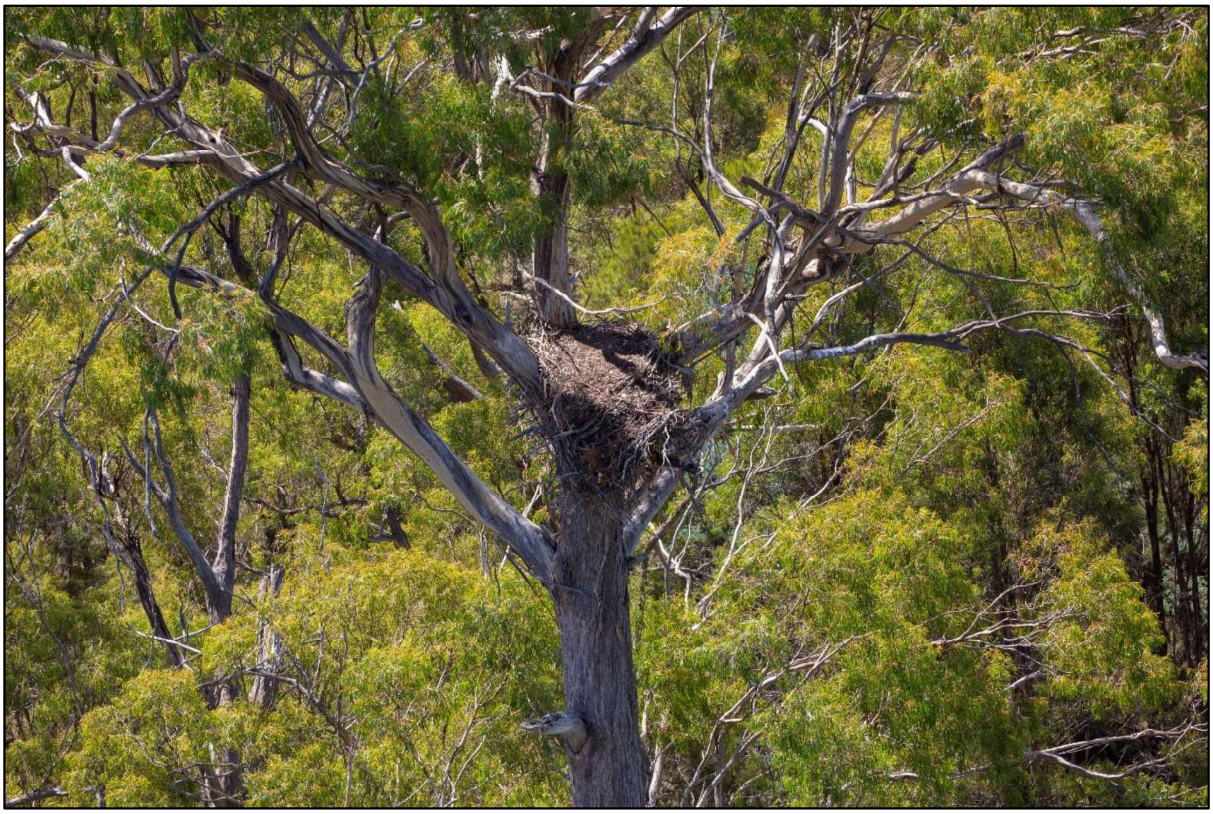

Plate 51b: Nest ID #3026

APPENDIX B: Raptor nest search form

Location: East Cam to Poatina. Grid Coordinates - Centroid: 436063E, 5432989N (GDA)
Location East Cam to Hampshire Hills. Grid Coordinates – Centroid: 400217E, 5445609N (GDA)

Action	Person	Date	Result
Previously searched? **Yes, however search area was broadened for the addition of alternative alignments in 2022,** **Area searched in 2023 was the same as 2022.**	Nick Mooney Jaidan Draper And Erin Harris Tim Leaman Janet Morley Mel Hills Liz Browne And Erin Harris Frank Bird Alice Grieve Karen Ziegler Mel Hills	17/06/2019 28/06/2019 17/05/2021 18/05/2021 21/05/2021 24/05/2021 27/05/2021 28/05/2021 02/06/2021 24/03/2022 – 08/04/2022	11 new nests found 6 nests relocated 8 known nests not found 4 new nests found 21 nests relocated 15 known nests not found 21 new nests found 28 nests relocated 10 nests not found 12 nests confirmed absent
Potential nesting habitat assessment	NBES	07/05/2020 14/05/2021 01/03/2022 01/02/2023	Potential nesting habitat area as indicated but not limited to the FPA nesting suitability index (see Figures 2-11)
Search of nesting habitat	Erin Harris Karen Dick Adam Hardy Laura Cardona	13/02/2023–17/02/2023 20/02/2023–22/02/2023	11 new nests found 41 nests relocated 15 known nests not found See Figures 2-11 for new nests
Follow-up search(?)	N/A	N/A	
Notification to FPA	NBES	Pending	
Nest site added to NVA **Reserve added to planning maps/GIS**	NBES	13/05/2022	11 new nests added – nest verification data was added to NVA

APPENDIX C: Raptor nest location forms

Raptor nest location form – nest 3144

Nest number and name (Office use only):

SPECIES: Undetermined	
OBSERVER: name, address, phone/fax Erin Harris, Karen Dick, Adam Hardy North Barker Ecosystem Services Pty Ltd, 313 Macquarie Street, Hobart. (03) 6231 9788	
DATE OF THIS REPORT: **17/03/2023**	**WHEN WAS THE NEST FOUND?** 13/02/2023
HOW WAS THE NEST FOUND? eg. during pre-logging search, during forestry operation, etc. During aerial eagle nest search of selected area.	
HAD THE AREA BEEN PREVIOUSLY SEARCHED? give detail Yes, during aerial eagle nest searches in 2022.	
LOCATION OF NEST: 1.3 km NW of West Mooreville **Coordinates**: 401287E 5450719N **Datum (GDA/AGD):** GDA 94 MGA 55 **GPSed:** Yes **Accuracy (m):** 10 m	
NEST SITUATION: **was it in a tree (species?), on a cliff, or on the ground?** Nest is approximately 45 m up a 50 m tall *Eucalyptus obliqua* tree.	
HISTORY OF NEST USE: **known breeding attempts? results?** Unsure.	
NEST DISTURBANCE: forestry, recreation, roading, building, etc.? Proposed transmission line.	
WHAT WAS SEEN? eggs, birds, droppings, nest material, prey, etc.? The nest had a large amount of brown leaves on top and a slight bowl. See Plate 1a and 1b: Nest 3144.	

Raptor nest location form - nest 3145

Nest number and name (Office use only):

SPECIES: Undetermined	
OBSERVER: name, address, phone/fax Erin Harris, Adam Hardy, Laura Cardona North Barker Ecosystem Services Pty Ltd, 313 Macquarie Street, Hobart. (03) 6231 9788	
DATE OF THIS REPORT: **17/03/2023**	**WHEN WAS THE NEST FOUND?** 15/02/2023
HOW WAS THE NEST FOUND? e.g. during pre-logging search, during forestry operation, etc. During aerial eagle nest search of selected area.	
HAD THE AREA BEEN PREVIOUSLY SEARCHED? give detail Yes, during aerial eagle nest searches in 2022.	
LOCATION OF NEST: Mount Montgomery 4.2 km South of Penguin **Coordinates**: 421717E 5444021N **Datum (GDA/AGD):** GDA 94 MGA 55 **GPSed:** Yes **Accuracy (m):** 10 m	
NEST SITUATION: **was it in a tree (species?), on a cliff, or on the ground?** Nest is approximately 47 m up a 57 m tall *Eucalyptus obliqua* tree.	
HISTORY OF NEST USE: **known breeding attempts? results?** Unsure.	
NEST DISTURBANCE: forestry, recreation, roading, building, etc.? Proposed transmission line.	
WHAT WAS SEEN? eggs, birds, droppings, nest material, prey, etc.? This was a large robust nest with a flat top, brown sticks and whitewash on adjacent branches. See Plate 2a and 2b: Nest 3145.	

Raptor nest location form – nest 3146

Nest number and name (Office use only):

SPECIES: Undetermined	
OBSERVER: name, address, phone/fax Erin Harris, Adam Hardy, Laura Cardona North Barker Ecosystem Services Pty Ltd, 313 Macquarie Street, Hobart. (03) 6231 9788	
DATE OF THIS REPORT: **17/03/2023**	**WHEN WAS THE NEST FOUND?** 16/02/2023
HOW WAS THE NEST FOUND? e.g. during pre-logging search, during forestry operation, etc. During aerial eagle nest search of selected area.	
HAD THE AREA BEEN PREVIOUSLY SEARCHED? give detail Yes, during aerial eagle nest searches in 2022.	
LOCATION OF NEST: 150 m SW of the conjunction of Mckennas Road and West Gawler Road. **Coordinates**: 428761E 5441072N **Datum (GDA/AGD):** GDA 94 MGA 55 **GPSed:** Yes **Accuracy (m):** 10 m	
NEST SITUATION: **was it in a tree (species?), on a cliff, or on the ground?** Nest is approximately 20 m up a 35 m tall *Eucalyptus obliqua* tree.	
HISTORY OF NEST USE: **known breeding attempts? results?** Unsure.	
NEST DISTURBANCE: forestry, recreation, roading, building, etc.? Proposed transmission line.	
WHAT WAS SEEN? eggs, birds, droppings, nest material, prey, etc.? A small nest that is hard to see under the canopy, with brown sticks on top but no signs of recent use. See Plate 3: Nest 3146.	

Raptor nest location form – nest 3147

Nest number and name (Office use only):

SPECIES: White-bellied Sea Eagle	
OBSERVER: name, address, phone/fax Erin Harris, Adam Hardy, Laura Cardona North Barker Ecosystem Services Pty Ltd, 313 Macquarie Street, Hobart. (03) 6231 9788	
DATE OF THIS REPORT: **17/03/2023**	**WHEN WAS THE NEST FOUND?** 17/02/2023
HOW WAS THE NEST FOUND? e.g. during pre-logging search, during forestry operation, etc. During aerial eagle nest search of selected area.	
HAD THE AREA BEEN PREVIOUSLY SEARCHED? give detail Yes, during aerial eagle nest searches in 2022.	
LOCATION OF NEST: Claytons Ruvulet 1.9 km NE of Moreton. **Coordinates**: 433608E 5432624N **Datum (GDA/AGD):** GDA 94 MGA 55 **GPSed:** Yes **Accuracy (m):** 10 m	
NEST SITUATION: **was it in a tree (species?), on a cliff, or on the ground?** Nest is approximately 26 m up a 32 m tall *Eucalyptus viminalis* tree.	
HISTORY OF NEST USE: **known breeding attempts? results?** Unsure.	
NEST DISTURBANCE: forestry, recreation, roading, building, etc.? Proposed transmission line.	
WHAT WAS SEEN? eggs, birds, droppings, nest material, prey, etc.? The nest had brown leaves and sticks and flat top. A juvenile White-bellied Sea Eagle was seen flushing from a nearby tree. See Plate 4a and 4b: Nest 3147.	

Raptor nest location form – nest 3148

Nest number and name (Office use only):

SPECIES: Undetermined	
OBSERVER: name, address, phone/fax Erin Harris, Adam Hardy, Laura Cardona North Barker Ecosystem Services Pty Ltd, 313 Macquarie Street, Hobart. (03) 6231 9788	
DATE OF THIS REPORT: **17/03/2023**	**WHEN WAS THE NEST FOUND?** 17/02/2023
HOW WAS THE NEST FOUND? e.g. during pre-logging search, during forestry operation, etc. During aerial eagle nest search of selected area.	
HAD THE AREA BEEN PREVIOUSLY SEARCHED? give detail Yes, during aerial eagle nest searches in 2022.	
LOCATION OF NEST: 490 m SW of Barren Hill and 2.7 km SE of Lower Barrington. **Coordinates**: 442409E 5426702N **Datum (GDA/AGD):** GDA 94 MGA 55 **GPSed:** Yes **Accuracy (m):** 10 m	
NEST SITUATION: **was it in a tree (species?), on a cliff, or on the ground?** Nest is approximately 30 m up a 36 m tall dead *Eucalyptus sp.* tree.	
HISTORY OF NEST USE: **known breeding attempts? results?** Unsure.	
NEST DISTURBANCE: forestry, recreation, roading, building, etc.? Proposed transmission line.	
WHAT WAS SEEN? eggs, birds, droppings, nest material, prey, etc.? The nest had large amounts of bark lining a nest bowl although the nest does not appear to have been used. See Plate 5a and 5b: Nest 3148.	

Raptor nest location form – nest 3149

Nest number and name (Office use only):

SPECIES: Undetermined	
OBSERVER: name, address, phone/fax Erin Harris, Karen Dick, Adam Hardy North Barker Ecosystem Services Pty Ltd, 313 Macquarie Street, Hobart. (03) 6231 9788	
DATE OF THIS REPORT: **17/03/2023**	**WHEN WAS THE NEST FOUND?** 20/02/2023
HOW WAS THE NEST FOUND? eg. during pre-logging search, during forestry operation, etc. During aerial eagle nest search of selected area.	
HAD THE AREA BEEN PREVIOUSLY SEARCHED? give detail Yes, during aerial eagle nest searches in 2022.	
LOCATION OF NEST: 1.7 km NW of Kimberley. **Coordinates**: 456528E 5417067N **Datum (GDA/AGD):** GDA 94 MGA 55 **GPSed:** Yes **Accuracy (m):** 10 m	
NEST SITUATION: **was it in a tree (species?), on a cliff, or on the ground?** Nest is approximately 41 m up a 45 m tall dead *Eucalyptus* tree.	
HISTORY OF NEST USE: **known breeding attempts? results?** Unsure.	
NEST DISTURBANCE: forestry, recreation, roading, building, etc.? Proposed transmission line.	
WHAT WAS SEEN? eggs, birds, droppings, nest material, prey, etc.? The nest was bleached with loose stickson top and a slight bowl. See Plate 6a and 6b: Nest 3149.	

Raptor nest location form – nest 3150

Nest number and name (Office use only):

SPECIES: Undetermined	
OBSERVER: name, address, phone/fax Erin Harris, Karen Dick, Adam Hardy North Barker Ecosystem Services Pty Ltd, 313 Macquarie Street, Hobart. (03) 6231 9788	
DATE OF THIS REPORT: **17/03/2023**	**WHEN WAS THE NEST FOUND?** 21/02/2023
HOW WAS THE NEST FOUND? e.g. during pre-logging search, during forestry operation, etc. During aerial eagle nest search of selected area.	
HAD THE AREA BEEN PREVIOUSLY SEARCHED? give detail Yes, during aerial eagle nest searches in 2022.	
LOCATION OF NEST: 1.4 km SE of Elizabeth Town (near Ribucon River). **Coordinates**: 464078E 5408092N **Datum (GDA/AGD):** GDA 94 MGA 55 **GPSed:** Yes **Accuracy (m):** 10 m	
NEST SITUATION: **was it in a tree (species?), on a cliff, or on the ground?** Nest is approximately 32 m up a 33 m tall *Eucalyptus obliqua* tree.	
HISTORY OF NEST USE: **known breeding attempts? results?** Unsure.	
NEST DISTURBANCE: forestry, recreation, roading, building, etc.? Proposed transmission line.	
WHAT WAS SEEN? eggs, birds, droppings, nest material, prey, etc.? A large, exposed nest with loose sticks on top and bleaching and a deep nest bowl. See Plate 7a and 7b: Nest 3150.	

Raptor nest location form – nest 3151

Nest number and name (Office use only):

SPECIES: Undetermined	
OBSERVER: name, address, phone/fax Erin Harris, Karen Dick, Adam Hardy North Barker Ecosystem Services Pty Ltd, 313 Macquarie Street, Hobart. (03) 6231 9788	
DATE OF THIS REPORT: **17/03/2023**	**WHEN WAS THE NEST FOUND?** 21/02/2023
HOW WAS THE NEST FOUND? e.g. during pre-logging search, during forestry operation, etc. During aerial eagle nest search of selected area.	
HAD THE AREA BEEN PREVIOUSLY SEARCHED? give detail Yes, during aerial eagle nest searches in 2022.	
LOCATION OF NEST: 4.5 NE of Deloraine along Meander River. **Coordinates**: 475219E 5404715N **Datum (GDA/AGD):** GDA 94 MGA 55 **GPSed:** Yes **Accuracy (m):** 10 m	
NEST SITUATION: **was it in a tree (species?), on a cliff, or on the ground?** Nest is approximately 28 m up a 35 m tall dead *Eucalyptus* tree.	
HISTORY OF NEST USE: **known breeding attempts? results?** Unsure.	
NEST DISTURBANCE: forestry, recreation, roading, building, etc.? Proposed transmission line.	
WHAT WAS SEEN? eggs, birds, droppings, nest material, prey, etc.? A large nest with small pieces of down feathers present around a nest bowl. See Plate 8a and 8b: Nest 3151.	

Raptor nest location form – nest 3152

Nest number and name (Office use only):

SPECIES: Undetermined

OBSERVER: name, address, phone/fax
Erin Harris, Karen Dick, Adam Hardy

North Barker Ecosystem Services Pty Ltd, 313 Macquarie Street, Hobart.

(03) 6231 9788

DATE OF THIS REPORT:	WHEN WAS THE NEST FOUND?
17/03/2023	21/02/2023

HOW WAS THE NEST FOUND? e.g. during pre-logging search, during forestry operation, etc.

During aerial eagle nest search of selected area.

HAD THE AREA BEEN PREVIOUSLY SEARCHED? give detail

Yes, during aerial eagle nest searches in 2022.

LOCATION OF NEST:

8.5 km SW of Westbury.

Coordinates: 483427E 5394802N **Datum (GDA/AGD):** GDA 94 MGA 55 **GPSed:** Yes

Accuracy (m): 10 m

NEST SITUATION: **was it in a tree (species?), on a cliff, or on the ground?**

Nest is approximately 45 m up a 55 m tall *Eucalyptus viminalis* tree.

HISTORY OF NEST USE: **known breeding attempts? results?**

Unsure.

NEST DISTURBANCE: forestry, recreation, roading, building, etc.?

Proposed transmission line.

WHAT WAS SEEN? eggs, birds, droppings, nest material, prey, etc.?

An atypical cluster of nesting material in the tree with sticks large enough for an eagle but no nest shape

See Plate 9: Nest 3152.

Raptor nest location form – nest 3153

Nest number and name (Office use only):

SPECIES: Undetermined	
OBSERVER: name, address, phone/fax Erin Harris, Karen Dick, Adam Hardy North Barker Ecosystem Services Pty Ltd, 313 Macquarie Street, Hobart. (03) 6231 9788	
DATE OF THIS REPORT: **17/03/2023**	**WHEN WAS THE NEST FOUND?** 21/02/2023
HOW WAS THE NEST FOUND? e.g. during pre-logging search, during forestry operation, etc. During aerial eagle nest search of selected area.	
HAD THE AREA BEEN PREVIOUSLY SEARCHED? give detail Yes, during aerial eagle nest searches in 2022.	
LOCATION OF NEST: 4.2 km NW of McRaes Hills. **Coordinates**: 496087E 5383187N **Datum (GDA/AGD):** GDA 94 MGA 55 **GPSed:** Yes **Accuracy (m):** 10 m	
NEST SITUATION: **was it in a tree (species?), on a cliff, or on the ground?** Nest is approximately 20 m up a 30 m tall *Eucalyptus amygdalina* tree.	
HISTORY OF NEST USE: **known breeding attempts? results?** Unsure.	
NEST DISTURBANCE: forestry, recreation, roading, building, etc.? Proposed transmission line.	
WHAT WAS SEEN? eggs, birds, droppings, nest material, prey, etc.? A small nest with loose, bleached materials and brown leaves, as well as a slight nest bowl. See Plate 10a and 10b: Nest 3153.	

Raptor nest location form – nest 3154

Nest number and name (Office use only):

SPECIES: White-bellied Sea Eagle	
OBSERVER: name, address, phone/fax Erin Harris, Karen Dick, Adam Hardy North Barker Ecosystem Services Pty Ltd, 313 Macquarie Street, Hobart. (03) 6231 9788	
DATE OF THIS REPORT: **17/03/2023**	**WHEN WAS THE NEST FOUND?** 22/02/2023
HOW WAS THE NEST FOUND? e.g. during pre-logging search, during forestry operation, etc. During aerial eagle nest search of selected area.	
HAD THE AREA BEEN PREVIOUSLY SEARCHED? give detail Yes, during aerial eagle nest searches in 2022.	
LOCATION OF NEST: Along Brumbys Creek 1.2 km South of McRaes Hills. **Coordinates**: 497647E 5378353N **Datum (GDA/AGD):** GDA 94 MGA 55 **GPSed:** Yes **Accuracy (m):** 10 m	
NEST SITUATION: **was it in a tree (species?), on a cliff, or on the ground?** Nest is approximately 35 m up a 45 m tall *Eucalyptus viminalis* tree.	
HISTORY OF NEST USE: **known breeding attempts? results?** Unsure.	
NEST DISTURBANCE: forestry, recreation, roading, building, etc.? Proposed transmission line.	
WHAT WAS SEEN? eggs, birds, droppings, nest material, prey, etc.? A small, newly-built nest approximately 160 m northeast of fallen nest #2960; likely to be the same pair of birds, trying to rebuild. Nest has lots of new, loose material. See Plate 11a and 11b: Nest 3154.	

APPENDIX D. Absent nests

Nest details of previously reported nests that could not be found or could not be searched for within the 2023 survey. WTE = Wedge-tailed Eagle; WBSE = White-bellied Sea Eagle; GG = Grey Goshawk.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
14/03/2023	1323	412243	5453102	N/A	30	WBSE	This nest could not be found during this survey, nor in 2022 and was not searched for in 2021, 2020 and 2019. This nest was last recorded on the NVA in 2006.
14/02/2023	2677	400969	5448750	N/A	10	Indeterminate	No nest sticks remaining, the site is barely recognisable as a previous location of a nest. The only evidence of a past nest is a small algal smear near the fork of the tree where the nest would likely have been. Nest site is roughly 15 m up a 30 m *E. obliqua*.
15/02/2023	2771	413160	5450129	N/A	10	Indeterminate	This nest has completely degraded, and nothing remains.
17/02/2023	3022	437290	5427552	N/A	10	WBSE	This nest appears to have fallen based on the nest still standing. It is near nest #3021.
20/02/2023	2681	438744	5429507	N/A	10	Indeterminate	This nest could not be found, it is likely the nest along with the tree has fallen as a few broken tree branches were evident in the area.

Date surveyed	NVA nest ID	Easting	Northing	Classification	Position accuracy (m)	Likely species	Comments
22/02/2023	2960	497793	5378281	N/A	10	WBSE	This nest was a large prime nest at the end of a strip of trees that follows a small creek, however it has now fallen. It appears that the tree branch snapped. A new nest is being constructed approximately 160 m to the NW of this fallen nest location.
22/02/2023	675	491743	5385209	N/A	20	WTE	This nest was not found. The last record of this nest was from 2017. It was considered degraded at the time. This nest has been surveyed regularly since 2003, with no activity witnessed; over time the nest has become bleached and slumped with no nesting material ever being added. This nest location is right next to a plantation and has likely completely degraded or is at a stage where it is a remnant and hard to spot.

E Recently proposed Tasmanian development projects near Marinus Link landfall

Table E.1: Tasmanian development projects with potential impacts relevant to the project.

	Proposal / proponent	Description	Location	Timing
1	Guilford Wind Farm / Epuron Pty Ltd	Wind farm in Guildford with up to 80 wind turbines Generation of up to 450 megawatts (MW) of wind energy Estimated capital: $50 million	7 km northeast of Waratah and 15 km south of Hampshire	Notice of intent submitted September 2020 Deemed a controlled action by DAWE in September 2021 Construction to commence: 2024
2	Robbins Island Renewable Energy Park / UPC Robbins Island Pty Ltd	Wind farm on Robbins Island with up to 122 wind turbines Generation of up to 900 MW of wind energy Estimated construction value: $1.2 billion Construction workforce: 250 personnel	Robbins Island, northwest coast of Tasmania	Approved by the Commonwealth Government and assessment by the EPA underway Construction to commence: 2023-2025
3	Jim's Plain Renewable Energy Park / UPC Robbins Island Pty Ltd	Wind farm in Jim's Plain with up to 31 wind turbines and possible solar generation of up to 200 MW of wind energy and up to 40 MW of solar energy Capital investment: $350 million. Construction workforce: over 150 personnel	23 km west of Smithton	Approved by the Council and State and Commonwealth governments in 2020 Construction to commence: 2023
4	Robbins Island Road to Hampshire Transmission Line / UPC Robbins Island Pty Ltd	A new 220 kV overhead transmission line (OHTL) spanning 115 km, estimated to have 245 towers. Connects Jim's Plain and Robbins Island Renewable Energy Parks transmission infrastructure to Tasmanian transmission network. Construction workforce: up to 100 personnel over 24 months	Between Robbins Island Rd at West Montagu and Hampshire	Detailed planning/environmental approvals phase underway. Commonwealth Government determined the project to be a controlled action under the EPBC Act in September 2020. Construction to commence: 2023
5	Bass Highway, targeted upgrades between Deloraine and Devonport /	Targeted highway upgrades between Deloraine and Devonport. Roads of strategic importance Estimated project cost: $50 million	Targeted areas along Bass Highway between Deloraine and Devonport	In planning; Construction expected to commence: late 2023 Expected completion: 2027

	Department of State Growth			
6	Staverton to Hampshire Hills Transmission Line / TasNetworks	A component of the North West Transmission Developments, comprising a new 60-km-long new 220 kV OHTL between a new switching station at Staverton and Hampshire Hills Supports new and existing renewable energy developments in North West Tasmania, including the project. Estimated project cost: $220 million	Between Staverton and Hampshire Hills	Planning and approvals phase in progress Construction expected to commence: 2024
7	Hellyer Wind Farm / Epuron Pty Ltd	Wind farm with up to 48 wind turbines Generation of up to 300 MW of wind energy	8.5 km southwest of Hampshire	Design phase. Notice of intent issued. Tasmanian EPA -EIS Guidelines issued in November 2022
8	Western Plains / Epuron Pty Ltd	Wind farm with up to 12 wind turbines Generation of up to 50.4 MW of wind energy	4 to 5 km northwest of Stanley	Work on the Development Proposal and Environmental Management Plan (DPEMP) is continuing. The DPEMP has been drafted in accordance with the project Specific Guidelines issued for the project by the Environment Protection Authority (EPA Tasmania). The EPA Tasmania recently extended the timeframe for submission to enable completion of the required documentation
9	Table Cape Luxury Resort / Table Cape Enterprises	Proposed accommodation	Table Cape, 4.5 km north of Wynyard, Ransleys Road	Approved by Waratah-Wynyard Council
10	Lake Cethana Pumped Hydro / Hydro Tasmania	Storage and underground pumped hydro power station with associated infrastructure, with up to 600 MW capacity Estimated construction cost: $900 million	19 km southwest of Sheffield	Hydro Tasmania will progress with the final feasibility stage Construction likely to commence: 2027

11	Youngmans Road Quarry / Railton Agricultural Lime Pty Ltd	Limestone quarry development on old quarry site Average annual production of 72,000 tonnes of limestone	2.5 km northwest of Railton	EPA approved the development in February 2021. Kentish Council is reviewing the land permit for the proposed development
12	Port Latta Wind Farm / Nekon Pty Ltd's	Wind farm with up to 7 wind turbines Generation of up to 25 MW of wind energy Construction workforce: 15 people over six months Estimated capital: $50 million	Mawbanna Plain, 2 km southwest of Cowrie Point	Environmental Assessment Report and EPA decision issued October 2018 Website states intent to start construction late 2020, no further updates available
13	Port of Burnie Shiploader Upgrade / TasRail	Minerals shiploader and storage expansion at TasRail's existing Bulk Minerals Export Facility Estimated cost: $64 million Design and construction workforce: 140 personnel	Port of Burnie	Onsite works and detailed design (commenced in April 2022). Commissioning expected to commence: 2023
14	Bass Highway – Cooee to Wynyard / Department of State Growth	Priority works upgrade along the Bass Highway between Cooee and Wynyard to realign and upgrade approximately 3.2 km of road Estimated cost: $50 million	Bass Highway from the intersection of Brickport Road in Cooee, across the Cam River Bridge, to the intersection of the Old Bass Highway at Doctors Rocks near Wynyard	Construction (commenced late 2021) Expected completion:2025
15	Sheffield to Staverton Upgrades / TasNetworks	A component of the North West Transmission Developments, comprising modifications to two 18.5 km-long sections of existing 220 kV OHTLs between Staverton and Sheffield. Supports new and existing renewable energy developments in North West Tasmania, including the project.	Between Staverton and Sheffield	Planning and approvals phase Construction expected to commence: 2025

16	QuayLink - Devonport East Redevelopment / TasPorts	Port terminal upgrade project to support TasPorts in increasing capacity of both freight and passenger ferry services across Bass Strait. Estimated cost: $240 million Design and construction workforce: 1060 direct and indirect jobs in North West Tasmania, and a further 655 broader Tasmanian jobs during construction.	Port of Devonport	Early works/construction (commenced 2022); approvals phase ongoing. Expected completion: 2027

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29 August 2024

Marinus Link Pty Ltd.

1-7 Maria Street, Lenah Valley TAS 7008

Addendum to the Marinus Link Heybridge Converter Station Terrestrial Ecology Baseline and Impact Assessment

To whom it may concern,

In May 2024, Entura provided the Heybridge Converter Station Terrestrial Ecology Baseline and Impact assessment report to support the Project's Environmental Impact Statement (EIS) documentation (Technical Appendix B of the Marinus Link Shore Crossing EIS; Technical Appendix F of the Marinus Link Heybridge Converter Station EIS). The purpose of this letter is to clarify the results and implication of the assessment following receipt of comments and queries from the Tasmanian Environment Protection Authority.

Database search area

The "database search area," included in Figure 5-2 refers to the databases outlined in section 5.2 of the Terrestrial Ecology Baseline and Impact assessment report: the Tasmanian Natural Values Atlas (NVA), the EPBC Act Protected Matters Search Tool (PMST), TasVeg4.0 mapping, the Threatened Native Vegetation Communities (TNVC 2020) mapping (DPIPWE 2021, derived from TASVEG 3, TASVEG 4 and previous TNVC 2014 maps), the Tasmanian Geoconservation database, and publicly available aerial imagery including current and historical images from Google Earth™ and from the Environmental Systems Research Institute (ESRI).

Declared weeds

The following declared weeds that occur at the Shore Crossing site listed in section 6.8.1 of the Terrestrial Ecology Baseline and Impact assessment report are also weeds of national significance: *Chrysanthemoides monilifera* subsp. *monilifera* (boneseed), *Rubus fruticosus* aggregate (blackberry), and *Ulex europaeus* (gorse). The significance of the risk of introducing weeds, pests and diseases to the vegetation communities present in the survey area has been assessed as low, based on the context of the site being already highly degraded and weed-infested.

Native vegetation

No proposed construction works associated with the Converter Station or Shore Crossing will require the removal of the *Eucalyptus amygdalina* coastal forest and woodland (TasVeg4.0 code DAC), which is not listed as threatened under the Tasmanian *Nature Conservation Act 2002* (NC Act)[1], nor of the *Eucalyptus viminalis - Eucalyptus globulus* coastal forest and woodland (TasVeg4.0 code DVC), which is listed as threatened by the NC Act (see Section 6.1 of the Ecology Baseline and Impact assessment report). No removal of "extant vegetation" at the proposed Converter Station site, i.e., the patch of

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[1] The Tasmanian *Nature Conservation Act 2002* (NC Act) lists threatened vegetation communities. The Tasmanian *Threatened Species Protection Act 1995* (TSP Act) lists threatened species. The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) protects Matters of Environmental Significance, which include threatened ecological communities and threatened species.

Eucalyptus amygdalina coastal forest and woodland (DAC), will occur. Therefore, the increased risk of "erosivity and instability" described in the Terrestrial Geomorphology and Soils Assessment report (ESG, 2023) is not relevant to the construction nor operation of the proposed Heybridge Converter Station. Both mapped vegetation communities were verified on the ground during field surveys. Entura's verified vegetation community mapping is periodically provided to Natural Resources and Environment Tasmania to help to inform TASVEG (the Tasmanian Vegetation Map).

Native fauna species

Fauna species that are listed by both the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Tasmanian *Threatened Species Protection Act 1995* (TSP Act) that are relevant to this project are the Tasmanian devil (*Sarcophilus harrisii*), the Tasmanian population of the spotted-tailed quoll (*Dasyurus maculatus maculatus*), and Tasmanian wedge-tailed eagle (*Aquila audax fleayi*, a Tasmanian subspecies).

Nocturnal fauna

There is existing night-time anthropogenic lighting associated with the Bass Highway and with nearby residences. As such, additional night-time lighting to facilitate the 24-hour operation of the HDD works are not likely to result in increased risk of disorientation nor collisions by nocturnal fauna. Nonetheless, the following measures outlined in the Commonwealth *National Light Pollution Guidelines for Wildlife* Appendix A (Best Practice Lighting Design) are recommended:

1. night-time lighting required for the 24-hour operation of the HDD works will be minimised to the greatest extent practicable

2. red light will be used at night where possible.

Devils and quolls

The extant population of devils and quolls was assessed as relatively small based on the NVA database's records as well as the landscape context and on-ground surveys. Similarly, the absence of suitable devil and quoll denning habitat in the vicinity of the Projects is based on the lack of denning features (rocky outcrops, large hollow logs, old wombat burrows, etc.) observed during field surveys as well as the NVA database's records and the landscape context.

White-throated needletail

The white-throated needletail (*Hirundapus caudacutus*) is listed as a vulnerable, marine, and migratory species under the EPBC Act and is not listed under the Tasmanian TSP Act. This species is unlikely to be impacted by the Projects, given the absence of suitable dense foliage and hollows for white-throated needletail roosting and given the minimal vegetation clearance required.

Little penguin

The little penguin (*Eudyptula minor*) is listed as a marine species[3] under the EPBC Act; it is not listed under the Tasmanian TSP Act. Disorientation due to night-time light pollution is a known threat to little penguins; however, no penguin burrows nor individuals have been recorded as occurring at the Heybridge Shore Crossing site despite targeted surveys.

White-bellied sea-eagle

The white-bellied sea-eagle (*Haliaeetus leucogaster*) is not listed as threatened under the EPBC Act but is listed as vulnerable under the TSP Act. The white-bellied sea-eagle is listed as a marine species[2] under the EPBC Act.

Tasmanian wedge-tailed eagle

Eagle nesting habitat has been identified in the *Tasmanian Eagles Recovery Plan* (Threatened Species Section 2006) as important to the survival of both eagle species. Eagle nest activity checks are a highly specialised activity that is only to be undertaken by a suitably qualified and experienced species expert. Eagle nest activity checks are conducted during the eagle breeding season, and as such pose a risk of disturbing a breeding pair and potentially causing nest abandonment.

Eagle nest checks are not recommended for the Marinus Link Heybridge Converter Station and Shore Crossing, given the lack of known eagle nests within 1 km of either site. The nearest known nest, nest #1323, is 1.6 km away from the project site; three consecutive aerial searches have failed to find this nest despite targeted search effort.

Aerial eagle nest searches are required within 12 months prior to the commencement of construction, and annually throughout the duration of construction works at the Heybridge Converter Station and Shore Crossing sites. Eagle nest searches are to be undertaken outside the eagle management constraint period of July to January. Any newly constructed eagle nests near the Heybridge Project Areas will be detected and managed in accordance with the Tasmanian EPA's *Guide to Eagle Nest Searches and Activity Checks* (EPA 2023), the Tasmanian Forest Practice Authority's *Fauna Technical Note No. 1: Eagle nest searching, activity checking and nest management* (Forest Practices Authority 2023), and the Commonwealth's *Survey Guidelines for Australia's Threatened Birds* (Department of the Environment, Water, Heritage and the Arts, now DCCEEW, 2010).

If a new eagle nest were to be discovered within 500 m or 1 km line-of-sight of proposed works, then the eagle constraint management period would apply and potentially disturbing activities would be prohibited during this period of the year, unless a suitably qualified species expert were to conduct an activity check during the breeding season and confirmed that the nest was inactive for that breeding season. Whilst an eagle nest within 500 m or 1 km line-of-sight is active, the management constraints would be applied; an inactive nest status would have to be confirmed each year for works to proceed during the July to January inclusive (or July to February inclusive, in late seasons) breeding period.

Traffic movements and vehicle strikes

Increases in night-time traffic have the potential to increase the risk of vehicle strikes to devils and quolls, the carcasses of which have been recorded on both the Bass Highway and Minna Road in recent years (see Appendix A). Initial calculations of the expected percent increase in night-time traffic associated with the Converter Station construction were based on the initial assumption of a 6-day working week and 7:00AM to 4:00PM working day. However, permissible hours for works are expected to be as follows: 7:00AM to 6:00PM Mondays through Fridays, 8:00AM to 6:00PM

[2] The listing of species as Marine under the EPBC Act applies to those species where they occur in a Commonwealth marine area that is not in State waters (Department of Sustainability, Environment, Water Populations and Communities 2013; DAWE 2022).

Saturdays, and 10:00AM to 6:00PM Sundays. After updating the calculations based on these nominated permissible working hours, the increased night-time traffic on the Bass Highway caused by construction traffic for both components of the Project will still not exceed the 10% threshold at which the risk to Tasmanian devils and spotted-tailed quolls is considered to be substantially increased, according to the 2023 *Survey Guidelines and Management Advice for Development Proposals that may impact the Tasmanian Devil* [3].
For the Converter Station construction, the initial estimate of increases in night-time traffic to and from site were 3.2% for the Bass Highway and 165% for Minna Road. With the changes in working times above, the revised estimated increases in night-time traffic for the converter station construction are 4.0% for the Bass Highway and 204% for Minna Road.

For the HDD works, the working times and shift changes utilised to estimate changes in night-time traffic remain unchanged from those indicated in our initial assessment. However, here we add the estimated increases in night-time traffic based on the proposed traffic movements for the HDD works. These increases are 0.2% for the Bass Highway and 10.8% for Minna Road. For the HDD works, the *Technical Report – Traffic & Transport* (Stantec 2023) specified that the works will involve six light vehicles, one franna crane, three twinsteer rigid trucks (22-26 tonne), one 30-36 tonne excavator, two large drill rigs, a light truck, which will be on site at all times during the works.

The measures to reduce impacts to Tasmanian devils and spotted-tailed quolls on Minna Road presented in section 8.1.3.1 of the Terrestrial Ecology Baseline and Impact assessment report are requirements to manage the risk of vehicle strikes on Tasmanian devils and spotted-tailed quolls.

The risk of vehicle strikes to Tasmanian devils and spotted-tailed quolls within the Converter Station site has been assessed as negligible, given that internal site traffic speeds at night will be less than 15 kilometres per hour; additionally, it is expected that the vast majority of internal site traffic will occur during the day throughout the operational lifetime of the Project.

Duration of HDD works

Subsequent to the initial submission of the terrestrial ecology baseline and impact assessment report in May 2024, the planned duration of the horizontal directional drilling (HDD) works at the Shore Crossing have changed from 12 months to 6 months. There is no change in the ecological impact assessment associated with this shortening of the duration of HDD works from 12 months to 6 months.

Based on the information above, the terrestrial ecology assessment has confirmed that there are no residual impacts to terrestrial ecological values expected at the highly disturbed, ex-industrial site proposed for the Converter Station, nor at the Shore Crossing site.

Yours sincerely,

Raymond Brereton, Senior Ecologist at Entura
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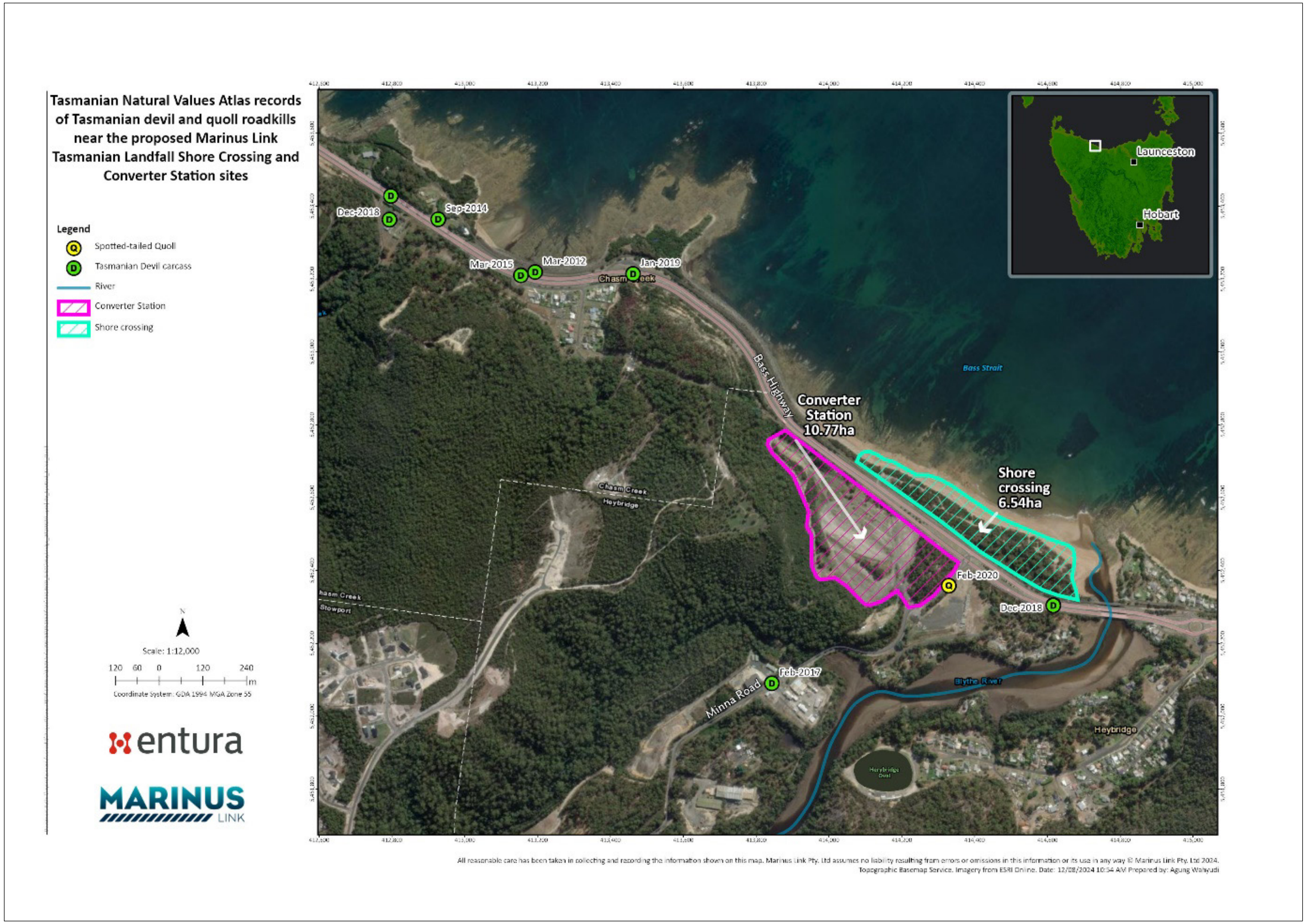
e Ray.Brereton@entura.com.au

[3] Environment Strategic Business Unit (2023) *Survey Guidelines and Management Advice for Development Proposals that may impact the Tasmanian Devil (Sarcophilus harrisii).* Department of Natural Resources and Environment, Tasmania.

Appendix A. Map of Tasmanian devil and spotted-tailed quoll roadkill carcass NVA records near Heybridge.



Appendix D. Noise and Vibration Impact Assessment

MARINUS LINK

TASMANIAN TERRESTRIAL & COASTAL PROCESSES

TECHNICAL NOISE AND VIBRATION REPORT

Rp 005 20191171 | 21 November 2024

MARSHALL DAY Acoustics

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Project: **MARINUS LINK – TASMANIAN TERRESTRIAL & COASTAL PROCESSES**

Prepared for: **Tetra Tech Coffey Pty Ltd**
Level 11, 2 Riverside Quay
Southbank VIC 3006

Attention: **K W**

Report No.: **Rp 005 20191171**

Document Control

Status:	Rev:	Comments:	Date:	Author:	Reviewer:
Complete	-	-	21 Nov 2024	JA / BK	JA / BK

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EXECUTIVE SUMMARY

Marinus Link Pty Ltd (MLPL) proposes to construct, operate and maintain a 1500 megawatt high voltage direct current (HVDC) electricity interconnector between Tasmania and Victoria. The interconnector is referred to as Marinus Link (the project) and would provide a second link between Tasmania's renewable energy resources and the Victorian electricity grid. The project would be implemented as two 750 MW circuits to meet transmission network operation requirements in Tasmania and Victoria, and would extend from Heybridge in northwest Tasmania to the Latrobe Valley in Victoria. The link is intended to enable efficient energy trade, transmission and distribution from a diverse range of generation sources to where it is most needed, and increased energy capacity and security across the National Electricity Market (NEM).

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

This report presents the technical noise and vibration assessment of the Tasmanian terrestrial component of the project. Specifically, the converter station and proposed interconnector shore crossing at Heybridge. This report has been prepared for submission with the two EISs being prepared for the project by Tetra Tech Coffey Pty Ltd (Tetra Tech Coffey).

The assessment considers sources of environmental noise and vibration associated with both the construction and operational stages of the project.

At the end of its operational lifespan (anticipated to be at least 40 years), the project will either be decommissioned or upgraded to extend the operational lifespan. If the project is decommissioned, all above-ground infrastructure would be removed, and associated land returned to the previous land use or as agreed with the landowner. All underground infrastructure would be decommissioned in accordance with the requirements of the time. This may include removal of infrastructure or some components remaining underground where it is safe to do so (or the impact of infrastructure remaining in the ground being lower than removing it). The types of equipment and processes associated with decommissioning are similar to construction but the works are generally less intensive (and therefore noise and vibration emissions are generally comparable or lower). A separate assessment for the decommissioning phase has therefore not been conducted as part of this study, but associated noise levels would be readily manageable with the types of noise mitigation and management measures used to address construction noise.

The report addresses the assessment requirements of the:

- EPA Tasmania (EPA) publication *Environmental Impact Statement Guidelines – Marinus Link Pty Ltd – Converter Station for Marinus Link* dated September 2022 (the Tasmanian converter station EIS guidelines);
- EPA publication *Environmental Impact Statement Guidelines – Marinus Link Pty Ltd – Heybridge shore crossing for Marinus Link* dated September 2022 (the Tasmanian shore crossing EIS guidelines);
- *Environmental Management and Pollution Control Act 1994* (Tas) (the EMPCA);
- *Environmental Management and Pollution Control (Noise) Regulations 2016* (Tas) (the EMPC Noise Regulations); and
- *Environment Protection Policy (Noise) 2009* (Tas) (the Noise EPP).

A risk-based assessment was used to evaluate noise and vibration impacts associated with construction and operation of the project. Given that noise and vibration is an inevitable consequence of the construction and operation of a major infrastructure project, it is the risk of unacceptable impacts from noise and vibration which is assessed in this study. Risks are assessed by accounting for both their consequence (having regard to the noise level, character and duration) and likelihood. The objective of the risk assessment was to determine the appropriate risk controls.

The sensitive locations addressed in this report comprise buildings used by people for purposes that may be sensitive to noise and vibration. These locations are collectively referred to as receivers in this report. The assessment accounts for all receivers comprising both existing dwellings and proposed future dwellings identified in the vicinity of the project.

Noise and vibration effects on fauna (terrestrial) are addressed in a separate technical study of ecology. Similarly, the Victorian and subsea components of the project are addressed in separate noise and vibration studies.

Construction of the project would broadly involve transitory noise and vibration generating activities which occur along, and in the vicinity of, the project. Off-site truck movements on public roads are also a relevant environmental noise consideration.

The key source of operational noise associated with the project addressed in this study is the proposed converter station which would comprise indoor and outdoor plant including transformers and cooling systems.

Construction noise and vibration

An assessment of construction noise has been conducted based on noise modelling for the types of activities that are likely to result in the highest noise levels during construction. The noise modelling is based on empirical noise emission data sourced from Australian and British standards and the contractor for the project, and includes conservative assumptions about the amount of equipment operating at any given time.

The project is proposed to be constructed in two stages over approximately five years.

The construction noise assessment addresses all relevant Tasmanian legislative and policy requirements, including the EMPC Noise Regulations. In lieu of set criteria for construction noise in Tasmanian legislation and policy, the noise management levels detailed in the NSW government publication *Interim Construction Noise Guideline* dated July 2009 (NSW ICNG) were discussed with the Tasmanian EPA and agreed as a suitable basis for the assessment. Project-specific standard working hours, which comply with the EMPC Noise Regulations, have been defined for consistency with a recent Tasmanian project approval. The proposed standard working hours for the project are:

- Monday-Friday: 0700 – 1800 hrs
- Saturday: 0800 – 1800 hrs

Extended working hours resulting from unavoidable works relate to:

- drilling for shore crossings which is expected to involve horizontal directional drilling (HDD) works occurring 24 hours per day, 7 days per week, for a combined period of up to 6 months to ensure the stability of the bore hole;
- works that need to be undertaken without a break in program, such as concrete pouring;
- delivery of essential, oversized plant or equipment;
- time sensitive maintenance or repair of public infrastructure;
- emergency works required due to unforeseen circumstances;
- protection and control commissioning work within the switching station; and
- project activities that would be scheduled to reduce the need for night-time work.

Where extended hours are required for any of the above reasons, noise management would be factored in the planning of the work. The relevant authorities and the affected receivers would be consulted on the nature and duration of planned works.

Construction noise modelling was conducted to:

- provide an indication of the range of noise levels that can be expected at the nearest receivers;
- identify the locations where noise levels are predicted to be highest; and
- inform the selection of suitable noise controls for construction of the project.

In relation to the noise of construction activities during the proposed standard working hours, the assessment demonstrates the risk rating is medium.

The main noise consideration for construction is work that needs to be conducted outside of the proposed standard working hours. In particular, the need for continuous HDD works for the shore crossing to ensure the stability of the boreholes. HDD works are expected to occur continuously for a total period of up to 6 months. The assessment demonstrates the risk of noise impacts from HDD works outside of the proposed standard working hours, particularly during the night, is high.

Management and mitigation measures have been recommended to control the risk of construction noise and vibration as far as reasonably practical. The measures comprise:

- **NV01: Conduct additional background noise monitoring**

  A requirement to obtain additional background noise data which will then inform the development of a construction noise and vibration management plan.

- **NV02: Develop and implement a construction noise and vibration management plan**

  A requirement for a comprehensive plan which describes all measures that would be used to minimise the impact of construction noise and vibration as far as reasonably practical, based on updated information for the planned construction works and equipment selections.

- **NV03: Conduct construction noise monitoring**

  A requirement to conduct construction noise monitoring at locations specified in the construction noise and vibration management plan, and requirements concerning construction noise monitoring reports.

Provided that the management and mitigation measures are adhered to, and the construction noise and vibration management plan (CNVMP) is fully implemented, the residual risk of noise impacts from construction during the proposed standard working hours, and HDD shore crossing works conducted at night, would be reduced to low and medium respectively.

In relation to construction vibration, the assessment considers potential effects in terms of both the potential for cosmetic building damage and disturbance of human comfort. Based on the separating distances to construction activities, vibration from construction activities is not a material consideration for the project.

Operational noise

Operational noise levels from the converter station have been assessed on the basis of a concept design incorporating a range of noise mitigation measures to address site-specific constraints.

The assessment addresses all relevant Tasmanian legislative and policy requirements, including the *Environment Protection Policy (Noise) 2009* as referenced in the Tasmanian EIS Guidelines. Design targets that the project would ultimately be designed and assessed against have been proposed. The proposed design targets are based on guidance sourced from EPA Victoria Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues*, and are more stringent than the reference levels sourced from Tasmanian policy. Separate design targets are proposed for typical operations and the testing periods for the emergency standby generator plant.

The predicted operational noise levels are well below the reference levels from Tasmanian policy, and achieve the proposed design targets at all receivers. However, in recognition of the extent of noise mitigation required to achieve the design targets, and the requirement for mitigation to prevent noise characteristics which could attract penalties, the risk of operational noise impacts has been assessed as medium. Accordingly, noise controls to minimise the risk have been recommended and comprise the following management and mitigation measures:

- **NV01: Conduct additional background noise monitoring**

  A requirement to obtain additional background noise data which will inform the design noise assessment report and operational noise management plan for the converter station.

- **NV04: Prepare a design noise assessment report for the final converter station design**

  A requirement to prepare a detailed assessment and report, based on the final converter station design and equipment selections, demonstrating that the impact of operational noise would be minimised to the extent reasonably practical.

- **NV05: Prepare an operational noise management plan for the converter station site**

  A requirement to document all measures to be implemented and maintained to control operational noise, including noise monitoring requirements and procedures for investigating noise complaints and potential compliance issues.

- **NV06: Prepare an operational noise compliance assessment report**

  A requirement to prepare a report verifying that the measures documented in the operational noise management plan have been fully implemented and that operational noise levels comply with the applicable noise limits.

Adhering to the recommended management and mitigation measures reduces the consequence of the risk to minor. However, in recognition of the stringency of the design requirements, and the need for verification measures at the design and commissioning stages of the project, the residual impacts of operational noise remain medium.

The assessment findings indicate that environmental noise will be an important consideration to address for the construction and operational stages of the project. However, the risks of noise impacts can be reduced to acceptable levels by implementing the recommended mitigation and management measures.

GLOSSARY AND ABBREVIATIONS

Term	Description
Ambient noise level	The noise level measured in the absence of the intrusive noise or the noise requiring control. Ambient noise levels are frequently measured to determine the situation prior to the addition of a new noise source.
A-weighting	A set of adjustments which are applied to sound pressure levels to account for variations in the human ear's perception of sound at different frequencies. The A-weighting may also be applied to sound power levels. Sound pressure levels or sound power levels that are adjusted by the A-weighting are expressed as dB L_A in accordance with international standard conventions. Alternative ways of expressing A-weighted decibels such as dBA or dB(A) are therefore not used within this report.
Decibel (dB)	The unit of sound pressure level and sound power level.
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EMPCA	Environmental Management and Pollution Control Act 1994 (Tas)
EMPC Noise Regulations	Environmental Management and Pollution Control (Noise) Regulations 2016 (Tas)
EPA	Environment Protection Authority (of Tasmania)
Noise EPP	Environment Protection Policy (Noise) 2009 (Tas)
Frequency	The number of pressure fluctuation cycles per second of a sound wave. Measured in units of Hertz (Hz).
Hertz (Hz)	Hertz is the unit of frequency. One hertz is one cycle per second. One thousand hertz is a kilohertz (kHz).
HDD	Horizontal directional drilling, a trenchless construction method that installs ducts under obstacles and environmentally sensitive features by drilling, subject to suitable geotechnical conditions.
L_{A90}	The A-weighted noise level exceeded for 90% of the measurement period, measured in dB. This is commonly referred to as the background noise level.
L_{Aeq}	The A-weighted equivalent continuous sound level, measured in dB. This is commonly referred to as the average noise level.
MDA	Marshall Day Acoustics Pty Ltd ATF Marshall Day Unit Trust
MLPL	Marinus Link Pty Ltd
NSW CNVG	NSW Roads and Maritime Services publication *Construction Noise and Vibration Guideline* dated August 2016
NWTD	North West Transmission Developments
PPV	Peak Particle Velocity
The project	The proposed Marinus Link interconnector between Tasmania and Victoria, comprising land-based infrastructure in both Tasmania and Victoria, and subsea cable connections.
Sound power level (L_w)	A measure of the total sound energy emitted by a source and is independent of the distance from the source (it is therefore different to the sound pressure level which depends on distance from the source)

Term	Description
Sound pressure level	The change in atmospheric pressure caused by a sound wave. The sound pressure level (along with the frequency of the sound) relates to the perceived loudness of a sound source.
TNMG	*Tasmanian State Road Traffic Noise Management Guidelines* revision 1 dated October 2015
Tetra Tech Coffey	Tetra Tech Coffey Pty Ltd
VDV	Vibration Dose Value

1.0 INTRODUCTION

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

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

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

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

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

This report has been prepared by Marshall Day Acoustics Pty Ltd (MDA) for the Tasmanian jurisdiction as part of the two EISs being prepared for the project.

