Appendix F

Groundwater Impact Assessment

MARINUS LINK

Marinus Link

Heybridge Groundwater Impact Assessment

Marinus Link Pty Ltd

Reference: 754-MELEN215878ML_R18

November 2024

HEYBRIDGE GROUNDWATER IMPACT ASSESSMENT

Marinus Link

Report reference number: 754-MELEN215878ML_R18

November 2024

PREPARED FOR

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Restriction on Disclosure and Use of Data

A Statement of Limitations for the Groundwater Baseline and Impact Assessment of the Marinus Link project is provided in Appendix A.

EXECUTIVE SUMMARY[1]

Tetra Tech Coffey Pty Ltd (Tetra Tech Coffey) was contracted by Marinus Link Pty Ltd (MLPL) to conduct a groundwater impact assessment to inform the environmental impact assessment of the proposed Marinus Link (the project).

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 covered in this assessment is located at Heybridge in Tasmania. The scope of the groundwater impact assessment was to characterise groundwater within the study area and identify potential groundwater impacts from the project to groundwater values.

This assessment included a desktop review to support a baseline characterisation drawing on publicly available spatial information on ground surface elevation, the inferred average water table elevation, surface geological conditions and groundwater quality. The baseline characterisation also draws on limited hydrogeological data that has been collected at the site as part of geotechnical studies (Jacobs 2022a, 2022b) conducted for the project. The information obtained by the desktop literature and data review was considered sufficiently detailed to characterise baseline groundwater conditions to a level that is proportionate to the risk of adverse effects posed by the project.

The site is mapped as being underlain by Quaternary deposits of aeolian sand, and river and marine gravels, sand and clays, which overlie bedrock. These two main geological formations were assessed by the geotechnical investigation and are expected to comprise the two primary aquifers present beneath the site; the Quaternary sand aquifer and the bedrock aquifer. Four groundwater monitoring wells were installed to assess the bedrock aquifer and one shallow well was installed to assess the shallow Quaternary sand aquifer.

The water table in the Quaternary sand aquifer is likely to be shallow (within 0.5 m below ground surface) and is expected to follow a northerly flow direction towards the coastline. The Quaternary sand aquifer is likely to be recharged by rainfall infiltration and the upward discharge of groundwater from the underlying bedrock aquifer. Hydraulic conductivity may be high in the Quaternary sand aquifer and variable in the bedrock aquifer where presence of fracture and fault zones and weathered horizons may influence groundwater flow rates.

The site was previously occupied by the former Tioxide Australia plant which may have caused soil and potentially groundwater contamination. Previous remediation efforts are reported to have occurred, and subsequent contamination investigations have been completed by Tetra Tech Coffey (2023). Limited groundwater sampling from the upper Quaternary sand aquifer did not encounter significant groundwater contamination.

Where potential impacts are identified as having potential to result in an impact to groundwater levels or quality, the assessment has identified measures to avoid and minimise the risk of harm arising from project activities to human health and the environment so far as reasonably practicable.

Based on the findings and results of the assessment, potential impacts were determined based on the associated environmental values of groundwater that may be threatened by project construction and operation activities.

A significance assessment approach has been adopted to assess potential impacts which identified mostly negligible and minor magnitude impacts, resulting in low impacts. The following project construction and operation activities were identified as potential hazards to groundwater and its associated groundwater values (groundwater dependent ecosystems (GDEs) and groundwater users):

- Temporary dewatering and groundwater drawdown for the construction of the converter station foundations, HDD entry/exit pits or other minor excavations that extend below the shallow water table.

[1] This executive summary must be read in the context of the full report and the attached limitations.

- Temporary dewatering and groundwater drawdown, which can lead to groundwater acidification (due to enhance presence of acid sulphate soils) or saline intrusion.
- Mobilisation of existing groundwater contamination towards the project's dewatering activities, and releases of contaminated groundwater during temporary dewatering to the environment.
- Storage, handling, use, transport, disposal and accidental spills and leakage of hazardous materials, including chemicals, herbicides, pesticides, and fuels during construction and operation (including an onsite septic tank, interceptor traps and storage tanks).

The following potential impacts were assessed to have raised initial moderate to major magnitude of impacts, which corresponds to an overall moderate un-mitigated impact on groundwater values and were considered further:

- Mobilisation of existing groundwater contamination towards the project's dewatering activities.
- Release of contaminated groundwater generated during dewatering to the environment.
- Saline groundwater intrusion due to temporary groundwater level drawdown.
- Groundwater acidification due to temporary groundwater level drawdown.
- Groundwater contamination from operational activities including leaks of hazardous chemicals (e.g., transformer oil, lead acid batteries, and diesel fuel).

A total of six mitigation and management measures were developed to reduce the level of all potential impacts further (Table A), in addition to other relevant measures developed by the Contaminated Land and Acid Sulfate Soil Assessment. All residual impacts were considered to be low.

Groundwater management plans (GMPs) will be developed prior to, and implemented during construction (GWMM05) and operation (GWMM06). The GMPs will document the monitoring requirements informed by the pre-construction hydrogeological assessment proposed (GWMM01) and groundwater monitoring program (GWMM05) to ensure that adequate understanding of shallow groundwater conditions are established prior to construction commencing. These measures will also ensure that any additional mitigations, such as dewatering controls, are developed to ensure low potential impact significance (GWMM02).

This report is presented within the limitations of the work which has been undertaken. Data gaps are summarised in Section 10. This executive summary should be read in conjunction with the body of the report and statement of limitation, which is provided in Appendix A.

Table A: Summary of management and mitigation measures

Measure ID	Mitigation and management measures	Project Stage
GWMM01	Conduct a pre-construction hydrogeological assessment at the converter station site to inform appropriate detailed design and construction methods.	Design
GWMM02	Minimise groundwater inflow into excavations, limit groundwater level drawdown, avoid mobilising contaminated or saline groundwater, and prevent groundwater acidification.	Design, Construction
GWMM03	Prevent groundwater movement and contamination as a result of Horizontal Directional Drilling (HDD) and other drilling activities.	Construction
GWMM04	Develop and implement a groundwater management plan to manage, monitor, reuse, treat, and dispose of groundwater during construction dewatering.	Design, Construction
GWMM05	Develop and implement a construction groundwater monitoring plan to establish baseline and background groundwater conditions prior to construction and monitor potential project impacts during construction.	Design, Construction

Measure ID	Mitigation and management measures	Project Stage
GWMM06	Develop and implement an operational groundwater management plan to detect and minimise potential contamination impacts during the project's operation.	Operation

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
AEMO	Australian Energy Market Operator
AEP	Annual exceedance probability
ARI	Average recurrence interval
ASS	Acid sulfate soils
BOD	Biological oxygen demand
CEMP	Construction Environment Management Plan
CMPP	Conservation Management Priority – Potential
EMPCA	Environmental Management and Pollution Control Act 1994 (Tas)
EPA	Environment Protection Agency
GED	General environmental duty
GMA	Groundwater management area
HDD	Horizontal directional drilling
HSEQ	Health Safety, Environment and Quality
ICV	Integrated Conservation Value
ISP	Integrated System Plan
NATA	National Association of Testing Authorities
OEMP	Operation Environment Management Plan
OHTL	Overhead transmission line
PCB	Polychlorinated biphenyl
PFAS	Per- and poly-fluoroalkyl substances
RCV	Representative Conservation Value
SDS	Safety Data Sheet
SOBN	State observation bore network
SRW	Southern Rural Water
SV	Special Value
WMIS	Water Measurement Information System
%	Percentage
°C	Celsius
µg/L	Microgram per litre
AHD	Australian Height Datum
BoM	Bureau of Meteorology
C	Centigrade
CEMP	Construction Environment Management Plan
CFEV	Conservation of Freshwater Ecosystems Values
CIA	Cumulative impact assessment
CSIRO	Commonwealth Scientific and Industrial Research Organisation

Acronyms/Abbreviations	Definition
DAWE	Department of Agriculture, Water and the Environment
DCCEEW	Australian Department of Climate Change, Energy, Environment and Water
DTP	Department of Transport and Planning (DTP) (previously known as the Department of Environment, Land, Water and Planning (DELWP))
DNRE (DPIPWE/DPIWE)	Department of Natural Resources and Environment Tasmania (previously known as Department of Primary Industries, Parks, Water and Environment (DPIPWE)/Department of Primary Industries, Water and Environment (DPIWE))
EC (µS/cm)	Electrical conductivity (microsiemens per centimetre)
EES	Environment effects statement
EIS	Environmental impact statement
EMP	Environmental Management Plan
EMPCA	*Environmental Management and Pollution Control Act 1994* (Tas)
EPA	Environmental Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999 (Cwlth)
EV	Environmental Values
GDEs	Groundwater dependent ecosystems
GED	General environmental duty
GL	Gigalitres
GMP	Groundwater Management Plan
ha	hectares
HDD	Horizontal directional drilling
HVAC	High voltage alternating current
HVDC	High voltage direct current
IFC	International Finance Corporation
km	Kilometres
km^2	Square kilometres
kV	Kilovolt
KVA	Kilovolt-amp
L/s	Litres per second
m	Metres
m AHD	Metres Australian Height Datum
mbgl	Metres below ground level
m/day	Metres per day
mg/kg	Milligrams per kilogram
mg/L	Milligrams per litre
mm	millimetres
Mva	Megavolt-amp
MW	Megawatt

Acronyms/Abbreviations	Definition
NEM	National Electricity Market
NORM	naturally occurring radioactive materials
NWTD	North West Transmission Developments
PAH	Polycyclic Aromatic Hydrocarbon
PEV	Protected environmental value
REZ	Renewable Energy Zones
SPWQM	State Policy on Water Quality Management
sVOCs	Semi-Volatile Organic Compounds
TasNetworks	Tasmanian Networks Pty Ltd
TDS	Total Dissolved Solids
TRH	Total Recoverable Hydrocarbons
UNESCO	United Nations Educational, Scientific and Cultural Organization
V DC	Volts of direct current
VOCs	Volatile Organic Compounds
WQO	Water quality objective

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 by Tetra Tech Coffey for the Tasmanian jurisdiction as part of the two EISs being prepared for the project.

1.1 PURPOSE AND OBJECTIVES

This report incorporates the groundwater 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 groundwater and identify and assess any potential impacts to groundwater which may arise from project-related activities. This report will also recommend management strategies or measures to be implemented with the interest of avoiding and/or minimising the groundwater impacts to human health and the environment, so far as is reasonably practicable.

The key objectives of this groundwater impact assessment are to:

- Describe applicable policy, legislation, regulations, standards, and guidelines for the minimisation and management of impacts to groundwater;
- Characterise existing groundwater conditions based on a desktop review of available data;
- Undertake a desktop study to obtain sufficient hydrogeological information to allow potential impacts on groundwater associated with the construction and operation of the project to be identified;
- Undertake a groundwater impact assessment that will inform the EIS for the project; and
- Identify potential residual groundwater impacts and describe the proposed inspection and monitoring programs that will demonstrate achievement of the relevant environmental objectives.

This report documents the outcomes of the groundwater impact assessment within the Heybridge site. The Victorian component is provided within a separate groundwater impact assessment, which is specific to the Victorian assessment guidelines.

1.2 PROJECT OVERVIEW

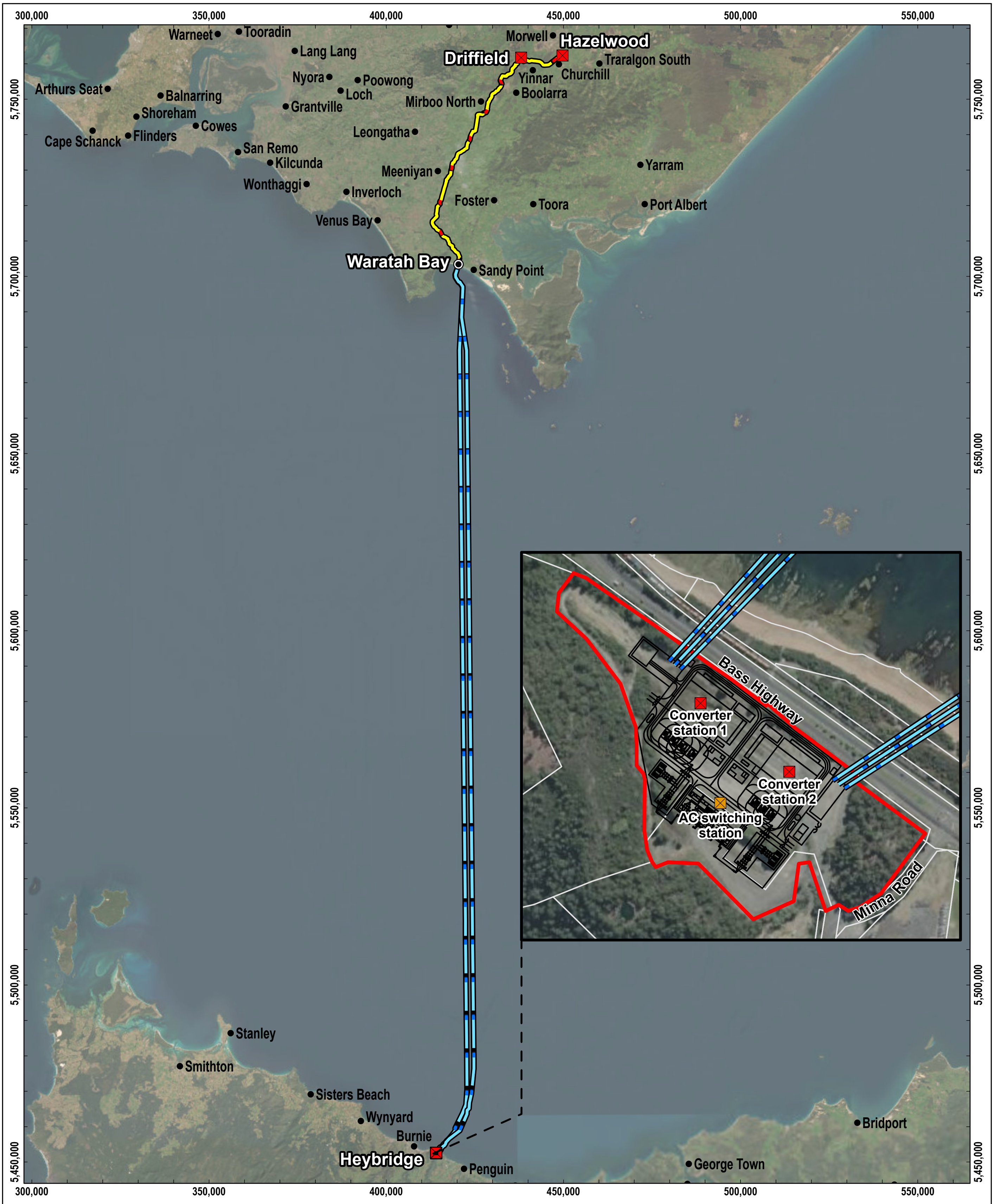
The project is a proposed 1,500 megawatt (MW) HVDC electricity interconnector between Heybridge in North West Tasmania and the Latrobe Valley in Victoria (Figure 1-1). The project is proposed to provide a second link between the Tasmanian renewable energy resources and the Victorian electricity grids 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 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.



LEGEND

- Landfall
- Proposed converter station
- Proposed switching station

Proposed route

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

MARINUS LINK

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MARINUS LINK HEYBRIDGE GROUNDWATER IMPACT ASSESSMENT REPORT

FIGURE 1-1

Marinus Link location and overview

0 10 20 km

SCALE 1:1,500,000

PAGE SIZE: A4

PROJECTION: GDA2020 MGA Zone 55

TETRA TECH COFFEY

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

DATE: 30.04.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_R18_F001.1_GIS

DOC REFERENCE: \\TT.LOCAL\COF\S772\GIS\215878_MELEN_TASNETWORKS_PROJECTMARINUS\GIS\MXD_APRX\215878ML_R18_HB_HYDRO\215878ML_R18_FIGS.APRX LAYOUT: 215878ML_R18_F001.1_GIS_2

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1.3 ASSESSMENT CONTEXT

Groundwater refers to the water present in saturated natural geological formations (aquifers) beneath the ground surface. It is an essential resource that can provide reliable drinking water supplies to communities, support agriculture, and offer alternative water supplies to the community during periods of drought. In many settings groundwater is critical component of the water cycle, supplying water to the environment, and sustaining the aquatic ecosystems associated with our creeks and rivers, swamps, wetlands and estuary systems. Groundwater also directly supports some areas of terrestrial vegetation where their root systems access shallow groundwater.

Changes to land use, water management practices, and the effects of large construction projects can alter groundwater levels or quality to the extent that it may adversely affect the groundwater resource and those users and segments of the environment that rely on it.

It is important that the project considers the potential interactions that it may have with groundwater particularly where construction activities might extend below the water table and require dewatering, or where project activities might cause groundwater contamination.

It is also important to assess whether these activities could impact the environmental values of groundwater, including groundwater users and/or groundwater dependent ecosystems (GDEs). Groundwater users include those people who pump water from existing groundwater bores and GDEs. GDEs are those ecosystems that require access to groundwater to meet all or some of their water requirements to maintain the terrestrial and aquatic communities and ecological processes they support, and ecosystem services they provide. These can include streams or lakes that groundwater flows into, vegetation with roots that access groundwater or biota living in cave systems. This assessment provides an understanding of the areas of potential groundwater level and groundwater quality impacts that may arise from the project, potential risks to groundwater users and EVs, and informs the development of suitable management and mitigation measures that avoid or mitigate these risks.

2. ASSESSMENT GUIDELINES

This section outlines the assessment guidelines relevant to groundwater 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 sections relevant to the groundwater impact assessment are provided in Table 2-1.

Table 2-1 Tasmanian EIS guideline requirements

Relevant section of EIS guidelines	Requirements	Relevant section of this report
Converter station		
5.2 Environmental aspects – overview	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 sulphate soils), vegetation, fauna, groundwater and surface drainage (including waterways, lakes, wetlands, coastal areas etc).	Section 6
6.4 Water quality (surface and groundwater)	Discuss potential impacts of construction and operation of the proposal on surface and groundwater, including:	Section 6.6.3
	Results of any baseline water quality, biological and sediment monitoring undertaken of potentially impacted waterways.	
	Consideration of Protected Environmental Values under the *State Policy on Water Quality Management 1997*.	Section 7.2
	Where any subsurface works are proposed:	
	Provide a map showing the location of any groundwater bores (refer to the Groundwater Information Portal), a conceptual groundwater model for regional and local aquifer flows and details of any baseline groundwater quality monitoring undertaken;	Section 6.6.6
	Identify any surface water and groundwater dependant ecosystems that may receive groundwater from areas impacted by the proposal.	Section 6.6.5
	Discuss potential impacts of the proposal on groundwater (quality and quantity), including interruption of flow and release of sediment, and cumulative impact with proposed shoreline crossing works.	Section 7.3
	Discuss proposed avoidance and mitigation measures to minimise potential impacts on surface and groundwater quality.	Section 9
	Provide justification for any potential impact to groundwater in accordance with the principles under the *State Policy on Water Quality Management 1997* and with reference to likely groundwater community values, associated guideline values and guideline values for receiving surface waters. For information regarding the water quality management framework and evaluation criteria in Tasmania refer to *Technical Guidance for Water Quality Objectives (WQOs) Setting for Tasmania*, August 2020.	Section 7.2 and 7.7

Relevant section of EIS guidelines	Requirements	Relevant section of this report
6.12 Hazard analysis and risk assessment	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 decommissioning of the proposal. It is expected that risks to receiving aquatic waterbodies and ecosystems will be considered through HAZOPS and emergency management planning and that environmental impact mitigation measures will be incorporated into emergency response plans as appropriate.	Section 7
Shore crossing		
9.2 Environmental aspects – overview	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 sulphate soils), vegetation, fauna, groundwater and surface drainage (including waterways, lakes, wetlands, coastal areas etc), and seabed characteristics.	Section 6
10.5 Water quality (surface and groundwater)	Discuss potential impacts of construction and operation of the proposal on surface and groundwater, including:	Section 7.1
	Results of any baseline water quality, biological and sediment monitoring undertaken of potentially impacted waterways.	Section 6.6.3
	Consideration of Protected Environmental Values under the *State Policy on Water Quality Management 1997*.	Section 7.2
	Where any subsurface works are proposed:	
	Provide a map showing the location of any groundwater bores (refer to the Groundwater Information Portal), a conceptual groundwater model for regional and local aquifer flows and details of any baseline groundwater quality monitoring undertaken.	Section 6.6
	Identify any surface water and groundwater dependant ecosystems that may receive groundwater from areas impacted by the proposal.	Section 6.6.5
	Discuss potential impacts of the proposal on groundwater (quality and quantity), including interruption of flow, release of sediment, disturbance of contaminated material, and cumulative impact with proposed converter station works.	Section 7.1
	Discuss proposed avoidance and mitigation measures to minimise potential impacts on surface and groundwater quality.	Section 9
	Provide justification for any potential impact to groundwater in accordance with the principles under the *State Policy on Water Quality Management 1997* and with reference to likely groundwater community values, associated guideline values and guideline values for receiving surface waters. For information regarding the water quality management framework and evaluation criteria in Tasmania refer to *Technical Guidance for Water Quality Objectives (WQOs) Setting for Tasmania, August 2020*.	Section 7.7

2.2 LINKAGE TO OTHER TECHNICAL ASSESSMENTS

The groundwater impact assessment is informed by or informs the technical assessments outlined in Table 2-2.

Table 2-2 Relevant technical studies

Technical assessment	Relevance to this assessment
Geotechnical factual report (Jacobs, 2022a)	Study provides factual summary of desktop review of geological setting, site investigation works including drilled boreholes, monitoring well installation, groundwater monitoring, test pits, geophysical investigations, and contamination assessment. The information provided in the report supported the development of a conceptual hydrogeological model, baseline groundwater characterisation, and preliminary assessment of soil and groundwater contamination status.
Geotechnical interpretive report (Jacobs, 2022b)	The interpretive report provides further discussion and interpretation of the primary data presented in the geotechnical factual report (Jacobs, 2022a), including assessment of water-bearing formations, comparison of water quality against adopted screening criteria, estimation of aquifer hydraulic properties and assessment of likelihood that construction activities may intersect groundwater. The information provided was considered during development of the hydrogeological conceptual model and identification of potential impacts to groundwater.
Climate and climate change assessment (Katestone, 2023)	Characterises the climate change predictions and risk that could affect the project. This report provides review of climate setting and anticipated range of climate change scenarios for the Heybridge site, including changes to rainfall allowing inferred changes to groundwater recharge rates and future changes to average groundwater levels.
Contaminated land and acid sulfate soils impact assessment **(Tetra Tech Coffey, 2023)**	Report identifies the potential for contamination and/or acid sulfate soils (ASS) to be present in the study area and assesses the risks and residual impacts to the environment and human health posed by the potential contamination. This assessment includes 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.
Terrestrial ecology baseline and impact assessment **(Entura, 2023)**	Report characterises the ecological setting relevant to groundwater within the study area.

3. LEGISLATION, POLICY AND GUIDELINES

The legislation, policies and guidelines applicable to this report are described below.

3.1 TASMANIA

In Tasmania the key documents that relate to the groundwater management and this impact assessment are:

- *Environment Management and Pollution Control Act 1994* (Tas) (EMPCA)
- EPA Tasmania, *State Policy on Water Quality Management 1997* (EPA Tas, 1997)

3.1.1 Environment Management and Pollution Control Act 1994 (Tas)

The *Environment Management and Pollution Control Act 1994* (Tas) (EMPCA) is the primary environmental protection legislation in Tasmania. The basis of the EMPCA is prevention, reduction and remediation of environmental harm. In Tasmania, the responsibility for environmental management is shared by the EPA and local councils under the EMPCA.

3.1.2 State Policy on Water Quality 1997

Surface waters and groundwater in Tasmania are protected under the *State Policy on Water Quality Management* (EPA Tas, 1997) (State Policy). The State Policy provides a framework for the sustainable management of water quality throughout Tasmania and refers to water quality guidelines and objectives to be implemented.

Section 7.1 of the State Policy defines six protected environmental values which are defined as values or uses of the environment which should be protected. These are summarised in Table 3-1 below and assessed further in Section 7.

