

# ENVIRONMENTAL SUPPORTING DOCUMENT

South Thomson Barge Landing Development, Wadjemup / Rottnest Island



AU213014226.001

08 August 2024

Rev 0

## REPORT

## Document status

| Version | Purpose of document     | Authored by | Reviewed by | Approved by | Review date |
|---------|-------------------------|-------------|-------------|-------------|-------------|
| Draft A | Draft for client review | RebDaw      | SteRol      | NA          | 12/06/2024  |
| Draft B | Draft for client review | RebDaw      | SteRol      | NA          | 21/06/2024  |
| Draft C | Draft for client review | RebDaw      | GilGlas     | NA          | 28/07/2024  |
| Rev 0   | Final for issue         | RebDaw      | GilGlas     | RebDaw      | 01/08/2024  |

## Approval for issue

R. Dawson

08 August 2024

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## Prepared by:

## RPS

Dawson, Rebecca  
Principal Scientist

Level 3, 500 Hay Street  
Subiaco, WA 6008

T +61 8 9211 1111  
E rebecca.dawson@rpsconsulting.com

## Prepared for:

## Rottnest Island Authority

David Pond  
Environment Compliance and Approvals  
Coordinator

1 Mews Road  
Fremantle, WA 6160

T +61 8 9432 9300  
E david.pond@dbca.wa.gov.au

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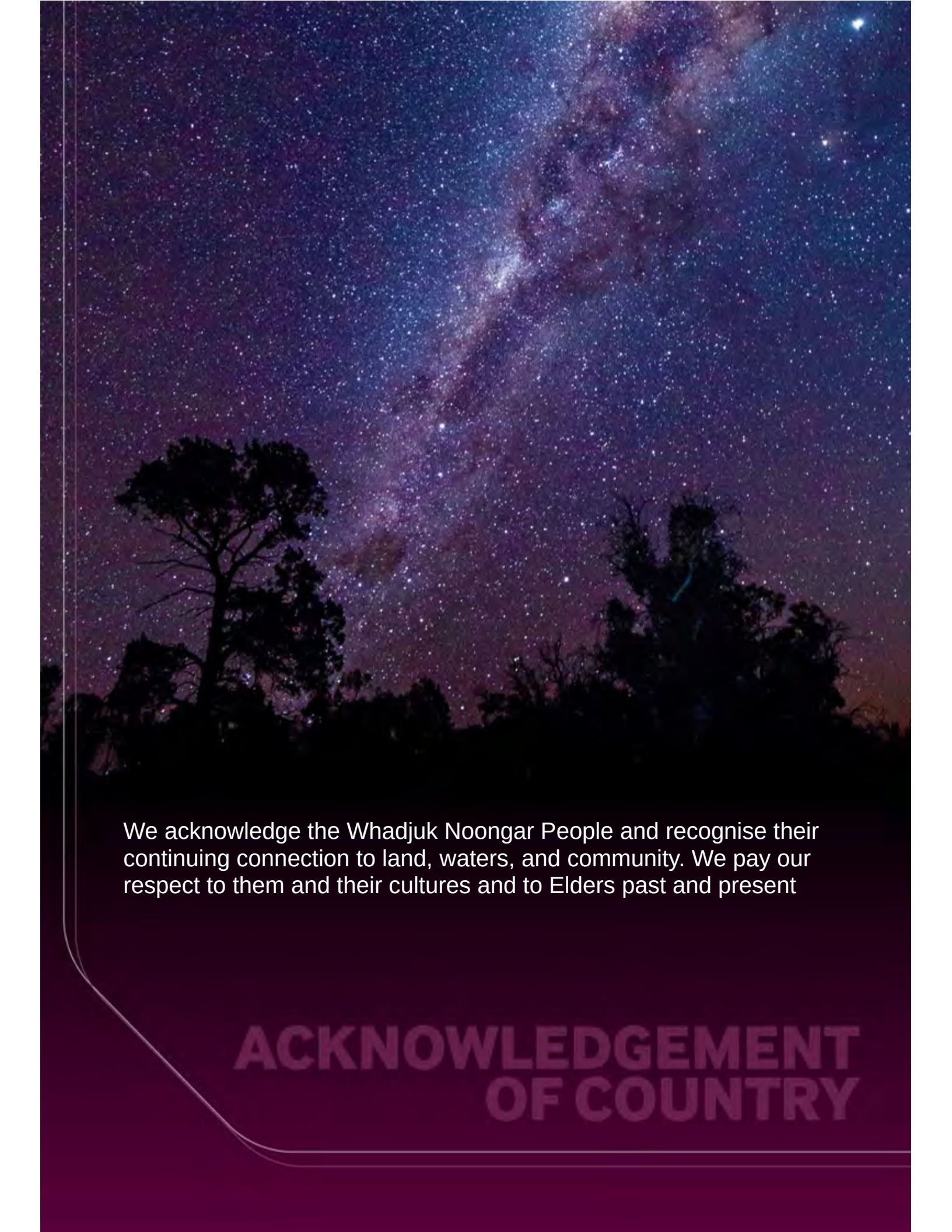


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We acknowledge the Whadjuk Noongar People and recognise their continuing connection to land, waters, and community. We pay our respect to them and their cultures and to Elders past and present