1.1 Purpose of this report

This document presents the technical noise and vibration assessment of the Tasmanian component of the project. The assessment considers sources of environmental noise and vibration associated with both the construction and operational stages of the project. Noise and vibration levels associated with decommissioning activities (i.e. decommissioning of the project) are expected to be similar to or lower than those experienced during the construction phase. A separate assessment for the decommissioning phase is therefore not warranted. The relevant noise and vibration controls nominated for the construction phase should also be applied during decommissioning.

Construction of the project would broadly involve transitory noise and vibration generating activities which occur along, and in the vicinity of, the project. Off-site truck movements on public roads are also a relevant environmental noise and vibration consideration. The primary source of operational noise associated with the project is the proposed converter station at Heybridge which would comprise indoor and outdoor plant including transformers and cooling systems.

This report presents:

- details of the environmental noise and vibration criteria that apply to the project;
- the noise and vibration sensitive locations in the vicinity of the project;
- predicted construction noise and vibration levels at sensitive locations;
- a risk assessment of the potential noise and vibration impacts of the project; and

- recommended management and mitigation measures for the control of noise and vibration.

The sensitive locations addressed in this report comprise buildings and areas used by people for purposes that are sensitive to noise and vibration. These locations are collectively referred to as receivers in this report.

Noise and vibration effects on fauna (terrestrial) are addressed in a separate technical study of ecology. Similarly, the Victorian and subsea components of the project are addressed in separate noise and vibration assessment reports.

1.2 Project overview

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

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

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

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

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

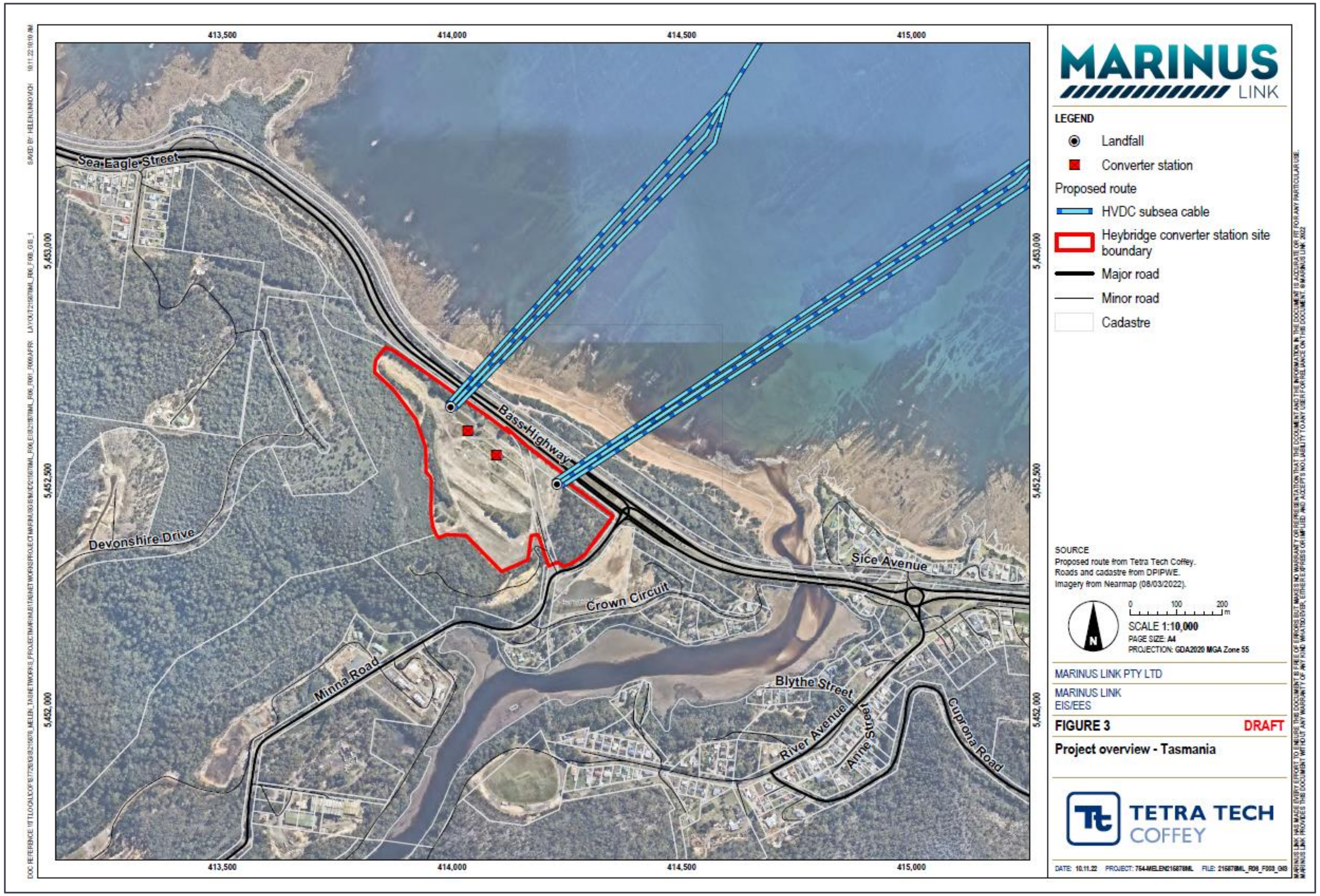


Figure 1: Project overview
(figure courtesy of Tetra Tech Coffey)

1.3 Assessment context

Construction and operation of the project has the potential to result in noise and vibration impacts at receivers in the area around the project, primarily consisting of residential dwellings.

The impacts can range from annoyance and minor disturbance of domestic and recreational activities (e.g. speech interference), potentially resulting in behavioural changes to adapt to the noise (e.g. avoiding outdoor areas or closing windows), through to complete disruption of typical residential activities and health impacts such as sleep disturbance.

Environmental noise and vibration are therefore important considerations to be addressed as part of the EIS. Specifically, an assessment is required to identify and quantify the risk of noise and vibration impacts, and determine the types of management and mitigation measures that should apply to the project to minimise the risks.

2.0 ASSESSMENT GUIDELINES

This section outlines the assessment guidelines relevant to noise and vibration and the linkages to other technical assessments completed for the project. Two separate EISs are being prepared to address the EIS guidelines published by EPA Tasmania for the Heybridge converter station and shore crossing.

2.1 EPA Tasmania Guidelines

EPA Tasmania has published two sets of guidelines (September 2022) for the preparation of an EIS for the Marinus Link converter station and shore crossing. A separate set of guidelines have been prepared for each of these project components:

- *Environmental Impact Statement Guidelines Marinus Link Pty Ltd Converter Station for Marinus Link, September 2022*, Environment Protection Authority Tasmania (Tas converter station EIS guidelines)
- *Environmental Impact Statement Guidelines Marinus Link Pty Ltd Shore Crossing for Marinus Link, September 2022,* Environment Protection Authority Tasmania (Tas shore crossing EIS guidelines)

The section titled *Potential Impacts and their Management* in the EIS guidelines for both the converter station and the shore crossing identifies key environmental issues associated with the project. The Tasmanian EIS guidelines note that all potential effects of the proposal should be evaluated, but that the key issues should be the principal focus. Key issue 3 is defined as noise and vibration:

> *Potential impacts of noise and vibration emissions on sensitive receptors.*

The EIS guidelines establish assessment requirements that are specific to noise and vibration (see section 6.3 of the Tasmanian converter station EIS guidelines and section 10.3 of the Tasmanian shore crossing EIS guidelines). The guidance is equivalent in each of the EIS guidelines, with the only difference being a reference to maintenance work for the shore crossing, and cross-references in each document to the converter station and shore crossing with respect to cumulative noise. The combined requirements of the EIS guidelines are reproduced in Table 1 along with the section of this report where each requirement is addressed.

In terms of the legislative and policy requirements, the Tasmanian converter station EIS guidelines state that:

> *Consideration should be given to the requirements of the Tasmanian Environment Protection Policy (Noise) 2009.*

Table 1: Combined requirements of the Tasmanian EIS guidelines

Requirement	Report section
Discuss impacts on human sensitive receptors of the proposal on ambient (surrounding) noise levels during both the construction and operational phases (e.g., maintenance works), including:	
• Identifying and describing all sources of noise with the potential to cause nuisance, including vehicle movements;	Section 4.1, Section 4.2, Section 4.3 and Section 4.4
• A map of the location of all such sources of noise;	Section 4.3 and Section 7.2.1
• Considering the potential for noise emissions during both the construction and operational phases to cause nuisance for nearby land users, particularly at noise sensitive premises, including:	
– Establishing the baseline (pre-existing) noise in the area with particular focus on sensitive receptors likely to be influenced by the proposal;	Section 6.0 and Appendix C
– Establishing noise level criteria for the operational phases of the proposal;	Section 5.4.1
– Predicting noise levels at noise sensitive premises;	Section 7.1.3 and Section 7.2.2
– Consideration of timing and duration of noise;	Section 7.1.4, Section 7.1.5 and Section 7.2.3
– Consideration of existing noise levels to determine whether predicted noise levels are likely to result in nuisance for sensitive premises;	Section 7.1.2 and Section 7.2.3
– Consideration of the potential for cumulative noise impact from the Heybridge converter station and shore crossing works;	Section 7.1.4
– Development of a construction noise and vibration management plan, including management of noise complaints and options for noise and vibration monitoring, if required;	Section 7.1.8 and Section 7.5
– Discussion of proposed mitigation measures for operational noise.	Section 7.2.1, Section 7.2.5 and Section 7.5

2.2 Linkages to other reports

This report is informed by or informs the technical assessments outlined in Table 2.

Table 2: Relevant technical assessments

Technical assessment	Relevance to this assessment
Heybridge Converter Station Terrestrial Ecology Baseline and Impact assessment report, Entura 2024	Noise level data presented in this report may be referenced in the biodiversity and ecology study.
Marinus Link Project, Environmental Impact Statement (Tasmania) Technical Report – Traffic & Transport, Stantec 2024	Provides details of transport routes and heavy vehicle numbers during the construction of the project and informs the assessment of off-site transportation noise.

3.0 LEGISLATION, POLICY AND GUIDELINES

This section presents:

- legislation and guidelines for the assessment of environmental noise; and
- guidelines for the assessment of vibration (in lieu of formal polices or legislation that apply to vibration).

3.1 Noise legislation and guidelines

The following publications are relevant to the assessment of environmental noise levels in Tasmania:

- *Environmental Management and Pollution Control Act 1994* (Tas) (the EMPCA);
- *Environmental Management and Pollution Control (Noise) Regulations 2016* (Tas) (the EMPC Noise Regulations);
- *Environment Protection Policy (Noise) 2009* (Tas) (the Noise EPP); and
- *Noise Measurement Procedures Manual 2008* (Tas) (the Tasmanian noise measurement manual).

The EMPCA represents the overarching legislation for the prevention, reduction and remediation of environmental harm.

The EMPC Noise Regulations and the Noise EPP subsequently define requirements that are specific to the management of noise.

The Tasmanian noise measurement manual does not specify noise limits or noise control requirements but sets the procedures that are to be used for *measuring, estimating, calculating and assessing sound pressure levels* as required by the EMPC Noise Regulations and the Noise EPP.

The requirements of the EMPC Noise Regulations and the Noise EPP are presented in the following sub-sections, along with supplementary guidance referenced in this assessment for construction noise and off-site traffic movements.

3.1.1 EMPC Noise Regulations

The EMPC Noise Regulations apply to noise that is not controlled by measures specified in an approved instrument, such as a permit under the *Land Use Planning and Approvals Act 1993* (Tas).

The following sections outline provisions relevant to construction noise and fixed plant.

Construction noise

The EMPC Noise Regulations' primary mechanism for controlling construction noise is the definition of prohibited hours for equipment and machinery used on construction and demolition sites (excluding road construction) which can be heard in any neighbouring residential premises. Specific requirements also apply to the operation of chainsaws powered by an internal combustion engine operated within 300 m of residential premises.

Unless dedicated noise control requirements are established via an approved instrument, construction work that could result in audible noise inside neighbouring residential premises (with windows open) must not occur during the prohibited hours. An approval instrument is required for the operation of chainsaws on land other than residential premises that is within 300 m of residential premises, regardless of the hours of use.

The relevant restrictions of use are summarised in Table 3 based on times of the day.

Table 3: EMPC Noise Regulations – relevant provisions relating to operation of equipment

Equipment	Day of the week	Prohibited hours of use
(2) Mobile machinery, forklift or portable equipment	Monday – Friday	Before 0700 hrs and after 1800 hrs
	Saturday	Before 0800 hrs and after 1800 hrs
	Sunday or public holiday	Before 1000 hrs and after 1800 hrs
(3) Motor vehicles (unless the vehicle…is being operated to move into or out of…a construction or demolition site)	Monday-Friday	Before 0700 hrs and after 1800 hrs
	Saturday	Before 0900 hrs and after 1800 hrs
	Sunday or public holiday	Before 1000 hrs and after 1800 hrs
Chainsaws within 300 m of residential premises (when operated on a non-residential premises)	Sunday – Saturday	Requires approved instrument

Fixed equipment

The EMPC Noise Regulations define requirements for fixed equipment which is defined as including:

> *domestic heating equipment, systems for the production of hot water, air conditioners, evaporative coolers, pumps, generators or wind turbines, that are affixed at the location at which they are in use.*

These definitions are not specifically stated as applicable to commercial or industrial activities. Conversely, unless noise control requirements for the operation of the project are established via an approved instrument, the EMPC Noise Regulations do not specifically exclude application of the fixed plant requirements to the operational noise of the project.

Clause 7 establishes the following requirements for fixed plant:

> *(1) A person must not operate fixed equipment on any premises –*
>
> *(a) from 7.00 a.m. until 10.00 p.m., if the fixed equipment, when so operated, emits noise that is greater than 45dB(A); or*
>
> *(b) from 10.00 p.m. until 7.00 a.m., if the fixed equipment, when so operated, emits noise that is greater than 40dB(A).*

The fixed plant noise limits are defined for locations adjacent the external walls of residential premises that are nearest to the fixed plan (specifically, at 1 m from the external wall, unless the property boundary is less than 1 m from the external wall).

3.1.2 Environment Protection Policy (Noise) 2009

Overview

The Noise EPP is a strategic framework document which defines overarching principles and objectives to provide a basis for reducing health risks and amenity impacts associated with environmental noise.

For specific requirements relating to noise levels and hours of operation, the Noise EPP notes that these are principally covered by the EMPC Noise Regulations and permits issued for particular activities.

In setting the strategic framework, the Noise EPP notes the following important points of context:

> *Establishing suitable benchmarks for what are acceptable levels of noise is difficult for a number of reasons. These include the fact that different people have differing tolerance to noise in loudness and frequency, different situations can justify different noise levels and tolerance to noise can vary depending on the time of day or the day of the week.*
>
> *There are number of different authorities which have a role in regulating noise in different situations, and different approaches may be taken to the various noise issues.*
>
> *...*
>
> *This policy does not exist in isolation and its provisions should be considered in the context of other policy frameworks, in particular Tasmania Together and the Resource Management and Planning System. Other environmental issues and the social and economic needs of the community should be taken into account when addressing noise issues.*

The Noise EPP therefore identifies that a range of factors need to be considered when setting appropriate noise controls, including both the protection of amenity and the wider economic and social benefits of new development (note: the publications Tasmania Together and the Resource Management and Planning System referred to above do not set additional noise criteria or provide specific guidance on noise assessment requirements that are relevant to this study).

The objectives of the Noise EPP are defined in Part 2 under sub-clause 6 (1):

> *(a) to further the objectives of the Act as they relate to the acoustic environment; and*
>
> *(b) to protect the environmental values specified in clause 7.*

Clause 7 of the Noise EPP then defines the environmental values as follows:

> *(1) Environmental values are the values or uses of the environment that are to be protected.*
>
> *(2) The environmental values to be protected under this policy are the qualities of the acoustic environment that are conducive to –*
>
> *(a) the wellbeing of the community or a part of the community, including its social and economic amenity; or*
>
> *(b) the wellbeing of an individual, including the individual's –*
>
> *(i) health; and*
>
> *(ii) opportunity to work and study and to have sleep, relaxation and conversation without unreasonable interference from noise.*
>
> *(3) It can be assumed that the environmental values specified in sub-clause (2)(b) will be protected for the majority of the human population where the acoustic environment indicator levels are not exceeded, and there are no individual sources of noise with dominant or intrusive characteristics.*

The acoustic environment indicator levels referred to in sub-clause 7 (3) are provided as a reference for considering the condition of the acoustic environment and the effectiveness of noise control measures and strategies. The Noise EPP notes that they are indicative, not mandatory noise levels.

The relevant acoustic environment indicator levels for external noise at residential locations are reproduced in Table 4.

Table 4: Residential locations – outdoor acoustic environment indicator levels

Specific environment	Critical health effect(s)	Average noise levels and time base (hours)	Maximum noise levels
Outdoor living area	Serious annoyance, daytime and evening	55 dB $L_{Aeq,16h}$	-
	Moderate annoyance, daytime and evening	50 dB $L_{Aeq,16h}$	-
Outside bedrooms	Sleep disturbance, window open	45 dB $L_{Aeq,8h}$	60 dB L_{AFmax}

The acoustic environment indicator levels correspond to criteria defined by the World Health Organisation (WHO)[1] that are applied to long-term/permanent sources of noise. This is a key point of context, as the acoustic environment indicator levels do not differentiate between short-term and long-term/permanent noise sources.

Construction noise

The Noise EPP does not set requirements or define principles that are specific to construction noise, however Part 6 provides guidance relating to domestic and miscellaneous activities, the latter being defined as an activity that is neither domestic, commercial, industrial nor related to transport infrastructure. The provisions of Part 6 therefore do not specifically exclude construction noise, and may be referenced when assessing construction noise. The following general principles are noted:

- regulatory authorities should assess, manage and regulate proposed domestic and miscellaneous activities that are sources of noise with the objective of protecting environmental values
- best practice environmental management should be employed in every activity to reduce noise emissions to the greatest extent reasonably practical
- dominant or intrusive noise characteristics of noise emission from an activity should be reduced by the greatest extent reasonably practical.

These types of principles are consistent with construction noise requirements in other Australian jurisdictions where the emphasis is on limiting construction to standard working hours where practical, and the use of practical measures to manage and reduce the noise of activities. In particular, this type of management approach is commonly used in lieu of rigidly defined compliance limits for construction activity during standard working hours.

[1] World Health Organization publication *Guidelines for Community Noise* dated 1999

Commercial and industrial activities

Commercial and industrial activities are addressed in Part 5 of the Noise EPP. In particular, clause 12 outlines the following key requirements that are directly relevant to operational noise associated with the project:

> *(1) Regulatory authorities should assess, manage and regulate proposed commercial and industrial activities that are sources of noise with the objective of protecting the environmental values.*
>
> *(2) Best practice environmental management should be employed in every activity to reduce noise emissions to the greatest extent that is reasonably practical.*
>
> *(3) Dominant or intrusive noise characteristics of noise emissions from an activity should be reduced to the greatest extent that is reasonably practical.*
>
> *(4) To retain a reserve capacity in the acoustic environment at a particular location, no activity should be permitted to emit noise at a level or in a manner that, allowing for other reasonable emissions of noise in the vicinity, would prejudice the protection of the environmental values at that location.*
>
> *(5) Notwithstanding sub-clause (4), regulatory authorities may determine not to require a reserve capacity if –*
>
> *(a) (i) best practice environmental management is employed in the activity; and*
>
> *(ii) it is highly unlikely that there will be significant additional sources of noise in the vicinity; or*
>
> *(b) this would prevent a proposal that is clearly in the public interest from proceeding.*

Clause 12 also set out provisions for activities that are not able to meet the above requirements and the measures that regulatory authorities are able to adopt to address these situations.

Measurement and monitoring

The Noise EPP Part 7 establishes requirements for noise monitoring and noise impact studies.

In terms of noise monitoring, the Noise EPP specifies that any noise measurements for the purposes of the policy should made in accordance with the relevant requirements of the Noise Measurement Procedures Manual, as amended from the time to time.

In relation to noise impact studies, the following requirements are specified:

> *(1) If a regulatory authority has reasonable grounds to consider that a proposed or existing emission of noise from an industrial, commercial or infrastructural activity might prejudice protection of the environmental values, it should, where possible and appropriate, require any person responsible for the activity to undertake a noise impact study in accordance with an approved methodology.*
>
> *(2) Where a noise impact study is carried out, it should consider –*
>
> *(a) noise levels at appropriate locations compared with noise limits applicable to the activity in any legislation, approval or proposed approval;*
>
> *(b) compliance with any other relevant requirements of legislation, approval or proposed approval;*
>
> *(c) the potential for reducing the impact of the activity's noise emissions or proposed emissions on the acoustic environment; and*
>
> *(d) the cumulative effect of the noise emissions or proposed emissions from the activity.*

3.1.3 Supplementary noise guideline documents

The requirements and principles set out in the EMPC Noise Regulations and the Noise EPP provide the primary references for assessing construction noise associated with the project.

To supplement these documents for the assessment of the project, the following additional guidelines have been referenced where applicable for informative purposes:

- Australian Standard AS 2436-2010 *Guide to noise and vibration control on construction, demolition and maintenance sites* (AS 2436)

  This standard provides empirical noise emission data for a range of different construction activities and is frequently referenced as a basis for predicting construction noise levels at receiver locations. The standard also provides general guidance on good practice measures for the management and control of construction noise

- British Standard BS 5228-1:2009+A12014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise* (BS 5228-1)

  This standard is commonly used in conjunction with AS 2436 as an additional noise emission data reference for a much wider range of activities and plant than is documented in AS 2436

- NSW government publication *Interim Construction Noise Guideline* dated July 2009 (NSW ICNG)

  This document provides guidance on managing noise from construction sites which is specific to the NSW regulatory setting. The document was developed with a *focus on applying a range of work practices most suited to minimum construction noise impacts, rather than focussing only on achieving numeric noise levels*. The NSW ICNG does however provide an example approach to quantitative assessment of noise levels when required.

- NSW Roads and Maritime Services publication *Construction Noise and Vibration Guideline* dated August 2016 (NSW CNVG)

  This document provides additional guidance on reasonable and practical measures for controlling construction noise and vibration, as well as guidance on typical minimum working distances to satisfy human comfort and structural damage criteria at receivers.

- EPA Victoria Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* (Victorian Noise Protocol)

  This document defines a procedure for setting noise limits that apply to the operation of industry premises in Victoria. This publication has been referenced for additional guidance on design targets for operational noise levels associated with the project.

3.1.4 Guidelines for noise from off-site vehicle movements

There is no Tasmanian guidance document for the assessment of construction traffic noise levels on public roads[2].

The *Tasmanian State Road Traffic Noise Management Guidelines* revision 1 dated October 2015 (the TNMG) provides target noise levels for public roads. Specifically, target criteria of 63 dB to 68 dB $L_{A10,18h}$ are specified for public roads, along with the Noise EPP acoustic indicator levels (as presented in Section 3.1.2) as alternative criteria for sheltered assessment locations.

[2] The Tasmanian TNMG does provide target noise limits for public roads but does not address temporary increases associated with construction traffic.

However, the criteria represent targets for normal traffic flows, and the TNMG does not address temporary increases associated with construction traffic. The target criteria are therefore not directly applicable to construction related traffic. However, given that noise criteria applied to construction activity are normally less stringent than those applied to long-term/permanent sources of noise (on account of the temporary nature of construction activity), the target noise levels can be used as a conservative reference for contextualising predicted construction traffic noise levels.

3.2 Vibration guidelines

There is no standard or regulation that specifies criteria for the control of construction vibration levels in Tasmania.

In lieu of Tasmanian guidance for construction vibration, for assessment purposes, reference is made to the NSW CNVG.

In general, empirical limits relating to vibration from commerce or industry generally distinguish between the effects on humans and the effects on buildings. For example, effects on humans depend on whether the vibration is continuous, intermittent or occasional. For buildings, the effect depends on whether the vibration is short term or long term. Also, human perception of vibration is evident at levels well below the thresholds for structural effects on a building and thus the assessment parameters commonly differ.

The safe working distances detailed in the NSW CNVG are the primary reference for assessing construction vibration related risks at the planning stage. The relevant criteria that would subsequently apply to any compliance monitoring are defined in separate guidelines presented in Section 3.2.2 and Section 3.2.3.

3.2.1 NSW Construction Noise and Vibration Guideline (CNVG)

The NSW CNVG sets out minimum working distances from receivers for typical items of vibration intensive plant. The minimum distances are specified in Section 7.1 of the guidance and are quoted for effects relating to cosmetic damage and human comfort. In relation to cosmetic damage, the guidance contained in the NSW CNVG is based on the criteria contained in BS 7385[3]. For human comfort, the guidance is based on criteria on guidance from the former NSW Department of Environment and Conservation titled *Assessing Vibration: a technical guideline* dated February 2006.

The minimum working distances are reproduced below in Table 5.

The NSW CNVG notes that the minimum working distances are indicative and will vary depending on the particular item of plant and local geotechnical conditions. The guideline also notes the values are defined in relation to cosmetic damage of typical buildings under typical geotechnical conditions and recommends vibration monitoring to confirm the minimum working distances at specific sites.

In relation to human comfort, the NSW CNVG notes that the minimum working distances relate to continuous vibration. The guideline further notes that for most construction activities, vibration emissions are intermittent in nature and for this reason, higher vibration levels, occurring over shorter periods are allowed.

The data presented in Table 5 indicates that the minimum working distances for human comfort are significantly greater than for the avoidance of cosmetic damage. This is based on the thresholds for human exposure to vibration being generally well below accepted thresholds for minor cosmetic damage to lightweight structures.

[3] BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings* Part 2

Table 5: Recommended minimum working distances for vibration intensive plant from receivers (reproduced from Table 2 of Section 7.1 of the NSW CNVG)

Plant item	Rating / description	Minimum working distance	
		Cosmetic damage	Human response
Vibratory Roller	< 50 kN (Typically 1-2 tonnes)	5 m	15 m to 20 m
	< 100 kN (Typically 2-4 tonnes)	6 m	20 m
	< 200 kN (Typically 4-6 tonnes)	12 m	40 m
	< 300 kN (Typically 7-13 tonnes)	15 m	100 m
	> 300 kN (Typically 13-18 tonnes)	20 m	100 m
	> 300 kN (> 18 tonnes)	25 m	100 m
Small Hydraulic Hammer	(300 kg – 5 to 12 t excavator)	2 m	7 m
Medium Hydraulic Hammer	(900 kg – 12 to 18 t excavator)	7 m	23 m
Large Hydraulic Hammer	(1600 kg – 18 to 34 t excavator)	22 m	73 m
Vibratory Pile Driver	Sheet piles	2 m to 20 m	20 m
Pile Boring	≤ 800 mm	2 m (nominal)	4 m
Jackhammer	Handheld	1 m (nominal)	2 m

3.2.2 Human response to vibration

The NSW CNVG provides indicative minimum working distances that are a suitable guide for planning stage assessments of vibration and potential impacts to human comfort.

However, if construction vibration monitoring is found to be warranted during the construction stage of a project (e.g. as a result of activity occurring at distances less than or comparable to the indicative minimum working distances), it is necessary to refer to alternative guidance that specifies criteria that can be used to assess measured vibration levels.

In lieu of current Australian Standards that present vibration criteria for human responses, there are a number of international standards and reference documents available that provide relevant guidance. Of these, BS 6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings* (BS 6472-1) is the most current of the relevant standards and is widely accepted within the industry.

BS 6472-1 provides a range of vibration dose value (VDV) levels to assess the likelihood of adverse comment from different types of vibration (constant, impulsive, occasional, and intermittent). These are reproduced in Table 6. The VDV levels can be applied to all types of vibration and take into account the duration of exposure. This has practical benefits for situations where vibration may be generated from multiple different sources operating at different times and different locations.

Table 6: Vibration dose value ranges which might result in various probabilities of adverse comment within residential buildings

Place and time	Low probability of adverse comment $m \cdot s^{-1.75}$	Adverse comment possible $m \cdot s^{-1.75}$	Adverse comment probable $m \cdot s^{-1.75}$
Residential building 16 h day	0.2 to 0.4	0.4 to 0.8	0.8 to 1.6
Residential building 8 h night	0.1 to 0.2	0.2 to 0.4	0.4 to 0.8

Note: The guideline targets are non-mandatory; they are goals that should be sought to be achieved through the application of feasible and reasonable mitigation measures.

The VDVs recommended in the document for vibration of an intermittent nature (i.e. construction works) are presented in Table 7. These represent the values which could be nominated in a Construction Noise and Vibration Monitoring Plan (CNVMP) for the project, for reference in the event of construction vibration monitoring being warranted.

Table 7: Acceptable vibration dose values for intermittent vibration (VDV $m/s^{1.75}$)

Location	Day (0700 to 2200 hrs)		Night (2200 to 0700 hrs)	
	Preferred Value	Maximum Value	Preferred Value	Maximum Value
Residences	0.20	0.40	0.10	0.20
Offices, schools, educational institutions, places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Note: The guideline targets are non-mandatory; they are goals that should be sought to be achieved through the application of feasible and reasonable mitigation measures.

3.2.3 Vibration damage to buildings and structures

The NSW CNVG provides indicative minimum working distances that are a suitable guide for planning stage assessments of vibration with respect to potential structural damage.

However, if construction vibration monitoring is found to be warranted during the construction stage of a project (e.g. as a result of activity occurring at distances less than or comparable to the indicative minimum working distances), it is necessary to refer to alternative guidance that specifies criteria that can be used to assess measured vibration levels.

There are no current Australian Standards that present vibration criteria for building damage. A widely referenced and accepted international standard for the assessment of building vibration is the German Standard DIN 4150-3:2016-12 *Vibrations in buildings – Part 3: Effects on structures* (DIN 4150-3). The structural damage criteria specified by DIN 4150-3 over the range 1–100 Hz are presented in Table 8. DIN 4150-3 specifies Peak Particle Velocity (PPV) as the assessable vibration parameter.

Table 8: Vibration limits according to DIN 4150-3

Line	Type of building	Guideline values for velocity, v_i, in mm/s (peak)				
		Foundation, all directions, i = x, y, z, at a frequency of			Topmost floor, horizontal direction, i = x, y	Floor slabs, vertical direction, i = z
		1-10 Hz	10-50 Hz	50-100 Hz[a]	All frequencies	All frequencies
1	Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20	20-40	40-50	40	10
2	Residential buildings and buildings of similar design and/or occupancy	5	5-15	15-20	15	5
3	Structures that, because of their particular sensitivity to vibration, cannot be classified under lines 1 and 2 and are of great intrinsic value (e.g. listed buildings)	3	3-8	8-10	8	2.5[b]

NOTE Even if guideline values as in line 1, columns 2 to 5, are complied with, minor damage cannot be excluded.

[a] At frequencies above 100 Hz, the guideline values for 100 Hz can be applied as minimum values.
[b] Paragraph 2 of DIN 4150-3 5.1.2 shall be observed.

4.0 PROJECT DESCRIPTION

This section presents:

- an overview of the project;
- the main construction activities that are relevant to noise and vibration; and
- the main sources of operational noise associated with the project.

4.1 Overview

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

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

- HVAC switching station and HVAC-HVDC converter station at Heybridge in Tasmania. This is where the project will connect to the North West Tasmania transmission network being augmented and upgraded by the North West Transmission Developments (NWTD).
- Shore crossing in Tasmania adjacent to the converter station.
- Subsea cable across Bass Strait from Heybridge in Tasmania to Waratah Bay in Victoria.

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

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

This assessment is focused on the Tasmanian terrestrial and shore crossing section of the project. This report will inform the two EISs being prepared to assess the project's potential environmental effects in accordance with the legislative requirements of the Tasmanian government (Figure 2).

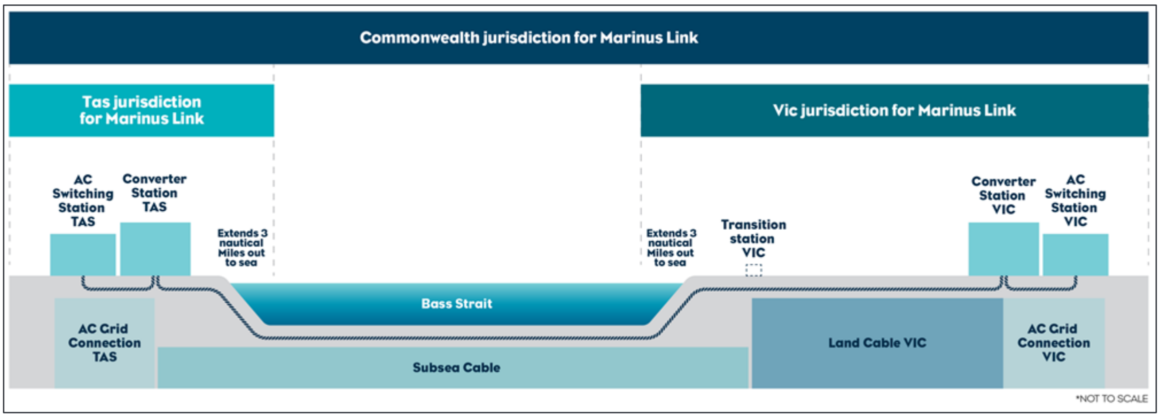


Figure 2: Project components considered under applicable jurisdictions (Marinus Link Pty Ltd 2022)

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

4.2 Construction

This section of the report provides information about construction of the project that is relevant to the noise and vibration assessment.

4.2.1 Proposed works

The project would be constructed in two 750 MW stages, with each stage having three cables bundled. The western circuit is referred to as stage one and would be commissioned first. The eastern circuit is referred to as stage two and would be commissioned after stage one.

Construction of the Heybridge converter station (the converter station) includes works associated with the HVDC converter station plant, the switching station, and the two launch points for the shore crossings. The construction stage of the project would involve the following activities:

- site preparation, surveying and vegetation clearing as needed.
- establishing construction site offices and amenities, and laydown areas.
- civil works to construct the converter station bench (bulk earthworks), including remediation or disposal of contaminated soils disturbed during bulk earthworks.
- civil works including construction of the access road to the site and the internal roads, stormwater drainage system, foundations, cable trenches and transformer bays.
- construction of two horizontal directional drilling (HDD) pads within the boundary of the converter station site, and subsequently HDD works from these pads to construct the two shore crossings (followed by conduit and cable installation works)
- infrastructure works including structural steelwork for buildings and installation of electrical apparatus and infrastructure such as the DVDC converter equipment, HVAC switchgear and auxiliary transformers.
- testing and commissioning of the converter station, switching station and ancillary site systems (e.g. fire systems).

Construction of the converter station is expected to take up to three (3) years / 36 months for each stage, including up to 6 months of HDD drilling to construct both of the 750 MW circuits.

A plan of the site illustrating a conceptual arrangement of the plant and the location of the shore crossings is provided in Section 4.3.

4.2.2 Proposed construction hours

Construction activities would adhere to the following proposed standard working hours (see further discussion subsequently in Section 5.3.1), unless unavoidable works are required:

- Monday-Friday: 0700 – 1800 hrs
- Saturday: 0800 – 1800 hrs

Extended working hours resulting from unavoidable works relate to:

- drilling for shore crossings which is expected to involve HDD works occurring 24 hours per day, 7 days per week, for a combined period of up to 6 months to ensure the stability of the bore hole;
- works that need to be undertaken without a break in program, such as concrete pouring;
- delivery of essential, oversized plant or equipment;
- time sensitive maintenance or repair of public infrastructure;
- emergency works required due to unforeseen circumstances;

- protection and control commissioning work within the switching station; and
- project activities would be scheduled to reduce the need for night-time work.

4.3 Operation

The primary sources of operational noise associated with the project are the fixed items of plant to be located at the converter station.

The converter station would consist of two HVDC converters each housed in a separate building and a switching station.

A plan of the site illustrating a conceptual arrangement of the plant and the location of the shore crossings is provided in Figure 3.

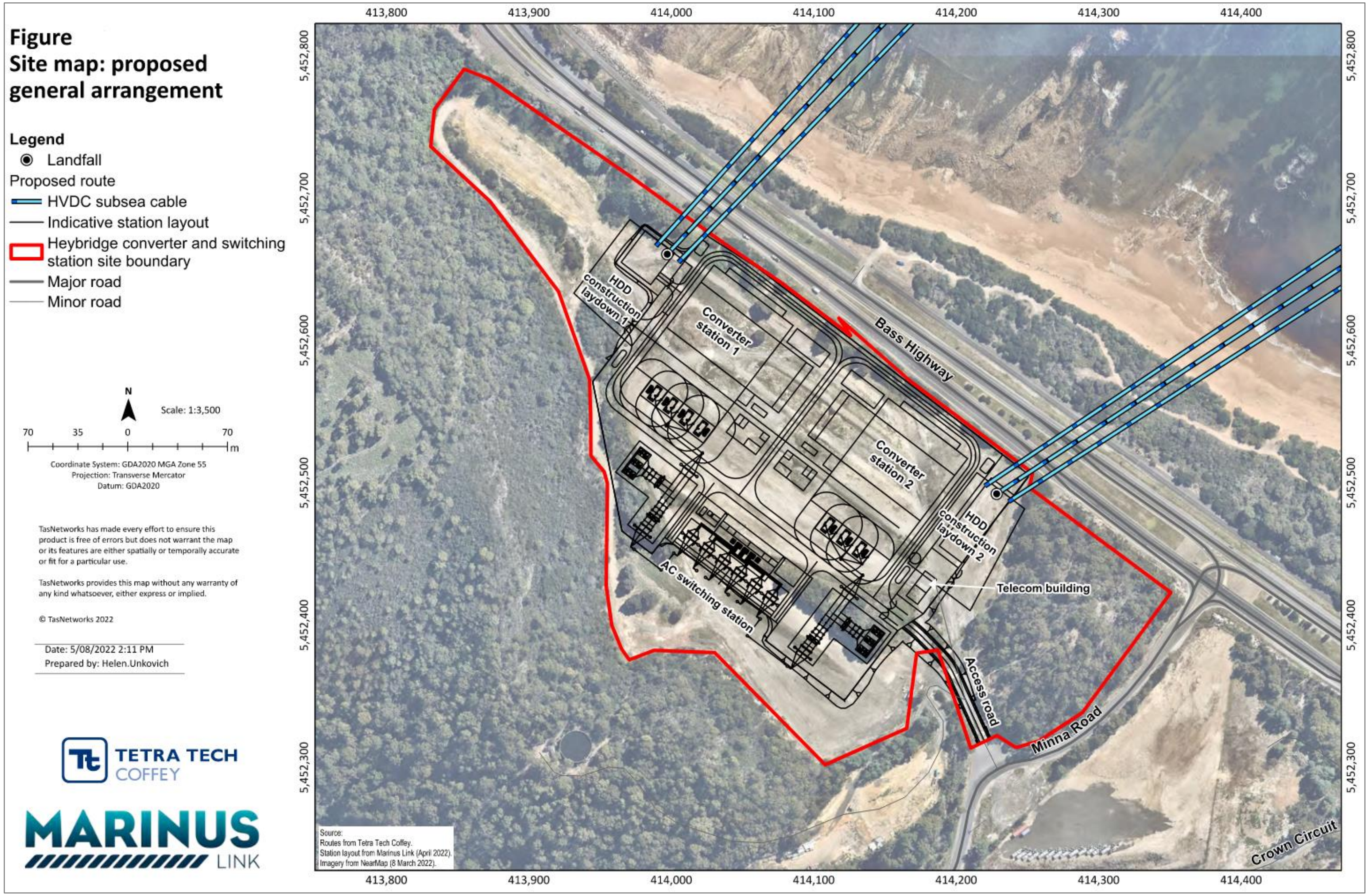


Figure 3: Heybridge Converter Station Site – indicative concept plan (figure courtesy of Tetra Tech Coffey)

4.4 Decommissioning

The operational lifespan of the project is a minimum of 40 years. At this time the project would be either decommissioned or upgraded to extend its operational lifespan.

Decommissioning would be planned and carried out in accordance with regulatory requirements at the time. A decommissioning plan in accordance with approvals conditions would be prepared prior to planned end of service and decommissioning of the project.

Requirements at the time would determine the scope of decommissioning activities and impacts. The key objective of decommissioning is to leave a safe, stable and non-polluting environment.

In the event that the project is decommissioned, all above-ground infrastructure would be removed and the site rehabilitated.

Decommissioning activities required to meet the objective would include, as a minimum, removal of above ground buildings and structures. Remediation of any contamination and reinstatement and rehabilitation of the site would be undertaken to provide a self-supporting landform suitable for the end land use.

Decommissioning and demolition of project infrastructure would implement the waste management hierarchy principles being avoid, minimise, reuse, recycle and appropriately dispose. Waste management would accord with applicable legislation at the time.

Decommissioning activities may include recovery of land and subsea cables. The conduits and shore crossing ducts would be left in-situ as removal would cause significant environmental impact. Subsea cables would be recovered by water jetting or removal of rock mattresses or armouring to free the cables from the seabed.

A decommissioning plan would be prepared to outline how activities would be undertaken and potential impacts managed.

5.0 ASSESSMENT METHOD

This section presents a summary of the methods used to assess noise and vibration associated with construction and operation of the project.

5.1 Study area – receivers

The converter station site is located near the coast at Heybridge, on land adjacent to the Bass Highway which was previously occupied by the former Tioxide factory.

The areas adjoining the site consist of a residential area to the east and southeast, existing commercial uses to the south, and conservation areas to the west and further south beyond the adjoining commercial uses.

The receivers considered in this report comprise the existing residential locations to the east, and approved residential developments sites to the west and southwest. The approved residential developments include:

- the Heybridge Residential Nature Reserve which consists of six hamlets for residential subdivision, the nearest being the Devonshire Drive Hamlet where local roads have been constructed (the remaining hamlets set further back from the site form the Eagle Sea Estate, some of which are currently in construction); and
- a residential development located just north of the Heybridge Residential Nature Reserve on George Street.

A total of 151 existing receivers in the areas to the east and southeast of the project have been identified by Tetra Tech Coffey and are shown as receiver points in Figure 4. Due to the large number of receivers in the area, a subset of these receivers has been selected to represent the distribution of residential dwellings in the area and provide the basis for the assessment of noise and vibration. This subset is listed in Table 9 and is shown in Figure 5.

Additional receiver points were defined from inspection of aerial imagery and cadastral parcels to represent a selection of potential future dwelling locations at the nearest approved residential development sites, the Devonshire Drive Hamlet and the George Street development. These locations are listed in Table 9 and are also shown in Figure 5, along with an indication of the Devonshire Drive Hamlet lot boundaries. Note that the lot boundaries have been estimated based on LISTMAP parcel boundaries for Lot 93 & Lot 94 Minna Road, Heybridge and are indicative only.

Table 9: Representative assessment receivers – existing and potential dwelling locations

Receiver	Description	Distance to site boundary, m
B1539	Existing dwelling	233
B1540	Existing dwelling	305
B1544	Existing dwelling	302
B1550	Existing dwelling	138
B1551	Existing dwelling	375
B1557	Existing dwelling	186
B6195	Existing dwelling	482
B7585	Existing dwelling	558
B7591	Existing dwelling	645
B7606	Existing dwelling	691
B7610	Existing dwelling	693
B7636	Existing dwelling	618
B7641	Existing dwelling	518
B7647	Existing dwelling	525
B7716	Existing dwelling	526
B7722	Existing dwelling	477
B7734	Existing dwelling	575
B7740	Existing dwelling	581
B7744	Existing dwelling	374
B4853*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	131
B4854*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	123
B4855*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	164
B4856*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	267
B4857*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	154
B4858*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	252
B4859	George Street residential development	436

Figure 4: Existing receivers in the vicinity of the project

Figure 5: Assessment points for existing and potential future receivers

5.2 Baseline characterisation

The baseline noise environment at receivers near the project is relevant to the assessment of both the construction and operational stages of the project. In both cases, the baseline noise environment provides context to the predicted noise levels associated with the project. The baseline noise levels also inform the selection of management levels for the assessment of construction noise and design targets for the assessment of operational noise.

The receivers around the project are located in different environments and the baseline noise conditions vary due to factors such as the presence of localised background sources and proximity to natural and anthropogenic sources in the wider area (e.g. proximity to the coast and arterial roads such as the Bass Highway).

To characterise the baseline noise environment, a survey of background noise levels was conducted at a selection of locations to represent different environments. The scope of the survey was selected to obtain a broad indication of baseline noise conditions for the purposes of this assessment.

Baseline vibration levels at receivers near the project are expected to be very low. The assessment of potential vibration impacts from construction of the project is also solely based on the level of vibration which may be produced by different works (i.e. the criteria are not set at values relative to the background vibration levels). Accordingly, a survey of baseline vibration levels was not warranted and was not undertaken as part of this study.

5.3 Construction noise

5.3.1 Assessment basis

Construction of the project would involve temporary noise generating activities in proximity to existing and approved receivers in the area.

The majority of the works are proposed to occur during daytime hours. Tasmanian environmental noise legislation and guidelines summarised in Section 3.1 do not set mandatory noise level requirements for construction activities which are proposed to occur during the daytime (i.e. outside of the time periods specified as prohibited hours). Instead, the legislation and guidelines promote the use of reasonable and practical measures to reduce environmental noise in all instances.

In lieu of mandatory noise requirements for construction activity during the day, reference has been made to supplementary guidance provided by the NSW ICNG discussed in Section 3.1.3. The NSW ICNG defines noise management levels which can be used to inform the extent of noise controls required for construction activities. During consultations with EPA Tasmania (see Section 5.6), the NSW ICNG noise management levels were discussed and agreed as a suitable basis for assessing construction activity during daytime hours.

While most construction activity is proposed to be restricted to daytime hours, drilling works associated with the shore would occur during the evening and night. Specifically, HDD work associated with the shore crossing is proposed to occur almost continuously for a total period of up to 6 months, and would therefore involve drilling activity 24 hours a day for 7 days a week. MLPL advises that the requirement for continuous drilling is to ensure the stability of the borehole. Under Tasmanian environmental noise legislation, an approved instrument would be required to enable these works to occur at night. Works conducted at night also generally represent the greatest environmental noise risk for construction. The noise management levels of the ICNG for the night period were also discussed with the EPA and agreed as an appropriate basis for the assessment.

Noise management levels based on the NSW ICNG are summarised in Table 10. Some of the noise management levels are set at a margin above the rating background level (RBL) which is a measure of the background noise environment in the absence of the noise being assessed. The RBL is defined in NSW policy documents but is determined using very similar procedures to those which apply under the Tasmanian noise measurement manual. For practical assessment purposes, the two are considered equivalent in this report.

In addition to management levels, the NSW ICNG refers to recommended standard working hours which are broadly equivalent to the permissible working hours defined under Tasmanian legislation, with the main difference being that the NSW ICNG defines more restrictive standard working hours for weekend works (i.e. standard working hours under the NSW ICNG do not include Saturday afternoons or Sundays). A recent Tasmanian approval for a major development included project-specific standard working hours which retained work on Saturday afternoons, consistent with permissible work hours under the EMPC Regulations, but excluded construction work on Sundays, consistent with the NSW ICNG. For consistency, the same modified standard working hours are proposed for the assessment of project construction activities.

In addition to the NSW ICNG noise management levels, and the modified standard working hours, the assessment of noise levels during the night period also refers to the Noise EPP acoustic environment indicator. This indicator is based on guidance from the WHO publication *Guidelines for Community Noise* dated 1999 (1999 WHO Guidelines[4]) which is commonly used to inform an assessment of the risk of sleep disturbance. The EPP acoustic indicator and 1999 WHO guidelines are set at a value of 45 dB at a facade location which includes the noise reflected from the dwelling. This is broadly equivalent to a level of 42 dB measured at a free-field location away from the facade.

It is noted that a more recent publication from the WHO in 2018 provides updated guidance on noise levels at night related to transportation noise. However, the 2018 publication notes that 1999 WHO guidelines remain valid for sources not covered by the publication (noting that construction and noise are not covered by the 2018 publication).

[4] The 1999 WHO Guidelines provides guidance on thresholds for health-related impacts of noise levels including sleep disturbance and community annoyance, expressed in noise metrics that are commonly considered in noise impact assessments (e.g. the equivalent noise level). More recent publications by the WHO in 2009 and 2018 are based on updated research findings, however the recommendations relate to strategic noise parameters (e.g. average night noise levels over a period of one year) and remain complementary to the guidance contained in the 1999 publication.

Table 10: Proposed project-specific standard working hours and noise management levels, dB $L_{Aeq,15min}$

Time of day	Noise management level	Description
Standard working hours: Monday to Friday 0700 to 1800 hrs Saturday 0800 to 1800 hrs No work on Sundays or public holidays	RBL + 10 dB	Above this level, locations are categorised as 'noise affected' and the NSW ICNG guidance notes that all feasible and reasonable work practices to minimise noise should be applied. In addition, all potentially impacted residents should be informed of the nature of the works to be carried out, the expected noise levels and duration, as well as contact details. As the noise management level is based on the RBL, different levels apply to different receivers.
	75 dB	Corresponds to the NSW ICNG definition for 'highly noise affected' locations. Above this level, the NSW ICNG guidance indicates there may be strong community reaction to noise, and additional noise controls are warranted (such as the introduction of respite periods, and consultation with the community around the times of day when the work would be least disruptive and possible changes to the duration of the work).
Outside recommended standard hours	RBL + 5 dB	Corresponds to the NSW ICNG noise management level outside recommended standard hours. The NSW ICNG guidance notes that all feasible and reasonable work practices should be applied to meet the noise management level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should consult with the community.

5.3.2 Assessment process

The level of noise at each receiver as a result of construction of the project would vary significantly throughout the construction period, according to the stage of the construction, the proximity of the activities as the works progress, the types of equipment being used for each activity, and the duration of operation of each equipment item. Predicting construction noise levels therefore necessitates a number of practical assumptions which result in a conservative assessment of construction noise levels.

The following provides a summary of the process for predicting and assessing construction noise levels associated with the project:

- The proposed construction activities and methods were reviewed to identify a subset of activities for assessment purposes which represent the highest noise levels associated with construction.
- Based on data from AS 2436, BS 5228-1, and the contractor for the project, an inventory of representative noise emission data was developed for major noise generating plant items associated with each construction activity to be assessed. In instances where data was not available in the standards, reference was made to historical MDA measurement data for similar types of equipment. This information was then used to develop overall aggregated noise emission values for each construction activity.
- Environmental noise modelling was carried out to predict the highest noise level at each assessment receiver for each construction activity (see section 5.3.3 for further details regarding noise predictions).
- The predicted noise levels were then compared with the NSW ICNG noise management levels and, where appropriate, the reference level for evaluating the risk of sleep disturbance.

The results of the above assessments and comparisons were used to assess the impact of construction noise and the types of mitigation and management measures that are likely to be required for the control of construction noise.

5.3.3 Noise prediction method

The standards AS 2436 and BS 5228-1 that are referenced for equipment noise emission data also define methods for predicting noise levels at receiver locations. However, the methods are relatively simple and are primarily intended for relatively short separating distances. As a result, the methods tend to overestimate noise levels at distant locations. In this respect, AS 2436 cautions against using calculation method for separating distances greater than 100 m, as is the case for the receivers around the project.

Given the above, and the complex terrain profile of the area around the project, a more detailed noise prediction method has been used for the study. Specifically, noise predictions have been calculated using ISO 9613-2:1996 *Attenuation of sound during propagation outdoors – Part 2: General method of calculation* (ISO 9613-2). ISO 9613-2 defines a general-purpose noise prediction method that has become established as the primary international standard for calculating environmental noise from commercial and industrial plant.

ISO 9613-2 predicts noise levels for atmospheric conditions which increase receiver noise levels comprising either:

- a wind directed from the noise source to the receivers; or
- a moderate ground-based thermal inversion (a condition when temperatures increase with height above ground, as may occur on clear and still nights).

The calculations were made using the octave band calculation method of ISO 9613-2 using proprietary noise modelling software SoundPLANnoise version 9.0. The adjustments are applied within the noise modelling software and relate to the influence of terrain screening and ground effects on sound propagation.

Conservative assumptions were adopted in applying ISO 9613-2 to predict noise levels from construction of the project. The following key aspects are noted:

- All equipment associated with each construction activity is assumed to operate continuously, simultaneously and at maximum operating duty. This is conservative as the intensity of equipment use would vary, and in many cases, equipment would not operate simultaneously or continuously.
- Atmospheric conditions are set at a temperature of 10 °C and a relative humidity of 70%. These values are commonly adopted across Australia to represent conditions which result in low levels of atmospheric absorption of sound, in turn leading to slightly higher predicted noise levels.

The following additional details of the modelling are noted:

- Ground conditions in the surrounding area were assigned a ground factor of G = 0.5

  The adopted value of G = 0.5 assumes that 50% of the ground cover is acoustically hard (G = 0) to account for potential variations in ground porosity. This is a conservative assessment choice since the ground conditions strictly correspond to porous conditions according to ISO 9613-2 (G = 1.0), which tend to result in lower predicted noise levels.
- Ground profiles around the site were accounted for using a 3D digital terrain model

  The data for this model was sourced from the Land Information System Tasmania (LIST) and comprises ground elevation contours at 1 m height intervals.
- Receiver calculation height of 1.5 m

  This corresponds to the normal measurement height for compliance measurements at receivers.

The modelling is used to predict the total A-weighted noise levels associated with the project.

5.4 Operational noise

5.4.1 Assessment basis

The Tasmanian EIS guidelines specify that consideration should be given to the requirements of the Noise EPP.

The Noise EPP notes that specific requirements relating to noise levels and hours of operation are principally covered by the EMPC Noise Regulations and permits issued for particular activities. The Noise EPP also identifies that a range of factors need to be considered when setting appropriate noise controls, including both the protection of amenity and the wider economic and social benefits of new development.

If the project is approved, permit requirements defining allowable noise levels are envisaged. The specific noise requirements that would apply to the project would be determined by the approval authority. For the purpose of this assessment, predicted noise levels are compared to:

- the acoustic environment indicator levels defined by the Noise EPP;
- the fixed plant noise limits detailed in the EMPC Noise Regulations; and
- design targets sourced from guidance contained in the Victorian Noise Protocol, corresponding to the base noise limits for noise sources located in major urban areas.

Table 11: Assessment basis – reference levels

Reference	Periods	Reference levels
Noise EPP acoustic environment indicator levels	• Day (0700 – 2200 hrs):	55 dB $L_{Aeq,16h}$
	• Night (2200 – 0700 hrs):	45 dB $L_{Aeq,8h}$
EMPC Noise Regulations fixed plant limits	• Day (0700 – 2200 hrs):	42 dB L_{Aeq} [1]
	• Night (2200 – 0700 hrs):	37 dB L_{Aeq} [1]
Victorian Noise Protocol design targets	• Day[2]:	45 dB $L_{Aeq,30\text{-}min}$
	• Evening[3]:	40 dB $L_{Aeq,30\text{-}min}$
	• Night[4]:	35 dB $L_{Aeq,30\text{-}min}$

Note 1: Free-field values equivalent to the facades value specified in the EMPC Noise Regulations

Note 2: Monday to Saturday 0700 – 1800 hrs

Note 3: Monday to Saturday 1800 – 2200 hrs, and 0700 – 2200 hrs on Sundays and public holidays

Note 4: Monday to Sunday 2200 – 0700 hrs

The documents and reference levels listed above are used to provide context to the predicted noise levels and address the Tasmanian EIS guidelines' requirement to consider the Noise EPP. However, the design targets sourced from the Victorian Noise Protocol (the design targets) are proposed as the criteria that typical operations (normal full-power operation of the site during elevated temperatures, excluding emergency standby generators and overload conditions) would ultimately be designed and assessed against. These design targets were selected for the following reasons:

- The design targets were referenced in the concept design assessment and during the initial consultations with EPA Tasmania (see stakeholder engagement details in Section 5.6).
- The low background noise levels measured in the area (see baseline characterisation in Section 6.0) support the use of criteria that are lower than the acoustic environment indicator levels of the Noise EPP to reduce the risk of disturbance as a result of clearly audible noise.