Table 3-1 Protected environmental values of water

	PEV
A	Protection of aquatic ecosystems
	A1 – Surface waters, including estuaries, but not including coastal waters: i) Pristine or nearly pristine ecosystems ii) Modified (not pristine) ecosystems (a) from which edible fish, crustacea and shellfish are harvested (b) from which edible fish, crustacea and shellfish are not harvested
	A2 – Coastal waters i) Coastal waters ecosystems
	A3 – Groundwaters i) Groundwater ecosystems *Environmental Value's relevant to groundwater are defined by the observed Total Dissolved Solids (TDS) concentration. Refer to Table 1 of the State Policy.*
B	Recreational water quality and aesthetics: i) Primary Contact ii) Secondary Contact iii) Aesthetics only
C	Raw water for town drinking water supply* ** All raw water from any surface water source or groundwater source which is to be used for domestic purposes should comply with the Australian Drinking Water Guidelines (NHMRC 2022), at the point of use, regardless of source.*
D	Raw water for homestead supply*
E	Agricultural water uses: i) irrigation, and ii) stock watering.
F	Industrial water supply *The specific industry type for which the water is to be used must be specified to identify appropriate guidelines (Australian Water Quality Guidelines for Fresh and Marine Water Quality, ANZG 2018)*

4. PROJECT DESCRIPTION

This section discusses the key component and details of the project and activities that are relevant to the groundwater impact assessment.

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 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 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 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 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 (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 4-1).

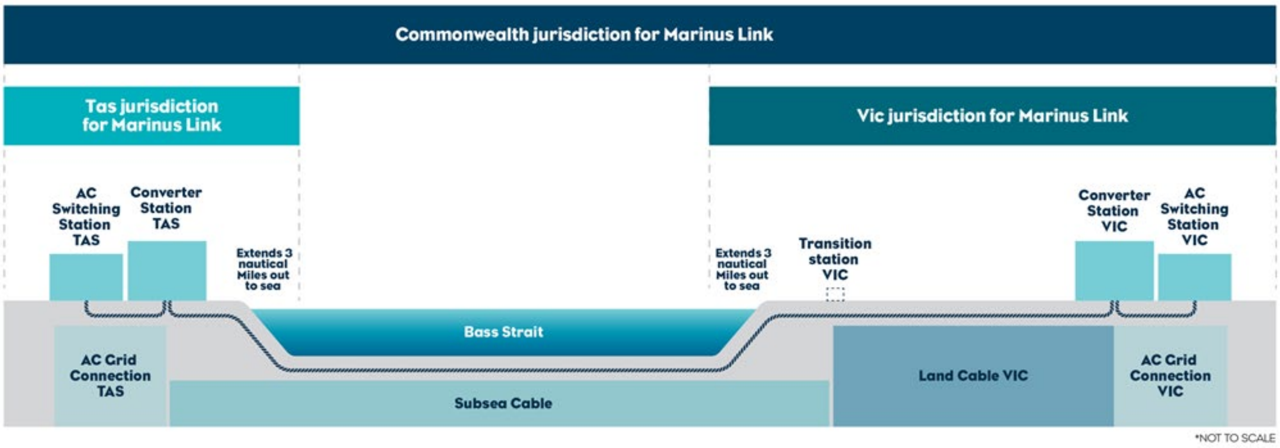


Figure 4-1 Project components considered under applicable jurisdictions (MLPL, 2022)

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 the project's key components during the construction phase that have the potential to impact on environmental or social groundwater values considered within this groundwater impact assessment are summarised below.

- **Bass Highway and shore crossing** – HDD launch pits (two) and drilling activities.
- **Converter station** – Site preparation, earthworks and civil works.

The project description outlines the following components that will be constructed at the Heybridge converter station which are highlighted by this report as having potential relevance to the groundwater impact assessment:

- Greywater and sewerage will be managed through two septic tanks to be located towards the centre of the site.
- A stormwater drainage system that will receive water from the converter station site including areas surrounding bunded infrastructure which will be directed to and collected in a gross pollutant trap or triple interceptor trap.
- The site will have underground oil separator tanks, in the centre-east of the site, which will be periodically pumped out by a licensed wastewater disposal contractor.
- Two 1500 kVA diesel generators with above ground fuel storage of 5000 L (sufficient for 8 hours at full load), to power a 2500 L diesel converter.
- Clean surface water runoff and overflow from the traps will discharge to a stormwater management system that adopts water sensitive urban design principals (e.g., swale drain), before discharge to the ocean via the existing site drainage culvert.
- An above ground fire water tank.

The following sections provide further detail on some key aspects of the project's construction that may interact with groundwater.

4.2.1 HDD launch pit

The shore crossing will comprise of six HDD bores, one for each cable (two power and one fibre optic per pad) drilled from 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 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 project alignment. The HDD bores will extend approximately 1 km offshore and end in approximately 10 m water depth. The subsea cables will be pulled from the cable laying vessel to the converter station HDD drill pads.

Two HDD launch pits are likely to be located at the converter site to provide subsurface access for deployment of the drill rods. Specific depths of the HDD launch pits have not been provided for the Heybridge site but are assumed to be in the order of 3 m below the existing ground surface.

4.2.2 Converter station earthworks

An elevated bench will be constructed to provide a stable base for the converter station and situate it above the 1 in 200-year flood level. The site will have a gentle slope from an RL of approximately 10 m in the south-eastern corner of the site towards an RL of 6.8 m at the north-western boundary with Bass Highway (over a 340 m section across the site).

Areas of unsuitable material and contaminated soil will be excavated and managed in accordance with relevant regulatory requirements.

A preliminary conceptual design of the Heybridge site's cut and fill requirement during construction has been provided by Jacobs (2022b). The draft concept design cut and fill isopach figure is reproduced as Figure 4-2. It indicates that excavation of the southwestern and eastern boundaries of the site will be required to level and fill the lower elevations in the centre and north of the site. The Jacobs (2022b) concept design describes the proposed earthworks which notes excavation of up to approximately 2.5 m depth in the east and southwest of the site (Figure 4-2). An excavated entryway is also shown from the east with similar maximum cut depths.

Jacobs (2024) provides further assessment of potential construction earthworks based on the revised assumption that the existing fill material at the site may not be geotechnically suitable for construction and may require excavation and offsite disposal. Excavation depths and the corresponding soil volumes that would require offsite disposal have been reproduced in Figure 4-3. The finished site level would be achieved by importing and placing clean fill.

Contaminated soil generated during removal of unsuitable fill material and construction of the converter station bench (if encountered) will be either remediated prior to onsite reuse or will be disposed offsite to a licenced landfill.

Civil works including station access and internal roads, stormwater drainage system, converter hall (comprising phase reactor, valve and HVDC reactor halls), building foundations, cable trenches and foundations for electrical apparatus and transformer bays, may all potentially encounter shallow groundwater which may be less than 0.5 m below ground level (m bgl) (refer to Section 6.6.1).

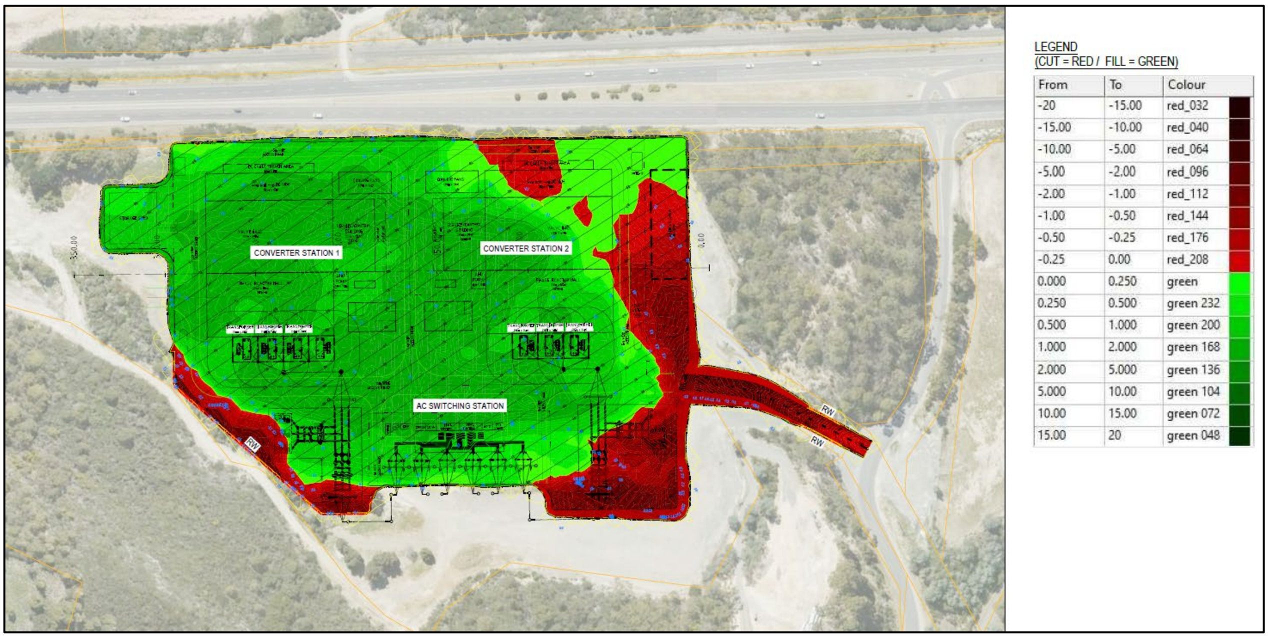


Figure 4-2 Heybridge converter station site cut/fill plan (sourced from Jacobs, 2022b)

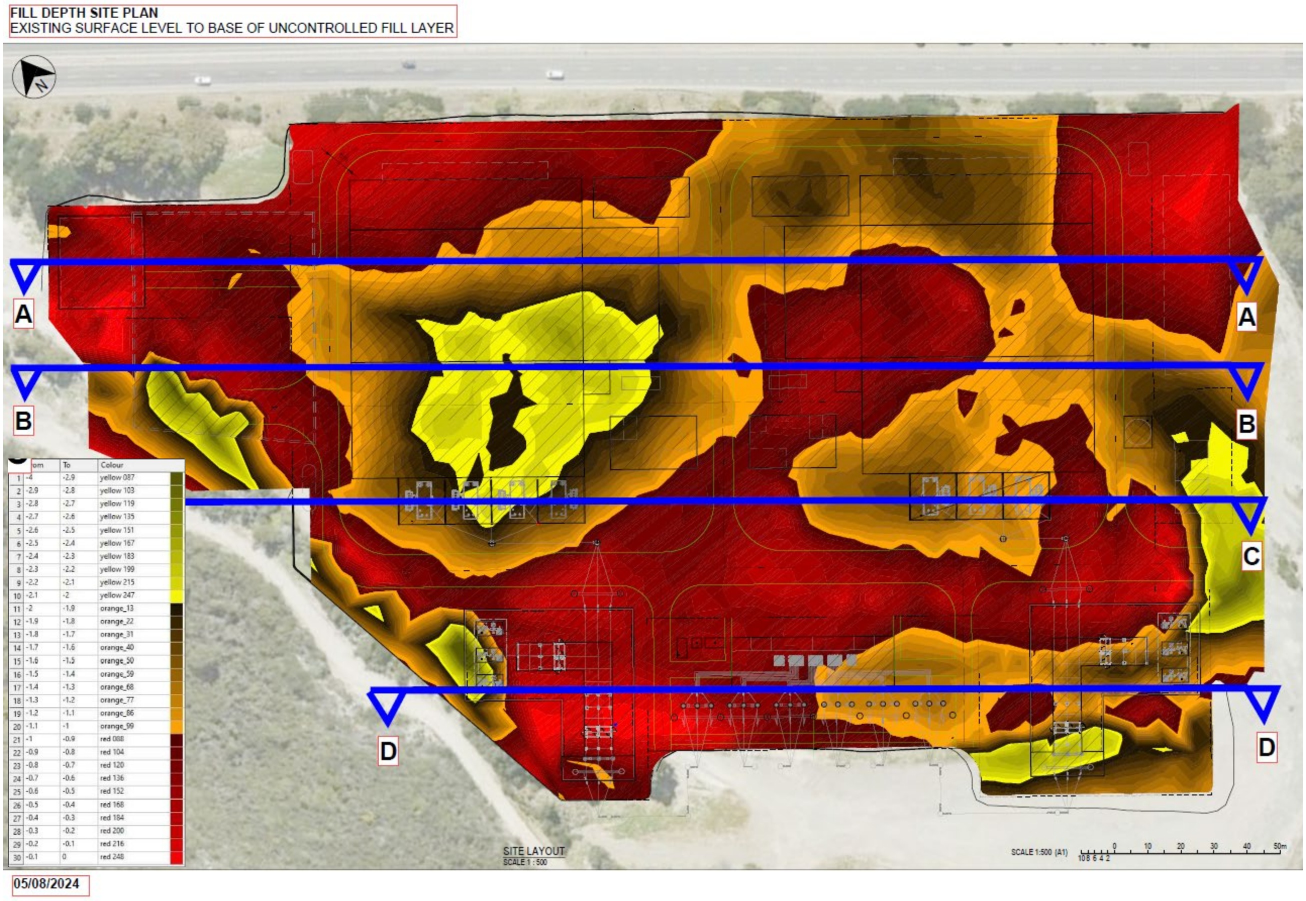
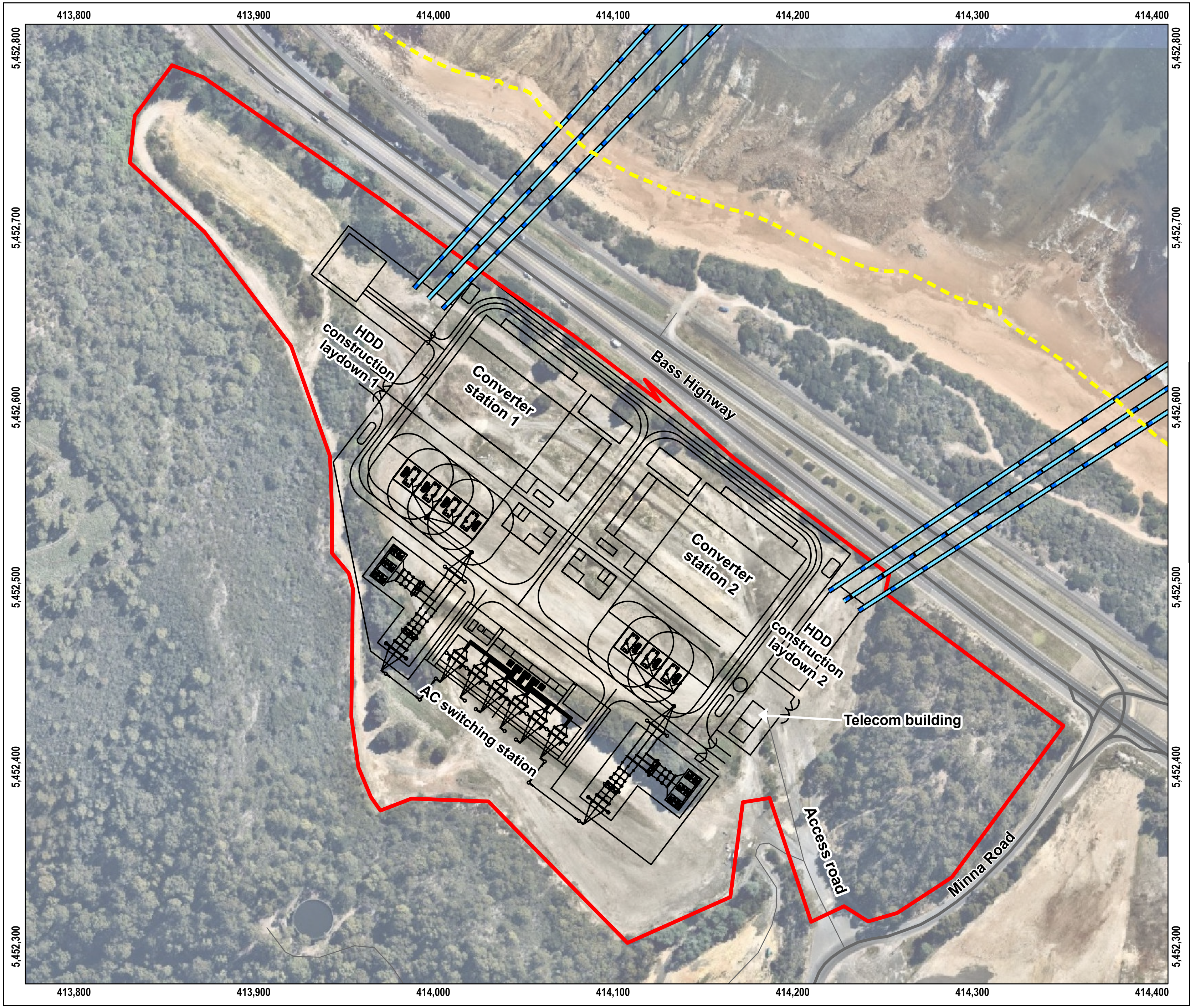


Figure 4-3 Heybridge converter station fill depth plan (sourced from Jacobs, 2024)

4.2.3 Converter station foundations

Jacobs (2022b, 2024) provided an assessment of the subsurface geotechnical conditions and concluded that bored piles would likely be adopted for foundations at the converter station which would be anchored to the underlying competent rock. Piles would extend below the water table and would require temporary casing or other means to maintain the pile hole stability through the saturated, unconsolidated fill and sediments (where it remains). Figure 4-4 presents the proposed site infrastructure layout including buildings that may require bored piled foundations.



MARINUS LINK

LEGEND

Proposed route
- HVDC subsea cable
- Indicative station layout
- Heybridge converter and switching station site boundary
- 500 m site buffer
- Major road
- Minor road

Source:
Routes from Tetra Tech Coffey.
Station layout from Jacobs.
Roads and watercourses from DPIPWE.
Imagery from NearMap (8 March 2022).

0 25 50 m

SCALE 1:3,000
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PROJECTION: GDA2020 MGA Zone 55

MARINUS LINK PTY LTD

MARINUS LINK HEYBRIDGE GROUNDWATER IMPACT ASSESSMENT REPORT

FIGURE 4-4

Heybridge converter station infrastructure layout

TETRA TECH COFFEY

DATE: 30.04.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_R18_F003.3_GIS

4.3 OPERATION

During the operational and maintenance phase, site workers will be undertaking tasks such as waste collection, triple interceptor trap maintenance, routine maintenance, changing filters, inspecting equipment, alarm response, outage coordination and planning, switching, and training.

Of relevance to the groundwater impact assessment, the following infrastructure is proposed to be installed at the Heybridge site for use during the operation phase:

- Two 1.5 MVA gensets with 2500 L of fuel storage each (assume to be consumed during testing and refuelled annually).
- Septic tank for onsite sewage treatment.
- Oil-cooled electrical transformers.

The following operational project activities have been considered:

- Accidental spills and leaks of transformer oil, lead acid batteries, and diesel fuel stored in above ground tanks;
- Accidental leaks from triple interceptor traps;
- Herbicide application (approximately 20 L every three months) at the converter station; and
- Discharge of treated effluent to subsurface soils and groundwater from the septic tank.

During operation, the site will generate very little waste. Any waste generated will be managed in accordance with the waste management hierarchy and the operational EMP. While there will be several transformers onsite containing large amounts of oil, this oil has a significant lifespan (40 years approximately) and is not expected to generate waste during that time.

Waste may be generated from operation and maintenance activities related to:

- Lead acid batteries that will need to be replaced approximately every 10 years. There are four 110/125 V DC battery banks which consist of 58 lead acid cells each (or equivalent lithium batteries).
- Approximately five rat bait stations will be required to be replaced every six months.

4.4 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 will be left in-situ as removal will 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

This section describes the method used to assess the potential groundwater impacts associated with project activities considering the values present in the project area. This assessment method addresses the requirements outlined in the Tasmanian assessment guidelines for the project (Section 2).

The assessment method has key three steps:

The first step is the evaluation of the baseline conditions to identify environmental values and potential of impacts. This includes:

- Defining a study area to provide context for identifying potential issue and assessing impacts.
- Baseline characterisation of groundwater quality, uses, levels and influences from factors such as climate, hydrology, existing land uses and geological conditions.
- Understanding the geology and nature of aquifers within and surrounding the project area.
- Developing a conceptual model of groundwater levels and flows.

The second step is the hydrogeological assessment to assess the possible range of changed to groundwater level or quality in response to proposed construction methods, such as groundwater dewatering.

The third step includes the assessment of the sensitivity of groundwater values and aquifers to change, the assessment of the magnitude of potential impacts, and the significance of those impacts. This step also includes considering possible mitigation measures to reduce the impact and assess a residual impact significance after application of further controls.

5.1 STUDY AREA

The study area of the groundwater impact assessment is defined as the converter and switching stations located in Heybridge, Tasmania which comprises an approximate area of 10.6 hectares (ha) (referred to as the site) plus a 500 m onshore zone surrounding the site (Figure 4-4).

The 500 m zone was set based on the inferred small groundwater catchment that is likely to interact with the proposed converter station location. This inferred catchment size was based on the site's position on a promontory of land that is bounded on three sides by major hydrogeological boundaries: the coastline of Bass Strait to the north, and the Blythe River estuary to the south and east. The remaining south and western boundaries are defined by the steeply rising topography formed by the outcropping bedrock formation which would likely form a groundwater catchment divide or low-flow boundary. Local hydrogeological conditions are discussed further in Section 6.6.

It is noted that the sub-sea cables and the NWTD project are excluded from the study area.

5.2 BASELINE GROUNDWATER CHARACTERISATION

Characterisation of the existing groundwater conditions within the study area has been based on the desktop review of published literature and data for the site and the region. It provides the necessary level of understanding of the existing groundwater environment at the Heybridge site to allow for an assessment of potential project impacts.

Data sources reviewed during the groundwater baseline characterisation (Section 6) include:

- Bureau of Meteorology (BoM):
  - Climate data.
  - Groundwater Dependent Ecosystem Atlas.

- Publicly available reports and mapping products commissioned by State (i.e., Mineral Resources Tasmania (MRT)), Department of Natural Resources and Environment Tasmania (DNRE)) and Federal agencies (i.e., Commonwealth Scientific and Industrial Research Organisation (CSIRO), (BoM), Department of Agriculture, Water and the Environment (DAWE)).
- DNRE ListMap geospatial datasets including:
  - River catchments, rivers, creeks and water bodies.
  - Water management plan areas.
  - Conservation of Freshwater Ecosystems Values (CFEV) wetlands, waterbodies, karsts and GDEs.
  - Sites currently regulated by EPA Tasmania under the EMPCA.
  - Geological mapping information including 1:25,000 and 1:250,000 scale geological maps.
- DNRE Groundwater Information Access Portal.
- CFEV spatial database tool and project database.
- Site geotechnical and contamination investigation reports prepared for the site (Table 2-2)

5.3 HYDROGEOLOGICAL ASSESSMENT METHOD

This assessment has considered the change in hydrogeological conditions due to the likely requirement for temporary dewatering during construction, resulting in groundwater level drawdown. The following sections describes the approach to the hydrogeological assessment to estimate the potential groundwater levels changes over distance. The assessment is then presented in Section 7.3.1.

5.3.1 Project dewatering requirements

Temporary dewatering may be required at excavations that extend below the water table beneath the site during construction.

Planned construction earthworks will be required to remove geotechnical unsuitable fill material and level the site (described in Section 4.2.2). In the case where fill material requires excavation and removal, a large portion of the site will require excavation below the water table. Extensive zones of dewatering are likely to be required during earthworks unless mitigations are put in place to prevent or minimise groundwater ingress. Given the suspected high hydraulic conductivity of the shallow fill material and the Quaternary aquifer, the unmitigated rate of groundwater ingress into dewatered excavations could be high.

It is noted that the final site levels conditions result in the water table periodically rising above the final finished ground level. This might feasibly occur along the southwestern and eastern site boundaries where site levelling earthworks may require retaining walls will be built. Depending on the groundwater levels in these areas, groundwater may emerge at the new ground surface and drain to the site stormwater management system.

Examples of possible infrastructure that may require dewatering for a period include:

- HDD launch pits
- Bored piles.

Two HDD launch pits are likely to be located at the converter site to provide subsurface access for deployment of the drill rods. Specific depths of the HDD launch pits have not been provided for the Heybridge site but are assumed to be in the order of 3 m below the existing ground surface. There are no indications that permanent infrastructure will be installed below the watertable that would require long term dewatering during operation.

A qualitative dewatering assessment method has been adopted to consider the potential drawdown impacts, which is discussed further in Section 7.3.1.