**ACKNOWLEDGEMENT  
OF COUNTRY**

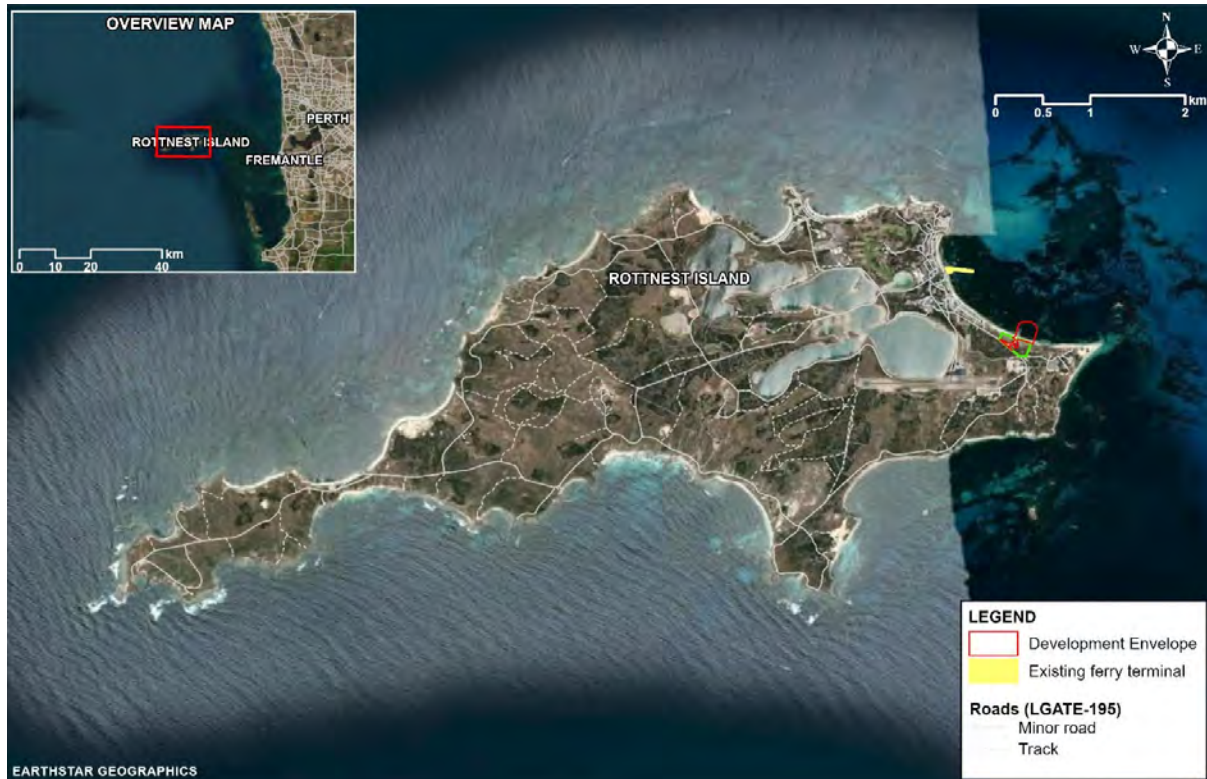


## REPORT

**EXECUTIVE SUMMARY****Introduction**

Ferry berthing and barge operations currently occur at the Main Jetty on Wadjemup / Rottnest Island. Rottnest Island Authority (RIA) is proposing to relocate the existing barge operations from the Main Jetty at central Thomson Bay to the Army Groyne in South Thomson Bay. This will separate barge operations from public passenger transfer activities and ease congestion at the ferry terminal at the Main Jetty.

Figure 1 provides a regional overview of the location of the proposed South Thomson Barge Landing development and the existing barge operations at the ferry terminal at central Thomson Bay.



**Figure 1: Regional overview**

**Purpose and scope of this document**

The purpose of this Environmental Supporting Document is to describe and assess the significance of the environmental impacts to the environmental values associated with the implementation of the proposal. This report provides information on the proposal, local and regional setting, key stakeholders, potential environmental impacts, cumulative impacts and proposed mitigation measures associated with the construction and operation of the proposal.

This document has been prepared to provide a detailed description of the proposal to inform an environmental impact assessment and support both the state and federal environmental approvals as outlined in Table 1.

## REPORT

Table 1: Environmental assessment process summary

| Jurisdiction | Environmental approval                                                                                                                                                                                                                                                                    | Relevant legislation                     | Key sections of this report                                                                                           |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| State        | Referral of the proposal to the Environmental Protection Authority (EPA) under Section 38 of the <i>Environmental Protection Act 1986</i> (EP Act) to describe and assess the potential impacts to the EPA's environmental factors.                                                       | Refer to Section 3.2 of this document.   | The environmental impact assessment process under state legislation is outlined in Sections 7 to 13 of this document. |
| Federal      | Referral of the proposal to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (EPBC Act) to address potential impacts to matters of national environmental significance (MNES). | Refer to Section 3.4.2 of this document. | The assessment of potential impacts to MNES is outlined in Section 14.2 of this document.                             |

## Overview of the South Thomson Barge Landing development

The proposal comprises an onshore component and offshore component (an area of reclamation and an extension of the existing Army Groyne to form the proposed wharf) as summarised below:

- Indicative disturbance footprint (Figure 2):** The indicative disturbance footprint encompasses the onshore and offshore physical infrastructure associated with proposal and dredge areas:
  - The onshore component comprises approximately 1 hectare (ha).
  - The offshore component comprises a wharf area (extension of the existing Army Groyne) (1.13 ha) and a dredge area (1.02 ha), resulting in a combined indicative disturbance footprint of up to 3.15 ha.
- Development envelope (Figure 2):** Comprises 4.6 ha and encompasses the indicative disturbance footprint and a buffer area (the majority of which comprises the dredge Zone of High Impact).

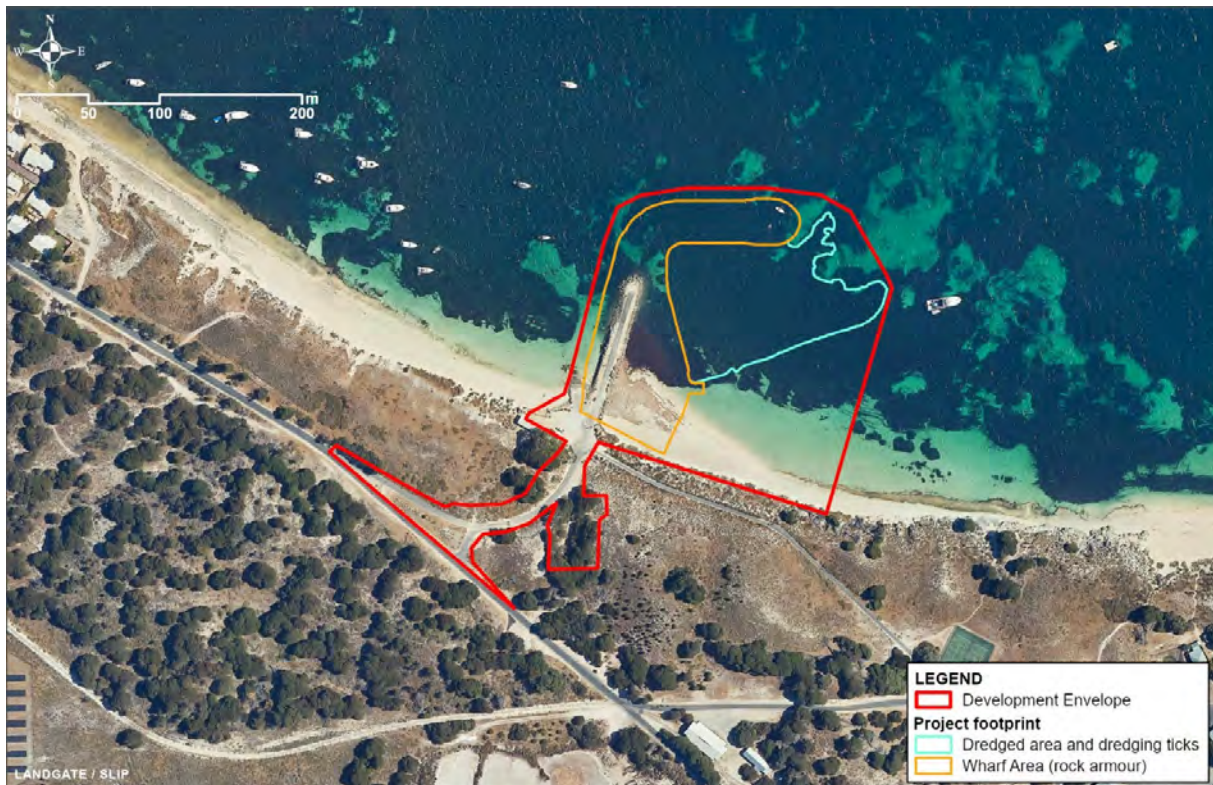


Figure 2: Development envelope



## REPORT

In addition to the development envelope, the environmental impact assessment presented in this report has included the predicted zone of impact from the proposed dredging activities. A Dredge Plume Modelling Assessment was undertaken by Baird (2024b) and modelled the zones of impact, these are summarised in Table 2 and shown in Figure 3.