- The project is proposed to operate up to 24 hours per day, 7 days per week, and the operational characteristics of the project are similar during the day, evening and night (i.e. same equipment operating at varying loads according to the requirements of the electricity network and ambient temperatures). This means that the criteria for the evening and night periods will determine the noise control requirements for the project. In this respect, the design targets provide the most stringent criteria for the evening and night period.
- The design targets are suitable for the protection of both external and internal amenity at residential locations, and the avoidance of sleep disturbance during the night. In particular, the design target of 35 dB L_{Aeq} is significantly lower than the 42 dB sleep disturbance criterion reflected in both the Noise EPP and the 1999 WHO Guidelines.
- The design targets for the evening and night are within 5 dB of the background noise levels determined in accordance with the Tasmanian noise measurement manual (an assessment approach commonly used in Australia to assess the risk of the noise being considered intrusive in background noise environments above 30-35 dB L_{A90}).

Community attitudes to environmental noise are highly subjective and vary between individuals and local circumstances. However, the design targets represent stringent requirements which are consistent with the lowest criteria typically applied to major infrastructure projects in Australia. Complying with the design targets, accounting for both the level and character of the noise, will provide a high level of amenity protection for neighbouring residents. Based on the above, the design targets are considered to represent reasonable and practicable levels for minimising the risk of community annoyance from normal operation of the converter station.

In lieu of Tasmanian guidance that is specific to emergency standby plant (for use in emergencies or periodic testing), the following guidance from the Victorian Noise Protocol has also been referenced:

> *Where the noise source under consideration is equipment used solely in relation to emergencies, the relevant noise limit applying to the testing or maintenance of such equipment … is increased by 10 dB for a day period and by 5 dB for all other periods.*

The Victorian Noise Protocol notes the following in relation to emergency equipment and standby generators:

> *… a standby generator means a generator for electrical power used as an alternative to the mains supply in emergencies, or for a maximum period of 4 hours per month for maintenance purposes*

The standby generators associated with the project are solely for emergency purposes, and are proposed to be tested one (1) hour every three (3) months during the daytime on weekdays. These operations are consistent with the emergency equipment provisions of the Victorian Noise Protocol. Accordingly, for consistency with the design targets used for normal operation, the Victorian Noise Protocol provisions for emergency plant are referenced for the emergency standby generators. The proposed requirements for periods of emergency standby generator plant testing are summarised in Table 12.

Table 12: Emergency standby generator plant testing periods

Test scheduling	Assessment criterion
Daytime on weekdays / one (1) hour every three (3) months	55 dB $L_{Aeq,30\text{-}min}$

5.4.2 Assessment process

The converter station is the primary operational noise consideration for the project.

Operational noise levels associated with the converter station were assessed by:

- collating representative noise emission data provided by MLPL for the converter station plant, based on manufacturer data provided for comparable projects;
- reviewing the noise emission data and noise control strategy;
- preparing a 3D digital model of the site using SoundPLAN proprietary noise modelling software;
- predicting environmental noise levels using international standards for the calculation of environmental sound propagation; and
- comparing the predicted noise levels with a range of reference levels, including guidance levels from the Tasmanian legislation presented in Section 3.1, and design targets discussed with EPA Tasmania as part of consultations conducted during the assessment process.

5.4.3 Noise prediction method

The octave band calculation method of ISO 9613-2 has been used to predict noise levels, as used for the construction noise modelling. Consistent with the calculations for construction noise, the method calculates predicted noise levels for atmospheric conditions which increase receiver noise levels.

The operational noise assessment is based on noise modelling for normal full-power operating conditions of stage one and stage two of the project. Specifically, the noise modelling accounts for:

- ambient temperatures of up to 40 °C during the day (0700 to 2200 hrs) and 35 °C during the night (2200 to 0700 hrs), when cooling demands would be high. In practice, ambient temperatures would regularly be lower, particularly at night, and cooling demands would be lower and equate to lower noise emissions; and
- brief periods of increased noise associated with routine testing (once every three months) and emergency use of the standby generator system.

Noise levels during atypical operating conditions, such as atypically high ambient temperatures or a network failure, are addressed qualitatively in the assessment.

5.5 Impact assessment

5.5.1 Risk assessment

A risk-based assessment is used to evaluate noise and vibration impacts associated with construction and operation of the project. Given that noise and vibration is an inevitable consequence of the construction and operation of a major infrastructure project, it is the risk of community disturbance as a result of noise which is assessed in this study. Risks are assessed by accounting for both their consequence (having regard to the noise level, character and duration) and likelihood. The objective of the risk assessment is to determine the appropriate risk controls.

There are multiple factors which influence both the consequence and likelihood of noise and vibration related risks. These include:

- the type of noise or vibration source being assessed and its characteristics (e.g. a continuous or varying noise source and its frequency characteristics);
- the nature of the noise or vibration source (e.g. an activity that can be readily modified or relocated versus an essential activity with limited opportunity to modify, relocate or reschedule);
- the environment in which the noise or vibration is produced (e.g. the context and the background level of noise or vibration);
- the time, duration and regularity of the noise or vibration;
- environmental factors which may change the background noise environment and/or the noise level of the source in question (e.g. wind conditions);
- the type and number of receivers potentially affected by the noise or vibration;
- the type of assessment being used to evaluate the risks (e.g. prediction or measurement-based assessments), and the level of information available for the assessment;
- the assessment framework which applies to each noise and vibration source, and whether acceptable levels of noise and vibration are clearly defined (e.g. legislation which defines prescriptive compliance requirements in quantitative terms or management-based guidance); and
- the options available to mitigate or manage the noise or vibration source.

Alternative methods are available for conducting a combined assessment of risk consequence and likelihood, such as AS ISO 3100:2018 *Risk management – Guidelines*. An adapted version of the risk consequence and likelihood guidance of AS ISO 3100:2018 has been generally adopted for the project EIS. The risk consequence and likelihood descriptors of the adapted version of AS ISO 3100:2018 are relevant to noise and vibration, however their definitions are based on prescriptive comparisons or events which are practically challenging to apply to noise and vibration. Key complicating factors are the varied and subjective reactions of individuals to sound and the challenge of distilling varied noise levels over large study areas into singular outcomes; particularly for effects related to the unavoidable noise of construction which is assessed and managed on the basis of a balance between amenity impacts and the benefits of new development.

In light of these factors, reference was made to EPA Victoria Publication 1695.1 *Assessing and controlling risk: A guide for business* (EPA Victoria Publication 1695.1). for guidance on definitions that could be practically applied to the assessment of noise and vibration. EPA Victoria Publication 1695.1 provides an example framework as depicted in Figure 6 and Figure 7 which includes the same number and range of descriptors for risk consequence and likelihood, but are defined more broadly in terms related to harm and health; considerations which are relevant to the assessment of noise and vibration under Victorian legislation.

Given the above, and in the interest of maintaining a consistent risk assessment framework for the noise and vibration studies of Marinus Link more broadly[5], the consequence and likelihood definitions of *EPA Publication 1695.1* have been adopted for the noise and vibration study of the project. Further, for consistency with *EPA Publication 1695.1*, the corresponding risk rating matrix has also been adopted for the noise and vibration assessment.

	Consequence					
Permanent or long-term serious environmental harm / life threatening or long-term harm to health and wellbeing.	Severe	Medium	High	High	Extreme	Extreme
Serious environment harm / high-level harm to health and wellbeing.	Major	Medium	Medium	High	High	Extreme
Medium level of harm to health and wellbeing or the environment over an extended period of time.	Moderate	Low	Medium	Medium	High	High
Low environmental impact / low potential for health and wellbeing impacts.	Minor	Low	Low	Medium	Medium	High
No or minimal environmental impact, or no health and wellbeing impacts.	Low	Low	Low	Low	Medium	Medium
		Rare	Unlikely	Possible	Likely	Certain
		Likelihood				
		Could happen but probably never will	Not likely to happen in normal circumst-ances	May happen at some time	Expected to happen at some time	Expected to happen regularly under normal circumst-ances

Figure 6: Example risk matrix reproduced from EPA Publication 1695.1

Risk level	Description
Extreme	Totally unacceptable level of risk. Stop work and/or take action immediately.
High	Unacceptable level of risk. Controls must be put in place to reduce to lower levels.
Medium	Can be acceptable if controls are in place. Attempt to reduce to *low*.
Low	Acceptable level or risk. Attempt to eliminate risk but higher risk levels take priority.

Figure 7: Description of risk ratings reproduced from EPA Publication 1695.1

[5] EPA Victoria Publication 1695.1 was adopted for the noise and vibration assessment of the Victorian terrestrial components of the project

Quantitative assessments of noise and vibration, such as measurement and prediction-based studies, inform the assessment of both consequence and likelihood. For example, where there are clearly defined noise limits, low and minor consequence ratings are generally assigned to a compliant noise level. A moderate or higher consequence is generally only applicable to a non-compliant noise level, although a moderate rating may be applicable if there are multiple contributing factors which individually increase the consequence.

Defining quantitative thresholds to further separate consequence levels according to the wide range of factors outlined earlier is complex and subject to considerable uncertainty. Given these uncertainties, defining quantitative boundaries between each consequence level would involve the assignment of arbitrary thresholds which could be misleading and imply a greater level of assessment accuracy than is afforded by the current state of knowledge.

To enable consequence levels to be practically assigned, it is therefore necessary for an element of the consequence ratings to be informed by qualitative assessment, accounting for the range of relevant factors.

A similar level of qualitative assessment is also required to determine the likelihood of the risk, accounting for the range of relevant factors.

5.5.2 Cumulative impact assessment

The EIS guidelines and EES scoping requirements both include requirements for the assessment of cumulative impacts. Cumulative impacts result from incremental impacts caused by multiple projects occurring at similar times and within proximity to each other.

To identify possible projects that could result in cumulative impacts, the International Finance Corporation (IFC) guidelines on cumulative impacts have been adopted. The IFC guidelines (IFC, 2013) define cumulative impacts as those that ‘result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones.’

The approach for identifying projects for assessment of cumulative impacts considers:

- Temporal boundary: the timing of the relative construction, operation and decommissioning of other existing developments and/or approved developments that coincides (partially or entirely) with the project.
- Spatial boundary: the location, scale and nature of the other approved or committed projects expected to occur in the same area of influence as the project. The area of influence is defined at the spatial extent of the impacts a project is expected to have.

Proposed and reasonably foreseeable projects were identified based on their potential to credibly contribute to cumulative impacts due to their temporal and spatial boundaries. Projects were identified based on publicly available information at the time of assessment. The projects considered for cumulative impact assessment in Tasmania are:

- Remaining North West Transmission Developments
- Guilford Windfarm
- Robbins Island Renewable Energy Park
- Jim’s Plain Renewable Energy Park
- Robbins Island Road to Hampshire Transmission Line
- Bass Highway upgrades between Deloraine and Devonport
- Bass Highway upgrades between Cooee and Wynard

- Hellyer Windfarm
- Table Cape Luxury Resort
- Youngmans Road Quarry
- Port Latta Windfarm
- Port of Burnie Shiploader Upgrade
- Quaylink – Devonport East Redevelopment.

The projects relevant to this assessment have been determined based on the potential for cumulative noise and vibration impacts. Out of the projects identified above, only the Remaining North West Transmission Developments project is relevant to this assessment, due to the interface with the Heybridge converter station site. All other projects have not been considered in the cumulative impact assessment as they have no noise or vibration interface with the project.

Further information on each of the projects is included in Section 7.3.

5.6 Stakeholder engagement

Table 13: Stakeholder engagement summary

Stakeholder	Engagement activity and timing	Discussion topics	Outcomes
EPA	Teleconference with EPA representatives on 17 January 2023	Project site and receivers, background noise levels, design constraints, converter station operational noise control strategy, and preliminary operational noise assessment findings.	The noise and vibration report for the converter station is to present: • baseline noise data in terms of the rating specified in the Tasmanian noise measurement manual; • a description of the noise control strategy; • a list of the number of sources contained in the model; and • an assessment of low frequency noise levels based on C-weighted predictions. A design target of 35 dB L_{Aeq} for the operation of the converter station at night was agreed subject to: • further review of the assessment presented in the noise and vibration report; • an updated assessment being conducted during the design phase of the project when the site layout is finalised and equipment selections have been made, accounting for any applicable adjustments for noise character; and • a post-construction noise assessment based on compliance monitoring conducted in accordance with the Tasmanian noise measurement manual, accounting for any applicable adjustments for noise character. Design targets for standby generator plant testing were discussed on the basis of preliminary details about the timing of tests. Revised test timing limited to once every 3 months was discussed and is confirmed in this report.
EPA	Teleconference with EPA representatives on 5 August 2024	Construction noise management levels	Use of management levels for construction activity in accordance with NSW ICNG

5.7 Assumptions and limitations

The assessment is based on the following assumptions:

- construction plant noise emissions: the make and model of equipment used to construct the project is unknown at this stage. Empirical noise emission data from standards and previous measurements are therefore assumed to represent the types of construction plant that are expected to be required. To provide a conservative assessment which is likely to overestimate construction noise levels, representative noise emission data was selected from the mid to upper range of the available empirical data.
- construction noise modelling: all plant associated with each of the construction activities are assumed to be operating simultaneously and producing their highest noise emissions for 100% of an assessment time period. In particular, HDD shore crossing works are assumed to involve two HDD rigs operating simultaneously and continuously for a period of up to 6 months. In practice, the noise emissions of individual plant items are likely to vary during an assessment time period (i.e. produce noise emissions lower than the assumed values) and some plant items would only operate for a portion of the time. The assessment assumption is therefore conservative and lead to higher predicted noise levels than is likely to occur in practice.
- converter station plant noise emissions: the equipment selections for the project would be the subject of a commercial tender process during the detailed design phase of the project. Representative noise emission data (sound power levels) provided by MLPL, based on manufacturer data provided for similar projects, has therefore been assumed for this assessment. The assumed data generally represents low noise emission equipment that has been selected to address site-specific noise constraints associated with the Heybridge converter station. The assumed emission data is expected to involve the use of proprietary noise attenuation systems and plant enclosures. The actual noise emissions of candidate plant items would need to be verified as part of the commercial tender process, and equipment selected to achieve assessment outcomes that are consistent with the findings of this study.

6.0 EXISTING CONDITIONS

A survey of existing noise levels was conducted at the following locations:

- on the site of the proposed converter station; and
- at the site of one of the proposed hamlets within the residential nature reserve to the west.

A more detailed description of each location is provided in Table 14. Each location is indicated on the aerial photo in Figure 8 below along with the location of nearest receivers considered in the assessment.

Table 14: Noise monitoring locations – description

Area	Nearest tower location and description
Site 1	Proposed converter station Disused commercial/industrial site amid a mixed-use suburban area affected by noise from local and main roads.
Site 2	Residential nature reserve Natural environment on the fringe of suburban areas, subject to a mix of noise influences from local natural sources and distant road traffic. The site is elevated and relatively exposed, and wind disturbed vegetation is also a feature of the ambient noise environment.

At each location, an unattended monitor was used to continuously sample noise levels during the day, evening and night periods. Measurements were conducted over a period of 1-2 weeks between Friday, 6 May and Wednesday, 25 May 2022.

Wind and rainfall were assessed based on a combination of publicly available data from the Bureau of Meteorology monitoring station at Burnie and local weather stations deployed as part of a simultaneous study for the Remaining NWTD project.

The measured background noise levels for each location were analysed in accordance with the *Tasmanian Noise Measurements Procedures Manual, Second Edition* dated 2008 (the *Tasmanian noise measurement manual*). This involved collating noise and weather measurement data for each 10-minute period of the survey and producing an aggregated single figure value to represent the day, evening and night background noise level for each location. Any 10-minute period in which rain fall was recorded, or the average wind speed was equal to or greater than 5 m/s, was removed from the analysis. The datasets were also reviewed to identify any potential systematic or anomalous trends which may relate to unrepresentative/extraneous noise influences; no clearly identifiable trends of this nature were evident in the measurements.

The derived background noise levels for the day, evening and night periods, as defined by the Tasmanian noise measurement manual, are summarised in Table 15.

Table 15: Measured background noise levels, dB L_{A90} per period

Location	Day (0700 – 1800 hrs)	Evening (0700 – 2200 hrs)	Night (2200 – 0700 hrs)
Site 1	42	36	32
Site 2	38	35	32

Full survey details, including images of the monitoring locations, daily survey results and graphical results are presented in Appendix C.

The background noise levels summarised in Table 15 are generally low. While the background noise levels represent the underlying, or quiet periods, at each location, the total ambient noise levels (average/equivalent noise levels) during the day at both locations were in the range of 40-50 dB $L_{Aeq,10min}$, except on days when noise is likely to have been elevated by high winds and rain. Existing noise levels are therefore below the Noise EPP indicator noise levels (see Section 3.1.2).

These results are consistent with expectations for the areas and are likely to be representative of the range of background noise levels at most receivers near the project. However, in recognition of the extent of adverse weather conditions during the survey, and to enable a more detailed account of background noise levels around the project, the management and mitigation measures discussed subsequently in Section 7.5 include a recommendation for further background noise monitoring before the commencement of construction activities which may result in environmental noise in the surrounding areas, such as vegetation clearance and civil works.

Figure 8: Background noise survey locations

7.0 IMPACT ASSESSMENT

This section presents assessment of:

- noise and vibration levels associated with construction of the project;
- noise levels associated with operation of the project (environmental vibration is not a relevant consideration for the operational stage of the project);
- recommended management and mitigation measures for controlling noise and vibration risks; and
- a summary of the environmental noise and vibration risk assessment.

7.1 Construction noise and vibration

This section presents the noise emission data which has been used to predict noise levels from key construction activities, followed by an assessment of construction noise and vibration.

The construction noise assessment considers the following activities:

- converter station earthworks and infrastructure construction;
- shore crossing construction; and
- off-site transportation.

These activities selected for assessment provide a representation of the range of upper noise levels of construction, and are suitable for informing the overall assessment of risk and defining recommended management and mitigation measures.

7.1.1 Noise emission data

Noise emission data for the proposed construction equipment associated with the HDD shore crossing has been provided by the contractor. Spectral data was not provided and was therefore estimated based on similar equipment from BS 5228-1.

Representative noise emission data for the proposed construction equipment associated with the converter station earthworks and infrastructure construction have been determined based on AS 2436 and BS 5228-1 as well as measured equipment noise levels sourced from historic MDA measurements.

Table 16 summarises the noise emissions (sound power levels) for the main noise generating plant items associated with construction of the project.

Table 16: Construction noise sources sound power data, dB L_{WA}

Noise source	Sound power level
Shore crossing construction	
Drill rig crawler	98
Drill rig powerpack*	108
Excavator 36T	104
High pressure mud pump	98
Isuzu D-Max light vehicles (4WD)	106
Isuzu NPS crew bus	106
Mud mixing System	104
Mud separation system	100

Noise source	Sound power level
Telehandler	104
Tensioner PowerPack	90
Water winning pump*	93
60KvA generator*	100
100KvA generator*	103
250KvA generator*	103
500KvA generator*	106
Converter station earthworks	
Concrete agitator	109
Concrete saw	117
Dozer	108
Dump truck	117
Excavator	107
Light vehicles	100
Roller	108
Tipper	107
Wheeled loader	113
Converter station infrastructure	
Hand tools	116
Light vehicles	100
Mobile crane	113
Non-slewing crane	104

* fitted with an acoustic enclosure

Overall aggregated total sound power levels for key construction activities have been determined based on the indicative equipment schedule presented in Table 17. Actual equipment choices and quantities for each task would vary as the design and construction method for the project is refined. Importantly, many items of equipment would only operate part of the time while the activity is taking place. The equipment quantities and choices therefore provide a conservative representation of the activity for risk assessment purposes.

The overall total aggregated sound power levels for each of the main construction activities are detailed in Table 17. The assessment assumes that each item of plant associated with a task operates simultaneously at the same point; this is appropriate for construction activity occurring at distance from the receivers, but will overestimate the noise of activity occurring close to the receivers (i.e. at reduced working distances where it is not physically possible for all of the equipment to be simultaneously working at the reduced distance).

Table 17: Overall sound power levels of main construction activities, dB L_{WA}

Construction activity	Plant/equipment	Approximate overall sound power level
Shore crossing	1x Drill Rig Crawler, 1x Drill Rig Powerpack, 1x Isuzu NPS crew bus, 4x Isuzu D-Max LVs (4WD), 1x Mud mixing system, 1x mud separation system, 1x telehandler, 1x water winning pump, 2x excavator, 1x 60KvA generator, 1x 100KvA generator, 1x 250KvA generator, 1x 500KvA generator, 1x high pressure mud pump, 1x tensioner power pack	117
Earthworks and civil works	2x excavator, 1x dozer, 1x wheeled loader, 2x dump truck, 1x roller, 2x tipper, 5x light vehicles, 1x concrete agitator, 1x concrete saw	120
Infrastructure works	5x light vehicles, 1x mobile crane, 4x hand tools, 3x non-slewing crane	125

7.1.2 Noise management levels

The noise management levels used to assess the predicted construction noise levels have been determined based on the method and standard working hours discussed in Section 5.3.1 and the background noise levels presented in Section 6.0.

As discussed in Section 5.3.1, the noise management levels referred to in the NSW ICNG are based on a measure of the background noise environment referred to as the rating background level, as defined in NSW policy documents. However, the RBL is determined using very similar procedures to those which apply under the Tasmanian noise measurement manual. For practical assessment purposes, the two are considered equivalent in this report and, for this reason, have been adopted as the basis for determining the noise management levels.

Section 6.0 also notes that, while the background noise levels are likely to be representative of the range of background noise levels at most receivers near the project, further background noise monitoring is recommended prior to the commencement of construction. This recommendation is reflected in the management and mitigation measures discussed subsequently in Section 7.5.

Accordingly, the noise management levels are indicative for assessment purposes, and would be subject to refinement based on updated background noise measurement data. For this reason, and in recognition of the night-time being the critical period for the assessment of construction outside standard working hours, the noise management levels are defined for the proposed standard working hours and the night-time only. Updated background noise data obtained in the future may be used to separately define noise management levels for the evening and Sundays.

Based on the above, the key noise management levels for the assessment are presented in Table 18. Note that the noise management levels based on the site 1 data are primarily relevant to existing receivers to the south, southeast and east of the project, whereas the noise management levels based on the site 2 data are primarily relevant to potential future receivers to the west.

Table 18: Noise management levels (indicative), dB $L_{Aeq,15min}$

Period	Noise management level		Brief description
	Site 1	Site 2	
Standard working hours	52	48	Above this noise management level, locations are categorised as noise affected. All feasible and reasonable work practices to minimise noise should be applied. In addition, all potentially impacted residents should be informed of the nature of the works to be carried out, the expected noise levels and duration, as well as contact details.
	75	75	Above this noise management level, locations are categorised as highly noise affected. Above this level, there may be strong community reaction to noise, and additional noise controls are warranted (such as the introduction of respite periods, and consultation with the community around the times of day when the work would be least disruptive and possible changes to the duration of the work).
Night	37	37	All feasible and reasonable work practices should be applied to meet the noise management level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent should consult with the community.

7.1.3 Predicted noise levels

The predicted noise levels for each receiver and assessed construction activity are presented in Table 19. The predicted noise levels are based on the combined simultaneous operation of all listed plant associated with the activity (as detailed in Table 17 Section 7.1.1).

For the shore crossing, only one rig would be working at a time. Hence, the predicted noise levels are shown separately for construction of the eastern and western shore crossings.

The results for construction activity are also presented as predicted noise contours in Figure 9, Figure 10, Figure 11 and Figure 12. These figures also show the location of the area sources used in the modelling to represent each activity.

The predicted noise levels do not include adjustments for noise characteristics such as tonality, impulsiveness or low frequency. These types of characteristics are a relevant risk factor for construction noise and may be applicable in some instances. Conversely, the predicted noise levels are based on very conservative scenarios involving simultaneous noise generation from all plant and activities for the entire duration of an assessment window. Applying penalties to these predictions is therefore likely to result in an unrealistic level of conservatism in many cases. However, character related adjustments are a relevant risk to consider and are discussed further in the subsequent assessment sections.

Table 19: Existing receivers – predicted construction noise levels, dB L_{Aeq}

Receiver	Direction	Type	Shore crossing HDD western rig	Shore crossing HDD eastern rig	Earthworks and civil	Infrastructure
B1539	Southeast	Existing dwelling	35	32	45	50
B1540	Southeast	Existing dwelling	41	30	43	48
B1544	Southeast	Existing dwelling	41	31	44	49
B1550	South	Existing dwelling	39	35	42	48
B1551	South	Existing dwelling	41	37	45	50
B1557	South	Existing dwelling	34	41	41	47
B6195	Southeast	Existing dwelling	39	32	44	49
B7585	Southeast	Existing dwelling	38	29	43	48
B7591	Southeast	Existing dwelling	37	28	41	46
B7606	Southeast	Existing dwelling	37	32	40	45
B7610	Southeast	Existing dwelling	37	36	39	44
B7636	East	Existing dwelling	37	33	33	38
B7641	East	Existing dwelling	39	36	38	43
B7647	East	Existing dwelling	41	41	39	44
B7716	Southeast	Existing dwelling	38	29	43	48
B7722	Southeast	Existing dwelling	35	29	42	47
B7734	Southeast	Existing dwelling	38	34	38	43
B7740	East	Existing dwelling	38	38	37	42
B7744	Southeast	Existing dwelling	40	33	45	50
Range – existing receivers			**34 - 41**	**28 - 41**	**33 - 45**	**38 - 50**

Table 20: Potential future receivers – predicted construction noise levels, dB L_{Aeq}

Receiver	Direction	Type	Shore crossing HDD western rig	Shore crossing HDD eastern rig	Earthworks and civil	Infrastructure
B4853*	West	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet (southeast corner)	60	54	58	64
B4854*	West	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet (southeast corner)	49	54	56	61
B4855*	West	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet (south end)	41	54	53	59
B4856*	West	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet (southwest corner)	39	49	46	51
B4857*	West	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet (centre)	42	43	37	43
B4858*	West	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet (north end)	34	37	38	43
B4859	West	George Street residential development (east boundary)	29	32	30	35
Range – potential future receivers			**29 - 60**	**32 - 54**	**30 - 58**	**35 - 64**

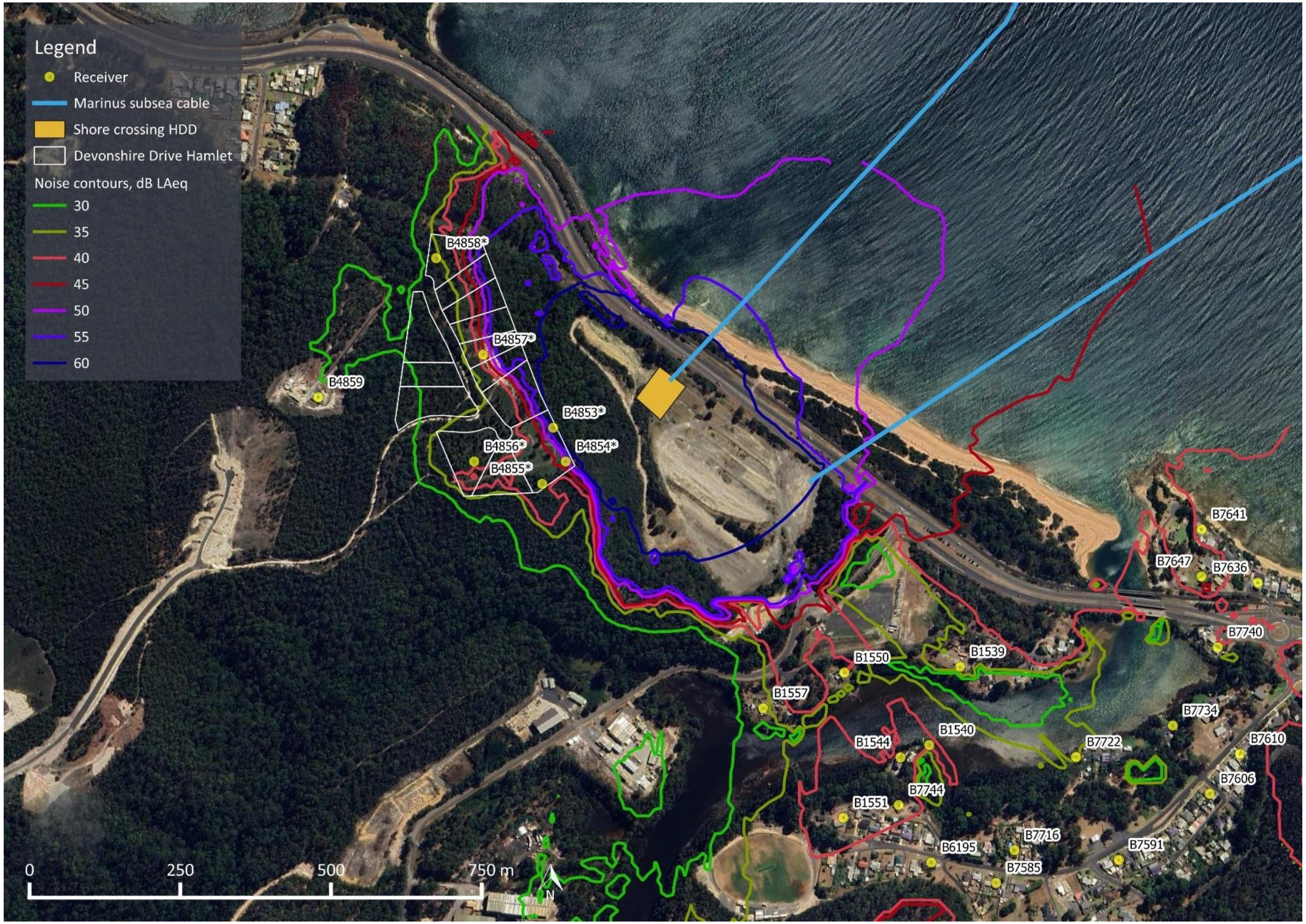


Figure 9: Heybridge converter station site – predicted noise contours for shore crossing HDD western rig, dB L_{Aeq}

Figure 10: Heybridge converter station site – predicted noise contours for shore crossing HDD eastern rig, dB L_{Aeq}

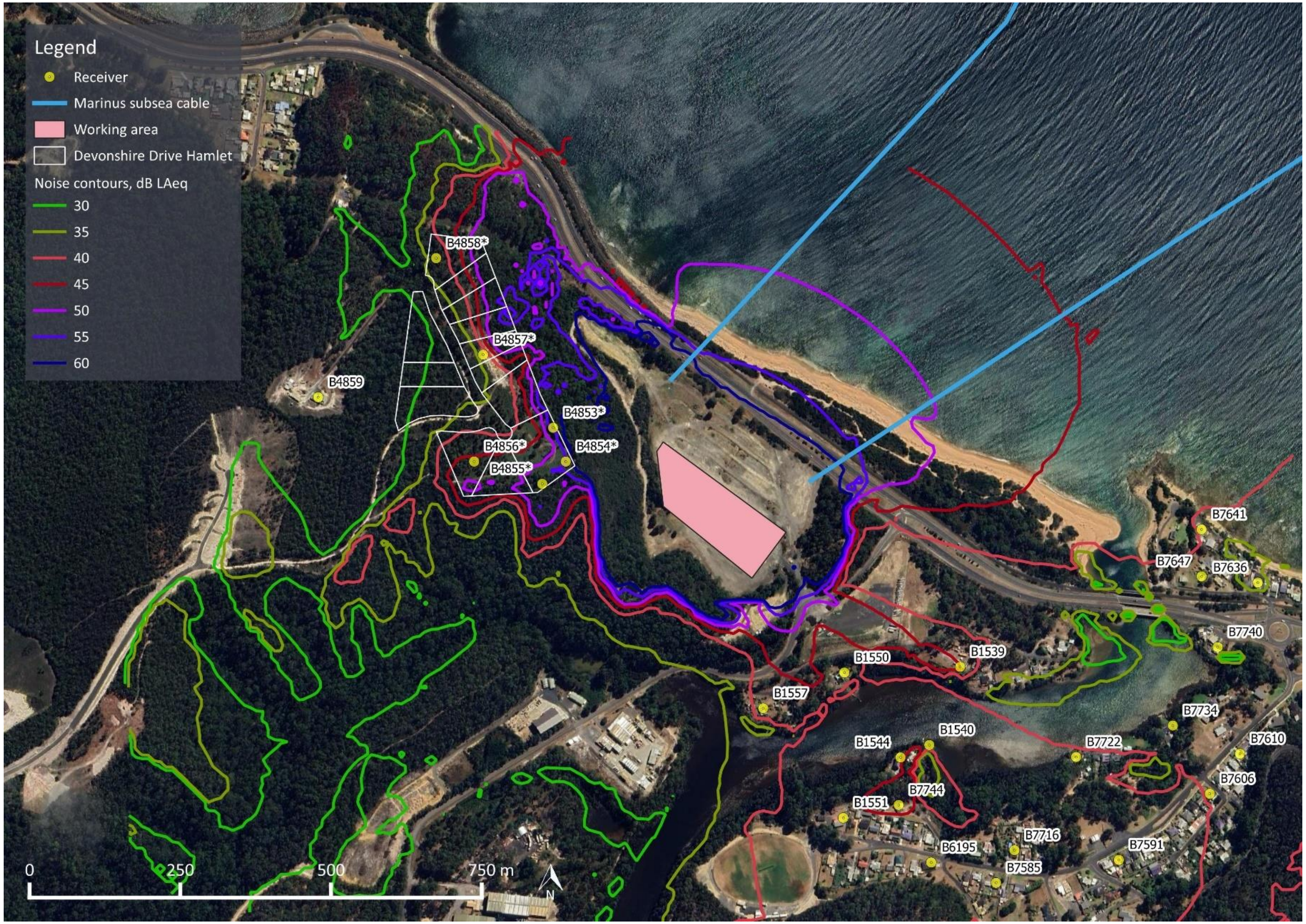


Figure 11: Heybridge converter station site – predicted noise contours for earthworks and civil works, dB L_{Aeq}

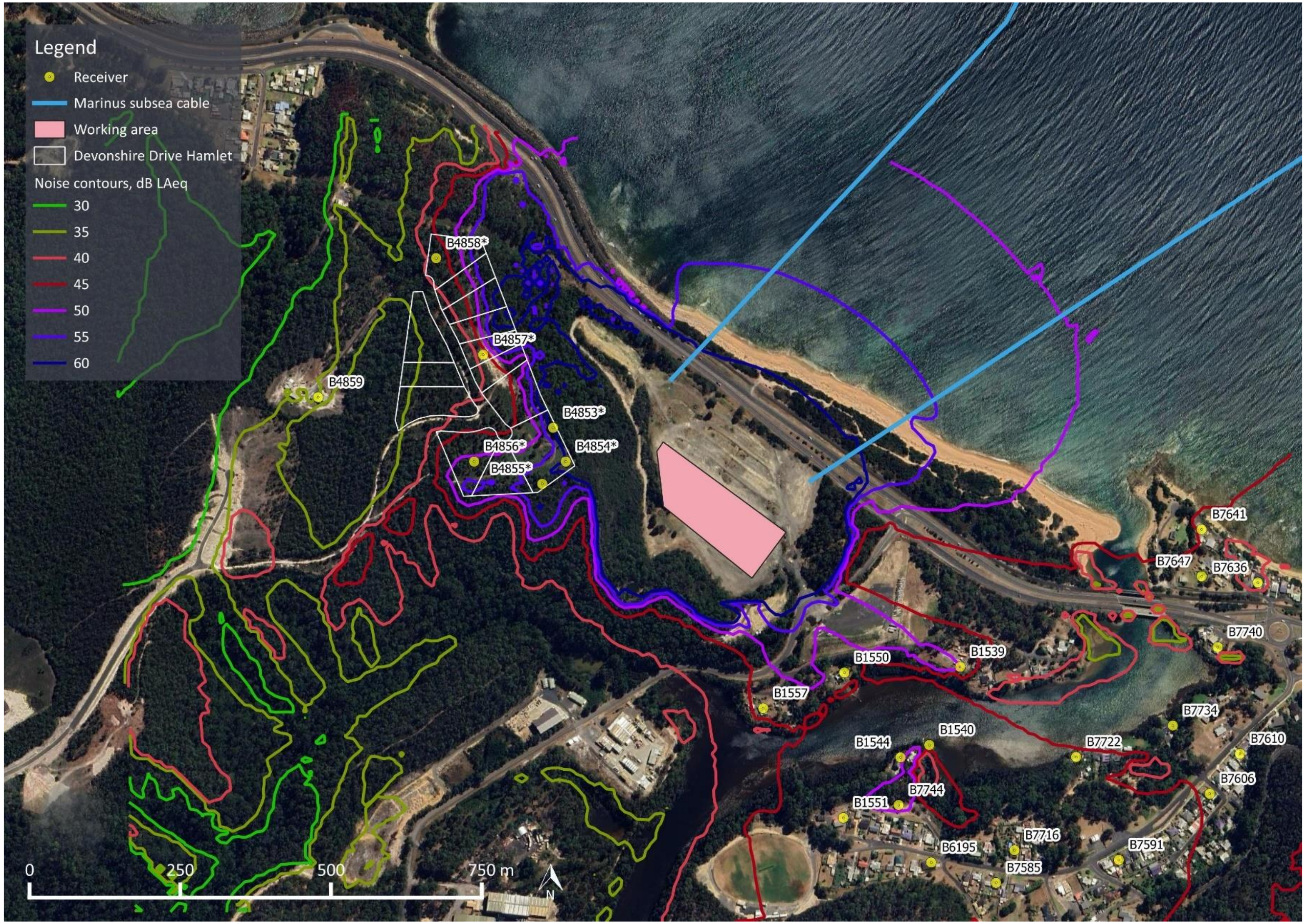


Figure 12: Heybridge converter station site – predicted noise contours for infrastructure works, dB L_{Aeq}

7.1.4 Assessment – works during the standard working hours

This section presents an assessment of the predicted noise levels presented in Section 7.1.3 against the relevant noise management levels for standard working hours.

In relation to existing receivers, the predicted noise levels for all of the assessed activities are below the relevant noise management level of 52 dB L_{Aeq}. Further, for most activities and receivers, the predictions are below the noise management level by a margin of at least 5 dB such that the application of an adjustment for noise character would not alter the assessment finding.

At the nearest existing receivers to the south and southeast, the predicted noise levels are within 5 dB of the noise management level for infrastructure works. Infrastructure works are among the activities which could attract adjustments for noise character, such as impulsive noise from metal impacts/contact and tonal noise from grinding and saws. While the prediction is inherently conservative, particularly for infrastructure works (activity is likely to be more sporadic than the continuous/simultaneous activity assumed in the modelling), there is a risk of noise levels above the noise management levels for these locations.

In relation to potential future receivers within the approved developments to the west, the predicted noise levels at the nearest locations of the Devonshire Drive Hamlet are above the relevant noise management level of 48 dB L_{Aeq} for all activities. The highest predicted noise levels for the various activities range from 54 to 64 dB L_{Aeq}, and the elevated noise levels increase the risk of character adjustments being applicable. In all cases though, the predicted noise levels are below the highly affected noise management level of 75 dB L_{Aeq}, including consideration of the risk of character related adjustments. Construction noise levels are predicted to be highest at the south and southeast section of the Devonshire Drive Hamlet. The site is presently undeveloped, and the risk of construction noise impacts to future dwellings depends on the timing of construction of these dwellings (i.e. whether the hamlet would be occupied at the time when constructions works are occurring). In relation to the George Street Development where construction work has commenced, the predicted construction noise levels are well below the noise management level, irrespective of any considerations relating to noise character (which are less likely for this location given the low predicted noise levels).

The predictions in Section 7.1.3 are listed separately for the three activities assessed, with the shore crossing activity further divided into the eastern and western rig. However, if HDD works associated with the shore crossing occur at the same time as the noisiest phases of the civil works or infrastructure works, the cumulative construction noise levels associated with the project could be higher than indicated. Specifically, cumulative construction noise levels during noisier phases of construction may be approximately 1-3 dB higher than indicated for civil works, infrastructure works or shore crossing if the works occur at the same. However, the existing locations with the potential for the greatest cumulative increases are the locations with lower predicted noise levels. Specifically, at all locations where the predicted cumulative noise increase is more than 1 dB, the highest predicted noise levels of each construction activity are at least 5 dB lower than the applicable noise management level. In relation to potential future receivers to the west, the effect of cumulative noise would increase the number of receivers where noise levels are predicted to be above the noise management level. These findings do not alter the management and mitigation measures which apply to each of the assessed construction activities.

It is however important to note that the predictions represent the upper noise levels of construction activities based on worst-case scenarios for each activity. In practice, noise levels are likely to be lower than predicted in most instances.

These findings represent a common outcome for construction work in semi-urban areas, particularly for a major infrastructure project. However, the results indicate there is a risk of community disturbance from construction noise, particularly given the duration of the construction program. Mitigation and management of construction noise impacts would therefore need to be prioritised during the development of detailed construction plans. This would need to address best practice measures for the control of both overall noise levels and noise characteristics, including selection of low noise emission plant, localised screening where practicable and effective, and use of broadband or visual warning signals to minimise potential disturbance from tonal sounds.

An assessment of risk based on these findings is presented in Table 21.

Table 21: Construction during standard working hours – risk assessment

Item	Rating	Comments
Risk consequence	Low to Moderate	Predicted noise levels are typical of the range expected for construction of a major infrastructure project in a semi-urban area. However, some activities could result in noise levels above the noise management level at the nearest existing receivers, and predicted noise levels at the nearest locations of the Devonshire Drive Hamlet are well above the noise management level, and are sufficient to represent a risk of disturbance to future residents in this area, particularly given the duration of construction works.
Likelihood	Possible	The predicted construction noise levels are based on conservative assumptions. Noise levels in practice are expected to be lower than predicted for most of the time. Further, the highest noise impacts relate to the Devonshire Drive Hamlet which remains undeveloped and it is presently unclear whether dwellings would be established at the time of the proposed construction works.
Overall risk	Low to Medium	The applicable guidance for this rating is that the risk can be acceptable if controls are in place, and attempts should be made to reduce the risk to low.

The medium risk rating determined in Table 21 supports that dedicated noise mitigation and management measures are warranted for construction activities at the converter station. Further discussion of controls is provided subsequently in Section 7.1.8 and Section 7.5.

7.1.5 Assessment – unavoidable works outside standard working hours

Civil and infrastructure works would be restricted to standard working hours generally. Exceptions to this would be unavoidable works for atypical tasks which occur infrequently (e.g. a concrete pour which needs to continue uninterrupted).

The primary consideration for works outside standard working hours is the shore crossing HDD works which could occur 24 hours per day, 7 days per week, for a period of up to 6 months in total. MLPL advises that these works would need to be continuous to ensure the stability of the bore holes.

The predicted HDD works noise levels at existing receivers in Table 19 range from 28 to 41dB L_{Aeq}, indicating noise levels below the relevant noise management level of 37 dB L_{Aeq} at most locations, but above the noise management level at various positions to the southeast and east of the site. The complexity of the terrain around the project is a key contributor to this variation, with some locations afforded shielding from the noise as a result of being located at a lower ground elevation, while others are shielded by the effect of a large mound in the terrain (proposed to be retained) directly to the east of the eastern drill rig work location.

The above findings are based on the predicted noise levels without adjustments for characteristics such as tonality or low frequency. The guidance of the NSW ICNG does note the application of adjustments for certain types of drilling activities, and there is a risk of penalties being applicable for tonality or low frequency, particularly diesel-powered drive systems for the drilling rig and standby power. If these penalties were applicable, noise levels would be above the noise management level for a greater portion of the existing receivers, and by a margin of more than 5 dB at the locations where predicted noise levels are highest.

At all of the existing receivers, the predicted noise levels are below the sleep disturbance reference level of 42 dB L_{Aeq}, based on the Noise EPP acoustic environment indicator and the 1999 WHO Guidelines.

In relation to potential future receivers within the approved developments to the west, the predicted noise levels at most of the Devonshire Drive Hamlet indicated in Table 20 are above the relevant noise management level of 37 dB L_{Aeq}, with the nearest locations being considerably higher at levels up to 60 dB for the western HDD location and 54 dB for the eastern HDD location. These findings would be exacerbated if adjustments were applicable for noise character. The predicted noise levels are also well above the sleep disturbance reference level of 42 dB L_{Aeq}. This indicates a risk of sleep disturbance at these locations if a dwelling was to be developed and occupied by the time the HDD works occur.

In terms of the George Street residential development where construction work has commenced, the predicted noise levels range between 29 and 32 dB for the two HDD locations and are therefore well below both the noise management level and the reference level for sleep disturbance.

Based on the findings for both existing and proposed future receivers, noise control for HDD works at night is a critical consideration.

Noise modelling was conducted to investigate the potential effectiveness of barriers located to the south and east of each drilling location to shield existing receivers. The results demonstrated the potential for noise reductions of up to 4 to 6 dB at some of the nearest existing receivers. However, the benefits at other locations were limited (less than 2 dB), and the effectiveness of this type of barrier configuration is likely to be limited in practice by the effect of access points for large vehicles and plant. Further, barriers are not a practical option for addressing noise levels to the potential future receivers of the Devonshire Drive Hamlet, due to the position of the development site at a much higher elevation. Large scale noise enclosures can be a viable consideration for certain types of projects involving works during the night, however this is typically more relevant for works over much longer periods than the 3 months of drilling proposed at each of the shore crossings.

Given the above, the priorities for noise control and noise management are expected to comprise:

- avoidance or limiting of HDD works at night where reasonably practicable;
- selection of HDD plant with the lowest available noise emissions and, where available, adoption of a noise mitigation kit such as exhaust silencers and treatment of engine enclosures;
- elimination or mitigation of annoying noise characteristics which could attract penalties, with particular attention to the frequency characteristics of the drive systems of the HDD rigs (i.e. addressing low frequency and tonality of diesel engines);
- localised noise barriers around specific plant items (as distinct from the broader barrier structures reviewed above) where effective noise reductions are achievable and local circumstances permit;
- efficient work practices to minimise the duration of the works; and
- advance communications with all potentially affected residents to advise them of planning works, and where scheduling is flexible, potentially identify scheduling options and dates which would be least disruptive for the local community.

An assessment of risk based on these findings is presented in Table 22.

Table 22: Shore crossing HDD works outside standard working hours – risk assessment

Item	Rating	Comments
Risk consequence	Moderate to major	Shore crossing HDD works are predicted to result in noise levels above the noise management level for the nearest existing receivers, and well above the noise management level for potential future receivers within the Devonshire Drive Hamlet. The predicted noise levels are also above the sleep disturbance reference level in the Devonshire Drive Hamlet. As HDD works may need to occur for a total period of up to 6 months, there is potential for noise levels above sleep disturbance thresholds for an extended period.
Likelihood	Possible to likely	The predicted construction noise levels are based on conservative assumptions, and noise levels in practice are expected to be lower than predicted for most of the time. Irrespective, the results are sufficient to indicate that noise levels above the reference level for sleep disturbance are likely to occur at receivers within the Devonshire Drive Hamlet, and possible at existing receivers, if dedicated noise control measures are not implemented.
Overall risk	High	The applicable guidance for this rating is that there is unacceptable level of risk and controls must be put in place to reduce to lower levels.

The high risk rating determined in Table 22 indicates that dedicated noise mitigation and management measures would be required to enable HDD shore crossing works to occur at night. Management and mitigation measures are discussed subsequently in Section 7.1.8 and Section 7.5, including examples of the measures that are expected to meet the requirements.

7.1.6 Construction vibration

Predicting vibration propagation through the ground is complex and subject to considerable uncertainty due to the variable influence of ground conditions at the source, propagation path and receiver.

At this stage in the assessment process, the indicative minimum working distances presented in the NSW CNVG provide a reference for risk assessment purposes. The indicative minimum working distances are reproduced in Table 5 of Section 3.2.1 and equate the following range of distances for different types of construction activity:

- indicative minimum working distance to avoid cosmetic building damage: up to 25 m; and
- indicative minimum working distance for human comfort: up to 100 m (greatest distance relates to vibratory rollers).

The nearest existing dwellings to the project are located approximately 138 m from the project boundary and are therefore beyond the indicative minimum working distances provided by the NSW CNVG for both cosmetic building damage and human comfort.

The nearest proposed residential lot boundaries (Devonshire Drive Hamlet) are located approximately 90 m from the project boundary. The exact dwelling locations are not known at this stage but are likely to be located further away, accounting for setback distances from the lot and project boundaries. Vibration may be perceptible at a receiver located less than 100 m from vibration intensive construction activities. However, the brief periods in which vibration may be perceived are expected to be acceptable, accounting for relevant international guidance concerning transient sources of vibration. In addition, the number of receivers where this is a risk is small and can be appropriately managed through a combination of appropriate plant selection, consultation with potentially affected receivers, and vibration monitoring if/where required.

Vibration from construction activities is therefore not a material consideration for the project.

An assessment of risk based on the findings is presented in Table 23.

Table 23: Construction vibration – risk assessment

Item	Rating	Comments
Risk consequence	Minor	All receivers are located well beyond the indicative distance where there is a risk of cosmetic building damage as a result of vibration intensive construction plant. However, some of the proposed receivers may be close enough for there to be the potential for disturbance of human comfort.
Likelihood	Unlikely	At the small number of receivers that may be within the indicative distance where there is a risk of disturbance of human comfort, the risk can be appropriately managed though suitable plant selections and vibration monitoring if/where required. Given that the receivers are significantly further than the distances for cosmetic building damage, vibration impacts are unlikely.
Overall risk	Low	The applicable guidance for this rating (the lowest risk rating under the Victorian EPA Publication 1695.1 guidance) is that the level of risk is acceptable. Attempts to eliminate the risk should be made, but higher risk levels take priority.

7.1.7 Off-site transportation noise

It is the aim to source all civil works materials for the Heybridge converter station locally. No air or sea transportation will be required. It is assumed the HVDC converter station components will be shipped to Port of Burnie and trucked to site.

The EIS (Tasmania) Technical Report – Traffic & Transport shows that during the construction stage the estimated number of heavy vehicles return trips would peak at 60 per day, based on the number of heavy vehicle trips for construction. The indicative transport routes are shown in Figure 13.

The majority of the routes to the project site are along the Bass Highway from either Burnie (west of the site), Devonport or Launceston (East of the site). Vehicles would turn off the Bass Highway into the site at the Minna Road intersection.

Noise levels from pass by of heavy vehicles have been estimated to assess the noise levels at receivers along the route. It is not considered practical or warranted for this type of noise source to review in detail the proximity of all potential receivers along each transport route. Accordingly, the estimates have been determined for example setbacks from the edge, ranging from 15 m to 100 m. It is expected that some receivers may be located less than 15 m from the transport route and may experience noise levels from the heavy vehicle movements that are higher than those presented in Table 24.

The prediction method is based on a simple model of a moving point source of noise and does not account for potential site-specific factors such as ground attenuation and shielding. These predictions are primarily intended as an indication of the potential contribution of construction related vehicle movements to total road traffic noise levels along the routes. The estimated off-site construction traffic noise levels at various distances are presented in Table 24.

Table 24: Estimated heavy vehicle noise levels at varying distances, dB $L_{Aeq,1hr}$

Distance from road	15 m	25 m	50 m	100 m
Average noise level	55	53	50	47

The TNMG noise targets are not directly applicable to short-term increases in noise levels from construction traffic, and also apply to noise levels over longer periods of the day and upper noise level metrics (i.e. 16 hour and 18 hour noise levels, described in terms of both equivalent L_{Aeq} and upper L_{A10} noise levels). However, the range of predicted equivalent noise levels presented in Table 24 indicate the following:

- The predicted noise contribution of off-site construction traffic is well below the 63 – 68 dB $L_{A10,\ 18\ hour}$ targets which apply to long-term / permanent road traffic noise levels
- The predicted noise contribution of off-site construction traffic is comparable to or lower than the 50 – 55 dB $L_{Aeq,16\ hour}$ range of acoustic indicator levels that are also referenced in the TNMG as an alternative assessment criterion for long-term / permanent road traffic noise levels.

The above are simplified comparisons given that the TNMG criteria apply to total noise levels. Conversely, noise criteria applied to construction activity are normally less stringent than those applied to long-term/permanent sources of noise.

However, in lieu of specific requirements, or information about baseline traffic flows, the comparison is sufficient to indicate that off-site traffic related to construction of the project is unlikely to warrant dedicated noise mitigation measures, particularly given the temporary nature of the associated impact.

Figure 13: Construction transport routes to the project site (image courtesy of Coffey)

7.1.8 Management and mitigation measures

The assessment of construction noise related risks presented in Section 7.1.4 and Section 7.1.5 generally indicate risk ratings ranging from low to medium, except for potential night works associated with the construction of the shore crossing which is rated as a high risk. The construction vibration risk is rated as low.

Noise mitigation and management measures are therefore required to minimise the risk as follows:

- **NV01: Conduct additional background noise monitoring**

  The purpose is to establish the requirement to obtain additional background noise data which will then inform the development of controls under (NV02).

- **NV02: Develop and implement a construction noise and vibration management plan**

  The purpose is to establish the requirement of a comprehensive plan which describes all measures that would be used to minimise the impact of construction noise and vibration as far as reasonably practical, based on updated information for the planned construction works and equipment selections.

- **NV03: Conduct construction noise monitoring**

  The purpose is to establish the requirement to conduct construction noise monitoring at locations specified in the construction noise and vibration management plan, and requirements concerning construction noise monitoring reports.

Each of the above measures are specified in detail in Section 7.5.

7.1.9 Residual impacts

Provided that the management and mitigation measures are adhered to, the risk rating of the residual impacts would be limited to low to medium. The inherent and residual risks for each aspect of construction noise are summarised in Section 7.6.

7.2 Operational noise

This section presents:

- details of the converter station noise sources and their noise emissions;
- predicted noise levels associated with operation of the converter station;
- discussion of the predicted noise levels and the impacts;
- recommended management and mitigation measures to control operational noise; and
- residual impacts based on compliance with the management and mitigation measures .

7.2.1 Converter station noise sources and noise control strategy

Environmental noise associated with operation of the converter station was identified as a key design consideration during the concept development for the project, primarily due to the proximity of potential future dwellings to the west of the site at the Devonshire Drive Hamlet of the Residential Nature Reserve. A particular consideration for these receivers is their elevated position relative to the site of the project; a ground elevation difference of more than 80 m. The effect of this height difference is that barriers are not a practical noise control measure. The main noise control options for the project therefore comprise strategic equipment placement, selection of low noise emission plant, and the use of acoustically-rated enclosures for certain equipment items.

MLPL collated noise emission data (sound power levels) for the plant from example vendor data for similar types of projects, including standard and noise attenuated plant options. The sound power levels nominated for the assessment generally range from 70 dB L_{WA} for auxiliary transformers through to 87 dB L_{WA} for the valve coolers. The key items of external plant with respect to noise emissions are the valve coolers and the converter transformers. The noise emissions provided for these equipment items are very low, and were selected by MLPL in recognition of the stringency of the noise constraints for the site. Achieving these emissions is expected to involve selection of inherently low noise emission design solutions and, in the case of the converter transformers, the use of proprietary noise attenuation measures such as enclosures.

Based on the results of iterative noise modelling, additional noise controls were identified for the operation of the valve coolers during the night. Specifically, an 8 dB reduction in noise levels has been accounted for in the noise modelling (i.e. 8 dB lower than the attenuated values referenced for operation during the day and evening periods) of the valve coolers at night, and would likely involve the use of reduced fan speeds (implemented via variable speed control systems specified for the valve coolers).

To facilitate the lowest practicable noise levels, the iterative noise modelling also included identification and evaluation of options to upgrade the sound insulation of the project's buildings. The objective of these upgrades was to reduce the noise contribution from plant located within buildings to levels that are significantly lower than the contribution of external plant (i.e. to enable the lowest overall total noise level with the proposed external plant by practically eliminating the contribution of internal plant).

The key noise emitting external plant associated with the converter station are listed in Table 25. These sources have been modelled as point or area source in the noise model, as appropriate. The relevant building structures, modelled as industrial buildings in the noise model, are summarised in Table 26. The noise control measures are also noted within these tables. A plan of this site is provided in Figure 14.

A switching station would also be included as part of the converter station, however this would not include any power transformers or any other significant operational noise sources that are relevant to a noise assessment.

Table 25: Key external noise generating plant and noise controls (where applicable)

Plant	Total number of items (stage one and stage two of Marinus Link combined)
Converter transformers	Six (6) Low noise emission specification envisaged to involve the use of proprietary acoustic enclosures.
Converter transformer coolers	Six (6)
Auxiliary transformers	Four (4)
Standby generators	Two (2)
Valve cooling banks	Two (2) (each bank comprising 7 cooling units) Low noise emission fan selections, with variable speed control systems to enable reduced fan speeds and lower noise emissions at night.