5.4 IMPACT ASSESSMENT

The assessment of potential groundwater impacts has been conducted by assessing the significance of an impact. This considers the project activities that might potentially impact on the protected environmental values of groundwater (identified in Section 7). This approach assesses the sensitivity of the environmental segment (in this case groundwater aquifers or sensitive receptors) (described further in Section 5.4.2) and the magnitude of the impact to relevant environmental values if it did occur (described further in Section 5.4.3).

Impacts are assessed initially based on the implementation of standard mitigation or management measures that are either proposed by the proponent or are common across the industry. If necessary, additional mitigation or management measures may need to be needed to reduce the residual predicted impact so far as reasonably practicable. The recommended mitigation and management measures are further discussed in Section 9.

5.4.1 Identifying potential impacts

The impact assessment approach requires that all credible potential impacts to groundwater are identified and considered.

This assessment included a review of the project description (Section 4) by Tetra Tech Coffey's technical specialist (hydrogeologists) to consider the potential adverse impacts that construction, operation, and decommissioning activities may have on groundwater.

Credible potential impacts were identified if any of the proposed activities might interact with groundwater and could cause changes to groundwater levels or quality. The identification of potential impacts was also informed by the understanding of the existing environment presented in Section 6 and draws on knowledge gained on other linear infrastructure projects.

The potential impacts identified are listed in Section 7.1 and are carried through the impact assessment in Section 7.3 through to Section 7.8.

5.4.2 Identification and sensitivity assessment of environmental values

The sensitivity of an identified environmental value of groundwater is determined with respect to the following factors as they relate to the aquifers on which those values rely:

- *Conservation status*: assigned to an environmental value by governments (including statutory and regulatory authorities) or recognised international organisations (e.g., United Nations Educational, Scientific and Cultural Organization (UNESCO)) through legislation, regulations, and international conventions.
- *Intactness*: an assessment of how intact an environmental value is. It is a measure (with respect to its characteristics or properties) of its existing condition, particularly its representativeness.
- *Uniqueness or rarity*: an assessment of its occurrence, abundance, and distribution within and beyond its reference area (e.g., bioregion/biosphere).
- *Resilience to change*: determined by the extent to which an environmental value can cope with change including that posed by threatening processes. This factor is an assessment of the ability of an

environmental value to adapt to change without adversely affecting its conservation status, intactness, uniqueness, or rarity.

- *Replacement potential*: the potential for a representative or equivalent example of the environmental value to be found to replace any losses.

The criteria for the different sensitivity levels of an EV, as applied in the groundwater significance impact assessment, are described in Table 5-1. The process of identifying groundwater values, which inform aquifer sensitivity, is presented in Section 5.4.1. The sensitivity assessment is presented in Section 7.2.1.

Table 5-1 Definitions for the sensitivity of aquifers (based on their capacity to support groundwater values)

Sensitivity criteria	Very high sensitivity	High sensitivity	Moderate sensitivity	Low sensitivity	Not sensitive
Environmental Values of groundwater *Potential uses of groundwater related to the suitability of the water to support ecosystems, and consumptive and productive uses.*	Attributes of the groundwater system support connected features that are of high ecological importance and/or cultural or spiritual significance. Intrinsic attributes support the use of the groundwater for potable supply, agricultural use, and food production.	Attributes of the groundwater system support ecosystems that are of high importance but may be slightly modified. Intrinsic attributes support the use of the groundwater for secondary domestic supply and some agricultural uses.	Attributes of the groundwater system support ecosystems that are characterised as slightly to moderately disturbed and may have reduced biodiversity and ecological value. Groundwater quality or levels may be altered from natural conditions and partly affect some environmental values. Intrinsic attributes support the use of the groundwater for construction and irrigation purposes, and might support some short-term agricultural uses (such as during drought)	The groundwater system supports ecosystems of limited ecological importance, which are characterised as highly altered from their natural state. Groundwater quality is highly altered from natural conditions. Groundwater supports a limited range of consumptive and productive uses.	Attributes of the groundwater system (quality, occurrence, volume, extraction potential) are not suitable for environmental values. Groundwater quality may be highly altered from natural conditions and may be impacted by existing contamination sources. Groundwater supports a very limited range of consumptive and productive uses and ecosystems that have low dependence on water quality parameters.
Uniqueness and rarity *Abundance of the aquifer type and availability of equivalent or representative alternatives. Uniqueness of the aquifer or connected feature that carries conservation status.*	Attributes of the groundwater system (including connected features) are unique. There are no known available alternatives. The groundwater system, or connected feature, is listed on a recognised or statutory state, national or international register as being of conservation significance.	Attributes of the groundwater system are locally unique, and with few regionally available alternatives. The groundwater system, or connected feature, is listed on a recognised or statutory state or national register as being of conservation significance.	Attributes of the groundwater system are locally unique but have regionally available alternatives. The groundwater system, or connected feature, is recorded as being important at a regional level, and may have been nominated for listing on recognised or statutory registers.	Attributes of the groundwater system are common on a regional and national basis, and therefore, have regionally available alternatives. The groundwater system, or connected feature, is not listed on any recognised or statutory register.	Attributes of the groundwater system are common on a local and regional scale, and therefore have both local and regionally available alternatives. The abundance and widespread distribution of the groundwater system, and any connected features, ensures replacement of unavoidable losses is assured. The groundwater system, and its connected features, are not listed on any recognised or statutory register, nor are they recognised locally by relevant suitably qualified experts or organisations.
Resilience to change *Groundwater properties such as water level or pressure changes, and quality change, and the nature of the aquifer's connection to the environment.*	The groundwater system, or connected features, have a very low capacity to adjust to level or quality change or disturbance. Intrinsic properties of the groundwater system are very susceptible to change. The overall function of the groundwater system would be permanently altered.	The groundwater system, or connected features, have a low capacity to adjust to level or quality change or disturbance. Intrinsic properties of the groundwater system are susceptible to change. The overall function of the groundwater system would be temporarily altered.	The groundwater system, or connected features, have a moderate capacity to adjust to level or quality change or disturbance. Intrinsic properties of the groundwater system are moderately susceptible to change. The overall function of the groundwater system could be partly altered.	The groundwater system, or connected features, have a high capacity to adjust to level or quality change or disturbance. Intrinsic properties of the groundwater system are slightly resistant to change. The overall function of the groundwater system remains relatively unchanged.	The groundwater system may be confined and deep. The groundwater system, or connected features are not sensitive to level or quality change or disturbance and is able to fully recover. Intrinsic properties of the groundwater system are resilient to change. The overall function of the groundwater system is unchanged.
Recovery potential *Potential for groundwater systems to recover from a level or quality change naturally.*	The groundwater system has very low recharge rates and very long recovery periods are expected. Permanent quality or quantity changes may occur.	Groundwater systems with low recharge rates and slow recovery periods. Recovery potential is limited or only successful in the minority of cases. Impact may require decades to centuries to resolve.	Groundwater systems with moderate recharge rates and medium-term recovery periods. Recovery is likely to be slow or only partially successful.	Groundwater systems with relatively high recharge rates and short recovery periods. Recovery will be successfully achieved in most cases.	Groundwater systems with very high recharge rates and very short recovery periods. Recovery will be successfully achieved in all cases.
Replacement potential *Potential for temporary replacement with alternative supply where relevant.*	There are no local water features (surface water or groundwater) that could provide alternative water sources to users.	There are very limited local water features (surface water or groundwater) could provide an alternative water source to users.	There are limited local water features (surface water or groundwater) that could provide alternative water sources to users.	There are several local water features (surface water or groundwater) that could provide alternative water sources to users.	There are numerous local water features (surface water or groundwater) that could provide alternative water sources to users.

5.4.3 Assessing the magnitude of impacts

The magnitude of impacts on an environmental value is assessed according to the following criteria:

- **Geographical extent***:* an assessment of the spatial extent of the impact where the extent is defined as site, local, regional or widespread (meaning state-wide or national or international).
- **Duration:** the timescale of the effect (i.e., short, medium or long term).
- **Severity:** an assessment of the scale or degree of change from the existing condition (positive or negative), as a result of the impact.

The criteria for determining the magnitude level of a potential impact, as applied in the groundwater significance impact assessment are described in Table 5-2. The assessed magnitude of potential groundwater impacts are presented throughout Section 7 and are summarised in Section 7.6.

Table 5-2 Magnitude criteria for groundwater impact assessment

Magnitude level	Criteria
Severe	An impact that causes permanent changes and irreversible harm to the environmental value(s) of the groundwater system, including in its capacity to support connected features. Avoidance through appropriate design responses is required to address the impact.
Major	An impact that is widespread, long lasting and results in substantial change to the environmental value(s) either temporarily or permanently to the groundwater system, including its capacity to support connected features. The impact can only be partially rehabilitated or there is some uncertainty it can successfully be rehabilitated. Appropriate design responses are required to address the impact.
Moderate	An effect that extends beyond the operational area to the environmental value(s) of the surrounding groundwater system and its connected features but is contained within the region where the project is being developed. The impacts are short term and result in changes that can be ameliorated with specific environmental management controls.
Minor	A localised impact to environmental value(s) of the groundwater system and its connected features that is short term and could be effectively mitigated through standard environmental management controls. Remediation work and follow-up required.
Negligible	A localised impact to environmental value(s) of the groundwater system and its connected features that is temporary and does not extend beyond the operational area. Either unlikely to be detectable or could be effectively mitigated through standard environmental management controls. Full recovery is expected.

5.4.4 Significance assessment

The significance of impacts on an environmental value is determined by the sensitivity of the value itself (and considering the aquifer(s) on which it relies) and the magnitude of the change it experiences. The matrix presented in Table 5-3 demonstrates how the significance of impacts is determined by considering the sensitivity of the environmental value and the magnitude of the expected change. This approach adopts a five-by-five matrix that has been established for the project and consistent across all technical studies that support the project EISs.

Table 5-3 Impact assessment matrix

Magnitude of impact	Sensitivity of value				
	Very high	High	Moderate	Low	Very low
Severe	Major	Major	Major	High	Moderate
Major	Major	Major	High	Moderate	Low
Moderate	High	High	Moderate	Low	Low
Minor	Moderate	Moderate	Low	Low	Very low
Negligible	Moderate	Low	Low	Very low	Very low

The impact assessment process considers the initial impact significance based on an assessment of magnitude prior to applying any additional controls (such as the proposed avoidance, mitigation and management measures).

A description of the assessed significance rating of an impact is provided in Table 5-4. The potential significance of impacts derived using Table 5-3 above are presented throughout Section 7 and summarised in Section 7.6.

Table 5-4 Description of significance of potential groundwater impacts

Significance of impact	Description
Major impact	Occurs when impacts will potentially cause irreversible or widespread harm to an environmental value(s) of the groundwater system, including its capacity to support connected features, that is irreplaceable because of its uniqueness or rarity. Avoidance through appropriate design responses is the only effective mitigation.
High impact	Occurs when the proposed activities are likely to exacerbate threatening processes already affecting the environmental value(s) of the groundwater system, including its capacity to support connected features. While replacement of unavoidable losses is possible, avoidance through appropriate design responses is preferred to preserve its intactness or conservation status.
Moderate impact	Occurs where, although reasonably resilient to change, the groundwater system would be further degraded, as would its capacity to support connected features, due to the scale of the impacts or its susceptibility to further change. The widespread occurrence of the groundwater system, and its connected receptors, ensures it has adequate representation in the region, and that replacement, if required, is achievable.
Low impact	Occurs where the groundwater system, and its connected features, are of local importance and temporary and transient changes will not adversely affect its viability to support environmental values provided standard environmental controls are implemented.
Very low impact	A degraded (very low sensitivity) groundwater system exposed to minor changes (negligible magnitude impact) will not result in any noticeable change in its intrinsic value and hence the proposed activities will have negligible or no effects. This typically occurs where activities occur in industrial or already highly disturbed areas.

5.4.5 Application of mitigation and management measures to determine residual impacts

Residual impacts are those remaining after the implementation of avoidance, mitigation, and management measures. The extent to which potential impacts have been reduced is determined by undertaking an assessment of the significance of the residual impacts. This is a measure of the effectiveness of the avoidance, mitigation, or mitigation measures expected to be implemented to reduce the magnitude of the potential impacts.

Avoidance, mitigation and management measures outline action that must be taken during design, construction, operation, and decommissioning of the project. If proposed measures or design responses are ineffective in reducing the residual impacts to an acceptable level, additional management measures will be developed. In addition, contingency measures will be documented in the GMP which will be developed prior to construction, may be formalised as a sub plan to the CEMP, and will be implemented during construction if unexpected groundwater issues are encountered. The management plan will be developed in consultation with relevant water authorities and the EPA Tasmania.

The summary of outcomes of the residual impact assessment and the details of the recommended management and mitigation measures are presented in Section 7.7 and 9, respectively.

5.4.6 Cumulative impact assessment

The EIS guidelines include requirements to assess 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 to be considered as by the cumulative impact assessment considered:

- 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 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 and relevant projects are listed in Section 7.8.

The assessment of the potential cumulative impacts of these projects draws on the findings from the impact assessment (see Section 7.7) and considers the potential effects from these credible projects and where they may interact and accumulate with the project's own effects, and therefore result in a cumulative impact on groundwater values within the study area. The cumulative impact assessment is provided in Section 7.8.

5.5 ASSUMPTIONS AND LIMITATIONS

The groundwater impact assessment recognises the following assumptions and limitations, which are informed by the data gaps described in Section 10.

Whilst site specific geotechnical and hydrogeological data was used together with regional and historical published information to identify baseline groundwater conditions, local variations in groundwater conditions across the converter station site may alter the assessed sensitivity of groundwater values or the impact magnitude. This introduces a level of uncertainty to the groundwater impact assessment.

The groundwater impact assessment has incorporated investigation results from other technical studies where relevant to gain site-specific information related to groundwater, such as investigations carried out by others (Jacobs, 2022a, 2022b) (see Section 2.2). These investigations focus predominantly on the lower bedrock aquifer and do not provide a complete assessment of the levels and quality of upper Quaternary aquifer that is likely to be encountered during construction. While substantially different groundwater quality conditions would not be anticipated, this is a noted limitation. The groundwater impact assessment has not undertaken site inspections and field investigations to further characterise hydrogeological features or attributes of the study area. Given this; the level of detail regarding the location, nature, and significance of groundwater values within and surrounding the site is limited.

Although constrained by these limitations, this groundwater impact assessment is based on information and data with a level of uncertainty that is considered sufficiently low to be suitable for the purpose of the EIS, specifically the identification and assessment of project activities that may pose a risk to groundwater. Various mitigation and management measures have been recommended in Section 9, which formalise the requirement to complete a pre-construction hydrogeological investigation where dewatering may be required.

No potential impacts to groundwater are considered for the decommissioning phase as the project has not identified the need for additional subsurface work or an increased environmental risk associated with future climate scenarios. However, it is acknowledged that during the decommissioning phase, some underground infrastructure may be removed, which could result in minimal impacts on groundwater (see Section 4.4). A decommissioning management plan will include mitigation measures to avoid and minimise any potential impacts to groundwater, specific to the conditions present at the time of decommissioning.

Overall, this groundwater impact assessment provides a level of data considered by the technical specialist and author of this assessment to be sufficiently detailed for the purpose of the two EISs, specifically the characterisation of baseline groundwater conditions and assessment of project activities that may pose impacts to groundwater.

As part of the recommended mitigation and management measures for the project, additional site inspection and monitoring programs have been recommended (Section 8 and Section 9) to address knowledge gaps and manage project risks to groundwater EV's and associated sensitive receptors.

The assumptions and limitations mentioned above were informed by the data gaps described in Section 10.

6. EXISTING CONDITIONS

The baseline groundwater characterisation assessed the following existing environmental features:

- Land use (Section 6.1)
- Climate and climate change (Section 6.2)
- Physiography and drainage (6.3)
- Geology (Section 6.4), including:
  - Regional geology (Section 6.4.1)
  - Local geology (Section 6.4.2)
- Acid sulfate soil (Section 6.5)
- Hydrogeology (Section 6.6), including:
  - Groundwater levels and flow direction (Section 6.6.2)
  - Groundwater quality (Section 6.6.3)
  - Groundwater-surface water interaction (Section 6.6.4)
  - GDEs (Section 6.6.5), including:
    - Terrestrial GDEs (Section 6.6.5.1)
    - Aquatic GDEs (Section 6.6.5.2)
  - Groundwater use (Section 6.6.6)
- Existing contamination issues (Section 6.7), including:
  - Naturally occurring radioactive material (Section 6.7.1)
  - Offshore sediment contamination (Section 6.7.2).

6.1 LAND USE

Land use can have a direct influence on the hydrogeological conditions within a groundwater catchment and the potential environmental values of groundwater that require protection. Surface activities, the presence of vegetation, and other land management practices in developed areas can all alter groundwater recharge rates, levels, and flow directions, and affect groundwater quality.

The land tenure of the proposed converter station site is listed as Private Freehold and is classified as a Rural (zone 20) under the Burnie Local Provisions Schedule (Burnie City Council, 2018). The site is currently vacant and, based on inspection of recent aerial imagery, appears to be largely undeveloped with sparse grasses and gravel covering most of the site. There is a 1.5 ha remnant dry eucalypt forest and woodland in the eastern corner of the site that is not proposed to be impacted by the project infrastructure (Entura, 2023). Areas of possible hardstands from past land uses are observed in places. Minimal vegetation is present on the site in areas where redevelopment is planned.

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 (Figure 6-1). The factory commenced operation in 1949 and produced up to 35,000 tons of paint pigment (titanium dioxide) per year prior to closure of the plant in 1996 (Centre for Tasmanian Historical Studies, 2023). The factory was subsequently demolished by 1998.

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).

Rehabilitation activities were reported to have occurred immediately following the site's closure in 1996; the details of the remediation completed, and the current contamination status of the site is unknown. A subsequent contamination assessment was conducted during 2007 at the site including Bullant ridge, immediately east of the site. Buried asbestos and crushed titanium tetrachloride drums were encountered at Bullant Ridge, which was subsequently investigated with test pitting, sampling and radiometric surveying. An estimated 3,00 to 4,000 m^3 of waste and fill was estimated in the southeastern embankment facing the Blythe River estuary. With the exception of the asbestos contamination, the chemical impact to soil was assessed to be "low level contaminated soil' if it were to be transported offsite. The leachability of detected contaminants suggested low potential for impact to groundwater. The site was subsequently capped to minimise infiltration and mobilisation to groundwater, which would be expected to migrate towards Blythe River estuary, away from the proposed converter station site.

Review of historical aerial imagery indicates that the site was vacant from 2007 to 2015, with periods of use as a wood mill or timber laydown area through until 2020. The study area was sold by the Burnie City Council to TasNetworks in 2021.

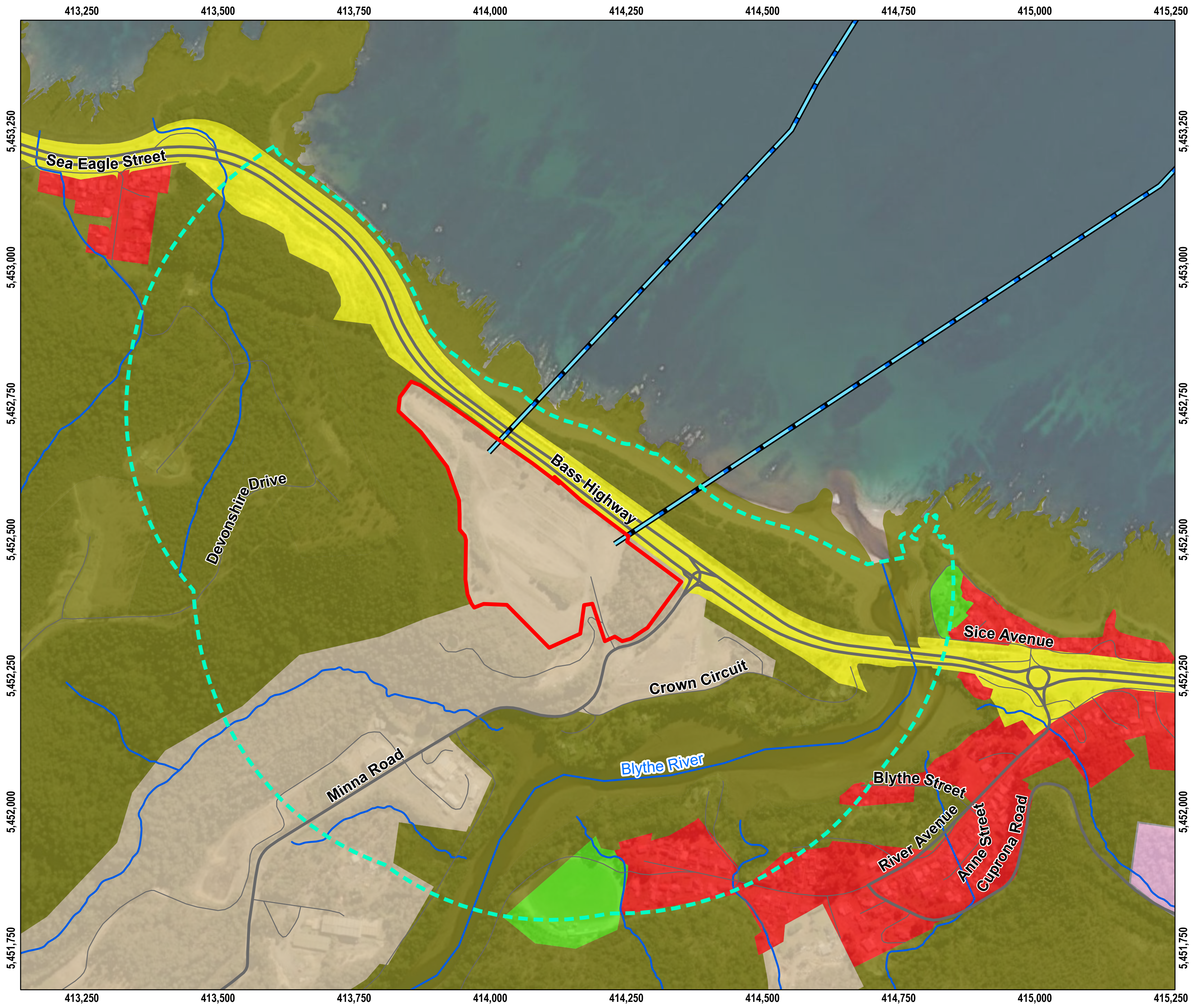
Figure 6-1 Photograph of the former Tioxide Australia manufacturing facility (ABC Radio Hobart, 2022)

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 6-2). The Blythe River discharges into Bass Straight, approximately 380 m to the east of the site. The north of the study area is bordered by a sealed highway (Bass Highway) which separates the proposed redevelopment site from 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 (Figure 6-2):

- Rural (zone 20) to the south with an associated Priority Vegetation Area overlay.
- Landscape Conservation (Zone 22) and Environmental Management (Zone 23) to the north, south and west.
- Areas of General Residential (Zone 8) and Recreation (Zone 28) follow the eastern 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 and switching station site boundary
- 500 m site buffer

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 6-2

Surrounding land use and topography

TETRA TECH COFFEY

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6.2 CLIMATE

6.2.1 Study area climate

Northwestern Tasmania is subject to a temperate marine climate. Heat absorption and storage by the ocean generates milder winters and cooler summers than in continental climates at the same latitudes. This effect diminishes with altitude and distance from the ocean.