**Table 2: Predicted zones of impact (Baird, 2024b)**

| Zone of impact                 | Definition                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Zone of High Impact (ZoHI)     | The area where impacts on benthic communities or habitats are predicted to be irreversible. The term irreversible means 'lacking a capacity to return or recover to a state resembling that prior to being impacted within a timeframe of five years or less'.                                                                                     |
| Zone of Moderate Impact (ZoMI) | The area within which predicted impacts on benthic communities or habitats are recoverable within a period of five years following completion of the dredging activities. This zone abuts, and lies immediately outside of, the ZoHI.                                                                                                              |
| Zone of Influence (Zol)        | The area within which changes in environmental quality associated with dredge plumes are predicted and anticipated during the dredging operations, but where these changes would not result in a detectable impact on benthic biota. At any point in time, the dredge plumes are likely to be restricted to a relatively small portion of the Zol. |



**Figure 3: Development envelope and predicted zones of impact**

A summary of the proposal is provided in Table 3 and a description and identification of the elements for the proposal is provided in Table 4.



REPORT

Table 3: Summary of the proposal

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Proposal title    | South Thomson Development Barge Landing Development                                                                                                                                                                                                                                                                                                                                                                 |
| Proponent name    | Rottnest Island Authority                                                                                                                                                                                                                                                                                                                                                                                           |
| Short description | <p>Rottnest Island Authority is proposing to relocate the island's existing barging operations away from the Main Jetty to the existing Army Groyne in South Thomson Bay. This will help reduce congestion and improve the arrival experience to the island.</p> <p>To support the relocation of the barge operations, Rottnest Island Authority is proposing to extend and redevelop the existing Army Groyne.</p> |

Table 4: Description and identification of proposal elements

| Proposal element                         | Location / description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Maximum extent, capacity or range                                                                                                                                                                                                                                                            |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Physical elements                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                              |
| Development envelope                     | Figure 10<br>Encompasses the indicative disturbance footprint and a buffer area, the majority of which comprises the dredge Zone of High Impact (ZoHI)).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4.6 ha                                                                                                                                                                                                                                                                                       |
| Indicative disturbance footprint         | Figure 10<br>The indicative disturbance footprint encompasses the onshore and offshore physical infrastructure associated with proposal and dredge areas.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Total area: 3.15 ha<br>Terrestrial disturbance footprint: 1 ha<br>Wharf and laydown area (marine footprint): 1.13 ha<br>Dredge area (marine footprint): 1.02 ha                                                                                                                              |
| Construction elements                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                              |
| Dredging                                 | Construction methodologies are provided as Appendix A.<br>Dredging and piling are likely to be undertaken in the winter months of 2026. Dredge plume modelling by Baird (2024b) estimates that dredging may take up to 7.5 weeks to complete.<br>The dredging methodology is summarised below: <ul style="list-style-type: none"><li>Dredging will be undertaken with the use of a Backhoe Dredge (BHD).</li><li>The BHD is positioned with a support tug and then using its spud piles and excavator arm it manoeuvres into the required dredging location.</li><li>The loosening or cutting process breaks the in-situ materials' cohesion, allowing these materials to be removed. The process will be carried out mechanically using the cutting edge of a bucket on a BHD. Once loosened or dislodged, these materials will be raised to the water's surface mechanically via raising the bucket or grab of a BHD.</li><li>Excavated material is placed onto a flat-top barge moored alongside the BHD. When the barge is filled to its safe working capacity, it will drive to the RORO facility to be unloaded.</li><li>A silt curtain around BHD will be installed to mitigate the potential environmental impact from the dredge plume.</li><li>The dredged material will be reused as fill material in the laydown/hardstand and reclamation area.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                        | The proposed dredge area is shown in Figure 10 and comprises 1.02 ha.<br>Dredging will be undertaken to a declared depth of – 3.0 m Chart Datum, which will include a turning basin with a nominal diameter of 80 m.<br>An estimated 14,000 m³ of sand and 2,017 m³ of rock will be dredged. |
| Reclamation                              | Construction methodologies are provided as Appendix A.<br>The reclamation methodology depicted in Figure 11 is summarised below: <ul style="list-style-type: none"><li>Existing armour from the eastern side of the Army Groyne will be removed and used for construction of bunding. Bunding will be constructed along the eastern and northern sides of the reclamation zone to allow dredge spoil to settle and remain in place. This bunding will prevent dredge spoil from being washed away into the marine environment. Figure 11 provides an indication of the bund wall location.</li><li>The bunding will be constructed using core materials, followed by a geotextile filter layer and an armour layer. Figure 12 provides a conceptual cross-section of the bunding, reclamation fill and then adjacent dredge zone.</li><li>As reclamation progresses, the bunding on the marine side of the reclamation zone will need to be progressively moved to the north to ensure that each successive round of dredge spoil placed will remain in place.</li><li>Using the dredged spoil, the contractor will establish a tip head to place the dredged material into the water in the south-west corner of the reclamation area. Dredge spoil will be placed and spread in a north and east direction.</li><li>Material will be tipped from the Articulated Dump Truck and pushed out over the tip head using a wheel loader or similar.</li><li>Material will be compacted using a static pad foot roller.</li><li>Reclamation will continue until all dredge spoil has been placed. AECOM (2020) and PAEMAC (2024) estimated that the dredge spoil will be sufficient to complete the laydown area. There is not expected to be a requirement to import fill to complete the laydown area.</li></ul> | The proposed reclamation area is shown in Figure 10                                                                                                                                                                                                                                          |
| Construction of the wharf                | Construction methodologies are provided as Appendix A.<br>On completion of the reclamation works summarised above, the wharf will be constructed through extending the existing Army Groyne with rock armour as outlined below: <ul style="list-style-type: none"><li>Remove excess rock and materials and reshape the existing Army Groyne.</li><li>Import all rock and core materials from the mainland using a conventional barge converted for handling rock.</li><li>Place core materials along exposed batter.</li><li>Place filter layer (geotextile).</li><li>Place class 2 rock armour along exposed batter and class 1 rock armour along the northern breakwater. The proposed rock armour classes are shown in Figure 13.</li><li>Place a layer of crushed rock basecourse and asphalt along the Army Groyne extension to match that placed in the reclamation area.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | The proposed wharf area is shown in Figure 10                                                                                                                                                                                                                                                |
| Piling                                   | <ul style="list-style-type: none"><li>The barge landing ramp works will include Installation of mooring piles to a maximum depth of 10 m using a vibro hammer.</li><li>Construction of the ferry berth will require installation of piles using a vibro hammer rig operated from a barge located adjacent. The dimensions and number of piles is estimated at 16 × 610 mm that will be installed to a depth of 15 m. If the contractor does not install piles concurrently with construction of the breakwater, then 1200 mm sleeves will need to be installed in the rock armour so piles can be driven through the sleeves.</li><li>Construction of the small craft landing facility will include installation of piles using a vibro hammer rig operated from a barge located adjacent. The dimensions and number of piles is estimated at 6 × 500 mm that will be installed to a depth of 10 m. If the contractor does not install piles concurrently with construction of the breakwater, then 1200 mm sleeves will need to be installed in the rock armour so piles can be driven through the sleeves.</li></ul> <p>As discussed in Table 14, all piling proposed will be undertaken using a vibro hammer. However, a contingency of using a hammer pile has been adopted should the vibro hammer meet refusal. Both the proposed piling method (vibro hammer) and contingency method (hammer piling) have been included in the impact assessment.</p>                                                                                                                                                                                                                                                                                                                                                  | Piling locations will be determined during detailed engineering design                                                                                                                                                                                                                       |
| Other marine infrastructure and services | Hardstand and a shed structure will be constructed within the onshore component of the development envelope.<br>Services will be installed conventionally using a combination of on island and imported small plant. Services consist of water, fire service, power, CCTV and fuel provisions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | All works will occur within the development envelope shown in Figure 10.                                                                                                                                                                                                                     |
| Operational elements                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                              |
| Vessel movements                         | The proposed facility shall allow barge berthing, unloading and loading and departure for all conditions permitting safe transit across to Wadjemup / Rottnest Island. Typically barge and ferry operations are suspended when wind speed (ten-minute average) exceeds 40 kn and/or Hs >4 m for waters inshore of Wadjemup / Rottnest Island.<br>The existing barge schedule, as per Pelagic Marine Services operations, is provided below. There may be exemptions to these times to accommodate for special deliveries.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                              |
|                                          | Current barge activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Time                                                                                                                                                                                                                                                                                         |
|                                          | Gates open (20 Rous Head Road, North Fremantle)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 5:30 am                                                                                                                                                                                                                                                                                      |
|                                          | Same day perishable deliveries                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 6:15 am                                                                                                                                                                                                                                                                                      |
|                                          | Scheduled vessel departure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 6:45 am                                                                                                                                                                                                                                                                                      |
|                                          | Scheduled arrival – Thomson Bay                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 8:30 am                                                                                                                                                                                                                                                                                      |
|                                          | Last time for arrival of vehicles and returning goods at the Thomson Bay wharf                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 10:30 am                                                                                                                                                                                                                                                                                     |
|                                          | Departure (Thomson Bay, depending on volumes, returning freight)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 12:00 am to 1.00 pm                                                                                                                                                                                                                                                                          |
|                                          | Gates close (16 Mews Road, Fremantle)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 4:00 pm                                                                                                                                                                                                                                                                                      |