Table 26: Converter station buildings and noise controls (where applicable)

Building/room	Description
Two (2) AC phase reactor halls	One (1) hall for each stage of the project, with each hall containing six (6) valve reactors. The following sound insulation upgrades were identified for these halls: • walls: tilt-up concrete panel walls • ventilation openings: acoustic louvres (allowance made for two ventilation openings for each hall – 2 m^2 each on the west and east elevations of the halls) • roof: suspended mass layer ceiling and an acoustically insulated ceiling void.
Two (2) DC side halls	One (1) hall for each stage of the project, with each hall containing two (2) DC reactors. The walls and roof have been assessed as lightweight sheet steel cladding, and allowance made for two ventilation openings (approximately 2 m^2 each on the west and east elevations of the halls).
Two (2) Valve halls	One (1) hall for each stage of the project. Each hall would contain converter modules and valves which are understood to produce low noise emissions relative to other plant at the site. Noise emission data is not available for the equipment located within these halls. For the purposes of this assessment, noise levels within these halls are assumed to be low and not contribute to the total predicted noise levels.
Two (2) Handling Unit (AHU) rooms	One (1) room for each stage of the project, with each room containing two (2) air handling units (1 each for the AC phase reactor halls and the DC side halls). The walls and roof have been assessed as lightweight sheet steel cladding, and allowance made for two ventilation openings (approximately 2 m^2 each on the west and east elevations of the halls).
Two (2) filter buildings	One (1) building for each stage of the project, with each building containing three (3) AC filter banks. The following sound insulation upgrades were identified for these buildings: • walls: tilt-up concrete panel walls • roof: suspended mass layer ceiling and an acoustically insulated ceiling void.

A schedule of the equipment sound power levels used in the noise modelling is presented in Appendix D. Performance data for building attenuation measures is provided in Appendix E.

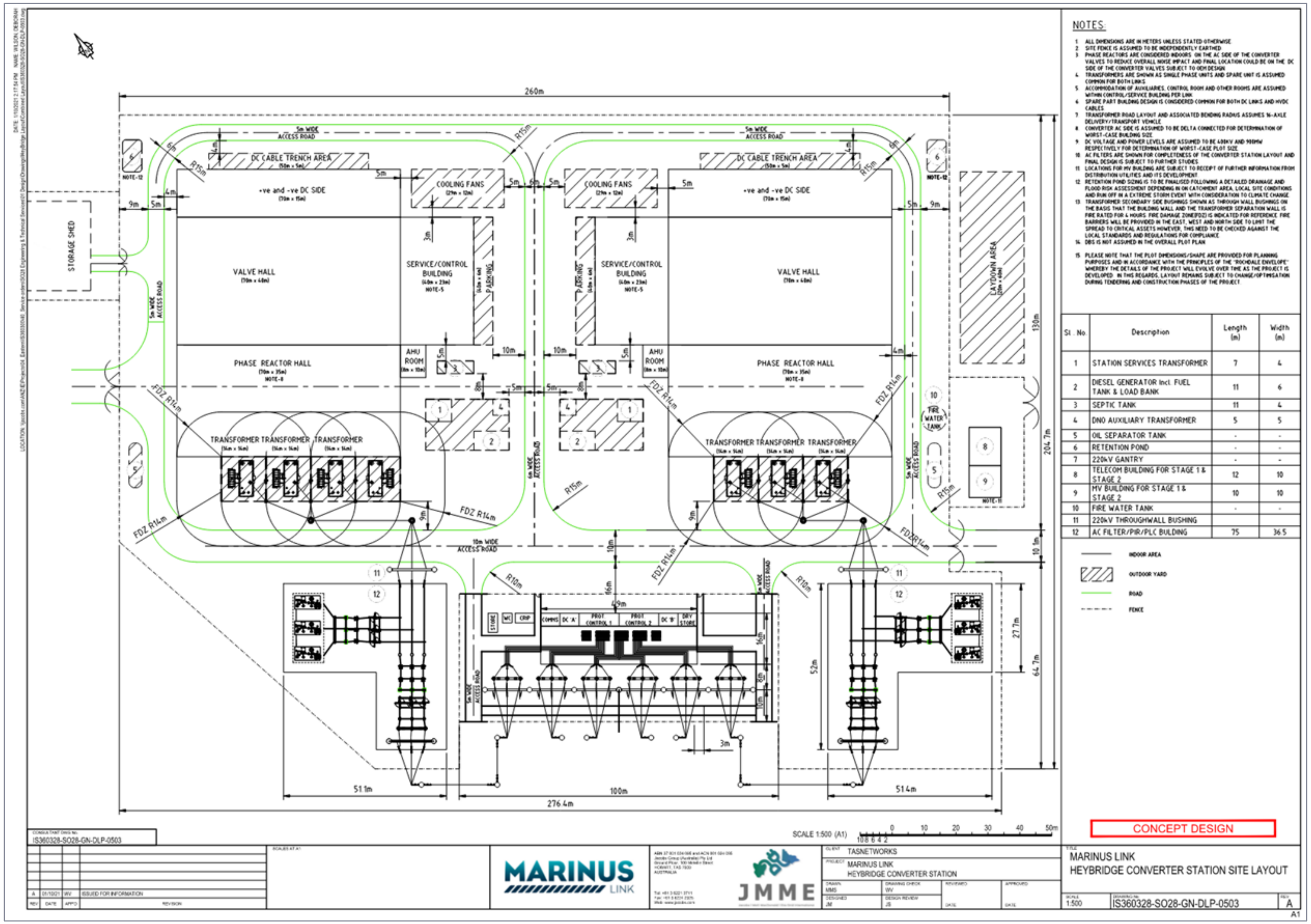


Figure 14: Converter station site plan

(Image courtesy of MLPL)

7.2.2 Predicted noise levels

Operational noise levels associated with the converter station were calculated for:

- typical operations: representative of normal full-power operation during the day, evening and night, accounting for temperatures up to 40 °C during the day and evening and up to 35 °C at night; and
- emergency standby generator operation: normal full-power typical operations of the converter station with simultaneous maintenance testing of the two emergency standby generators.

The predicted noise levels are based on simultaneous operation of all plant items scheduled in Section 7.2.1 (excluding standby generators during typical operations), using the ISO 9613-2 prediction method described in Section 5.3.3.

Adjustments for characteristics such as tonality or low frequency have not been applied to the predicted noise levels. These types of adjustments are addressed in the discussion of the results.

The results for typical operations during the day/evening and night are also presented as predicted noise contours in Figure 15 and Figure 16 respectively.

Table 27: Predicted noise levels – typical operations (no standby generators), dB L_{Aeq}

Receiver	Description	Day/Evening	Night
B1539	Existing dwelling	22	19
B1540	Existing dwelling	23	22
B1544	Existing dwelling	24	23
B1550	Existing dwelling	24	23
B1551	Existing dwelling	24	22
B1557	Existing dwelling	22	21
B6195	Existing dwelling	23	21
B7585	Existing dwelling	22	20
B7591	Existing dwelling	21	18
B7606	Existing dwelling	18	14
B7610	Existing dwelling	20	15
B7636	Existing dwelling	23	16
B7641	Existing dwelling	25	18
B7647	Existing dwelling	28	20
B7716	Existing dwelling	22	20
B7722	Existing dwelling	20	17
B7734	Existing dwelling	20	15
B7740	Existing dwelling	23	17
B7744	Existing dwelling	24	23
B4853*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	37	35
B4854*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	34	31

Receiver	Description	Day/Evening	Night
B4855*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	33	30
B4856*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	29	25
B4857*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	27	22
B4858*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	22	17
B4859	George Street residential development	18	12

The predicted noise levels with the emergency standby generators operating are presented in Table 28. These are the predicted noise levels for brief periods of testing with both generators operating simultaneously (or in an emergency situation when the generators are required as a result of a network power cut).

The results for atypical operations are also presented as predicted noise contours in Figure 17.

Table 28: Predicted noise levels – atypical operations (with standby generators), dB L_{Aeq}

Receiver	Description	Day (1 hour every 3 months)
B1539	Existing dwelling	31
B1540	Existing dwelling	35
B1544	Existing dwelling	34
B1550	Existing dwelling	32
B1551	Existing dwelling	35
B1557	Existing dwelling	32
B6195	Existing dwelling	34
B7585	Existing dwelling	33
B7591	Existing dwelling	32
B7606	Existing dwelling	29
B7610	Existing dwelling	28
B7636	Existing dwelling	25
B7641	Existing dwelling	29
B7647	Existing dwelling	31
B7716	Existing dwelling	34
B7722	Existing dwelling	29
B7734	Existing dwelling	26
B7740	Existing dwelling	29
B7744	Existing dwelling	35
B4853*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	51
B4854*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	45
B4855*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	45
B4856*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	38
B4857*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	35
B4858*	Heybridge Residential Nature Reserve – Devonshire Drive Hamlet	31
B4859	George Street residential development	24

Figure 15: Heybridge converter station site – predicted noise contours for typical day operation, dB L_{Aeq}

Figure 16: Heybridge converter station site – predicted noise contours for typical night operation, dB L_{Aeq}

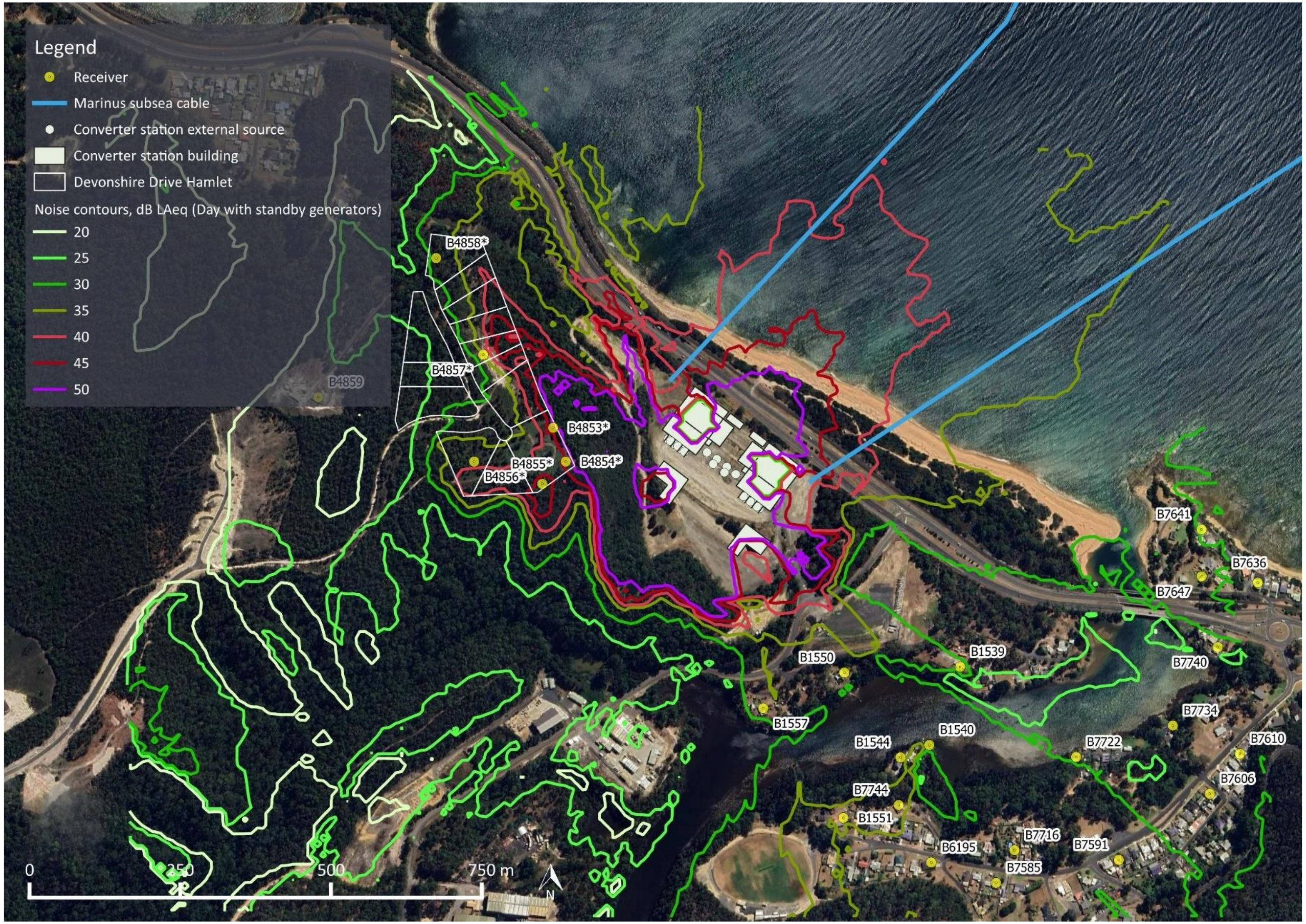


Figure 17: Heybridge converter station site – predicted noise contours for atypical day operation (normal operations plus emergency standby generator testing), dB L_{Aeq}

7.2.3 Discussion

The results for full-power typical operations presented in Table 27 indicate:

- the highest predicted noise levels at an existing dwelling location are 28 and 23 dB L_{Aeq} for the day/evening and night periods respectively – these represent relatively low noise levels which would be comparable to or below the background noise levels in most instances;
- the highest predicted noise levels at the boundary of a proposed future residential area are 37 and 35 dB L_{Aeq} for the day/evening and night periods respectively (Heybridge Residential Nature Reserve, Devonshire Drive Hamlet) – these levels are within the range of background noise levels, but would likely be audible during quiet periods (particularly at night);
- the predicted noise levels are lower than the Noise EPP acoustic environment indicator levels for the day and night periods;
- the predicted noise levels are below the EMPC Noise Regulations for fixed plant items; and
- the predicted noise levels meet the Victorian Noise Protocol design targets that are proposed for the design and assessment of the plant at all locations.

The results therefore indicate compliance with the reference levels and design targets. As a further point of context, the predicted noise levels are below criteria defined by the WHO for the protection of sleep at night at all locations (existing and future dwellings).

However, in the case of the design targets (and the EMPC Noise Regulations reference levels), compliance is based on the premise that the converter station does not attract a penalty for annoying characteristics such as tonality or low frequency.

The application of a penalty would be inconsequential to the assessment outcome at all locations other than the Devonshire Drive Hamlet within the Residential Nature Reserve to the west i.e. even with a penalty, the adjusted predicted noise levels would remain below the design targets at most locations. However, at the Devonshire Drive Hamlet, a penalty adjustment would result in noise levels above the design target.

Plant, such as transformers, are typically characterised by tonal noise emissions which can result in audible tones at receivers. Under the Tasmanian noise measurement manual, the presence of audible tones at a receiver can attract a penalty of up to 5 dB. Similarly, transformers have the potential to be characterised by low frequencies and, under the Tasmanian noise measurement manual, a penalty of 5 dB can also apply for this characteristic. The following contextual factors are noted for the predicted noise levels at the Devonshire Drive Hamlet:

- The predicted noise contribution of the converter transformers is 31 dB L_{Aeq}, compared to a total predicted noise level of 32 dB L_{Aeq} for all of the remaining plant at the site during the night (31 dB and 32 dB summing to the total predicted noise level of 35 dB L_{Aeq} presented in Table 27). This indicates that, while the converter transformers are the highest contributor, the converter transformers do not control/dominate the total predicted noise level.
- The 31 dB L_{Aeq} predicted noise contribution of the converter transformers is below the night-time background noise level of 32 dB L_{A90} determined in accordance with the Tasmania measurement manual (see median value of the data presented in Section 6.0, noting however the potential for lower background noise levels on some nights).
- Achieving the low converter transformer noise emissions accounted for in this assessment is expected to involve the use of acoustic enclosures which are designed to reduce the prominence of tones in the noise emission characteristics of the transformers.
- A risk assessment of low-frequency noise levels indicates a C-weighted predicted noise level of 49 dB L_{Ceq} at night at the Devonshire Drive Hamlet, which is below the criterion for the

application of low frequency penalties under the Tasmanian noise measurement manual (i.e. the difference between the A-weighted and C-weighted noise level is less than 15 dB).

For the above reasons, penalties have not been assumed in this assessment. However, there is a risk that tones could be audible or characterised as a low frequency. If this were to occur in practice, the predictions indicate that the noise levels would be above the design targets at the Devonshire Drive Hamlet. This aspect of the converter station therefore warrants further scrutiny and review during the design and procurement of the plant to verify that:

- the noise of the converter station will not contain audible tones or be characterised as a low frequency noise at the receivers; or
- there will be sufficient margin between the predicted noise levels and the final applicable noise limit to accommodate the potential for tone and/or low frequency related penalty adjustments.

In terms of the emergency standby generator plant, the predicted noise levels are less than 40 dB L_{Aeq} at most locations. The only exceptions are the southeast section of the Devonshire Drive Hamlet where the predicted noise levels are up to 51 dB L_{Aeq}. This noise level is still within the design target reference level of 55 dB L_{Aeq} and below the Noise EPP acoustic environment indictor noise level. Further, during routine testing of the plant for one (1) hour every three (3) months, the diesel generators may not be operated simultaneously, and predicted noise levels would be approximately 3 dB lower.

In terms of noise character, practical noise mitigation options are available to mitigate potential low-frequency and tonal characteristics associated with standby generator plant. Penalties have therefore not been applied to the predictions. However, consistent with the plant associated with normal operations, the frequency characteristics of the selected plant will require review as part of the detailed design process to identify and assess any mitigation measures required for the control of these characteristics.

The noise modelling accounts for full-power operation during typical worst-case conditions, including emergency standby generator plant, and demonstrates predicted noise levels within the assessment criteria proposed for the project, corresponding to stringent noise limits derived from the Victorian Noise Protocol.

The plant would be designed to enable continued operation and power supply during atypical conditions, including:

- peak network demand occurring simultaneously with ambient temperatures above 40 °C during the day/evening and 35 °C at night (the design temperatures for the project); and
- peak network demand occurring simultaneously during an emergency outage in the network that requires an overload of one of the project's circuits (for example, diversion of power transmission via one stage of the project only, involving the use of reserve capacity which temporarily increases the rating of the link from 750 MW to 900 MW until alternative power sources are dispatched across the network to return the grid to a stable state).

These atypical operating scenarios would result in slightly higher noise emissions than the typical worst-case conditions represented in the noise modelling. However, these are infrequent conditions which would typically only result in brief periods of slightly higher noise levels. The effect of these atypical operating conditions primarily relates to the cooling plant operating at increased duty. The cooling plant is not a dominant noise source for the converter station, and increases in their noise emissions would not equate to equivalent changes in the total noise levels of the project. Noise data to for these conditions is not available, but the potential increase in noise levels is expected to be less than 5 dB. This represents a minor increase in noise level for brief and atypical conditions which are not representative of normal operation of the plant. The risks of noise related impacts during these atypical conditions are therefore considered low.

7.2.4 Risk assessment

Based on the findings discussed above, an assessment of the risk associated with converter station operational noise levels is presented in Table 29.

Table 29: Converter station operational noise levels – risk assessment

Item	Rating	Comments
Risk consequence	Minor to moderate	The predicted noise levels are below the reference levels of the Noise EPP and the EMPC Noise Regulations, and below the design targets determined from the Victorian Noise Protocol. However, compliance is dependent on penalty adjustments for tonality and low frequency not being applicable, and this risk will need to be addressed during the detailed design of the project.
Likelihood	Possible	The assessment is based on the selection of low noise emission plant and site-specific noise attenuation. While the predicted noise levels are well below the reference levels and the design targets in most instances, the night-time predicted noise level at one of the future residential development sites is equal to the design target. Attention to noise emissions would be essential during subsequent design and equipment procurement to achieve outcomes that are consistent with the assessment findings.
Overall risk	Medium	The applicable EPA Victoria Publication 1695.1 guidance for this rating is that the risk can be acceptable if controls are in place, and attempts should be made to reduce the risk to low.

The risk rating determined in Table 29 supports that measures should be established to reduce the risk, and dedicated controls is warranted to provide assurance that operational noise would be appropriately addressed during the design and commissioning of the project.

7.2.5 Management and mitigation measures

Management and mitigation measures are recommended to control the risks of operational noise. The applicable measures are described below.

- **NV01: Conduct additional background noise monitoring**

  The purpose of this recommendation is to establish the requirement to obtain additional background noise data which will inform the design noise assessment report (NV04) and operational noise management plan (NV05) for the converter station.

- **NV04: Prepare a design noise assessment report for the final converter station design**

  The purpose of this recommendation is to establish the requirement to prepare a detailed assessment and report, based on the final converter station design and equipment selections, demonstrating that the impact of operational noise would be minimised to the extent reasonably practical.

- **NV05: Prepare an operational noise management plan for the converter station site**

  The purpose of this recommendation is to establish the requirement to document all controls to be implemented and maintained to control operational noise, including noise monitoring requirements and procedures for investigating noise complaints and potential compliance issues.

- **NV06: Prepare an operational noise compliance assessment report**

  The purpose of this recommendation is to establish a requirement to prepare a report verifying that the measures documented in the operational noise management plan have been fully implemented and that operational noise levels comply with the applicable noise limits.

Each of the above measures are specified in detail in Section 7.5.

7.2.6 Residual impacts

Adhering to the management and mitigation measures would limit the risk consequence to minor, however the overall risk rating of the residual impacts of operational noise would remain medium. The inherent and residual risks for operational noise are summarised in section 7.6.

7.3 Cumulative impacts

Development and operation of multiple projects at the same time and in proximity to each other can lead to cumulative environmental impacts. The EIS therefore includes an assessment of the potential cumulative impacts associated with other proposed and foreseeable projects near the study area.

Other projects were identified for inclusion in the EIS cumulative impact assessment where they:

- are under construction;
- have received approval but the project has not yet commenced construction;
- have officially commenced the approvals process and are in the process of developing applications; or
- have submitted approval application(s) that have not yet been determined.

The projects being considered in the EIS are listed in Table 30 along with a brief summary of relevant available information.

Table 30: Projects being considered in the EIS cumulative impact assessment

Project	Description	Location	Status and timing
Guilford Wind Farm / Epuron Pty Ltd	Wind farm in Guildford with up to 80 wind turbines Generation of up to 450 megawatts (MW) of wind energy Estimated capital: $50 million	7 km northeast of Waratah and 15 km south of Hampshire	Current status: Notice of intent submitted September 2020 Deemed a controlled action by DAWE in September 2021 Construction to commence: 2024
Robbins Island Renewable Energy Park / UPC Robbins Island Pty Ltd	Wind farm on Robbins Island with up to 122 wind turbines Generation of up to 900 MW of wind energy Estimated construction value: $1.2 billion Construction workforce: 250 personnel	Robbins Island, northwest coast of Tasmania	Current status: Approved by the Commonwealth Government and assessment by the EPA underway Construction to commence: 2023-2025
Jim's Plain Renewable Energy Park / UPC Robbins Island Pty Ltd	Wind farm in Jim's Plain with up to 31 wind turbines and possible solar generation Generation of up to 200 MW of wind energy and up to 40 MW of solar energy Capital investment: $350 million Construction workforce: over 150 personnel Operations workforce: 15 personnel	23 km west of Smithton	Current status: Approved by the Council and State and Commonwealth governments in 2020 Construction to commence: 2023
Robbins Island Road to Hampshire Transmission Line / UPC Robbins Island Pty Ltd	A new 220 kV overhead transmission line (OHTL) spanning 115 km, estimated to have 245 towers Connects Jim's Plain and Robbins Island Renewable Energy Parks transmission infrastructure to Tasmanian transmission network Construction workforce: up to 100 personnel over 24 months	Between Robbins Island Rd at West Montagu and Hampshire	Current status: Detailed planning/environmental approvals phase underway Commonwealth Government determined the project to be a controlled action under the EPBC Act in September 2020 Construction to commence: 2023

Project	Description	Location	Status and timing
Bass Highway, targeted upgrades between Deloraine and Devonport / Department of State Growth	Targeted highway upgrades between Deloraine and Devonport Roads of strategic importance Estimated project cost: $50 million	Targeted areas along Bass Highway between Deloraine and Devonport	Current status: In planning Construction expected to commence: late 2023 Expected completion: 2027
Remaining North West Transmission Developments (Remaining NWTD) Transmission Line / TasNetworks	Remaining NWTD is a component of the North West Transmission Developments, comprising of a new double-circuit 220 kV (OHTLs in North West Tasmania, upgrades to the existing Palmerston, Sheffield and Burnie substations, and a new switching station at Hampshire Hills Remaining NWTD will connect to the project at the Heybridge converter station Supports new and existing renewable energy developments in North West Tasmania, including Marinus Link Estimated project cost: $220 million	Between Palmerston, Sheffield, Burnie and Hampshire Hills	Current status: Planning and approvals phase in progress Construction expected to commence: 2025
Hellyer Wind Farm / Epuron Pty Ltd	Wind farm with up to 48 wind turbines Generation of up to 300 MW of wind energy	8.5km southwest of Hampshire	Current status: Design phase Notice of intent issued Tasmanian EPA -EIS Guidelines issued in November 2022
Western Plains / Epuron Pty Ltd	Wind farm with up to 12 wind turbines Generation of up to 50.4 MW of wind energy	4 to 5 km northwest of Stanley	Current status: Work on the Development Proposal and Environmental Management Plan (DPEMP) is continuing. The DPEMP has been drafted in accordance with the Project Specific Guidelines issued for the project by the Environment Protection Authority (EPA Tasmania). The EPA Tasmania recently extended the timeframe for submission to enable completion of the required documentation

Project	Description	Location	Status and timing
Table Cape Luxury Resort / Table Cape Enterprises	Proposed accommodation	Table Cape, 4.5 km north of Wynyard, Ransleys Road	Current status: Approved by Waratah-Wynyard Council
Lake Cethana Pumped Hydro / Hydro Tasmania	Storage and underground pumped hydro power station with associated infrastructure, with up to 600 MW capacity Estimated construction cost: $900 million	19 km southwest of Sheffield	Current status: Hydro Tasmania will progress with the final feasibility stage Construction likely to commence: 2027
Youngmans Road Quarry / Railton Agricultural Lime Pty Ltd	Limestone quarry development on old quarry site Average annual production of 72,000 tonnes of limestone	2.5km northwest of Railton	Current status: EPA approved the development in February 2021 Kentish Council is reviewing the land permit for the proposed development
Port Latta Wind Farm / Nekon Pty Ltd	Wind farm with up to 7 wind turbines Generation of up to 25 MW of wind energy Construction workforce: 15 people over six months Estimated capital: $50 million	Mawbanna Plain, 2 km southwest of Cowrie Point	Current status: Environmental Assessment Report and EPA decision issued October 2018 Website states intent to start construction late 2020, no further updates available
Port of Burnie Shiploader Upgrade / TasRail	Minerals shiploader and storage expansion at TasRail's existing Bulk Minerals Export Facility Estimated cost: $64 million Design and construction workforce: 140 personnel	Port of Burnie	Current status: onsite works and detailed design (commenced in April 2022) Commissioning expected to commence: 2023
Bass Highway – Cooee to Wynyard / Department of State Growth	Priority works upgrade along the Bass Highway between Cooee and Wynyard to realign and upgrade approximately 3.2 km of road Estimated cost: $50 million	Bass Highway from the intersection of Brickport Road in Cooee, across the Cam River Bridge, to the intersection of the Old Bass Highway at Doctors Rocks near Wynyard	Current status: Construction (commenced late 2021) Expected completion:2025

Project	Description	Location	Status and timing
QuayLink - Devonport East Redevelopment / TasPorts	Port terminal upgrade project to support TasPorts in increasing capacity of both freight and passenger ferry services across Bass Strait Estimated cost: $240 million Design and construction workforce: 1060 direct and indirect jobs in North West Tasmania, and a further 655 broader Tasmanian jobs during construction	Port of Devonport	Current status: Early works/construction (commenced 2022); approvals phase ongoing Expected completion: 2027

Out of the projects above, only the Remaining North West Transmission Developments (Remaining NWTD) is in close proximity to the project. All other projects are located over 5 km away and are therefore not considered relevant for the study.

The primary cumulative consideration that is relevant to the technical noise and vibration study is the potential for cumulative operational noise. However, the operational noise sources associated with the Remaining NWTD are limited, and are not expected to represent a noise compliance consideration for the project (in isolation or cumulatively with other neighbouring developments). All of the other proposed and foreseeable projects being considered in the EIS, and which may produce noise during operation, are distant from the project and would not result in cumulative operational noise.

While there is potential for cumulative construction noise to arise from other projects, the risk of cumulative noise is low on account of the transient nature of construction and due to the separation of the projects in most instances. Heavy vehicle traffic is one aspect of construction where the development of multiple projects at the same time can potentially result in cumulative increases in traffic movements on the surrounding road network, with corresponding increases in road traffic noise levels. However, for this to occur, the projects must use the same construction traffic routes, and the construction phases of the projects must overlap. Further, as construction traffic volumes typically vary throughout the construction of a project, the potential for cumulative construction traffic noise is also likely to depend on the peak phases of construction traffic for each project overlapping. These factors reduce the likelihood of cumulative construction traffic noise being a material consideration in practice. Irrespective, the high-level assessment of construction traffic associated with the project (Section 7.1.7) indicated construction traffic is unlikely to warrant dedicated noise mitigation measures; on account of the relatively low estimated levels when compared with benchmarks that are typically used for the assessment of permanent/long-term noise sources. Based on these considerations, the risk of cumulative construction traffic noise impacts is also low.

In terms of other existing sources of operational noise in the area around the project, there are existing commercial premises to the south of the project. However, at the receivers to the south of the project, the predicted operational noise levels associated with the converter station are low (e.g. less than 25 dB L_{Aeq} at B1550 and B1557) and do not indicate a risk of cumulative noise considerations (i.e. on account of the predicted noise levels being well below any of the reference levels considered for the assessment of operational noise from commercial premises).

7.4 Inspection, monitoring and review

Monitoring and review requirements are established as part of the management and mitigation measures for construction and operational noise detailed in Section 7.1.8 and Section 7.2.5 respectively, and summarised in Section 7.5.

7.5 Management and mitigation measures

The recommended management and mitigation measures for the control of noise and vibration associated with the project are summarised in Table 31.

The following key items are noted:

- The converter station EIS proposes the development of a decommissioning management plan, and this plan would need to address environmental noise and vibration impacts. It is envisaged that a decommissioning plan would also be required for the shore crossing for the project, and similarly would need to address environmental noise and vibration impacts. Dedicated controls for noise and vibration associated with decommissioning activities have therefore not been documented in the mitigation and management measures presented subsequently in this section.
- The following recommendations identify activities to occur prior to commencement of construction. In all cases, this refers to commencement of construction activities which may result in environmental noise in the surrounding areas, such as earthworks.

Table 31: Noise and vibration management and mitigation measures

ID	Management and mitigation measures	Project stage
NV01	**Conduct additional background noise monitoring** Prior to commencement of construction, conduct additional background noise monitoring for receivers in the areas around the project. The background noise monitoring data must: • Inform the assessment of construction noise (NV02 and NV03) and operational noise (NV04, NV05 and NV06). • Be conducted at a selection of locations which are representative of the receivers that could be impacted by construction and operation of the project. The background noise monitoring and results analysis must be conducted in accordance with procedural guidance detailed in: • *Noise Measurement and Procedures Manual 2008* (Tas) • Australian Standard 1055:2018 *Acoustics - Description and measurement of environmental noise* where relevant. The results must be documented in a background noise report and made available to EPA Tasmania on request.	Construction
NV02	**Develop and implement a construction noise and vibration management plan** Prior to commencement of construction, develop a construction noise and vibration management plan in consultation with EPA Tasmania for onshore construction including the shore crossing. The construction noise and vibration management plan must document: • A description of all noise generating construction activities and their locations. This must include a schedule of equipment types and numbers for each activity and location. • A description of the proposed construction program including timing and duration of construction activities. This must include confirmation that the works will adhere to standard working hours, other than unavoidable works that must occur outside standard working hours. • The results of additional background monitoring conducted under NV01. • Details of the location, duration and type of unavoidable works which may need to occur outside of standard working hours and the protocols that will apply for the management of unavoidable works outside standard working hours. • Details of all reasonable and practicable measures that are proposed to minimise the impact of noise and vibration associated with both on-site and off-site sources of construction activities (including heavy vehicle movements on local roads), including: – requirements for the selection of major plant items with low noise emissions, characterised by sound power levels that are equivalent to, or lower than, the values/ranges indicated in AS 2436 *Guide to Noise and Vibration Control on Construction, Demolition and Maintenance Sites (Reconfirmed 2016)*, unless it can be demonstrated that adhering to these values would not be reasonably practicable.	Construction

ID	Management and mitigation measures	Project stage
	– Measures for the control of potentially annoying characteristics such as tonality, impulsive and low-frequency. – Scheduling protocols for minimising the potential disruption caused by high noise levels as a result of transient construction activities which occur near to receivers for brief periods. – Details of any locations where temporary screens or enclosures are identified as a reasonably practicable control measure, informed by updated construction noise modelling. • Requirements for monitoring noise of construction works, including: – unavoidable works – verification noise testing (if warranted) to assess the effectiveness of the noise controls before commencing continuous night works. • Communication protocols for notifying landowners and land managers in advance of the works occurring. • Protocols for providing respite in circumstances where residents are affected by prolonged exposure to elevated noise levels as a result of unavoidable works out of hours. • Complaint handling and response protocols, in accordance with the MLPL complaints management system. The construction noise and vibration management plan must address the requirements of: • *Environmental Management and Pollution Control (Noise) Regulations 2016* (Tas). • *Environment Protection Policy (Noise) 2009* (Tas). • Australian Standard AS 2436. The construction noise and vibration management plan must be made available to EPA Tasmania on request. The construction noise and vibration management plan must be a sub plan to the Construction Environmental Management Plan and implemented during construction.	
NV03	**Conduct construction noise monitoring** Conduct construction noise monitoring in accordance with the requirements of the construction noise and vibration management plan prepared in accordance with NV02. This shall include, at minimum, construction noise monitoring for the shore crossing. The results of the construction noise monitoring must be documented in accordance with the timeframe and reporting requirements established in the construction noise and vibration management plan. The report must identify if changes to the construction noise mitigation and management measures are warranted to minimise the impact of noise as far as reasonably practicable.	Construction

ID	Management and mitigation measures	Project stage
NV04	**Prepare a design noise assessment report for the final converter station design** Prior to installing the converter station plant and any enclosing structures, prepare a design noise assessment report for the final converter station design. The report must: • Include predicted noise levels based on the final design of the converter station and representative noise emission data for the final equipment selections for the project. • Provide a schedule of the measures that have been incorporated into the design for the control of environmental noise levels, demonstrating that all reasonable and practical measures would be implemented to minimise the impact of operational noise. • Present the results of updated background noise monitoring conducted for the nearest receivers to the converter station (NV01). • Provide details of the noise frequency characteristics of key items of plant such as the transformers and valve coolers, and assessment of whether character adjustments are warranted. • Demonstrate that noise levels for the final design and equipment selections during typical operations (normal full-power operation during elevated temperatures, excluding emergency standby generators and overload conditions), when assessed in accordance with the procedures of the *Tasmanian Noise Measurements Procedures Manual*, Second Edition dated 2008, are predicted to comply with: - Day (Monday to Saturday 0700 – 1800 hrs) 45 dB $L_{Aeq,30\text{-}min}$ - Evening (Monday to Saturday 1800 – 2200 hrs, and 0700 – 2200 hrs on Sundays and public holidays) 40 dB $L_{Aeq,30\text{-}min}$ - Night (Monday to Sunday 2200 – 0700 hrs) 35 dB $L_{Aeq,30\text{-}min}$ • Demonstrate that noise levels for the final design and equipment selections during testing of the emergency standby generators, when assessed in accordance with the procedures of the Tasmanian Noise Measurements Procedures Manual, Second Edition dated 2008, are predicted to comply with a level of 55 dB $L_{Aeq,30\text{-}min}$ (testing to occur during the day on weekdays for a period of not more than one hour every three months). The design noise assessment report must be made available to EPA Tasmania on request.	Construction
NV05	**Prepare an operational noise management plan** As part of the Operation Environmental Management Plan, develop an operational noise management plan for the converter station in consultation with EPA Tasmania. The operational noise management plan must: • Document the noise mitigation and management measures developed in design (NV04) that apply to the operation and maintenance of the converter station. • Procedures for, and timing of, noise monitoring to be carried out to assess compliance with the applicable noise limits when the converter station commences operation.	Operation

ID	Management and mitigation measures	Project stage
	• Details and timing of noise compliance reporting to be submitted to EPA Tasmania. • Details of any maintenance and monitoring measures that are required to maintain ongoing compliance. • Procedures for routine operational testing of plant that is used solely for emergencies (e.g. regularity, days and times of testing). • Procedures to investigate noise complaints or suspected noise compliance issues. The operational noise management plan must be made available to EPA Tasmania on request. The operational noise management plan must be a sub plan to the Operation Environmental Management Plan and implemented during operation.	
NV06	**Prepare an operational noise compliance assessment report** Prepare an operational noise compliance assessment report based on: • An inspection of the converter station to confirm that the noise mitigation and management measures documented in the operational noise management plan (NV05) have been fully implemented. • The results of noise monitoring conducted in accordance with the operational noise management plan (NV05), to assess compliance with the applicable noise limits. The report must be submitted to EPA Tasmania within six months of each stage of the converter station becoming fully operational.	Operation

7.6 Summary of risks

The inherent and residual risks for construction and operational noise are summarised in Table 32.

Table 32: Risk assessment summary

Affected value	Potential risk of harm	Project phase	Initial risk assessment			Management and mitigation measures	Residual risk assessment		
			Consequence	Likelihood	Risk		Consequence	Likelihood	Risk
Ambient noise environment	Airborne noise generated by construction activities associated with the converter station during standard working hours impacting noise sensitive areas.	Construction	Moderate	Possible	Medium	NV02 - requirement for a CNVMP	Minor	Unlikely	Low
Ambient noise environment	Airborne noise generated by construction of the shore crossing involving night works over an extended period, affecting noise sensitive areas (including disturbance of sleep).	Construction	Moderate to major	Likely	High	NV02 - requirement for a CNVMP	Moderate	Possible	Medium
Ambient noise environment	Airborne noise generated by heavy construction vehicles using the public road network during standard working hours affecting noise sensitive areas.	Construction	Low	Possible	Low	NV02 - requirement for a CNVMP	Low	Possible	Low
Ambient vibration environment	Ground borne vibration generated by construction activities resulting in perceptible vibration in sensitive (habited) areas or building damage.	Construction	Low	Unlikely	Low	NV02 - requirement for a CNVMP	Low	Unlikely	Low

Affected value	Potential risk of harm	Project phase	Initial risk assessment			Management and mitigation measures	Residual risk assessment		
			Consequence	Likelihood	Risk		Consequence	Likelihood	Risk
Ambient noise environment	Airborne noise generated by operation of the converter station affecting noise sensitive areas	Operation	Minor to moderate	Possible	Medium	NV04 – requirement for a pre-construction noise assessment NV05 – requirement for an operational noise management plan NV06 – requirement for a post-construction operational noise compliance assessment	Minor	Possible	Medium

8.0 CONCLUSION

A technical noise and vibration assessment of the Tasmanian terrestrial component of the project has been completed for submission with the environmental impact statement for the project.

A risk-based assessment was used to evaluate noise and vibration impacts associated with construction and operation of the project. Risks are assessed by accounting for both their consequence and likelihood. The objective of the risk assessment was to determine appropriate risk controls in the form of management and mitigation measures for the project.

Construction of the project would broadly involve transitory noise and vibration generating activities. Off-site truck movements on public roads are also a relevant environmental noise consideration.

The primary source of operational noise associated with the project is the proposed converter station which would comprise indoor and outdoor plant including transformers and cooling systems.

Construction noise and vibration

In relation to the noise of construction activities during the proposed standard working hours, the assessment demonstrates that the risk rating is medium.

The main noise consideration for construction is work that needs to be conducted outside of the proposed standard working hours. In particular, the need for continuous horizontal directional drilling (HDD) works for the shore crossing to ensure the stability of the boreholes. HDD works are expected to occur continuously for a total period of up to 6 months. The assessment demonstrates that the risk of noise impacts from HDD works during the night is high.

Management and mitigation measures have been recommended to minimise the risk of construction noise and vibration as far as reasonably practical. The measures comprise:

- **NV01: Conduct additional background noise monitoring**

  A requirement to obtain additional background noise data which will then inform the development of controls under NV02.

- **NV02: Develop and implement a construction noise and vibration management plan**

  A requirement for a comprehensive plan which describes all measures that would be used to minimise the impact of construction noise and vibration as far as reasonably practical, based on updated information for the planned construction works and equipment selections.

- **NV03: Conduct construction noise monitoring**

  A requirement to conduct construction noise monitoring at locations specified in the construction noise and vibration management plan, and requirements concerning construction noise monitoring reports.

Provided that the management and mitigation measures are adhered to, and the CNVMP is fully implemented, the residual risk of noise impacts from construction during the proposed standard working hours and HDD shore crossing works conducted at night would be reduced to low and medium respectively.

In relation to construction vibration, the assessment considers potential effects in terms of both the potential for cosmetic building damage and disturbance of human comfort. Based on the separating distances to construction activities, vibration from construction activities is not a material consideration for the project.

In relation to off-site traffic movements associated with construction of the project, there are no specific criteria or policy requirements. However, a high level of assessment of potential noise level increases, considered in the context of criteria normally applied to long-term or permanent noise levels, supports that dedicated mitigation measures are not expected to be warranted for the control of off-site vehicle noise.

Operational noise

Operational noise levels from the converter station have been assessed on the basis of a concept design incorporating a range of noise controls to address site-specific constraints.

The assessment addresses all relevant Tasmanian legislative and policy requirements, including the *Environment Protection Policy (Noise) 2009* as referenced in the Tasmanian EIS Guidelines. Assessment criteria that the project would ultimately be designed and assessed against have been proposed. The proposed criteria are based on guidance sourced from the Victorian Noise Protocol and are more stringent than the reference levels sourced from Tasmanian legislation and guidelines. Separate criteria are proposed for typical operations and the testing periods for the emergency standby generator plant.

The predicted operational noise levels are well below the reference levels from Tasmanian policy and achieve the proposed assessment criteria at all receivers. However, in recognition of the extent of noise control measures required to achieve the design targets, and the requirement for measures to prevent noise characteristics which could attract penalties, the risk of operational noise impacts has been assessed as medium. Accordingly, management and mitigation measures to minimise the risk have been recommended and comprise:

- **NV01: Conduct additional background noise monitoring**

  A requirement to obtain additional background noise data which will inform the design noise assessment report (NV04) and operational noise management plan (NV05) for the converter station.

- **NV04: Prepare a design noise assessment report for the final converter station design**

  A requirement to prepare a detailed assessment and report, based on the final converter station design and equipment selections, demonstrating that the impact of operational noise would be minimised to the extent reasonably practical.

- **NV05: Prepare an operational noise management plan for the converter station site**

  A requirement to document all measures to be implemented and maintained to control operational noise, including noise monitoring requirements and procedures for investigating noise complaints and potential compliance issues.

- **NV06: Prepare an operational noise compliance assessment report**

  A requirement to prepare a report verifying that the measures documented in the operational noise management plan have been fully implemented and that operational noise levels comply with the applicable noise limits.

Adhering to the recommended management and mitigation measures reduces the consequence of the risk to minor. However, in recognition of the stringency of the design requirements, and the need for verification measures at the design and commissioning stages of the project, the residual impacts of operational noise remain medium.

The assessment findings indicate that environmental noise will be an important consideration to address for the construction and operational stages of the project. However, the risks of noise impacts can be reduced to acceptable levels by implementing suitable controls in accordance with the recommended management and mitigation measures.

APPENDIX A REFERENCES

Australian Standard AS 2436-2010 *Guide to noise and vibration control on construction, demolition and maintenance sites*

British Standard BS 5228-1:2009+A12014 *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise*

British Standard BS 6472-1:2008 *Guide to evaluation of human exposure to vibration in buildings*

British Standard BS 7385 Part 2-1993 *Evaluation and measurement for vibration in buildings* Part 2

Deutsche Institut fur Normung (German Institute for Standards) DIN 4150-3:2016-12 *Vibrations in buildings – Part 3: Effects on structures*

EPA Victoria Publication 1826.4 *Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues* published May 2021 (Victoria) (Noise Protocol)

Environmental Management and Pollution Control Act 1994 (Tas)

Environmental Management and Pollution Control (Noise) Regulations 2016 (Tas)

Environment Protection Policy (Noise) 2009 (Tas)

Noise Measurement Procedures Manual 2008 (Tas)

NSW government publication *Interim Construction Noise Guideline* dated July 2009

NSW Roads and Maritime Services publication *Construction Noise and Vibration Guideline* dated August 2016

World Health Organization (WHO) publication *Guidelines for Community Noise* dated 1999

APPENDIX B DESCRIPTION OF SOUND

Sound is an important feature of the environment in which we live; it provides information about our surroundings and influences our overall perception of amenity and environmental quality.

While sound is a familiar concept, its description can be complex. A glossary of terms and abbreviations is provided at the front of this report. This appendix provides general information about the definition of sound and the ways that different sound characteristics are described.

B1 Definition of sound

Sound is a term used to describe very small and rapid changes in the pressure of the atmosphere. Importantly, for pressure fluctuations to be considered sound, the rise and fall in pressure needs to be repeated at rates ranging from tens to thousands of times per second.

These small and repetitive fluctuations in pressure can be caused by many things such as a vibrating surface in contact with the air (e.g. the cone of a speaker) or turbulent air movement patterns. The common feature is a surface or region of disturbance that displaces the adjacent air, causing a very small and localised compression of the air, followed by a small expansion of the air.

These repeated compressions and expansions then spread into the surrounding air as waves of pressure changes. Upon reaching the ear of an observer, these waves of changing pressure cause structures within the ear to vibrate; these vibrations then generate signals which can be perceived as sounds.

The waves of pressure changes usually occur as complex patterns, comprising varied rates and magnitudes of pressure changes. The pattern of these changes will determine how a sound spreads through the air and how the sound is ultimately perceived when it reaches the ear of an observer.

B2 Physical description of sound

There are many situations where it can be useful to objectively describe sound, such as the writing or recording of music, hearing testing, measuring the sound environment in an area, or evaluating new man-made sources of sound.

Sound is usually composed of complex and varied patterns of pressure changes. As a result, several attributes are used to describe sound. Two of the most fundamental sound attributes are:

- sound pressure; and
- sound frequency.

Each of these attributes is explained in the following sections, followed by a discussion about how each of these attributes varies.

B2.1 Sound pressure

The compression and expansion of the air that is associated with the passage of a sound wave results in changes in atmospheric pressure. The pressure changes associated with sound represent very small and repetitive variations that occur amidst much greater pressures associated with the atmosphere.

The magnitude of these pressure changes influences how quiet or loud a sound will be; the smaller the pressure change, the quieter the sound, and vice versa. The perception of loudness is complex though, and different sounds can seem quieter or louder for reasons other than differences in pressure changes.

To provide some context, Table 33 lists example values of pressure associated with the atmosphere and different sounds. The key point from these example values is that even an extremely loud sound equates to a change in pressure that is thousands of times smaller than the typical pressure of the atmosphere.

Table 33: Atmospheric pressure versus sound pressure – example values of pressure

Example	Pascals (Pa)	Bars	Pounds per Square Inch (PSI)
Atmospheric pressure	100,000	1	14.5
Pressure change due to weather front	10,000	0.1	1.5
Pressure change associated with sound at the threshold of pain	20	0.0002	0.003
Pressure change associated with sound at the threshold of hearing	0.00002	0.0000000002	0.000000003

The pressure values in Table 33 also show that the range of pressure changes associated with quiet and loud sounds span over a very large range, albeit still very small changes compared to atmospheric pressure. To make the description of pressure changes more practical, sound pressure is expressed in decibels or dB.

To illustrate the pressure variation associated with sound, Figure 18 shows the repetitive rise and fall in pressure of a very simple and steady sound. This figure illustrates the peaks and troughs of pressure changes relative to the underlying pressure of the atmosphere in the absence of sound. The magnitude of the change in pressure caused by the sound is then described as the sound pressure level. Since the magnitude of the change is constantly varying, the sound pressure may be defined in terms of:

- Peak sound pressure levels: the maximum change in pressure relative to atmospheric pressure i.e. the amplitude as defined by the maximum depth or height of the peaks and troughs respectively; or
- Root Mean Square (RMS) sound pressure levels: the average of the amplitude of pressure changes, accounting for positive changes above atmospheric pressure, and negative pressure changes below atmospheric pressure.

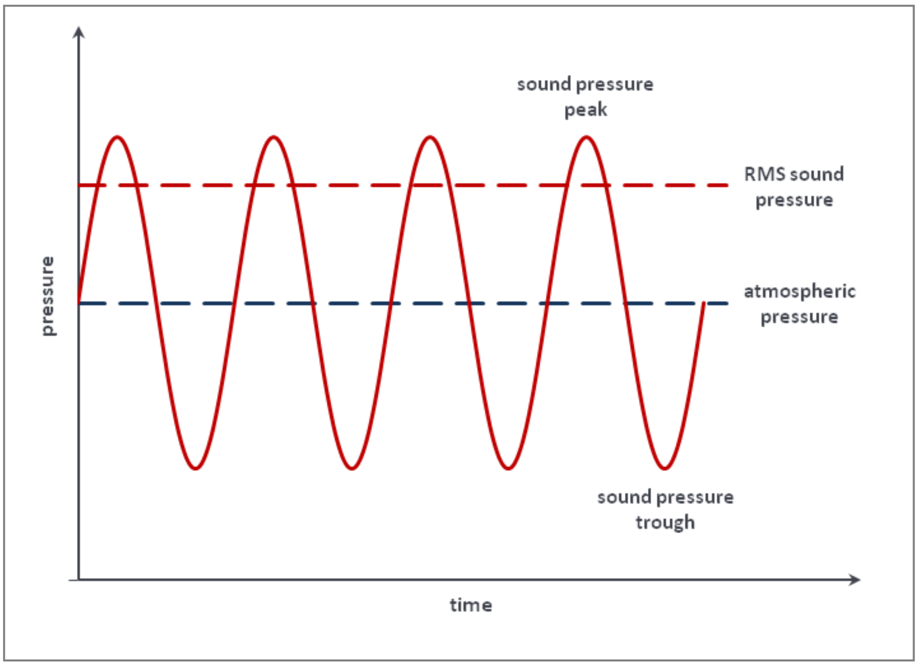


Figure 18: Pressure changes relative to atmospheric pressure associated with sound

B2.2 Frequency

Frequency is a term used to describe the number of times a sound causes the pressure to rise and fall in a given period. The rate of change in pressure is an important feature that determines whether it can be perceived as a sound by the human ear.

Repetitive changes in pressure can occur as a result of a range of factors with widely varying rates of fluctuation. However, only a portion of these fluctuations can be perceived as sound. In many cases, the rate of fluctuation will either be too slow or too fast for the human ear to detect the pressure change as a sound. For example, local fluctuations in atmospheric pressure can be created by someone waving their hands back and forth through the air; the reason this cannot be perceived as a sound is the rate of fluctuation is too slow.

At the rates of fluctuation that can be detected as sound, the rate will influence the character of the sound that is perceived. For example, slow rates of pressure change correspond to rumbling sounds, while fast rates correspond to whistling sounds.

The rate of fluctuation is numerically described in terms of the number of pressure fluctuations that occur in a single second. Specifically, it is the number of cycles per second of the pressure rising above, falling below, and then returning to atmospheric pressure. The number of these cycles per second is expressed in Hertz (Hz). This concept of cycles per second is illustrated in Figure 19 which illustrates a 1 Hz pressure fluctuation. The figure provides a simple illustration of a single cycle of pressure rise and fall occurring in a period of a single second.

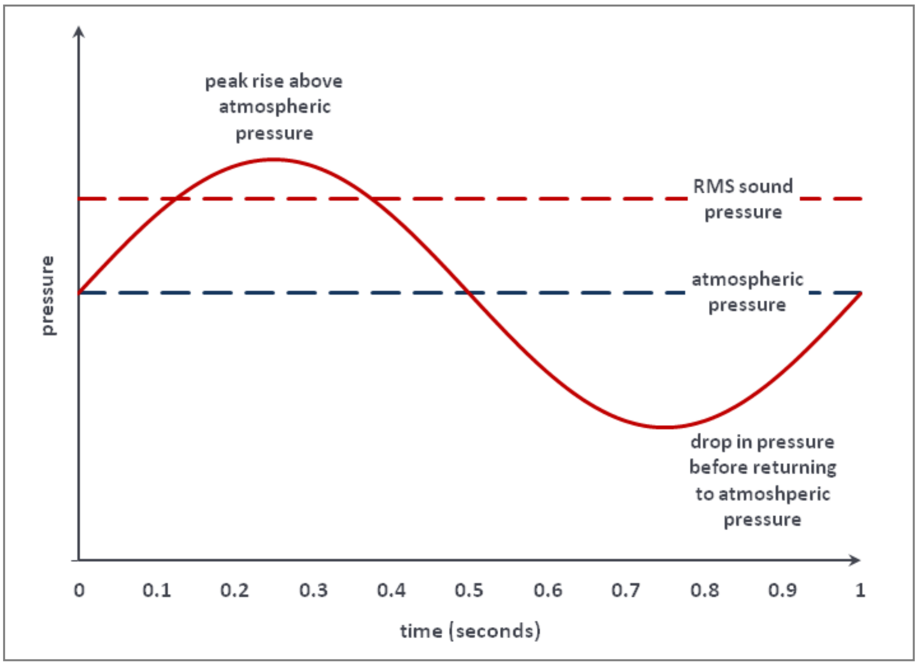
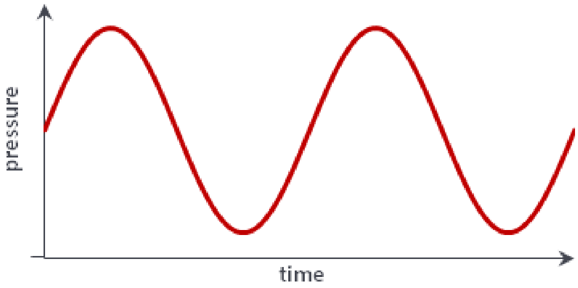


Figure 19: Illustration of a pressure fluctuation with a frequency of 1Hz

The rate that sound pressure rises and falls will vary depending on the source of the sound. For example, the surface of a tuning fork vibrates at a specific rate, in turn causing the pressure of the adjacent air to fluctuate at the same rate. Recalling the idea of pressure fluctuations from someone waving their hands, the pressure would fluctuate at the same rate as the hands move back and forth; a few times a second translating to a very low frequency below our hearing range (termed an infrasonic frequency). Examples of low and high frequency sound are easily recognisable, such as the low frequency sound of thunder, and the high frequency sound of crashing cymbals. To demonstrate the differences in the patterns of different frequencies of sound, Figure 20 illustrates the relative rates of pressure change for low, mid and high frequency sounds. Note that in each case the amplitude of the pressure changes remains the same; the only change is the number of fluctuations in pressure that occur over time.

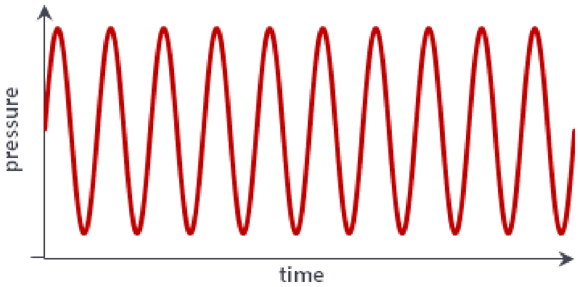
Low frequency sounds:

20 to 200 Hz



Mid-frequency sounds:

200 to 800 Hz



High frequency sounds:

greater than 800 Hz

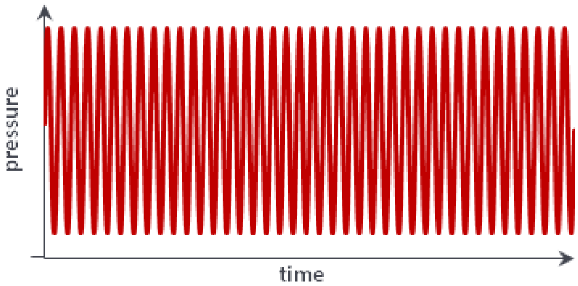


Figure 20: Examples of the rate of change in pressure fluctuations for low, mid and high frequencies

B2.3 Sound pressure and frequency variations

The preceding sections describe important aspects of the nature of sound, the changes in pressure and the changes in the rate of pressure fluctuations.