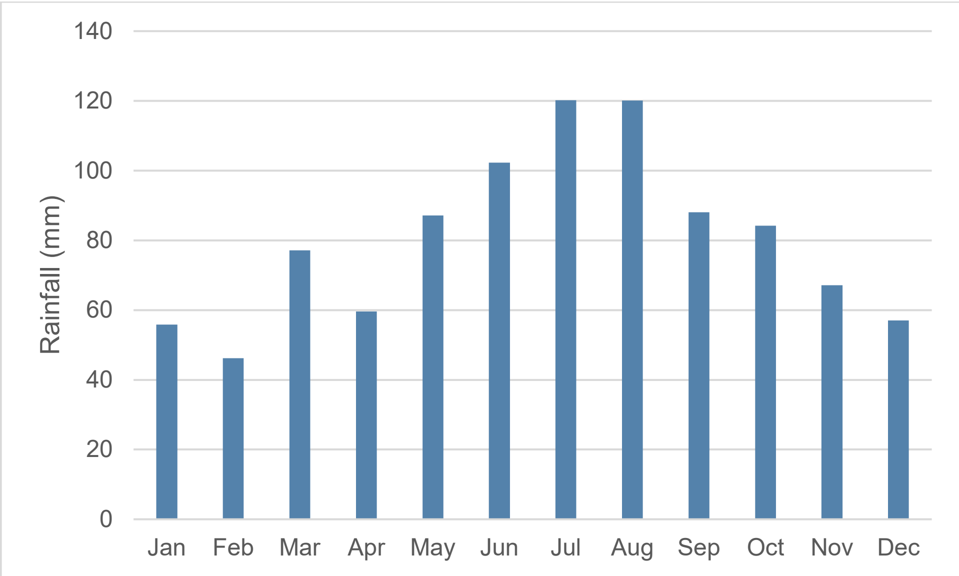


Figure 6-3 Mean monthly rainfall (Burnie Park Grove, Station ID 091355)

Average annual rainfall in the study area is approximately 970 mm (Burnie (Park Grove), Station ID: 091355). Average monthly rainfall is presented in Figure 6-3 for Burnie (Park Grove), Station ID: 091355. The highest rainfalls are experienced in winter, with 25 % of annual rainfall occurring in July and August. The driest period is between January to February, accounting for 11 % of annual rainfall.

Due to the lower temperatures and solar radiation levels in the region, potential evapotranspiration is relatively low. No evaporation data is available for the selected weather stations; however, the BoM mapped average areal actual evapotranspiration is approximately 600-700 mm/year (BoM, 2005).

A rainfall residual mass curve has been prepared based on average monthly rainfall from September 2009 to March 2022 (Figure 6-4). Rainfall residual mass curves show the cumulative sum of differences between the value at any time point and the average and, therefore, how individual monthly rainfall compares to average monthly rainfall. As the average is subtracted from each value, the cumulative sum also finishes at zero. A rising slope of the curve indicates a period of excess rainfall compared to the long-term monthly average (e.g., wetter than average period). Conversely, where the slope of the curve is falling, a rainfall deficit period has been recorded, relative to the long-term average (e.g., drier than average period).

Figure 6-4 demonstrates that annual to biennial rainfall trends are experienced within the longer term (5 to 10 years) above or below average rainfall cycles. Since 2017 (to August 2020), a generally negative slope is indicated, representative of below average rainfall conditions. Since mid-2021, above average rainfall has generally been observed.

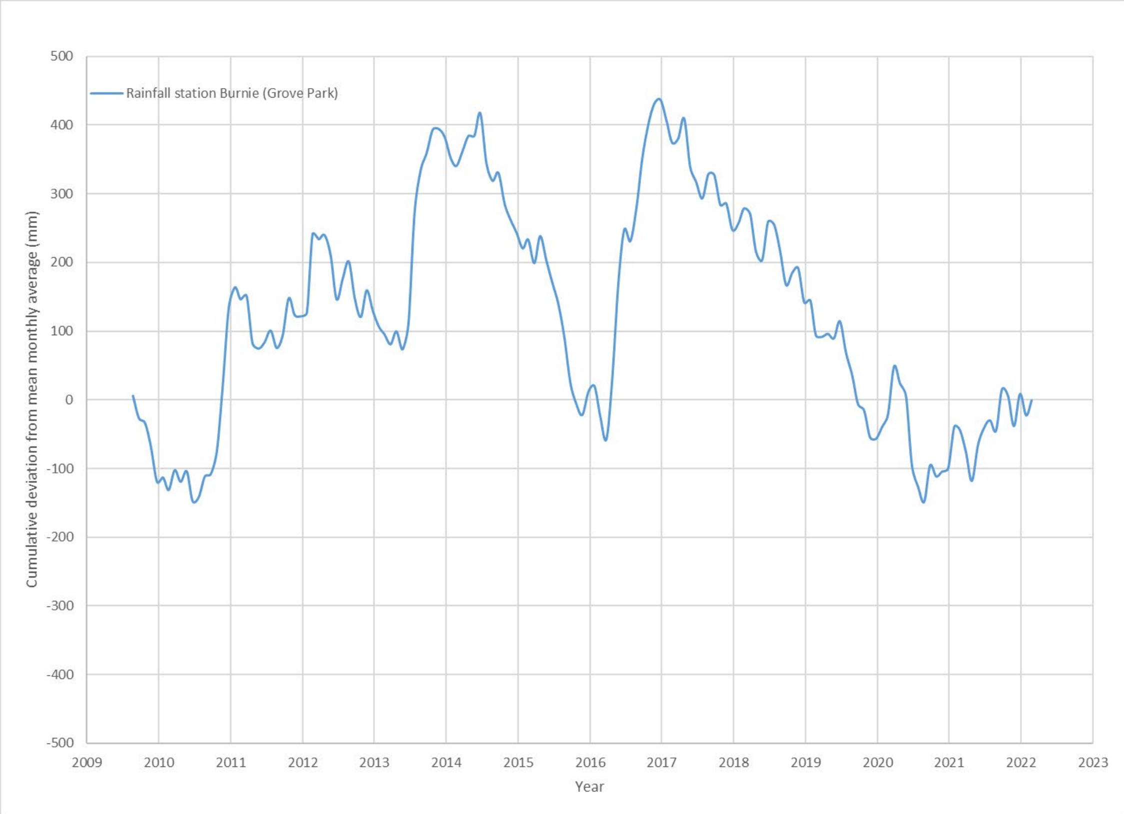


Figure 6-4 Rainfall residual mass curves for the Burnie (Park Grove; Station ID 091355) weather station

6.2.2 Climate change

In general terms, climate change is projected to result in higher, and more extreme temperatures, more extreme weather events, and sea-level rise. Some of the direct impacts of climate change in coastal zones are expected to include more hazardous storm surges, flood inundation, increased erosion, and increased seasonality in groundwater recharge. This is expected to have direct impacts on groundwater including rising groundwater levels and potentially areas of saline groundwater intrusion into coastal aquifers (Anderson, 2017).

The maximum projected median summer temperatures increase ranges from 0.9°C (2030) to 3.3°C (2090), with the hottest day at the Heybridge site projected to increase from 37°C to 39°C (Katestone, 2023).

There has been a trend towards decreased annual rainfall in southern Australia with a decline of 12% in April to October rainfall since 1970 (CSIRO and BoM 2020), particularly as the number of low-pressure systems that bring heavy rainfall to southern Australia is declining (Katestone, 2023). Median annual rainfall is projected to decrease further by 2 % by 2030 and 5 % by 2090.

The projected effects of climate change might result in long term declining groundwater levels particularly in the water table aquifers present at the site. These effects are considered further in Section 7.5.

The rate of global mean sea level rise is increasing and was 3.5 cm (± 0.4 cm) from 1993 to 2019 as derived from offshore satellite altimetry. The rate of future sea level rise in southeast Australia predicted to be is higher than the global average with median estimates for Burnie of 0.13 m by 2030 and 0.61 m by 2090 (Katestone, 2023).

6.3 PHYSIOGRAPHY AND DRAINAGE

The converter station development site is located on a small, lower elevation promontory of land that is bordered by steeply rising topography along the western and part of the southern boundary (Figure 6-5). The study area and surrounding region is characterised by mountain ranges and undulating plateaus dissected by deeply incised rivers and creeks.

The study area includes the coastline of Bass Strait to the north and the Blythe River estuary to the east. The tidally influence Blythe River estuary wraps partly around the southern side of the development site where the smaller, Minna Creek discharges.

Blythe River catchment drains 273 km^2 of the northern side of the Grasstree Ridge, originating at headwaters at an elevation of 670 m above the Australian Height Datum (AHD), flowing in a northerly direction across undulating plans over a 62 km course to the estuary and mouth of the river on the northern coastline (DPIWE, 2001). A substantial portion of the catchment includes native vegetation and forest, protected by The Blythe River Conservation Area which commences near Heybridge and follows the river alignment upstream for approximately 10 km. The Upper Blythe Conservation Area continues through to the headwaters with an approximately 3 km intervening zone of cleared agricultural land.

The Blythe River estuary is understood to have experienced significant impact on the integrity of the estuarine ecosystem and environment and local investigations have determined that the estuary is rated as being of low conservation significance and of a moderately degraded nature (DPIWE, 2001). It is understood that the lower section of the 145 ha Minna Creek catchment hosts three waste sludge dams that were formally used by the Tioxide Australia site, and a disposal location of waste generated during the former efforts to remediate the site (DPIWE, 2000). Leachate from these dams was pumped to the existing tioxide beach outfall for marine disposal at the time of the report's publishing in 2000. A waste dump associated with the tioxide site remediation program is also located between the two upstream sludge dams on Minna Creek (DPIWE, 2000). These former land uses and waste disposal practices have contributed to reported water quality impacts to the estuary.

Figure 6-5 Local hill shade physiography and drainage in the vicinity of the site

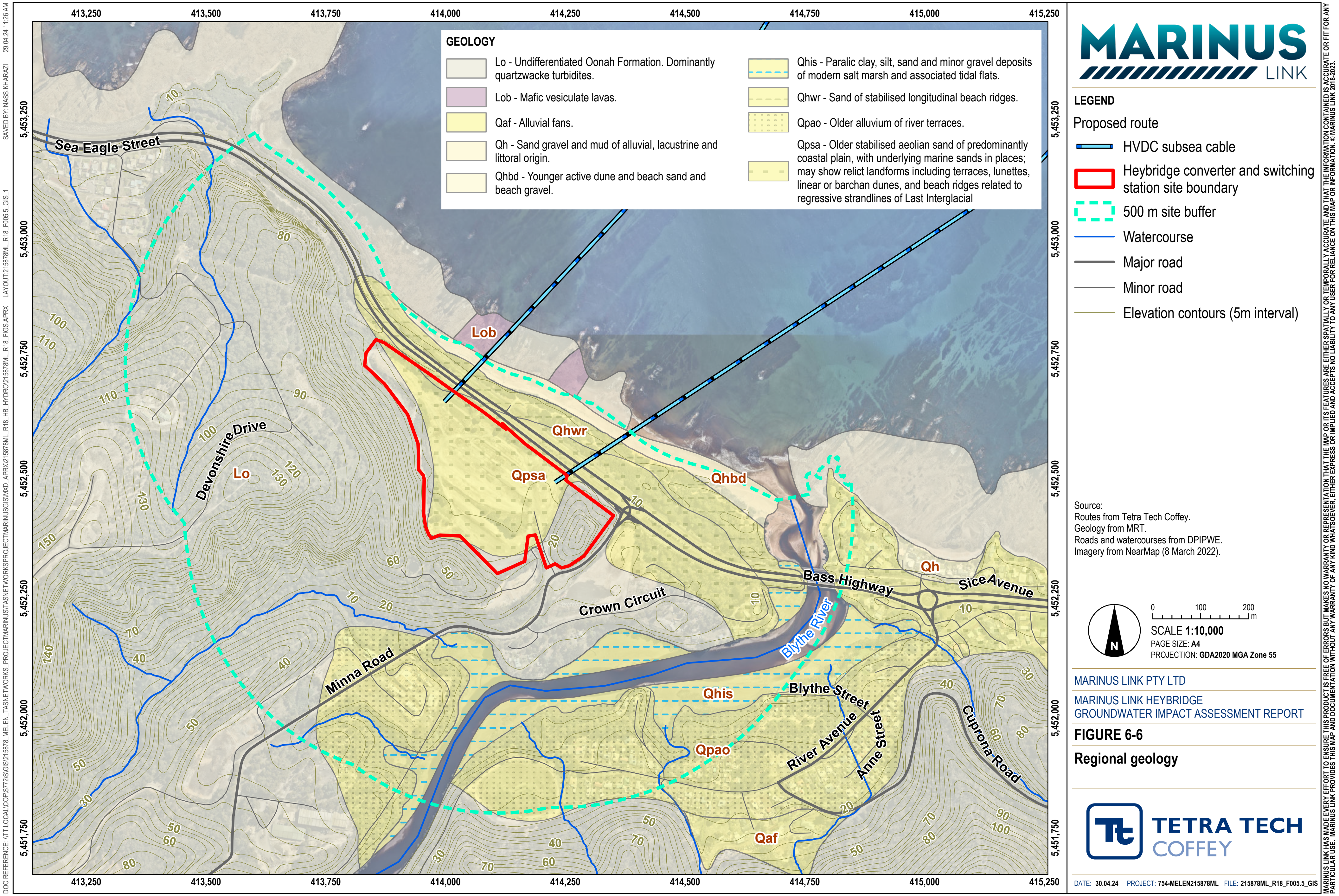
6.4 GEOLOGY

6.4.1 Regional geology

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 overlie the Precambrian aged Burnie and Oonah Formation (Po, Lo) bedrock of the Sheffield Element. This formation is comprised of pale grey coloured metamorphosed turbidite sequences of interbedded quartz sandstone, siltstone, and mudstone. It 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 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 are expected to be absent from the study area.

The regional geology within the study area is show in Figure 6-6.


GEOLOGY
Lo - Undifferentiated Oonah Formation. Dominantly quartzwacke turbidites.
Lob - Mafic vesiculate lavas.
Qaf - Alluvial fans.
Qh - Sand gravel and mud of alluvial, lacustrine and littoral origin.
Qhbd - Younger active dune and beach sand and beach gravel.
Qhis - Paralic clay, silt, sand and minor gravel deposits of modern salt marsh and associated tidal flats.
Qhwr - Sand of stabilised longitudinal beach ridges.
Qpao - Older alluvium of river terraces.
Qpsa - Older stabilised aeolian sand of predominantly coastal plain, with underlying marine sands in places; may show relict landforms including terraces, lunettes, linear or barchan dunes, and beach ridges related to regressive strandlines of Last Interglacial
Sea Eagle Street
Devonshire Drive
Crown Circuit
Minna Road
Bass Highway
Sice Avenue
Blythe River
Blythe Street
River Avenue
Anne Street
Cuprona Road
Lob
Qhwr
Qpsa
Qhbd
Lo
Qh
Qhis
Qpao
Qaf
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MARINUS LINK
LEGEND
Proposed route
HVDC subsea cable
Heybridge converter and switching station site boundary
500 m site buffer
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).
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MARINUS LINK PTY LTD
MARINUS LINK HEYBRIDGE
GROUNDWATER IMPACT ASSESSMENT REPORT
FIGURE 6-6
Regional geology
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6.4.2 Local geology

Jacobs was engaged to conduct a combined geotechnical, contaminated land and groundwater investigation for the EIS (Jacobs, 2022a,b). A total of nine test pits (maximum 3 m depth) and six drilled boreholes (maximum 15 m depth) were completed across the site to assess geotechnical soil properties, soil chemical quality, and groundwater level and quality conditions.

Table 6-1 provides a summary of the local geological conditions encountered beneath the site during the Jacobs (2022a,b) assessment. A geological map of the site is provided in Figures 2-3 and 2-4 of the Jacobs (2022b) report.

Table 6-1 Local geological summary (Jacobs, 2022b)

Unit	Geological unit	Depth to top	Thickness (m)	Description
HB-1	Fill	0	0.15 to 2.2	Highly variable, ranging from sandy SILT to sandy GRAVEL. Includes solid inert waste.
HB-2	Colluvium	0.15 to 0.25	0.15 to 2.75	Silty CLAY / Clayey SILT
HB-3	Aeolian	1.0 to 2.30	0.3 to 0.8	Sandy SILT to Gravelly SAND
HB-4	Residual soil	0.2 to 2.2	0.3 to 2.6	Gravelly/sandy/clayey SILT to Sandy GRAVEL
HB-5	Quartzwacke – Burnie and Oonah Formation	0.00 to 3.10	Base not encountered	Highly to slightly weathered quartzwacke, low to high strength. Occasional extremely weathered seams

6.5 ACID SULFATE SOIL

A preliminary acid sulfate soil assessment has been conducted for both the onshore soils beneath the converter station (Jacobs, 2022a) and the offshore environment that may be encountered during HDD (Tetra Tech Coffey, 2022b). This work found that the field tests conducted on unconsolidated soils beneath the converter station development site may generate acidic conditions if previously unoxidized soils are exposed during construction activities (Jacobs, 2022a). There was some uncertainty with this assessment due to the presence of organic sulfur which generally does not pose a significant risk of acidification.

Further site assessment work was conducted by Tetra Tech Coffey (Tetra Tech Coffey, 2023) which concluded that potential ASS is present at the northwest and southeast ends of the site in the vicinity of the planned HVDC subsea cable landfall points. 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 to the assumed maximum excavation depth of 1.5 mbgs. The extent of potential ASS is not consistent across the site, and some units have neutralising capacity to mitigate potential acid generation. Analysis of marine sediments also identified a potential oxidation response, which could suggest the presence of potential acid sulfate soils; however, the neutralising capacity of the sediments was sufficiently high to neutralise all acid that may be generated with at least a 20 times factor of safety (Tetra Tech Coffey, 2022b). The assessment concluded that if the sediments were brought to the surface, it is unlikely that acid generation would result in measurable acidic impacts to the environment (Tetra Tech Coffey, 2022b).

6.6 HYDROGEOLOGY

6.6.1 Hydrogeological setting

Review of the geological setting of the study area (Section 6.4) provides an indication of the likely hydrogeological setting that will be encountered beneath the site. The site is mapped as being underlain by Quaternary deposits of aeolian sand, and river and marine gravels, sand, and clays, which overlie Precambrian aged Burnie and Oonah Formation (Po, Lo) bedrock.

Groundwater within the study area is likely to be present within two primary aquifers identified based on the site geotechnical investigations (Jacobs, 2022a,b). The two primary aquifers identified are:

- Quaternary sand aquifer – a shallow unconfined porous media aquifer represented by the unconsolidated Quaternary deposits of aeolian sand, and river and marine gravels, sand and clays; and
- Bedrock aquifer – a fractured rock aquifer formed by the Precambrian aged Burnie and Oonah Formation turbidite sequence. The bedrock aquifer is likely to be weathered in the upper horizon, and may be confined or semi confined by the overlying Quaternary sand aquifer at the development site and unconfined to the south and west where the bedrock outcrops at surface.

6.6.2 Groundwater levels and flow direction

Jacobs (2022a,b) installed four groundwater monitoring wells in the study area; HB-BH01-C, HB-BH02-C, HB-BH03-C, and HB-BH06-C. Location HB-BH06-C was installed as a nested well site with BH06-C(S) being a shallow well (to 2 m bgl) and HB-BH06-C being deeper (to 14 m bgl). A summary of well construction details is provided in Table 6-2 and monitoring well locations are shown on Figure 6-9.

All monitoring wells were installed to screen the bedrock aquifer, logged as ‘quartzwacke’ lithology, with the exception of the shallow well (HB-BH06-C(S)), which screened the fill, sand and gravel of the shallow aquifer (Table 6-2).

Groundwater levels were measured in all wells on one occasion and results are provided in Table 6-3. Calculated groundwater elevations relative to the AHD are provided.

The water table beneath the site, as measured at the single well screening the upper Quaternary aquifer (HB-BH06-C(S)), was shallow at a depth of 0.74 m bgl (8.72 m AHD).

The measured groundwater levels in the deeper wells screening the bedrock aquifer relate to the groundwater potentiometric surface at depth. In confined systems, the potentiometric surface of the underlying aquifer may be different to the water table of the unconfined aquifer. In this case, the measured water table elevation at well HB-BH06-C(S) was comparable to the potentiometric surface of the fractured rock aquifer at the same location (8.74 m AHD at HB-BH06-C). This comparison suggests that the Quaternary sand aquifer and the bedrock aquifer may be hydraulically connected, with a slight upward gradient that would promote flow of groundwater from the deeper bedrock into the overlying sand aquifer.

Based on the available information, the water table is likely to be shallow across the development area, typically less than 1 m bgl. The relative elevation of groundwater has been inferred based on measured levels in the deeper bedrock aquifer, which ranges from approximately 8 m AHD at the southern site boundary to 5 m AHD on the northern site boundary near Bass Highway. The hydraulic gradient of the bedrock aquifer shows an inferred northerly groundwater flow direct towards the coastline, which is likely to represent the main groundwater discharge point.

Shallow groundwater in the Quaternary sand aquifer is likely to follow a similar northerly flow direction. The Quaternary sand aquifer is likely to be recharged by a combination of rainfall infiltration uniformly across the area of outcrop and the upward discharge of groundwater from the underlying bedrock aquifer. The bedrock aquifer, in turn, is likely to be recharged by rainfall infiltration in areas of higher topography to the west and south where the bedrock outcrops.

An assessment of groundwater level fluctuation has not been completed and natural fluctuations may occur in response to seasonal changes in groundwater recharge which can frequently be observed to range up to 0.5 m or more. Groundwater levels within the study area may also be variably affected by tidal influences depending on the proximity to the coast or estuary.

An assessment of aquifer hydraulic properties was completed by Jacobs (2022a, 2022b), which included completion of rising and falling head test (commonly referred to as slug tests) to estimate the aquifer hydraulic conductivity (Jacobs, 2022a). These tests were completed at three wells that screen the bedrock aquifer. Estimated hydraulic conductivity results ranged from 0.009 m/day to 13.2 m/day, indicating potentially high variability, which is not uncommon for fractured rock aquifers (Table 6-4). Groundwater flow directions and flow velocities in the bedrock aquifer are likely to be highly variable and may be based on the presence of fault or fracture zones.

While no aquifer hydraulic tests were completed on wells screening the shallow Quaternary aquifer, hydraulic conductivities are conservatively assumed to be relatively high based on the frequently logged presence of sands and gravels. High hydraulic conductivities would also be expected in the fill material present across the site.

Table 6-2 Monitoring well construction summary

Monitoring well ID	Screened material	Completed Date	Surface RL (m AHD)	Screened interval (m bGL)	Drilled depth (m bGL)	Groundwater levels (m bTOC)	Approximate groundwater elevation (m AHD)
HB-BH01-C	Quartzwacke	7/02/2022	6.21	5.8-11.8	12.5	1.12	5.09
HB-BH02-C	Quartzwacke	4/02/2022	6.59	3.5-6.5	8.5	0.96	5.63
HB-BH03-C	Quartzwacke	3/02/2022	8.68	6.5-9.5	9.9	3.05	5.63
HB-BH06-C	Quartzwacke	1/02/2022	9.42	10.0-14.0	15.4	0.68	8.74
HB-BH06-C(S)	Fill / silty sand/gravel	44593	9.46	1.0-2.0	2.5	0.74	8.72

Table 6-3 Summary of groundwater monitoring wells (Jacobs, 2022a)

Borehole ID	Screened material	Surface elevation (m AHD)	Date	Groundwater levels (m bTOC)	Approximate groundwater evaluation (m AHD)
HB-BH01-C	Quartzwacke	6.21	14/02/22	1.12	5.09
HB-BH02-C	Quartzwacke	6.59	14/02/22	0.96	5.63
HB-BH03-C	Quartzwacke	8.68	14/02/22	3.05	5.63
HB-HB06-C	Quartzwacke	9.42	14/02/22	0.68	8.74
HB-BH06-C(S)	Fill / silty sand/gravel	9.46	14/02/22	0.74	8.72

Table 6-4 Summary of aquifer hydraulic testing (Jacobs, 2022a)

Borehole ID	Screened material	Effective screened interval (m)	Test type	Estimated hydraulic conductivity (m/day)
HB-BH02-C	Quartzwacke	4.0	Falling head test Rising head test	0.89 0.90 (avg 0.9) 0.009
HB-BH03-C	Quartzwacke	3.9	Falling head test	0.009
HB-HB06-C	Quartzwacke	4.8	Falling head test	13.2

Note: Individual results of repeated tests at HB-BH02-C are included

6.6.3 Groundwater quality

Five groundwater samples were collected by Jacobs (2022a) from boreholes HB-BH01-C, HB-BH02-C, HB-BH03-C, HB-BH06-C and HB-BH06-C(S) and were submitted for the following analysis:

- pH, Total Dissolved Solids (TDS), major cations and anions
- Ammonia, nitrite, nitrate, total nitrogen
- Total cyanide, free cyanide
- Sulfate, sulfide
- Dissolved metals (arsenic, boron, barium, beryllium, cadmium, chromium, cobalt, copper, manganese, nickel, lead, selenium, titanium, vanadium, zinc)
- Volatile organic compounds (VOCs), semi-volatile organic compounds (sVOCs)
- Perfluoroalkyl and polyfluoroalkyl substances (PFAS).

