

APPENDIX F

Coastal Environment

F-1 Coastal Processes Impact Assessment

NORTHERN
WATER PROJECT





NORTHERN WATER PROJECT

Department for Infrastructure and Transport

Coastal Processes Assessment

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Northern Water Project – Coastal Processes Impact Assessment

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Executive Summary

The Northern Water Project (the Project) aims to provide a secure climate resilient water source for industry in South Australia's Upper Spencer Gulf and Far North. Delivery of the Project will involve the construction and operation of a 51 giganlitre per year (GL/year) seawater reverse osmosis desalination plant located at Mullaquana Station on the Upper Spencer Gulf, and associated water transfer system (including pipelines, transfer pump stations, product water storages) and electricity infrastructure.

Jacobs, in partnership with JBS&G, are currently undertaking the Environmental Impact Statement (EIS) for the Project. To inform the EIS, Jacobs have undertaken a coastal processes impact assessment for the proposed marine works (i.e. seawater intake and outfall). The coastal processes assessment included a desktop review of the existing marine environment, including metocean conditions, seafloor characterisation and sediment transport in the vicinity of the proposed development. Findings from this review were used to undertake a qualitative coastal processes impact assessment for the proposed construction and permanent works.

The assessment has been based on the Reference Design option in which the tunnels for the intake and outfall will be constructed using a Tunnel Boring Machine (TBM). The tunnels extend from the onshore entry point, approximately 400 m inland from mean high water mark, to the offshore intake and outfall sites located in approximately 13 to 17 m water depth relative to the Lowest Astronomical Tide (LAT), respectively. An alternative option has also been identified, comprising a single tunnel extending to the intake location and continuing offshore via approximately 1,000 m of additional outlet conduit founded on the seabed and likely installed using a float and sink method.

During construction, the seafloor will remain largely unchanged with the proposed tunnelling construction method, with the exception of limited ground replacement (3,000 m³ of spoil) and offshore construction works associated with the intake and outfall structures (e.g. drilling of the risers). Impacts from construction of the offshore intake and outfall structures on coastal processes are anticipated to be minor and localised (e.g. deflection of currents around the structures and construction equipment).

Any construction spoil or wastewater produced by the offshore construction works or TBM is proposed to be transported to the Mullaquana Station desalination plant site where it will be managed via retention and sedimentation basins. Additional turbidity curtains are proposed to control the spread of suspended sediments during offshore dredging and drilling activities, limiting the impacts of the offshore works on the marine water quality. Daily turbidity grab samples are also proposed to monitor the increase in sediment turbidity and ensure Environment Protection Authority (EPA) requirements are met. Accordingly, no impacts on coastal processes are expected from construction spoil or wastewater.

For the Reference Design, results from the assessment indicate operation of the Project will have minimal impacts on coastal processes. This is primarily due to there being no permanent infrastructure in the nearshore active coastal zone based on the proposed tunnelled construction approach and location of the offshore intake and outfall sites, which are located in relatively deep water where sediment transport is negligible. The Reference Design indicates that the offshore intake and outfall infrastructure will have a limited footprint (width < 12 m) and height (< 6 m) above the seabed relative to the water depth at the site (13 to 17 m below LAT). Hence operational impacts associated with the structures will be localised and minor (e.g. localised scour/accretion around the structure). Impacts on farfield coastal processes and sediment transport are anticipated to be negligible.

The Project is therefore considered to be of low risk to impact the coastal processes when progressed with the Reference Design, with potential impacts able to be managed through the implementation of appropriate management plans (including the Construction Environmental Management Plan and the Operational Environmental Management Plan).

Should the alternative single tunnel with submarine conduit option be progressed, coastal process impacts may differ as the conduit will be founded on the seafloor. However, based on the information available

impacts on coastal processes are expected to be negligible. Although the conduit would extend for up to approximately 1 km offshore, its low profile and limited footprint are not expected to significantly influence wave climate or local hydrodynamics. Furthermore, as the conduit would be located below the depth of closure, it is not expected to affect wave-driven sediment transport processes. Consequently, no measurable changes to sediment transport pathways, shoreline morphology, or broader coastal processes are anticipated.

At present, assessment of the alternative case option is constrained by limited design and construction information (e.g. conduit trajectory, collar dimensions and the extent of required scour protection). Accordingly, the long-term coastal impacts, especially on the seabed and environmental values, should be revised if this option is pursued and once further design details become available.

Contents

Executive Summary.....	iv
Acronyms and abbreviations.....	viii
1. Introduction.....	9
1.1 Background.....	9
1.2 Objective	9
1.3 Methodology.....	9
1.4 Relevant legislation and policies	10
2. Proposed Project	11
2.1 Project Location	11
2.2 Key Project Components.....	11
2.3 Study Area Definition.....	12
3. Proposed Marine Works.....	14
3.1 Overview.....	14
3.2 Desalination Plant Intake Pipe	15
3.3 Desalination Plant Outfall Pipe.....	17
3.4 Construction Spoil and Water Management	20
3.5 Alternative Construction Methods.....	20
4. Existing Environment.....	22
4.1 Bathymetry	22
4.2 Coastline	23
4.3 Seafloor characteristics.....	24
4.4 Physical processes	26
5. Assessment.....	38
5.1 Construction works	38
5.2 Operational infrastructure	40
6. Mitigation.....	43
7. Conclusion	44
8. References	45

Tables

Table 4-1 D ₅₀ per sample location (based on data collected by JBS&G, 2025).....	26
Table 4-2. Tide levels at Whyalla (Australian Hydrographic Office AHP11, 2025) as per GHD (2025b).....	27
Table 4-3 Design wave conditions (GHD, 2025b).....	35

Figures

Figure 2-1 Northern Water Project alignment.....	13
Figure 3-1 Preliminary layout desalination plant and proposed TBM decline and launch box (Based on Reference Design drawing NW-DIT-BAS-1000-CIV-DRG-1001).	15
Figure 3-2 Example of a typical intake section (source: Reference Design drawing NW-DIT-BAS-1000-CIV-DRG-1101).	17
Figure 3-3 Example of a typical outfall section (source: Reference Design drawing NW-DIT-BAS-1000-CIV-DRG-1104)	19
Figure 3-4 Example of riser and multiport array arrangement (as per Reference Design)	20
Figure 3-5 Conceptual layout single tunnel (source: GHD 2025c)	21
Figure 4-1 Spencer Gulf bathymetry relative to MSL (Lat/Lon) (SARDI, 2024)	22
Figure 4-2 Bathymetry map with proposed intake and outfall structures (Data source: MES, 2025)	23
Figure 4-3 Coastline near the project site showing a sandy shore and typical coastal vegetation (mangroves) (Photos by JBS&G, August 2025).	24
Figure 4-4 Proposed desalination plant marine infrastructure and potential seabed disturbance area (marine Project footprint) showing habitat classification across the site (JBS&G, 2026).	25
Figure 4-5. Site photographs of mangrove habitats (COOE, 2025).	25
Figure 4-6 Sediment classification: Proportion of silt, sand and gravel per sample location (Data adopted from JBS&G, 2025).....	26
Figure 4-7 Wind rose for hourly averaged wind speeds at Spencer Gulf based on Centre for Australian Climate and Weather Research (CACWR) dataset from 1979 to 2023.	27
Figure 4-8 Locations of two ADCP deployment sites (SAMUSG and NWP3) for the 2023-2024 measurement campaign in Spencer Gulf, South Australia.....	28
Figure 4-9 Measured depth averaged current speed from November 2022 to May 2023 for ADCP NWP3 (Watertech 2025).	29
Figure 4-10 Current rose for depth averaged currents measured at ADCP mooring location NWP3 (Watertech, 2025).....	29
Figure 4-11 Current rose for depth averaged currents measured at ADCP mooring location SAMUSG (Watertech, 2025).....	30
Figure 4-12 Current speed for typical spring flood tide based on NWP hydrodynamic model (Watertech, 2025).....	31
Figure 4-13 Current speed for typical spring ebb tide based on NWP hydrodynamic model (Watertech, 2025)	31
Figure 4-14 Current speed for typical neap flood tide based on NWP hydrodynamic model (Watertech, 2025)	32
Figure 4-15 Current speed for typical neap ebb tide based on NWP hydrodynamic model (Watertech, 2025)	32
Figure 4-16 Wave rose based on recordings from NWP3 (left) and SAMUSG (right)	33
Figure 4-17 NWP3 ADCP measured significant wave height and peak period from October 2022 to May 2023 (SARDI, 2025).....	34
Figure 4-18 SAMUSG ADCP measured significant wave height, peak period and mean wave direction from February 2022 to May 2025 (SARDI, 2025)	34
Figure 4-19 Jacobs model extraction locations.....	36

Acronyms and abbreviations

ADCP	Acoustic Doppler Current Profiler
AHD	Australian Height Datum
ARI	Average Recurrence Interval
CAWCR	Centre for Australian Climate and Weather Research
CD	Chart Datum
CSIRO	Commonwealth Scientific and Industrial Research Organisation
D ₅₀	Median Diameter
DIT	Department for Infrastructure and Transport
ECMWF	The European Centre for Medium-Range Weather Forecasts
EIS	Environmental Impact Statement
EPA	Environment Protection Authority
GL	Gigalitres
H _s	Significant wave height
HAT	Highest Astronomical Tide
LAT	Lowest Astronomical Tide
MHHW	Mean Higher High Water
MHLW	Mean Higher Low Water
MLHW	Mean Lower High Water
MLLW	Mean Lower Low Water
ML/d	Megalitres per day
MSL	Mean Sea Level
NWP	Northern Water Project
SBP	Single Beam Profiler
TBM	Tunnel Boring Machine
° TN	Degrees True North
T _p	Peak wave period

1. Introduction

1.1 Background

The Northern Water Project (the Project) aims to provide a secure climate resilient water source for industry in South Australia's Upper Spencer Gulf and Far North. Delivery of the Project will involve the construction and operation of a 51 gigalitre per year (GL/year) seawater reverse osmosis desalination plant located at Mullaquana Station on the Upper Spencer Gulf, and associated water transfer system (including pipelines, transfer pump stations, product water storages) and electricity infrastructure.

JBS&G Australia Pty Ltd (JBS&G) and Jacobs Group (Australia) Pty Ltd (Jacobs) have been engaged by the Department for Infrastructure and Transport (DIT) to prepare and deliver the primary environmental assessments and approvals for all marine and terrestrial works to support the Project.

This technical report documents the coastal processes impact assessment undertaken by Jacobs to support preparation of the Environmental Impact Statement (EIS).

1.2 Objective

The objective of this study is to undertake a desktop assessment of the coastal processes at the proposed site location, and subsequently assess the potential impact of the proposed intake and outfall infrastructure on the prevailing coastal processes. Results from this assessment will inform the EIS to be prepared for the Project.

1.3 Methodology

The coastal processes assessment documented in this report is based on review of existing information. Key tasks undertaken as part of the assessment include:

- Review of the proposed extents and configuration of the proposed intake and outfall infrastructure, as well as the proposed construction approach (refer to Section 3).
- Collation and review of available information on the existing marine environment, including metocean conditions, seafloor characterisation and coastal processes in the vicinity of the proposed development (refer to Section 4).
- Qualitative impact assessment of the proposed construction and permanent marine works on the coastal processes and sediment transport regime (refer to Section 5).
- Recommendations of mitigation measures (refer to Section 6).

This impact assessment considers two potential construction methodologies:

- 1) The current engineering Reference Design in which the tunnels for the intake and outfall will be constructed using a Tunnel Boring Machine (TBM);
- 2) Alternative design comprising a single tunnel with the outfall pipeline constructed within the intake tunnel. From beyond the intake location, up to 1,000 m of additional outlet conduit will be placed on the sea floor to the outfall manifold using a float and sink method.

The coastal processes impact assessment is based on a desktop review of available information. Various site-specific investigations have been used to inform this assessment, including Acoustic Doppler Current Profiler (ADCP) measurement campaigns by SARDI (2023, 2024) and marine geophysical and hydrographic surveys by Marine and Earth Sciences Pty Ltd (MES) (2025). To support the Project, a dedicated hydrodynamic model was developed by Watertech (2025) and integrated into this assessment. Where relevant, data from GHD's

(2025a) Extreme Wave Conditions report has also been considered, together with numerical wave modelling data obtained by Jacobs for a previous (confidential) project. No project specific coastal processes impact modelling has been undertaken as part of this assessment.

1.4 Relevant legislation and policies

South Australian legislation and policies relevant to the coastal processes assessment includes the following:

- *Coast Protection Act, 1972*
- *Environment Protection Act, 1993*
- *Environment Protection (Water Quality) Policy, 2015*
- *Planning, Development and Infrastructure Act, 2016.*

2. Proposed Project

2.1 Project Location

The proposed desalination plant location is on the western shore of Spencer Gulf at Mullaquana Station, approximately 25 km south-west of Whyalla. The water delivery pipeline runs north from the desalination plant to Olympic Dam passing Whyalla, Port Augusta, Woomera and Roxby Downs.

2.2 Key Project Components

The Project comprises the following key elements:

- a 51 gigalitre (GL)/year seawater reverse osmosis desalination plant located at Mullaquana Station approximately 25 km south-west of Whyalla
- marine intake and outfall tunnels extending underneath the seabed and into Spencer Gulf
- Intake structure to collect seawater from the Spencer Gulf
- Outfall diffuser structures for discharge of return water into Spencer Gulf
- a transfer system consisting of:
 - o a ~360 km main transfer pipeline, largely constructed underground terminating at the delivery point at the Olympic Dam copper-gold mine
 - o a ~46 km lateral branch to a delivery point at the Carrapateena copper-gold mine (which may be constructed above or below ground)
 - o associated transfer pump stations and product water storage
- high voltage electricity supply including new transmission and distribution lines and new network and facility substations to provide power to the desalination plant and transfer pump stations
- associated temporary construction-related infrastructure (e.g. construction camps, site offices and amenities, yards, storages and laydown areas)
- access tracks including establishing new tracks and upgrading existing tracks
- enabling roadworks and road upgrades

Key project components related to the coastal processes assessment include the following elements of the desalination plant:

- Reference Design:
 - o Intake pipe / tunnel (3.9 km from the intake pump station to 13 m water depth relative to LAT)
 - o Outfall pipe / tunnel (4.8 km outfall tunnel to 17 m water depth relative to LAT)
 - o Intake and outfall structures and intake pumping station.
- Alternative Construction Method (refer to Section 3.5)
 - o Combined intake and outfall pipe / tunnel (3.9 km from the pump station to 13 m water depth relative to LAT)
 - o Additional outfall pipe / tunnel (1 km of submarine conduit founded on the seafloor)

- o Intake and outfall structures and intake pumping station.

Additional details on the proposed marine works are outlined in Section 3. The Project is shown in full in Figure 2-1.

2.3 Study Area Definition

The coastal processes assessment has used the Project area definition (for approvals) as the basis for the study area, i.e. a 2.5 km buffer of the desalination plant footprint and either side of the centreline of linear infrastructure (i.e. a 5 km wide corridor). The Project area is used as a guide for the assessment of impacts and final location of infrastructure is expected to remain inside this corridor.

The coastal processes assessment focuses on the offshore marine environment surrounding the intake and outfall infrastructures, as well as the active coastal zone, which lies between the landward boundary (e.g. front dune) and the closure depth (depth at which wave action no longer significantly influences the seabed profile and sediment transport).