The simplest type of sound comprises a single constant sound pressure level and a single constant frequency. However, most sounds are made up of many frequencies, and may include low, mid and high frequencies. Sounds that are made up of a relatively even mix of frequencies across a broad range of frequencies are referred to as being 'broad band'. Common examples of broad band sounds include flowing water, the rustling of leaves, ventilation fans and traffic noise.

Further, sound quite often changes from moment to moment, in terms of both pressure levels and frequencies. The time varying characteristics of sound are important to how we perceive sound. For example, rapid changes in sound level produced by voices provide the component of sound that we interpret as intelligible speech. Variations in sound pressure levels and frequencies are also features which can draw our attention to a new source of sound in the environment.

To demonstrate this, Figure 21 illustrates an example time-trace of total sound pressure levels which varies with time. This variation presents challenges when attempting to describe sound pressure levels. As a result, multiple metrics are generally needed to describe sound pressure, such as the average, minimum or maximum noise levels. Other ways of describing sound include statistics for describing how often a defined sound pressure level is exceeded; for example, typical upper sound levels are often described as an L_{10} which refers to the sound pressure exceeded for 10% of the time, or typical lower levels or lulls which are often described as an L_{90} which refers to the sound exceeded for 90% of the time.

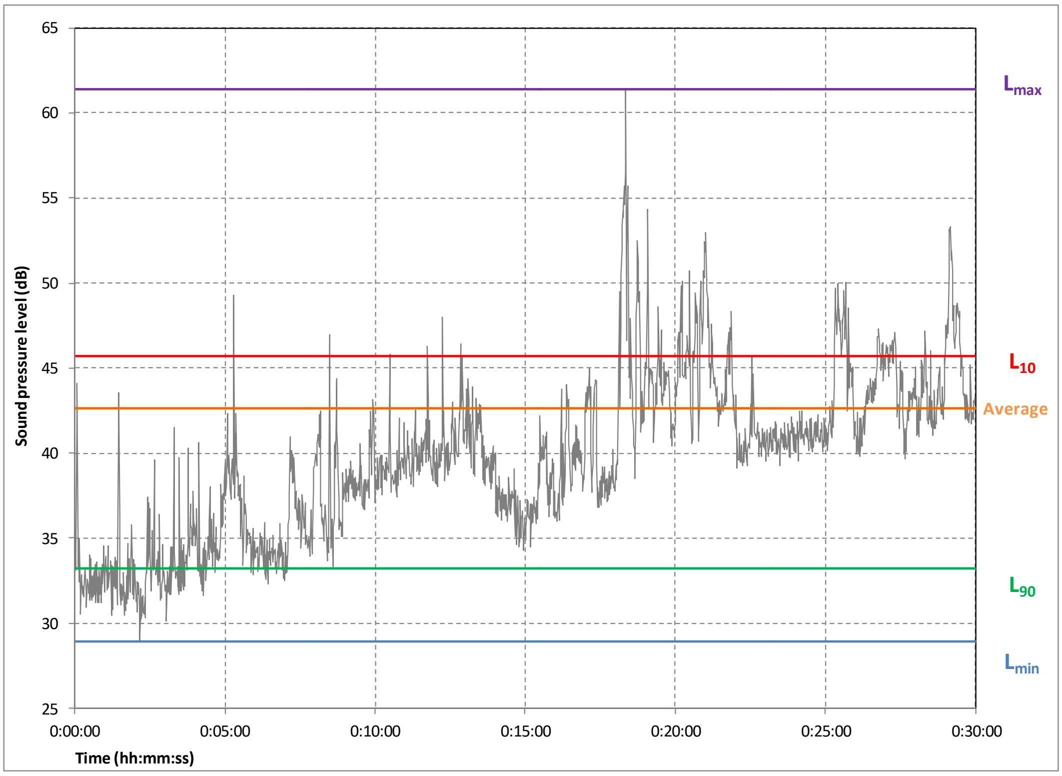


Figure 21: Example of noise metrics that may be used to measure a time-varying sound level

This example illustrates variations in terms of just total sound pressure levels, but the variations can also relate to the frequency of the sound, and frequently the number of sources affecting the sound.

These types of variations are an inherent feature of most sound fields and are an important point of context in any attempt to describe sound.

B3 Hearing and perception of sound

This section provides a discussion of:

- the use of the decibel to practically describe sound levels in a way that corresponds to the pressure levels the human ear can detect as sounds
- the relationship between sound frequency and human hearing.

The section concludes with a discussion of some of the complicating non-acoustic factors that influence our perception of sound.

B3.1 Sound pressure and the decibel

Previous sections discussed the wide range of small pressure fluctuations that the ear can detect as sound. Owing to the wide range of these fluctuations, the way we hear sound is more practically described using the decibel (dB). The decibel system serves two key purposes:

- Compressing the numerical range of the quietest and loudest sounds commonly experienced.

  As an indication of this benefit, the pressure of the loudest sound that might be encountered is around a million times greater than the quietest sound that can be detected. In contrast, the decibel system reduces this to a range of approximately 0-120 dB.

- Consistently representing sound pressure level changes in a way that correlate more closely with how we perceive sound pressure level changes.

  For example, a 10 dB change from 20-30 dB will generally be subjectively like a 10 dB change from 40-50 dB. However, expressed in units of pressure as Pascals, the 40-50 dB change is ten times greater than the 20-30 dB change. For this reason, sound pressure changes cannot be meaningfully communicated in terms of units of pressure such as Pascals.

Sound pressure levels in most environments are highly variable, so it can be misleading to describe what different ranges of sound pressure levels correspond to. However, as a broad indication, Table 34 provides some example ranges of sound pressure levels, expressed in both dB and units of pressure.

Table 34: Example sound pressure levels that might be experienced in different environments

Environment	Example Sound Pressure Level	
Outside in an urban area with traffic noise	50-70 dB	0.006-0.06 Pa
Outside in a rural area with distant sounds or moderate wind rustling leaves	30-50 dB	0.0006-0.006 Pa
Outside in a quiet rural environment in calm conditions	20-30 dB	0.0002-0.0006 Pa
Inside a quiet bedroom at night	<20 dB	0.0002 Pa

The impression of how much louder or quieter a sound is will be influenced by the magnitude of the change in sound pressure. Other important factors will also influence this, such as the frequency of the sound which is discussed in the following section. However, to provide a broad indication, Table 35 provides some examples of how changes in sound pressure levels, for a sound with the same character, can be perceived.

Table 35: Perceived changes in sound pressure levels

Sound pressure level change	Indicative change in perceived sound
1 dB	Unlikely to be noticeable
2-3 dB	Likely to be just noticeable
4-5 dB	Clearly noticeable change
10 dB	Distinct change – often subjectively described as halving or doubling the loudness

The example sound pressure level changes in Table 35 are based on a side-by-side comparison of a steady sample of sound heard at different levels. In practice, changes in sound pressure levels may be more difficult to perceive for a range of reasons, including the presence of other sources of sound, or gradual changes which occur over a longer period.

B3.2 Sound frequency and loudness

Although sound pressure level and the sensation of loudness are related, the sound pressure level is not a direct measure of how loud a sound appears to humans. Human perception of sound varies and depends on a number of physical attributes, including frequency, level and duration.

An example of the relationship between the sensation of loudness and frequency is demonstrated in Figure 22. The chart presents equal loudness curves for sounds of different frequencies expressed in 'phons'. Each point on the phon curve represents a sound of equal loudness. For example, the 40 phon curve shows that a sound level of 100 dB at 20 Hz (a very low frequency sound) would be of equal loudness to a level of 40 dB at 1,000 Hz (a whistling sound) or approximately 50 dB at just under 8,000 Hz (a very high pitch sound). The information presented is based on an international standard[6] that defines equal loudness levels for sounds comprising individual frequencies. In practice, sound is usually composed of many different frequencies, so this type of data can only be used as an indication of how different frequencies of sound may be perceived. An individual's perceptions of sound can also vary significantly. For example, the lower dashed line in Figure 22 shows the threshold of hearing, which represents the sounds an average listener could correctly identify at least 50% of the time. However, these thresholds represent the average of the population. In practice, an individual's hearing threshold can vary significantly from these values, particularly at the low frequencies.

[6] ISO 226:2003 *Acoustics - Normal equal-loudness-level contours*, 2003

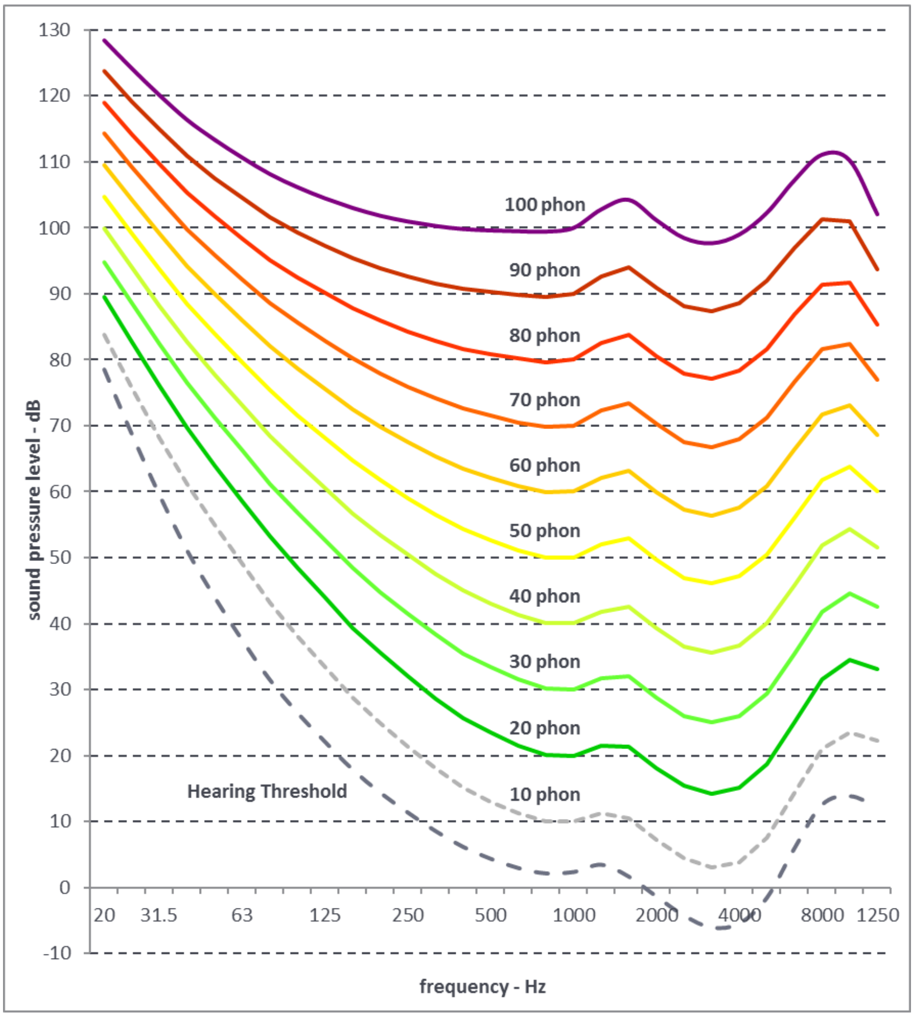


Figure 22: Equal loudness contours for pure tone sounds

The noise curves in Figure 22 demonstrate that human hearing is most sensitive at frequencies from 500 to 4000 Hz, which usefully corresponds to the main frequencies of human speech. The contours also demonstrate that sounds at low frequencies must be at much higher sound pressure levels to be judged equally loud as sounds at mid to high frequencies.

To account for the sensitivity of the ear to different frequencies, a set of adjustments were developed to enable sound levels to be measured in a way that more closely aligns with human hearing. Sound levels adjusted in this way are referred to as A-weighted sound levels.

B3.3 Interpretation of sound and noise

Human interpretation of sound is influenced by many factors other than its physical characteristics, such as how often the sound occurs, the time of day it occurs and a person's attitude towards the source of the sound.

For example, the sound of music can cause very different reactions, from relaxation and pleasure through to annoyance and stress, depending on individual preferences, the type of music and the circumstances in which the music is heard. This example illustrates how sound can sometimes be considered noise – a term broadly used to describe unwanted sounds or sounds that have the potential to cause negative reactions.

The effects of excess environmental sound are varied and complicated, and may be perceived in various ways including sensations of loudness, interference with speech communication, interference with working concentration or studying, disruption of resting/leisure periods, and disturbance of sleep. These effects can give rise to behavioural changes such as avoiding the use of exposed external spaces, keeping windows closed, or timing restful activities to avoid the most intense periods of disruption. Prolonged annoyance or interference with normal patterns can lead to possible effects on mental and physical health. In this respect, the World Health Organization (preamble to the *Constitution of the World Health Organization*, 1946) defines health in the following broad terms:

> *A state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*

The World Health Organization Guidelines for Community Noise (Berglund, Lindvall and Schwela, 1999) documents a relationship between the definition of health and the effects of community noise exposure by noting that:

> *This broad definition of health embraces the concept of well-being, and thereby, renders noise impacts such as population annoyance, interference with communication, and impaired task performance as 'health' issues.*

The reaction that a community has to sound is highly subjective and depends on a range of factors including:

- The hearing threshold of individuals across the audible frequency range. These thresholds vary widely across the population, particularly at the lower and upper ends of the audible frequency range. For example, at low frequencies the distribution of hearing thresholds varies above and below the mean threshold by more than 10 dB.
- The attitudes and sensitivities of individuals to sound, and their expectations of what is considered an acceptable level of sound or intrusion. This in turn depends on a range of factors such as general health and the perceived importance of sound amongst other factors relevant to overall amenity perception.
- The absolute sound pressure level of the sound in question. The threshold for the onset of community annoyance varies according to the type of sound; above such thresholds, the percentage of the population annoyed generally increases with increasing sound pressure level.
- The sound pressure level of the noise relative to background noise conditions in the area, and the extent to which general background noise may offer beneficial masking effects.
- The characteristics of the sound in question such as whether the sound is constant, continually varies, or contains distinctive audible features such as tones, low frequency components or impulsive sound which may draw attention to the noise.
- The site location and the compatibility of the source in question with other surrounding land uses. For example, whether the source is in an industrial or residential area.

- The attitudes of the community to the source of the sound. This may be influenced by factors such as the extent to which those responsible for the sound are perceived to be adopting reasonable and practicable measures to reduce their emissions, whether the activity is of local or national significance and whether the noise producer actively consults and/or liaises with the community.
- The times when the sound is present, the duration of exposure to increased sound levels, and the extent of respite periods when the sound is reduced or absent (for example, whether the sound ceases at weekends).

The combined influence of the above considerations means that physical sound levels are only one factor influencing community reaction to sound. Importantly, this means that individual reactions and attitudes to the same type and level of sound will vary within a community.

APPENDIX C BACKGROUND NOISE SURVEY

This appendix presents details of the background noise monitoring conducted between Friday, 6 May and Wednesday, 25 May 2022, at a selection of sites in the vicinity of the project, including:

- monitoring equipment locations and installation photos
- tabular measured background noise levels for each location
- a time history of the measured background and ambient noise levels for each location.

All noise monitoring was undertaken using Class 1 sound level meters (highest class rating for environmental noise surveys). Instrument calibration conformed with the requirements of AS 1055:2018 *Acoustics – Description and measurement of environmental noise* (independent laboratory calibration and reference level checks during deployment and retrieval of the instrumentation).

The measured background noise levels for each location were analysed in accordance with the Tasmanian Noise Measurements Procedures Manual, Second Edition dated 2008 (the Tasmanian noise measurement manual). This involved collating noise and weather measurement data for each 10-minute period of the survey and producing:

1. A derived background noise level for each period (i.e. day, evening and night) of each day

   This process involves screening the data to exclude any 10-minute periods in which rainfall was measured or average wind speeds greater than 5 m/s were recorded, and determining the 10th percentile of the screened $L_{A90,10min}$ values for each period i.e. the quietest 10% of the 10-minute background values, which in turn represent the quietest 10% of each 10-minute sample.

2. An aggregated single figure value to represent each period

   This process involved aggregating the period values for each day to determine the minimum, mean and median values; the median being the value specified by the Tasmanian noise measurement manual to derive a representative single value for each period.

In deriving the aggregated median background noise level value of all periods, a sensitivity analysis was conducted to gauge the potential effect of weather related data exclusions. Specifically, the median background noise level was calculated with and without certain periods included, according to the amount of 10-minute measurement samples excluded on account of weather (i.e. calculation of the median background noise level value for periods containing different minimum percentages of retained data). The review indicated the derived median was relatively insensitive to the exclusion of periods in which a greater portion of 10-minute data was screened; the variation was typically 1 dB or less and there was no clear pattern of higher median noise levels with or without the removal of periods where part of the period was affected by weather. Accordingly, the median background noise values were derived from the available periods for all days (i.e. including those periods when a portion of the 10-minute background noise levels needed to be removed). However, for reference, the periods in which more than 20% of the 10-minute periods were excluded as a result of rain and/or wind are designated by grey shading.

The above processes relate to the background noise levels, dB L_{A90}, used to quantify the quietest periods at a location; this is commonly used to gauge the potential for new noise sources to be intrusive on the existing noise environment. The total ambient noise environment, often measured by the average (equivalent) noise over the same period, is typically around 5 dB higher (note that this equivalent noise level includes all sounds present at the locations, and is distinct from the mean or median background noise values). The ambient noise levels are illustrated on the measurement time history charts for each location.

C1 Background noise monitoring locations

Table 36: Monitoring equipment and locations

Site	Location	Equipment	Easting	Northing	Weather station
1	Proposed Heybridge converter station site	Cube 11276	413958	5452418	No
2	Heybridge Residential Nature Reserve development site	Cube 10521	413273	5452373	No

Wind and rainfall were assessed based on a combination of data from publicly available data from the Bureau of Meteorology monitoring station at Burnie and weather stations deployed in the area as part of a separate survey being undertaken for the Remaining NWTD project.

Figure 23: Equipment set-up – Site 1 – proposed Heybridge converter station site

Figure 24: Equipment set-up – Site 2 – Heybridge residential development site

C2 Measured background noise levels – Site 1 – converter station site

The measured background noise levels at site 1, analysed in accordance with the Tasmanian noise measurement manual, are summarised in Table 37. Periods in which more than 20% of the 10-minute periods were excluded as a result of rain and/or wind are designated by grey shading.

As a result of an interruption of the power supply to the monitoring equipment at this location, the equipment ceased monitoring from 20 May onwards.

The time history of noise levels and periods of inclement weather (i.e. excluded periods) for site 4a is shown on the following page in Figure 25, and also presents the ambient (L_{Aeq}) and maximum (L_{Amax}) noise levels.

Table 37: Site 1 – proposed Heybridge converter station site – background noise levels , dB L_{A90}

Date	Day	Evening	Night
05/05/2022 - Thursday	-	-	26
06/05/2022 - Friday	43	34	32
07/05/2022 - Saturday	42	37	32
08/05/2022 - Sunday	35	-	28
09/05/2022 - Monday	42	29	26
10/05/2022 - Tuesday	42	36	34
11/05/2022 - Wednesday	44	-	-
12/05/2022 - Thursday	44	34	32
13/05/2022 - Friday	42	35	-
14/05/2022 - Saturday	-	38	36
15/05/2022 - Sunday	38	42	39
16/05/2022 - Monday	44	38	37
17/05/2022 - Tuesday	46	38	37
18/05/2022 - Wednesday	46	37	32
19/05/2022 - Thursday	42	35	27
20/05/2022 - Friday	-	-	-
21/05/2022 - Saturday	-	-	-
22/05/2022 - Sunday	-	-	-
23/05/2022 - Monday	-	-	-
24/05/2022 - Tuesday	-	-	-
Minimum	**35**	**29**	**26**
Average	**42**	**36**	**32**
Median	**42**	**36**	**32**

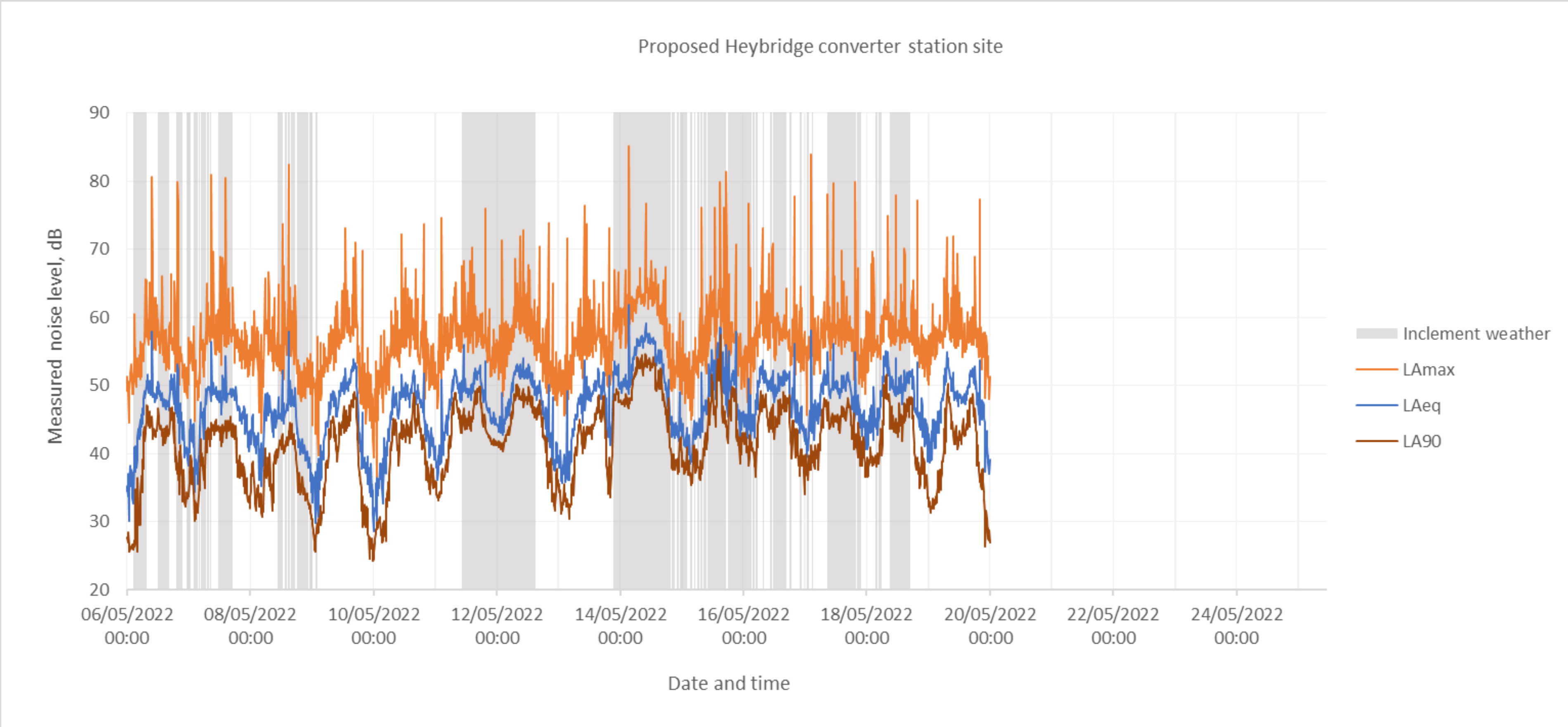


Figure 25: Site 1 – proposed Heybridge converter station site

C3 Measured noise levels – Site 2 – Heybridge Residential Reserve development site

The measured background noise levels at site 2, analysed in accordance with the Tasmanian noise measurement manual, are summarised in Table 38. Periods in which more than 20% of the 10-minute periods were excluded as a result of rain and/or wind are designated by grey shading.

The time history of noise levels and periods of inclement weather (i.e. excluded periods) for site 4b is shown on the following page in Figure 26, and also presents the ambient (L_{Aeq}) and maximum (L_{Amax}) noise levels.

Table 38: Site 2 – Heybridge Residential Nature Reserve development site – background noise levels , dB L_{A90}

Date	Day	Evening	Night
05/05/2022 - Thursday	-	-	36
06/05/2022 - Friday	38	31	30
07/05/2022 - Saturday	36	31	26
08/05/2022 - Sunday	36	-	32
09/05/2022 - Monday	35	33	27
10/05/2022 - Tuesday	38	35	33
11/05/2022 - Wednesday	42	-	-
12/05/2022 - Thursday	42	38	36
13/05/2022 - Friday	38	37	-
14/05/2022 - Saturday	-	41	34
15/05/2022 - Sunday	36	42	40
16/05/2022 - Monday	42	36	37
17/05/2022 - Tuesday	42	39	38
18/05/2022 - Wednesday	39	31	32
19/05/2022 - Thursday	37	34	37
20/05/2022 - Friday	39	38	31
21/05/2022 - Saturday	36	32	24
22/05/2022 - Sunday	35	30	29
23/05/2022 - Monday	38	34	30
24/05/2022 - Tuesday	39	37	33
Minimum	**35**	**30**	**24**
Average	**38**	**35**	**32**
Median	**38**	**35**	**32**

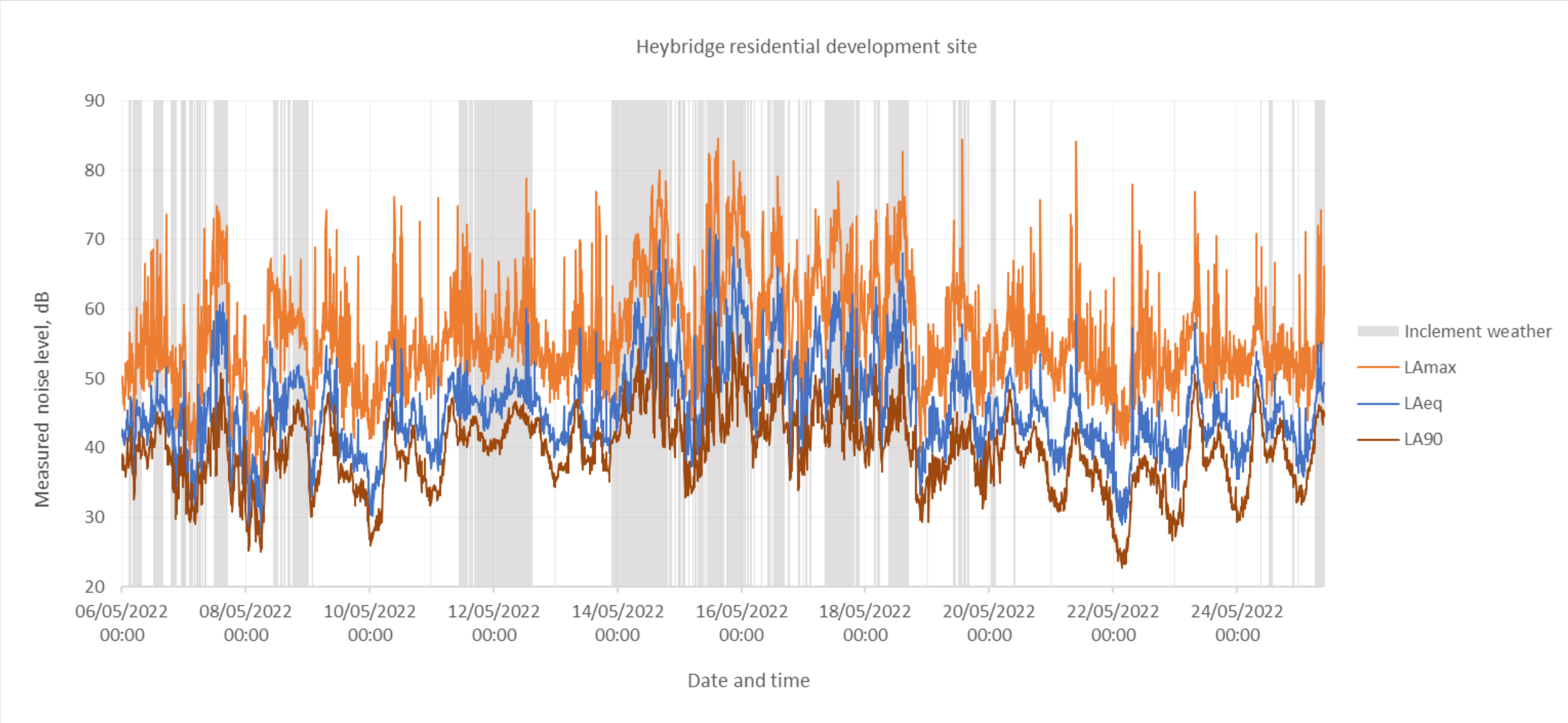


Figure 26: Site 2 – Heybridge Residential Nature Reserve development site

APPENDIX D CONVERTER STATION SOUND POWER LEVELS

The noise emission data provided by MLPL for the assessment are reproduced in Table 39.

Noise emission data was not available for the converter modules and valves that would be housed in the two valve halls. However, the converter modules and valves are understood to be low noise emission plant items that are not expected to materially contribute to environmental noise levels associated with the converter station.

Table 39: Sound power levels, dB L_{WA}
(note: all data including spectrum values are A-weighted)

Source name	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	Total
AHU – valve hall	67	74	76	80	80	77	73	85
AHU – AC/DC yard	68	75	77	80	81	78	74	86
Auxiliary Transformer 1	57	59	65	63	61	59	57	70
Auxiliary Transformer 2	57	59	65	63	61	59	57	70
Auxiliary Transformer 3	57	59	65	63	61	59	57	70
Converter Transformer 1	53	82	71	64	58	57	44	82
Converter Transformer 2	51	80	69	62	56	55	42	80
Converter Transformer 3	49	78	67	60	54	53	40	78
Converter Transformer 4	53	82	71	64	58	57	44	82
Converter Transformer 5	51	80	69	62	56	55	42	80
Converter Transformer 6	49	78	67	60	54	53	40	78
DC Reactor 1	-	59	71	77	55	37	21	78
DC Reactor 2	-	59	71	77	55	37	21	78
DC Reactor 3	-	59	71	77	55	37	21	78
DC Reactor 4	-	59	71	77	55	37	21	78
Transformer Cooler 1	64	66	73	76	66	64	63	80
Transformer Cooler 2	64	66	73	76	66	64	63	80
Transformer Cooler 3	64	66	73	76	66	64	63	80
Transformer Cooler 4	64	66	73	76	66	64	63	80
Transformer Cooler 5	64	66	73	76	66	64	63	80
Transformer Cooler 6	64	66	73	76	66	64	63	80
Valve Cooler 1 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 2 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 3 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 4 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 5 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 6 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 7 – day/evening	74	82	84	76	72	68	67	87

Source name	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	Total
Valve Cooler 8 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 9 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 10 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 11 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 12 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 13 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 14 – day/evening	74	82	84	76	72	68	67	87
Valve Cooler 1 – night	66	74	76	68	64	60	59	79
Valve Cooler 2 – night	66	74	76	68	64	60	59	79
Valve Cooler 3 – night	66	74	76	68	64	60	59	79
Valve Cooler 4 – night	66	74	76	68	64	60	59	79
Valve Cooler 5 – night	66	74	76	68	64	60	59	79
Valve Cooler 6 – night	66	74	76	68	64	60	59	79
Valve Cooler 7 – night	66	74	76	68	64	60	59	79
Valve Cooler 8 – night	66	74	76	68	64	60	59	79
Valve Cooler 9 – night	66	74	76	68	64	60	59	79
Valve Cooler 10 – night	66	74	76	68	64	60	59	79
Valve Cooler 11 – night	66	74	76	68	64	60	59	79
Valve Cooler 12 – night	66	74	76	68	64	60	59	79
Valve Cooler 13 – night	66	74	76	68	64	60	59	79
Valve Cooler 14 – night	66	74	76	68	64	60	59	79
Valve Reactor 1	n/a	66	78	84	62	44	28	85
Valve Reactor 2	n/a	66	78	84	62	44	28	85
Valve Reactor 3	n/a	66	78	84	62	44	28	85
Valve Reactor 4	n/a	66	78	84	62	44	28	85
Valve Reactor 5	n/a	66	78	84	62	44	28	85
Valve Reactor 6	n/a	66	78	84	62	44	28	85
Valve Reactor 7	n/a	66	78	84	62	44	28	85
Valve Reactor 8	n/a	66	78	84	62	44	28	85
Valve Reactor 9	n/a	66	78	84	62	44	28	85
Valve Reactor 10	n/a	66	78	84	62	44	28	85
Valve Reactor 11	n/a	66	78	84	62	44	28	85
Valve Reactor 12	n/a	66	78	84	62	44	28	85

APPENDIX E CONVERTER STATION BUILDING UPGRADES

E1 AC Phase Reactor Hall and AC Filter Building – wall and roof

The noise modelling for these elements of the converter station account for example building fabric upgrades comprising tilt-up concrete walls and a proprietary acoustically-rated roof system (comprising a metal deck upper, insulated void and solid ceiling system).

The sound transmission loss values for these elements are summarised in Table 40.

Table 40: Upgraded wall and roof – sound transmission loss values, dB

Element	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Wall – tilt-up concrete	39	42	40	43	51	58	63
Roof – proprietary system	17	23	39	49	57	62	72

E2 AC Phase Reactor Hall – acoustic louvre

The noise modelling of the ventilation openings for the AC Phase Reactor Hall includes 300 mm acoustic louvres providing the insertion loss values detailed in Table 41.

Table 41: Acoustic louvre insertion loss values, dB

Element	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz
Acoustic louvre	4	7	9	13	14	12	12

Appendix E. Surface Water Impact Assessment

Marinus Link – Tasmania Surface Water Impact Assessment

FINAL

21 November 2024

alluvium

Alluvium recognises and acknowledges the unique relationship and deep connection to Country shared by Aboriginal and Torres Strait Islander people, as First Peoples and Traditional Owners of Australia. We pay our respects to their Cultures, Country and Elders past and present.

Artwork by Vicki Golding. This piece was commissioned by Alluvium and has told our story of water across Country, from catchment to coast, with people from all cultures learning, understanding, sharing stories, walking to and talking at the meeting places as one nation.

This report has been prepared by Alluvium Consulting Australia Pty Ltd for **Tetra Tech Coffey** under the contract titled '**Marinus Link Crossing Assessment**'.

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Abbreviations

AEP	Annual Exceedance Probability
ANZG	Australian and New Zealand Governments
ARR	Australian Rainfall and Runoff
CIA	Cumulative Impacts Assessment
cm	Centimetres
CMA	Catchment Management Authority
DCCEEW	Commonwealth Government Department of Climate Change, Energy, the Environment and Water
DELWP	Department of Environment, Land, Water and Planning (Vic)
DEM	Digital Elevation Model
DEP	Derwent Estuary Program
DGV	Default Guideline Values
DNRET	Department of Natural Resources and Environment Tasmania
DPIWE	Tasmanian Department of Primary Industries, Water and Environment
D50	Mean rock size for which 50% of rocks are smaller
EE Act	*Environment Effects Act 1978 (Vic)*
EES	Environmental Effects Statement
EIS	Environmental Impact Statement
EMPCA	*Environmental Management and Pollution Control Act 1994 (Tas)*
EPA	Environment Protection Authority (Tasmania)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999 (Cwth)*
ERS	Environmental Reference Standard
GIS	Gas insulated switchgear
GIS	Geographic Information System
HDD	Horizontal direction drilling
HDPE	High density polyethylene
HVAC	High voltage alternating current
HVDC	High voltage direct current
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
ISC	Index of Stream Condition
km	Kilometres
km^2	Square kilometres
kV	Kilovolt
kVA	Kilo-Volt-Amperes
L	Litre
LGAT	Local Government Association Tasmania
LiDAR	Light Detection and Ranging
LIST	Land Information System Tasmania
LUPAA	*Land Use Planning and Approvals Act 1993*
m	Metres
m^2	Square metres
mm	Millimetres
MERI	Monitoring, Evaluation, Reporting and Improvement
mg	Milligrams
MLPL	Marinus Link Pty Ltd
MNES	Matters of national environmental significance
MW	Megawatt
N	Newtons
NEM	National Electricity Market
NTU	Nephelometric Turbidity Units
NWQMS	National Water Quality Management Strategy
NWTD	North West Transmission Developments
pH	Potential of hydrogen
PEV	Protected environmental values
RCP	Representative Concentration Pathway
RMPS	Resource Management and Planning System
SEPP	State Environment Protection Policies
SPWQM	State Policy on Water Quality Management
TCM	Trenchless Construction Method

TPS	Tasmanian Planning Scheme
VSC	Voltage source converter
W	Watts
WQG	Water Quality Guidelines
WQO	Water Quality Objectives
WSUD	Water sensitive urban design
XLPE	Cross-linked
4WD	Four-wheel drive
µg	Microgram
µS	Micro siemens
°C	Degrees Celsius
%	Percent

Glossary

AEP	Annual Exceedance Probability- The probability that a given flow event will be exceeded in any one year
Aggradation	The deposition of material by a river, stream or current.
Confined	The channel abuts the valley margin along more than 90% of its length and occasional floodplain pockets occur on the inside of bends (discontinuous).
Deposition	Process of sediment being 'dropped' or deposited, generally due to a reduction in transport capacity.
Erosion (fluvial)	Detachment/removal of material on river beds and banks through fluvial (river) processes (e.g. flow conditions)
Floodplain	A relatively flat area, adjacent to a waterway that is likely to be inundated under a maximum flood.
Fluvial	Pertaining to water flow and rivers
Geomorphology (fluvial)	The physical form of the bed and banks of a waterway, including habitat features and physical processes (erosion and deposition)
Hydraulic modelling	Computer models that calculate water flow characteristics (velocity, depth, etc.) using information on channel and floodplain geometry, stream slope, land cover/vegetation, man-made factors (bridges, levees, culverts) and different flow (hydrologic) conditions.
Hydrologic modelling	Computer models designed to estimate the amount of runoff or streamflow generated by individual rainfall (or other precipitation) events or by a combination of various rainfall events over a catchment. These models consider different land cover, soil types and topography.
Hyetograph	A graphical representation of the distribution of rainfall intensity over time.
Incision	A process of channel deepening and widening.
Levees	A natural or human made earthen bank that restricts flooding.
LiDAR	Light Detection and Ranging, a remote sensing method that uses light in the form of a pulsed laser to measure distances to the Earth.
Manning's n	A roughness coefficient used in Manning's equation to represent the resistance to flow in channels and floodplains
Riparian zone	Any land which adjoins, directly influences, or is influenced by a body of water.
Scour	A form of bank erosion caused by sediment being removed from stream banks particle by particle. Scour occurs when the force applied to a bank by flowing water exceeds the resistance of the bank surface to withstand those forces.
Shear stress	The external force acting on an object or surface parallel to the slope or plane in which it lies; the stress tending to produce shear. Measured in Newtons per square metre (N/m^2).
tioxide	Titanium dioxide, a white pigment used mainly in paint.
Topography	The form and features of land surfaces

Executive summary

Marinus Link (the project) is a proposed 1,500-megawatt (MW) HDVC electricity interconnector between Heybridge in northwest Tasmania and the Latrobe Valley in Victoria. The portion of the project alignment covered in this surface water impact assessment is defined as Heybridge in Tasmania.

The project was referred to the Australian Minister for the Environment 5 October 2021. On 4 November 2021, a delegate of the Minister for the Environment determined that the proposed action has the potential to have a significant impact on the environment and requires assessment and approval under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act) and will be assessed by an environmental impact statement (EIS) under the EPBC Act.

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

Surface water includes any natural water on land that has not infiltrated below the ground, including runoff from rainfall, and waterways and wetlands. As well as providing aquatic and riparian habitat, and recreation and amenity values, surface water also provides a valuable resource for domestic, industrial and agricultural use, and supports Aboriginal cultural heritage values. It is therefore important to consider when assessing the impacts of the project.

This report incorporates the surface water impact assessment relevant to the Heybridge study area located in the Tasmanian jurisdiction. The purpose of this study is to characterise the baseline condition of surface water and assess the potential impacts associated with the project to inform the preparation of the EIS under the Commonwealth (Cwlth) and Tasmanian (Tas) EIS guideline requirements required for the project.

This report also provides recommended mitigation measures to reduce the risk of the project impacting on surface water values to meet the EIS guideline requirements relevant to surface water.

Assessment guidelines overview

EPA Tasmania has published two sets of guidelines (September 2022) for the preparation of an EIS for the Marinus Link converter station and shore crossing. A separate set of guidelines have been prepared for each of these project components:

- Environmental Impact Statement Guidelines Marinus Link Pty Ltd Converter Station for Marinus Link (EPA Tasmania, 2022)
- Environmental Impact Statement Guidelines Marinus Link Pty Ltd Heybridge shore crossing for Marinus Link (EPA Tasmania, 2022)

The requirement for the EIS guidelines (Tas) includes defining and assessing:

- Existing conditions
- Performance requirements
- Potential impacts
- Avoidance and mitigation measures

- Assessment of residual impacts
- Offsetting unavoidable adverse impacts
- Key issues to be addressed.

The purpose of this report is to assess the potential surface water impacts associated with the Heybridge converter station and shore crossing to inform the two EISs being prepared to address the Tasmanian EPA requirements required for the project.

Study area

This study focuses on the potential surface water impact of the proposed converter station and shore crossing at Heybridge in Tasmania. The site is located northwest of the town of Heybridge on Tasmania's north coast, within the Blythe River catchment. To the south of the proposed site, the Blythe River flows north towards the sea. Smaller tributaries are also located to the west and southwest of the site. The town of Chasm Creek lies to the northwest of the proposed site.

Baseline characterisation (existing conditions)

Desktop assessments were undertaken to identify and document surface water related environmental values relevant to the converter station and shore crossing in Heybridge. Section 6 provides a baseline characterisation to describe existing surface water conditions of the study area. This outlines the existing flooding, water quality and geomorphic conditions, based on available data and information from the desktop assessment. This includes review of available data and literature as well as baseline flood modelling. Baseline conditions include:

- Flooding- Flood mapping of existing conditions in the 0.5 % AEP event indicates that the Blythe River is largely confined to its floodplain and does not interact with the Heybridge converter station development site. Surface flows follow well defined valleys before joining the Blythe River. the proposed development area, the former tioxide plant, is situated outside the Blythe River floodplain, adjacent to the Bass Highway. The existing conditions model highlights significant ponding of water in the northern extent of the converter station footprint, with depths up to 1.6m at the entrance to the outfall culvert that passes beneath the Bass Highway
- Water quality – monitoring data for the site and Blythe River estuary is lacking. Known factors influencing existing water quality in the Blythe catchment, river and estuary include:
    - Forestry, cropping, dairy, and other agricultural activities.
    - Industrial activities such as:
        - The paint pigment factory (tioxide Australia) at the site of the proposed converter station that historically released an iron-rich acid solution into the water until it was closed in 1996.
        - Mineral processing operations with significant discharges of silica sand to the Lower Blythe River
- Geomorphology- the shear stress analysis for the 0.5 % AEP and climate change events indicate that the areas of higher shear stress are concentrated in the confined valleys with surface flows coalescing before joining the low energy, Blythe River. Given the existing land use of the area, the bed material is predominately bare land and sand at the former tioxide plant, erosion is typically expected under the current and climate change scenarios as the values through these areas are subject to 10-20 N/m^2. It is anticipated that this erosion would mobilise sand and transport it over the site from west to east and result in sediment build up at the entrance to the culvert outfall.

Impact assessment

The impact assessment has considered the potential for the construction and operation of the project to influence water quality, geomorphology and flooding. From these key surface water values, a range of potential risks associated, including their respective hazards and impact pathways for these risks were identified, with a risk assessment approach adopted for the purposes of determining these potential effects of the project. Table 11 outlines this risk assessment, prior to development of the mitigation measures. The residual risk assessment takes into account the implementation of the specified mitigation measures, which is summarised in section 7.7.

The risk assessment identified two high risk activities and several moderate risk actives. Identified moderate risk activities centre around excavation or filling to create the converter station fill pad leading to a reduction in the floodplain's capacity to store and or transport flood water. This mechanism risks increasing flood frequency, velocity or flood levels which can affect users, adjacent assets or water quality.

The two identified high risk activities centre around the impacts from potentially contaminated water during construction or from bunded areas during operation. Changes to water quality, such as from spill events has potential to increase sediment loads, nutrient loads, addition of metals, hydrocarbons or other chemicals leading to degradation in water quality, ecosystem health/reproduction or aesthetics.

It was noted that clean surface water runoff and overflow from the proposed interceptor traps will discharge to the ocean via the existing site drainage culvert under Bass Highway. This introduces the potential that if construction spills or if the interceptor trap is undersized and overwhelmed it may release contaminants to the downstream environment.

Mitigation measures

In order to address the risks posed by the project on surface water, a list of mitigation measures have been developed as presented in Table 12 to Table 14 and are further described in section 7.6. The table groups measures recommended in the two projects phases: construction and operation.

The two identified high-risk activities will be managed through Implementation of mitigation measures SW02 and SW04, which will reduce the likelihood of spill of hazardous or potentially polluting chemicals over the duration of the project activity to rare (not anticipated), with widespread, long lasting and results in substantial change to surface water values requiring design responses. Standard management controls include use of spill kits, bunding, dewatering procedures, emergency response and monitoring.

Identified moderate risks will be managed through implementation of mitigation measures SW01, SW02 and SW03, which will reduce the likelihood of impacting flood conveyance behaviour over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls may include earthwork design to maintain overland / surface flow pathway capacity and include erosion control armouring where required.

By implementing these surface water mitigation measures, the project aims to minimise the likelihood of impacts, resulting in a low overall risk rating for surface water values which are flooding, water quality and geomorphology. The assessment of residual risks, considering the implementation of mitigation measures, has been assessed and the outcomes are presented in Table 15, which confirms the low residual risks to surface water during both construction and operation phases of the project.

Risks associated with decommissioning will need to be assessed at the time of decommissioning.

Cumulative impacts

This surface water impact assessment includes a Cumulative Impacts Assessment (CIA) of multiple projects occurring at similar times and within proximity to each other. Proposed and reasonably foreseeable projects have been identified based on their potential to contribute to cumulative impacts by overlapping with the proposed project location and timeframe.

An assessment was conducted on the cumulative impact of flooding, water quality, and geomorphology of these projects. Through implementation of the specified mitigation measures proposed in Table 12 to Table 14, the project is not expected to impact water quality, flows, or bed and bank stability within local waterways. The project is also not expected to create adverse flood impacts or pose an increased health and safety risk to workers or operational staff.

Conclusion

This report has been prepared within the limitations and identified data gaps of the work outlined in Section 5.5.

Based on the risks and their associated mechanisms identified above, a series of mitigation measures have been developed to effectively manage these potential risks, including the requirement to develop of an Progressive Erosion and Sediment Management Plan (SW02) that would specify the measures the construction process would be required to adhere to, so that flood risk was minimised. Following the application of these mitigation measures, the residual surface water risks are substantially reduced.

While the flood mapping indicates that the proposed converter station will result in minor increases in flood depth and extent as a result of the works, this is generally limited to less than 100 mm, contained to the immediate area and are considered to be within acceptable change/impacts to flood behaviour. However, additional detailed flood modelling through the design phase should be undertaken to confirm the flood impact of the final design on adjacent infrastructure (such as the existing culvert outfall to the west of the station footprint), refine migration options and seek acceptance from Burnie City Council (as per SW01).

The implementation of the mitigation measures proposed within this report directly address the impacts identified and provide an effectively means manage the identified risks associated with the construction and operation phases to an acceptable level.

1 Introduction

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

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

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

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

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

This report has been prepared by Alluvium Consulting Australia Pty Ltd (Alluvium) for the Tasmanian jurisdiction as part of the two EISs being prepared for the project.

1.1 Project overview

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

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

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

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

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

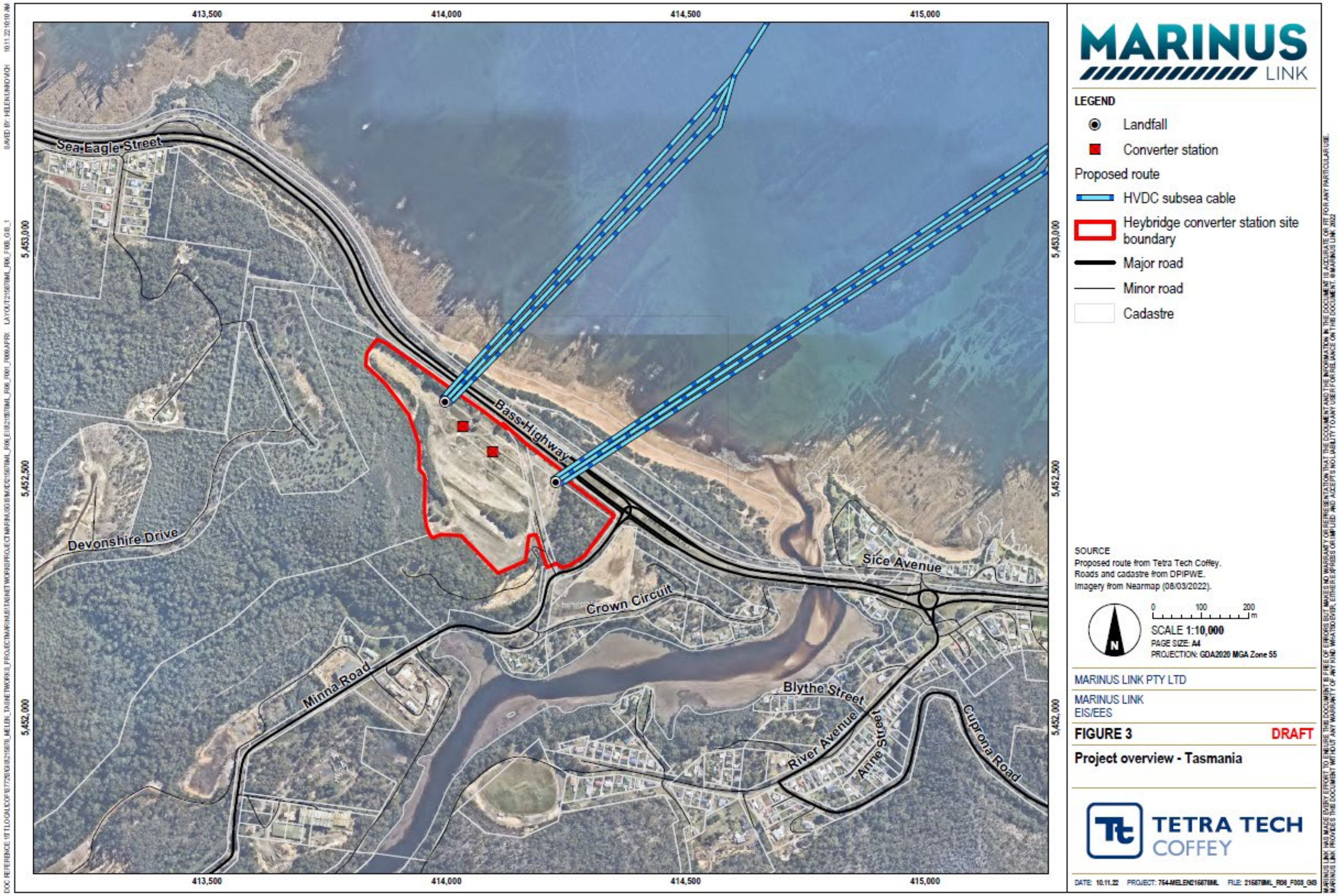

Figure 1. *Project Overview*

1.2 Purpose of this report

The purpose of this study is to characterise the existing surface water conditions and assess the potential surface water impacts associated with Heybridge converter station and shore crossing, to inform the preparation of the two separate EISs under the Tasmanian EIS guideline requirements required for the project.

This report has also defined recommended mitigation measures to limit potential risks of the project on surface water values to meet the Tasmanian EIS guideline requirements relevant to surface water.

Study objectives

This study focuses on the potential surface water impact of the proposed converter station and shore crossing in Heybridge. The study objectives are to identify and evaluate the potential impacts on surface water values that the proposed project may pose and propose appropriate measures to avoid, minimise, mitigate and manage identified impacts, as far as reasonably practicable. This includes development of mitigation measures to be implemented to reduce relevant environmental impacts.

Assessment context

Surface water includes any natural water on land that has not infiltrated below the ground, including runoff from rainfall, and waterways and wetlands. Aside from providing aquatic and riparian habitat, and recreation and amenity values, surface water also provides a valuable resource for domestic, industrial and agricultural use, and supports Aboriginal cultural heritage values. It is therefore important to consider when assessing the impacts of the project.

Healthy waterways can be described in numerous different ways. Key components of waterway health include:

- Flow – the volume, timing, frequency and characteristics (e.g., velocity) of water flow
- Connectivity – both longitudinally up and down a waterway and laterally across the floodplain
- Water quality – parameters such as temperature, dissolved oxygen, pollutants, nutrients and turbidity that support waterway ecosystems.
- Geomorphology – the physical form of the bed and banks of a waterway, including habitat features and physical processes (erosion and deposition)
- Fringing riparian and floodplain vegetation – providing shading, nutrient inputs and physical habitat.

Surface water is also important to human values through provision of water for domestic and stock use; social, cultural, and recreational uses of surface water; and minimised flood impacts on property and assets.

Potential impacts

Potential impacts from the project on the surface water environment have been identified in the Commonwealth and Tasmanian EIS guideline requirements and are considered further by this impact assessment. These potential impacts were also identified based on the professional experience of Alluvium's hydrologists and their environmental team on other similar linear infrastructure projects and is informed by the understanding of the existing conditions presented in Section 6.

The project has potential to impact on these waterways during construction and operation through the following processes:

- Changed flood behaviour, either reducing or increasing flood extents (through redirection of flow), increasing risk to property or assets elsewhere.
- Reduced water quality through release of pollutants or sediment to waterways, impacting on surface water ecosystems and human uses.
- Altered geomorphic condition resulting in changes in physical habitat, erosion, or deposition processes.

The loss of water availability or storage is not considered through this assessment, given no dams or water storages are proposed. Impacts associated with decommissioning will need to be assessed at the time of decommissioning.

2 Assessment guidelines

This section outlines the assessment guidelines relevant to the surface water impact assessment and the linkages to other technical studies completed for the project. Two separate EISs are being prepared to address the EIS guidelines published by EPA Tasmania for the Heybridge converter station and shore crossing.

2.1 EPA Tasmania Guidelines

EPA Tasmania has published two sets of guidelines (September 2022) for the preparation of an EIS for the Marinus Link converter station and shore crossing. A separate set of guidelines have been prepared for each of these project components:

- *Environmental Impact Statement Guidelines Marinus Link Pty Ltd Converter Station for Marinus Link, September 2022,* Environment Protection Authority Tasmania (Tas converter station EIS guidelines)
- *Environmental Impact Statement Guidelines Marinus Link Pty Ltd Shore Crossing for Marinus Link, September 2022*, Environment Protection Authority Tasmania (Tas shore crossing EIS guidelines)

The requirement for the EIS guidelines (Tas) includes defining and assessing:

- Existing conditions
- Performance requirements
- Potential impacts
- Avoidance and mitigation measures
- Assessment of residual impacts
- Offsetting unavoidable adverse impacts
- Key issues to be addressed.

The sections of the EIS guidelines (Tas) relevant to the surface impact water assessment are provided in Table 1.

Table 1. Guidelines for the EIS relating to the surface water impact assessment.