| Proposal element                                                | Location / description                                                                                                                                                                                                                                                                                      | Maximum extent, capacity or range                                                                                                                                                                                                                                                                         |
|-----------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ongoing maintenance                                             | There may be requirements for maintenance dredging during operations. Maintenance dredging (if required) will be undertaken in previously disturbed / sandy areas within the development envelope / project footprint. Maintenance dredging frequency, volumes and disposal will be determined as required. | This will be undertaken as required. Environmental management will be undertaken in a manner that is consistent with the document Maintenance Dredging Environmental Management Framework (BMT Oceanica, 2016) prepared for Department of Transport for similar types of maintenance dredging activities. |
| Other elements that affect extent of effects on the environment |                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                           |
| Proposal time                                                   | Maximum project life                                                                                                                                                                                                                                                                                        | Design life shall be 50 years in accordance with AS4997–2005 Normal commercial structure.                                                                                                                                                                                                                 |
|                                                                 | Construction phase                                                                                                                                                                                                                                                                                          | Construction is proposed to be undertaken between 2026 and 2027.                                                                                                                                                                                                                                          |
|                                                                 | Operations phase                                                                                                                                                                                                                                                                                            | 50 years.                                                                                                                                                                                                                                                                                                 |

---

## Summary of environmental factors and proposed mitigation and management outcomes

This supporting document has been prepared to address the following EPA key environmental factors that are relevant to the proposal:

- Benthic communities and habitats (Table 5)
- Coastal processes (Table 6)
- Marine environmental quality (Table 7)
- Marine fauna (Table 8)
- Flora and vegetation (Table 9)
- Terrestrial fauna (Table 10)

Social surroundings (

- Table 11).

Assessment of potential impacts to the environmental factors was undertaken based on the environmental investigations listed in Tables 5 to 11.

Appropriate management and mitigation measures have been developed to address potential impacts and ensure that the EPA's identified environmental objectives for each relevant environmental factor can be achieved. A range of measures will be implemented to provide certainty that the identified environmental objectives will be achieved. These measures and outcomes are summarised in Tables 5 to 11.

The assessment has concluded that the proposal is expected to be able to meet EPA's objectives for all environmental factors, subject to the implementation of the management and mitigations measures outlined in the following management plans:

- Dredging Environmental Monitoring and Management Plan (02 Environment, 2024) (Appendix O)
- Construction Environmental Management Plan (Emerge, 2024a) (Appendix P)
- Operational Environmental Management Plan (Emerge, 2024b) (Appendix Q).



Table 5: Summary of the potential impacts, proposed mitigation and outcomes – benthic communities and habitats