Groundwater quality was found to be relatively fresh, with TDS concentrations ranging from 260 mg/L (HB-BH03-C) to 1,400 mg/L (HB-BH01-C), electrical conductivity (EC) values ranging from 370 µS/cm to 1,290 µS/cm. TDS and EC values were not reported for shallow aquifer well HB-BH06-C(S). Samples indicated that groundwater across both the shallow aquifer (represented by well HB-BH06-C(S)) and the deeper bedrock aquifer was generally oxidising (redox potential ranging from 78 to 375 mV and had slightly acidic pH (5.49 to 6.55).

The laboratory dataset reported by Jacobs (2022a) provides a preliminary assessment of groundwater quality expected beneath the site. With the exception of monitoring well HB-BH06-C(S) which screens the shallow aquifer, the reported results are expected to represent mostly the lower fractured bedrock aquifer.

The following metals were reported to exceed the ANZG (2018) Marine Water 95 % ecosystem protection criteria: cobalt (2 to 18 µg/L), copper (3 to 8 µg/L), and zinc (22 to 57 µg/L) at most locations, including both the shallow and deep wells. Concentrations of titanium were below the 10 µg/L laboratory limit of report (LOR) with the exception of a concentration of 20 µg/L reported at HB-BH02-C. The location of elevated metals concentrations in groundwater are distributed across the converter station site, do not appear to be associated with any particular point source, and may in some cases reflect background water quality in the area. No background groundwater analysis has been undertaken to confirm the concentrations of naturally occurring metals, however given the widespread nature of the impacts, and that zinc and cobalt are not associated with any known anthropogenic activities that have been conducted at the converter station site, it is likely that the concentrations are naturally occurring.

No detectable concentrations of polycyclic aromatic hydrocarbons (PAHs), monocyclic aromatic hydrocarbons (MAHs), phenols, phthalates, herbicides, pesticides, explosives, halogenated benzenes and halogenated hydrocarbons, solvents or other volatile organic compounds (VOCs) were reported, with the exception of detectable concentrations of chloroform reported at HB-BH01-C (6 ug/L) and HB-BH02-C (13 ug/L). Total recoverable hydrocarbons were not analysed by the laboratory.

Several PFAS were detected in both the Quaternary sand aquifer and the fractured bedrock aquifer. The compounds detected included PFOS and PFHxS, which represented the highest concentration PFAS (maximum of 0.11 ug/L for both compounds), PFOA (maximum of 0.02 ug/L), and PFPeA (maximum of 0.04 ug/L). PFAS concentrations were generally greatest at HB-BH06-C and C(S), showing comparable results between the shallow and deep wells at this location. The reported concentration of PFOS may exceed the marine ecosystem protection criteria based on a requirement to achieve either 95 % (0.13 ug/L) or 99 % (0.00023 ug/L) species protection (NEMP, 2020).

Based on the preliminary groundwater quality data available, groundwater produced during construction dewatering and may not be suitable for disposal to surface water without further assessment and permissions from the relevant regulators.

As most of the installed wells screen the deeper fractured bedrock aquifer, it is possible that if groundwater contamination is present in the shallow Quaternary aquifer, it may not have been detected by monitoring the deeper wells.

6.6.4 Groundwater-surface water interaction

Groundwater – surface water interactions occur in a catchment when water moves from groundwater to surface water (or to the marine environment), or vice versa. These flow dynamics can change or be absent in different sections of a catchment and can also vary or reverse over time. Typically, in the highlands region, rainfall infiltration and surface water (as losing streams) recharges outcropping aquifers and groundwater discharges to connected gaining surface water systems in the lowlands.

Groundwater-surface water interactions in the study area are expected to be predominantly characterised by discharge from shallow groundwater to gaining rivers, creeks, and wetlands (typically considered as GDEs, which are discussed in Section 6.6.5).

Similar interactions occur between groundwater and the marine environment where aquifers are connected in the coastal zone and the tidally influenced Blythe River estuary. At low tide, the water table within the surrounding groundwater system may be higher than the coastal and estuarine waters and groundwater will discharge freshwater into the marine environment. At high tide, the marine water level may be higher than the onshore groundwater level, resulting in reversal of hydraulic gradients and the recharge of saline water back into the groundwater system (Anderson, 2017). The magnitude of this natural tidal influence on groundwater decreases with distance from the coast and estuary, creating a naturally occurring fresh-saline transition or dispersion zone that typically extends onshore into the freshwater aquifer (Figure 6-7).

Sustained dewatering activities may cause groundwater level drawdown to propagate towards the coastal zone and can induce further saltwater encroachment into the aquifer, increasing salinity of the groundwater resource. Further discussion of potential groundwater interactions with groundwater dependant surface water courses and waterbodies are provided in Section 7.3.3. Potential dewatering impacts to groundwater and migration of the saline interface are further discussed in Section 7.3.5.

Long term climate change and rising sea levels are likely to alter the freshwater-seawater interface dynamics, promoting further inland encroachment, increasing groundwater salinity in the coastal zone. Overland inundation of the estuarine wetlands and nearshore zone is also expected to increase in the future due to higher tidal and storm surge activity (Section 6.2.2). These effects would be relevant to the long-term operation phase of the project.

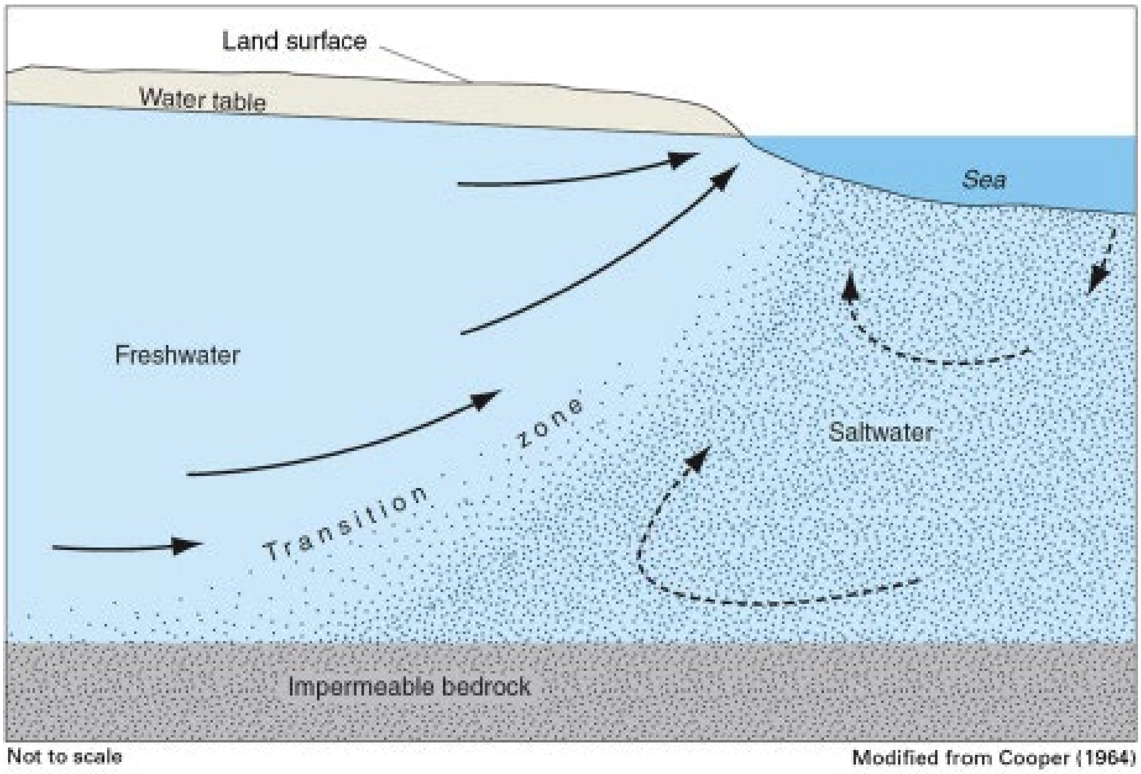


Figure 6-7 Conceptual diagram of freshwater – saline water interface in an idealised, homogeneous coastal aquifer (source: USGS 2017)

6.6.5 Groundwater dependent ecosystems

GDEs are receptors that rely wholly or partially on groundwater to provide all or some of their water needs. GDEs relevant to this project can broadly be categorised as:

- Terrestrial GDEs: Ecosystems reliant on the subsurface presence of groundwater (i.e., vegetation that is accessing the water table and/or capillary fringe).
- Aquatic GDEs: Ecosystems reliant on the surface expression of groundwater (i.e., wetlands, swamps, springs, estuaries and baseflow fed watercourses).
- Subterranean GDEs: Ecosystems associated with caves and aquifers (stygofauna).

A desktop assessment was conducted to identify potential GDEs within 500 m of the site, where these ecosystems might interact with groundwater that also interacts with the site. The approach to identifying GDEs has relied on published resources such as the Bureau of Meteorology's Groundwater Dependent Ecosystem Atlas (BoM, 2012) and the state-wide freshwater ecosystem mapping provided by the CFEV spatial database tool project.

The GDE mapping tool provides information concerning both known and potential GDEs (SKM, 2012). Known GDEs are those identified during previous desktop or field studies, and potential GDEs are those derived through analysis of spatial data sets. Derivation of potential GDEs relies heavily upon remote sensing data to identify vegetation growth response patterns.

Information pertaining to CFEVs within the search area was sourced from ListMap (https://maps.thelist.tas.gov.au/listmap/app/list/map; DPIW, 2008a). This included a range of aquatic ecosystems (that may include both GDE and non-GDE) as well as specified GDEs, mostly relating to springs and karst areas.

6.6.5.1 Terrestrial GDEs

Vegetation communities

Terrestrial GDEs are ecosystems with vegetation that rely on the availability of shallow groundwater, which is within reach of the root zone. Mature, large trees are likely to have the deepest root systems and are the most likely vegetation type in a given ecosystem to access groundwater.

In the case of terrestrial GDEs, ecosystems may be either obligate GDEs, with a continuous or entire dependence on groundwater, or facultative GDEs, with an infrequent or partial dependence on groundwater (Zencich et al., 2002). Published data does not typically distinguish between obligate or facultative terrestrial GDEs, and site-specific investigations may be required to determine this should it be necessary.

One 0.44 ha area of wet heathland vegetation (Eucalyptus amygdalina coastal forest and woodland) located at the study boundary along Minna Rd (Entura, 2023) was mapped with a moderate potential for groundwater dependence (Figure 6-8). Entura (2023) completed local vegetation surveys and describe this stand of vegetation as being comprised of small, relatively young trees on elevated ground.

This vegetation is unlikely to be groundwater dependent based on the elevated topography (and therefore greater depth to groundwater) and the juvenile age of the trees, which would be less likely to have deep root systems and have established dependence on groundwater.

It is suspected that the GDE atlas's assessment of moderate likelihood of groundwater dependence may be attributed to the remote sensing data detecting the effect of rainfall runoff from Mina Road and the former treatment ponds to the north, which has provided an additional water source to the wet heathland vegetation and supported it during drought periods rather than the vegetation accessing groundwater.

No terrestrial GDEs are considered to be present within the study area.

Burrowing crayfish

The GDE Atlas includes records of listed "karstic aquifer/cave" terrestrial GDEs in the wider Burnie region, which identify relatively small (approximately 2,000m^2) areas where two species of burrowing crayfish habitat have been identified by on local assessments (BoM, 2012b). The crayfish species are:

- *Engaeus yabbimunna* (Burnie Burrowing Crayfish); and
- *Engaeus fossor*

Engaeus yabimunna is listed as Vulnerable under the EPBC Act. No similar state or EPBC Act listings have been identified for *Engaeus fossor*. This species of crayfish is rarely seen above ground or in water bodies, preferring to live mostly within deep burrows. Their burrow networks require a connection with a water source, which can include either direct connection to streams or lakes (type 1), connection to the water table (type 2), or alternatively they may rely on runoff inputs (type 3) (Doran, 2000).

Past reviews completed by Tetra Tech Coffey found that these habitat areas generally corresponded with areas of Tertiary basalt outcrop where basaltic clays are likely to overlie weathered basalt rock.

No published accounts of burrowing crayfish habitat exist within the study area and suitable habitat was absent from the study area (Entura, 2023). The closest mapped habitat is located 4 km south of the site (Entura, 2023).

6.6.5.2 Aquatic GDEs

This section identifies creeks and rivers that are reported with moderate or high likelihood for groundwater dependence based on published layers in the BoM GDE Atlas.

The Blythe River is identified as an aquatic GDE with high likelihood for groundwater dependence. It passes the site boundary approximately 260 m to the south at its closest point. The BoM GDE Atlas entry for Blythe

River notes the presence of associated terminal wetlands which are also identified separately on the southern side of the estuary (Figure 6-8).

These wetlands are likely to have aquatic ecosystems that rely on periodic fresh groundwater input to balance the saline inundations that may occur during tidal fluctuations. As the Blythe River estuary will act as a regional groundwater boundary the wetlands are expected to be effectively isolated from the groundwater environment on the northern side.

This means that while the estuary itself may receive a component of groundwater discharge from the groundwater sub-catchment on the northern side of the estuary (including those which hosts the converter station site), the wetlands on the southern side of the estuary are unlikely to either receive groundwater discharge from the site or be influenced by future development activities.

The rate of groundwater discharge to the Blythe River estuary is unknown. However, the small size of the sub-catchment that hosts the proposed converter station would result in equally small contribution of fresh groundwater input (based on professional experience in similar environments).

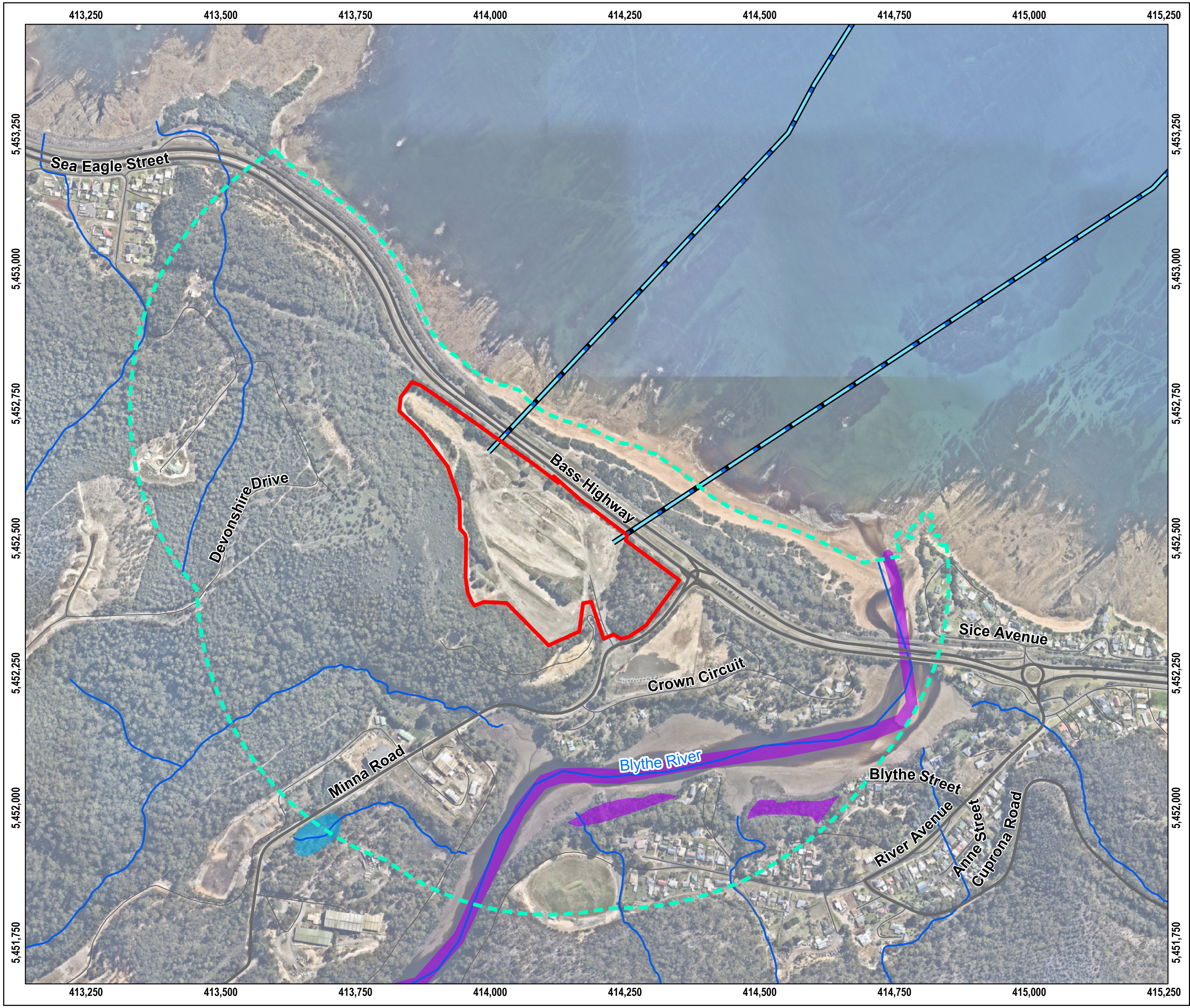
The assessment that informs the potential groundwater impacts related to aquatic GDEs, such as the Blythe River estuary are discussed in Section 7.3.

6.6.6 Groundwater use

Groundwater extraction in Tasmania is not metered and as such there are limited records of groundwater use. The available information on registered groundwater bores was obtained for the study area.

One registered bore (ID: 41789) was identified approximately 350 m south of the site on the left bank of the Blythe River. The bore is located in an area where Quaternary deposits are mapped as present. The bore is listed with an unknown use and ‘capped’ status, suggesting that it is unlikely to remain in active use. The bore was originally drilled to 66 m depth and would have likely screened the deeper bedrock aquifer.

Based on the bore search completed, it is unlikely that any active groundwater users are present within the study area.



MARINUS LINK

LEGEND

Proposed route

HVDC subsea cable

GDEs Aquatic

High potential GDE (national assessment)

GDEs Terrestrial

Moderate potential GDE (national assessment)

Source:
Routes from Tetra Tech Coffey.
GDEs from BoM.
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**

MARINUS LINK PTY LTD

MARINUS LINK HEYBRIDGE
GROUNDWATER IMPACT ASSESSMENT REPORT

FIGURE 6-8

Groundwater users and GDEs

TETRA TECH COFFEY

DATE: 30.04.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_R18_F005.9_GIS

6.7 EXISTING CONTAMINATION ISSUES

The proposed converter stations site in Heybridge, Tasmania is located at the site of the former Tioxide Australia plant, west of the Blythe River mouth. The plant produced titanium dioxide pigment between 1949 and 1996, primarily for use in paints and plastics, and the factory was subsequently demolished by 1998.

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 sulphuric acid, cheap electricity, local coal, water and access to the deep-water port of Burnie (Queen Victoria Museum and Art Gallery, Undated). The location of the site also facilitated the direct discharge of effluent into Bass Strait.

The location of the site also facilitated the direct discharge of effluent into Bass Strait (Queen Victoria Museum and Art Gallery, Undated). 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 sulphates) 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.

The tioxide plant used chemicals and practices that could have resulted in site contamination including groundwater contamination. Sulphuric acid and ilmenite ore were used to produce high grade titanium dioxide. Iron, titanium and manganese are the three main contaminants in ilmenite. Thorium 232 and Radium 228 are also present in ilmenite in minute concentrations, and this can be enriched in lead in the process. Due to this historical use of the site and potential for contamination due to these chemicals, the site was rehabilitated when the plant was decommissioned.

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).

Throughout the operation of the tioxide plant, an acid-iron liquor waste from the production process was discharged directly to Bass Strait via outfall pipelines which extends approximately 2.8 km offshore from the plant. Anecdotal evidence suggests that at the time of operations, the discharged effluent caused red (iron oxide) staining of nearshore waters and the coastline. The construction method of the pipelines is also unknown; however, it is expected that it was constructed from multiple lengths of pipe. If the lengths of pipe were joined by bolting the sections together with a flange joint, there is the potential that any gaskets within the flange joints are asbestos containing.

Following the decommissioning and remediation of the titanium dioxide plant the site was utilised as a timber storage and loading yard between 2007 and 2020.

A site contamination assessment, including the assessment of groundwater contamination, is provided in a separate contamination assessment report prepared by Tetra Tech Coffey (Tetra Tech Coffey, 2023).

Jacobs have issued factual (Jacobs, 2022a) and interpretive (Jacobs, 2022b) reports of the ground conditions which included assessment of the site contamination status at the Heybridge converter site. This work included contamination assessment from nine test pits and four boreholes which was interpreted by Jacobs (2022b) to not report any contaminant concentrations above the adopted health and ecological guideline values. Fragments of non-friable asbestos sheeting were identified on the ground surface at HB-TP09-C. Management of soil contamination and asbestos for the project are discussed further in the Tasmanian Contaminated Land and Acid Sulphate Soil Impact Assessment (Tetra Tech Coffey, 2023).

The landfall site was not investigated as it was outside of the former industrial site and was considered to have a lower likelihood of contamination from past industrial activities.

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 Fill Material criteria.

Beneath the eastern portion of the converter station site is a former effluent tunnel that is understood to have been blocked at both ends. It is unknown whether the tunnel is to remain at the site, or be removed, however no testing of any residual sediments or scale within the tunnel has been undertaken and the contamination status of these materials is unknown.

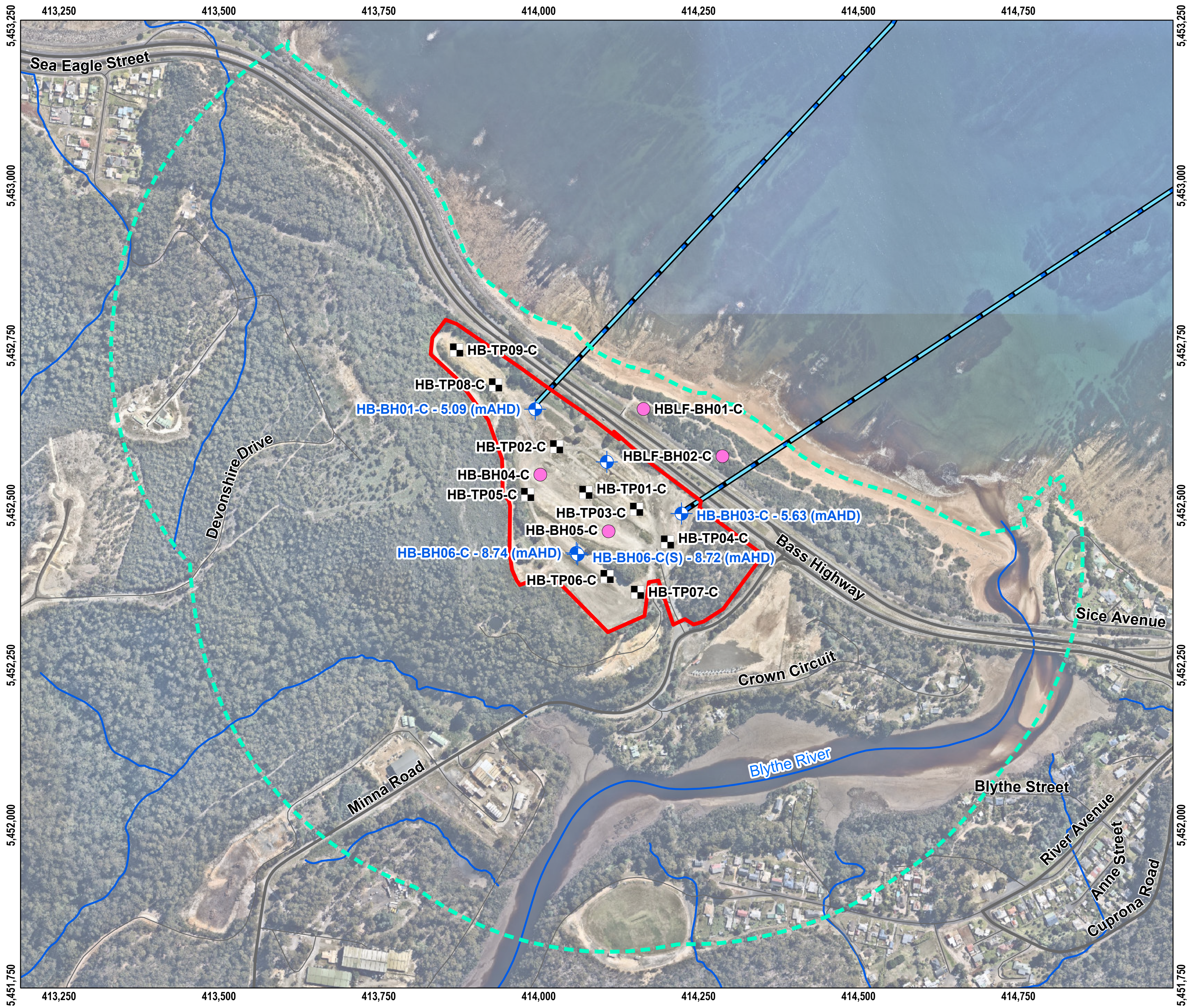
6.7.1 Naturally occurring radioactive material

Jacobs (2022a) completed a site assessment of naturally occurring radioactive material (NORM) which occurs in titanium ore at various concentrations. As the ore is processed, uranium (U238), thorium (Th232), and their decay products are concentrated and can exceed the regulatory levels for waste materials such as mineral sludges, dusts and sands from the titanium extraction process.