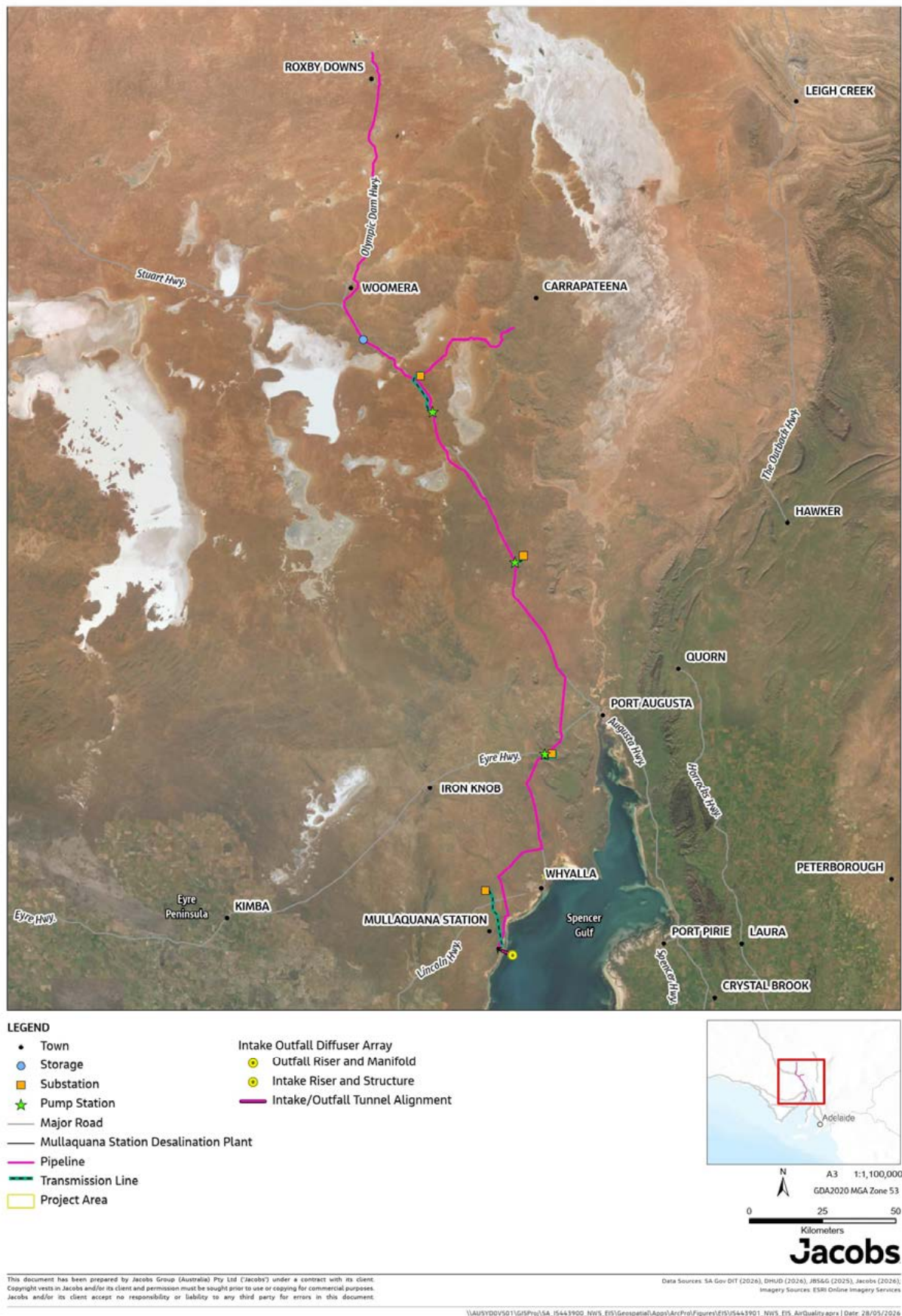


Figure 2-1 Northern Water Project alignment

3. Proposed Marine Works

3.1 Overview

A Reference Design (GHD 2025a) for the desalination plant and transfer system from Mullaquana Station to Olympic Dam has been completed for the Project. The Project design is preliminary and is expected to change through the detailed design process, or in response to cultural heritage matters or other refinements to minimise impacts as design and technical studies continue.

In accordance with the Reference Design drawing (NW-DIT-BAS-1000-CIV-DRG-1101 to 1104, June 2025) (GHD, 2025a), the seawater desalination plant will draw seawater through an intake tunnel connected to a singular intake structure, and discharge the return water back into Spencer Gulf through an outfall tunnel connected to a diffuser manifold, with eight diffuser nozzles at 12 m centres.

The onshore intake pumping station is located 400 m from the coast (**Figure 3-1**). It is connected by a tunnel of approximately 3,900 m to a singular offshore intake structure located on the seabed at a minimum distance of 13 m below LAT, with the top of the structure located approximately 7 m below LAT (GHD, 2025a).

The tunnel connecting the pumping station and outfall is approximately 4,800 m long and connected to a diffuser manifold located at a minimum water depth of 17 m below LAT. The height of the manifold structures above the seabed is approximately 3 m, with the eight discharge nozzles positioned approximately 14 m below LAT.

An alternative construction option has also been identified, comprising a single tunnel for both intake and outfall, extending to the intake location and continuing to the outfall manifold via approximately 1,000 m of additional outlet conduit founded on the seabed, likely installed using a float and sink method (refer to Section 3.5).

The intake and the outfall tunnels have a minimum cover of 9 m under the seafloor (based on preliminary geotechnical investigations). Relevant design details of the intake and outfall design are discussed in Section 3.2 and 3.3 respectively. Further design details and construction methodology can be found in the Reference Design Report (GHD, 2025a) and Reference Design overall constructability report (Systra, 2025).

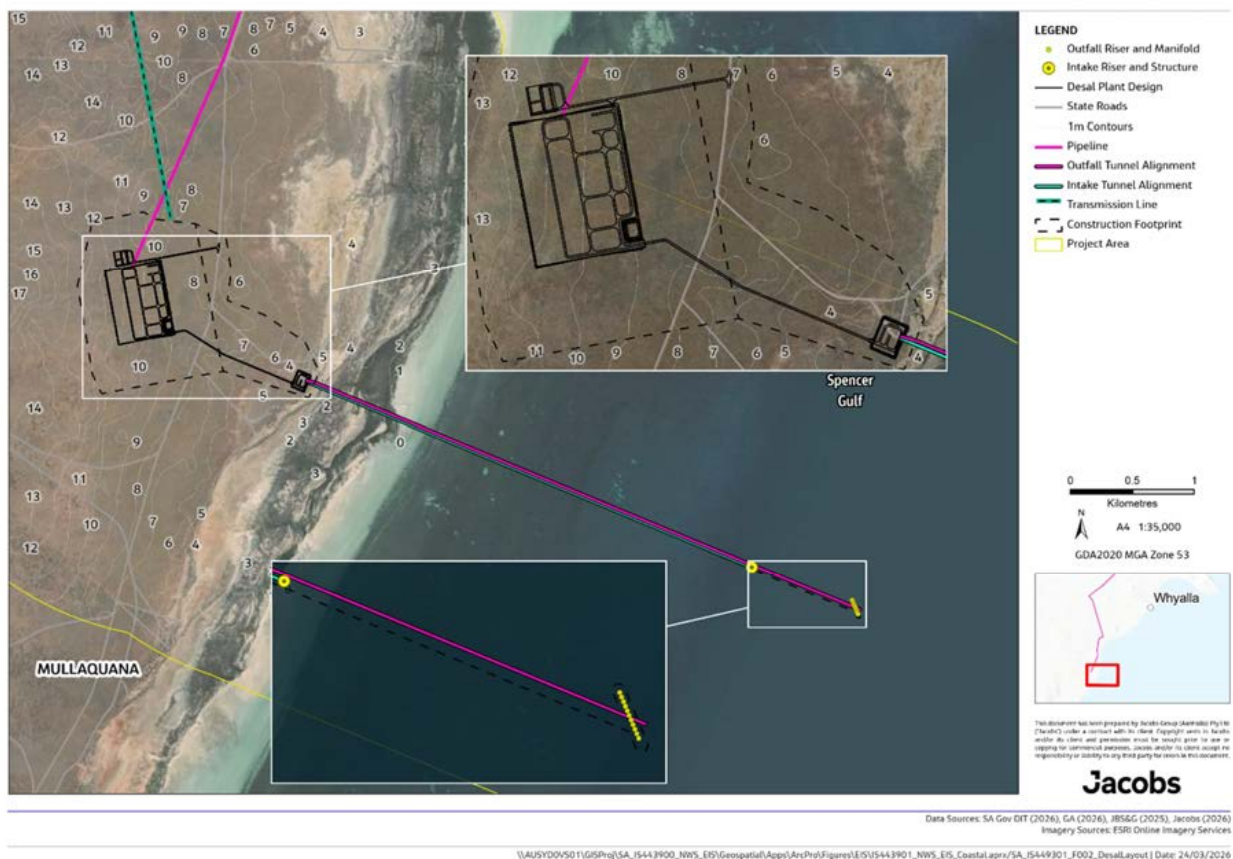


Figure 3-1 Preliminary layout desalination plant and proposed TBM decline and launch box (Based on Reference Design drawing NW-DIT-BAS-1000-CIV-DRG-1001).

3.2 Desalination Plant Intake Pipe

The intake structure is proposed to be located at a minimum water depth of 13 m relative to LAT, with the top of the structure located 7 m below LAT, to provide sufficient clearance from surface to reduce impact of navigation as well as storm wave loads (GHD, 2025a).

Key information related to the construction of the intake is as follows:

- Based on the Reference Design construction methodology, a TBM will be used to construct a 3,900 m concrete lined intake tunnel with an internal conduit diameter of 3.2 m.
- The tunnel has been extended from the Reference Design by 30 m to allow for the TBM to advance a sufficient distance past the riser connection enabling space for the machines to be stripped and a bulkhead built to facilitate grouting the shields.
- Construction of the riser installation will be completed before the tunnels approach the riser connection point. A jack-up barge will be employed to carry out ground replacement and improvement work at the riser location and to execute the installation of the permanent offshore intake structure.
- The ground replacement block concept consists of a number of overlapping low-strength concrete/cement stabilized sand columns of approximately 2m diameter, closely drilled to form a ring. The central portion of the block will be drilled out to allow installation and grouting of the riser assembly.

- Dredging and scour protection works will be undertaken, comprising the removal of seabed material using a grab dredge, with disposal assumed to be onshore..
- The intake structure will be connected to the tunnel via a riser which is pre-drilled to a depth below the tunnel invert level. The connection to the riser from the tunnel will be completed within the zone of ground replacement to mitigate risk of inundation of the tunnel with water-bearing substrate under pressure.
- Rock armour and scour protection details for the intake structure, including rock type and size, will be an outcome of the detailed design development and documented in the final design and plans.

A cross section of the intake Reference Design is shown in **Figure 3-2**. The structure comprises a precast concrete caisson, stainless steel intake grills and precast concrete cap. Key configurations of the Reference Design are as follows:

- Intake head diameter = 11.3 m.
- Height of intake screens = 2.5 m.
- Intake structural cap = 0.5 m.
- Clearance of bottom of screen to seabed = 3.0 m.
- Total height = approximately 6 m.
- Shallowest level of the seabed = -13.0 m LAT.

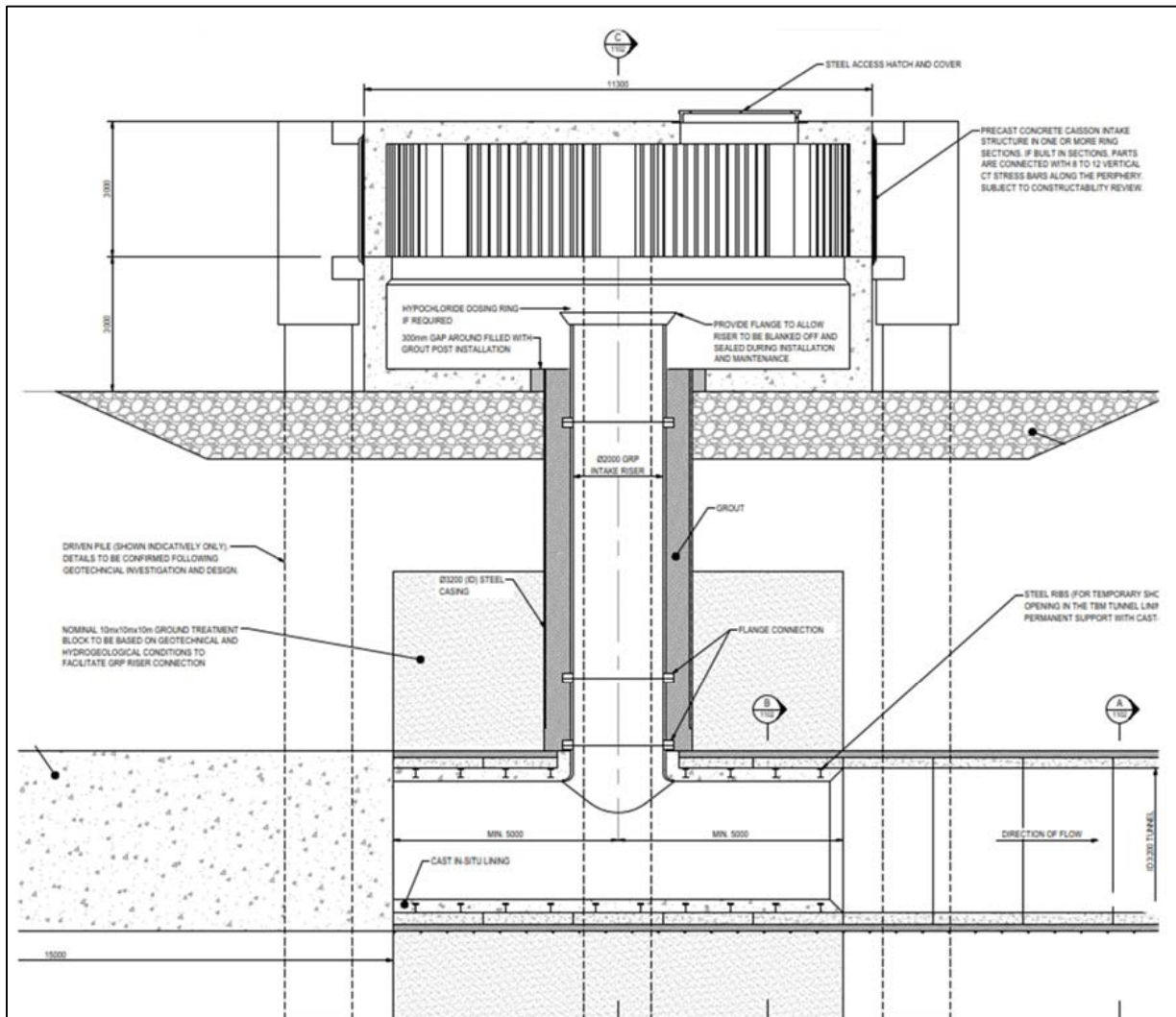


Figure 3-2 Example of a typical intake section (source: Reference Design drawing NW-DIT-BAS-1000-CIV-DRG-1101).