| Benthic communities and habitats                |                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   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|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------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| EPA environmental objective                     | To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained.                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Relevant policy and guidance                    | <ul style="list-style-type: none"><li>Environmental Factor Guideline: Benthic Communities and Habitats (EPA, 2016f)</li><li>Technical Guidance: Protection of Benthic Communities and Habitats (EPA, 2016h)</li><li>Technical Guidance: Environmental Impact Assessment of Marine Dredging Proposals (EPA, 2021a) and National Assessment Guidelines for Dredging (Australian Government, 2009)</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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| Supporting technical investigations and reports | <ul style="list-style-type: none"><li>South Thomson Barge Landing Development; Marine fauna and benthic habitat assessment (RPS, 2024a) (Appendix B)</li><li>South Thomson Barge Landing; Benthic habitat assessment: Plume Extension Survey Area (RPS, 2023b) (Appendix C)</li></ul>                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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| Potential environmental impacts                 | Direct impacts                                                                                                                                                                                                                                                                                                                                                                                            | <b>Loss of benthic habitats</b> <ul style="list-style-type: none"><li>Permanent loss of 3.23 ha of benthic communities and habitat, comprising:<ul style="list-style-type: none"><li>2.06 ha mixed seagrass. The loss of 2.06 ha of mixed seagrass represents 0.52% of seagrass within the Local Assessment Unit (LAU)</li><li>1.26 ha sand with wrack.</li></ul></li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           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|                                                 | Indirect impacts                                                                                                                                                                                                                                                                                                                                                                                          | <b>Reduced environmental quality</b> <ul style="list-style-type: none"><li>Temporary decrease in light availability resulting from increased turbidity in the water column within the ZoI and ZoMI, leading to reduced primary productivity and potential increased mortality rates of primary producers under conditions of prolonged or acute exposure</li><li>Increased sedimentation rates, or burial, resulting in stress or increased mortality rates (under extreme conditions)</li><li>Accidental fuel spills resulting in reduced water quality and impacts on benthic communities and habitats</li></ul> <b>Loss of benthic habitats</b> <ul style="list-style-type: none"><li>Recoverable loss of 3.71 ha of benthic habitats and communities within the ZoMI (the area within which predicted impacts on benthic organisms are recoverable within a period of five years following completion of the dredging activities):<ul style="list-style-type: none"><li>Temporary loss of 2.62 ha mixed seagrass</li><li>Temporary loss of 1.09 ha sand with wrack.</li></ul></li></ul> <b>Introduction of invasive marine species (IMS)</b> <ul style="list-style-type: none"><li>Alteration of the natural benthic communities in the area caused by the introduction of IMS.</li></ul> <b>Impacts from marine infrastructure</b> <ul style="list-style-type: none"><li>Altered water flows and sediment transport caused by the presence of new marine infrastructure.</li></ul>                                                                                                                          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| Mitigation                                      | Avoid                                                                                                                                                                                                                                                                                                                                                                                                     | <ul style="list-style-type: none"><li>Site selection includes an already disturbed area of 0.19 ha of disturbed seabed within the existing Army Groyne footprint. As benthic communities and habitats are widespread within South Thomson Bay, total avoidance of direct impacts is not possible.</li><li>RIA amended the project design to reduce the dredging requirements. By changing the berthing and barge turn pocket, the volume of required dredging was reduced from 26,000 m<sup>3</sup> to 16,050 m<sup>3</sup>.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 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|                                                 | Minimise                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Reduced environmental quality and loss of benthic communities and habitats</b> <ul style="list-style-type: none"><li>The AECOM and PAEMAC value engineering works helped to not only reduce dredging requirements, but also reduce the footprint to the minimum possible to achieve the objectives of constructing a new barge landing.</li><li>Management and mitigation proposed during construction to minimise impacts to benthic communities and habitats is detailed in the Construction Environmental Management Plan (CEMP) (Emerge, 2024a) (Appendix P) and Dredging Environmental Monitoring and Management Plan (DEMMP) (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that:<ul style="list-style-type: none"><li>The area impacted by suspended sediments during dredging and construction will be limited (wherever possible) and will not extend past the modelled ZoHI, ZoMI and ZoI shown in Figure 15.</li><li>Implementation of the CEMP and DEMMP will ensure that permanent loss of benthic communities and habitats resulting from construction of the proposal does not exceed 3.32 ha.</li><li>The potential for indirect water quality impacts to adjacent areas will be mitigated through implementation of the Marine Water Quality Monitoring Program provided in Appendix B.2 of the DEMMP. This program is discussed in further detail in Section 9.6.</li></ul></li><li>Implementation of the CEMP and DEMMP provides the monitoring and management framework to address potential indirect impacts to benthic communities and habitats from impacts to marine environmental quality during construction. Key management and monitoring measures include:<ul style="list-style-type: none"><li>Implementation of the Marine Water Quality Monitoring Program (MWQMP) provided in the DEMMP for suspended sediment</li><li>Implementation of the tiered management framework provided in the DEMMP</li><li>Implement the Benthic Communities and Habitat Monitoring Program provided in the DEMMP, including:<ul style="list-style-type: none"><li>Pre-disturbance Survey Report</li><li>Post-dredging Survey Report</li><li>Reactive Survey Report (if the trigger levels specified in the DEMMP and summarised in Section 9.6 of this report are exceeded)</li><li>Monitoring Close-out Report</li><li>Use of silt curtains which will minimise the potential impacts associated with increased suspended sediments</li><li>The placement of geofabric (such as Texcel 1200R) textile weave along the bund wall will ensure that the placement of dredge spoil during reclamation works will not impact or increase the dredge plume zones.</li></ul></li></ul></li><li>Maintenance dredging (if required) will be undertaken in previously disturbed / sandy areas within the development envelope / project footprint. Maintenance dredging frequency, volumes and disposal will be determined as required. Environmental management and monitoring will be undertaken in a manner that is consistent with the document Maintenance Dredging Environmental Management Framework (BMT Oceanica, 2016) prepared for Department of Transport for similar types of maintenance dredging activities.</li><li>The Operational Environmental Management Plan (OEMP) (Emerge, 2024b) (Appendix Q) outlines the mitigations and management measures to minimise impacts to marine environmental quality during operation.</li></ul> <b>Loss of benthic communities and habitats</b> <ul style="list-style-type: none"><li>Management and mitigation proposed during construction to minimise impacts to benthic communities and habitats is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that the area of benthic communities and habitats permanently impacted by the proposal is limited to the development envelope and ZoHI. These measures include:<ul style="list-style-type: none"><li>Employing high-resolution positioning system to control dredge operations to ensure that they do not occur outside the proposed dredging area</li><li>Implementing the management measures to minimise impacts to marine environmental quality as outlined in Section 9.6 of this report.</li></ul></li></ul> <b>Introduction of invasive marine species</b> <ul style="list-style-type: none"><li>Implementation of the CEMP (Emerge, 2024a) (Appendix P), DEMMP (02 Environment, 2024) (Appendix O) and OEMP (Appendix Q) will minimise the risk of introduction of IMS.</li><li>The proposal will be primarily used for barge operations to transport bulk cargo to and from Wadjemup / Rottnest Island. As such, the likelihood of vessels visiting the facility from international or interstate waters is low. However, any vessels from interstate or international waters will comply with commonwealth biosecurity requirements and complete the WA Department of Primary Industries and Regional Development 'Vessel Check' risk assessment (<a href="https://www.vessel-check.com/">https://www.vessel-check.com/</a>).</li><li>All vessels will have a ballast water management plan and ballast water exchanges will be in accordance with IMO requirements and the Commonwealth <i>Biosecurity Act 2015</i>.</li></ul> <b>Impacts from marine infrastructure</b> <ul style="list-style-type: none"><li>Baird (2024) identified that, due to the presence of existing infrastructure within the project footprint (Army Jetty), changes to coastal processes as a result of the proposal would be minimal.</li><li>A five-metre buffer is notionally considered a reasonable estimate of the area surrounding marine infrastructure that may be subject to events causing additional habitat loss, including localised erosion, slumping of dredged area walls and backwash (the halo effect). The development envelope and ZoHI encompasses an area around the marine infrastructure ranging from 7 m to 125 m. Consequently, the development envelope encompasses the area that may be impacted by the halo effect and impacts outside the development envelope as a result of the halo effect are not anticipated.</li></ul> |