During test pit excavation and borehole advancement, NORM measurements were taken at regular intervals in accordance with the Radiation Management Plan 2021.

Jacobs (2022a) concluded that, *“background radiation levels for the site were found to range from approximately 41 nSv/hr to 73 nSv/hr. Readings from test pits and boreholes were found to be within the background radiation levels and below trigger values trigger levels were defined as > than two times background radiation levels. Specific readings recorded during test pit excavation and borehole advancement ranged from 43 nSv/hr through to 115 nSv/hr. The highest measured reading of 115 nSv/hr was found in TP01 at a depth of 1 m bgl.”*

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 (Tetra Tech Coffey, 2023).



MARINUS LINK

LEGEND

- Groundwater monitoring well (Groundwater level Feb 2022)
- Soil bore
- Test pit

Proposed route

- HVDC subsea cable
- Heybridge converter and switching station site boundary
- 500 m site buffer
- Watercourse
- Major road
- Minor road

Source:
Routes from Tetra Tech Coffey.
Monitoring locations from Jacobs.
Imagery from NearMap (8 March 2022).

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PROJECTION: GDA2020 MGA Zone 55

MARINUS LINK PTY LTD

MARINUS LINK HEYBRIDGE
GROUNDWATER IMPACT ASSESSMENT REPORT

FIGURE 6-9

Soil and groundwater assessment locations

TETRA TECH COFFEY

DATE: 20.11.24 PROJECT: 754-MELEN215878ML FILE: 215878ML_R18_F005.6_GIS

6.7.2 Offshore sediment contamination

Tioxide Australia Pty Ltd contracted CSIRO to undertake a survey of the waters surrounding its discharge point to determine the levels of heavy metals in fish and marine sediments (reported in Commonwealth of Australia, 1991). Benthic surveys of the seabed sediments and local species identified that the effluent had a minor local impact. The levels of metals in fish were found to be low and there was no evidence of significant contamination of the sediments. The primary impact of the effluent was the noticeable visible discolouration of the inshore waters.

Other historic contamination sources, such as copper mining in the Blythe River catchment and submarine calcine dumping near Burnie, may have also contributed to marine sediment contamination.

Limited sampling of the offshore sediment profile was conducted and has been considered where the results might provide an indication of the sediment quality that may be generated during HDD (Tetra Tech Coffey, 2022b). Sediment samples may not be representative of the bulk spoil generated by HDD activities, as drilling will extend to depths greater than the <1.0 m depth achieved for sediment assessment.

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 would 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 sediment sampling 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. 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 at locations closer to the shore, 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 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.

7. IMPACT ASSESSMENT

The following sections present the groundwater impact assessment for the periods of construction (Section 7.3) and operation (Section 7.4) of the project.

7.1 POTENTIAL IMPACTS

Each potential impact is discussed with an assessment of impact magnitude and significance provided. A summary of the individual impact magnitudes is provided in Section 7.6. Where residual impacts are likely to occur that warrant further mitigation, measures have been recommended throughout the impact assessment and are summarised in Section 9. The subsequent assessment of both initial and residual impact significance, following the application of additional mitigation or management measures, is summarised in Section 7.7.

The groundwater impact assessment considers potential impacts to groundwater level and quantity and groundwater quality may occur from the following construction and/or operational activities:

Groundwater levels and quantity:

- Temporary dewatering of onshore HDD entry/exit pits and other minor excavations during construction leading to groundwater level drawdown.
- Temporary dewatering of bored piles during construction leading to groundwater level drawdown.
- Permanent alteration of the land surface leading to permanent groundwater level changes.

Groundwater quality:

- Mobilisation of existing groundwater contamination towards the project due to temporary groundwater level drawdown.
- Release of contaminated groundwater to the environment generated during dewatering.
- Groundwater acidification due to temporary or permanent groundwater level drawdown.
- Saline water intrusion to aquifers due to temporary groundwater level drawdown.
- Herbicide application at the converter station migrating to groundwater.
- Discharge from the septic tank system causing groundwater contamination.
- Accidental spills and leaks of transformer oil, lead acid batteries, and diesel fuel stored in above ground tanks at the converter station.
- Enhanced recharge of stormwater runoff (including flood waters) to shallow groundwater via higher-conductivity backfilled cable trench.

No potential impacts to groundwater are identified for the decommissioning phase as the need for subsurface work is not expected. It is assumed the subsurface infrastructure will be left in place.

There are a range of potential impacts that are common to most construction sites, and which are routinely addressed by well-established standard operating procedures or guidelines in the construction industry, including construction and operation environmental plans. Examples of these potential impacts considered to be negligible or not feasible are summarised below:

- Contamination of groundwater from storage and handling of small volumes of cleaning chemicals, fuels, and other materials.
- Contamination of groundwater from subsurface construction materials (sealing products, chemical grouts etc).
- Minor excavations for roads and drainage infrastructure intercepting groundwater and altering levels.
- Infiltration of water from temporary construction sedimentation ponds recharging groundwater and altering levels or quality.

- Removal of topsoil and vegetation leading to enhanced groundwater recharge.

7.2 GROUNDWATER VALUES AND SENSITIVITY ASSESSMENT

The State Policy on Water Quality Management (1997) sets protected environmental values for groundwater based on the reported TDS concentrations. Groundwater protected environmental values are reproduced in Table 7-1.

Mineral Resources Tasmania published a series of groundwater quality maps and corresponding protected environmental values for some regions of Tasmania. The study area falls within the Northwest Map zone but outside of areas where groundwater quality and associated potential uses have been declared.

Groundwater TDS in the lower bedrock aquifer ranged from 261 mg/L to 1,400 mg/L and would likely be assigned to the Category A band (<1,000 mg/L) and all protected environmental values may need to be considered (Table 7-1). While TDS concentrations were not reported for the Quaternary aquifer, this aquifer is also likely to be assigned Category A.

Table 7-1 Protected environmental values of groundwater (reproduced from DPIWE, 2000)

Category	A	B	C	D
TDS (mg/L)	Less than 1,000	1,000 – 3,500	3,500 – 13,000	Greater than 13,000
Protected Environmental Value				
Drinking water	✓			
Irrigation	✓	✓		
Industry	✓	✓	✓	
Stock	✓	✓	✓	
Ecosystem Protection	✓	✓	✓	✓

Category A groundwater requires the protection of the environmental values of drinking water, irrigation, industrial water use, stock watering, and ecosystem protection. The Board of the Tasmanian EPA may determine that these beneficial uses do not apply when:

- There is insufficient yield;
- The background level of water quality indicator other than TDS precludes a beneficial use;
- The soil characteristics preclude a beneficial use; or
- A groundwater quality restricted use zone has been declared.

Additional values have been conservatively adopted that are not referenced by Tasmanian legislation, but which are protective of values commonly recognised in other states of Australia, and which are likely to apply in the receiving environment at the site. Specifically, the following values are adopted in addition to the minimum legislated values:

- Recreational use - including swimming in baseflow-fed rivers and creeks, and the marine environment.
- Cultural or spiritual values - including Indigenous cultural values that may exist at the point of discharge.

Table 7-2 presents a preliminary assessment of groundwater protected environmental values, taking into account the known existing and potential future uses of groundwater, and existing groundwater quality issues which may preclude some protected environmental values.

Based on this assessment, the following environmental values of groundwater will be adopted by the groundwater impact assessment when assessing the sensitivity of groundwater:

- Industrial water use
- Ecosystem protection
- Recreational use
- Indigenous cultural values

Table 7-2 Assessment of environmental values of groundwater requiring protection

Protected Environmental Value	Existing Use	Potential Future Use	Value requiring protection	Comments
Drinking water	No	Unlikely	No	There are no registered groundwater users in the vicinity of the study area. The industrial setting of Heybridge and known existing groundwater contamination beneath the site would likely preclude this value from being realised in the immediate vicinity of the site in the future. Reticulated potable water supply is readily available and would be a preferred potable supply due to cost, reliability and quality aspects of exploiting the groundwater resource.
Irrigation	No	Unlikely	No	Land use zoning in study area includes Rural which may include some limited agricultural activities, such as those associated with hobby farming. Irrigated agriculture for food or fibre production is highly unlikely, particularly given the topography in the study area and the limited land available between the site and the coastline. Sports fields and public parks which might view groundwater as a preferred water supply during drought periods, are not located within the study area and would be unlikely due to the limited available land.
Industry	No	Possible	Yes	Groundwater is not currently exploited for industrial use and is unlikely to be a preferred future industrial water supply considering low yields from the fractured rock aquifer and the limited aerial extent (and likely sustainable yield) of the alluvial aquifer. The presence of readily available surface water and reticulated water alternatives make it possible but unlikely that groundwater would be used for industrial purposes.
Stock	No	Unlikely	No	Land use zoning in study area includes Rural which may include some limited agricultural activities, such as those associated with hobby farming. The presence of existing groundwater contamination (including PFAS) would likely preclude use for stock water.
Ecosystem protection	Yes	Yes	Yes	This value applies at the point of discharge to surface water receptors. Groundwater originating from the proposed converter site is likely to discharge to marine environment of Bass Strait. All marine and freshwater features in the study area require protection of the aquatic ecosystem.
Recreational use	Yes	Yes	Yes	Groundwater is likely to discharge to the estuarine and marine environment where recreational uses include swimming, boating and recreational fishing.
Indigenous cultural values	Yes	Yes	Yes	While not a legislated environmental value of groundwater, this environmental value is recognised due the connected nature of groundwater and surface water, including the marine and estuarine ecosystems which may have tangible and intangible cultural values to the First Peoples of the area.

Note: shaded rows denote Protected environmental values that may apply to groundwater

7.2.1 Sensitivity assessment

Groundwater sensitivity has been assessed in relation to its suitability to support the identified environmental values, which have been summarised into the following categories:

- Consumptive or productive uses: including industrial water use, some cultural water uses, and to support water-based recreation such as swimming.
- Water dependent ecosystems: as baseflow contribution to the Blythe River estuary or the marine environment Bass Strait.
- Cultural or spiritual values: including aesthetic, historical, scientific, social or other significance to the present generation or past or future generations.

On the basis of the sensitivity criteria presented in Table 5-1, the sensitivity levels assigned to aquifers present beneath the study area are summarised in Table 7-3. Each aquifer has been assigned a low sensitivity based on the rounded mean ranking across the five sensitivity criteria, where:

- high sensitivity = 3
- moderate sensitivity = 2
- low sensitivity = 1
- very low sensitivity = 0

This assessment relates to the process of establishing the sensitivity of aquifers which is a requisite step of the groundwater impact assessment methodology established for the project and is consistent with the Tasmanian EIS guideline requirements (Section 2).

The potential impacts to environmental values as a result of the project construction and operation activities are discussed further in the following sections below as they relate to either impacts to groundwater quantity and levels or groundwater quality.

Table 7-3 Sensitivity assignments for aquifers within the study area

Aquifer	Supported environmental values	Uniqueness and rarity	Resilience to change	Recovery potential	Replacement potential	Overall sensitivity
Quaternary sand	Moderate (2)	Low (1)	Low (1)	Moderate (2)	Not sensitive (0)	Low (1.2)
Bedrock	Moderate (2)	Low (1)	Low (1)	Moderate (2)	Not sensitive (0)	Low (1.2)
Justification	Groundwater supports slightly to moderately disturbed marine ecosystems. Altered groundwater quality affecting some environmental values. Predominantly construction and irrigation use.	Common aquifers at a regional scale with numerous alternatives. Aquifer and connected features not listed or recognised by statutory registers	Highly conductive aquifers in high rainfall environments have resilience to change. Connection with nearby hydraulic boundary features minimise change.	Recovery to quality changes (such as saline water intrusion) would be slow or only partly successful	There are numerous local water features that could provide alternative water sources to users. Groundwater would be an unlikely preferred resource in this setting	

7.3 CONSTRUCTION

This section identifies the potential impacts of the project on groundwater during the construction phase on identified groundwater values.

7.3.1 Project dewatering assessment

This section provides an assessment of the potential impacts associated with groundwater dewatering during construction and has been completed to inform the assessment of impacts which are documented in the following section.

Often dewatering assessments adopt analytical assessment or numerical groundwater models to simulate the possible range of groundwater level drawdown that may propagate away from dewatered excavations or bores. In this case, the dewatering assessment has adopted a qualitative approach that considers the hydrogeological conceptual model, and specifically, the presence of major hydraulic boundaries in close proximity to the site. The site setting and proximity to major aquifer boundaries is likely to limit extensive groundwater level drawdown and allows a conservative, qualitative assessment to be adopted. This approach is suitable for predicting potential groundwater drawdown impacts so that appropriate mitigation measures can be established.

The site in underlain by a shallow water table that is likely to be encountered at depths of less than 1 m below the current ground surface. Limited information is available on the proposed excavations that may be required during construction; however, it is assumed that most excavations would potentially extend below the water table and might require temporary or permanent dewatering.

It is assumed that most excavations will extend into the Quaternary sand aquifer, which, in the absence of site-specific aquifer hydraulic conductivity data, is assumed to have high (greater than 10 m/day) hydraulic conductivity. Under these conditions, in a homogenous, infinite aquifer, dewatering rates would be high and groundwater drawdown would propagate quickly away from the excavation. However, the outcropping bedrock along the western, southern and parts of the eastern site boundary provides a low hydraulic conductivity barrier that will limit drawdown propagation in these directions. The steeply rising topography (including the underlying bedrock) away from the site and the presence of groundwater catchment boundaries to the west and south of the site will further limit drawdown offsite in these directions through the bedrock aquifer.

The presence of these low/no-flow barriers will result in an increased rate of groundwater drawdown towards the north where the Quaternary sand aquifer extends offsite and connects with Bass Strait coastline, approximately 120 m from the converter station site. The coastline represents a major recharge boundary that will halt or significantly slow the further propagation of drawdown once it is encountered.

For this reason, the radius of influence of construction dewatering is likely to be in the order of approximately 150 m (based on a conservative assumption of the distance between the southern site boundary and the coastline to the north). Drawdown is assessed as unlikely to extend offsite to the south, east or west due to the presence of outcropping, low permeability bedrock.

Refined analytical or numerical modelling approaches may be warranted during design when additional information on the project dewatering requirements is known and additional baseline hydrogeological investigations have been completed.

If construction dewatering is maintained at high discharge rates and for a sufficient period of time, it could result in the ingress of saline water to the freshwater aquifer.

7.3.2 Temporary dewatering impacts to groundwater users

There are no registered or known unregistered groundwater users located within the study area.

Considering both the absence of known groundwater users from the study area and the limited extent of groundwater level drawdown that can propagate away from the site, it is highly unlikely that any temporary construction dewatering activities would impact on groundwater users.

The environmental values of groundwater also consider potential future extractive groundwater users, specifically for industrial water use. Temporary groundwater level drawdown as a result of construction dewatering would rapidly recover in the highly conductive Quaternary sand aquifer. There would be unlikely to be a measurable effect to the long-term groundwater availability to future users.

Impact significance

Temporary dewatering is unlikely to have a measurable effect (negligible magnitude) on current or potential future industrial groundwater users. A corresponding very low impact is considered to apply.

Mitigation and management measures

No mitigation or management measures are proposed or required to address this potential impact.

Residual impacts

As the initial assessment of impacts to groundwater users was assessed as being very low, and no mitigation or management measures are proposed, the residual impact is consistent with the initial very low impact assessment.

7.3.3 Temporary dewatering impacts to GDEs

There are no suspected terrestrial GDEs within the study area. Groundwater drawdown has been assessed as unlikely to propagate offsite to the south and west where large areas of non-groundwater dependent native vegetation is present, further limiting unforeseen potential impacts. In the unlikely event that, unplanned drawdown occurred beneath unknown terrestrial GDEs, the proposed short-duration dewatering would be unlikely to have a measurable effect on vegetation health.

The Blythe River estuary is the primary aquatic GDE that exists within the study area. The drawdown assessment considered that southern and eastern drawdown was likely to be limited by the presence of outcropping bedrock along the site boundaries. However, planned earthworks along these boundaries may feasibly reduce the effectiveness of this hydraulic barrier and permit a degree of drawdown. This could temporarily reduce the freshwater input to the estuarine zone. The aquatic ecosystem of the estuary would be adapted to highly variable salinity and changes to the freshwater input over a short section of the total catchment would have a negligible effect on the aquatic ecosystem.

Impact significance

Temporary dewatering is unlikely to have a measurable effect (negligible magnitude) on terrestrial or aquatic GDEs. A corresponding very low impact is considered to apply.

Mitigation and management measures

No mitigation or management measures are proposed or required to address this potential impact.

Residual impacts

As the initial impact assessment is assessed as being very low, and no mitigation or management measures are proposed, the residual impact is consistent with the initial impact assessment of very low.

7.3.4 Groundwater acidification

Where potential ASS is present and it is allowed to oxidise (either in-situ or in temporary stockpiles), it may result in the acidification of groundwater. In addition to increased acidity, which can have adverse ecological effects, lower pH groundwater commonly results in increased concentrations of dissolved metals. Acidic groundwater conditions might pose a risk to underground structures (such as building foundations) and/or the receiving marine ecosystem.

Impact significance

The magnitude of a groundwater quality impact (if it occurred) would be a function of the duration that dewatering was required, and the time required for groundwater levels to recover.

If unmitigated and sustained, a degree of groundwater acidification may persist during construction as a result of localised groundwater drawdown. Acidic groundwater, if it were generated, would be relatively limited in extent, but would likely migrate over the short distance to Bass Strait coastline, discharging to the marine environment. It could potentially have major impacts to the aquatic ecosystem and affect various environmental values of the receiving environment, including human health.

A major magnitude of impact is conservatively assumed under this scenario, corresponding to a moderate impact.

Measures to comply with GWMM01 are proposed to further assess the potential for groundwater acidification from ASS that may be present at the site. Measures to comply with GWMM02 are proposed to prevent impacts from groundwater drawdown in ASS areas. In the case where dewatering is required in areas of likely ASS, a range of engineering approaches are available to meet GWMM02, such as installation of sheet pile walls or other barriers extending into the weathered bedrock to minimise groundwater drawdown in the Quaternary sediments during construction.

Mitigation and management measures

The following mitigation and management measures are proposed to reduce the significance of the potential impacts:

Table 7-4 Mitigation and management measures: groundwater acidification

Measure ID	Mitigation and management measures	Project stage
GWMM01	Conduct a pre-construction hydrogeological assessment at the converter station site to inform appropriate detailed design and construction methods.	Design
GWMM02	Minimise groundwater inflow into excavations, limit groundwater level drawdown, avoid mobilising contaminated or saline groundwater, and prevent groundwater acidification.	Design, Construction
GWMM05	Develop and implement a construction groundwater monitoring plan to establish baseline and background groundwater conditions prior to construction and monitor potential Project impacts during construction.	Design, Construction

Residual impacts

When applying the stated measures, groundwater level drawdown and subsequent oxidation of ASS would be minimised to the extent practicable, which would result in an assumed minor residual magnitude of impact to the marine environment. Groundwater level and quality monitoring would likely be required to demonstrate that this mitigation measure is achieving the intended outcome during construction in areas where dewatering is proposed and ASS is potentially present (GWMM05).

7.3.5 Saline groundwater intrusion

Temporary dewatering may result in groundwater level drawdown propagating through the aquifer towards the coastline. Drawdown in coastal zones may alter the naturally occurring fresh/saline water interface within the aquifer that runs parallel with the coastline, causing salinisation of the fresh groundwater resource.

There would be limited direct impacts as a result of increased groundwater salinity due to the absence of existing local groundwater users and GDEs between the coastline and the site. Potential future industrial groundwater users would be adversely affected as it is possible that recovery from saline intrusion could take several years or decades.

The effluent outfall pipeline and associated tunnel may represent a preferential pathway for marine water or saline groundwater in the coastal zone to migrate inland, either as a result of long term climate change or during periods when construction dewatering is active. The pipeline and tunnel may have been partially decommissioned by historical remedial works and further decommissioning activities may be undertaken as a part of the project. Depending on the decommissioning method (such as decommission and retain in place or demolish and remove the pipelines) there is the potential that the trench backfill and/or the pipelines itself could provide continue to provide a preferential pathway for saline water to migrate onshore during dewatering.

The potential for saline intrusion via the HDD borehole and cable conduit is assessed in Section 7.3.9.

Impact significance

Under the conditions described, it is feasible that relatively significant changes to groundwater salinity could occur; however, further work would be required to confirm this drawing on site-specific aquifer hydraulic properties which will support transient drawdown assessments. If unmitigated, a moderate magnitude of impact would be anticipated to potential future consumptive or productive groundwater users, corresponding to a low impact significance. It is recognised that a legislative requirement exists under the EMPCA (Section 23A – general environmental duty (GED)) to minimise environmental impacts to the extent practicable or reasonable which would warrant mitigations to prevent saline intrusion into the aquifer.

Measures to comply with GWMM01 should include further assessment in areas of proposed dewatering to verify the aquifer hydraulic properties and modelling to simulate groundwater level drawdown, and assess whether saline intrusion risk are generally consistent with those assessed by this impact assessment. To meet legislative requirements and minimise environmental impacts as far as reasonably practicable, measures to comply with GWMM02 are recommended to limit the volume and duration of dewatering that may be required at excavations, minimising groundwater level drawdown and potential for saline water intrusion to occur. Furthermore, GWMM02 and GWMM03 are designed to prevent preferential pathways for saline water intrusion along the HDD borehole annulus towards the inland aquifer and the decommissioned discharge pipelines.

Mitigation and management measures

The following mitigation and management measures are proposed to reduce the significance of the potential impact:

Table 7-5 Mitigation and management measures: saline water intrusion

Measure ID	Mitigation and management measures	Project stage
GWMM01	Conduct a pre-construction hydrogeological assessment at the converter station site to inform appropriate detailed design and construction methods.	Design
GWMM02	Minimise groundwater inflow into excavations, limit groundwater level drawdown, avoid mobilising contaminated or saline groundwater, and prevent groundwater acidification.	Design, Construction
GWMM03	Develop specifications and implement methods for Horizontal Directional Drilling (HDD) and other drilling activities to prevent groundwater movement and contamination.	Construction

Residual impacts

Following the application of dewatering controls, groundwater level drawdown would be limited from propagating towards the coastline, and the magnitude of impact associated with saline groundwater intrusion would be significantly reduced, resulting in a minor magnitude impact. A residual impact of low significance is assumed.

7.3.6 Mobilisation of existing groundwater contamination

Historical and current land uses in the vicinity of the project may have caused groundwater contamination. A comprehensive review of land and groundwater contamination across converter station site has been reported separately in the Tasmanian contaminated land and acid sulphate soil impact assessment (Tetra Tech Coffey, 2023).

Whilst groundwater contamination has been detected beneath the site in both the shallow Quaternary sand aquifer and the deeper bedrock aquifer, there are no known discreet plumes of groundwater contamination present which might represent a source of impact to sensitive receptors should they be mobilised by the project's dewatering activities.

As described above, there are no existing groundwater users within the study area that would experience an increased risk posed by mobilising known or undetected groundwater contamination. There would be negligible magnitude risks to existing groundwater users. It is possible that uncontrolled mobilisation of existing contamination could limit use of previously uncontaminated sections of the groundwater resource by possible future users. This would have a minor impact due to the alternative water supply options that are readily available.

Similarly, there are no terrestrial or freshwater aquatic GDEs that are within the study area that would experience an increased risk of impact if groundwater flow paths were altered. The marine environment of Bass Strait is the current groundwater discharge point that is likely to be affected by existing groundwater contamination from the site. There are no foreseeable scenarios where dewatering might increase the risk posed by existing contamination to the marine discharge point.