3.3 Desalination Plant Outfall Pipe

A diffuser manifold array was selected as the outlet structure for the Reference Design to achieve the targeted mixing requirements. The outfall manifold structure is proposed to be located at a minimum 17 m below LAT, with the top of the structure at 13 m below LAT, and at a distance from the mapped dense seagrass zone.

Key information related to the construction of the outfall is as follows:

- Based on the Reference Design methodology, a TBM will be used to construct a 4,800 m long concrete lined outfall tunnel with an internal conduit diameter of 3.2 m.
- The tunnel has been extended from the Reference Design by 30 m to allow for the TBM to advance a sufficient distance past the riser connection enabling space for the machines to be stripped and a bulkhead built to facilitate grouting the shields.
- Construction of the riser installation will be completed before the tunnels approach the riser connection point. A jack-up barge will be employed to carry out ground replacement and ground improvement work at the riser location and to execute the installation of the permanent offshore outfall structure.

- The ground replacement block concept consists of a number of overlapping low-strength concrete/cement stabilized sand columns of approximately 2m diameter, closely drilled to form a ring. The central portion of the block will be drilled out to allow installation and grouting in of the ground replacement riser assembly.
- Dredging and scour protection works will be undertaken, comprising the removal of seabed material using a grab dredge, with disposal of the spoil assumed to be onshore.
- The outfall structure, containing an outfall manifold, is connected to an intake riser, which is pre-drilled to a depth below the tunnel invert level. The outfall diffuser array will have 12 m spacing between driven support piles.
- Rock armour and scour protection details for the outfall structure, including rock type and size, will be an outcome of the detailed design development and documented in the final design and plans.

A cross section of the proposed outfall diffuser structure is shown in **Figure 3-3**. The foundation of the diffuser structure will comprise of rockfill placed into a 1.5 m deep trench. The configuration of the outlet manifold is shown in **Figure 3-4** and consists of the following:

- 8 x DN250 nozzles at 45 degrees.
- 12 m spacing between nozzles.
- 12 m spacing between driven support piles.
- Shallowest level of seabed = -17 m LAT.

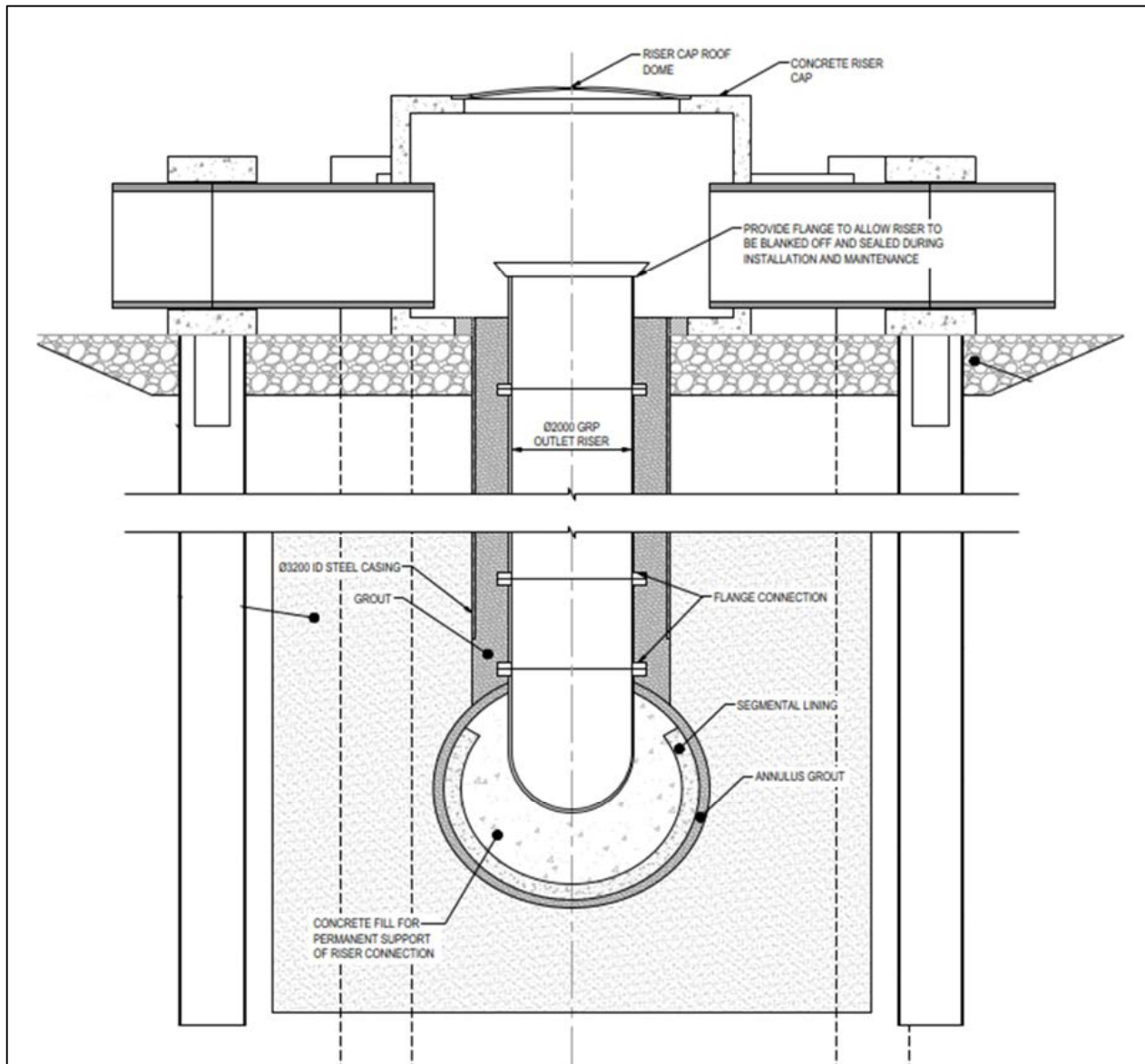


Figure 3-3 Example of a typical outfall section (source: Reference Design drawing NW-DIT-BAS-1000-CIV-DRG-1104)



Figure 3-4 Example of riser and multiport array arrangement (as per Reference Design)

3.4 Construction Spoil and Water Management

During construction, spoil and wastewater will be produced by the TBM and other excavation works (e.g. launch box and offshore marine works). The anticipated spoil and wastewater will be managed as far as is practicable via retention and sedimentation basins on site, so that marine discharge of water is avoided.

Offshore dredging for the Reference Design involves the removal of approximately 3,000 m³ of seabed material associated with jack-up barge operations at the intake and outfall structures, with all dredged material transported to shore for disposal or reuse. The potential for increased turbidity during offshore works will be managed using localised turbidity curtains around marine structures. These curtains will extend 10 m around the marine structure and will be anchored to the seabed using weights.

Any wastewater produced by the TBM or offshore works will enter the water treatment process culminating in testing, treating, retesting and pumping to evaporation ponds. Throughout the operation, continuous monitoring of water quality is maintained to ensure compliance and minimise any adverse environmental impact arising from the tunnelling project. Construction methodology is set out in the Reference Design Overall Constructability Report (Systra, 2025).

3.5 Alternative Construction Methods

An alternative marine intake and outfall construction methodology is to construct one tunnel, rather than two (GHD, 2025b). If this option proves to be feasible and offers a benefit to the Project, the arrangement is likely to remove the need for a separate outlet tunnel (approximately 4,800 m in length based on the Reference Design (GHD, 2025a)).

The single tunnel option comprises an outfall pipeline within the intake tunnel (refer to **Figure 3-5**). It is anticipated that from beyond the intake location, up to 1,000 m of additional outlet conduit will need to be founded on the sea floor to the diffuser array. This submarine outlet pipe, with an internal diameter of 2 m, will be placed on the sea floor using the float and sink method. This method involves floating the pipeline into position after tunnelling reaches a suitable depth, then lowered and secured to the seabed using piled collars.

At this stage, information provided for this alternative is limited. Associated spoil and water management will likely be similar to the two tunnel option. However, further assessment of this alternative will be required should additional information on construction and design (e.g. scour protection measures) become available.

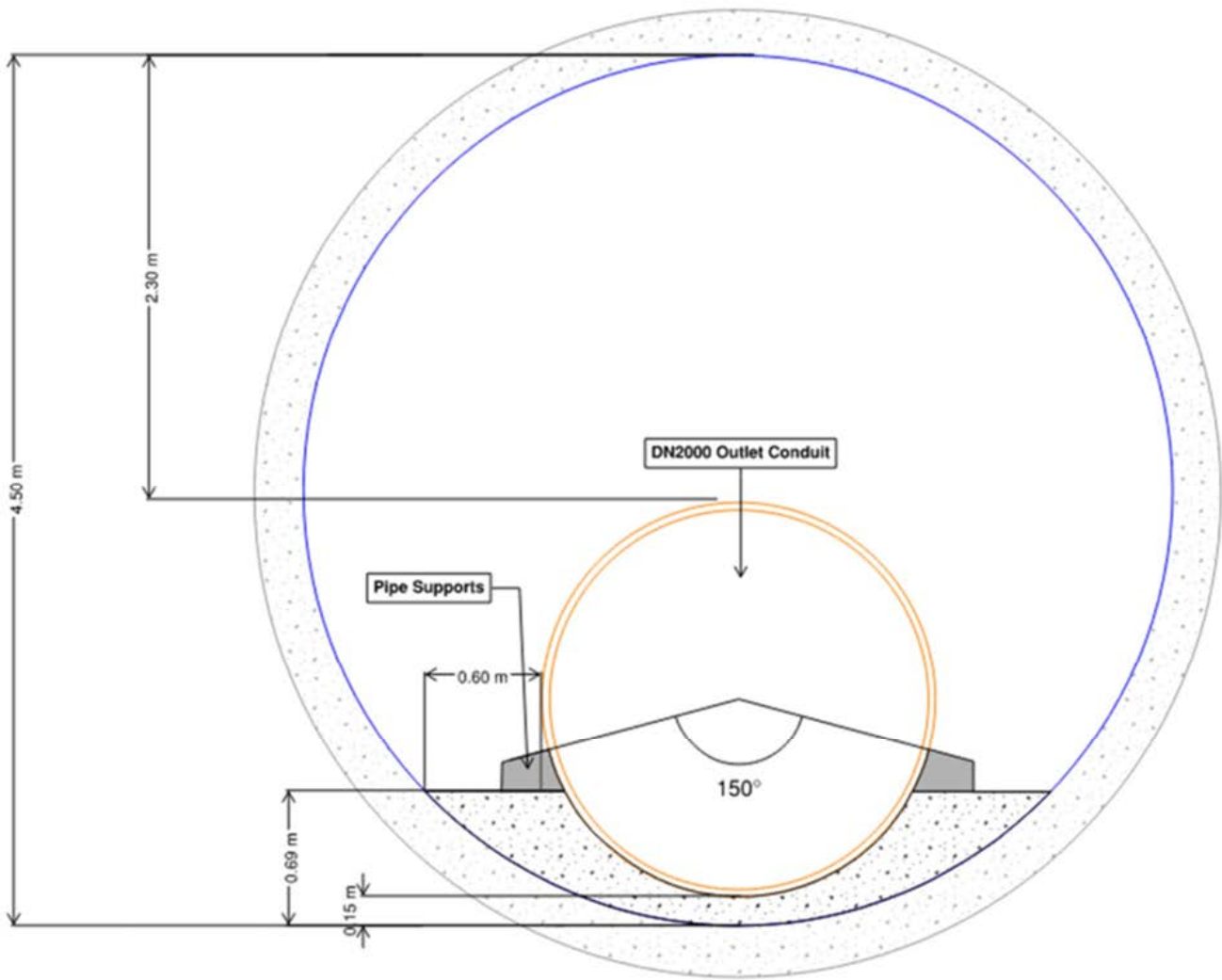


Figure 3-5 Conceptual layout single tunnel (source: GHD 2025c)

4. Existing Environment

This section provides an overview of the existing environment adjacent Mullaquana Station Project area.

4.1 Bathymetry

Spencer Gulf is a semi-enclosed body of water bordered by the Yorke Peninsula to the east and the Eyre Peninsula to the west. The Gulf extends for approximately 300 km from Port Augusta in the north to the entrance in the south, with a maximum width of 130 km, narrowing to less than 1 km in the upper Gulf (refer to **Figure 4-1**). Spencer Gulf is a relatively shallow body of water, with a typical depth of 40 m in the lower Gulf and 15 m to 20 m in the northern reaches (Bullock, 1975).

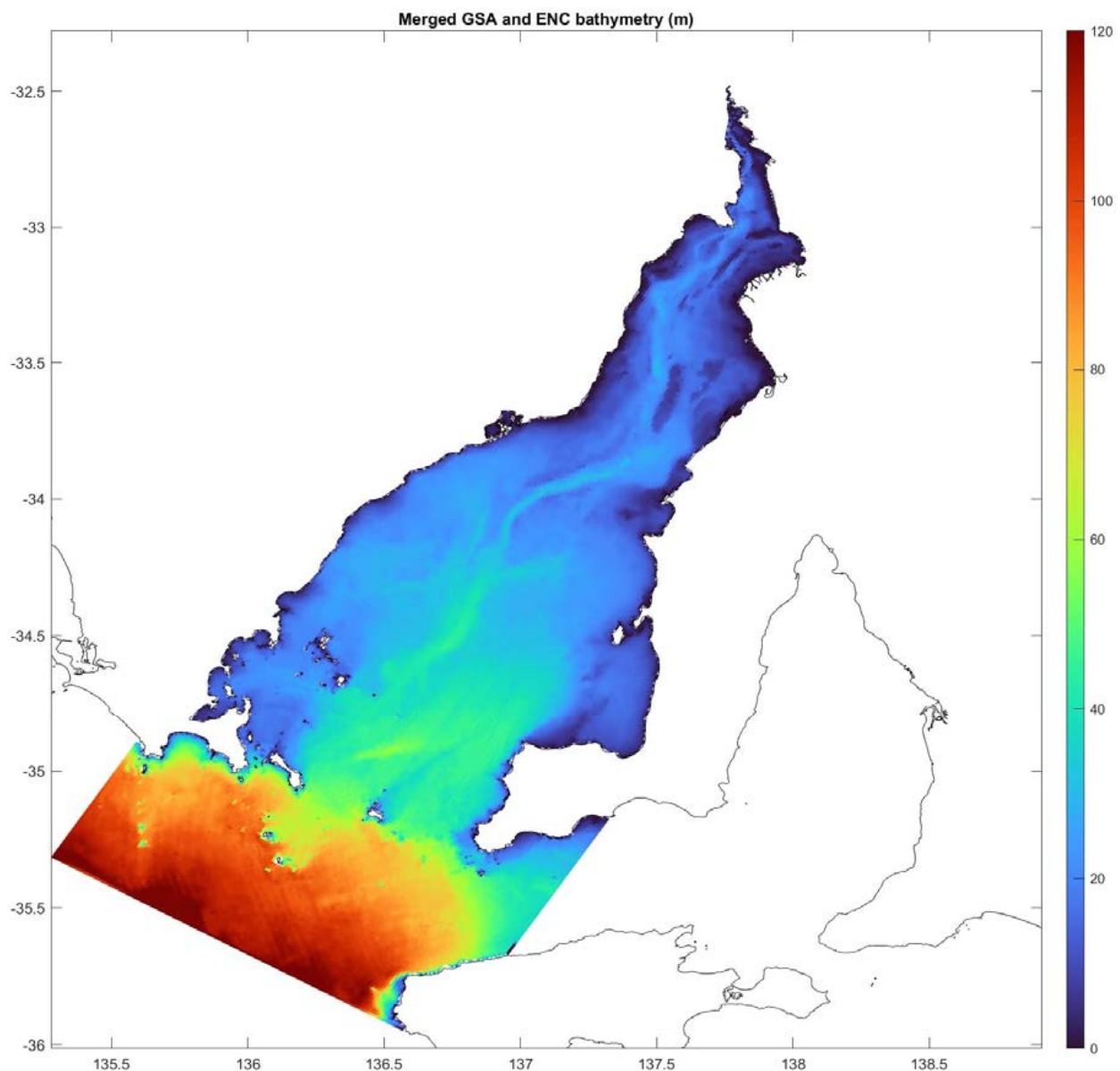


Figure 4-1 Spencer Gulf bathymetry relative to MSL (Lat/Lon) (SARDI, 2024)

As part of the investigations for the Northern Water Project, MES was commissioned by Maritime Constructions to conduct a marine geophysical survey near the proposed desalination plant (MES, 2025). Data acquisition was completed over multiple mobilisations due to weather restrictions from March to April 2025. An Applied Acoustics boomer system was used to acquire Single Beam Profiler (SBP) data for mapping geological layers across the study area (**Figure 4-2**). Survey data indicates a relative shallow foreshore with the 15 m depth contour generally around 3 km from the shore (at LAT).