Benthic communities and habitats

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|------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        | Rehabilitate | <ul style="list-style-type: none"><li>Construction effects will be temporary and natural amelioration will mitigate or remove long-term impacts following cessation of construction activities. It is predicted that the temporary impacts within the ZoMI are recoverable within a period of five years following completion of the dredging activities (Baird, 2024b).</li><li>The 'halo effect' from the proposed marine infrastructure is included in the calculated direct impacts (within the development envelope and ZoHI). Areas of benthic communities and habitats which will be directly impacted are not proposed to be rehabilitated.</li></ul>                                                                                                                                                                                                                                                                                                                            |
|                        | Offset       | Benthic communities and habitat offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Residual impacts       |              | <ul style="list-style-type: none"><li>Permanent loss of mixed seagrass of up to 2.06 ha (or 0.52% of mixed seagrass within the LAU)</li><li>Permanent loss of sand / sand with wrack of up to 1.26 ha. Consideration of this as a residual impact is a conservative approach, as post-dredging activities, sand / sand with wrack is likely to accumulate and therefore this impact is likely to be temporary</li><li>Temporary loss of 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI. Baird (2024b) predicts that impacts to these benthic communities and habitats will be recoverable within a period of five years following completion of the dredging activities.</li></ul>                                                                                                                                                                                                                                                                      |
| Environmental outcomes |              | <p><b>Environmental outcomes for construction of the proposal</b></p> <ul style="list-style-type: none"><li>Direct disturbance of benthic communities and habitats from construction activities is confined to the development envelope and ZoHI.</li><li>Irreversible impacts to benthic communities and habitats from dredging and construction activities is confined to the development envelope and ZoHI.</li><li>No irreversible impacts to benthic communities and habitats from dredging activities within the ZoMI.</li><li>No observable impacts to benthic communities and habitats outside the ZoMI.</li></ul> <p><b>Environmental outcomes for operation of the proposal</b></p> <ul style="list-style-type: none"><li>Maintain the health and cover of benthic communities and habitats outside the proposal footprint during operations associated with the proposal (excludes other RIA activities associated with other approvals e.g. mooring installation).</li></ul> |

Table 6: Summary of the potential impacts, proposed mitigation and outcomes – coastal processes

Coastal processes

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|-------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EPA environmental objective                     | To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Relevant policy and guidance                    | <ul style="list-style-type: none"><li>Environmental Factor Guideline: Coastal Processes (EPA, 2016i)</li><li>SPP No. 2.6: State Coastal Planning Policy (Western Australian Planning Commission, 2013a) and State Coastal Planning Policy Guidelines (Western Australian Planning Commission, 2013b)</li><li>Coastal Hazard Risk Management and Adaptation Planning Guidelines (Department of Planning and Western Australian Planning Commission, 2014)</li><li>Sea Level Change in Western Australia, Application to Coastal Planning (Department of Transport, 2010).</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Supporting technical investigations and reports | <ul style="list-style-type: none"><li>South Thomson Barge Landing Development; Coastal processes assessment (Baird, 2024a) (Appendix D)</li><li>RIA Peer Review of Dredge Plume Modelling and Coastal Processes Reports (RPS, 2024c) (Appendix E).</li></ul>                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Potential environmental impacts                 | Direct impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p><b>Interruption to longshore currents, resulting in changes to wrack and sediment accumulation</b></p> <ul style="list-style-type: none"><li>Engineered marine structures have the potential to interrupt longshore currents, trapping sediments and wrack.</li><li>The Coastal Processes Assessment undertaken by Baird (2024) identified that longshore currents within South Thomson Bay are currently interrupted by the existing Army Groyne and the proposed extension of the existing groyne is unlikely to result in a significant change to these coastal processes. Although the proposed wharf will block longshore currents to a similar degree as the existing Army Groyne, there may be some potential for the following minor impacts:<ul style="list-style-type: none"><li>Build-up of sediment on the eastern side of the proposed wharf when compared to the present condition</li><li>There is potential for the accumulation of seagrass to occur on the eastern side of the proposed wharf, which may lead to ingress of seagrass to the harbour footprint.</li></ul></li></ul> <p><b>Reduction of wave energy in lee of structures</b></p> <ul style="list-style-type: none"><li>Overall, the main changes in wave energy as a result of the proposed wharf is the reduction in wave height (when compared to the existing conditions) within the harbour basin area and some reduction in wave height along the shoreline on the western side of the wharf. Consequently, the proposal is unlikely to have a significant to coastal processes within the larger South Thomson Bay area.</li></ul> <p><b>Reflection of waves off structures resulting in increased wave energy in the structures vicinity</b></p> <ul style="list-style-type: none"><li>The impact on wave conditions outside of the proposed wharf structure was determined to be minimal by Baird, with decreases in wave height being the main observation across each of the cases modelled. No detrimental increase in wave height caused by reflections from the breakwater structure is seen at the moorings managed by RIA (Baird, 2024).</li></ul> |
| Mitigation                                      | Avoid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <ul style="list-style-type: none"><li>The Army Groyne creates an existing barrier to longshore sediment transport. Therefore, as the proposed wharf will block longshore sediment transport to a similar degree to the existing Army Groyne, the proposal is not anticipated to result in a significant change in longshore sediment transport and significant impacts have been avoided.</li><li>Impacts on coastal process from marine structures cannot be completely avoided due to the nature of the proposal.</li><li>Overall, the main changes in wave energy as a result of the proposed wharf is the reduction in wave height (when compared to the existing conditions) within the harbour basin area and some reduction in wave height along the shoreline on the western side of the wharf.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                                 | Minimise                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <p><b>Interruption to longshore currents</b></p> <ul style="list-style-type: none"><li>The proposed wharf structure has been subject to coastal processes modelling.</li><li>Monitoring of shoreline accretion and seagrass accumulating on the eastern side of the wharf will be undertaken during the operational phase. As outlined in the Operational Environmental Management Plan (OEMP) (Appendix Q), a coastal monitoring program will be implemented as required in the Coastal Hazard Risk Management and Adaptation Planning (CHRMAP) (Cardno, 2023).</li></ul> <p><b>Reduction of wave energy in lee of structures</b></p> <ul style="list-style-type: none"><li>The proposed wharf structure has been subject to coastal processes modelling. This modelling identified that changes are likely to be limited to:<ul style="list-style-type: none"><li>The reduction in wave height (when compared to the existing conditions) within the harbour basin area</li><li>A small reduction in wave height along the shoreline on the western side of the wharf</li></ul></li><li>As the vessels manoeuvre into or away from the facility within the turning circle, the waves would be 90 degrees to the vessel and further investigation into potential implications of this on the barge will be investigated as part of future detailed design</li><li>Implementation of the Rottnest Island Coastal Hazard Risk Management and Adaptation Plan (Cardno, 2023).</li></ul> <p><b>Reflection of waves off structures resulting in increased wave energy in the structures vicinity</b></p> <ul style="list-style-type: none"><li>The proposed wharf structure has been subject to coastal processes modelling and the impact on wave conditions outside of the proposed wharf structure was determined to be minimal by Baird (2024).</li></ul>                                                                                                                                                                                                                                                                                            |
|                                                 | Rehabilitate                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"><li>Depending on the accumulation volume of wrack and the reshaping of the shoreline towards the protection nib on the eastern side of the wharf, the above maintenance and monitoring activities may need to be actioned (Baird, 2024a).</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                                 | Offset                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Coastal processes offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Residual impacts                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <ul style="list-style-type: none"><li>Due to the presence of the existing Army Groyne, residual impacts to longshore currents from the proposed wharf are unlikely to be significant and are limited to:<ul style="list-style-type: none"><li>Sediment accretion and wrack accumulating on the eastern side of the wharf</li><li>A reduction of wave energy in lee of the wharf.</li></ul></li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Environmental outcomes                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <ul style="list-style-type: none"><li>Changes to coastal processes resulting from the proposal will be limited to the accumulation of sediment and seagrass against the wharf structure.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