Requirement	Report section
Existing conditions	
Outline the existing conditions relevant to the impact.	Section 6
Performance requirements	
Identify the mitigation measures to be achieved for each environmental impact and provide evidence to demonstrate that these can be complied with. These may be standards or requirements specified in legislation, codes of practice, state policies, national guidelines (including relevant recovery plans or conservation advice) or as determined by agreement with the assessing agencies. Industry best practice standards should be referred to where appropriate.	Section 5.2 and 7.6
Potential impacts	
Outline the potential environmental, social, and economic impacts of the proposal (positive and negative) through all stages, including construction, operation, and closure, in the absence of special control measures. Any	Section 7

Requirement	Report section
foreseeable variations in impacts during the start-up and operational phases should be identified. Include an analysis of the significance of the relevant impacts.	
Provide an assessment of the potential cumulative impacts of the proposal in the context of existing and approved developments in the region	Section 7.8
Avoidance and mitigation measures	
Describe the measures proposed to avoid or mitigate potential adverse impacts (having regard to best practice environmental management as defined in the EMPC Act) in order to achieve the environmental performance requirements (such as through pollution control technology or management practices).	Section 7.6
Assessment of residual impacts	
Undertake an assessment of the overall impacts of the development on the environment after allowing for the implementation of proposed avoidance and mitigation measures.	Section 7.7
Key issues	
Potential impacts on terrestrial natural values. • Specify, map and discuss impacts on known sites of conservation significance or natural processes (such as fluvial or coastal features) • Describe natural processes of particular importance for the maintenance of the existing environment (e.g., fire, flooding, etc)	Marinus Link Heybridge converter station – Terrestrial ecology baseline and impact assessment (Entura 2024)
Potentially contaminated material and acid sulfate soils	Contaminated Land and Acid Sulfate Soils Impact Assessment – Heybridge Converter Station Tasmania (Tetra Tech Coffey, 2024)
Potential impacts on marine natural values.	Marine Ecology and Resource Use Impact Assessment (EnviroGulf Consulting, 2024)
Water quality (surface and groundwater): Discuss potential impacts of construction and operation of the proposal on surface and groundwater, including: • Results of any baseline water quality, biological and sediment monitoring undertaken of potentially impacted waterways. • Consideration of Protected Environmental Values (PEVs). • Identify any freshwater ecosystems of high conservation management priority using the Conservation of Freshwater Ecosystem Values (CFEV). • Details of potential stormwater management (including during reasonably foreseeable flood events). • Consideration of construction and operational impacts on water quality Discuss proposed avoidance and mitigation measures • Provide a quantitative analysis of any identified risk of impact to groundwaters or surface water quality and aquatic ecosystems as a result of a major hazard event and detail relevant mitigation measures. The analysis should systematically identify all potential major environmental hazards (internal and external) to people and the environment associated with the construction, operation, maintenance and	Section 6 Section 6.2 Heybridge Groundwater Impact Assessment (Tetra Tech Coffey, 2024) Section 4 and 6.1 Section 7.2 and 7.3 Section 7.6 Section 7

Requirement	Report section
decommissioning of the proposal. It is expected that risks to receiving aquatic waterbodies and ecosystems will be considered through emergency management planning (or similar) and that environmental impact mitigation measures will be incorporated into emergency response plans as appropriate.	
• Discuss proposed avoidance and mitigation measures to minimise potential impacts on surface water quality.	Section 7.6 and 7.7

The relevant planning criteria and EIS guidance requirements also states that:

> "It must be demonstrated that the proposal is consistent with the objectives and requirements of relevant water management policies and legislation including the *Water Management Act 1999*, the *State Policy on Water Quality Management 1997*, and the *Tasmanian State Coastal Policy 1996*.
>
> In particular, it must be demonstrated that the proposal will not prejudice the achievement of any water quality objectives set for water bodies under the *State Policy on Water Quality Management 1997*.
>
> Where water quality objectives have not yet been set, EPA Tasmania should be consulted to identify the baseline water quality data required to enable the water quality objectives to be determined."

These requirements are discussed further in Section 3.

2.2 Linkages to other technical studies

This report is informed by or informs the technical studies outlined in Table 2.

Table 2. Relevant technical studies

Technical Study	Relevance to this assessment
Contaminated Land and Acid Sulfate Soils Assessment – Heybridge Converter Station Tasmania **(Tetra Tech Coffey, 2024)**	Disturbance of contaminated land, storage of spoil during the project and disturbance of acid sulfate soils are a potential source of contamination to surface waters. This has been considered in the Contaminated Land and Acid Sulfate Soils Assessment report for the Heybridge converter station prepared by Tetra Tech Coffey (2024).
Heybridge Groundwater Impact Assessment **(Tetra Tech Coffey, 2024)**	Impacts to groundwater environments can impact surface waters (and vice versa) due to the interconnected nature of surface water and groundwater systems. Surface waters are a potential receptor for disposal of groundwater from de-watering activities or seepage during the Project. This has been considered in the Heybridge Groundwater Impact Assessment Report prepared by Tetra Tech Coffey (2024).
Marinus Link Heybridge converter station – Terrestrial ecology baseline and impact assessment **(Entura, 2024)**	Disturbance to surface waters including impacts to water quality or flow regime can impact on aquatic and riparian flora and fauna species that rely on those surface water ecosystems (water-dependent species). This could include EPBC listed species. This has been considered in the ecology baseline and impact assessment for the Heybridge converter station, prepared by Entura (2024).

Technical Study	Relevance to this assessment
Marinus Link: Climate and Climate Change Assessment **(Katestone Environmental, 2024)**	Climate change has potential to impact on rainfall and surface water runoff. The Climate and Climate Change Assessment report outlines these predicted changes and impact on surface water runoff. A climate change scenario has also been modelled for the converter and transition stations in this surface water report.
Marinus Link, Heybridge Tasmania: Terrestrial Geomorphology and Soils Assessment Report **(Environmental GeoSurveys Pty Ltd, 2024)**	The terrestrial geomorphology impact assessment details the potential baseline conditions and potential impacts on geomorphology and soils, including ground stability and hillslope erosion. This surface water impact assessment has considered geomorphology and soils aspects where relevant. Further geomorphology and soil related impacts and management are addressed in the Terrestrial Geomorphology and Soils Assessment Report by Environmental GeoSurveys (2024).

3 Legislation, policy and guidelines

The other legislation, policies and guidelines applicable to this report are described below.

3.1 Tasmania

Resource Management and Planning System

All planning decisions made in Tasmania fall under Tasmania's Resource Management and Planning System (RMPS). The RMPS is a framework to achieve sustainable outcomes from the use or development of Tasmania's natural and physical resources.

There are several pieces of legislation that contribute to the RMPS (Figure 2), which all have five common objectives. These umbrella objectives drive decision making about the use of land and natural resources across the State. The objectives are to:

- Promote the sustainable development of natural and physical resources and the maintenance of ecological processes and genetic diversity.
- Provide for the fair, orderly and sustainable use and development of air, land, and water.
- Encourage public involvement in resource management and planning.
- Facilitate economic development in accordance with these objectives.
- Promote the sharing of responsibility for resource management and planning between the different spheres of government, the community, and industry in the state.

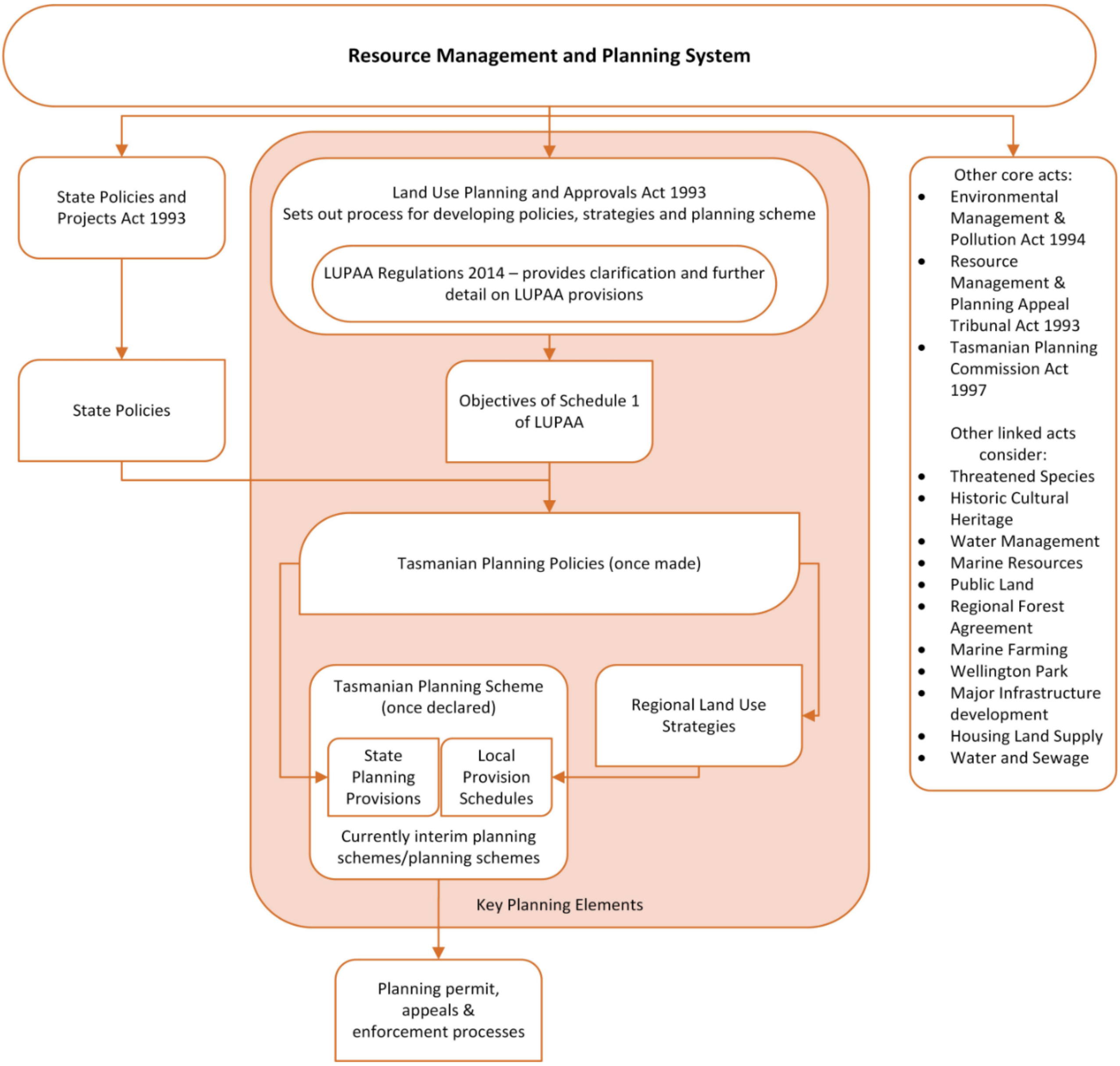

Figure 2. Resource Management and Planning System summary diagram (Tasmanian Government, 2020)

Legislation under the RMPS

Legislation under or linked to the RMPS includes (but is not limited to):

- *Land Use Planning and Approvals Act 1993 (Tas).* This is the primary land use planning legislation in Tasmania, providing the legal framework for the development and operation of planning schemes. It also sets out the requirements and timeframes that apply, for example, for making an application for a permit or requesting an amendment to a planning scheme. In 2015, it was amended to provide for the Tasmanian Planning Scheme (below). Some recent planning schemes specifically incorporate a Wetlands & Waterway Schedule, which specifies the objectives and standards for development near wetlands and waterways. Works in wetlands and waterways may also be subject to council requirements, as detailed in council by-laws and/or abatement notices (the *Local Government Act 1993* established the powers and functions of Tasmanian councils).

- *Environmental Management and Pollution Control Act 1994 (Tas)*. This is the primary environmental protection and pollution control legislation in Tasmania. It is a performance-based style of legislation, with the fundamental basis being the prevention, reduction and remediation of environmental harm. The focus of the Act is on preventing environmental harm from pollution and waste – for example, by setting penalties for causing environmental harm. According to the Tasmanian Stormwater Policy Guidance and Standards for Development (2021), it may be made applicable to stormwater pollution and to erosion and sediment control on building and construction sites.

- *Water Management Act 1999 (Tas)*. This legislation provides for the management of Tasmania's freshwater resources, such as the need to 'Maintain ecological processes and genetic diversity for aquatic and riparian ecosystems.' The focus of the Act is on management of water as a resource. It only mentions erosion in relation to environmental risks associated with licensing and allocation of water, and to Division 4 (dam works) permits. This Act is not being applied to the project.

State policies

At the policy level, the *State Policy on Water Quality Management 1997* provides the overarching principles and objectives for water quality management in Tasmania, and the management framework for the development of protected environmental values (PEVs), water quality guidelines (WQGs) and water quality objectives (WQOs). It details a range of mechanisms for the control of point source and diffuse source pollutants in surface waters and groundwaters.

The *Tasmanian State Coastal Policy 1996* guides coastal planning in Tasmania. Its three guiding principles are that natural and cultural values of the coast shall be protected, the coast shall be used and developed in a sustainable manner and integrated management and protection of the coastal zone is a shared responsibility.

Guidance documents

The *Wetlands and Waterways Works Manual* (Department of Primary Industries, Parks, Water and Environment, 2003) provides environmental best practice guidelines for minimising environmental harm when undertaking works on waterways and wetlands in Tasmania. It covers works that are often undertaken by government, industry, farmers and community groups. It is comprised of eight documents – *Legislative and Policy Requirements for Protecting Waterways and Wetlands when Undertaking Works*, and seven environmental best practice guidelines:

- Construction practices in waterways & wetlands.
- Excavating in waterways.
- Minimising environmental harm from agricultural drainage channels.
- Siting and design stream crossings.
- Managing large woody debris in waterways.
- Managing riparian vegetation.
- Guiding community involvement in works on waterways & wetlands.

The manual has been incorporated into other planning documents. For example, the *Northern Tasmania Regional Land Use Strategy* states that: 'Works undertaken on wetlands and waterways are to be in accordance with the *Wetlands and Waterways Works Manual*'.

The *Tasmanian Stormwater Policy Guidance and Standards for Development* (DEP and LGAT, 2021) is also a useful resource but focused on stormwater management in urban areas. It is a policy guidance document designed to assist any Tasmanian council acting as a planning authority to regulate development under the *Land Use Planning and Approvals Act 1993* and the Tasmanian Planning Scheme (TPS).

Relevance to this assessment

The *State Policy on Water Quality Management 1997* (as introduced above) provides a framework for the identification of protected environmental values (PEVs) of water bodies, development of water quality guidelines (WQGs) and water quality objectives (WQOs) setting process, and the management and regulation of point and diffuse sources of emissions to surface waters and groundwater. The WQOs are the most conservative of the WQGs, for the protection of PEVs such as aquatic ecosystems. Many of the strategies and requirements of the *State Policy on Water Quality Management 1997* rely upon WQOs being set to measure success of water pollution management from point and diffuse sources.

The WQOs are set by the EPA Board, following the methodology set under the *National Water Quality Management Strategy* (1992). The *Technical Guidance for Water Quality Objectives (WQOs) Setting for Tasmania* (EPA Tasmania, 2020) also provides detail on the process for deriving water quality guideline values, and the use of those values in the water quality objective setting process by the EPA Board.

The control of diffuse source pollution is the aspect of the *State Policy on Water Quality Management 1997* most relevant to the erosion and geomorphology component of our risk assessment, and the development and implementation of best practice environmental management strategies are seen under the policy as the key principle for control of such pollution. For roads in particular, the policy states that: 'road construction and maintenance operations will be carried out in accordance with guidelines or a code of practice or employ other measures consistent with best practice environmental management, to prevent erosion and the pollution of streams and waterways by runoff from sites of road construction and maintenance.'

For all aspects of this assessment, this code of practice will be the *Wetlands and Waterways Works Manual* (introduced above). In particular, the 'Construction Practices in Waterways and Wetlands' document sets out measures relevant to the project. Examples under '2.2 Minimise sediment disturbance and control erosion' include:

- 'The works should be scheduled appropriately. For example, works should be timed to coincide with periods of low flow and completed quickly, and works should be stopped if conditions are not suitable, such as during and after heavy rain.'
- 'Damage to the ground cover should be minimised and confined to the works site. Blading and grubbing of the banks and the area adjacent to the works site should be avoided. The width of any access tracks should be minimised. Vegetation on unstable and erodible banks should be cleared by hand. If possible, trees should be felled away from the waterway.'
- 'Surface and sub-surface flows at the site should be managed to minimise erosion and sedimentation of the waterway or wetland. Geo-textile sediment fences should be used to stop sediment entering the water. They should be installed along the bases of fills and cuts, on the downhill side of soil stockpiles, and along stream banks and around wetlands adjacent to cleared areas. They should be installed along a contour and be entrenched and staked. They should extend the full width of the cleared area.'

4 Project Description

This section discusses the key components and details of the Project Description and activities that are relevant to the surface water impact assessment.

4.1 Overview

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

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

- HVAC switching station and HVAC-HVDC converter station at Heybridge in Tasmania. This is where the project will connect to the North West Tasmania transmission network being augmented and upgraded by the North West Transmission Developments (NWTD).
- Shore crossing in Tasmania adjacent to the converter station.
- Subsea cable across Bass Strait from Heybridge in Tasmania to Waratah Bay in Victoria.

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

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

This assessment is focused on the Tasmanian terrestrial and shore crossing section of the project. This report will inform the two EISs being prepared to assess the project's potential environmental effects in accordance with the legislative requirements of the Tasmanian governments (Figure 3).

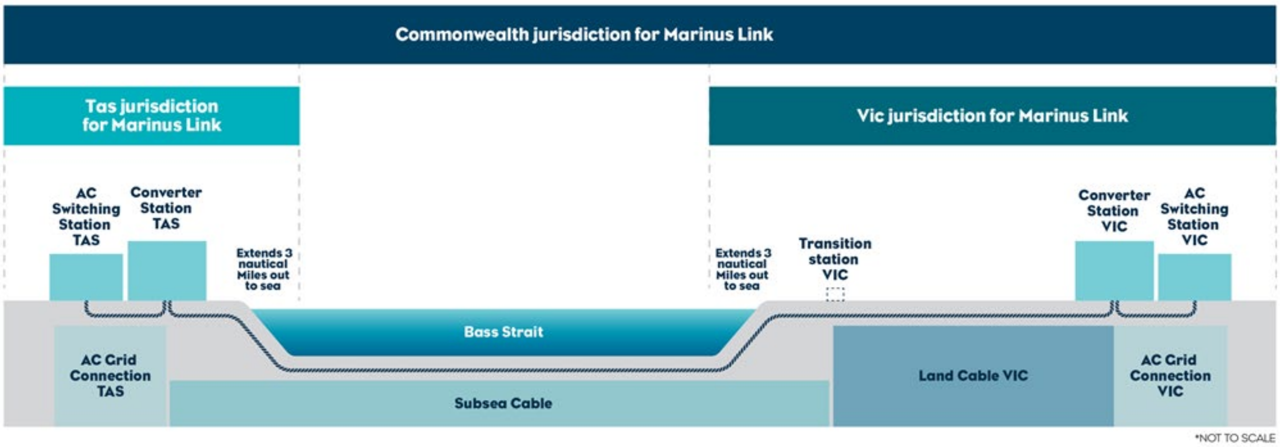

Figure 3. *Project components considered under applicable jurisdictions (Marinus Link Pty Ltd 2022,).*

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

4.2 Tasmania converter station

Two converter stations and a high voltage alternating current (HVAC) switching station will be located near the coast at Heybridge, on the site of the former tioxide plant near Burnie. The site and all components located on it will be referred to as the Heybridge Converter Station site. The subsea cables will connect directly into the two converter stations which are connected to the HVAC switching station that facilitates Marinus Link connecting to the Tasmanian 220 kV HVAC network. The HVDC voltage will be ±320 kV.

The development footprint of the converter stations and associated HVAC switching station is expected to be 280 m by 220 m. It has been assumed that buildings and infrastructure for the converter station would be designed to a level to be protected from inundation in a 1 in 200-year rainfall event.

Access will be from Minna Road. The site will have internal access roads that will be sealed. There are no high risk contaminating activities proposed during construction or operation of the converter station.

The Heybridge converter station will comprise the following key components and equipment:

- Overhead steel lattice gantries on which the HVAC 220 kV transmission lines (connection to Tasmanian transmission network) will terminate.
- HVAC 220 kV AC switching station with gas insulated switchgear (GIS). Sulfur hexafluoride (SF6) gas will be used in the switchgear. A building will enclose the GIS equipment.
- HVAC 220 kV filter banks, assumed to be housed within a building, however there is potential for open air depending on the visual impacts.
- Converter transformers and coolers. The transformers will be housed in bunds designed in accordance with applicable Australian standards. A spare transformer (without transformer oil) will be stored adjacent to the western transformer bays.
- Main building that will include a phase reactor hall, a valve hall and an HVDC hall. The three halls are separate areas in the one building.

- HVAC phase reactor hall containing valve reactors.
  - Valve hall containing the converter modules and valves.
  - HVDC hall with HVDC reactors and HVDC land cable terminations.
- Two-storey service and control building containing system control, protection and data acquisition equipment, station services such as UPS systems with batteries, fire suppression systems, control room and amenities.
- Spare parts buildings and workshop (common to both converter stations).
- Telecoms building for purposes of providing control systems for Marinus Link and commercial telecoms services where there is available capacity (common to both converter stations).
- Firefighting systems including 1,000,000 L (estimated) fire water tank.
- Stormwater drainage system. Potentially contaminated water from bunded areas will be directed to and collected in a gross pollutant trap or triple interceptor trap which will be periodically pumped out by a licensed wastewater disposal contractor. Clean surface water runoff and overflow from the traps will discharge to a form of water sensitive urban design (e.g., swale drain), before discharge to the ocean via the existing site drainage culvert. The stormwater drainage design is shown in Figure 4.
- Greywater and sewerage will be managed through a septic tank. The site will also have underground oil separator tanks.
- Security fencing will be weldmesh, 3.2 m high, with barbed wire on top section.
- Onsite temporary fuel storage for backup generators.
- Two 1500 kVA diesel generators with above ground fuel storage of 5000 L (sufficient for 8 hours at full load), (2500 L diesel per converter).
- Building materials: roof and walls will be a standard sheet steel construction; however, alternatives may include adding insulating panels or pre-cast concrete tilt panels if required for acoustic attenuation.

The phase reactor hall, valve hall and HVDC hall will have maximum dimensions (based on ±400 kV design) of approximately 70 m wide, 90 m long and 27 m high, as indicated in Figure 4. The attached control and auxiliaries building will be approximately 40 m long by 25 m wide by 10 m high. The GIS switching station building will be a portal frame building approximately 49 m long, 16 m wide and 10 m high.

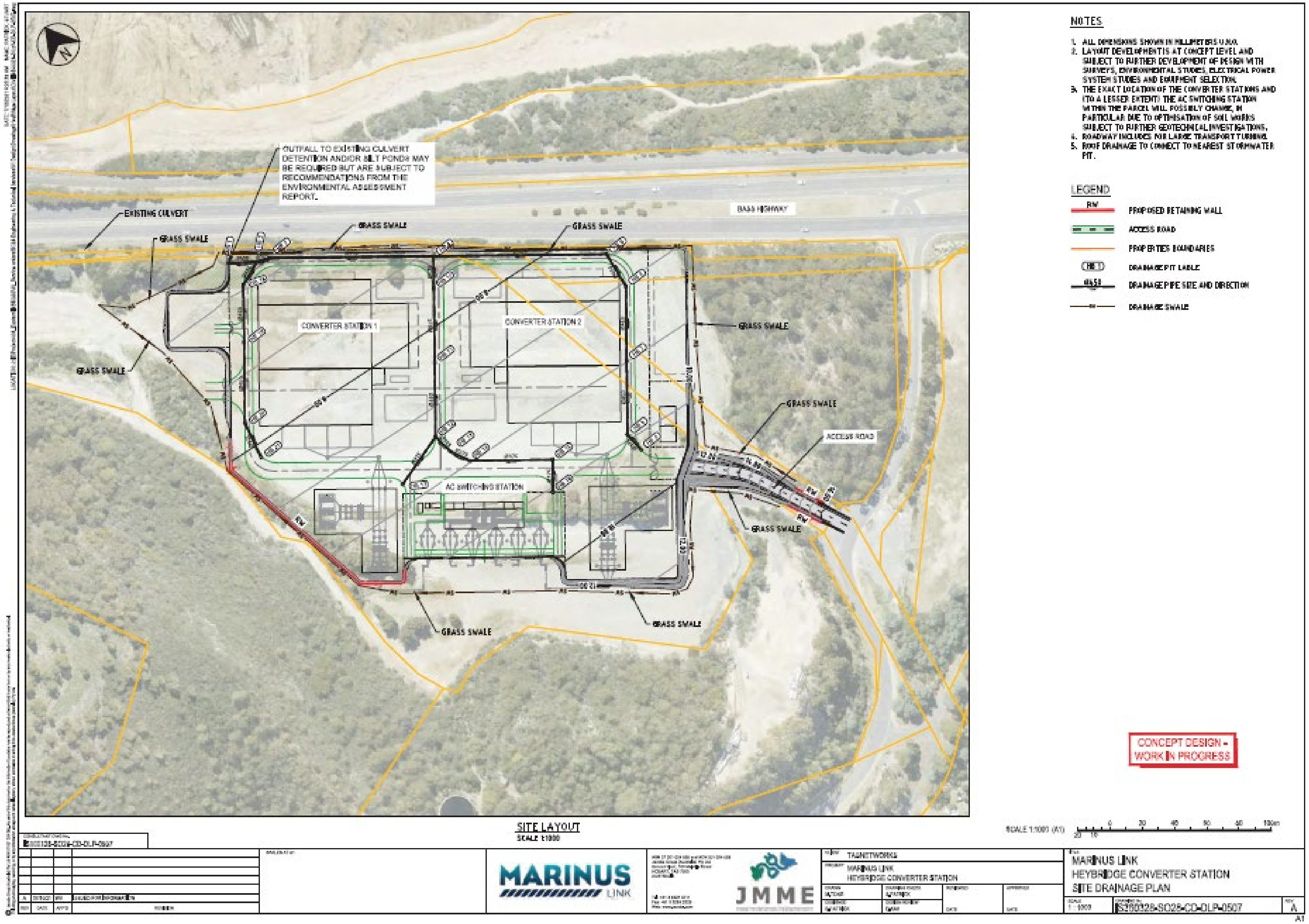

Figure 4. *Heybridge converter station – concept site drainage plan.*

4.3 Construction

A description of elements of the project during the construction phase that have the potential to impact on environmental or surface water values considered within this surface water impact assessment are summarised below.

- Shore crossing – HDD.
- Transition station – Civil works (access road, transition station bench, foundations and hardstand area).
- Land cables – Site establishment, topsoil stripping and stockpiling and haul road construction, construction of joint pits, HDD, excavation of trenches, installation of ducts and backfilling.
- Converter station – Site preparation, earthworks and civil works.

These activities can impact on surface water quality and/or quantity through mechanisms such as:

- Displacement of flood waters that lead to adverse flood impacts to surrounding property, key infrastructure and the environment
- Reducing the volume of temporary storage within the floodplain that leads to adverse flood impacts to surrounding property, key infrastructure and the environment
- Constricting the passage of flows passing through the site along the river channel or flow path that leads to increased shear stress values and increased scour of adjacent bed and banks
- Altered fluvial geomorphic processes, initiation of bed and bank scour and sediment delivery, which can result in habitat loss and ecosystem decline
- Changes to water quality, such as increased sediment loads, nutrient loads, addition of metals, hydrocarbons or other chemicals from spills that can lead to degradation in water quality, ecosystem health/reproduction or aesthetics
- Alteration of the flow regime, such as diversion, duration, frequency, duration and timing of high and/or low flow events have potential to initiate bed and bank scour, resulting in habitat loss, sediment delivery which could have both ecological and physical form consequences

4.4 Operation

The Marinus Link will be operational 24 hours a day, 365 days per year over a minimum lifespan of 40 years. Operational and maintenance activities in the Tasmanian portion of the Marinus Link are likely to include servicing, testing and repair of the transition station and converter stations equipment and infrastructure including scheduled minor and major outages.

4.5 Decommissioning

The operational lifespan of the project is a minimum 40 years. At this time the project will be either decommissioned or upgraded to extend its operational lifespan.

Decommissioning will be planned and carried out in accordance with regulatory requirements at the time. A decommissioning plan in accordance with approvals conditions will be prepared prior to planned end of service and decommissioning of the project.

Requirements at the time will determine the scope of decommissioning activities and impacts. The key objective of decommissioning is to leave a safe, stable and non-polluting environment.

In the event that the project is decommissioned, all above-ground infrastructure will be removed, the site rehabilitated.

Decommissioning activities required to meet the objective will include, as a minimum, removal of above ground buildings and structures. Remediation of any contamination and reinstatement and rehabilitation of the site will be undertaken to provide a self-supporting landform suitable for the end land use.

Decommissioning and demolition of project infrastructure will implement the waste management hierarchy principles being avoid, minimise, reuse, recycle and appropriately dispose. Waste management will accord with applicable legislation at the time.

Decommissioning activities may include recovery of land and subsea cables. The conduits and shore crossing ducts would be left in-situ as removal would cause significant environmental impact. Subsea cables would be recovered by water jetting or removal of rock mattresses or armouring to free the cables from the seabed.

A decommissioning plan will be prepared to outline how activities would be undertaken and potential impacts managed.

5 Assessment method

To address the EIS guidelines outlined in Section 2 as well as the legislative and policy requirements outlined in Section 3, this assessment seeks to detail the surface water key issues, existing environment, likely effects and mitigation strategies for the project.

This report covers potential risks to the existing surface water environment posed by the project activities. Three main aspects relating to surface water have been considered in this assessment:

- Flooding: the potential for the project to affect waterways and hydrology with respect to flooding and future climate change scenarios
- Water quality: the potential for contaminated runoff or sediment to be transported into surface waters.
- Geomorphology: the study of landforms and their origin. The assessment focused on the banks and beds of waterways, for example, the potential for the project to contribute to or initiate erosion.

Relevant sections of this report for each aspect are:

- Project description – Section 4
- Study area and baseline characterisation (existing conditions) – Section 5.1 and Section 6
- Impact assessment – Section 7, including:
    - Risk assessment – Section 7.5
    - Mitigation measures – Section 7.6
    - Residual risk – Section 7.7
    - Cumulative impacts – Section 7.8

5.1 Study area

The study area for the existing conditions assessment considers the proposed Heybridge converter station and shore crossing, and the surrounding area, with the proposed arrangement presented in Figure 5. The site is located north west of the town of Heybridge on Tasmania's north coast., within the Blythe River catchment. To the south of the proposed site, the Blythe River flows north towards the sea. Smaller tributaries are also located to the west and south west of the site. The town of Chasm Creek lies to the north west of the proposed site.

Section 6 provides the existing conditions of the study area. This outlines the existing flooding, water quality and geomorphic conditions, based on available data and information from the desktop assessment.

Figure 5. *Heybridge proposed converter station and shore crossing.*

Baseline characterisation

A baseline characterisation of the existing surface water conditions within the study area has been conducted based on desktop assessments to identify and document water related environmental values relevant to the proposed project. The following data was used to develop the detailed baseline characterisation modelling:

- Aerial photography from various sources, including:
  - ESRI
  - Google
  - Nearmap
- Topographic (LiDAR) data sourced from Land Information System Tasmania (The LIST) – Tasmania Statewide 2m_DEM (14-08-2021)
- Waterway mapping – based on State waterway layers in The LIST waterway vector mapping.
- State-wide land use, soil and geomorphological mapping
- Australian Rainfall and Runoff (ARR) data hub, rainfall depth and storm temporal patterns
- Tetra Tech Coffey provided data:
  - LiDAR (Date February 2021)
  - Heybridge converter station design lines and design surface, dated 27 October 2022

5.2 Impact assessment

A surface water impact assessment has been completed to identify likely impacts on flood levels and depths, water quality and flow regime from construction and operation of the project. Mitigation measures are proposed where necessary. As the methods used for the flooding impact assessment differed to those used for the water quality and geomorphology impact assessment, the impact assessment approaches are described separately.

An environmental risk assessment has been completed to identify environmental risks associated with construction and operation of the project. The risk assessment identifies and ranks the risk of potential harm, based on likelihood and consequence of harm to the environment. This risk rating is identified for both pre-mitigation and post-mitigation scenarios.

The approach to the risk assessment includes (Figure 6):

1. Identifying existing conditions and values (Section 6, above)
2. Identifying potential hazards and risks
3. Assessing the likelihood of a change to values occurring, prior to implementation of risk controls and measures
4. Assessing the consequence (impact) of identified risks prior to implementation of risk controls and measures.
5. Calculating risk
6. Identifying risk controls and mitigation measures to reduce the residual risk of environmental harm.
7. Assessing residual risk

A qualitative assessment will be used to assess the likelihood, consequence and resulting risk of harm to values from construction and operation / maintenance activities.

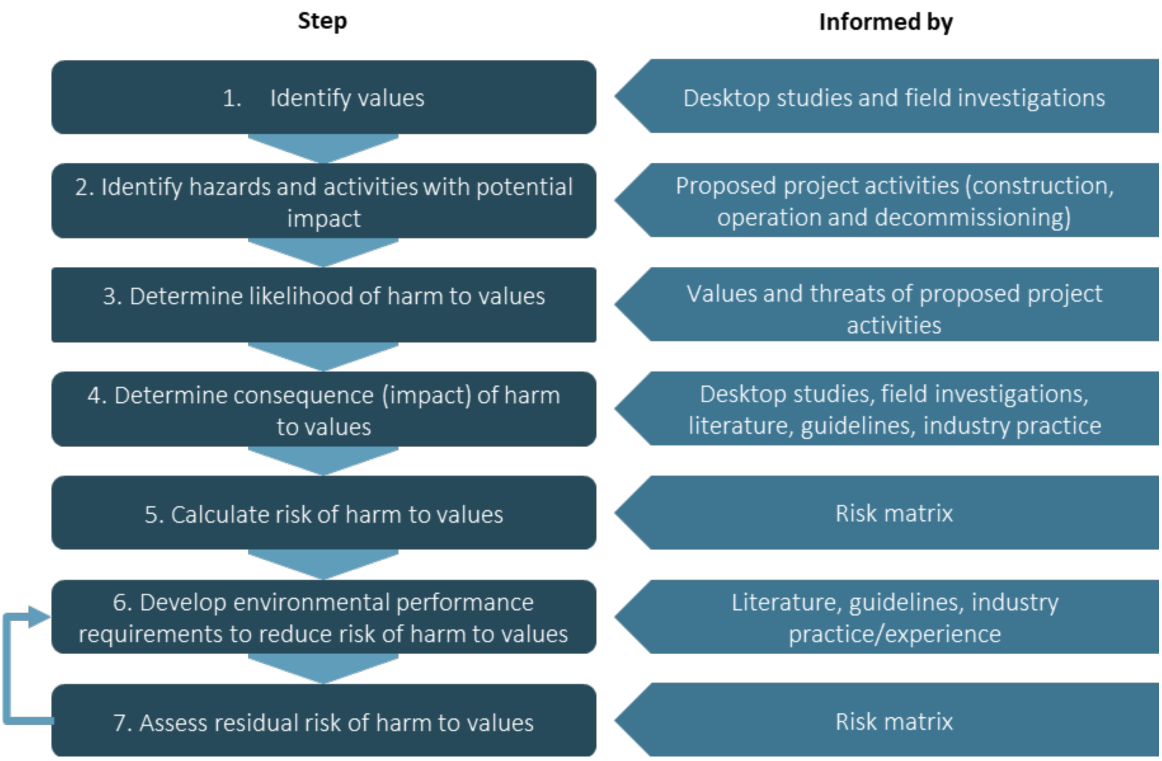

Figure 6. *Risk-based assessment approach*

Works associated with the project have potential to impact on surface water in three main ways: flooding, water quality and geomorphology. A risk assessment approach has been adopted for the purposes of determining these potential effects of the project. The risk assessment addresses the potential impacts on surface water through changed flooding/connectivity, water quality and fluvial geomorphology/physical form.

Flood impact assessment

The flood impact assessment for the converter station location has been based on site specific developed flood models used to undertake a comparison of flood levels and shear stress in the existing and post-development conditions. The resultant changes in water level are herein referred to as 'afflux'. The assessment of afflux has focussed on the 0.5 % AEP and the 0.5 % AEP climate change events.

Potential flooding impact pathways

Potential flooding impact pathways from the project include:

- The design for the converter station and shore crossing locations, causing the displacement of flood waters that lead to adverse flood impacts to surrounding property, key infrastructure and the environment (construction and operation).
- The design for the converter station and shore crossing locations, reducing the volume of temporary storage within the floodplain that leads to adverse flood impacts to surrounding property, key infrastructure and the environment (construction and operation).
- The design for the converter station and shore crossing locations, constricting the passage of flows passing through the site along the river channel or flow path that leads to increased shear stress values and increased scour of adjacent bed and banks (construction and operation).

- Floodwaters inundating the critical converter station and shore crossing infrastructure that leads to operational safety hazards or failure of system infrastructure (operation).

Modelling methodology

The impact assessment in the context of surface water and fluvial flooding for the transition station locations has been based on a comparison of flood levels and shear stress in the existing and post-development conditions. The resultant changes in water level are herein referred to as 'afflux'. The assessment of afflux has focussed on the 0.5 % AEP and the 0.5 % AEP + climate change events.

The adopted hydrologic and hydraulic modelling approach for the project has assessed the relevant catchment area for the Heybridge converter station, with its immediate catchment considered for the purposes of assessing the potential impact.

Due to the nature of the upstream catchment, and the location of the proposed infrastructure lying largely outside the Blythe River floodplain, a direct-rainfall (or rain-on-grid) approach has been adopted to simulate flooding in the subject area, rather than the application of hydrographs at the upstream boundary of the model into the Blythe River. With the direct-rainfall approach, rainfall is applied directly to the Digital Elevation Model (DEM) of the entire hydraulic model extent. Under this methodology, hydrologic analysis is limited to the development of the rainfall hyetographs which are used as boundary conditions in the hydraulic model. Rainfall hyetographs have been developed for the 0.5 % AEP and 0.5 % AEP + climate change events only. Noting that the Climate and Climate Change Assessment prepared for the project (Katestone Environmental, 2024) provided details on variability of total precipitation, both seasonal and annual, the surface water impact assessment required further analysis of difference is extreme sub-daily rainfall as a result of climate change.

The Tasmanian Stormwater Policy Guidance and Standards for Development state "*Climate change factors can be taken from the ARR data hub which holds interim climate change factors for RCP (Representative Concentration Pathways) 4.5, 6 and 8.5. It is recommended that Councils use the RCP 8.5 pathway as applicable at 2100* (DEP and LGAT, 2021)*"*

The ARR national guideline document contains a guide for estimating the impacts of climate change on rainfall, leading to changes in streamflow (Ball, et al., 2019). The methodology outlined in Ball et al. (2019) is based on the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5). The ARR guideline document outlines an approach to develop emissions scenarios, where the prescribed pathways for greenhouse gas and aerosol concentrations over time, or representative concentration pathways (RCPs), combined with land use change, are consistent with a set of broad climate outcomes used by the climate modelling community.

The four RCPs are characterised by the extra heat that the lower atmosphere will retain as a result of additional greenhouse gases (Jubb, et al., 2013) produced by the end of the 21st century relative to pre-industrial values.

These concentration pathways (RCP8.5, RCP6, RCP4.5 or RCP2.6) are then used to simulate how the climate will change around the world using global climate models. The four climate change pathways have been extrapolated to 2100 based on the predicted increases in emissions and are presented in Figure 7. The RCP scenarios are labelled according to their assumed radiative forcing in the year 2100. For example, the RCP8.5 trajectory assumes a radiative forcing of 8.5 W/m^2, while the RCP2.6 trajectory assumes a radiative forcing of 2.6 W/m^2. RCP8.5 is the highest concentration scenarios available (Figure 7) and is broadly described by the IPCC as "a scenario with very high greenhouse gas emissions […] without additional efforts to constrain emissions" (Intergovernmental Panel on Climate Change, 2015).

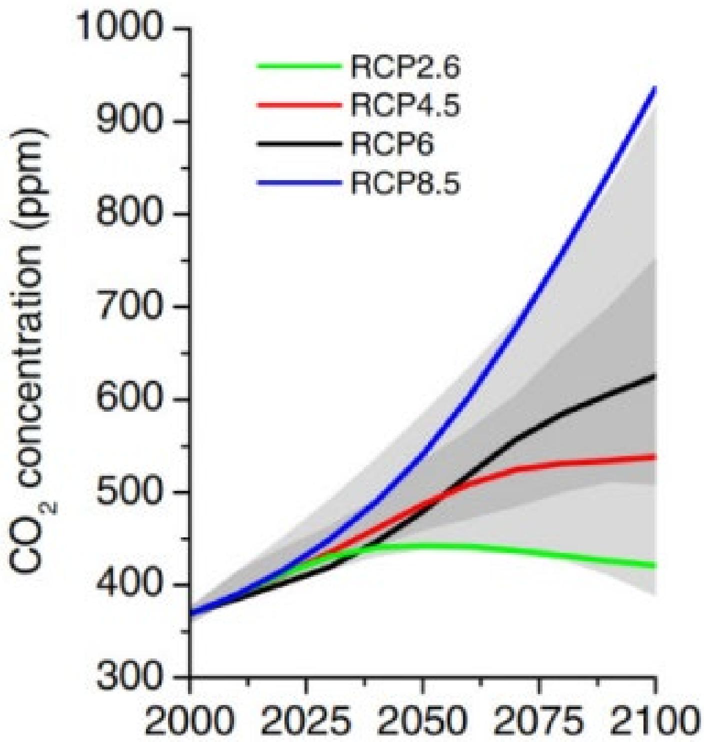

Figure 7. *Four representative concentration pathways and their expected increase in emissions up to 2100. Grey bands indicate the 98th and 90th percentiles (light/dark grey) of an earlier modelling study. Source:* (van Vuuren, et al., 2011).

In line with recommendations for impact assessment contained *within Book 1 – Scope and Philosophy Australian Rainfall and Runoff: A Guide to Flood Estimation* (Ball, et al., 2019) and for the purposes of undertaking a sensitivity analysis on the implications of climate change on the rainfall and flooding expected in the region, the RCP4.5 or RCP8.5 scenarios have been adopted. These scenarios assume a marginal increase to more frequent flood events, while more rare events, such as the 1% AEP, result in an increase in peak rainfall of 7.6 % (RCP 4.5) or 15.4 % (RCP8.5). This scenario represents the current trajectory of increases in greenhouse gas concentrations in the atmosphere without any significant mitigating actions. In the context of this assessment, it represents a conservative assessment of climate change impacts on rainfall over the life of the infrastructure.

Water quality and geomorphology impact assessment

Suitable habitat for watercourse ecosystems relies on water availability and flow characteristics, water quality, and physical habitat characteristics such as the form of watercourse bed and banks. Human social, cultural and economic uses and values also rely on water availability, good water quality and manageable flood risk.

Note: Given this assessment focusses on surface water alone and not aquatic or terrestrial ecology, we have focussed our analysis on watercourse processes, conditions and functions that generally support water-dependent species and healthy watercourse ecosystems. It is understood that analysis of species presence, value and impacts of the project on these will be covered in separate ecological assessments (refer to Entura 2024).

Potential water quality and geomorphology impact pathways

Potential surface water quality and geomorphology impact pathways from the project include:

- Altered fluvial geomorphic processes, initiation of bed and bank scour and sediment delivery, which can result in habitat loss and ecosystem decline (construction)
    - disturbance to the bed or banks of the drainage outfall under Bass Highway through ground disturbance activities (excavation, trenching, clearing, vehicular traffic etc.) within the riparian zone or instream.
- Changes to water quality, such as increased sediment loads, nutrient loads, addition of metals, hydrocarbons or other chemicals from spills that can lead to degradation in water quality, ecosystem health/reproduction or aesthetics through:
    - Spill or release events (construction or operation).
    - Dewatering activities that discharge directly to watercourses (construction and operation).
    - Contaminated surface water runoff following rainfall (construction).
    - Stormwater runoff both concentrated and increased volume from new impervious surfaces (operation).
- Alteration of the flow regime, such as diversion, duration, frequency, duration and timing of high and/or low flow events have potential to initiate bed and bank scour, resulting in habitat loss, sediment delivery which could have both ecological and physical form consequences:
    - Reinstatement of drainage lines to alternative shape/form and leading to altered fluvial geomorphic process initiating bed and bank scour (construction or operation)
    - Concentrated discharge of wastewater from de-watering activities initiating bed and bank scour (construction or operation)
    - Concentrated stormwater runoff across disturbed ground (construction) or impervious surfaces (operation) initiating scour/sediment runoff.

Risk assessment

Once the risk pathway has been identified, the risk of harm rating can be assessed. The risk of harm is the change to the identified value as a result of the hazard, mechanism, and pathway.

Likelihood

Likelihood is the chance of a risk and impact to values occurring. Table 3 outlines the qualitative criteria used to define likelihood. Likelihood can be determined both prior to and post implementation of risk controls and measures.

Table 3. Qualitative criteria utilised to define likelihood.

Likelihood	Description
Almost certain	A hazard, event and pathway exist, and harm has occurred in similar environments and circumstances elsewhere and is expected to occur more than once over the duration of the project activity, project phase or project life.
Likely	A hazard, event and pathway exist, and harm has occurred in similar environments and circumstances elsewhere and is likely to occur at least once over the duration of the project activity, project phase or project life.
Possible	A hazard, event and pathway exist, and harm has occurred in similar environments and circumstances elsewhere and may occur over the duration of the project activity, project phase or project life.
Unlikely	A hazard, event and pathway exist, and harm has occurred in similar environments and circumstances elsewhere but is unlikely to occur over the duration of the project activity, project phase or project life.
Rare	A hazard, event and pathway are theoretically possible on this project and has occurred once elsewhere, but not anticipated over the duration of the project activity, project phase or project life.

Consequence

Consequence is the impact of identified risks on values. Table 4 outlines the qualitative criteria used to define consequence. Consequence can be determined both prior to and post implementation of risk controls and measures.

Table 4. Qualitative criteria utilised to define consequence.

Consequence	Description
Severe	An effect that causes permanent changes to the environment and irreversible harm to physical, ecological, or social environmental surface water values or consequences of the impact are unknown and management controls are untested. Causes major public outrage, sustained widespread community complaints. Prosecution by regulatory authorities. Avoidance through appropriate design responses is required to address the impact
Major	An effect that is widespread, long lasting and results in substantial change to surface water values either temporary or permanent. Can only be partially rehabilitated or uncertain if it can successfully be rehabilitated. Appropriate design responses are required to address the impact. Causes major public outrage, possible prosecution by regulatory authorities. Receives widespread local community complaints.
Moderate	An effect that extends beyond the operational area to the surrounding area but is contained within the region where the project is being developed. The harm is short term and result in changes that can be ameliorated with specific management controls
Minor	A localised effect that is short term and could be effectively mitigated through standard management controls. Remediation work and follow-up required.
Negligible	A localised effect that is temporary and does not extend beyond operational area. Either unlikely to be detectable or could be effectively mitigated through standard management controls. Full recovery expected.

Risk rating

The risk of harm is determined by combining likelihood and consequence using the matrix in Table 5. The risk assessment guides the avoidance, mitigation and management measures proposed to manage these risks. Higher risks require specific controls or management, whereas lower risks can be managed using standard controls.

Table 5. Risk evaluation matrix

		Likelihood				
		Rare	Unlikely	Possible	Likely	Almost certain
	Negligible	Very low	Very low	Very low	Low	Moderate
	Minor	Very low	Low	Low	Moderate	Moderate
	Moderate	Low	Low	Moderate	High	High
Co	Major	Low	Moderate	High	Very high	Very high
	Severe	Moderate	High	Very high	Very high	Very high

Cumulative impact assessment

The EIS guidelines include requirements for the assessment of cumulative impacts. Cumulative impacts result from incremental impacts caused by multiple projects occurring at similar times and within proximity to each other.

To identify possible projects that could result in cumulative impacts, the International Finance Corporation (IFC) guidelines on cumulative impacts have been adopted. The IFC guidelines (IFC, 2013) define cumulative impacts as those that 'result from the successive, incremental, and/or combined effects of an action, project, or activity when added to other existing, planned, and/or reasonably anticipated future ones.'

The approach for identifying projects for assessment of cumulative impacts considers:

- Temporary boundary: the timing of the relative construction, operation and decommissioning of other existing developments and/or approved developments that coincides (partially or entirely) with Marinus Link.
- Spatial boundary: the location, scale and nature of the other approved or committed projects expected to occur in the same area of influence as Marinus Link. The area of influence is defined at the spatial extent of the impacts a project is expected to have.

Proposed and reasonably foreseeable projects were identified based on their potential to credibly contribute to cumulative impacts due to their temporal and spatial boundaries. Projects were identified based on publicly available information at the time of assessment. The projects considered for cumulative impact assessment in Tasmania are:

- Remaining North West Transmission Developments
- Guilford Windfarm
- Robbins Island Renewable Energy Park
- Jim's Plain Renewable Energy Park
- Robbins Island Road to Hampshire Transmission Line
- Bass Highway upgrades between Deloraine and Devonport

- Bass Highway upgrades between Cooee and Wynard
- Hellyer Windfarm
- Table Cape Luxury Resort
- Youngmans Road Quarry
- Port Latta Windfarm
- Port of Burnie Shiploader Upgrade
- Quaylink – Devonport East Redevelopment.

The projects relevant to this surface water impact assessment have been determined based on the potential for cumulative impacts to surface water values (flooding, water quality and geomorphology). These projects are occurring concurrently and/or are situated in close proximity to the Marinus Link project.

The assessment of the potential cumulative impacts draws on the findings from the impact assessment (see Section 7) and the identification of where effects from these credible projects and their associated activities may overlap, interact, and accumulate, and therefore result in a cumulative impact on surface water values within the study area.

The projects assessed relevant to this surface water impact assessment are:

- **Guilford Windfarm**: This project, located 7 km northwest of Waratah Bay and 15 km south of Hampshire, is pertinent to the Marinus Link project due to its substantial generation capacity of up to 450 MW of wind energy in close geographic proximity to the proposed converter station and shore crossing at Heybridge.

- **Robbins Island Renewable Energy Park**: With its potential energy generation of up to 900 MW, this project is highly relevant to the cumulative impact assessment of the Marinus Link project due to its substantial project scale and its location on Robbins Island, on the northwest coast of Tasmania.

- **Jim's Plain Renewable Energy Park**: Featuring up to 31 wind turbines and solar generation, with a combined capacity of up to 200 MW of wind energy and up to 40 MW of solar energy, this project is relevant to the Marinus Link project due to its capacity for generating renewable energy and its proximity, situated 23 km west of Smithton.

- **Robbins Island Road to Hampshire Transmission Line**: The construction of a new 220 kV overhead transmission line (OHTL) covering 115 km, with an estimated 245 towers, connecting the Jim's Plain and Robbins Island Renewable Energy Parks' transmission infrastructure to the Tasmanian transmission network, is relevant to the Marinus Link project due to its scale and infrastructure additions within the vicinity of the proposed project alignment, spanning between Robbins Island Road at West Montagu and Hampshire.

- **Bass Highway upgrades between Deloraine and Devonport**: This targeted highway upgrade along the Bass Highway, situated between Deloraine and Devonport and classified as roads of strategic importance, is relevant to the Marinus Link project as it involves significant transportation infrastructure improvements within the vicinity of the Marinus Link project.

- **Remaining North West Transmission Developments, including Staverton to Hampshire Hills and the Sheffield to Staverton upgrades**: This project involves a new 60 km long and modified 18.5 km long sections of the existing 220 kV overhead transmission line between Staverton and Hampshire Hills, and Staverton to Sheffield. It is relevant to the Marinus Link project due to its support for new and existing renewable energy developments, including Marinus Link itself.

- **Hellyer Windfarm**: Comprising up to 48 wind turbines generating up to 300 MW of wind energy and located 8.5 km southwest of Hampshire, this project is relevant to the Marinus Link project due to its potential cumulative effects associated with energy infrastructure on the environment in the region.

- **Table Cape Luxury Resort**: This project is located 4.5 km north of Wynyard, Ransleys Road, which is approximately 37 km from the proposed Heybridge converter station and shore crossing.
- **Youngmans Road Quarry**: Situated 2.5 km northwest of Railton, this project is relevant to the Marinus Link project as both may have potential cumulative impacts on land use in the area.

- **Port Latta Windfarm**: This project is located 2 km southwest of Cowrie Point, near Mawbanna Plain, and is relevant to the Marinus Link project due to its potential cumulative impacts associated with renewable energy infrastructure.

- **Port of Burnie Shiploader Upgrade**: Situated in the Port of Burnie, this project involves the expansion of minerals shiploader and storage facilities. It is relevant to the cumulative impact assessment of the Marinus Link project due to its potential influence on port infrastructure and operations in the region.

- **Bass Highway upgrades between Cooee and Wynard**: This project involves a priority upgrade of the Bass Highway between Cooee and Wynyard, which is relevant to the Marinus Link project due to its potential cumulative impacts associated with freight ferry services in the region.
- **Quarry Link**: Located in the Port of Devonport, this project involves a port terminal upgrade that is relevant to the Marinus Link project due to its potential cumulative impacts associated with freight ferry services in the region.

Other projects, which were not listed above have also been considered relevant to this cumulative impact assessment due to their potential cumulative effects associated with energy infrastructure to the environment. These projects are:

- **Western Plains**: This project, featuring up to 12 wind turbines to generate up to 50.4 MW of wind energy is located 4 to 5 km northwest of Stanley.
  Lake Cethana Pumped Hydro: This project, features up to 600 MW energy capacity, which is located 19 km southwest of Sheffield.

The assessment of cumulative impacts on surface water values at the Heybridge converter station and shore crossing is further detailed in Section 7.8.

5.3 Mitigation measures

Standard mitigation measures have been identified below to help guide the selection of final mitigation measures in Section 7.6.

The risk assessment process was used to identify mitigation measures, minimisation measures and the subsequent final mitigation measures as part of the surface water impact assessment.

Final mitigation measures and their development are presented in Section 7.6.

Flooding mitigation measures

Standard avoidance and mitigation measures to minimise the potential flooding impacts of the project include:

- Implementing appropriate flood mitigation measures in the design of the Heybridge converter station site to minimise adverse flood impacts to surrounding property, key infrastructure and the environment.
- Implementing appropriate erosion control measures in the design for Heybridge converter station site to minimise adverse scour/stability impacts and potential to impact on adjacent property, key infrastructure and the environment.
- Implementing appropriate flood immunity requirements for the Heybridge converter station infrastructure to eliminate impacts and protect the health and safety workers, operational staff, and the public.

Water quality and geomorphology mitigation measures

Standard mitigation measures to minimise the potential water quality and geomorphology impacts of the project include:

- Develop and implement an Progressive Erosion and Sediment Control Plan based on available guidelines including:
    - EPA TAS fact sheets: *Soil and Water Management on Large Building and Construction Sites, Erosion Control Matts and Blankets, Scour Protection – Stormwater Pipe Outfalls and Check Dams, Stabilised Access and Sediment Fences and Fibre Rolls, Bunding and Spill Management Guidelines*.
    - Discharge/runoff to meet the *Tasmanian Stormwater Policy Guidance and Standards for Development* requirements for discharge and run-off from the project.
    - Comply with the *Technical Guidance for Water Quality Objectives Setting for Tasmania, Environmental Effects Report Guidelines (EPA Tasmania)* and relevant EAP Tasmania fact sheets such as *Soil and Water Management Plans.*

5.4 Stakeholder engagement

Stakeholders and the community are being consulted throughout the development of the project and the EIS process. Formal engagement with landholders and stakeholders has not been undertaken specifically for the purposes of the surface water impact assessment. The public engagement process is ongoing with details of the program contained at https://www.marinuslink.com.au/engagement/.

5.5 Assumptions and limitations

The following limitations, uncertainties and assumptions apply to this study:

- Impact and risk assessments are largely qualitative constraints, including, but not limited to lack of complete, long-term, consistent quantitative data and field site access constraints. To overcome this multiple data sets (i.e. repeat aerial photography from multiple data sources to fill in sites unable to be inspected) have been used to help inform the impact assessment process.
- Any use which a third party makes of this document, or any reliance on or decision to be made based on this document, is the responsibility of such third parties. The client and the project team accept no responsibility for damages, if any, suffered by any third party as a result of decisions or actions made based on this document.
- Information and data such as GIS layers, models and other data have been obtained from a range of external sources including Tetra Tech Coffey, The LIST, other authorities and groups. It is only practical to verify or independently review some of this information. The data is sometimes provided with caveats or with missing or obviously inconsistent information. These indicated limitations have been considered, and known limitations addressed and or documented adequately and the data has been considered suitable for the specific purpose of informing the EIS. While care has been taken in interpreting the provided data, neither the original provider nor the project team take any responsibility for incorrect or inaccurate information or make any representation as to its suitability for other purposes.
- Flood modelling developed specifically for the project is assumed to be sufficiently accurate for informing the investigations covered in this impact assessment and in line with TAS EPA assessment guidelines.
- Flood modelling has been undertaken based upon available information including limited feature and topographic survey and incomplete spatial data from third parties (including pit and pipe data). Where adverse pit and pipe gradients and invert inconsistences were encountered, nominal depths were assumed from LiDAR, or gradients were calculated from surface profiles.