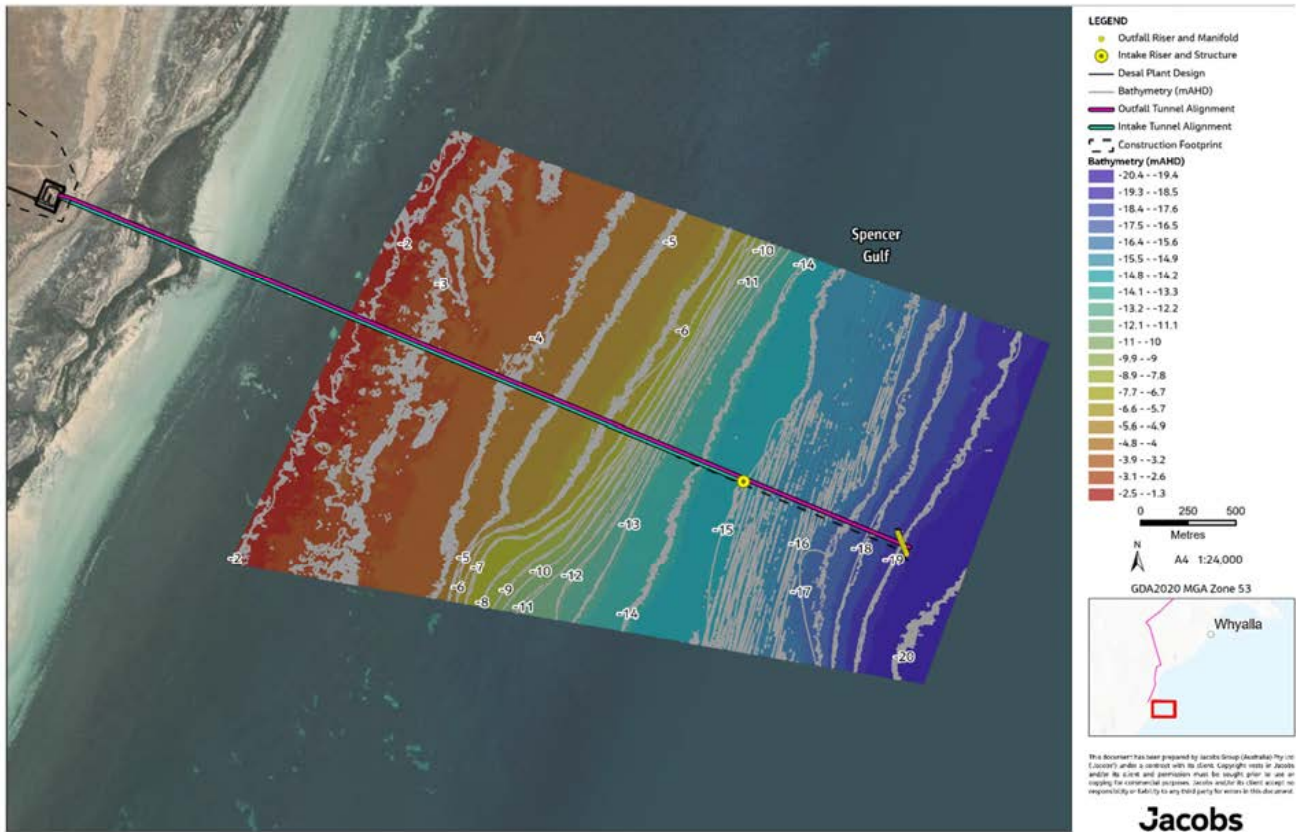


Figure 4-2 Bathymetry map with proposed intake and outfall structures (Data source: MES, 2025)

4.2 Coastline

The coastal zone comprises a low coastal plain which is almost entirely mid-tide level and subject to tidal inundation. Beach ridges appear as small sand spits, suggesting sediment drift from the south, with continued onshore accretion. This accretionary coastline is built during the Holocene and comprises marine sands, and terrestrial clays and silt (Caton, B. et al., 2019).

The area comprises largely saltmarsh, with frequent beach ridges and cheniers. These ridges are frequently cut by short tidal channels (Caton, B. et al., 2019). The shore is typically covered with mangroves behind extensive low-tide sand and inter-tidal seagrass (refer to **Figure 4-3**).



Figure 4-3 Coastline near the project site showing a sandy shore and typical coastal vegetation (mangroves) (Photos by JBS&G, August 2025).

4.3 Seafloor characteristics

4.3.1 Benthic habitats and flora

Benthic habitats at the site are generally sandy and flat with mangroves (Figure 4-5) and tidal flats in the intertidal zone, and extensive seagrass beds to approximately 16 m. Habitat mapping has been undertaken for the Project marine study area and is shown in Figure 4-4. Seagrass habitats within the marine study area vary along a depth gradient with *Posidonia* seagrasses dominating the subtidal area to 13 m where the seagrass then transitions to seasonally driven cover of *Zostera* sp. out to approximately 16 m depth. Beyond the seagrass, bare sand dominates with interspersed bryozoans, algae and other invertebrates. The benthic habitats and flora are described in the Marine Ecology Impact Assessment Report (an Appendix to the EIS), and in the Marine Environment Chapter of the EIS.

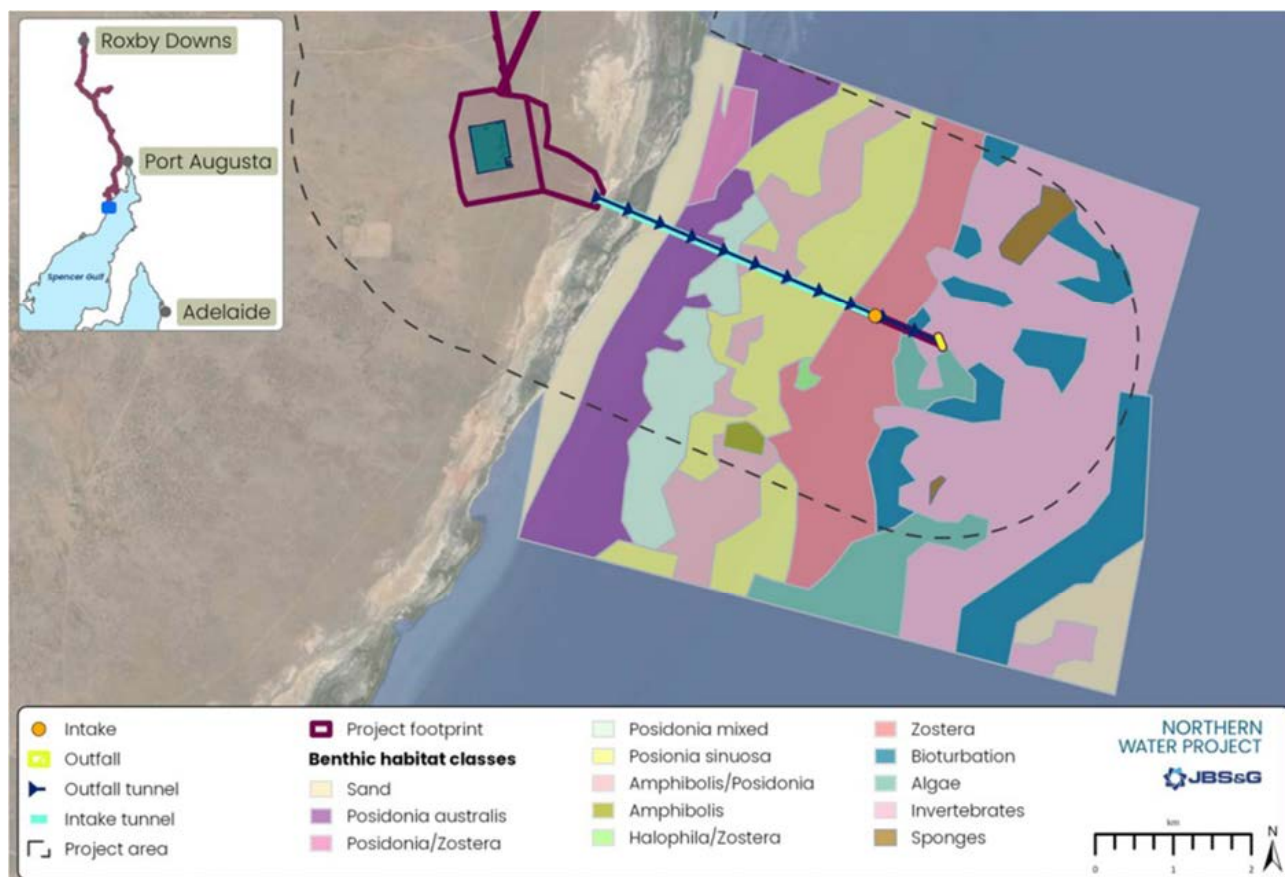


Figure 4-4 Proposed desalination plant marine infrastructure and potential seabed disturbance area (marine Project footprint) showing habitat classification across the site (JBS&G, 2026).



Figure 4-5. Site photographs of mangrove habitats (COOE, 2025)

4.3.2 Sediment characteristics

In support of the EIS studies, a limited baseline in-situ sediment characterisation program was undertaken by JBS&G in October 2025 to assess sediment quality near the proposed offshore intake and outfall structures. Sediment cores were obtained at six locations to a maximum depth of 0.5 m (or prior refusal) using a sediment coring tube manually driven into the sediments by a dive team with the aid of a mallet (JBS&G, 2025). The median diameter (D_{50}) of each of the samples is summarised in **Table 4-1**, and the proportions of silt ($<63 \mu\text{m}$), sand and gravel ($>2 \text{ mm}$) at each location are shown in **Figure 4-6**.

The sediment particle sizes across the site ranged from a minimum D_{50} of 124.9 μm (very fine sand) at sample location SI3, to a maximum D_{50} of 559.6 μm (medium sand) at location Z03, the location closest to the coast (**Figure 4-6**). Higher proportions of gravel were found at the sample locations close to the shore, ranging from 10% to 20% between sample locations Z03 and Z04. Silt fractions varied between 10% to 35%, with the highest silt fraction found at sample location SB3, closest to the proposed intake and outfall.

Table 4-1 D_{50} per sample location (based on data collected by JBS&G, 2025)

Parameter	SB4	SB3	SI4	SI3	Z03	Z04
D_{50} (μm)	179.5	154.4	146.6	124.9	559.6	398.9



Figure 4-6 Sediment classification: Proportion of silt, sand and gravel per sample location (Data adopted from JBS&G, 2025)

4.4 Physical processes

4.4.1 Tidal levels

The water levels at Mullaquana Station are primarily driven by the astronomical tides. These tides are predominantly semi-diurnal with two high and low tides each day. There is also a marginal diurnal component during the neap cycles ('dodge tide'). As Mullaquana Station lies high up the Gulf, it is subject to increased tidal amplitude, especially during major storms, which can raise tides 1.0 to 1.5 m above predicted heights (Harvey and Caton, 2010; Jacobs, 2014).

GHD (2025b) reported tidal levels based on the Whyalla tide gauge (Station ID 61840), which are summarised in **Table 4-2**. The typical tidal range is around 3 m.

Table 4-2. Tide levels at Whyalla (Australian Hydrographic Office AHP11, 2025) as per GHD (2025b)

Tidal level	Acronym	Water Level (m)		
		CD	MSL	AHD
Highest Astronomical Tide	HAT	3.3	1.65	1.53
Mean Higher High Water	MHHW	2.8	1.15	1.03
Mean Lower High Water	MLHW	1.9	0.25	0.13
Mean Sea Level	MSL	1.65	0	-0.12
Mean Higher Low Water	MHLW	1.4	-0.25	-0.37
Mean Lower Low Water	MLLS	0.5	-1.15	-1.27
Lowest Astronomical Tide	LAT	0	-1.65	-1.77

4.4.2 Wind

The wind rose of long-term reanalysis wind speed and directional data extracted in Spencer Gulf, at a location 50 km to the south-east of the Project site at Mullaquana Station, is shown in **Figure 4-7**. The dataset indicates that winds predominantly occur from the southerly quadrants, with the majority of wind events being less than 20 metres per second (m/s). Furthermore, winds from the westerly quadrants tend to be stronger when compared to winds originating from the easterly quadrants.

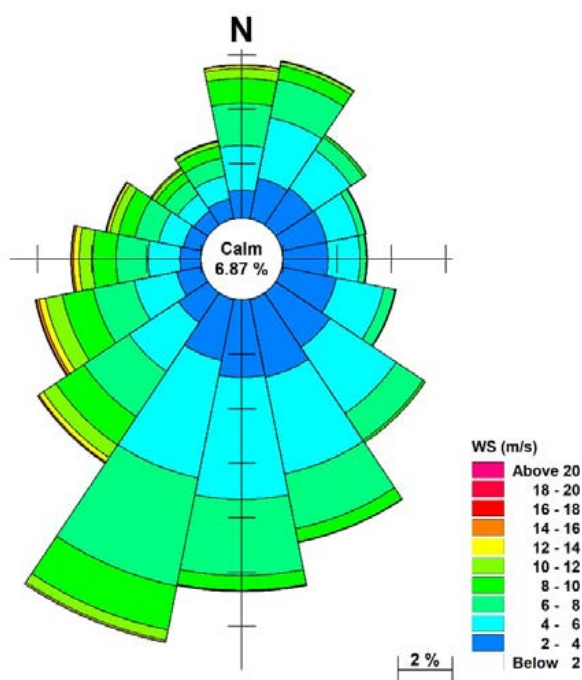


Figure 4-7 Wind rose for hourly averaged wind speeds at Spencer Gulf based on Centre for Australian Climate and Weather Research (CACWR) dataset from 1979 to 2023.