Table 7: Summary of the potential impacts, proposed mitigation and outcomes – marine environmental quality

| Marine environmental quality                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EPA environmental objective                     | To maintain the quality of water, sediment and biota so that environmental values are protected.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Relevant policy and guidance                    | <ul style="list-style-type: none"><li>Environmental Factor Guideline: Marine Environmental Quality (EPA, 2016e)</li><li>Environmental Factor Guideline: Benthic Communities and Habitats (EPA, 2016f)</li><li>Technical Guidance: Environmental Impact Assessment of Marine Dredging Proposals (EPA 2021a)</li><li>Technical Guidance: Environmental Impact Assessment of Marine Dredging Proposals (EPA 2021a)</li><li>Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand., 2018)</li><li>Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand., 2018)</li><li>Perth's Coastal Waters, Environmental Values and Objectives (EPA, 2000)</li><li>State Water Quality Management Strategy No.2, Implementation Plan: Status Report (Government of Western Australia, 2004)</li><li>Background quality for coastal marine waters of Perth, Western Australia (Department of Environment, 2004).</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Supporting technical investigations and reports | <ul style="list-style-type: none"><li>South Thomson Barge Landing Development; Dredge Plume Modelling Assessment (Baird, 2024b) (Appendix F)</li><li>RIA Peer Review of Dredge Plume Modelling and Coastal Processes Reports (RPS, 2024c) (Appendix E)</li><li>Rottnest Island Authority has undertaken baseline water quality monitoring to support the proposal (Appendix G)</li><li>Rottnest Island Army Jetty Dredging; SAP Implementation report (RPS, 2020) (Appendix H).</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Potential environmental impacts                 | Direct impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p><b>Temporary increase in total suspended solids</b></p> <ul style="list-style-type: none"><li>Mobilisation of sediment during dredging activities, construction of the breakwater, reclamation and piling will result in a temporary increase in total suspended solids (TSS) within the following zones of impact. The zones of impact are shown in Figure 3:<ul style="list-style-type: none"><li>Zone of High Impact (ZoHI) – The area where impacts on benthic communities or habitats are predicted to be irreversible. The term irreversible means 'lacking a capacity to return or recover to a state resembling that prior to being impacted within a timeframe of five years or less'. The ZoHI encompasses an area of 1.37 ha. The majority of the ZoHI is located within the development envelope</li><li>Zone of Moderate Impact (ZoMI) – The area within which predicted impacts on benthic communities or habitats are recoverable within a period of five years following completion of the dredging activities. This zone abuts, and lies immediately outside of, the ZoHI. The ZoMI encompasses an area of 4.5 ha</li><li>Zone of Influence (Zol) – The area within which changes in environmental quality associated with dredge plumes are predicted and anticipated during the dredging operations, but where these changes would not result in a detectable impact on benthic biota. At any point in time, the dredge plumes are likely to be restricted to a relatively small portion of the Zol. The Zol encompasses an area of 13.44 ha.</li></ul></li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                 | Indirect impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p><b>Temporary increase in total suspended solids</b></p> <ul style="list-style-type: none"><li>Disturbance of sediments from vessel operations (including propeller wash) in shallow water may result in a temporary increase in suspended sediments during operation of the proposal</li><li>Temporary decrease in light availability for benthic communities and habitats due to increased TSS.</li></ul> <p><b>Increased risk of pollution incidents</b></p> <ul style="list-style-type: none"><li>Increased boat numbers during operation, and to lesser degree construction, of the proposal has the potential to increase the risk of pollution, including from antifouling paints, anti-corrosion anodes, increased risk of accidental discharges (e.g. fuel spills, oils and greases) and sillage</li><li>A fuel facility, including underground storage tanks is proposed as part of the proposal. There is a risk for fuel spills to occur during refuelling or from fuel storage facilities. Fuel spills from the fuel facility have the potential to impact marine environmental quality.</li></ul> <p><b>Temporary release of contaminants from marine sediment during dredging and reclamation activities</b></p> <ul style="list-style-type: none"><li>The proposed dredging activities and resulting suspension of sediments have the potential to result in the temporary release of contaminants from sediments.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Mitigation                                      | Avoid                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <ul style="list-style-type: none"><li>Dredging to a depth of RL -3 m will significantly avoid vessel operations disturbing sediments.</li><li>RIA amended the project design to reduce the dredging requirements. By changing the berthing and barge turn pocket, the volume of required dredging was reduced from 26,000 m³ to 16,050 m³.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                 | Minimise                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p><b>Temporary increase in total suspended solids</b></p> <ul style="list-style-type: none"><li>RIA amended the project design to reduce the dredging requirements. By changing the berthing and barge turn pocket, the volume of required dredging was reduced from 26,000 m³ to 16,050 m³</li><li>Management and mitigation proposed during construction to minimise impacts to marine environmental quality is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that:<ul style="list-style-type: none"><li>The area affected by suspended sediments during dredging and construction will be limited (wherever possible) and will not extend past the modelled ZoHI, ZoMI and Zol shown in Figure 23.</li><li>Marine environmental quality will be maintained at a moderate level of ecological protection during dredging and return to a High Level of Ecological Protection within two weeks following completion of dredging</li></ul></li><li>Implementation of the CEMP and DEMMP provides the monitoring and management framework to address potential impacts to marine environmental quality during construction. Key management and monitoring measures include:<ul style="list-style-type: none"><li>Implementation of the Marine Water Quality Monitoring Program (MWQMP) provided in the DEMMP for suspended sediment. This program specifies that if the specified triggers are exceeded, then the following management actions will be implemented to ensure impacts to marine environmental quality do not extend past the modelled zone of influence:<ul style="list-style-type: none"><li>If trigger 1 has been exceeded:<ul style="list-style-type: none"><li>Investigate if trigger 2 has been exceeded for any sites</li><li>Sample again at the exceeded monitoring site and associated reference site each day until turbidity has decreased.</li></ul></li><li>If trigger 2 has been exceeded:<ul style="list-style-type: none"><li>Assess metocean and weather conditions</li><li>Investigate if dredging or disposal has been occurring and if that is likely to be attributable to the exceedance</li><li>Investigate results of the other parameters to determine if there is likely to be stress on the surrounding seagrass.</li><li>Sample again at that monitoring site and associated reference site each day until turbidity has decreased.</li></ul></li><li>If the trigger levels are exceeded (or indicate a progressive increase towards the trigger levels) then modifications to the dredging program are to be considered, and may include, but not necessarily be limited to:<ul style="list-style-type: none"><li>Reactive benthic communities and habitats survey</li><li>Temporary pause to dredging activities (e.g. if exceedance appears to be due to factors other than dredging vessel movements, then pausing dredging activities will minimise cumulative effects)</li><li>Relocate the dredge (e.g. to an area of coarser sediment)</li><li>Reduce the dredge cut depth, rate of swing-speed and/or increase the dredge pump flow</li><li>Reduce disposal of material if the plume is coming from the reclamation area.</li></ul></li></ul></li></ul></li><li>Implementation of the tiered management framework provided in the DEMMP</li><li>Use of silt curtains which will minimise the potential impacts associated with increased suspended sediments</li><li>The placement of geofabric (such as Texcel 1200R®) textile weave along the bund wall will ensure that the placement of dredge spoil during reclamation works will not impact or increase the dredge plume zones.</li></ul> |