The study acknowledges the above limitations for the surface water impact assessment of the project and the level of detail has been considered suitable to support the specific purposes of informing the two EISs.

6 Existing conditions

This section describes the existing conditions and values within the study area based on the information obtained from the baseline assessment.

The study area for the baseline characterisation assessment is concerned with the watercourses and areas surrounding the Heybridge converter station and shore crossing. This section outlines the existing flooding, water quality and geomorphic conditions in these watercourses and areas surrounding the Heybridge converter station and shore crossing, based on available data and information from desktop assessments and targeted field investigations.

6.1 Existing flooding conditions

Flood mapping and subsequent assessment of the Heybridge converter station has been developed from outputs of the flood modelling in accordance with the methodology detailed in Section 5. Figure 8 and Figure 9 highlight the spatial distribution of surface roughness parameters selected.

Flood mapping of existing conditions in the 0.5 % AEP event indicates that the Blythe River is largely confined to its floodplain and does not interact with the Heybridge converter station development site. In both the existing (Figure 10 and Figure 11), and existing climate change scenarios (Figure 12 and Figure 13) surface flows follow well defined valleys before joining the Blythe River. Also evident is that the proposed development area, the former tioxide plant, is situated outside the Blythe River floodplain, adjacent to the Bass Highway. A relatively major tributary can be seen south of the study area that joins the Blythe River approximately 300 m from the site boundary and does not impact the site.

The existing access/haul road that surrounds the western and southern lengths of the site is subject to flood depths up to 0.2 m (Figure 10 and Figure 11), while localised flows move across the site from west to east and accumulate in a settling pond. The existing conditions model highlights significant ponding of water in the northern extent of the converter station and shore crossing, with depths up to 1.6 m at the entrance to the outfall culvert that passes beneath the Bass Highway.

Under the climate change scenario in Figure 12 and Figure 13, depths and extents marginally increased across the site, however, importantly, the Blythe River is still contained within its floodplain, and does not interact with the proposed development site.

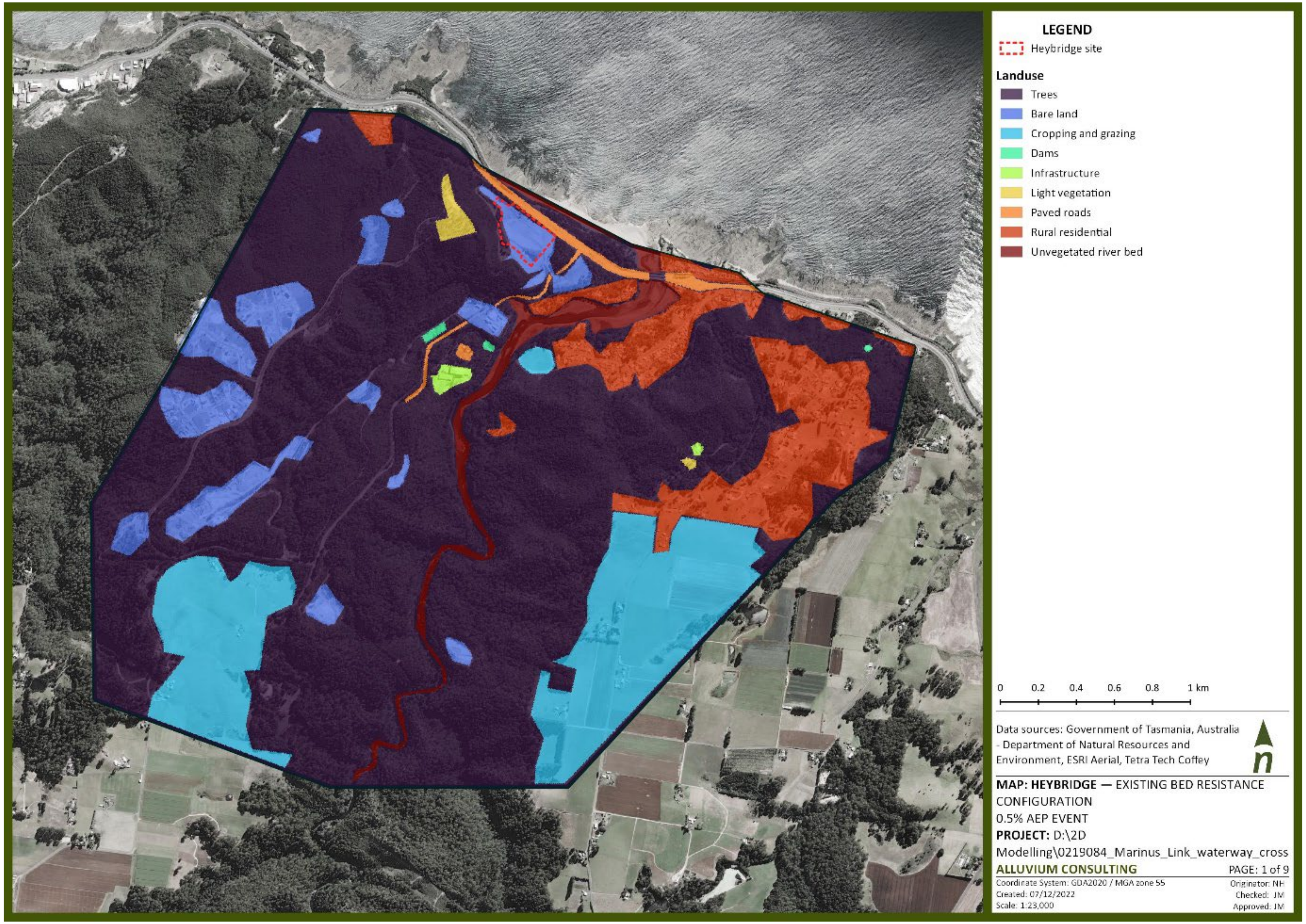

Figure 8. *Heybridge baseline characterisation bed resistance configuration (Manning's n) – full model extent.*

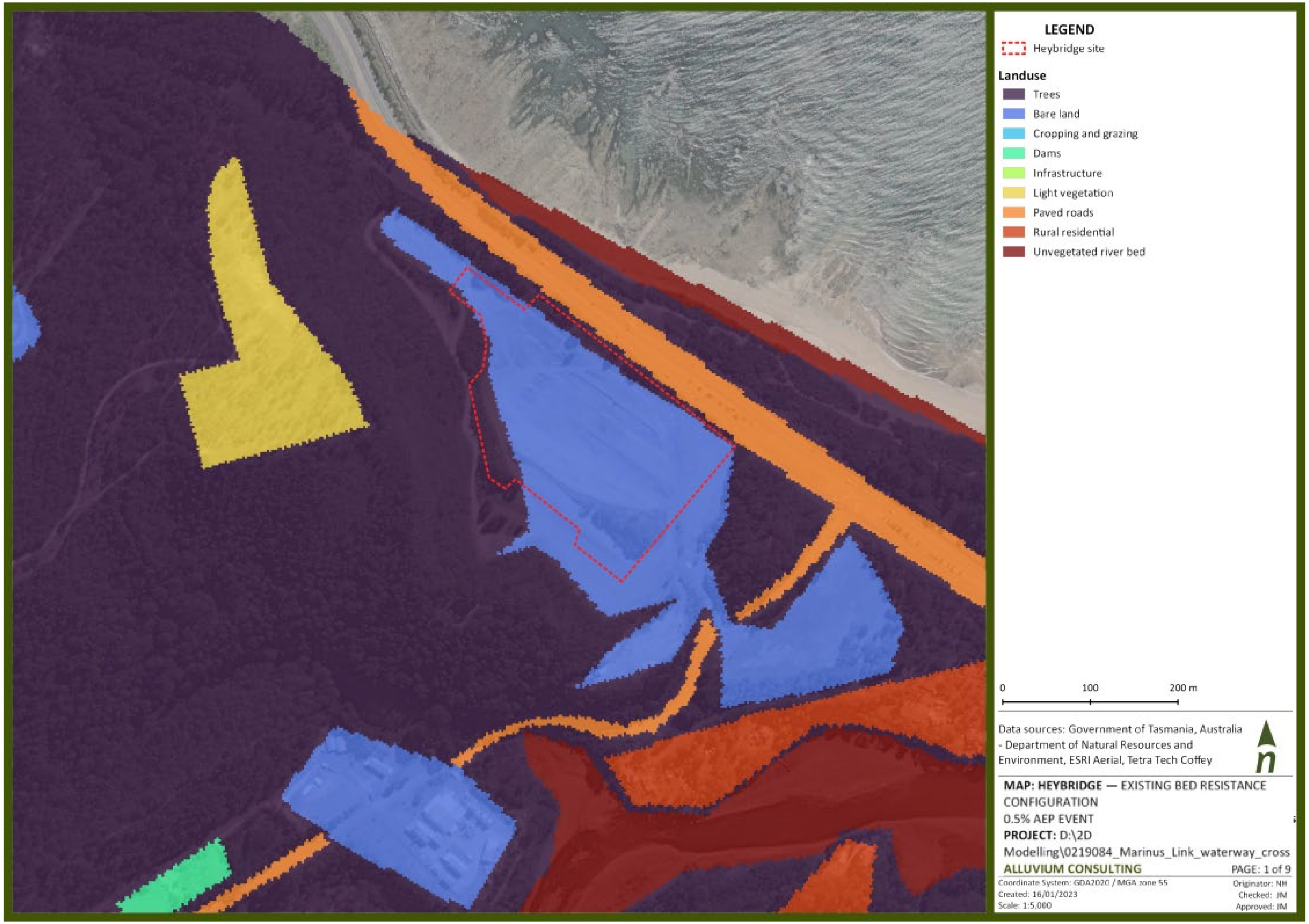

Figure 9. *Heybridge baseline characterisation bed resistance configuration (Manning's n) – Heybridge site.*

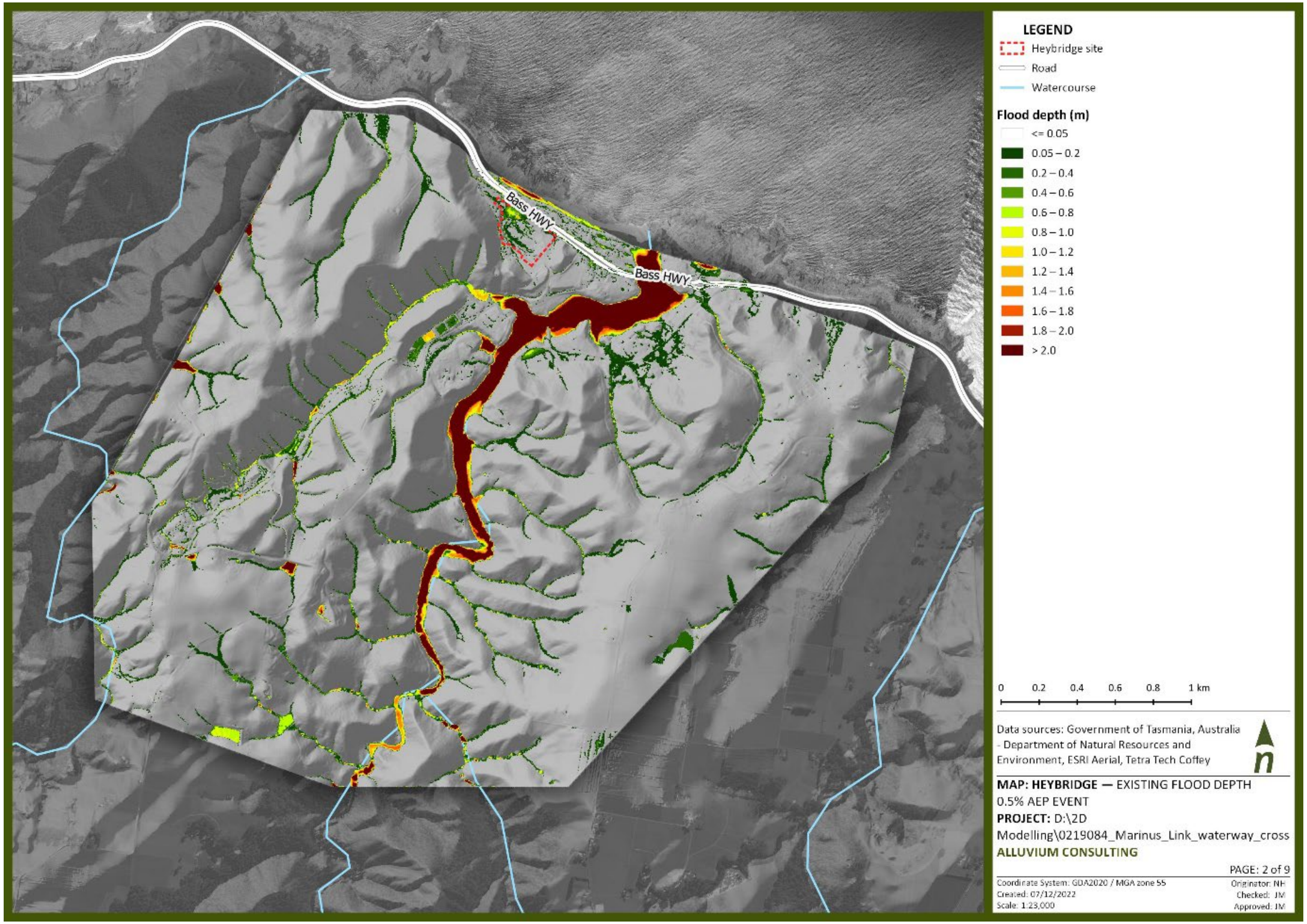

Figure 10. *Heybridge baseline characterisation 0.5% AEP flood depth – full model extent.*

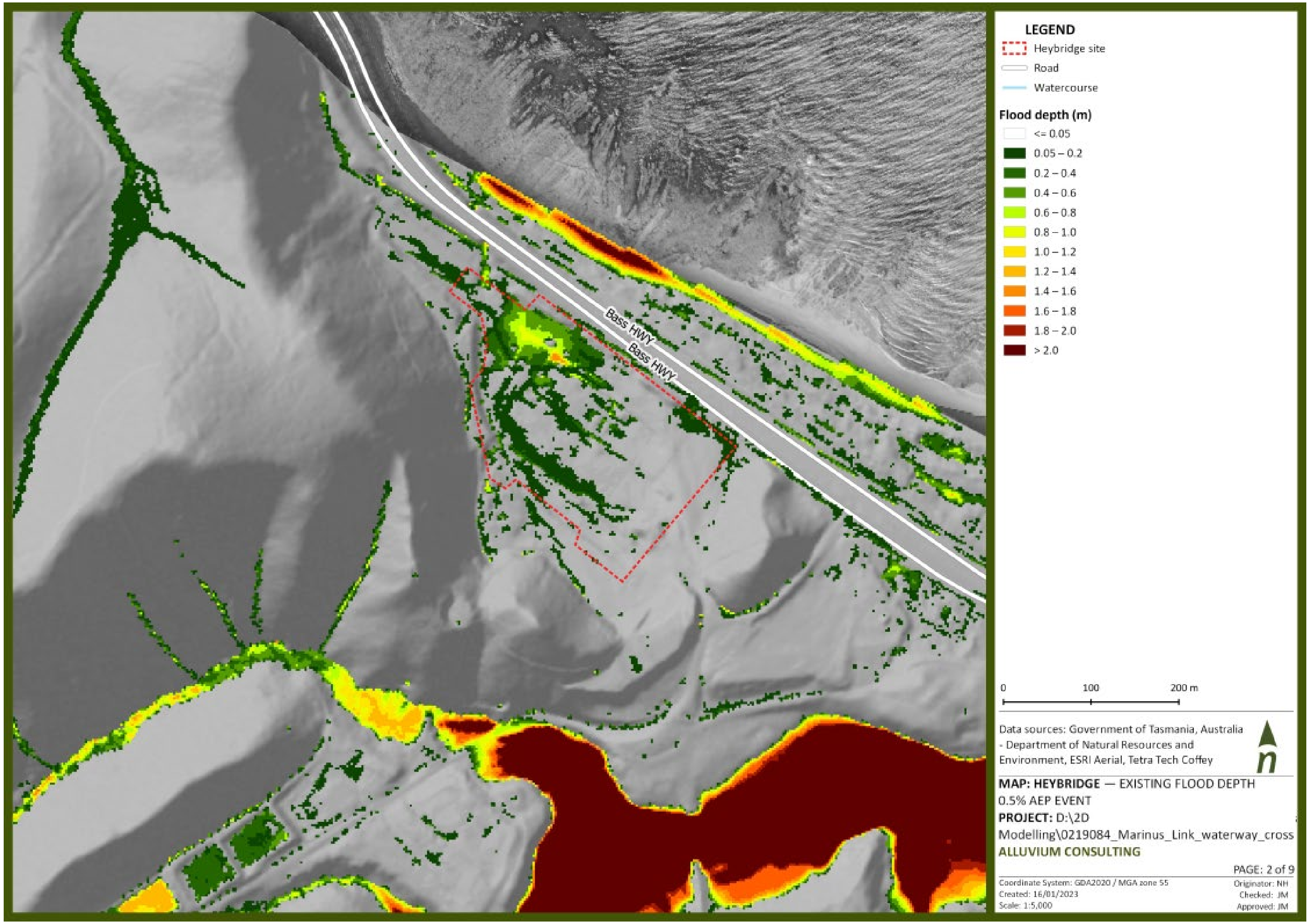

Figure 11. *Heybridge baseline characterisation 0.5% AEP flood depth – Heybridge site.*

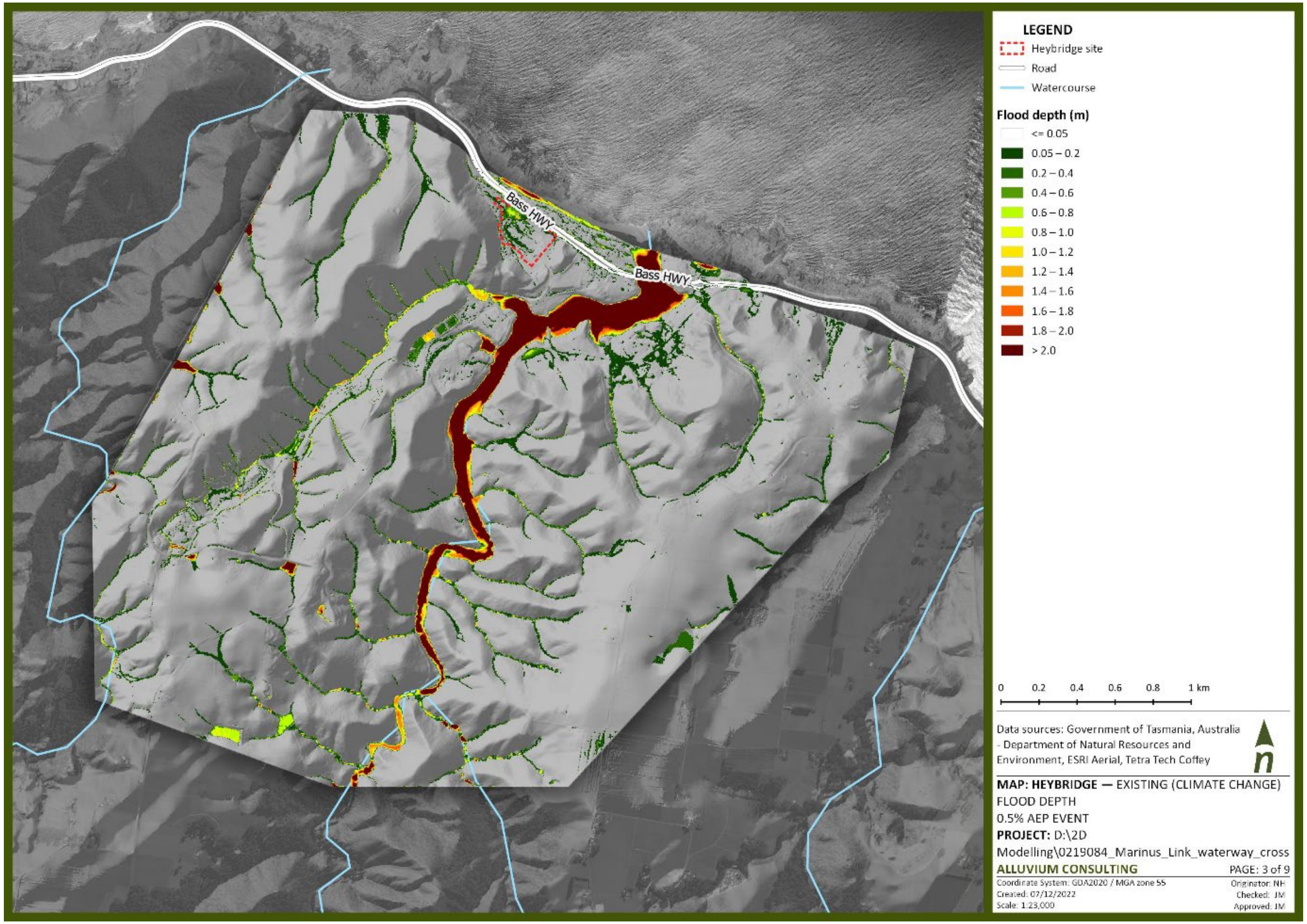

Figure 12. *Heybridge baseline characterisation climate change 0.5% AEP flood depth – full model extent.*

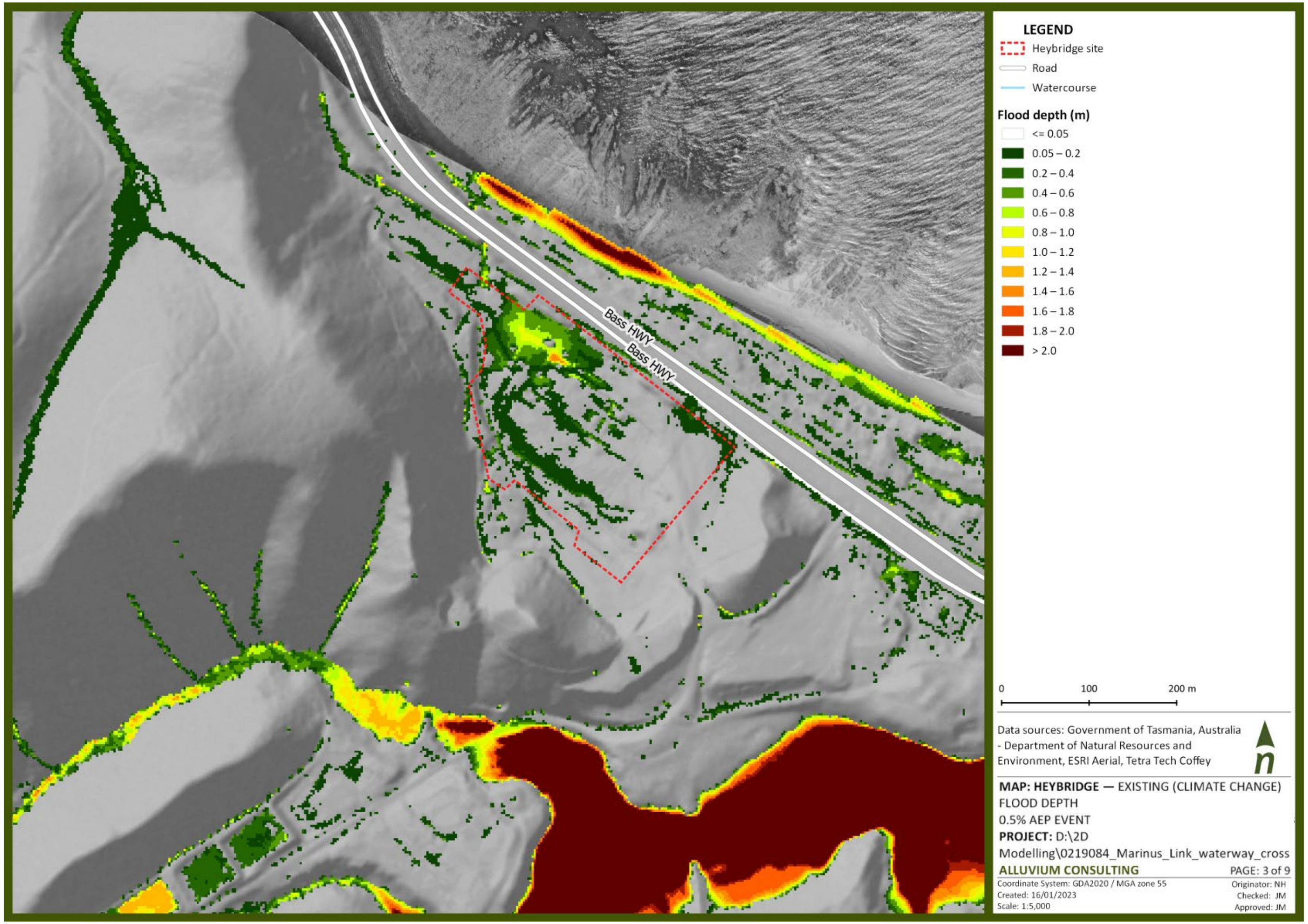

Figure 13. *Heybridge baseline characterisation climate change 0.5% AEP flood depth – Heybridge site.*

6.2 Existing water quality

Stormwater outfall

The current arrangement sees stormwater discharged from the site via a culvert that passes beneath the Bass Highway. Stormwater then makes its way to coastal waters via Tioxide Beach at Heybridge.

The Tasmanian State Policy on Water Quality Management 1997 (SPWQM) establishes a framework that is compatible and consistent with national guidelines including the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018 (ANZG, 2018) and the National Water Quality Management Strategy 1994 (NWQMS). As part of the implementation of the State Policy, protected environmental values (PEVs) have not been set at a State level for coastal and marine waters, however the Default Guideline Values (DGVs) for Aquatic Ecosystems of Tasmania Coastal and Marine Waters (EPA, 2021) set out interim PEVs. These are:

A. Protection of Aquatic Ecosystems
   i. Coastal waters ecosystems
B. Recreational Water Quality and Aesthetics:
   i. Primary contact water quality;
   ii. Secondary contact water quality; and
   iii. Aesthetic water quality
C. Industrial water supply (Selected areas of aquaculture in Marine Farming Zones)

This requires, at a minimum, water quality management strategies to provide water of a physical and chemical nature to support coastal ecosystems (either pristine or modified) from which edible fish, shellfish and crustacea can be harvested. Allow people to safely engage in recreation activities such as swimming, paddling or fishing in aesthetically pleasing waters; and provide water suitable for marine farming in relevant zones; and suitable for use as industrial water supplies (including for intensive aquaculture).

DGVs for the stormwater discharge location are set by the relevant Provincial and Mesoscale bioregions assigned by the EPA (2021) which is located in the Boags Mesoscale bioregion and are presented below:

Boags Bioregion	Physico-chemical indicators and DGVs for Aquatic Ecosystems											
	Dissolved oxygen (mg/L)		Salinity	pH		Temperature (°C)		Nitrate as N	Orthophosphate as P	Silicate as SI	Fluorescence	PAR
	lower	upper	(PPT)	lower	upper	lower	upper	(µg/L)	(µg/L)	(µg/L)	(unit less)	(µEm-2sec-1)
Annual	7.4	8.3	35.7	8.1	8.4	13.2	17.2	22.0	10.0	56.0	41.7	24.6
Summer	7.3	8.0	35.3	8.1	8.2	14.6	18.8	5.0	5.6	36.4^	22.7	ND
Autumn	7.4	7.8	35.8	8.2	8.4	15.0	17.2	12.6	10.0	59.4	42.1	24.6
Winter	7.9	8.5	35.2	8.1	8.2	11.7	13.4	37.6	12.3	56.0~	13.9^	11.9^
Spring	8.1	8.7	34.8	8.1	8.2	12.5	14.4	15.4	9.0	28.0^	ND	ND

NB: ND= No Data, ~ <95% Confidence, ^ Province derived values

Figure 14. *Physio-chemical indicators and DGVs for Aquatic Ecosystems in the Boags bioregion*

Blythe River

The SPWQM also sets out PEVs for inland and estuarine waters that are determined through extensive stakeholder consultation and identification of community values and uses. The Environmental Management Goals for Tasmanian Surface Waters: The Blythe River Estuary and Minna Creek and Tip Creek Catchments (DPIWE, 2000) states that for the Blythe River Estuary, these PEVs are:

A. Protection of Aquatic Ecosystems
   i. Protection of modified (not pristine) ecosystems from which fish are harvested.

B. Recreational Water Quality and Aesthetics:
   i. Primary contact water quality (between bridge and estuary mouth);
   ii. Secondary contact water quality; and
   iii. Aesthetic water quality

That is, as a minimum, water quality management strategies should provide water of a physical and chemical nature to support a modified, but healthy aquatic ecosystem from which edible fish may be harvested; that allows people to safely engage in primary contact recreational activities such as swimming (between the Blythe Bridge and the estuary mouth) and secondary recreational activities such as paddling, boating and fishing in aesthetically pleasing waters (DPIWE, 2000).

DGVs apply to key indicators and are numerical concentrations or descriptive statements recommended for the support and maintenance of the designated water use or value, i.e. the PEVs. DGVs are set for High Ecological Value ecosystems and Slightly to Moderately Disturbed ecosystems for the Blythe catchment. These DGVs are outlined in Table 6, below.

Water quality monitoring data is lacking in the Blythe River estuary, with monitoring stations largely located further up the catchment.

Known factors influencing existing water quality in the Blythe catchment, river and estuary include:

- Forestry, cropping, dairy, and other agricultural activities (Crawford & White, 2007)
- Industrial activities such as:
  - The paint pigment factory (Tioxide Australia) at the site of the proposed converter station that historically released an iron-rich acid solution into the water until it was closed in 1996 (Crawford & White, 2007).
  - Mineral processing operations with significant discharges of silica sand to the Lower Blythe River (Green, 2001)

A classification of Tasmanian estuaries classified the Blythe estuary as a degraded estuary of low conservation significance (Class D), meaning the estuary and associated catchment have been moderately degraded by human impacts (Edgar, et al., 1999).

Table 6. Physio-chemical indicators and water quality DGVs for Aquatic Ecosystems of the Blythe Catchment (EPA Tasmania, 2021)

		High Ecological Value ecosystem					Slightly to Moderately Disturbed				
		Annual	Summer	Autumn	Winter	Spring	Annual	Summer	Autumn	Winter	Spring
Dissolved oxygen (mg/L)	lower	8.7	7.6	8.3	9.7	8.9	9.0	8.5~	9.5~	10.5~	9.1~
	upper	10.9	10.0	10.6	11.6	10.9	10.6	9.2~	10.3~	11.1~	10.3~
Dissolved oxygen (% saturation)	lower	78.4	89.7	64.2	77.0	79.7	88.0	85.2	88.1	86.8	90.7
	upper	100.4	104.5	101.3	95.3	98.5	100.0	105.0	99.8	98.0	100.0
Electrical conductivity (µs/cm)		178.6	172.3	187.6	216.6	170.8	80.7	80.0~	114~	75.0~	73.5~
pH	lower	5.3	5.6	5.6	4.8	5.2	6.7	6.7~	6.4~	6.5~	7.0~
	upper	7.2	7.4	7.2	6.8	7.0	7.1	7.2~	7.1~	7.2~	7.1~
Turbidity (NTU)		8.8	7.1	7.3	11.0	11.7	3.8	2.8~	4.6~	5.6~	2.5~
Temperature (°C)	lower	8.7	12.7	9.2	7.0	8.9	8.9	13.5~	9.2~	7.1~	11.1~
	upper	14.0	16.6	13.1	9.9	12.6	16.2	17.5~	15.3~	8.8~	17.0~
Total ammonia nitrogen (Nitrogen mg/L)		0.051	0.048~	0.070~	0.055~	0.043~	0.038	0.030	0.044	0.023	0.055
NO_3 (Nitrogen mg/L)		0.136	0.172	0.130	0.091~	0.087	0.187	0.136	0.125	0.353	0.299
NO_2 (Nitrogen mg/L)		0.008	0.007~	0.007~	0.008~	0.009~	0.004	0.004	0.003	0.003	0.004
Total Nitrogen (mg/L)		0.706	0.662	0.643	0.825	0.717	0.663	0.591	0.525	0.742	0.780
Dissolved reactive phosphorus (Phosphorus mg/L)		0.004	0.005~	0.004~	0.004~	0.004~	0.005	0.005	0.005	0.005	0.005
Total Phosphorus (mg/L)		0.025	0.024	0.029	0.065	0.018	0.025	0.024	0.027	0.026	0.025
Total suspended solids (1.5 µm) (mg/L)		5.00	5.00~	5.00~	5.00~	5.00~	5.00	5.00	5.00~	8.00	11.20~
Total suspended solids (0.45 µm) (mg/L)		3.00	3.00	5.00	3.00	3.00	11.00	15.20	12.00	7.00	8.20

Figures shown above are based on data from 8 High Ecological Value sites across the H4 Hydrological region and 1 Slightly Modified Ecological Value site within the Blythe Catchment unless noted otherwise as below:

Green = Hydrological region values

Blue = State derived values

~ = <95% confidence

6.3 Existing geomorphic conditions

Fluvial geomorphology describes the size, shape and diversity of the river channel and the processes by which these elements of the stream system form and change through time. Fluvial geomorphology shapes river channels, sediment dynamics, floodplain development, bank erosion, riparian vegetation, and instream features to create a variety of habitats. The variety of habitat types create distinct ecological niches, contributing to the ecological health and functioning of a fluvial system.

Streams and waterways adjust dynamically over time in response to the temporal sequence of sediment and water flows delivered from the upstream catchment (Bledsoe, 2002). Erosion occurs when the shear stress associated with water movement is greater than the shear resistance of the bed and bank materials. In general, disturbance in the mobilisation of sediments can often result in waterway instability and erosion and is typically assessed and represented through shear stress assessments and modelling.

Shear stress is calculated as the multiple of the unit weight of water, hydraulic radius and friction slope. These values are described in further detail in *Technical Guidelines for Waterway Management* (Department of Sustainability and Environment (DSE), 2007). Typical values for various channel boundary materials have been selected to provide a representation of the shear stress required to initiate erosion in Table 7.

Table 7. Maximum shear stress for various channel boundary materials (Fischenich, 2001).

Parameter	Shear stress (N/m^2)
Sand	1.44
Gravel	3.59
Grass	4.55
Clay	12.45
Cobble	32.08
Wattle	47.88
Long native grasses	81.40
Gravels (D50 = 150 mm)	95.76
Structurally diverse hardwood and understory planting	150.00
Rock (D50 = 300 mm)	244.19
Concrete	598.50

Existing geomorphic conditions and relative erosion potential at the site have been established through hydraulic modelling, with the methodology described in Section 5.2. Hydraulic modelling was used to establish typical shear stress values across the site.

The shear stress analysis for the 0.5 % AEP (Figure 15 and Figure 16) and the 0.5 % AEP climate change (Figure 17 and Figure 18) events indicate that the areas of higher shear stress are concentrated in the confined valleys with surface flows coalescing before joining the low energy Blythe River. Given the existing land use of the area, the bed material is predominately bare land and sand at the former tioxide plant, erosion is typically expected under the current and climate change scenarios as the values through these areas are subject to 10-20 Newtons per square metre (N/m^2). From the aerial imagery, the surrounding area appears to be sand, which from Table 7, has a shear resistance value of 1.44 N/m^2. Under the current and climate change scenarios, it is anticipated that this erosion would mobilise sand and transport it over the site from west to east and result in sediment build up at the entrance to the culvert outfall.

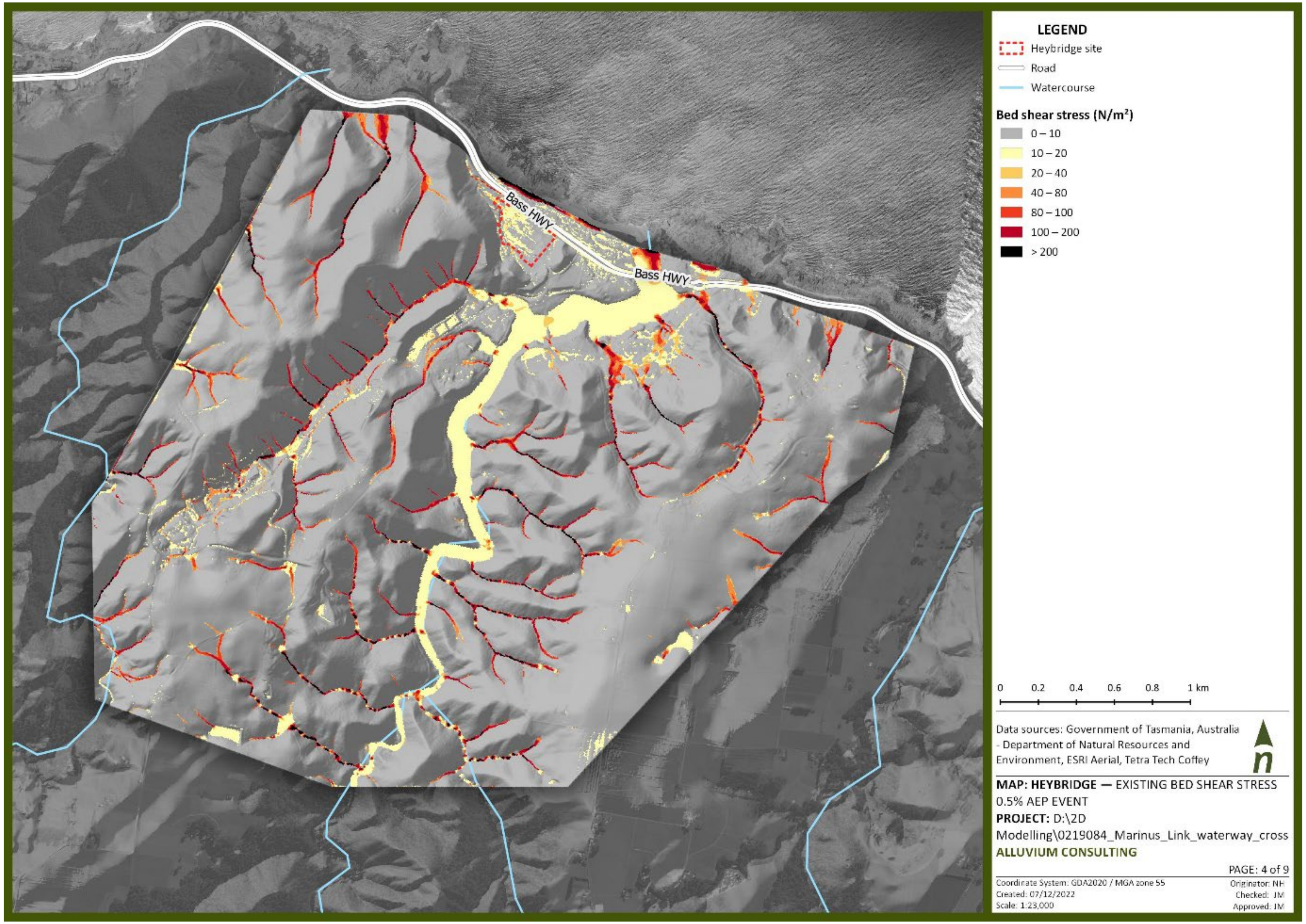

Figure 15. *Heybridge baseline characterisation bed shear stress for 0.5% AEP – full model extent.*

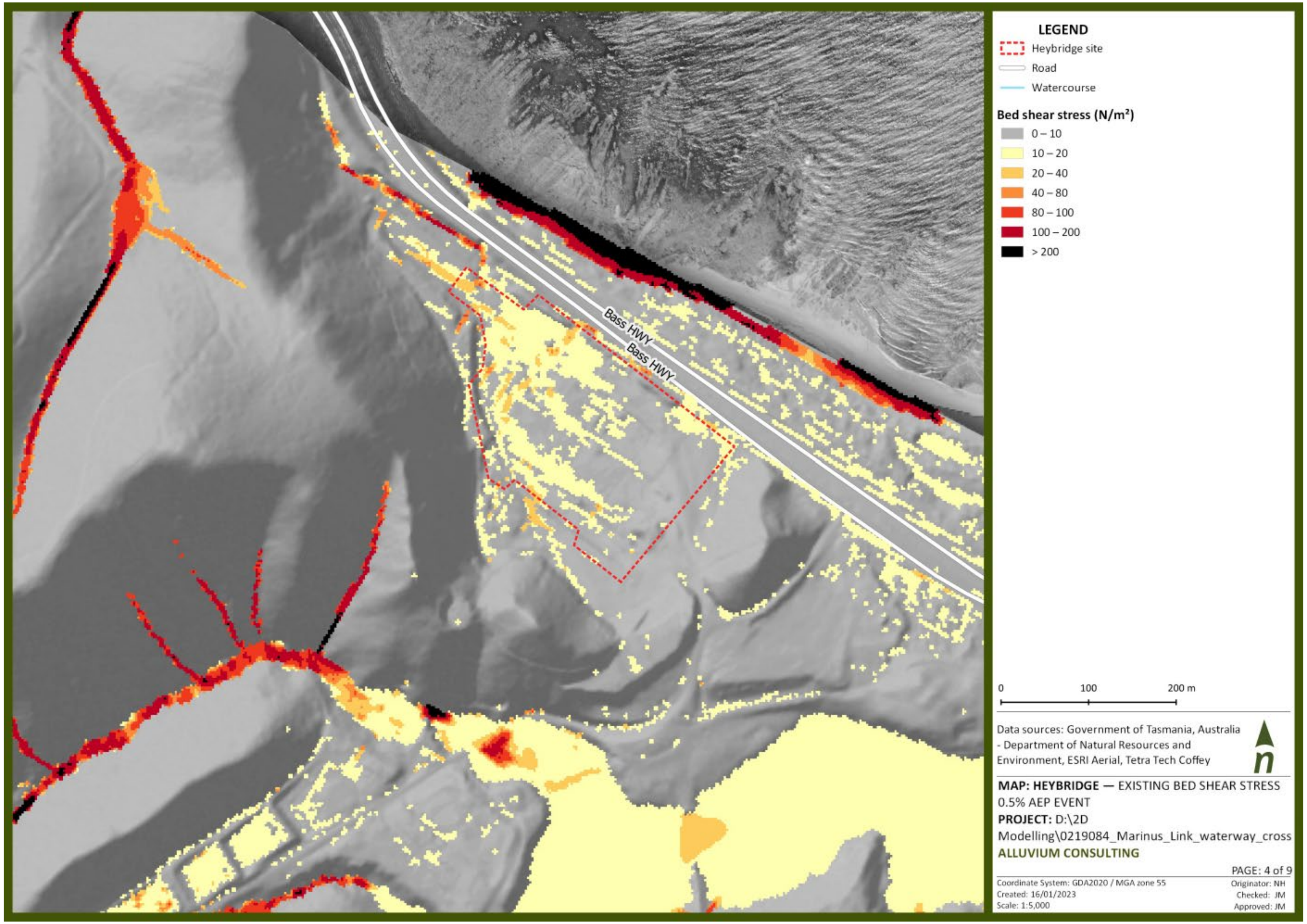

Figure 16. *Heybridge baseline characterisation bed shear stress for 0.5% AEP – Heybridge site.*

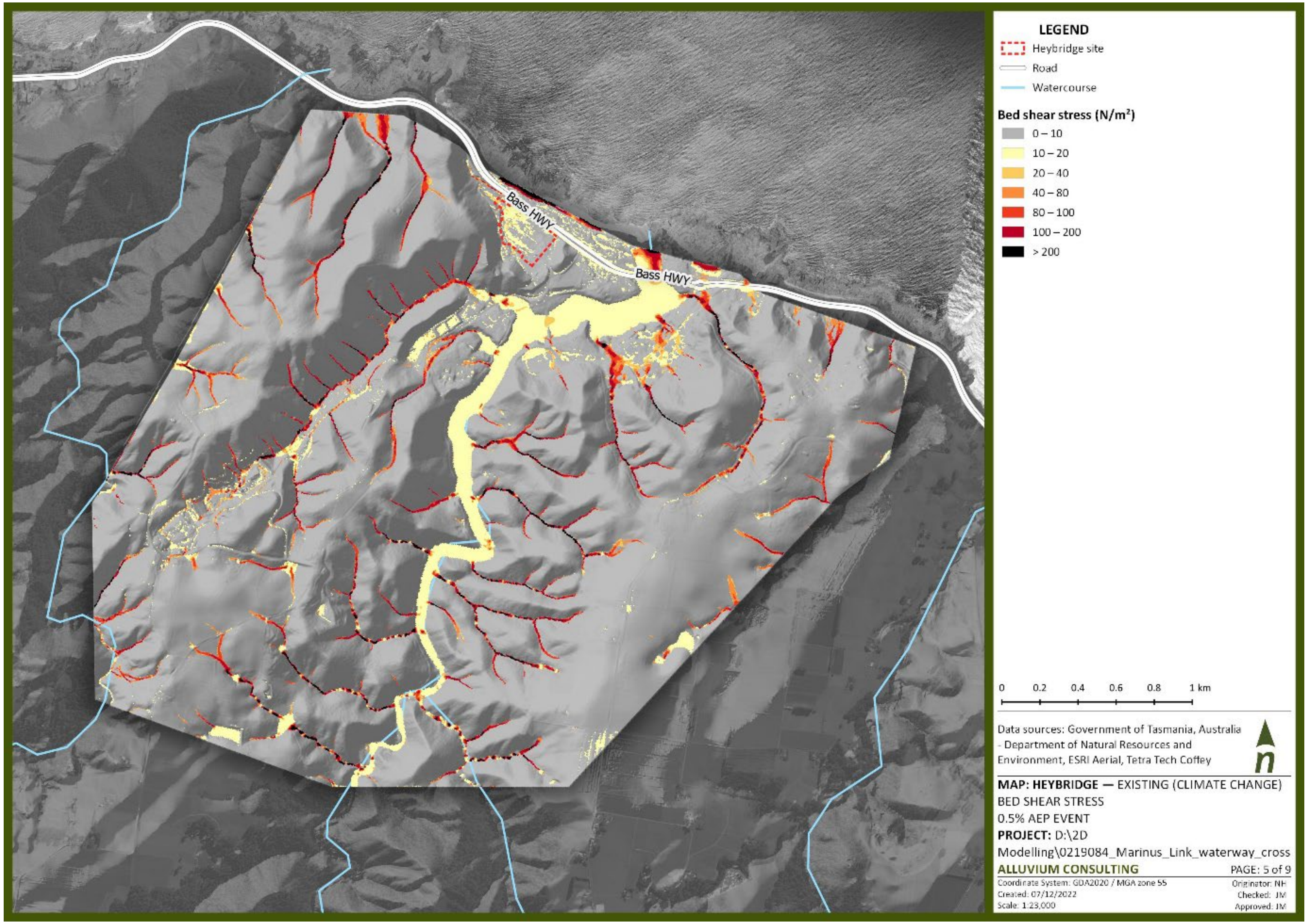

Figure 17. *Heybridge baseline characterisation bed shear stress for climate change 0.5% AEP – full model extent.*

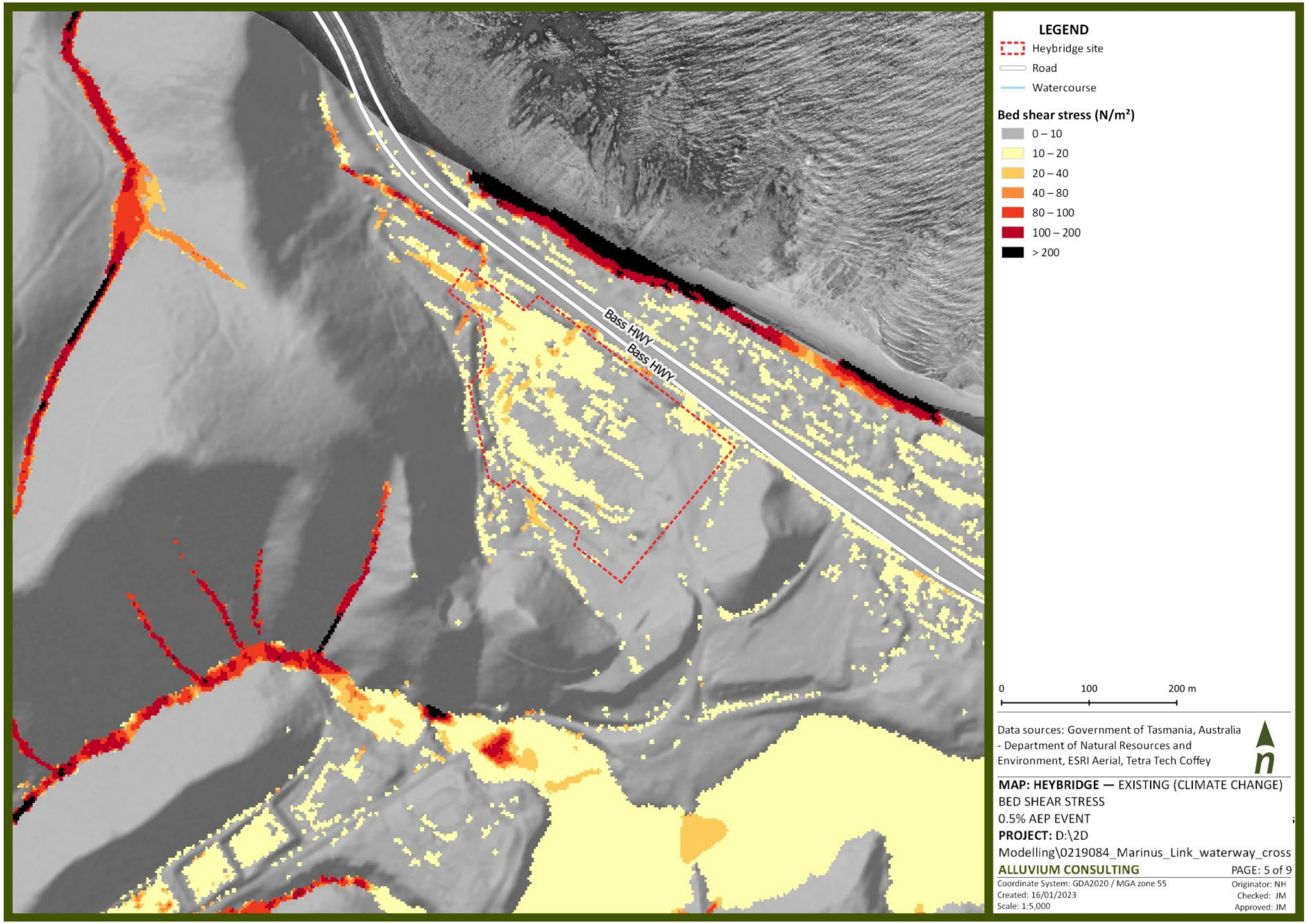

Figure 18. *Heybridge baseline characterisation bed shear stress for climate change 0.5% AEP – Heybridge site.*

7 Impact assessment

The following sections present the surface water impact assessment for the project.

7.1 Key issues on environmental values

Key issues relevant to project impacts on surface water have been identified through an assessment of the effects on surface water as a result of construction and operation activities of the project. In relation to the EIS guideline requirements these key issues have considered the potential for adverse effects on:

- The functions and environmental values of surface water environments, such as interception or diversion of flows or changed water quality or flow regimes.
- Nearby and downstream water environment due to changes in flow regimes, floodplain storage, run-off rates, water quality changes, or other watercourse conditions, including in the context of climate change projections.

Sections 7.2, 7.3 and 7.4 provides an assessment of the key potential impacts and risks on surface water in regards to flooding, water quality and geomorphology as a result of construction and operational activities of the project.

7.2 Flooding impacts

This section identifies the potential flooding impacts and risks of the project on watercourses and surrounding areas during construction and operation phases on identified surface water environmental values.

Impacts to flooding from the construction and operation of the converter station at Heybridge was assessed as part of detailed, site-specific flood modelling. Results from the flood modelling indicate as a result of the proposed converter station, flood levels are expected to increase by 0.05-0.1 m at the location of the existing culvert outfall to the west of the station footprint under the current 0.5 % AEP scenario (Figure 19). A significant reduction in areas that “were wet, now dry” were identified in the development footprint associated with the proposed site contouring works (utilising the existing outfall arrangement under Bass Highway) in both the design condition and under climate change conditions. Both scenarios demonstrate a reduction in pooling on the site due to the proposed cut and fill site design. Under climate change projections, the increase in flood depths is also concentrated at the existing culvert outfall (Figure 20) with increases typically in the order of 0.05-0.1 m increases.

It is understood that clean surface water runoff and overflow from the site interceptor trap will discharge to a form of water sensitive urban design (WSUD) such as a swale drain, before discharging to the ocean via the existing site drainage culvert. Details on the interceptor trap or swale drain was not available at the time of assessment and was not incorporated into the modelling. This is important to note as and WSUD features are typically bypassed or drowned-out under a 0.5 % AEP streamflow event.

Figure 19. *Heybridge 0.5% AEP afflux.*

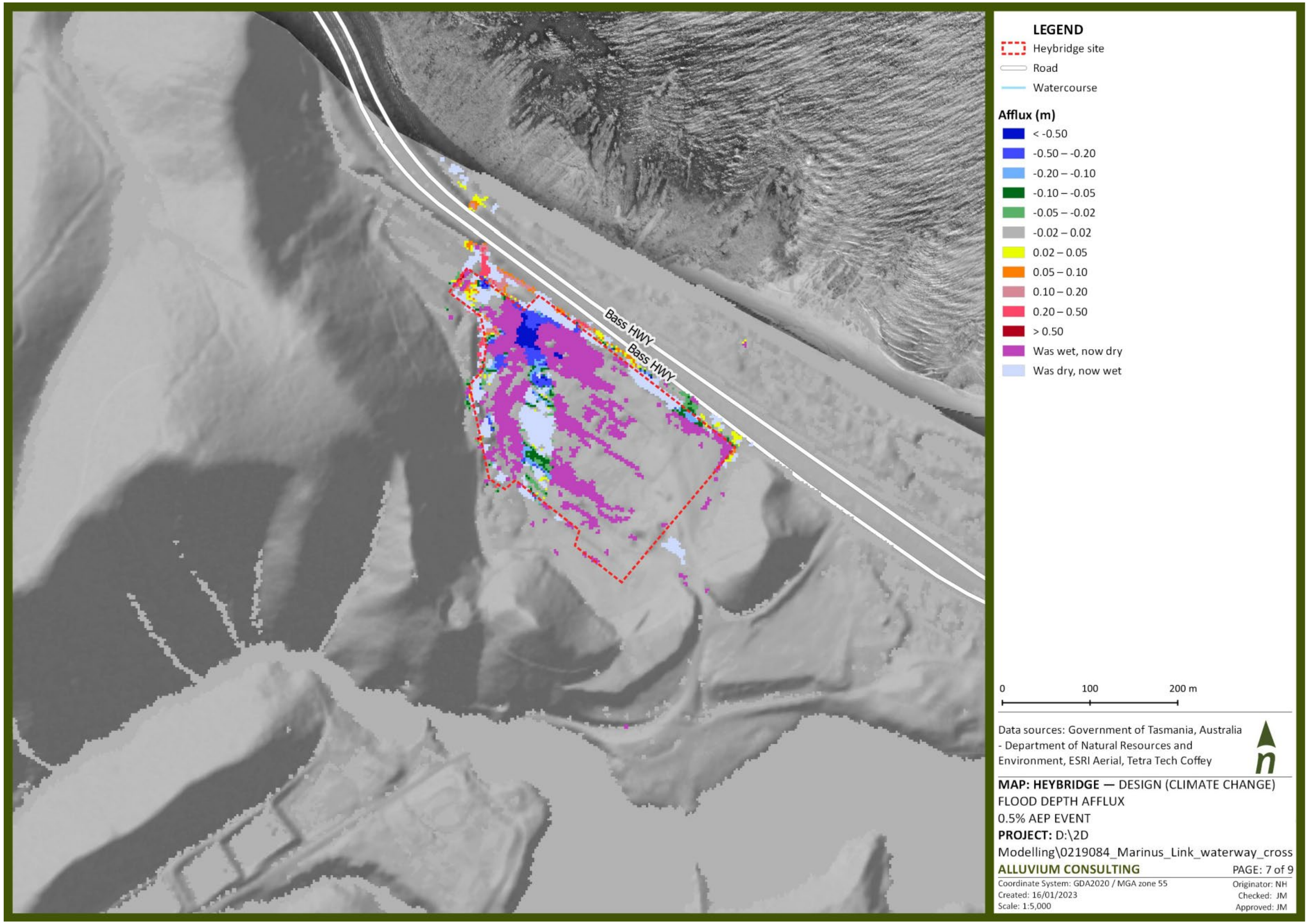

Figure 20. *Heybridge climate change 0.5% AEP afflux.*

Flooding risks identified

Based on the flooding assessment several risks were identified, the hazard and pathways/mechanism for these risks are outlined in Table 8.