4.4.3 Hydrodynamics

Tidal, thermohaline (flow of ocean water caused by changes in temperature, or the addition of fresh water or salt), wind, and wave-driven currents play a major role in Spencer Gulf's circulation with diffusion in the upper Gulf driving water mixing rather than turbulence (Middleton et al., 2013).

Thermohaline currents are the result of density variations caused by evaporation over the Spencer Gulf region and subsequent temperature and salinity differences. During the summer, the upper regions of the Gulf become highly saline due to evaporation. This highly saline water exits the Gulf along the seafloor, giving way to less saline (less dense) water flowing along the surface, resulting in a net flow of saline water out of the Gulf (Alendal et al. 1994; Middleton et al. 2013).

To inform the Project, ADCP measurements were undertaken by SARDI between June 2023 and March 2024 at two locations near the proposed intake and outfall infrastructure locations at NWP3 station (~2.7 km offshore of the outfall) and SAMUSG (approximately 31.5 km NE of the outfall) (refer to **Figure 4-8**).

Figure 4-9 shows the depth averaged current speed timeseries and **Figure 4-10** and **Figure 4-11** displays the current roses for the measured depth averaged current speed at ADCP locations NWP3 and SAMUSG respectively. Typical current speeds range between 0.05 to 0.4 m/s at ADCP NWP3 and between 0.05 and 0.6m/s at ADCP SAMUSG. The current direction at both ADCPs is found to be predominantly parallel to the shoreline.



Figure 4-8 Locations of two ADCP deployment sites (SAMUSG and NWP3) for the 2023-2024 measurement campaign in Spencer Gulf, South Australia.

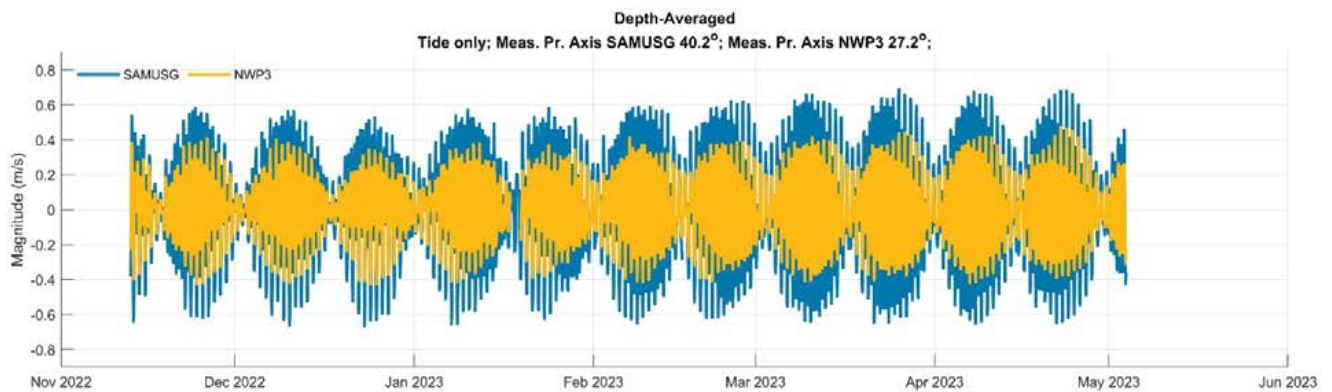


Figure 4-9 Measured depth averaged current speed from November 2022 to May 2023 for ADCP NWP3 (Watertech 2025).

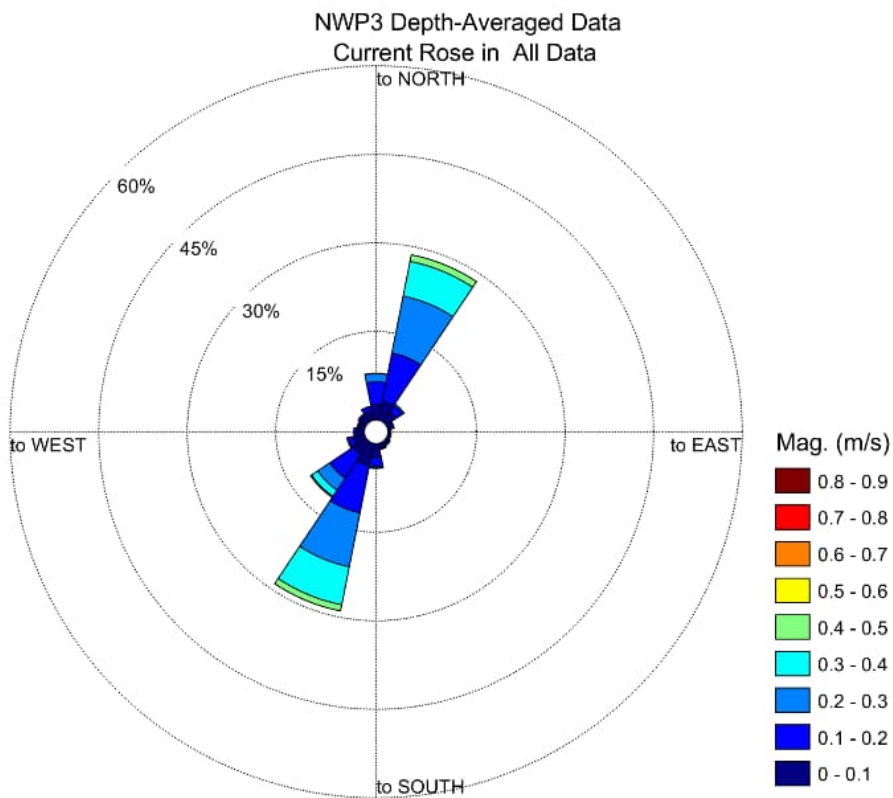


Figure 4-10 Current rose for depth averaged currents measured at ADCP mooring location NWP3 (Watertech, 2025)

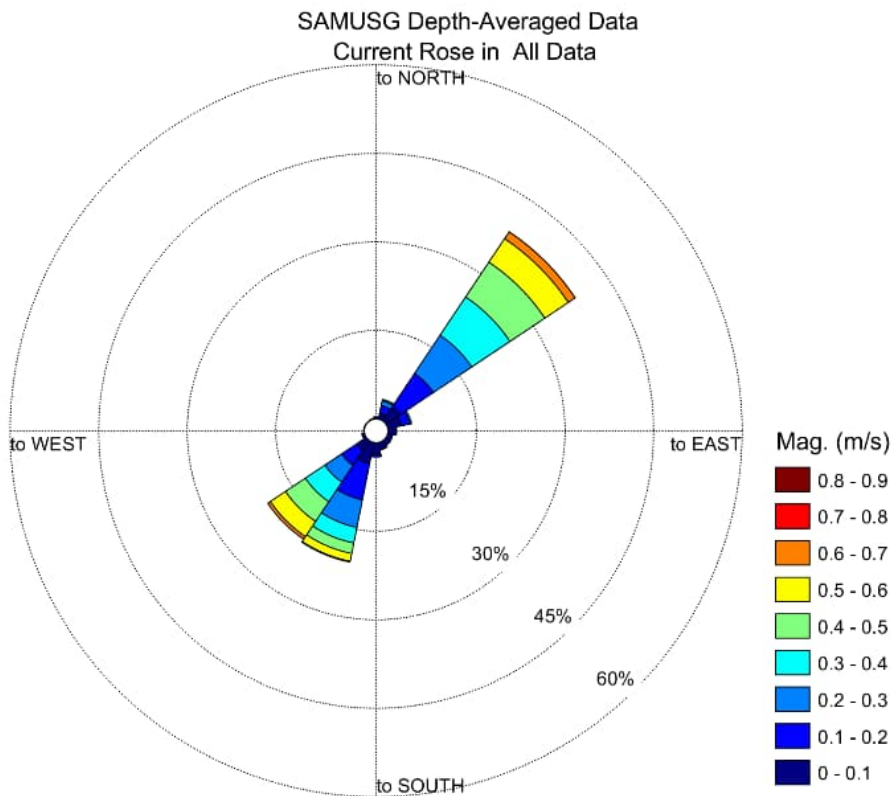


Figure 4-11 Current rose for depth averaged currents measured at ADCP mooring location SAMUSG (Watertech, 2025)

Watertech (2025) developed a hydrodynamic model of Spencer Gulf to assess regional circulation patterns and salt dispersion associated with the Project. The model was calibrated using several ADCP available in the Spencer Gulf. The modelled current speeds at the site for typical spring and neap tide conditions during both flood and ebb tides are shown in **Figure 4-12** to **Figure 4-15**.

The modelled spring tide conditions indicate that current speeds exceeding 0.35 m/s are generated offshore of the -20 m contour (**Figure 4-12** and **Figure 4-13**, respectively). At the location of the proposed intake and outfall structures, current speeds are typically in the order of 0.18 to 0.22 m/s. In the shallow coastal zone (depth < 5 m), between the coast and the intake and outfall, conditions are less dynamic, with currents generally reduced to below 0.15 m/s. The predominant current direction is parallel to the shoreline, with the exception of currents during flood in the shallow zone where the nearshore currents are spread out resulting in current circulation in this zone. During an ebb tide the currents are all directed south to flow out of the Gulf.

The hydrodynamic results for a typical neap flood and ebb tides indicate that current speeds drop compared to spring tide conditions (**Figure 4-14** and **Figure 4-15**, respectively). Current speeds range between 0.1 to 0.15 m/s at the locations of the proposed intake and outfall structures. Similar to the spring tides, the direction of the offshore currents is parallel to the shoreline following the bathymetry contours with lower nearshore currents, below 0.05 m/s to 0.1 m/s, within shallow coastal zone, in between the coastline and the intake and outfall.

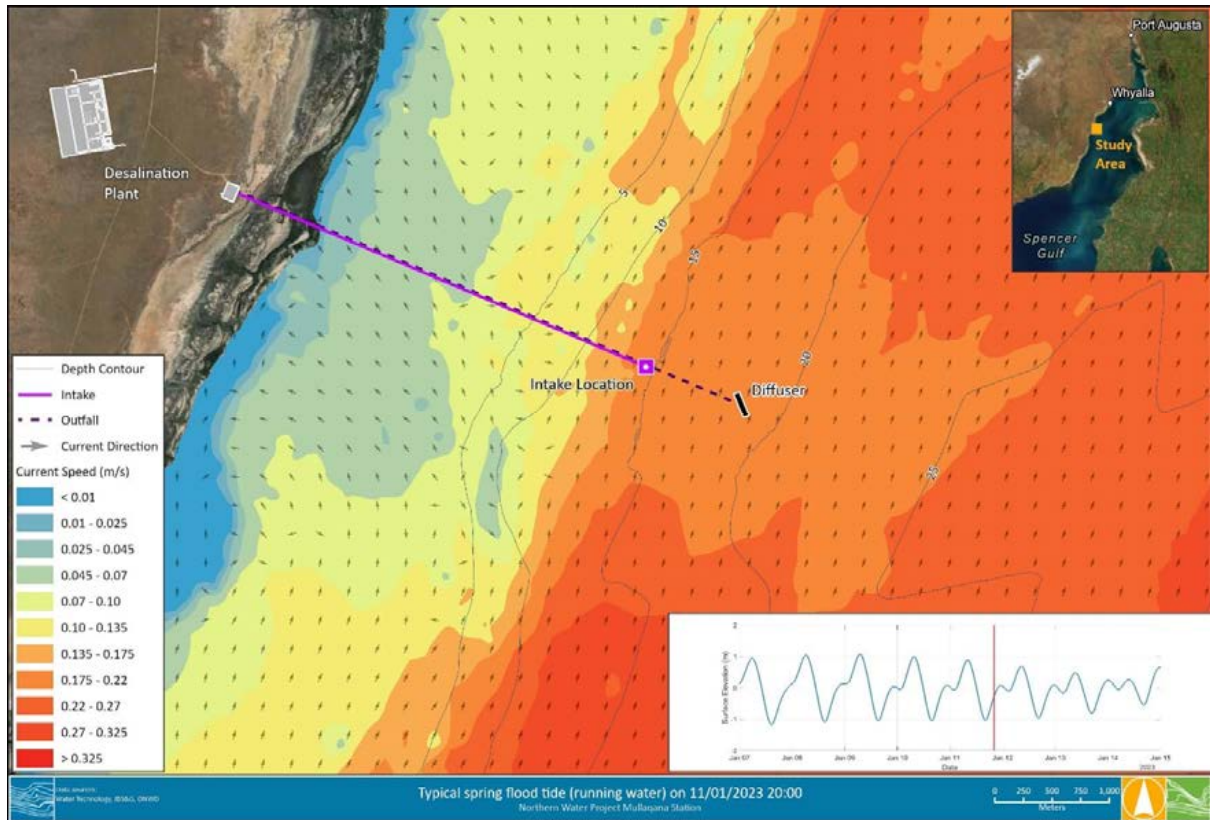


Figure 4-12 Current speed for typical spring flood tide based on NWP hydrodynamic model (Watertech, 2025)

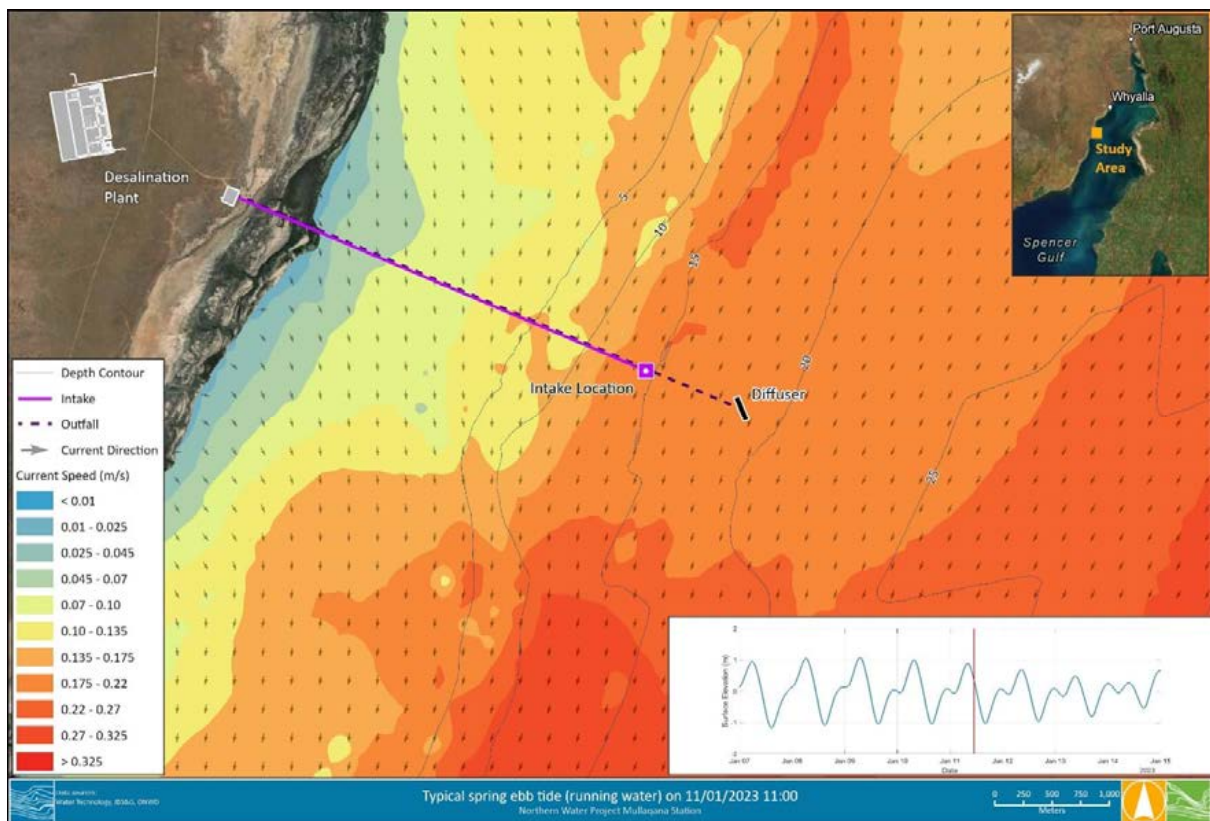


Figure 4-13 Current speed for typical spring ebb tide based on NWP hydrodynamic model (Watertech, 2025)