As such, limited impact to environmental values of groundwater is anticipated and a negligible magnitude is adopted.

Impact significance

The assessment has not identified any areas where dewatering might mobilise contaminated groundwater and result in an increased risk profile to the environmental values of groundwater. Negligible to minor magnitude impacts would be anticipated if it did occur.

It is recognised that a legislative requirement exists under the EMPCA (Section 23A – general environmental duty (GED)) to minimise environmental impacts to the extent practicable or reasonable, regardless of the significance of the potential impact assessed in this report. Measures to comply with GWMM01 is recommended to complete a hydrogeological investigation in areas of anticipated dewatering, which will provide further information on the existing groundwater quality and allow for measures to be developed that prevent mobilisation of contamination.

Mitigation and management measures

The following mitigation and management measures are proposed to reduce the significance of the potential impact:

Table 7-6 Mitigation and management measures: contaminant mobilisation

Measure ID	Mitigation and management measures	Project stage
GWMM01	Conduct a pre-construction hydrogeological assessment at the converter station site to inform appropriate detailed design and construction methods.	Design
GWMM02	Minimise groundwater inflow into excavations, limit groundwater level drawdown, avoid mobilising contaminated or saline groundwater, and prevent groundwater acidification.	Design, Construction
GWMM03	Prevent groundwater movement and contamination as a result of HDD and other drilling activities.	Construction
GWMM05	Develop and implement a construction groundwater monitoring plan to establish baseline and background groundwater conditions prior to construction and monitor potential Project impacts during construction.	Construction

Residual impacts

The implementation of measures to comply with GWMM01 and GWMM02 will limit the volume and duration of dewatering that may be required at excavations, minimising groundwater level drawdown and potential for existing groundwater contamination to be mobilised. The implementation of measures to comply with GWMM03, including the requirement to seal the borehole annulus of directionally drilled bores or otherwise prevent water movement, will minimise the potential for groundwater contamination to be mobilised along preferential flow paths. Measures to comply with GWMM05 will provide additional groundwater level and quality monitoring data in areas where potential groundwater interactions are planned. This additional data will inform construction managers and allow them to avoid existing contamination or implement measures to otherwise control or adequately assess the risk of mobilising groundwater contamination that might cause increased risk of harm to sensitive receptors. These measures maintain a low impact and supports compliance with the GED.

7.3.7 Release of contaminated groundwater to the environment

Limited information is available on groundwater quality in the Quaternary sand aquifer and the potential to encounter unexpected groundwater contamination exists. The available data indicates that, at a minimum, groundwater may be contaminated by metals and PFAS at concentrations that exceed marine ecosystem protection criteria.

Dewatering activities are likely to generate groundwater that may be contaminated by metals, PFAS and potentially other contaminants that may be unsuitable for discharge to the environment without prior treatment.

Impact significance

Uncontrolled discharge of impacted groundwater may result in moderate magnitude impacts, corresponding with a low impact significance where discharge occurs back to the groundwater system. Higher impacts would be expected to surface water features such as the Blythe River estuary or Bass Strait if direct discharge of contaminated groundwater occurred. While the impact to groundwater would likely be low, there is a requirement to minimise potential adverse impacts to the extent practicable under the GED of the EMPCA. Management and appropriate disposal of extracted groundwater from dewatering activities will be required to minimise potential impacts to groundwater values.

Mitigation and management measures

The following mitigation and management measures are proposed to reduce the significance of the potential impact:

Table 7-7 Mitigation and management measures: contaminated groundwater management

Measure ID	Mitigation and management measures	Project stage
GWMM01	Conduct a pre-construction hydrogeological assessment at the converter station site to inform appropriate detailed design and construction methods.	Design
GWMM02	Minimise groundwater inflow into excavations, limit groundwater level drawdown, avoid mobilising contaminated or saline groundwater, and prevent groundwater acidification.	Design, Construction
GWMM04	Develop and implement a groundwater management plan to manage, monitor, reuse, treat, and dispose of groundwater during construction dewatering.	Construction
GWMM05	Develop and implement a construction groundwater monitoring plan to establish baseline and background groundwater conditions prior to construction and monitor potential Project impacts during construction.	Construction

Residual impacts

Compliance with GWMM01 and GWMM05 will require groundwater investigations in areas where dewatering is likely to be required to ensure adequate information on existing groundwater contamination is available prior to construction commencing. Measures to comply with GWMM04 are recommended to ensure that all groundwater generated is managed appropriately based on its quality and potential contamination status. This may require treatment and/or disposal via trade waste in some situations where contaminated groundwater is encountered. These requirements would be formalised in a groundwater management plan, as a sub plan to the CEMP and implemented during construction.

Measures to comply with GWMM02 are recommended to prevent groundwater acidification in areas where ASS may be present, which may contribute to the development of contaminated groundwater that may be released during construction.

Together, these mitigation and management measures would ensure that the residual magnitude of impact is reduced to minor, maintaining a low impact significance and supporting compliance with the GED.

7.3.8 Groundwater contamination from construction activities

7.3.8.1 Groundwater contamination from drilling fluids

Prior to construction, geotechnical and hydrogeological investigation boreholes will be drilled at some locations where construction activities are planned. Construction activities will also include HDD deployed from the site beneath the coastline and to the offshore environment.

Drilling can require the use of relatively low volumes of drilling fluids in addition to potable water. These fluid assist with lubricating and cooling the drill bit, borehole stability, and the removal of drill cuttings from the borehole. In the case of groundwater monitoring wells, drillers are required to install wells in general accordance with the following guidance:

- National Uniform Drillers Licensing Committee 2020. Minimum construction requirements for water bores in Australia. Fourth Edition.

This guidance requires that, “Chemicals and other drilling fluid additives that could leave a residual toxicity should not be added to any drilling fluids or cement slurries (i.e., grouts) used to drill and complete any water bore”.

It is possible that drilling conducted for purposes other than groundwater investigation (such as HDD and geotechnical drilling) could use alternative drilling fluid additives that might cause contamination by low concentrations of toxic chemicals.

Impact significance

Considering the local scale of the site investigations and HDD activities, the magnitude of impact (if it occurred) might be conservatively considered to be moderate, particularly to future extractive groundwater users. This equates to a low impact significance.

Mitigation and management measures

The following mitigation and management measures are proposed to further reduce the magnitude of the impact as far as reasonably practicable:

Table 7-8 Mitigation and management measures: groundwater movement and contamination from drilling

Measure ID	Mitigation and management measures	Project stage
GWMM03	Prevent groundwater movement and contamination as a result of HDD and other drilling activities.	Construction

Residual impacts

Geotechnical drilling and HDD construction activities will be completed without the use of toxic additives (GWMM03). The impact magnitude would be reduced to minor after implementing GWMM03, maintaining a low impact significance.

7.3.8.2 Groundwater contamination from construction chemicals and fuels

Construction activities will require the use of light vehicles, drill rigs, excavators and other construction machinery for planned construction of the converter station and ancillary infrastructure. Hydrocarbon based fuels, lubricants and degreasing agents are likely to be required on site to power and maintain machinery.

These, and other raw materials may either be hazardous or pose a contamination risk to groundwater if not adequately stored, handled and used during the construction period. Spills and leaks during storage and use may infiltrate to groundwater and cause contamination.

The following is noted in relation to the planned use of chemicals and fuel during construction activities:

- Construction activities will be managed under a Construction Environment Management Plan (CEMP) that will include the following elements:
  - A hazardous materials register.
  - Minimum requirements for the handling, use and disposal of hazardous materials consistent with regulatory guidance and Australian Standards, including designated areas where hazardous materials should not be stored or used (such as near waterways and wetlands).
  - Spill response and incident management plans, including provision of spill kits, drains and booms and other equipment that may be identified as necessary by site-specific risk assessments.
- Light vehicles used by contractors and other project staff will be maintained and refuelled offsite at commercial service stations. Some construction equipment and earthworks machinery will be refuelled onsite during the construction period by a mobile diesel fuel tanker.
- All wastes, including controlled wastes (e.g., contaminated groundwater generated during construction), will be transported, stored, handled and disposed. Hydrocarbon contaminated material will be removed to an appropriate disposal site or treatment facility. Further discussion of impacts of controlled waste is provided in the Tasmanian Contaminated Land and Acid Sulphate Soil Impact Assessment (Tetra Tech Coffey 2023).

The proposed construction activities and the volumes and nature of chemicals and fuels that are likely to be use are not dissimilar to most common construction activities (such as road construction and commercial building projects).

These activities are commonly managed through a project specific CEMP that aligns with the minimum standards and regulatory guidance published in relation to these commonly occurring construction activities or broader industry guidance.

The following Tasmanian and Australian legislation, regulations and standards are noted as applicable to the planned construction activities:

- EMPCA
- Development Regulations 2014
- Tasmania Waste Management and Resource Recovery Regulations 2013
- AS/NZS ISO 14001:2016: Environmental management systems – Requirements with guidance for use (Australian Standards)

Impact significance

The magnitude of impact associated with groundwater contamination resulting from the use of relatively small volume chemicals and mobile refuelling during construction of the converter station would be considered minor. This is based on the assessment that where impact occurred, it would be localised, of short duration and could be effectively mitigated through standard environmental management controls. The minor impact magnitude if groundwater contamination did occur in small volumes, would equate to a low impact significance.

Mitigation and management measures

The following mitigation and management measures will further reduce potential groundwater impacts from construction chemicals and fuels to the extent practicable.

Table 7-9 Mitigation and management measures: groundwater contamination from chemicals and fuels

Measure ID	Mitigation and management measures	Project stage
GWMM04	Develop and implement a groundwater management plan to manage, monitor, reuse, treat, and dispose of groundwater during construction dewatering.	Design, Construction
GWMM05	Develop and implement a construction groundwater monitoring plan to establish baseline and background groundwater conditions prior to construction and monitor potential Project impacts during construction.	Design, Construction

Residual impacts

Application of controls in GWMM04 and GWMM05 would reduce magnitude of impact associated with a minor release of chemicals or fuels during construction to minor, corresponding to a low residual impact significance.

7.3.9 Horizontal directional drilling

HDD can create preferential pathways for groundwater to travel along the borehole annulus and the installed cable conduit if not adequately sealed. This is commonly not of concern when drilling vertically within the same aquifer formation (such as for geotechnical investigation or groundwater monitoring) but can be problematic when drilling crosses confining layers or might connect previously isolated aquifers or water sources (such as the marine environment with inland freshwater aquifers).

HDD and the permanently installed cable conduit may result in the following potential impacts to groundwater, several of which have been considered in previous sections:

- Dewatering of the launch pit causing drawdown and temporary dewatering impacts to groundwater users (assessed in Section 7.3.2) and GDEs (assessed in Section 7.3.3), and acidification of groundwater (assessed in Section 7.3.4).
- Creating preferential pathways for saline marine water to enter freshwater aquifers (partly assessed in Section 7.3.5).
- Groundwater contamination from drilling fluids (assessed in Section 7.3.8.1).
- Drilling ‘frac out’ causing impacts to surface water features, buildings, roads, and other infrastructure.

The following sections expand on impacts relating to HDD and the cable shore crossing that are no addressed in previous sections.

7.3.9.1 Groundwater contamination via preferential pathways

The HDD borehole annulus and conduit, if not adequately sealed, can provide a pathway for contaminants from the surface (such as runoff from roads, or potential spills from the future converter station) to enter groundwater more rapidly and affect associated environmental values of groundwater.

The HDD borehole and conduit connect the marine zone with the converter station may provide a preferential pathway for saline marine water to move inland and impact freshwater groundwater resources. These may occur particularly in response to tidal fluctuations, storm surge, or temporary dewatering of excavations at the converter site drawing water along the pathway.

There would be limited direct impacts as a result of increased groundwater salinity beneath the converter station site due to the absence of existing local groundwater users or GDEs at the site. Potential future industrial groundwater users would be adversely affected as it is possible that recovery from saline intrusion could take several years or decades.

Impact significance

It is feasible that significant changes to groundwater salinity could occur within the aquifer surrounding the alignment of the HDD borehole. If unmitigated, a moderate magnitude of impact would be anticipated to potential future consumptive or productive groundwater users, corresponding to a low impact significance. Negligible impacts would be expected at the identified GDEs at a distance from the converter station and shore crossing site.

It is recognised that a legislative requirement exists under the EMPCA (Section 23A –GED) to minimise environmental impacts to the extent practicable or reasonable which warrants mitigations to prevent saline intrusion into the aquifer.

Mitigation and management measures

Measures to comply with GWMM01 should be undertaken to verify the aquifer hydraulic conditions and ensure that drawdown estimates are generally consistent with those assessed by this impact assessment. To meet legislative requirements and minimise environmental impacts as far as reasonably practicable, measures to comply with GWMM02 are recommended to limit the volume and duration of dewatering that may be required during earthworks and construction, minimising groundwater level drawdown and potential for saline water intrusion to occur along the HDD borehole and cable conduit. Furthermore, GWMM03 is designed to prevent preferential pathways for saline water intrusion along the HDD borehole annulus and conduit towards the inland aquifer.

Table 7-10 Mitigation and management measures: groundwater contamination via preferential pathways

Measure ID	Mitigation and management measures	Project stage
GWMM01	Conduct a pre-construction hydrogeological assessment at the converter station site to inform appropriate detailed design and construction methods.	Design
GWMM02	Minimise groundwater inflow into excavations, limit groundwater level drawdown, avoid mobilising contaminated or saline groundwater, and prevent groundwater acidification.	Design, Construction
GWMM03	Prevent groundwater movement and contamination as a result of HDD and other drilling activities.	Construction

Residual impacts

Following the application of mitigation measures GWMM01, GWMM02 and GWMM03, potential for saline water intrusion via the HDD borehole and cable conduit would be minimised as far as reasonably practicable, and the magnitude of impact associated with saline groundwater intrusion would be significantly reduced, resulting in a minor magnitude impact and a low residual impact significance.

7.3.9.2 HDD frac out

All HDD activities have potential for ‘frac out’ to occur during drilling. Frac-out is the unintentional return of drilling fluids to the surface, other than via the drilling entry and exit point, as a result of the pressure in the borehole exceeding the pressure of the surrounding ground. This could result in the loss of drilling fluids to the surface environment and the development of new hydraulic connections between aquifers, across confining layers or between surface water and groundwater.

Frac-out occurs most frequently near the borehole entry and exit points where the drilling depth is shallowest. Frac-out occurring near the entry and exit points would have lower potential for impact to groundwater and associated environmental values due to the shallow depth, greater distance from surface water features, and the localised disturbance by the main borehole that would already exist around the drilling activities and converter station site.

Impact significance

In some scenarios, significant, uncontrolled frac-out events could impact existing infrastructure such as the Bass Highway, the adjacent railway line, or subsurface infrastructure that may be present. Groundwater impacts (which is the focus of this assessment) associated with frac-out would be relatively minor and limited to a local area that would be readily remediated. A low impact significance is assessed.

Mitigation and management measures

Recognising the higher potential impact of a frac-out event to infrastructure and potential quality impacts to the marine environment, additional mitigation measures are listed in GWMM03.

GWMM03 includes requirements to develop an HDD frac out prevention and management plan that will minimise potential for frac-outs to occur. The plan will include completing a review of the geotechnical investigation data and a risk assessment with the drilling contractor, agreeing minimum monitoring and observation requirements during drilling to detect potential frac-outs (such as loss of fluid circulation), pressure relief methods, and other mitigations or contingencies.

Table 7-11 Mitigation and management measures: HDD frac out

Measure ID	Mitigation and management measures	Project stage
GWMM03	Prevent groundwater movement and contamination as a result of Horizontal Directional Drilling (HDD) and other drilling activities.	Construction

Residual impacts

With the implementation of GWMM03, a low impact significance is maintained, and the likelihood of a frac-out event will be minimised so far as is reasonably practicable.

7.4 OPERATION

This section identifies the potential impacts of the project on groundwater during the operation phase on identified groundwater values.

7.4.1 Groundwater contamination from operational activities

The ongoing operation of the Heybridge converter station will include the use of site features or ongoing maintenance activities that take have potential to cause groundwater contamination. They include:

- Accidental spills and leaks of transformer oil, the contents of lead acid batteries, and diesel fuel stored in above ground tanks.

- Discharge from the proposed septic tank system causing groundwater contamination from nutrients and pathogens.
- Herbicide application migrating to groundwater.

Contaminants potentially released during operation may migrate via groundwater towards Bass Strait coastline and the marine environment. There are no registered extractive use bores in the vicinity of the proposed converter station but contamination might reduce the quality of groundwater resources for future users or migrate towards GDEs and the marine environment.

Impact significance

The design and operation of the septic tank and the application of herbicides will be consistent with regulatory requirements and manufacturer's guidance. Contaminants that might infiltrate to groundwater and cause quality impacts would be localised at the source and generally be of low volume. Furthermore, they would attenuate over distance if they were allowed to migrate towards the marine discharge point of Bass Strait. As minor releases, they would potentially have low magnitude impact to environmental values at the point of discharge. A corresponding low impact significance is assumed.

Larger volumes of transformer oils and fuels that may be handled at the converter station may pose a risk to groundwater values if accidental release occurred. While no extractive uses of groundwater are registered or known to exist in the local area around the proposed converter station, the aquatic ecosystem of Bass Strait may reasonably be impacted by a spill that was allowed to migrate via groundwater if it was not adequately remediated. The magnitude could be moderate depending on the volumes released and the response taken.

Mitigation and management measures

The Contaminated Land and Acid Sulfate Soil Assessment proposed environmental performance requirement (EPR) CL03 that requires the operator develop and implement measures to avoid causing contamination during the operation of the project. EPR CL03 will minimise the significance of potential contamination impacts to groundwater. No further groundwater management measures are proposed.

Residual impacts

When considering minimum industry requirements for storage of fuels, such as bunding and environmental reporting of incidents, commitments made to achieve EPR CL03, and the ability for contamination to be readily remediated via conventional remediation methods, a low residual impact magnitude is assumed. The residual impact of operational activities causing groundwater contamination is assessed as being low with the implementation of the identified mitigation and management measures.

7.5 CLIMATE CHANGE

The predicted effect of climate change in northern Tasmania and on the groundwater resources in the area are discussed in Section 6.2.2. The discussion draws on the climate change projections and assessment completed for the project (Katestone, 2023).

The effect of a changing climate on groundwater may be realised over the operation and decommissioning periods of the project and could result in groundwater levels that may be higher or lower than those assessed by this report (as a result of changing rainfall recharge rates and sea level rise), and/or groundwater that is more saline than currently observed (as a result of sea level rise and/or increase storm surge intensity).

These climate change effects on groundwater are not considered to be relevant to most potential project impacts which are associated with dewatering drawdown that may occur during the construction period. Construction activities will take place under the present-day climate.

Long term reduced or raised groundwater levels, or increased groundwater salinity would not alter the potential impacts of the project on the groundwater environment during operation and decommissioning, as these impacts relate primarily to project hazards that might affect groundwater quality (such as contamination from site activities. Therefore, the effects of climate change are not considered further.

7.6 SUMMARY OF POTENTIAL IMPACT MAGNITUDE ASSESSMENT

The potential impact magnitude assessment is summarised below (Table 7-12). This potential impact magnitude assessment does not account for implementation of the specified mitigation and management measures, which are considered in the residual impact summary (Section 7.7).

Table 7-12 Summary of the potential impact magnitude assessment

Project phase	Potential impact	Affected groundwater values	Assigned magnitude	Justification
Groundwater level and quantity				
Construction	Temporary dewatering of onshore cable trenches, cable joint pits, and HDD entry/exit pits during construction leading to groundwater level drawdown.	Consumptive or productive uses	Negligible	There are no registered or known unregistered groundwater users located within the study area. It is highly unlikely that any temporary construction dewatering activities would impact on groundwater users.
		Potential future extractive groundwater users (industrial water use)	Negligible	Temporary groundwater level drawdown as a result of construction dewatering would rapidly recover in the highly conductive Quaternary sand aquifer. There would be unlikely to be a measurable effect to the long-term groundwater availability to future users.
		Terrestrial GDEs	Negligible	There are no known terrestrial GDEs within the study area. In the unlikely event that unplanned drawdown occurred beneath unknown terrestrial GDEs, the proposed short-duration dewatering would be unlikely to have a measurable effect on vegetation health.
		Aquatic GDEs – Blythe River estuary	Negligible	The Blythe River estuary is the primary aquatic GDE that exists within the study area. The drawdown assessment considered that southern and eastern drawdown was likely to be limited by the presence of outcropping bedrock along the site boundaries. However, planned earthworks along these boundaries may feasibly reduce the effectiveness of this hydraulic barrier and permit a degree of drawdown. This could temporarily reduce the freshwater input to the estuarine zone. The aquatic ecosystem of the estuary would be adapted to highly variable salinity and changes to the freshwater input over a short section of the total catchment would have a negligible effect on the aquatic ecosystem.
Groundwater Quality				
Construction	Mobilisation of existing groundwater contamination towards the project due to temporary groundwater level drawdown	Consumptive or productive uses	Negligible	There are no existing groundwater users within the study area that would experience an increased risk posed by mobilising known or undetected groundwater contamination.
		Terrestrial GDEs	Negligible	There are no terrestrial or freshwater aquatic GDEs that are within the study area that would experience an increased risk of impact if groundwater flow paths were altered.
		Aquatic GDEs	Minor	The marine environment of Bass Strait is the current groundwater discharge point that is likely to be affected by existing groundwater contamination from the site.
Construction	Release of contaminated groundwater generated during dewatering to the environment	All	Moderate	Dewatering activities are likely to generate groundwater that may be contaminated by metals, PFAS and other contaminants that may be unsuitable for discharge to the environment without prior treatment. Uncontrolled discharge of impacted groundwater may result in moderate magnitude impacts, corresponding with a low impact where discharge occurs back to the groundwater system. Higher impacts to surface water features such as the Blythe River estuary or Bass Strait if discharge occurred.
Construction	Groundwater contamination from drilling fluids	Consumptive or productive uses	Moderate	Drilling can require the use of relatively low volumes of drilling fluids in addition to potable water. These fluid assist with lubricating and cooling the drill bit, borehole stability, and the removal of drill cuttings from the borehole. It is possible that drilling conducted for purposes other than groundwater investigation (such as HDD and geotechnical drilling) could use alternative drilling fluid additives that might cause contamination by low concentrations of toxic chemicals.
		Terrestrial GDEs	Moderate	
		Aquatic GDEs	Moderate	
Construction and Operation	Groundwater contamination from construction chemicals and fuels	Consumptive or productive uses	Minor	Construction activities will require the use of light vehicles, drill rigs, earthworks and other construction machinery for planned construction of the converter station and ancillary infrastructure. Hydrocarbon based fuels, lubricants and degreasing agents are likely to be required on site to power and maintain machinery. Low volumes of chemicals and fuels will be required, which will be stored, handled and used in line with the project CEMP and OEMP, legislative requirements, and regulatory guidance.
		Terrestrial GDEs	Minor	
		Aquatic GDEs	Minor	
Construction	Saline groundwater intrusion due to temporary groundwater level drawdown	Consumptive or productive uses	Negligible	There would be limited direct impacts as a result of increased groundwater salinity due to the absence of existing local groundwater users and GDEs between the coastline and the site.
		Terrestrial GDEs	Negligible	
		Aquatic GDEs	Negligible	
Construction and Operation	Groundwater acidification due to temporary groundwater level drawdown	Consumptive or productive uses	Moderate	If unmitigated, a degree of groundwater acidification may persist during operation as a result of localised groundwater drawdown. Acidic groundwater, if it were generated, would be relatively limited in extent, but would likely migrate towards Bass Strait coastline, discharging to the marine environment.
		Terrestrial GDEs	Moderate	

Project phase	Potential impact	Affected groundwater values	Assigned magnitude	Justification
		Aquatic GDEs	Moderate	
Construction and Operation	Accidental spills and leaks of transformer oil, the contents of lead acid batteries, and diesel fuel stored in above ground tanks	All	Moderate	Larger volumes of transformer oils and fuels that may be handled at either of the converter station may pose a risk to the environmental values of groundwater if accidental release occurred. While no extractive uses of groundwater are recorded in the local area around the proposed converter station, the aquatic ecosystem of Bass Strait may reasonably be impacted by a spill if it was not adequately remediated.
Construction and Operation	Discharge from the proposed septic tank system causing groundwater contamination from nutrients and pathogens	All	Minor	In the case of septic tank discharge, contaminants may migrate via groundwater towards Bass Strait coastline and the marine environment (being diluted along the path). There are no registered extractive use bores in the vicinity of the proposed converter station.
Construction and Operation	Herbicide application migrating to groundwater	All	Minor	In the case of herbicide use, contaminants may migrate via groundwater towards Bass Strait coastline and the marine environment (being diluted along the path). There are no registered extractive use bores in the vicinity of the proposed converter station.