Table 8. Identified risks associated with flood behaviour and associated functions, including hazard and pathway/mechanism.

ID	Hazard	Pathway/mechanism	Risk
C.1	Construction activities	Temporary activities such as excavation, stockpiling and alteration of topography or change in impervious surfaces alters floodplain storage capacity to store/transport floodwaters and/or diverts flow.	Increase in flood inundation frequency, velocity or level which affects users or assets within the floodplain.
C.2	Construction activities	Excavation, filling or other interference with existing overland/surface flow pathways leading to changes in flow conveyance behaviour, direction, velocity or other characteristics	Construction activities on existing flow paths including piped flow, causing a change in flow.
C.3	Construction activities	Direct alteration of watercourses that alters flow behaviour, initiates/increases erosion and/or disrupts physical habitat (e.g. bank disturbance).	Construction activities causing unintended damage to watercourses, resulting in changed flow behaviour, bed or bank erosion, and/or physical habitat.
O.1	Operation/ permanent assets	Permanent project assets including bunds, access roads, drains and modification to surface levels, leading to changes in flow conveyance behaviour, direction, velocity or other characteristics.	Diversion of stormwater, drainage alignment or flow pathways causing a change to flow downstream.
O.2	Operation/ permanent assets	Changes to current land use from permanent project assets such as access tracks and hardstand areas are created which reduce the ability for water to infiltrate into the ground, causing increase in surface runoff, changes to flow discharge, and/or bed and bank erosion, increasing sediment supply to the drainage channel (discharging under Bass Highway directly to Tioxide Beach).	Land use changes, where an increase in impervious area results in an increase in flow discharge leading to bed or bank erosion.
O.3	Operation/ permanent assets	Road/access track drainage is insufficient to convey rainfall associated with increase rain intensities as a result of climate change. Reduced drainage capacity may lead to diversion of water/flooding elsewhere, erosion of watercourses and liberation of sediment travelling in surface water to watercourses.	Insufficient capacity of maintenance access road drainage design due to increased rainfall intensities from climate change resulting in an impact to flooding and sediment runoff.

ID	Hazard	Pathway/mechanism	Risk
O.4	Operation/ permanent assets	Permanent project assets such as access tracks, bunds, joint pits, or other modified areas causes diversion of runoff routes or flow pathways which leads to a loss of floodplain storage capacity to store/transport floodwaters and/or diverts flow.	Diversion of stormwater, drainage alignment or flow pathways leading to bed or bank erosion causing instability of assets adjacent to the watercourse and/or increased sediment loads.

7.3 Water quality impacts

This section identifies the potential water quality impacts and risks of the project on watercourses and surrounding areas during construction and operation phases on identified surface water environmental values.

Soil washed from land development or construction sites has potential to deposit as sediment in outfall drainage channels, culvert outfalls and watercourses. This process can greatly increase the concentration of materials suspended and dissolved in streams and coastal waters and the durations and frequencies for which downstream waters, including coastal remain turbid. Water pollution can also include contaminants such as suspended, dissolved, floatable and settleable soil, oils, cements materials and other chemicals.

Increased sediment supply and pollutants from construction activities can impact on waterways and coastal waters in the following ways:

- Reduce visibility for aquatic fauna to hunt for prey.
- Reduce growth of aquatic vegetation through lack of light due to increased turbidity.
- Increase turbidity such that it impacts on aesthetic values.
- Impact on safe water uses such as stock and domestic supply, recreation, consumption of fish and other human water uses.

The pathway for sediment and pollutants to impact on watercourses and drainage lines is either through travelling in runoff as a result of rainfall or interacting with floodwaters in flood events. An appreciation of the impacts on water quality has been gathered through understanding the area of disturbance within the 0.5 % flood extent across the Heybridge site. For the construction phase, this provides an appreciation of the disturbed area (assumed to be exposed soil) that could be inundated in a flood event, with sediment liberated. After construction, it is understood that exposed soil will be rehabilitated and/or covered, meaning sediment liberation during the operation phase would likely be minimal and not of a scale that could impact on surface water values.

It is understood that potentially contaminated water from bunded areas will be directed to and collected in a gross pollutant trap or triple interceptor trap which will be periodically pumped out by a licensed wastewater disposal contractor. Further, clean surface water runoff and overflow from the traps will discharge to the ocean via the existing site drainage culvert under Bass Highway. This introduces the potential that if the interceptor trap is undersized and overwhelmed it may release contaminants to the downstream environment.

Water quality risks identified

Based on the water quality assessment several risks were identified, the hazard and pathways/ mechanism for these risks are outlined in Table 9.

Table 9. Identified risks associated with water quality, including hazard and pathway/mechanism.

ID	Hazard	Pathway/mechanism	Risk
C.4	Construction activities	Spill of hazardous or potentially polluting chemicals or materials used in construction are released into the drainage channel (discharging under Bass Highway directly to Tioxide Beach) either through surface water (runoff or resulting from a flood event), groundwater or air transport.	Hazardous materials during construction of the project being released into the watercourses and drainage channel (discharging under Bass Highway directly to Tioxide Beach).
C.5	Construction activities	Direct or indirect activities that cause damage to the bed or bank of the drainage lines, such as bank slumping/collapse e.g., heavy machinery on channel banks, operations within the channel. Sediment release impacts water quality and watercourse stability through aggradation.	Construction activities resulting in bed or bank erosion and sediment released into the watercourses and drainage channels (discharging under Bass Highway directly to Tioxide Beach).
C.6	Construction activities	Open excavation or exposed soil is inundated in a flood event within construction period, causing sediment to be liberated and travel through surface water into drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and watercourse/drainage stability through aggradation.	A flood event due to overland flows on the Heybridge site occurring during construction causing inundation of assets and sediment liberation.
C.7	Construction activities	A flood event inundates soil stockpiled as part of construction activities, causing sediment to be liberated and travel through surface water into drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and waterway stability through aggradation.	A flood event occurring during construction, inundating soil stockpiles and resulting in sediment release.
C.8	Construction activities	Horizonal directional drilling results in frac out- where the clays used to line the tunnel walls leech into a waterway impacting on water quality.	Hazardous materials and potential contamination of land and acid sulfate soils during construction of the project being released into the waterways.
O.2	Operation/ permanent assets	Changes to current land use from permanent project assets such as access tracks, bunds, joint pits, or other modified areas causes diversion of runoff routes or flow pathways which leads to ongoing redirection of flow, initiation/ acceleration of bed/bank erosion and increased sediment supply to drainage channels (discharging under Bass Highway directly to Tioxide Beach).	Land use changes, where an increase in impervious area results in an increase in flow discharge leading to bed or bank erosion causing instability of assets adjacent to the drainage channels (discharging under Bass Highway directly to Tioxide Beach) and/or increased sediment loads.

ID	Hazard	Pathway/mechanism	Risk
O.3	Operation/ permanent assets	Road/access track drainage is insufficient to convey rainfall associated with increase rain intensities as a result of climate change. Reduced drainage capacity may lead to diversion of water/flooding elsewhere, erosion of drainage assets and liberation of sediment travelling in surface water to drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and system stability through aggradation.	Insufficient capacity of maintenance access road drainage design due to increased rainfall intensities from climate change resulting in an impact to flooding and sediment runoff.
O.5	Operation/ permanent assets	Permanent project assets such as access tracks, bunds, joint pits, or other modified areas causes diversion of runoff routes or flow pathways which leads to ongoing redirection of flow, initiation/ acceleration of watercourse bed/bank erosion and increased sediment supply to watercourse and drainage channels (discharging under Bass Highway directly to Tioxide Beach).	Diversion of stormwater, drainage alignment or flow pathways leading to bed or bank erosion causing instability of assets adjacent to the watercourse and drainage channels (discharging under Bass Highway directly to Tioxide Beach) and/or increased sediment loads.
O.6	Operation/ permanent assets	Spill of hazardous or potentially polluting chemicals or materials used during operation (including insufficient capacity of interceptor traps) are released into the watercourse during rainfall event (runoff or resulting from a flood event).	Hazardous materials during operation of the project being released into the to the drainage channels (discharging under Bass Highway directly to Tioxide Beach)

7.4 Geomorphology impacts

This section identifies the potential geomorphology related impacts and risks of the project on watercourses and surrounding areas during construction and operation phases on identified surface water environmental values.

Analysis of the shear stress results from the detailed flood modelling for the proposed works at the Heybridge converter station indicates that shear stress is expected to increase in both the current, and climate change scenarios. Figure 21 and Figure 22 indicate that the magnitude of increases is up to 5 N/m^2 at the existing culvert outfall to the northwest of the proposed development footprint. Results indicate that the proposed development will also result in some isolated increases in shear stress of up 10 N/m^2 to the northern outfall of the existing culvert that passes beneath the Bass Highway under the existing and climate change scenarios. Increases of this magnitude have the potential to initiate erosion beyond existing conditions as bed substrate is likely sand, with an erosion threshold of less than 2 N/m^2. Erosion control works at the outfall would be required to mitigate the impact of the development on the stability of the culvert outfall.

The marginal increases across the development footprint are not anticipated to be subject to erosion, given concrete has an erosion threshold of almost 600 N/m^2.

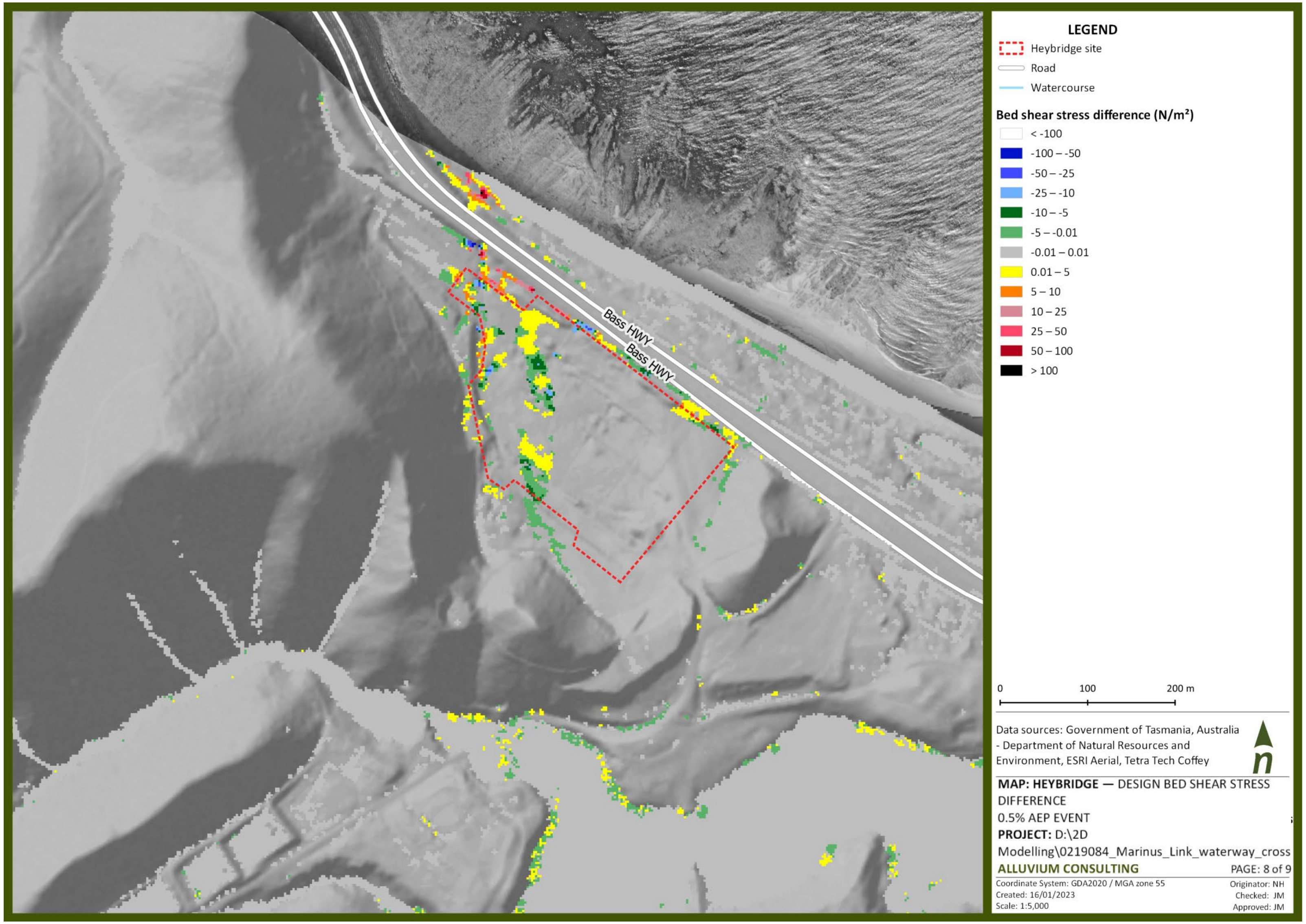

Figure 21. *Heybridge 0.5% AEP shear stress difference to design case.*

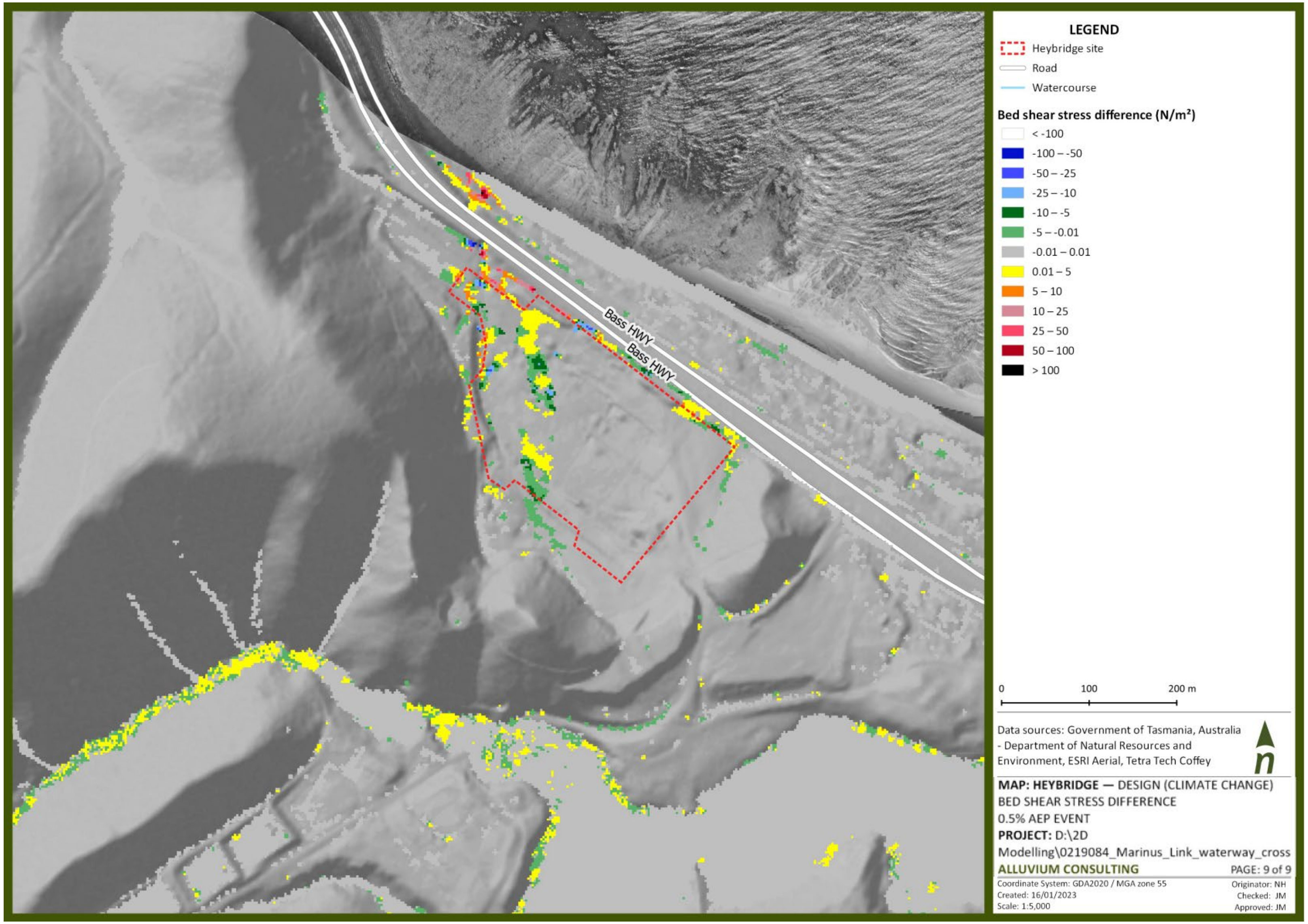

Figure 22. *Heybridge climate change 0.5% AEP shear stress difference to design case.*

Geomorphology risks identified

Based on the geomorphology assessment several risks were identified, the hazard and pathways/mechanism for these risks are outlined in Table 10.

Table 10. Identified risks associated with geomorphology, including hazard and pathway/mechanism.

ID	Hazard	Pathway/mechanism	Risk
C.3	Construction activities	Direct alteration of drainage assets (including existing drainage channels (discharging under Bass Highway directly to Tioxide Beach) that alters flow behaviour, initiates/increases erosion and/or disrupts physical habitat (e.g. bank disturbance).	Construction activities causing unintended damage to drainage assets resulting in changed flow behaviour, bed or bank erosion, and/or physical habitat.
C.5	Construction activities	Direct or indirect activities that cause damage to the bed or bank of the drainage lines, such as bank slumping/collapse e.g., heavy machinery on channel banks, operations within the channel. Sediment release impacts water quality and watercourse stability through aggradation.	Construction activities resulting in bed or bank erosion and sediment released into drainage channels (discharging under Bass Highway directly to Tioxide Beach).
C.6	Construction activities	Open excavation or exposed soil is inundated in a flood event within construction period, causing sediment to be liberated and travel through surface water into the drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and stability through aggradation.	A flood event occurring during construction causing inundation of assets and sediment liberation.
C.7	Construction activities	A flood event inundates soil stockpiled as part of construction activities, causing sediment to be liberated and travel through surface water into receiving drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and stability through aggradation.	A flood event occurring during construction, inundating soil stockpiles and resulting in sediment release.
O.2	Operation/ permanent assets	Changes to current land use from permanent project assets such as access tracks, joint pits, or other hardstand areas are created which reduce the ability for water to infiltrate into the ground, causing increase in surface runoff, changes to flow discharge, and/or bed and bank erosion, increasing sediment supply to receiving drainage channels (discharging under Bass Highway directly to Tioxide Beach).	Land use changes, where an increase in impervious area results in an increase in flow discharge leading to bed or bank erosion.
O.3	Operation/ permanent assets	Road/access track drainage is insufficient to convey rainfall associated with increase rain intensities as a result of climate change. Reduced drainage capacity may lead to diversion of water/flooding elsewhere, erosion of drainage assets and liberation of sediment travelling in surface water to drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and stability through aggradation.	Insufficient capacity of maintenance access road drainage design due to increased rainfall intensities from climate change resulting in an impact to flooding and sediment runoff.

ID	Hazard	Pathway/mechanism	Risk
O.4	Operation/ permanent assets	Diversion of stormwater, drainage alignment or flow pathways to ongoing, leading to bed or bank erosion, causing instability of assets and/or increased sediment supply to receiving drainage channels (discharging under Bass Highway directly to Tioxide Beach).	Diversion of stormwater, drainage alignment or flow pathways leading to bed or bank erosion causing instability of assets adjacent to the drainage channel (discharging under Bass Highway directly to Tioxide Beach) and/or increased sediment loads.

7.5 Summary of risk assessment

Based on the risks identified in Sections 7.2, 7.3 and 7.4, a combined risk assessment for surface water values was undertaken with respect to the construction and operation project stages. Table 11 outlines this risk assessment, prior to development of the mitigation measures. The residual risk assessment takes into account the implementation of the specified mitigation measures, which is summarised in section 7.7.

Risks associated with decommissioning will need to be assessed at the time of decommissioning.

Table 11. Surface water risk assessment prior to implementation of mitigation measures.

Risk ID	Impact pathway/mechanism	Risk identified	Values impacted	Likelihood	Consequence	Risk rating	Comment
Construction							
C.1	Temporary activities such as excavation, stockpiling and alteration of topography or change in impervious surfaces alters floodplain storage capacity to store/transport floodwaters and/or diverts flow.	Increase in flood inundation frequency, velocity or level which affects users or assets within the floodplain.	Flood storage behaviour and associated functions (flooding)	Possible	Moderate	Moderate	Through increases in impervious areas and changes to existing surface levels.
C.2	Excavation, filling or other interference with existing overland/surface flow pathways leading to changes in flow conveyance behaviour, direction, velocity or other characteristics	Construction activities on existing flow paths including piped flow, causing a change in flow.	Flood conveyance behaviour and associated functions (flooding)	Possible	Moderate	Moderate	
C.3	Direct alteration of watercourses that alters flow behaviour, initiates/increases erosion and/or disrupts physical habitat (e.g. bank disturbance).	Construction activities causing unintended damage to watercourses, resulting in changed flow behaviour, bed or bank erosion, and/or physical habitat.	Flood conveyance behaviour (flooding), water quality and site/drainage channel stability (geomorphology)	Unlikely	Moderate	Low	
C.4	Spill of hazardous or potentially polluting chemicals or materials used in construction are released into the drainage channel (discharging under Bass Highway directly to Tioxide Beach) either through surface water (runoff or resulting from a flood event), groundwater or air transport.	Hazardous materials during construction of the project being released into the watercourses and drainage channel (discharging under Bass Highway directly to Tioxide Beach).	Water quality	Possible	Major	High	

Risk ID	Impact pathway/mechanism	Risk identified	Values impacted	Likelihood	Consequence	Risk rating	Comment
C.5	Direct or indirect activities that cause damage to the bed or bank of the drainage lines, such as bank slumping/collapse e.g., heavy machinery on channel banks, operations within the channel. Sediment release impacts water quality and watercourse stability through aggradation.	Construction activities resulting in bed or bank erosion and sediment released into the watercourses and drainage channels (discharging under Bass Highway directly to Tioxide Beach).	Water quality, waterway stability (geomorphology), flood behaviour and associated functions (flooding)	Possible	Moderate	Moderate	Sediment or contaminant release in major flood event during construction.
C.6	Open excavation or exposed soil is inundated in a flood event within construction period, causing sediment to be liberated and travel through surface water into drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and watercourse/drainage stability through aggradation.	A flood event due to overland flows on the Heybridge site occurring during construction causing inundation of assets and sediment liberation.	Water quality, waterway stability (geomorphology)	Possible	Moderate	Moderate	
C.7	A flood event inundates soil stockpiled as part of construction activities, causing sediment to be liberated and travel through surface water into drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and waterway stability through aggradation.	A flood event occurring during construction, inundating soil stockpiles and resulting in sediment release.	Water quality, waterway stability (geomorphology).	Possible	Moderate	Moderate	
C.8	Horizonal directional drilling results in frac out-where the clays used to line the tunnel walls leech into a waterway impacting on water quality.	Hazardous materials during construction of the project being released into the waterways.	Water quality	Possible	Moderate	Moderate	
Operation							

Risk ID	Impact pathway/mechanism	Risk identified	Values impacted	Likelihood	Consequence	Risk rating	Comment
O.1	Permanent project assets including bunds, access roads, drains and modification to surface levels, leading to changes in flow conveyance behaviour, direction, velocity or other characteristics.	Diversion of stormwater, drainage alignment or flow pathways causing a change to flow downstream.	Flood conveyance behaviour and associated functions (flooding)	Possible	Moderate	Moderate	
O.2	Changes to current land use from permanent project assets such as access tracks and hardstand areas are created which reduce the ability for water to infiltrate into the ground, causing increase in surface runoff, changes to flow discharge, and/or bed and bank erosion, increasing sediment supply to the drainage channel (discharging under Bass Highway directly to Tioxide Beach).	Land use changes, where an increase in impervious area results in an increase in flow discharge leading to bed or bank erosion.	Flood behaviour and associated functions (flooding), water quality	Possible	Moderate	Moderate	
O.3	Road/access track drainage is insufficient to convey rainfall associated with increase rain intensities as a result of climate change. Reduced drainage capacity may lead to diversion of water/flooding elsewhere, erosion of watercourses and liberation of sediment travelling in surface water to watercourses	Insufficient capacity of maintenance access road drainage design due to increased rainfall intensities from climate change resulting in an impact to flooding and sediment runoff.	Flood behaviour and associated functions (flooding), water quality, waterway stability (geomorphology)	Possible	Moderate	Moderate	
O.4	Permanent project assets such as access tracks, bunds, joint pits, or other modified areas causes diversion of runoff routes or flow pathways which leads to a loss of floodplain storage capacity to store/transport floodwaters and/or diverts flow.	Diversion of stormwater, drainage alignment or flow pathways leading to bed or bank erosion causing instability of assets adjacent to the watercourse and/or increased sediment loads.	Water quality	Possible	Moderate	Moderate	

Risk ID	Impact pathway/mechanism	Risk identified	Values impacted	Likelihood	Consequence	Risk rating	Comment
O.5	Permanent project assets such as access tracks, bunds, joint pits, or other modified areas causes diversion of runoff routes or flow pathways which leads to ongoing redirection of flow, initiation/ acceleration of watercourse bed/bank erosion and increased sediment supply to watercourse and drainage channels (discharging under Bass Highway directly to Tioxide Beach).	Diversion of stormwater, drainage alignment or flow pathways leading to bed or bank erosion causing instability of assets adjacent to the watercourse and drainage channels (discharging under Bass Highway directly to Tioxide Beach) and/or increased sediment loads.	Flood behaviour and associated functions (flooding), water quality, waterway stability (geomorphology)	Unlikely	Moderate	Low	
O.6	Spill of hazardous or potentially polluting chemicals or materials used during operation (including insufficient capacity of interceptor traps) are released into the watercourse during rainfall event (runoff or resulting from a flood event).	Hazardous materials during operation of the project being released into the to the drainage channels (discharging under Bass Highway directly to Tioxide Beach)	Water quality	Possible	Major	High	Potential for interceptor trap to overflow and spills

7.6 Mitigation measures

In order to reduce the risks posed by the project on surface water, mitigation measures have been developed to reduce the risk of harm.

The following final mitigation measures have been informed by the example mitigation measures discussed in the impact assessment (Section 5.2). The mitigation measures have also been developed with consideration of industry standards and relevant legislation, guidelines and policies.

The recommended mitigation measures for design, construction and operation phases of the project are presented in Table 12.

In addition to the surface water mitigation measures outlined in Table 12, the other mitigation measures that would reduce the potential impacts due to surface water resulting from the project, include:

- Groundwater; and
- Contaminated land.

A decommissioning management plan will be prepared to outline how decommissioning activities would be undertaken and potential surface water impacts managed, including risks and addressing the items outlined in these surface water mitigation measures.

Table 12. Design: Management, mitigation or monitoring measure

ID	Design: Management, mitigation or monitoring measure
Management and mitigation (MM)	
SW01	**Minimise flood risk due to permanent infrastructure** The following key design measures will be applied to the project and will be fully documented in the final Marinus Link Design Report, to be submitted to the EPA for review and approval prior to construction: • All permanent infrastructure will be designed to take flood risk into account, the requirements outlined in the Floodplain Risk Assessment Guidelines for Municipal Councils in Tasmania (White CJ, 2019). • Roads/access ways will be designed with suitable drainage, including appropriate camber and natural drainage swales, and any concentrated discharges will pass through water mitigation infrastructure such as rock filters. • All permanent infrastructure will be designed to take storage locations of all environmentally hazardous materials into account, as is required by the building code.
Monitoring	
There is no surface water quality monitoring proposed during the design phase.	

Table 13. Construction: Management, mitigation or monitoring measure

ID	Construction: Management, mitigation or monitoring measure
Management and mitigation (MM)	
SW02	Develop and implement a Progressive Sediment and Erosion Control Plan

ID	Construction: Management, mitigation or monitoring measure
Management and mitigation (MM)	
	Prior to construction commencing, a Progressive Sediment and Erosion Control Plan for the Project will be developed (either as a standalone document or part of the CEMP) and submitted to the EPA for approval prior to commencement of construction. The plan will then be implemented throughout construction. The plan will identify all major drainage lines and waterways and site-specific management and mitigation to be implemented, including controls such as sandbags, sediment fences, sediment traps and diffusion paths to ensure stormwater is suitably contained, managed and released to avoid and minimise sediment release, pollution and erosion. The plan must describe sediment and erosion controls and monitoring requirements in accordance with EPA TAS fact sheets: *Soil and Water Management on Large Building and Construction Site (EPA Tasmania, 2008), Erosion Control Matts and Blankets (EPA Tasmania, 2008), Scour Protection – Stormwater Pipe Outfalls and Check Dams (EPA Tasmania, 2008), Stabilised Access and Sediment Fences and Fibre Rolls (EPA Tasmania, 2008), and with reference to the IECA Best Practice Erosion and Sediment Control Guidelines 2008 and EPA TAS (Bunding and Spill Management Guidelines) (EPA Tasmania, 2015).*
SW03	**Minimise impacts due to flooding during construction** Prior to construction commencing, a Flood Risk Management Plan for the Project will be developed (either as a standalone document or part of the CEMP) in line with the requirements outlined in the Floodplain Risk Assessment Guidelines for Municipal Councils in Tasmania (White CJ, 2019).
Monitoring	
SW04	**Develop and implement a surface water monitoring program** Prior to construction commencing, a Surface Water Monitoring Program for the Project will be developed (either as a standalone document or part of the CEMP) to assess surface water quality during construction. The monitoring program must, as a minimum: • Be developed in consultation with the EPA Tasmania. • Include parameters, frequency, durations of water quality monitoring, and flow paths and drainage channels condition inspections. • Daily visual monitoring of active construction areas for visible water quality issues including high sediment loads or erosion. • Fortnightly audits of the physical site construction controls (including sediment and erosion control measures). Additional audits will be undertaken after extreme weather events. • Monthly audits of all management measures set out in the CEMP. • Any non-conformance identified during inspections and audits will be documented, investigated and resolved. • Audits to be made available to the EPA on request. • Any non-conformance or incident with the potential for serious or material environmental harm to be reported to the Director, EPA within 24 hours. • Include monitoring locations at suitable distances both upstream and downstream of works to establish baseline conditions prior to construction, where required.

Table 14. Operation: Management, mitigation or monitoring measure

ID	Operation: Management, mitigation or monitoring measure
Management and mitigation (MM)	
SW05	**Develop and implement measures to manage potential impacts to surface water in operation** As part of the OEMP, develop and implement measures to avoid or minimise impacts to surface water during the operation in accordance with requirements from EPA Tasmania. These measures must include: • Controls for management of sites and materials to prevent erosion, runoff of contamination and sediments entering flow paths and drainage channels. • Ongoing surface water quality monitoring program requirements, as outlined in the surface water monitoring program (SW04).
Monitoring	
There is no surface water quality monitoring proposed during the operational phase.	

7.7 Residual risk assessment summary

The surface water mitigation measures, developed in section 7.6 have been designed to effectively reduce the likelihood of impacts on various impact pathways and mechanisms. These surface water mitigation measures incorporate specific management measures to target the risks to waterways associated with construction and operation activities of the project.

By implementing these surface water mitigation measures, the project aims to minimise the likelihood of impacts, resulting in a low overall risk rating for surface water values which are flooding, water quality and geomorphology.

The assessment of residual risks, considering the implementation of surface water mitigation measures, has been assessed and the outcomes are presented in Table 15, which confirms the low residual risks to surface water during both construction and operation phases of the project.

Table 15. Residual risk assessment

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
Construction											
C.1	Temporary activities such as excavation, stockpiling and alteration of topography or change in impervious surfaces alters floodplain storage capacity to store/transport floodwaters and/or diverts flow.	Increase in flood inundation frequency, velocity or level which affects users or assets within the floodplain.	Flood behaviour and associated functions (flooding)	Possible	Moderate	Moderate	SW02 and SW03	Unlikely	Moderate	Low	Implementation of SW02 and SW03 can reduce the likelihood of impacting flood storage behaviour over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls may include locating stockpiles outside floodplains, earthwork cut/fill balance to maintain floodplain storage.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
C.2	Excavation, filling, or other interference with existing overland/surface flow pathways leading to changes in flow conveyance behaviour, direction, velocity or other characteristics	Construction activities on existing flow paths including piped flow, causing a change in flow.	Flood behaviour and associated functions (flooding)	Possible	Moderate	Moderate	SW02 and SW03	Unlikely	Moderate	Low	Implementation of SW02 and SW03 can reduce the likelihood of impacting flood conveyance behaviour over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls may include earthwork design to maintain overland / surface flow pathway capacity and include erosion control armouring where required.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
C.3	Direct alteration of watercourses that alters flow behaviour, initiates/increases erosion and/or disrupts physical habitat (e.g. bank disturbance).	Construction activities causing unintended damage to watercourses, resulting in changed flow behaviour, bed or bank erosion, and/or physical habitat.	Flood behaviour (flooding), water quality and site/drainage channel stability (geomorphology)	Unlikely	Moderate	Low	SW02 and SW03	Rare	Moderate	Low	Implementation of SW02 and SW03 can reduce the likelihood of impacting flood conveyance behaviour and waterway stability over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls may include earthwork design to maintain overland / surface flow pathway alignment and protect/reinstate physical waterway habitat where required.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
C.4	Spill of hazardous or potentially polluting chemicals or materials used in construction are released into the drainage channel (discharging under Bass Highway directly to Tioxide Beach) either through surface water (runoff or resulting from a flood event), groundwater or air transport.	Hazardous materials during construction of the project being released into the watercourses and drainage channel (discharging under Bass Highway directly to Tioxide Beach).	Water quality	Possible	Major	Major	SW02, SW04	Unlikely	Moderate	Low	Implementation of SW02 and SW04 can reduce the likelihood of spill of hazardous or potentially polluting chemicals over the duration of the project activity to rare (not anticipated), with widespread, long lasting and results in substantial change to surface water values requiring design responses. Standard management controls include use of spill kits, bunding, dewatering procedures, emergency response and monitoring.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
C.5	Direct or indirect activities that cause damage to the bed or bank of the drainage lines, such as bank slumping/collapse e.g., heavy machinery on channel banks, operations within the channel. Sediment release impacts water quality and watercourse stability through aggradation.	Construction activities resulting in bed or bank erosion and sediment released into the watercourses and drainage channels (discharging under Bass Highway directly to Tioxide Beach).	Water quality, waterway stability (geomorphology), flood behaviour and associated functions (flooding)	Possible	Moderate	Moderate	SW02, SW04,	Unlikely	Moderate	Low	Implementation of SW02 and SW04 can reduce the likelihood of direct or indirect activities casing damage to the bed or bank of the waterway over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls may include limiting machinery movement to designated areas, sediment controls, erosion protection, monitoring.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
C.6	Open excavation or exposed soil is inundated in a flood event within construction period, causing sediment to be liberated and travel through surface water into drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and watercourse/drainage stability through aggradation.	A flood event due to overland flows on the Heybridge site occurring during construction causing inundation of assets and sediment liberation.	Water quality, waterway stability (geomorphology)	Possible	Moderate	Moderate	SW02, SW03 and SW04	Unlikely	Moderate	Low	Implementation of SW02, SW03 and SW04 can reduce the likelihood of sediment liberation from open excavation/bare soils over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls may include sediment controls, limiting bare soil exposure, erosion protection, monitoring.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
C.7	A flood event inundates soil stockpiled as part of construction activities, causing sediment to be liberated and travel through surface water into drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and waterway stability through aggradation.	A flood event occurring during construction, inundating soil stockpiles and resulting in sediment release.	Water quality, waterway stability (geomorphology)	Possible	Moderate	Moderate	SW02, SW03 and SW04	Unlikely	Moderate	Low	Implementation of SW02, SW03 and SW04 can reduce the likelihood of sediment liberation from stockpiles over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls may include sediment controls, limiting bare soil exposure, erosion protection, monitoring.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
C.8	Horizonal directional drilling results in frac out- where the clays used to line the tunnel walls leech into a waterway impacting on water quality.	Hazardous materials and potential contamination of land and acid sulfate soils during construction of the project being released into the waterways.		Possible	Moderate	Moderate	SW02 and SW04	Unlikely	Moderate	Low	Implementation of SW02 and SW04 can reduce the likelihood of frac out over the duration of the project activity to rare (not anticipated), with widespread, long lasting and results in substantial change to surface water values requiring design responses. Standard management controls may include emergency response procedures, monitoring.
Operation											

O.1	Permanent project assets including bunds, access roads, drains and modification to surface levels, leading to changes in flow conveyance behaviour, direction, velocity or other characteristics.	Diversion of stormwater, drainage alignment or flow pathways causing a change to flow downstream.	Flood behaviour and associated functions (flooding)	Possible	Moderate	Moderate	SW01, SW04 and SW05	Unlikely	Moderate	Low	Implementation of SW01, SW04 and SW05 can reduce the likelihood of impacting flood conveyance behaviour and water quality over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls to be implemented during construction and design phases may include access track/road design to maintain overland / surface flow pathway capacity and include erosion control armouring where required.
O.2	Changes to current land use from permanent	Land use changes, where	Flood behaviour and associated	Possible	Moderate	Moderate	SW01, SW04, SW05	Unlikely	Moderate	Low	Implementation of SW01, SW04

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
	project assets such as access tracks, bunds, joint pits, or other modified areas causes diversion of runoff routes or flow pathways which leads to ongoing redirection of flow, initiation/ acceleration of bed/bank erosion and increased sediment supply to drainage channels (discharging under Bass Highway directly to Tioxide Beach).	an increase in impervious area results in an increase in flow discharge leading to bed or bank erosion causing instability of assets adjacent to the drainage channels (discharging under Bass Highway directly to the Tioxide Beach) and/or increased sediment loads.	functions (flooding), water quality								and SW05 can reduce the likelihood of impacting flood behaviour, waterway stability and water quality over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls to be implemented during construction and design phases may include access track/road, hard surface areas design to minimise change surface flow discharge rates and volumes.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
O.3	Road/access track drainage is insufficient to convey rainfall associated with increase rain intensities as a result of climate change. Reduced drainage capacity may lead to diversion of water/flooding elsewhere, erosion of drainage assets and liberation of sediment travelling in surface water to drainage channels (discharging under Bass Highway directly to Tioxide Beach), impacting on water quality and system stability through aggradation.	Insufficient capacity of maintenance access road drainage design due to increased rainfall intensities from climate change resulting in an impact to flooding and sediment runoff	Flood behaviour and associated functions (flooding), water quality, waterway stability (geomorphology)	Possible	Moderate	Moderate	SW01, SW04, SW05	Unlikely	Moderate	Low	Implementation of SW01, SW04 and SW05 can reduce the likelihood of impacting flood behaviour, waterway stability and water quality over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls to be implemented during construction and design phases may include road/access track drainage design to consider climate change scenarios.

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
O.4	Permanent project assets such as access tracks, bunds, joint pits, or other modified areas causes diversion of runoff routes or flow pathways which leads to a loss of floodplain storage capacity to store/transport floodwaters and/or diverts flow.	Diversion of stormwater, drainage alignment or flow pathways leading to bed or bank erosion causing instability of assets adjacent to the watercourse and/or increased sediment loads.	Water quality	Possible	Moderate	Moderate	SW01, SW05	Unlikely	Moderate	Low	Implementation of SW01 and SW05 can reduce the likelihood of impacting flood storage behaviour and waterway stability over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls to be implemented during construction and design phases may include road/access track drainage design and earthwork cut/fill balance to maintain floodplain storage.

O.5	Permanent project assets such as access tracks, bunds, joint pits, or other modified areas causes diversion of runoff routes or flow pathways which leads to ongoing redirection of flow, initiation/ acceleration of watercourse bed/bank erosion and increased sediment supply to watercourse and drainage channels (discharging under Bass Highway directly to Tioxide Beach).	Diversion of stormwater, drainage alignment or flow pathways leading to bed or bank erosion causing instability of assets adjacent to the watercourse and drainage channels (discharging under Bass Highway directly to Tioxide Beach) and/or increased sediment loads.	Flood behaviour and associated functions (flooding), water quality, waterway stability (geomorphology)	Unlikely	Moderate	Low	SW01, SW04, SW05	Rare	Moderate	Low	Implementation of SW01, SW04 and SW05 can reduce the likelihood of impacting flood behaviour, waterway stability and water quality over the duration of the project activity to unlikely, with short term impacts extending beyond the operational area that can be ameliorated. Standard management controls to be implemented during construction and design phases may include access track/road, hard surface areas design to maintain flow pathways and consider outfall arrangements that minimise erosion potential.
O.6	Spill of hazardous or potentially polluting chemicals or materials	Hazardous materials during	Water quality	Possible	Major	High	SW01, SW04 and SW05	Unlikely	Moderate	Low	Implementation of SW01, SW04 and SW05 can

Risk ID	Impact pathway/mechanism	Initial risks (prior to implementation of the MMs, refer to Table 11)					Mitigation measure to be implemented	Residual risk (with MMs successfully implemented)			
		Initial risk	Values impacted	Likelihood	Consequence	Risk rating		Likelihood	Consequence	Risk rating	Description
	used during operation (including insufficient capacity of interceptor traps) are released into the watercourse during rainfall event (runoff or resulting from a flood event).	operation of the project being released into the to the drainage channels (discharging under Bass Highway directly to Tioxide Beach)									reduce the likelihood of spill of hazardous or potentially polluting chemicals over the duration of the project activity to rare (not anticipated), with widespread, long lasting and results in substantial change to surface water values requiring design responses. Standard management controls to be implemented during construction and design phases include use of spill kits, bunding, dewatering procedures, emergency response and monitoring.

7.8 Cumulative impacts

A cumulative impact assessment has been completed for the project in line with the impact assessment method outlined in Section 5.2. Several credible projects were identified that each might have potential the potential to affect surface water values in close proximity to the and/or within the Heybridge converter station and shore crossing A summary of these projects is outlined in Table 17 below.

Table 16. CIA potential projects for assessment

	Proposal / proponent	Description	Location	Timing
1	Guilford Wind Farm / Epuron Pty Ltd Guildford | Ark Energy Ark Energy Projects Pty Ltd, Guildford Wind Farm, North West Tasmania | EPA Tasmania EPBC Act referral (environment.gov.au)	Wind farm in Guildford with up to 80 wind turbines Generation of up to 450 megawatts (MW) of wind energy Estimated capital: $50 million	7 km northeast of Waratah and 15 km south of Hampshire	Current status: Notice of intent submitted September 2020 Deemed a controlled action by DAWE in September 2021 Construction to commence: 2024
2	Robbins Island Renewable Energy Park / UPC Robbins Island Pty Ltd Robbins Island | Robbins Island and Jim's Plain Wind (robbinsislandwind.com.au) ACEN Robbins Island Pty Ltd, Robbins Island Renewable Energy Park, Northwest Tasmania | EPA Tasmania ACEN Robbins Island Pty Ltd, Robbins Island Renewable Energy Park, Northwest Tasmania | EPA Tasmania	Wind farm on Robbins Island with up to 122 wind turbines Generation of up to 900 MW of wind energy Estimated construction value: $1.2 billion Construction workforce: 250 personnel	Robbins Island, northwest coast of Tasmania	Current status: Approved by the Commonwealth Government and the EPA Project approvals currently under appeal. Construction to commence: 2023-2025
3	Jim's Plain Renewable Energy Park / UPC Robbins Island Pty Ltd	Wind farm in Jim's Plain with up to 31 wind turbines and possible solar generation	23 km west of Smithton	Current status: Approved by the Council and State and Commonwealth governments in 2020 Construction to commence: 2023

	Proposal / proponent	Description	Location	Timing
	Jims Plain and Robbins Island Renewable Energy Park - Infrastructure Pipeline ACEN Robbins Island Pty Ltd, Jim's Plain Renewable Energy Park, North West Tasmania | EPA Tasmania	Generation of up to 200 MW of wind energy and up to 40 MW of solar energy Capital investment: $350 million. Construction workforce: over 150 personnel Operations workforce: 15 personnel		
4	Robbins Island Road to Hampshire Transmission Line / UPC Robbins Island Pty Ltd ACEN Robbins Island Pty Ltd, Robbins Island Road to Hampshire Transmission Line | EPA Tasmania	A new 220 kV overhead transmission line (OHTL) spanning 115 km, estimated to have 245 towers. Connects Jim's Plain and Robbins Island Renewable Energy Parks transmission infrastructure to Tasmanian transmission network. Construction workforce: up to 100 personnel over 24 months	Between Robbins Island Rd at West Montagu and Hampshire	Current status: Detailed planning/environmental approvals phase underway. Commonwealth Government determined the project to be a controlled action under the EPBC Act (Cwlth) in September 2020. Construction to commence: 2023
5	Bass Highway, targeted upgrades between Deloraine and Devonport / Department of State Growth Project Details (infrastructure.gov.au)	Targeted highway upgrades between Deloraine and Devonport. Roads of strategic importance Estimated project cost: $50 million	Targeted areas along Bass Highway between Deloraine and Devonport	Current status: In planning Construction expected to commence late 2023 Expected completion: 2027

	Proposal / proponent	Description	Location	Timing
6	Remaining North West Transmission Development (Staverton to Hampshire Hills Transmission Line) / TasNetworks timelinemay2022.pdf (tasnetworks.com.au) Staverton to Hampshire Hills - TasNetworks	A component of the North West Transmission Developments, comprising a new 60-km-long new 220 kV OHTL between a new switching station at Staverton and Hampshire Hills Supports new and existing renewable energy developments in North West Tasmania, including Marinus Link. Estimated project cost: $220 million	Between Staverton and Hampshire Hills	Current status: Planning and approvals phase in progress Construction expected to commence: 2024
8	Hellyer Wind Farm / Epuron Pty Ltd Epuron | Hellyer Wind Farm | Ark Energy Ark Energy Projects Pty Ltd, Hellyer Wind Farm, Hampshire | EPA Tasmania	Wind farm with up to 48 wind turbines Generation of up to 300 MW of wind energy	8.5km southwest of Hampshire	Current status: Design phase. Notice of intent issued. Tasmanian EPA -EIS Guidelines issued in November 2022
9	Western Plains / Epuron Pty Ltd WesternPlainsWindFarm_Update (arkenergy.com.au)	Wind farm with up to 12 wind turbines Generation of up to 50.4 MW of wind energy	4 to 5 km northwest of Stanley	Current status: Work on the Development Proposal and Environmental Management Plan (DPEMP) is continuing. The DPEMP has been drafted in accordance with the Project Specific Guidelines issued for the project by the Environment Protection Authority (EPA Tasmania). The EPA Tasmania recently extended the timeframe for

	Proposal / proponent	Description	Location	Timing
				submission to enable completion of the required documentation.
10	Table Cape Luxury Resort / Table Cape Enterprises	Proposed accommodation	Table Cape, 4.5 km north of Wynyard, Ransleys Road	Current status: Approved by Waratah-Wynyard Council
11	Lake Cethana Pumped Hydro / Hydro Tasmania Pumped hydro Lake Cethana selected as first pumped hydro project	Storage and underground pumped hydro power station with associated infrastructure, with up to 600 MW capacity Estimated construction cost: $900 million	19 km southwest of Sheffield	Current status: Hydro Tasmania will progress with the final feasibility stage Construction likely to commence: 2027
12	Youngmans Road Quarry / Railton Agricultural Lime Pty Ltd Railton Agricultural Lime Pty Ltd, Youngmans Road Quarry, Railton | EPA Tasmania	Limestone quarry development on old quarry site Average annual production of 72,000 tonnes of limestone	2.5km northwest of Railton	Current status: EPA approved the development in February 2021. Kentish Council is reviewing the land permit for the proposed development
13	Port Latta Wind Farm / Nekon Pty Ltd's Port Latta Wind Farm	Wind farm with up to 7 wind turbines Generation of up to 25 MW of wind energy Construction workforce: 15 people over six months Estimated capital: $50 million	Mawbanna Plain, 2 km southwest of Cowrie Point	Current status: Environmental Assessment Report and EPA decision issued October 2018 Website states intent to start construction late 2020, no further updates available

	Proposal / proponent	Description	Location	Timing
14	Port of Burnie Shiploader Upgrade / TasRail Shiploader Project - TasRail	Minerals shiploader and storage expansion at TasRail's existing Bulk Minerals Export Facility Estimated cost: $64 million Design and construction workforce: 140 personnel	Port of Burnie	Current status: onsite works and detailed design (commenced in April 2022). Commissioning expected to commence: 2023
15	Bass Highway – Cooee to Wynyard / Department of State Growth Bass Highway - Cooee to Wynyard – Transport Services Project Details (infrastructure.gov.au)	Priority works upgrade along the Bass Highway between Cooee and Wynyard to realign and upgrade approximately 3.2 km of road Estimated cost: $50 million	Bass Highway from the intersection of Brickport Road in Cooee, across the Cam River Bridge, to the intersection of the Old Bass Highway at Doctors Rocks near Wynyard	Current status: Construction (commenced late 2021) Expected completion:2025.
16	Sheffield to Staverton Upgrades / TasNetworks North West Transmission Developments - TasNetworks	A component of the North West Transmission Developments, comprising modifications to two 18.5-km-long sections of existing 220 kV OHTLs between Staverton and Sheffield. Supports new and existing renewable energy developments in North West Tasmania, including Marinus Link.	Between Staverton and Sheffield	Current status: Planning and approvals phase Construction expected to commence: 2025

	Proposal / proponent	Description	Location	Timing
17	QuayLink - Devonport East Redevelopment / TasPorts Devonport Quaylink (tasports.com.au) Devonport East Redevelopment (tasports.com.au)	Port terminal upgrade project to support TasPorts in increasing capacity of both freight and passenger ferry services across Bass Strait. Estimated cost: $240 million Design and construction workforce: 1060 direct and indirect jobs in North West Tasmania, and a further 655 broader Tasmanian jobs during construction.	Port of Devonport	Current status: Early works/construction (commenced 2022); approvals phase ongoing. Expected completion: 2027

Proposed and reasonably foreseeable projects have been identified based on their potential to contribute to cumulative impacts by overlapping with the proposed project location and timeframe. An assessment of these in regard to its cumulative impact on flooding, water quality and geomorphology is outlined below.

CIA – Flooding, water quality and geomorphology

Of the proposed Initial Works, activities such as site establishment, ground improvement or site levelling works could of themselves create adverse flooding impacts. The other Initial Works would have a negligible impact due to the nominal change to existing conditions as a result of the works. These impacts have been considered in the impact assessments for the individual project components.

Potential pathways through which the identified projects in Table 16 could impact flooding, water quality and geomorphology have been analysed in below.

Table 17. CIA potential project impact pathway assessment

Impact pathway assessment
These major projects are likely to have similar impacts to surface water quality, geomorphology and flooding as identified in this impact assessment (Sections 7.2, 7.3 and 7.4). As an example, these include: • displacement of flood waters/volume that led to adverse flood impacts to surrounding property, key infrastructure and the environment. • constricting the passage of flows passing through the site along the river channel or flow path that leads to increased shear stress values and increased scour of adjacent bed and banks. • altered fluvial geomorphic processes, initiation of bed and bank scour and sediment delivery, which can result in habitat loss and ecosystem decline. • disturbance to the bed or banks of waterways through ground disturbance activities (excavation, trenching, clearing, vehicular traffic etc.) within the riparian zone or instream. • changes to water quality, such as increased sediment loads, nutrient loads, addition of metals, hydrocarbons or other chemicals from spills that can lead to degradation in water quality, ecosystem health/reproduction or aesthetics. • alteration of the flow regime, such as diversion, duration, frequency, duration and timing of high and/or low flow events have potential to initiate bed and bank scour, resulting in habitat loss, sediment delivery which could have both ecological and physical form consequences

Through implementation of mitigation measures such as those outlined in Section 7.6, the project is not expected to impact water quality, flows or bed and bank stability within local waterways, or create adverse flood impacts or pose an increased health and safety risk to tunnel workers or operational staff.

As such, any significant cumulative impact to water quality and flow regime from the project to other major projects is unlikely.

7.9 Inspection, Monitoring and review

The proposed mitigation measures should be accompanied by the establishment of a monitoring and maintenance program (as per MM SW04 in section 7.6).

A specific surface water monitoring program for the site should be developed that can be used to monitor condition across all the works which can:

- Prior to construction: characterise the baseline condition of receiving waters.
- During construction: monitor water quality changes in receiving waters due to project activities.

The monitoring program should, as a minimum:

- Be developed in consultation with EPA Tasmania and DNRET (as the waterway manager) and asset owners (where applicable)
- Specify locations, parameters, and frequency of monitoring (refer to MM SW04)
- Specify length of monitoring pre and post construction
- Reference applicable policies and guidelines, including *Technical Guidance for Water Quality Objectives* (WQOs) *Setting for Tasmania* (EPA Tasmania, 2020), *Environmental Effects Report Guidelines* (EPA Tasmania, 2019) and relevant EPA Tasmania fact sheets such as *Soil and Water Management Plans* (EPA Tasmania, 2008).

The monitoring program must outline conditions under which changes to water quality parameters need to be investigated, when works on-site need to be stopped in response to changes in parameters and what action is required to rectify changes in water quality if they are attributable to the site construction.

The monitoring program should include sufficient detail to ensure that information on target metrics can be routinely assessed and progress towards the project objectives can be tracked.

8 Conclusion

This report presents the results of the surface water impact assessment for the portion of the Marinus Link project at Heybridge in Tasmania.

Three key surface water values were identified that the proposed works may have adverse effects on: flooding, water quality and geomorphology. In assessing the potential impacts on these three values, the report has considered the impact under existing conditions and those posed by climate change. The risk assessment has included the development of recommended mitigation measures to avoid and minimise adverse effects on surface water.

The Marinus Link has the potential to impact the drainage channels downstream of the proposed converter station and shore crossing at Heybridge. The impact assessment has considered the risk of construction and operation of the project, adversely impacting flooding of the site, adjoining waterways and their floodplains and impacts to their water quality and geomorphology.

Based on the identified risks and their associated mechanisms, a series of mitigation measures have been developed to effectively manage these potential risks, including the requirement to develop of a Progressive Sediment and Erosion Control Plan (SW02 and SW03) that would specify the measures the construction process would be required to adhere to, so that flood risk was minimised. Following the application of these mitigation measures, the residual surface water risks are substantially reduced.

With the mitigation measures in place there are no remaining high risks, and a small number of risks require additional flood modelling during the design phase to confirm impacts can be mitigated. These are summarised below.

8.1 Construction

Residual construction risk ratings that are subject to final design detailed modelling as per SW03 include:

- Construction activities causing an increase in flood frequency, velocity or level which affects users or assets within the floodplain.
- Construction activities causing unintended damage to drainage assets (including waterways and drainage channels) resulting in changed flow behaviour, bed, or bank erosion, and/or physical habitat.

8.2 Operation

Residual construction risk ratings that are subject to final design detailed modelling as per SW01 include:

- Diversion of stormwater, drainage alignment or flow pathways causing a change in flow to downstream.
- Increase in impervious area resulting in an increase in flow discharge leading to bed or bank erosion.
- Increase in impervious area leading to an increase in sediment or contaminants released into the waterways.

While the flood mapping indicates that the proposed converter station will result in minor increases in flood depth and extent as a result of the works, this is generally limited to less than 100 mm, contained to the immediate area and are considered to be within acceptable change/impacts to flood behaviour. However, additional detailed flood modelling through the design phase should be undertaken to confirm the flood impact of the final design on adjacent infrastructure (such as the existing culvert outfall to the west of the station footprint), refine migration options and seek acceptance from Burnie City Council (as per SW01 and SW05).

The implementation of the mitigation measures proposed within this report directly address the impacts identified and provide an effectively means manage the identified risks associated with the construction and operation phases to an acceptable level.

Risks associated with decommissioning will need to be assessed at the time of decommissioning.

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