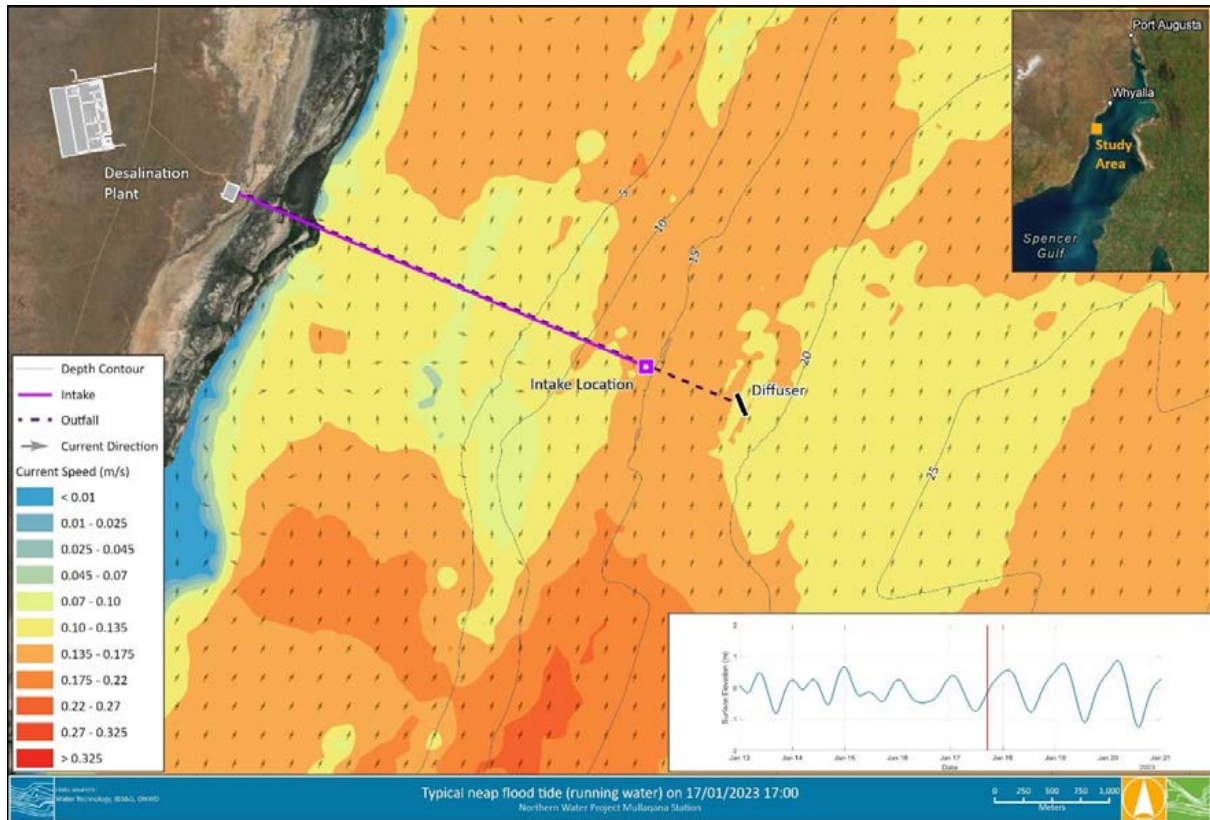


Figure 4-14 Current speed for typical neap flood tide based on NWP hydrodynamic model (Watertech, 2025)

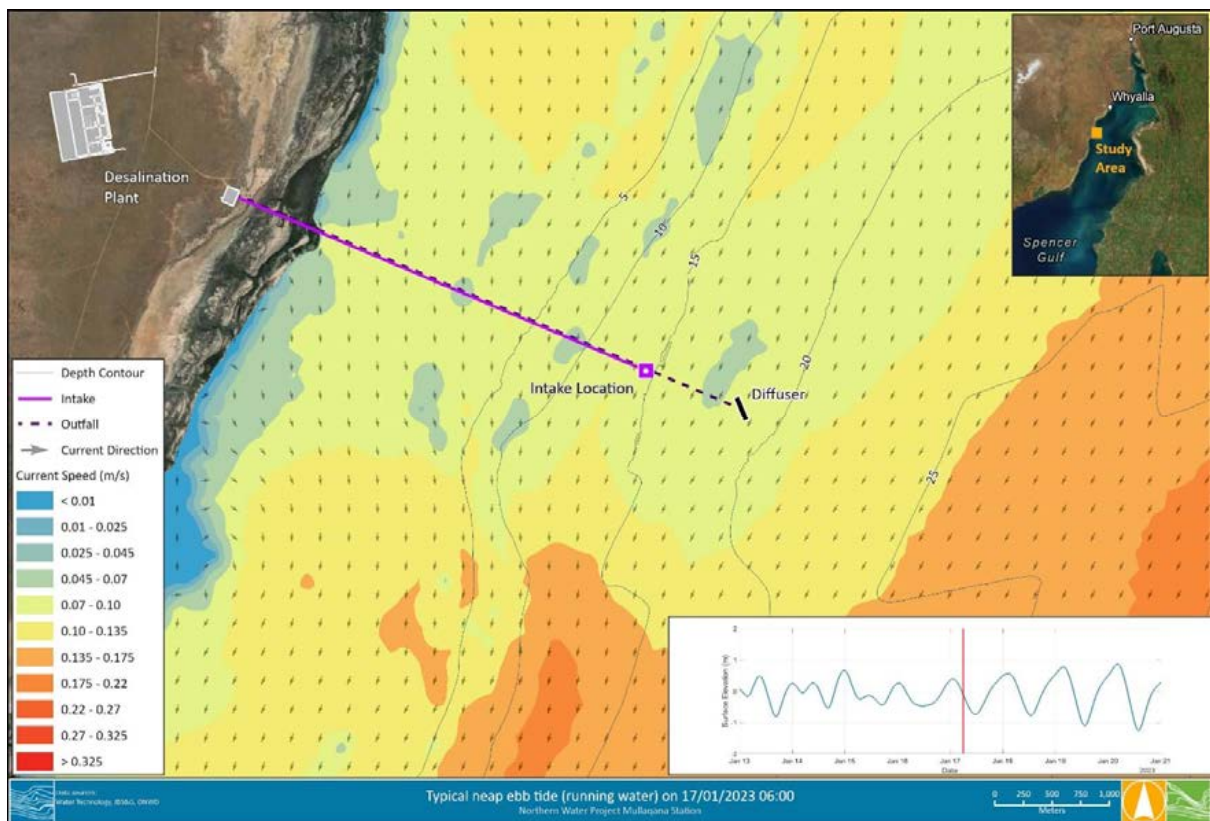


Figure 4-15 Current speed for typical neap ebb tide based on NWP hydrodynamic model (Watertech, 2025)

4.4.4 Waves

4.4.4.1 ADCP Measurements

Between February 2021 and March 2024, ADCP wave measurements were undertaken by SARDI at the two locations near the proposed intake and outfall structures, i.e. NWP3 and SAMUSG (refer to **Figure 4-8**), measuring significant wave height, peak period, and peak direction. Significant wave heights are generally below 1.5 m and peak wave periods typically less than approximately 6 s (**Figure 4-17**). Waves at NWP3 predominantly occur from 160°-210° TN, and from 180°-230° TN at SAMUSG.

It must be noted that at NWP3, the data recorded in the period between approximately 18 January 2023 and 13 March 2023 is flagged as erroneous by SARDI, as the wave height does not drop below 0.5 m and bad data flags were identified during that period. However, for the purposes of this assessment, there is sufficient data available to derive the typical conditions at site.

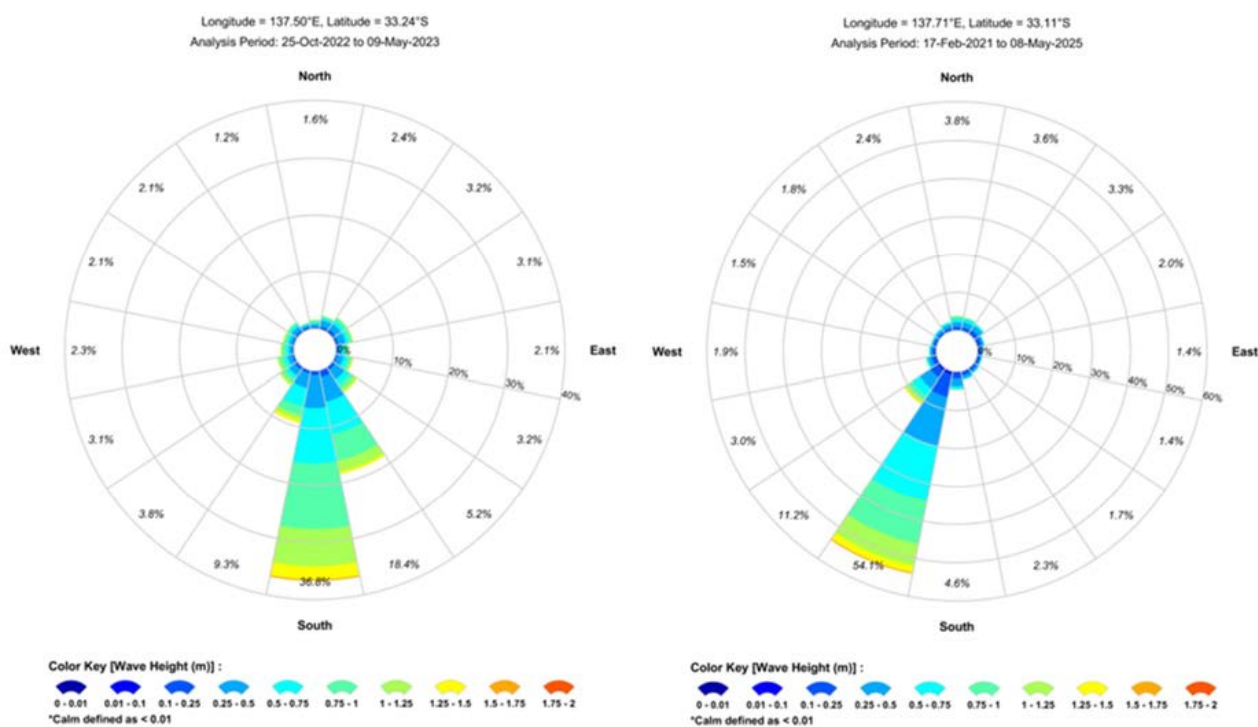


Figure 4-16 Wave rose based on recordings from NWP3 (left) and SAMUSG (right)

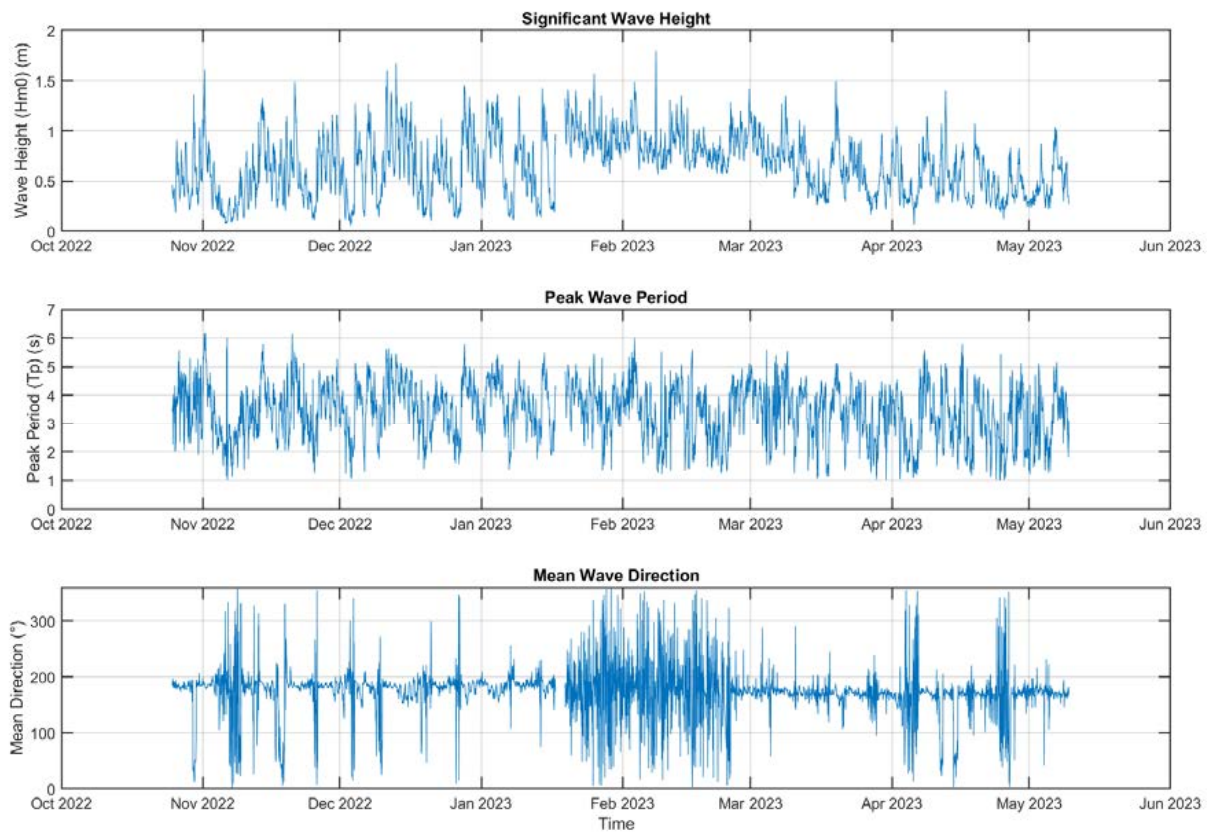


Figure 4-17 NWP3 ADCP measured significant wave height and peak period from October 2022 to May 2023 (SARDI, 2025)