7.7 SUMMARY OF RESIDUAL IMPACTS

A summary of the outcomes of the groundwater impact assessment using the sensitivity and magnitude approach and considering implementation of mitigation and management measures is presented in Table 7-13.

Table 7-13 Summary of residual impact assessment

Project phase	Potential impact	Affected value	Sensitivity	Initial impact assessment		Recommended mitigation and management measures	Residual impact assessment		
				Magnitude	Significance		Magnitude	Justification	Significance
Groundwater level and volume									
Construction	Temporary dewatering of onshore excavations during construction leading to groundwater level drawdown.	Consumptive or productive uses	Low	Negligible	Very low	No measures are proposed or required for this potential impact.	Unchanged	N/A	Very low
		Terrestrial GDEs	Low	Negligible	Very low		Unchanged	N/A	Very low
		Aquatic GDEs – Blythe River estuary	Low	Negligible	Very low		Unchanged	N/A	Very low
Groundwater Quality									
Design and Construction	Mobilisation of existing groundwater contamination towards the project's dewatering activities.	Consumptive or productive uses	Low	Minor	Low	GWMM01– Conduct a pre-construction hydrogeological assessment at the converter station site to inform appropriate detailed design and construction methods. GWMM02 – Minimise groundwater inflow into excavations, limit groundwater level drawdown, avoid mobilising contaminated or saline groundwater, and prevent groundwater acidification. GWMM03 – Prevent groundwater movement and contamination as a result of HDD and other drilling activities. GWMM05 – Develop and implement a construction groundwater monitoring plan to establish baseline and background groundwater conditions prior to construction and monitor potential Project impacts during construction.	Unchanged	Hydrological investigation (GWMM01) in areas of potential dewatering will provide further information on existing groundwater quality and allow contaminated groundwater to be avoided or managed appropriately. Measures to minimise the potential of groundwater drawdown (GWMM02), including the installation of sheet pile walls or other barriers, to prevent the release of contaminated groundwater. The use of non-toxic and/or biodegradable drilling additives (GWMM03), such as bentonite clay and xanthan gum for HDD and other drilling activities during construction, will remove a potential source of contamination. Groundwater monitoring (GWMM05) will confirm the existing sources of groundwater contamination and verify the adequacy of the proposed design and construction methods.	Low
		Terrestrial GDEs	Low	Negligible	Very low		Unchanged		Low
		Aquatic GDEs – Bass Strait	Low	Negligible	Very low		Unchanged		Low
Design and Construction	Release of contaminated groundwater generated during dewatering to the environment	Aquatic GDEs – Bass Strait	Low	Moderate	Low	GWMM03 – Prevent groundwater movement and contamination as a result of Horizontal Directional Drilling (HDD) and other drilling activities. GWMM04 – Develop and implement a groundwater management plan to manage, monitor, reuse, treat, and dispose of groundwater during construction dewatering. GWMM05 – Develop and implement a construction groundwater monitoring plan to establish baseline and background groundwater conditions prior to construction and monitor potential Project impacts during construction.	Minor	The use of non-toxic and/or biodegradable drilling additives (GWMM03), such as bentonite clay and xanthan gum for HDD and other drilling activities during construction, will minimise the potential of groundwater contamination. Management and disposal of extracted groundwater from dewatering activities (GWMM04) will be required to minimise potential impacts to environmental values. Groundwater monitoring (GWMM05) will confirm the existing groundwater conditions and verify the adequacy of the proposed design and construction methods.	Low
Design and Construction	Saline groundwater intrusion due to temporary groundwater level drawdown	Consumptive or productive uses	Low	Moderate	Low	GWMM01– Conduct a pre-construction hydrogeological assessment at the converter station site to inform appropriate detailed design and construction methods. GWMM02 – Minimise groundwater inflow into excavations, limit groundwater level drawdown, avoid mobilising contaminated or saline groundwater, and prevent groundwater acidification.	Minor	Hydrological investigation (GWMM01) in areas of potential dewatering will provide further information on existing groundwater quality and allow contaminated groundwater to be avoided or managed appropriately.	Low
		Terrestrial GDEs	Low	Negligible	Very Low		Unchanged		Very low
		Aquatic GDEs	Low	Moderate	Low		Minor		Low

Project phase	Potential impact	Affected value	Sensitivity	Initial impact assessment		Recommended mitigation and management measures	Residual impact assessment		
				Magnitude	Significance		Magnitude	Justification	Significance
						GWMM03 – Prevent groundwater movement and contamination as a result of Horizontal Directional Drilling (HDD) and other drilling activities. GWMM05 – Develop and implement a construction groundwater monitoring plan to establish baseline and background groundwater conditions prior to construction and monitor potential Project impacts during construction.		GWMM02 will limit the volume and duration of dewatering that may be required at excavations, minimising groundwater level drawdown and potential for saline water intrusion to occur. Furthermore, GWMM03 will prevent preferential pathways for saline water intrusion along the HDD borehole annulus towards the inland aquifer. Groundwater monitoring (GWMM05) will confirm the existing groundwater conditions and verify the adequacy of the proposed design and construction methods. GWMM02 requires the onshore effluent pipeline to be decommissioned using construction methods that remove preferential flow pathways for saline water intrusion that connect the marine water to onshore groundwater aquifers, if this impact is likely to be realised.	
Design and Construction	Groundwater acidification due to temporary groundwater level drawdown	Consumptive or productive uses	Low	Minor	Low	GWMM01– Conduct a pre-construction hydrogeological assessment at the converter station site to inform appropriate detailed design and construction methods. GWMM02 – Minimise groundwater inflow into excavations, limit groundwater level drawdown, avoid mobilising contaminated or saline groundwater, and prevent groundwater acidification. GWMM03 – Prevent groundwater movement and contamination as a result of Horizontal Directional Drilling (HDD) and other drilling activities. GWMM05 – Develop and implement a construction groundwater monitoring plan to establish baseline and background groundwater conditions prior to construction and monitor potential Project impacts during construction.	Unchanged	Hydrological investigation (GWMM01) in areas of potential dewatering will provide further information on existing groundwater quality and allow contaminated groundwater to be avoided or managed appropriately. GWMM02 will limit the volume and duration of dewatering that may be required at excavations, minimising groundwater level drawdown and potential for saline water intrusion to occur. Furthermore, GWMM03 will prevent preferential pathways for saline water intrusion along the HDD borehole annulus towards the inland aquifer. Groundwater monitoring (GWMM05) will confirm the existing groundwater conditions and verify the adequacy of the proposed design and construction methods. Measures, including sheet pile walls or other barriers, to prevent groundwater level drawdown, will prevent groundwater acidification within the zone of groundwater drawdown and in the coastal areas (GWMM02)	Low
		Terrestrial GDEs	Low	Negligible	Very low		Unchanged		Very low
		Aquatic GDEs	Low	Major	Moderate		Minor		Low
Construction	Groundwater contamination from drilling fluids	All	Low	Moderate	Low	GWMM03 – Prevent groundwater movement and contamination as a result of Horizontal Directional Drilling (HDD) and other drilling activities.	Minor	The use of non-toxic and/or biodegradable drilling additives (GWMM03), such as bentonite clay and xanthan gum for HDD and other drilling activities during construction, will remove a potential source of contamination.	Low
Construction	Groundwater contamination from construction chemicals and fuels	All	Low	Minor	Low	GWMM04 – Design and implement measures to manage and dispose of groundwater during construction to avoid (where possible) or minimise environmental impacts. GWMM05 – Develop and implement a construction groundwater monitoring plan to establish baseline and background	Unchanged	Management and disposal of extracted groundwater from dewatering activities (GWMM04) will be required to minimise potential impacts to environmental values.	Low

Project phase	Potential impact	Affected value	Sensitivity	Initial impact assessment		Recommended mitigation and management measures	Residual impact assessment		
				Magnitude	Significance		Magnitude	Justification	Significance
						groundwater conditions prior to construction and monitor potential Project impacts during construction.		Groundwater monitoring (GWMM05) will confirm the existing groundwater conditions and verify the adequacy of the proposed design and construction methods.	
Operation	Groundwater contamination from leaks of hazardous chemicals (e.g., transformer oil, lead acid batteries, and diesel fuel).	All	Low	Moderate	Low	EPR CL03 - Develop and implement measures to manage potential contamination impacts in operation. GWMM06 – Develop and implement an operational groundwater management plan to detect and minimise potential contamination impacts during the project's operation.	Minor	EPR CL03 and GWMM06 would significantly reduce any potential volume of hazardous chemicals released and subsequent clean up would further mitigate any impact.	Low
Construction and Operation	Discharge from the proposed septic tank system causing groundwater contamination	All	Low	Minor	Low		Unchanged	N/A	Low
Operation	Herbicide application migrating to groundwater	All	Low	Minor	Low		Unchanged	N/A	Low

7.8 CUMULATIVE IMPACTS

Proposed and reasonably foreseeable projects were identified based on their potential to credibly contribute to cumulative impacts due 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 are:

- Remaining NWTD
- 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.

All of the identified Tasmanian projects are located outside of the local groundwater catchment (defined in Section 6.6) and would not interact spatially with the groundwater effects from the proposed Heybridge converter station and shore crossing. Therefore, no cumulative impacts are expected to arise from these projects.

The exception could be the Remaining NWTD project, which includes the construction and operation of high voltage overhead transmission lines (OHTL) that will connect the Heybridge converter station with the Tasmanian power grid.

With respect to potential groundwater impacts, OHTL tower construction could require temporary dewatering of bored pile foundations during construction. This is unlikely to be the case for the closest towers that would be positioned south of the Heybridge converter site, where low hydraulic conductivity basement outcrops and topography rises to the surrounding hills. Deep bored piles are unlikely to be required at these locations where shallow competent rock is likely to be encountered. Even if bored piles were required, groundwater would be deeper along the elevate tower sites and temporary dewatering would be unlikely. Furthermore, if temporary dewatering was required, drawdown would not propagate through the low permeability basement rock to the Heybridge site over the short term construction period.

8. INSPECTION AND MONITORING

A range of groundwater inspection and monitoring activities are proposed to meet the recommended management and mitigation measures.

Most existing wells screen 2.5 to 10 m below the water table in the bedrock aquifer and are unlikely to accurately represent shallow groundwater contamination that may be present.

The pre-construction groundwater assessment (GWMM01) and construction groundwater monitoring plan (GWMM05) will require additional groundwater monitoring wells to be installed to measure groundwater levels and assess groundwater quality (including baseline and background conditions). Pre-construction monitoring will identify where existing contamination may exist and the quality condition in areas where construction dewatering may be required. Aquifer hydraulic tests may also be required to support detailed design (GWMM01) to ensure that groundwater drawdown effects can be predicted and adequately managed to meet the requirements of mitigation and management measure GWMM02.

The groundwater monitoring program will be designed, implemented, and used by project hydrogeologists and geotechnical engineers that form part of the design construction team, to ensure that relevant mitigation measures will be effective, should the project proceed (GWMM01 and GWMM02).

Groundwater monitoring requirements will be set out in the groundwater monitoring plans that are specific to the construction (GWMM05) and operational (GWMM06) phases. Details of the groundwater monitoring activities will be formalised in GMPs which will be developed as sub plans to the CEMP and OEMP, and implemented during construction and operation, respectively. The GMPs will be developed by project hydrogeologists engaged during the design and construction phase in consultation with EPA Tasmania. The plans should recognise the potential requirement for new wells to be installed that are suitable to detect groundwater contamination from project operational activities. They will include groundwater quality and level triggers and actions to be taken in response to a trigger exceedance to prevent impacts to groundwater values during construction and operation.

The GMP will ensure that the necessary environmental outcomes are achieved, and the environmental values of groundwater are maintained.

9. MANAGEMENT AND MITIGATION MEASURES

Management and mitigation measures that must be implemented during the design, construction, operation and decommissioning phases of the project are presented below and are discussed throughout Section 7. They have been developed with consideration of relevant legislation, guidelines, policies and industry standards.

Each measure is accompanied by directions that must be addressed when they are being developed and implemented. These directions ensure that the implemented measures achieve the level of risk reduction that has been assumed by the impact assessment in Section 7.

A decommissioning management plan will be prepared to outline how potential groundwater impacts associated with decommissioning activities of the project will be avoided, reduced or mitigated. The requirements for the decommissioning management plan are provided in the EIS.

Table 9-1 Mitigation and management measures

Measure ID	Mitigation and management measures	Project Stage
GWMM01	**Conduct a pre-construction hydrogeological assessment at the converter station site to inform appropriate detailed design and construction methods.**	Design

The hydrogeological assessment must include installing additional groundwater monitoring wells, performing aquifer hydraulic testing, and monitoring groundwater levels and quality to address identified data gaps and be sufficient to support development of further mitigation measures for GWMM02, GWMM04, and GWMM05. It should include a preliminary groundwater dewatering and drawdown assessment for areas where dewatering is anticipated, based on the engineering design and anticipated earthworks available at the time, using a revised hydrogeological conceptual model. The assessment should be completed by a suitably qualified hydrogeologist, and it should review whether the predicted impacts of the project on groundwater may be greater than those originally assessed in Section 7. The assessment results should be documented in a hydrogeological interpretive report that is made available prior to detailed design and be suitable to support development of other management and mitigation measures. Relevant conclusions should be presented as part of the groundwater management plan, that will be prepared prior to, and implemented during construction.

Measure ID	Mitigation and management measures	Project Stage
GWMM02	**Minimise groundwater inflow into excavations, limit groundwater level drawdown, avoid mobilising contaminated or saline groundwater, and prevent groundwater acidification.**	Design, Construction

GWMM02 must consider scheduling earthworks to reduce the duration of dewatering so far as reasonably practicable and assess the need for engineering controls such as sheet pile walls, aquifer injection, and decommissioning infrastructure, to ensure potential impacts to groundwater are avoided, and perform hydrogeological assessments to ensure the effectiveness of these controls. These measures must be informed by the ASS management plan (EPR CL02) and consider acidification risk in areas of predicted groundwater level drawdown defined by GWMM01. If identified by GWMM01 as a likely pathway for saline water intrusion during dewatering, decommission the disused onshore effluent pipeline and tunnel. These measures must be documented in a groundwater management plan that includes design specifications, monitoring requirements, and contingency plans.

Measure ID	Mitigation and management measures	Project Stage
GWMM03	**Prevent groundwater movement and contamination as a result of Horizontal Directional Drilling (HDD) and other drilling activities.**	Construction

Develop specifications and methods that address seal the borehole annulus, prevent saline water movement along the cable conduit, use non-toxic drilling additives (where additives are necessary), and include drainage systems to prevent runoff entering boreholes. Prepare a frac-out prevention and management plan to be implemented during HDD. These specifications and methods should be informed by site specific geotechnical data, be consistent with relevant guidelines, and must be documented in the CEMP.

Measure ID	Mitigation and management measures	Project Stage
GWMM04	**Develop and implement a groundwater management plan to manage, monitor, reuse, treat, and dispose of groundwater during construction dewatering.**	Design, Construction

The groundwater management plan developed for GWMM04 should prioritise groundwater reuse (such as for construction water supply, dust suppression, or reinjection for hydraulic control, where feasible), specify approved disposal options (e.g., discharge to surface water, sewer, or stormwater), and document agreed water quality discharge criteria and action trigger levels, and outline suitable treatment technologies that will be implemented or reserved as contingency measures should unforeseen contamination be encountered.

Measure ID	Mitigation and management measures	Project Stage
GWMM05	**Develop and implement a construction groundwater monitoring plan to establish baseline and background groundwater conditions prior to construction and monitor potential Project impacts during construction.**	Design, Construction,

The construction groundwater monitoring plan developed under GWMM05 should include an initial review of the groundwater monitoring network developed for GWMM01 and assess its suitability to establish baseline and background conditions prior to construction. Adequate monitoring should be completed prior to construction commencing to characterise groundwater quality and levels, including seasonal changes. The plan should recognise the potential requirement for the monitoring network to change over time in response to the project’s progress through design and construction. For construction impact monitoring, the plan should include groundwater quality and level triggers, and mitigation measures to be implemented in response to a trigger exceedance to prevent impacts to groundwater values during construction. The monitoring plan must be developed in consultation with EPA Tasmania and be documented in a groundwater management plan as part of the CEMP.

Measure ID	Mitigation and management measures	Project Stage
GWMM06	**Develop and implement an operational groundwater management plan to detect and minimise potential contamination impacts during the project's operation.**	Operation

The operational groundwater monitoring plan developed under GWMM06 should include an initial review of the adequacy of the available groundwater monitoring network remaining at the end of construction to monitor and validate the effectiveness of mitigation measures to detect and respond to project-related groundwater contamination that may occur during operation. It should recognise the potential requirement new wells to be installed that are suitable to detect groundwater contamination from project operational activities. It should include groundwater quality and level triggers and actions to be taken in response to a trigger exceedance to prevent impacts to groundwater values during construction and operation. The plan should include ongoing groundwater monitoring requirements and verification of groundwater level (and quality if relevant) recovery post-construction. The operational groundwater monitoring plan must be developed in consultation with EPA Tasmania and be documented in a groundwater management plan as part of the OEMP.

10. DATA GAPS

All major construction projects progress through increasing levels of design certainty prior to construction commencing. It is common for data gaps or some uncertainty to exist at the time when an EIS is prepared so long as those gaps would not materially affect the conclusions of the assessment.

In many cases, mitigation and management measures are proposed to ensure that the design process resolves data gaps and continues to minimise uncertainty.

The following data gaps are recognised. They are not considered to be uncommon for a project of this type, they are commensurate with the level of risk posed by the project to the groundwater environment, and they are consistent with the level of information required to provide a robust EIS:

- Site specific groundwater investigations have residual data gaps and uncertainty relating to groundwater quality, levels, and aquifer hydraulic properties. Specifically, limited information is available on the shallow aquifer that may be encountered during construction.
- Limited information is available on construction dewatering requirements, including the duration and volumes of dewatering that may be required, and the effect that unmitigated dewatering would have on surrounding groundwater levels and quality within the aquifers.

Uncertainty has been addressed by adopting conservative assumptions (such as groundwater drawdown extending to the coastline) which minimises the effect of this uncertainty on the impact assessment. The assessment has been provided in the assumption that further hydrogeological investigations are required to address these data gaps prior to construction and to inform detailed design (GWMM01).

11. CONCLUSION

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 Bass Strait to Waratah Bay in Victoria.

A desktop hydrogeological assessment has been completed drawing on publicly available spatial information on ground surface elevation, the inferred average water table elevation, surface geological conditions and groundwater quality. These inputs, together with information on GDEs and groundwater users has support and assessment of the potential impacts of the project's construction and operation on groundwater receptors. No potential impacts to groundwater were considered for the decommissioning phase as the project has not identified the need for subsurface work with the decommissioning approach assumed to be to leave subsurface infrastructure in place.

A significance assessment approach has been applied which identified mostly negligible and minor magnitude of potential impacts, equating to an overall low impact.

The following potential activities were assessed to have raised initial moderate to major magnitude of impacts, which corresponds to an overall moderate un-mitigated impacts on groundwater values and were considered further:

- Mobilisation of existing groundwater contamination towards the project's dewatering activities.
- Release of contaminated groundwater generated during dewatering to the environment.
- Saline groundwater intrusion due to temporary groundwater level drawdown.
- Groundwater acidification due to temporary groundwater level drawdown.
- Groundwater contamination from operational activities including leaks of hazardous chemicals (e.g., transformer oil, lead acid batteries, and diesel fuel).

Mitigation and management measures were developed to reduce the significance of all potential impacts to low and meet legislative requirements under the GED. With the implementation of mitigation and management measures, including the requirement to complete further site investigation to address identified data gaps, the overall residual impact to groundwater would be low during construction and operation of the project.

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APPENDIX A : STATEMENT OF LIMITATIONS

IMPORTANT INFORMATION ABOUT YOUR TETRA TECH COFFEY ENVIRONMENTAL REPORT

Introduction

This report has been prepared by Tetra Tech Coffey for you, as Tetra Tech Coffey's client, in accordance with our agreed purpose, scope, schedule and budget.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice.

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Tetra Tech Coffey may have also relied on data and other information provided by you and other qualified individuals in preparing this report. Tetra Tech Coffey has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

Your report has been written for a specific purpose

Your report has been developed for a specific purpose as agreed by us and applies only to the site or area investigated. Unless otherwise stated in the report, this report cannot be applied to an adjacent site or area, nor can it be used when the nature of the specific purpose changes from that which we agreed.

For each purpose, a tailored approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible quantify, risks that both recognised and potential contamination pose in the context of the agreed purpose. Such risks may be financial (for example, clean up costs or constraints on site use) and/or physical (for example, potential health risks to users of the site or the general public).

Limitations of the Report

The work was conducted, and the report has been prepared, in response to an agreed purpose and scope, within time and budgetary constraints, and in reliance on certain data and information made available to Tetra Tech Coffey.

The analyses, evaluations, opinions and conclusions presented in this report are based on that purpose and scope, requirements, data or information, and they could change if such requirements or data are inaccurate or incomplete.

This report is valid as of the date of preparation. The condition of the site (including subsurface conditions) and extent or nature of contamination or other environmental hazards can change over time, as a result of either natural processes or human influence. Tetra Tech Coffey should be kept appraised of any such events and should be consulted for further investigations if any changes are noted, particularly during construction activities where excavations often reveal subsurface conditions.

In addition, advancements in professional practice regarding contaminated land and changes in applicable statues and/or guidelines may affect the validity of this report. Consequently, the currency of conclusions and recommendations in this report should be verified if you propose to use this report more than 6 months after its date of issue.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the site.

Interpretation of factual data

Environmental site assessments identify actual conditions only at those points where samples are taken and on the date collected. Data derived from indirect field measurements, and sometimes other reports on the site, are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions.

Variations in soil and groundwater conditions may occur between test or sample locations and actual conditions may differ from those inferred to exist. No environmental assessment program, no matter how comprehensive, can reveal all subsurface details and anomalies. Similarly, no professional, no matter how well qualified, can reveal what is hidden by earth, rock or changed through time.

The actual interface between different materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions.

For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of a suitably qualified and experienced environmental consultant through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other unrecognised features encountered on site. Tetra Tech Coffey would be pleased to assist with any investigation or advice in such circumstances.

Recommendations in this report

This report assumes, in accordance with industry practice, that the site conditions recognised through discrete sampling are representative of actual conditions throughout the investigation area. Recommendations are based on the resulting interpretation.

Should further data be obtained that differs from the data on which the report recommendations are based (such as through excavation or other additional assessment), then the recommendations would need to be reviewed and may need to be revised.

Report for benefit of client

Unless otherwise agreed between us, the report has been prepared for your benefit and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendation and should make their own enquiries and obtain independent advice in relation to such matters.

Tetra Tech Coffey assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report.

To avoid misuse of the information presented in your report, we recommend that Tetra Tech Coffey be consulted before the report is provided to another party who may not be familiar with the background and the purpose of the report. In particular, an environmental disclosure report for a property vendor may not be suitable for satisfying the needs of that property’s purchaser. This report should not be applied for any purpose other than that stated in the report.

Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, a suitably qualified and experienced environmental consultant should be retained to explain the implications of the report to other professionals referring to the report and then review plans and specifications produced to see how other professionals have incorporated the report findings.

Given Tetra Tech Coffey prepared the report and has familiarity with the site, Tetra Tech Coffey is well placed to provide such assistance. If another party is engaged to interpret the recommendations of the report, there is a risk that the contents of the report may be misinterpreted and Tetra Tech Coffey disowns any responsibility for such misinterpretation.

Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists or engineers based on their interpretation of field logs, field testing and laboratory evaluation of samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

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Responsibility

Environmental reporting relies on interpretation of factual information using professional judgement and opinion and has a level of uncertainty attached to it, which is much less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. As noted earlier, the recommendations and findings set out in this report should only be regarded as interpretive and should not be taken as accurate and complete information about all environmental media at all depths and locations across the site.