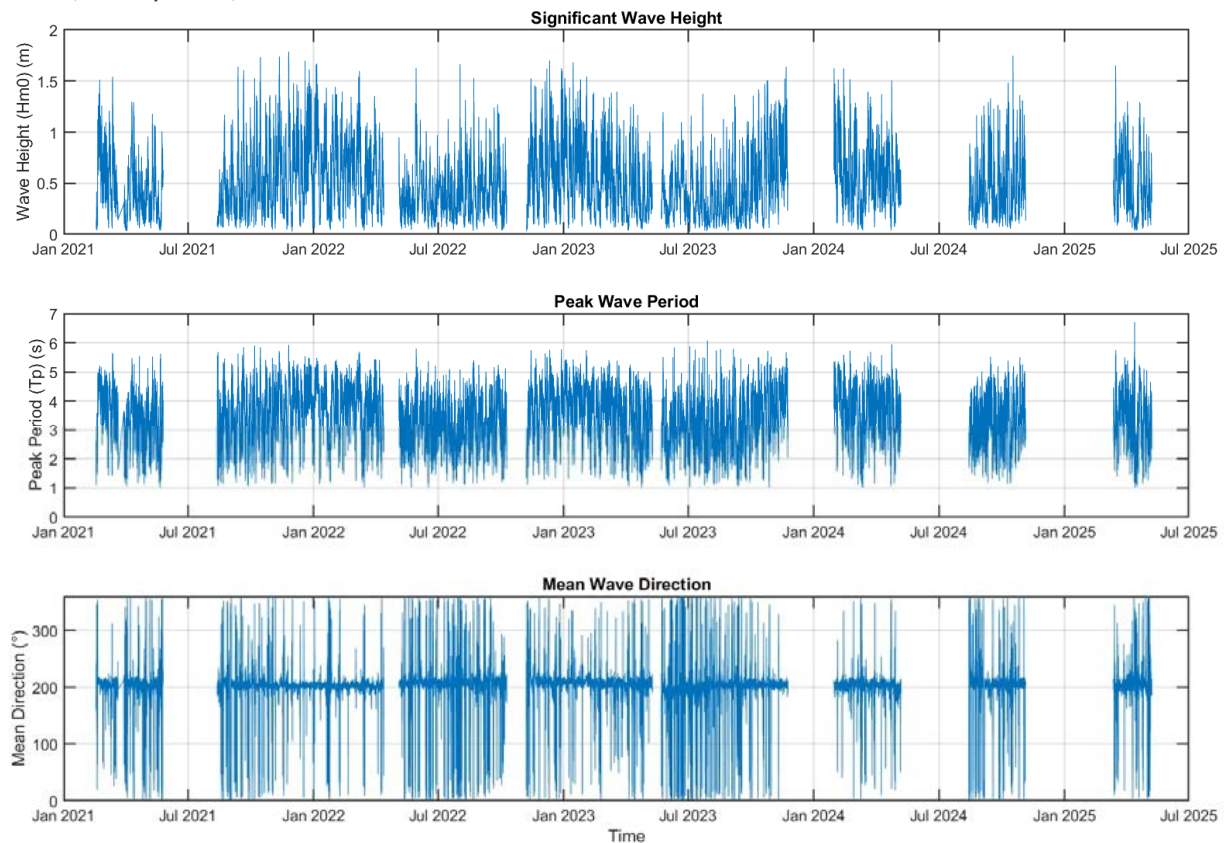


Figure 4-18 SAMUSG ADCP measured significant wave height, peak period and mean wave direction from February 2022 to May 2025 (SARDI, 2025)

4.4.4.2 Numerical wave modelling

The design wave conditions at the intake and outfall locations were determined by GHD (2025b) using numerical modelling undertaken with DHI's MIKE 21 SW software package.

Wave transformation was assessed across a range of water levels from present-day Mean Lower Low Water (MLLW) to Mean Higher High Water (MHHW) and across relevant future planning horizons. Design conditions were generated for seven average recurrence intervals (1, 5, 10, 50, 100, 500 and 1000 years ARI). Results indicate that wave conditions at the site are predominantly wind-driven, with local wind forcing exerting the primary influence on the wave climate. **Table 4-3** summarises the design wave conditions reported by GHD (2025b).

Table 4-3 Design wave conditions (GHD, 2025b)

ARI (year)	H _s (m)	H _{max} (m)	T _p range (sec)	Mean wave direction (°TN)	Water level (m AHD)
1	1.9	3.7	6 - 7	170	3.2
5	2.0	4.0	6 - 7	170	3.3
10	2.2	4.2	6 - 7	170	3.4
50	2.4	4.6	6 - 7	171	3.6
100	2.5	4.9	6 - 7	171	3.7
500	2.6	5.1	6 - 7	171	3.9
1000	2.9	5.7	6 - 7	172	4.3

Wave transformation modelling was also undertaken by Jacobs near the Mullaquana Station project site for a confidential project, for which local wind waves and offshore swell waves were investigated. In this study, wave conditions at the site were determined using over 40 years (1979-2022) of wind and wave inputs downloaded from the CAWRC dataset from the Commonwealth Scientific and Industrial Research Organisation (CSIRO). The most relevant locations for which the waves were determined in this study by Jacobs are shown in **Figure 4-19**. The associated annual wave roses for these locations are presented in **Figure 4-20**.



Figure 4-19 Jacobs model extraction locations

Near the -12.5m CD contour, the Jacobs model predicts approximately 95% of waves with significant wave heights (H_s) smaller than 0.9 m, primarily from southerly directions.

The modelling results suggest that the propagation of longer period swell waves from the ocean to Whyalla is unlikely to occur and wind-driven waves account for the majority of wave conditions near the study area.

The majority of the swell waves have $H_s < 0.3$ m due to energy dissipation when propagating through the shallow water in the Spencer Gulf. Sea waves are larger, with typical H_s ranging from 0.3 to 1.5 m. Unlike swell waves which are approaching from southerly directions, the wind-generated waves are driven by regional wind conditions and show more variable directions of origin.

The wave climate near the -5 m CD contour is similar to the -12.5 m CD contour, due to being exposed to the same wave environment. Wave height marginally reduces at the -5 m CD contour as a result of the energy dissipation within the shallower water. The model results show approximately 98% of waves with $H_s < 0.9$ m and about 40% of waves with $H_s < 0.3$ m.

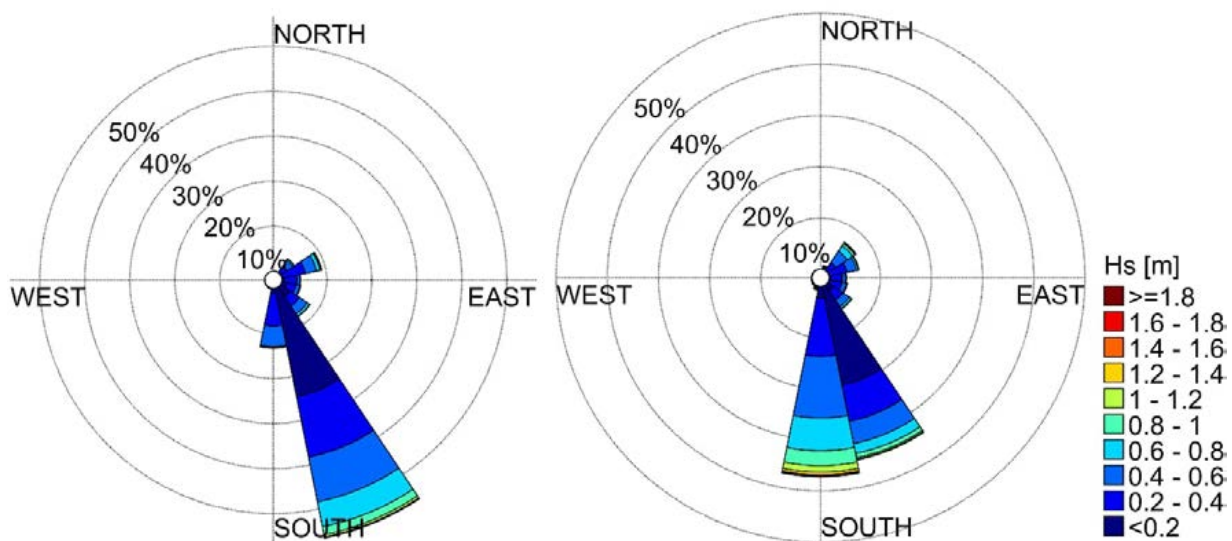


Figure 4-20 Significant wave height (Hs) rose for the 40 year dataset for at the -5 m CD contour (left) and -12.5 m CD contour (right) (Jacobs, 2023)

4.4.5 Sediment transport

Sand is transported through the coastal zone by the combined action of waves, currents and wind within the context of the shoreline shape, alignment and bathymetry. Wave-driven alongshore currents are the dominant current in the littoral zone. Based on the hydrodynamics at the site (refer to Section 4.4.3) it is estimated that tide- and wind-driven currents will generally be too small to, in isolation, result in significant sediment transport at the location of the planned offshore works for the Project.

As site specific offshore sediment transport modelling is not required by the EIS Assessment Requirements for the Project, a depth of closure calculation was adopted to provide an estimate of the depth at which sediment transport is initiated. The depth of closure was calculated using the empirical formulations of Hallermeier (1978), as presented in the Shore Protection Manual (SPM, 1984). Based on typical wave conditions, with a significant wave height of 1.9 m for the 1-year ARI, the typical average depth of closure in the coastal zone adjacent Mullaquana Station was estimated to be approximately 7 m. Sensitivity testing was undertaken for larger ARI events (e.g. 500-year ARI) and it was found that the estimated depth of closure was less than the intake depth. Hence, negligible sediment transport is expected at the water depths of the marine structures for both Reference Design and alternative (single tunnel) option.

For comparison, longshore sediment transport modelling at Cape Hardy, approximately 100 km south-west of the Mullaquana Station project site, on the eastern coast of the Eyre Peninsula was undertaken by Jacobs in 2014 as part of the Central Eyre Iron Project. The modelling was undertaken using the Littoral Drift component of DHI's Littoral Processes FM module. The results indicate that the majority of sediment transport occurs in water depths less than 8 m, which aligned with the estimated depth of closure of 8 m for typical wave conditions at the Cape Hardy site (Jacobs, 2014). This 1 m difference in closure depth estimates, can be attributed to the more energetic wave climate at the Cape Hardy project site, which lies further down in the Gulf and is more exposed to offshore swell than the Mullaquana Station site.

5. Assessment

A qualitative coastal processes impact assessment has been undertaken for the proposed construction works (i.e. TBM and offshore construction method) and permanent operational marine infrastructure (i.e. intake and outfall) associated with the Project. This assessment includes both the Reference Design and single tunnel option case and is based on a desktop review of available information of the marine environment as discussed in Section 4.

5.1 Construction works

The Reference Design intake and outfall construction method is via TBM tunnelling (refer to Section 3.2 and 3.3). An alternative option has also been identified, comprising a single tunnel extending to the intake location and continuing offshore via approximately 1,000 m of additional outlet conduit founded on the seabed and likely installed using a float and sink method (refer to Section 3.5). The preferred strategy for managing discharge of water resulting from the dewatering of TBM spoil is via retention and sedimentation basins adjacent the Mullaquana Station desalination plant site. For this assessment, it is assumed that there is no direct discharge of construction spoil to the marine environment. Marine discharge of water from the marine Jack-up barge would only occur if required and in accordance with EPA approval and requirements.

Key findings from the coastal processes impact assessment for the coastal and marine construction works are summarised below:

- **Seafloor:** The seabed will largely remain unchanged for the Reference Design intake and outfall construction approach using a TBM, with the intake and outfall tunnels located 9 m below the seabed. Disturbance of the seabed will occur at the intake and outfall structures during construction (e.g. drilling of the riser), however impacts are likely to be minor and localised around the footprint of the structures. A limited amount of spoil (3,000 m³) will be generated during the marine activities as part of the ground replacement and dredging works during the construction process. However, any spoil produced during these activities is proposed to be transported to shore where it will be used at the desalination plant site. Additionally, turbidity curtains are proposed to control the spread of suspended sediments during the offshore construction activities. Hence, negligible impacts are expected from the offshore construction activities.

For the single tunnel configuration, approximately 1,000 m of submarine conduit with an estimated diameter of 2 m is proposed to be installed on the seabed beyond the depth of the intake location (-13m LAT). The pipeline will be installed using a float and sink method and secured using piled collars. It is expected that some disturbance of the seabed will occur during the sinking of the pipeline on the seabed and during construction of the piled collars (e.g. drilling piles). Based on the footprint of the pipeline and depth of closure with respect to sediment transport, impacts are likely to be localised and minor.

- **Offshore hydrodynamics:** Negligible impact is expected on the offshore hydrodynamics due to the TBM operating 9 m below the seabed. Any hydrodynamic impacts associated with the construction of the intake and outfall will be minor and localised, such as deflection of currents around the structures and construction equipment. Similarly, vessels used for construction of the intake and outfall structures will have negligible impacts on the hydrodynamic regime due to their small footprint and draft compared to the water depth at the site. Hence, no significant impacts to the overall hydrodynamic regime are anticipated.

For the alternative method (single tunnel and additional 1km of submarine conduit) minor localised impacts around the pipe and collars are expected, with no significant impacts to the broader hydrodynamic regime at the proposed depths.

- **Wave climate:** Negligible impact is expected on the wave climate due to the construction of the intake and outfall tunnels using a TBM below the seabed. Additionally, any construction vessels or

barges used for the offshore construction works associated with the intake and outfall structures will have a negligible impact on the prevailing wave climate as the vessels have a relatively small size (surface area and draught) compared to the energy of the wave field. Similarly, due to the limited footprint and height of the structures, no significant impacts to the prevailing wave climate are anticipated during construction of the intake and outfall structures (refer to additional details in section 5.2).

For the alternative (single tunnel) option, the footprint will be larger due to submarine conduits, however, the height of the pipe and collars are expected to be low. Therefore, impacts on the wave climate are envisaged to be negligible at the proposed depths.

- **Sediment transport regime:** Construction of the offshore intake and outfall structures for both the Reference Design and alternative method are anticipated to have no significant impact on the overall sediment transport regime. Results from the sediment transport assessment indicate that sediment transport is negligible in water depths where the intake/outfall and 1,000m pipeline structures are proposed (refer to section 4.4.5). Moreover, any anticipated spoil and wastewater produced by the TBM and ground replacement and dredging works will be transported to the shore where it is proposed to be used on site. Furthermore, turbidity curtains are proposed to control the spread of any suspended sediments during the offshore construction activities.

Given the limited amount of dredge volume and instalment of the turbidity curtains, the tunnelling and construction of the intake and outfall structures will have negligible impacts on the sediment transport regime. However, turbidity monitoring is recommended during construction to ensure sediment concentrations are within acceptable limits (refer to additional details in Section 6).

- **Coastal erosion:** The tunnels extend from an onshore entry point (~400 m landward from the coast) to the offshore intake and outfall structures located at water depths greater than 13 m and 17 m LAT respectively (with the top of the structures at -7 m LAT and -13 m LAT, respectively). For the alternative method, the tunnel will extend to -13m LAT beyond which the submarine conduit will be founded on the sea floor to the diffuser array. No tunnelling or construction works associated with the intake and outfall structures are proposed at the shoreline or within the active coastal zone, which is predominantly in water depths less than 7 m LAT. Based on the sediment transport assessment (refer to Section 4.4.5) there is negligible sediment transport at the proposed construction depths. Additionally, as discussed above, construction of the structures is unlikely to significantly change the prevailing wave climate.

For both the Reference Design and alternative method, there is no infrastructure proposed within the active coastal zone. Hence, based on available information, it is not anticipated that there will be any significant impact on the coastal erosion and sedimentation processes.

- **Areas of environmental value:** Benthic habitat mapping indicates seagrass meadows, understood to be of environmental value, are present in the Project area (refer to section 4.3.1). As the TBM will operate 9 m underneath the seabed, no direct impact on the seagrass is expected. *Zostera* seagrass habitat is present at the proposed construction site for the intake structure only (refer to **Figure 4-4**), and disturbance and clearance of this *Zostera* seagrass is anticipated. The single tunnel alternative solution will have a greater impact due to the circa 1 km of conduit being founded on the seabed. The clearance of seagrass, and construction activities, can have an impact on the environment value of the seagrass, and the significance of these impacts will need to be reassessed once the final alignment, length, design configuration, construction method and footprint of the outfall pipeline are confirmed. Assessment of impacts to seagrass is outside the scope of this assessment and is being undertaken by others.

No significant impacts on coastal processes are expected from the proposed construction works for both the Reference Design and the alternative construction method. However, the alternative construction method, comprising a single tunnel with submarine outfall pipe, is currently high-level and limited design and

construction details have been provided for this option. Hence, it is recommended that when the construction design changes (e.g. single tunnel configuration) it should be developed in such a manner that the impacts to coastal processes and environmental values are minimised.

The coastal process analysis above is based on the construction methods described in this report, which assumes any construction taking place is in water with depths exceeding -7m LAT. Should further information become available and/or alternative construction methodologies be determined, the analysis can be revisited. This may change the findings of the coastal processes impact assessment and additional studies may be required.

5.2 Operational infrastructure

This section of the report addresses the coastal processes impact assessment of the permanent intake and outfall infrastructure when it is operational. Following the Reference Design, the intake and outfall tunnels are positioned 9 m below the seabed and therefore will have no impacts on coastal processes. For the alternative single tunnel configuration, a 1km long submarine conduit is proposed from the intake location at -13m LAT to the outfall diffuser manifold at -17m LAT (refer to section 3.5). This assessment focuses on the offshore intake and outfall structures and the proposed submarine conduits for the alternative design.

Key findings from the assessment are summarised below:

- **Seafloor:** For the Reference Design, permanent impacts on the seabed are confined to the footprint of the structures as shown in **Figure 3-2** and **Figure 3-3**, with the potential for localised scour and accretion at the edges of the structure. Hence the impact of the works on the seabed is therefore considered minor.

For the single-tunnel configuration, although the overall length of the pipeline is substantial, its lateral width is minimal, resulting in a relatively small footprint on the seabed. However, design information for this option remains limited, including details on the extent of scour protection and the size and spacing of any piled collars. Accordingly, further investigation and refinement of the coastal processes assessment are recommended should this design be progressed and once additional configuration and construction details for this option become available.

- **Offshore hydrodynamics:** Changes to the hydrodynamics due to the addition of the proposed infrastructure are anticipated to be localised. There may be a slight change in the speed of currents via interaction with the intake and outfall structures on the seabed. However, given the relatively small footprint of the structures (i.e. maximum 11.3 m width and 6 m height) compared to the total water depth at the site (i.e. minimum of 13 m from LAT to the seabed) it is anticipated these changes will be minor and localised, with no impact on the farfield hydrodynamics.

For the alternative (single tunnel) option, incorporating a submarine conduit founded on the seabed, impacts on hydrodynamics are similarly expected to be negligible. Although the conduit would extend for up to approximately 1 km, its height relative to the total water depth is minimal. At the proposed water depths, deflection of currents and alteration of the broader flow field are not anticipated to be significant, and hydrodynamic effects are expected to remain localised to the immediate vicinity of the conduit.

- **Wave climate:** The intake and outfall structures will be constructed in relatively deep water, between -13 m and -17 m LAT respectively, with the top of the structures between -7 m and -14 m LAT. The proposed intake and outfall structures have a limited footprint (max. 11.3 m wide) and height (max. 6 m) above the seabed compared to the total water depth (13 to 17 m relative to LAT). Due to the available water depth above the structure (at least 7 m) the prevailing wave climate in the region is unlikely to be significantly impacted, i.e. significant depth limited wave breaking will unlikely occur in this water depth based on the wave climate outlined in Section 4.4.4 and any changes in wave propagation processes will likely be minor to negligible and localised in the vicinity of the structures.

As a result, no significant impacts are expected to the prevailing wave climate due to the outfall and intake structures.

For the alternative (single tunnel) option, the footprint will be larger due to submarine conduits, however, the height of the pipe and collars are expected to be low. Therefore, impacts on the wave climate are envisaged to be negligible at the proposed depths.

- **Sediment transport regime:** The intake and outfall structures are anticipated to have no significant impact on the overall sediment transport regime. Results from the sediment transport assessment indicates that sediment transport is negligible at water depths greater than approximately 7 m (refer to Section 4.4.5). The intake and outfall structures, and in the alternative (single tunnel) option, the submarine conduits, are located in water depths significantly greater than this (i.e. a minimum 13 m water depth). Similarly, as discussed above, no significant changes in the prevailing wave climate are likely to occur due to the proposed structures. Hence, impacts on the sediment transport regime are anticipated to be negligible for both Reference Design and proposed alternative option comprising a single tunnel.
- **Coastal erosion:** No permanent works are proposed at the shoreline or within the active coastal zone for the preferred and alternative design, with the tunnel(s) extending from an onshore entry point (~400 m landward from the coast) to the offshore intake/outfall sites at water depths greater than 13 m. As the structures are anticipated to have negligible impact on the sediment transport regime in the region, therefore the planned permanent infrastructure will likely have negligible impact on coastal erosion at the shoreline, under present water level conditions and future sea level rise scenarios, as the intake and outfall structures are located outside the active coastal zone (discussed in Section 4.4.5).
- **Areas of environmental value:** Based on the benthic habitat mapping (refer to Section 4.3.1) seagrass meadows are present in the Project area, which are considered to be of environmental value. As discussed above, no significant changes in the existing coastal processes are anticipated from operation of the intake and outfall structures under the Reference Design, with any impacts (such as accretion and erosion around the structure) anticipated to be minor and localised. As such, the impacts to seagrass are localised around the intake structure only and hence are anticipated to be minor in extent. The ecological impacts of seagrass clearance is outside the scope of this report and is assessed by others.

For the alternative (single tunnel) option, details are limited, with no information on trajectory of the submarine conduit on the seabed and anticipated extent of the scour protection. Therefore, no assessment can be made to the impact on areas of environment values for the alternative design, acknowledging the ecological impacts to seagrass is outside the scope of this assessment. Accordingly, further investigation and refinement of the assessment is recommended should this design be progressed and once additional configuration and construction details for this option become available

Based on the above assessment, the tunnelled intake and outfall infrastructure is anticipated to have negligible impact on the coastal processes. No long-term impacts are expected to the regional coastal processes as there will be no infrastructure positioned in the active coastal zone (which is predominantly in less than 7 m water depth). Any impacts will be minor and localised around the intake and outfall structures, such as localised erosion/accretion.

For the alternative (single-tunnel) option, which incorporates a submarine conduit founded on the seabed, impacts on coastal processes are also expected to be negligible. Although the conduit would extend for up to approximately 1 km on the seabed, its low profile and limited footprint are not expected to significantly influence the wave climate or broader hydrodynamic regime. Furthermore, as the conduit would be located below the depth of closure, it is not expected to affect wave-driven sediment transport processes.

At present design information for the alternative option is limited, with no information on trajectory of the submarine conduit on the seabed, anticipated extent of the scour protection and the size and spacing of any piled collars. As a result, assessment of long-term coastal and seabed impacts should be revisited should this option be progressed and following additional design configuration and construction details become available.

6. Mitigation

The impacts to coastal processes from construction and permanent marine works are considered to be minimal based on the current preferred engineering Reference Design, comprising two tunnels and offshore intake and outfall structures, and project construction and operations methods.

During offshore ground replacement and dredging works, turbidity curtains will be installed by the contractor to control the spread of suspended sediments during construction activities. Curtains will extend 10 m around the marine structure and will be anchored to the seabed using weights. Daily turbidity grab samples are proposed to monitor suspended sediment caused by the construction works to the marine environment and ensure EPA requirements are met.

General impacts to the marine environment can be managed through the implementation of an appropriate Construction Environmental Management Plan and Operational Environmental Management Plan prepared to meet relevant criteria and standards to avoid impacts to the coastal environment.

7. Conclusion

To inform the EIS for the Project, a qualitative assessment has been undertaken to determine the impacts of the proposed marine works (i.e. intake and outfall infrastructure) associated with the desalination plant on coastal processes. This impact assessment is based on the construction of the intake and outfall pipes via a TBM. The tunnels extend from the onshore entry point, approximately 400 m from the coast, to the offshore intake and outfall sites located in approximately 13 to 17 m water depth relative to LAT.

During construction, the seafloor will remain largely unchanged with the proposed tunnelling construction method, with the exception of limited ground replacement (3,000 m³), rock protection (950 m² per structure) and offshore construction works associated with the intake and outfall structures (e.g. drilling of the risers). Impacts associated with the construction of the offshore structures are anticipated to be minor and localised, such as local disturbance of the seabed and deflection of currents around the structures and construction equipment. Moreover, turbidity curtains are proposed to control the spread of suspended sediments during offshore dredging and drilling activities, limiting the impacts of the offshore works on the prevailing environment.

Construction spoil and wastewater generated by the TBM and offshore construction works will, as far as practicable, be managed on land via retention and sedimentation basins, with no marine discharge of spoil proposed. A designated drying area of approximately 12,600 m² incorporating sediment control and dewatering systems will be used to process spoil and wastewater. Accordingly, no impacts on coastal processes are expected from the management of construction spoil or wastewater.

Permanent infrastructure associated with the operation of the offshore intake and outfall pipes have a limited footprint (< 12 m) and height above the seabed (< 6 m) compared to the water depth (13 to 17 m LAT), and therefore are unlikely to have a significant impact on the prevailing wave climate. Similarly, the structures are located in deep water where sediment transport is negligible. Hence impacts associated with these structures are anticipated to be minor and localised, such as scour/accretion and flow disturbance around the structure. Impacts on the farfield coastal processes and sediment transport regime are anticipated to be negligible.

Overall, the Reference Design intake and outfall structures are anticipated to have no significant impact on the coastal processes. Based on the information available to date, the Project is considered to be of low risk to impact coastal processes, with general impacts to the marine environment able to be managed through the implementation of appropriate management plans.

For the alternative (single-tunnel) option, which incorporates a submarine conduit founded on the seabed, impacts on coastal processes are also expected to be negligible. Although the conduit would extend for up to approximately 1 km offshore of the intake structure, its low profile and limited footprint are not expected to significantly influence the wave climate or farfield hydrodynamic regime. Furthermore, as the conduit would be located below the depth of closure, it is not expected to affect wave-driven sediment transport processes. Consequently, negligible impacts to sediment transport pathways, shoreline morphology, or broader coastal processes are anticipated.

Assessment of long-term coastal impacts, especially seabed and environmental values, should be revisited should this alternative be progressed and once additional design configuration and construction details become available.

8. References

- Alendal, G. Drange, H. And Haugan, P. M. (1994). *Modelling of Deep-Sea Gravity Currents Using an Integrated Plume Model* The Polar Oceans and Their Role in Shaping the Global Environment (pp.237-246)
- Bullock DA (1975). *The general water circulation of Spencer Gulf, South Australia, in the period February to May*, Transactions of the Royal Society of South Australia.
- Caton, B., Pelton, N., Turner, A., Detmar, S., Fotheringham, D., Laurence, S., Quinn, J., Royal, M., Rubbo, N. and Sandercock, R. (2019). Eyre Peninsula Coastal Action Plan and Conservation Priority Study, Volume 3 – A 2019 review of 2011 lower conservation priority coastal cells, Eyre Peninsula Landscape Board and Department for Environment and Water, Adelaide. Unpublished
- COOE (2025). MULLAQUANA MANGROVE SURVEYS, Seasonal Memo: Summer 2025. Report prepared for J Diversity Pty Ltd, COOE Pty Ltd. JBD.MUL.002_Summer report_final v1.4_fin.docx, Rev1.4, 19 June 2025.
- Duke NC (2006) Australia's Mangroves. The authoritative guide to Australia's mangrove plants. University of Queensland and Norman C Duke, Brisbane, 200 pages
- GHD (2025a). Reference Design report Northern Water Project. Prepared by GHD for Department for Infrastructure and Transport, 3 October 2025.
- GHD (2025b). Wave Height Study Modelling Report for the Northern Water Project. Prepared by GHD for Department for Infrastructure and Transport, report reference: 12601676-REP_DIT Wave Height Study Report, 04 November 2025.
- GHD (2025c). Single Tunnel Option Concept – DRAFT. Prepared by GHD for Department for Infrastructure and Transport, 6 November 2025.
- Harvey N, Caton B (2010). *Coastal Management in Australia*, ed. Dragovitch and Maude p28
- JBS&G (2025) Northern Water Pipeline Baseline Sediment Characterisation. Prepared by JBS&G for Department for Infrastructure and Transport, report reference: 172,455 (Rev A), 04 December 2025
- JBS&G (2026) Northern Water Project Marine Sediment – Summary Baseline Report. Prepared by JBS&G for Department for infrastructure and transport, report reference: 173,702 (Rev A), 24 February 2025
- J Diversity (2025). Northern Water Marine Ecology Studies – Mullaquana Summer Interim Report. Report prepared for JBS&G, J Diversity Pty Ltd Rev 0, 24 June 2025.
- Jacobs (2014). *Cape Hardy Coastal Modelling Report* number E-F-34-RPT-0030 prepared for Iron Road Ltd by Jacobs
- Jacobs (2015). *Central Eyre Iron Project: Port Site Marine Assessment report* number E-F-34-RPT-0039 prepared for Iron Road Ltd by Jacobs
- Marine & Earth Sciences Pty Ltd (MES) (2025). *Northern Water Supply Project Design Investigations – Geophysical Surveys*. Report MES_1262. Prepared for Maritime Constructions, 30 May 2025
- Middleton J, Doubell M, James C, Luick J and van Ruth P (2013). *PIRSA Initiative II: carrying capacity of Spencer Gulf: hydrodynamic and biogeochemical measurement modelling and performance monitoring*. Final Report for the Fisheries Research and Development Corporation. South Australian Research and Development Institute (Aquatic Sciences), Adelaide. SARDI Publication No. F2013/000311-1. SARDI Research Report Series No. 705. 97pp.
- SARDI (2024). *The South Australian Research and Development Institute (SARDI) Aquatic Sciences Environment and Analytical Laboratories – Oceanographic far-field modelling to inform the Northern Water Project: brine discharge and larval transport modelling 2024*

Systra (2025). Draft Reference Design Constructability Report, Northern Water Supply Project. Prepared by Systra for Department for Infrastructure and Transport, 2 October 2025.

Watertech (2025) Northern Water Desalination Plant Discharge Modelling – Nearfield Modelling. Prepared for JBS&G/Department for Infrastructure and Transport, 23 September 2025