Marine environmental quality

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|                        |              | <p><b>Increased risk of pollution incidents from vessels and underground fuel storage leading to degradation of marine environmental quality</b></p> <ul style="list-style-type: none"><li>Construction management measures to minimise impacts to marine environmental quality is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that the risk for hydrocarbon spills to the marine environment is minimal so that there are no adverse impacts to the marine environment</li><li>Implementation of the CEMP and DEMMP provides the monitoring and management framework to address potential impacts to marine environmental quality during construction. Key management and monitoring measures include:<ul style="list-style-type: none"><li>Implement industry standard hydrocarbon management practices (chemical handling, storage, segregation, and spill response)</li><li>Any construction vessels including piling vessels/barges to establish a sewage and garbage disposal plan</li><li>Undertake vessel maintenance and bunkering in accordance with contractors approved vessel management systems</li><li>Hydrocarbon spills into the marine environment be immediately reported and appropriately remediated</li></ul></li><li>Operational management to minimise impacts to the marine environment is detailed in the OEMP (Appendix Q). Implementation of this management plan will ensure that:<ul style="list-style-type: none"><li>Fuel / oil spill contingency plans are included in the OEMP and includes the provision of clean-up equipment and appropriate disposal of contaminated water and sediment</li><li>Pollution incidents will be reported to the DoT's Marine Environmental Emergency Response (MEER) unit, with clean up managed and monitored in accordance with MEER's requirements</li><li>Pollution incidents will be monitored during operation in accordance with the OEMP, with contingency actions implemented should pollution triggers be breached on a reoccurring basis</li><li>The underground fuel storage facility will be constructed in accordance with AS1940 and as outlined in the OEMP have safety and leak detection equipment installed.</li></ul></li></ul> <p><b>Disturbance of sediments from vessel operations (including propeller wash) in shallow water results in a temporary increase in suspended sediments</b></p> <ul style="list-style-type: none"><li>Operational management measures to minimise impacts to the marine environment are detailed in the OEMP (Appendix Q). Implementation of this management plan will ensure that marine users comply with vessel operational restrictions required by DoT and RIA.</li></ul> <p><b>Temporary decrease in light availability for benthic communities and habitats due to suspended sediments</b></p> <ul style="list-style-type: none"><li>As discussed in Section 7, temporary impacts from suspended sediments on benthic communities are predicted in the ZoMI only. These impacts include temporary loss of 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack. Baird (2024b) predicts that impacts to these benthic communities and habitats within the ZoMI will be recoverable within a period of five years following completion of the dredging activities</li><li>Management and mitigation proposed during construction to minimise impacts to marine environmental quality is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that:<ul style="list-style-type: none"><li>The area affected by suspended sediments during dredging and construction will be limited (wherever possible) and will not extend past the modelled ZoHI, ZoMI and ZoI shown in Figure 23</li><li>Marine environmental quality will be maintained at a moderate level of ecological protection during dredging and return to a High Level of Ecological Protection within two weeks following completion of dredging</li></ul></li><li>Maintenance dredging (if required) will be undertaken in previously disturbed / sandy areas within the development envelope / project footprint. Maintenance dredging frequency, volumes and disposal will be determined as required. Environmental management and monitoring will be undertaken in a manner that is consistent with the document Maintenance Dredging Environmental Management Framework (BMT Oceanica, 2016) prepared for Department of Transport for similar types of maintenance dredging activities.</li></ul> <p><b>Temporary release of contaminants from marine sediment during dredging and reclamation activities</b></p> <ul style="list-style-type: none"><li>The risk of temporary release of contaminants from marine sediments during dredging and reclamation activities will be minimal as all baseline sediment results did not record contaminants above the assessment criteria</li><li>Management and mitigation proposed during construction to minimise impacts to marine environmental quality is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that the area affected by suspended sediments during dredging and construction will be limited (wherever possible) and will not extend past the modelled ZoHI, ZoMI and ZoI shown in Figure 23</li><li>The CEMP and DEMMP provides the monitoring and management framework to address potential impacts to marine environmental quality during construction.</li></ul> <p><b>Disturbance of sediments from maintenance dredging during operation</b></p> <ul style="list-style-type: none"><li>Maintenance dredging (if required) will be undertaken in previously disturbed / sandy areas within the development envelope / project footprint. Maintenance dredging frequency, volumes and disposal will be determined as required. Environmental management and monitoring will be undertaken in a manner that is consistent with the document Maintenance Dredging Environmental Management Framework (BMT Oceanica, 2016) prepared for Department of Transport for similar types of maintenance dredging activities.</li></ul> |
|                        | Rehabilitate | <ul style="list-style-type: none"><li>Fuel and oil spills to be cleaned up in accordance with the contingency actions outlined in the DEMMP, CEMP and OEMP.</li><li>Impacts to marine water quality from an increase in TSS within the ZoMI and ZoI will be temporary only.</li><li>Impacts to marine water quality from operational activities will be temporary only (during vessel use) and due to the proposed design are considered unlikely to be significant. No rehabilitation is considered applicable.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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|                        | Offset       | Marine environmental quality offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            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| Residual impacts       |              | <ul style="list-style-type: none"><li>Temporary suspended sediments within the ZoHI (1.37 ha), ZoMI (4.5 ha) and ZoI (13.44 ha)</li><li>Temporary reduction in light due to suspended sediments in the water column within the ZoMI (4.5 ha) may impact benthic communities and habitats. As impacts to benthic communities and habitats within the ZoMI will be recoverable within a period of five years following completion of the dredging activities, these residual impacts are not considered significant.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       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| Environmental outcomes |              | <p><b>Environmental outcomes for construction of the proposal:</b></p> <ul style="list-style-type: none"><li>Marine environmental quality will be temporarily reduced to a Moderate Level of Ecological Protection during construction but will return to a High Level of Ecological Protection two weeks after completion of dredging and construction activities.</li><li>No reported hydrocarbon spills or release of waste into the marine environment from construction and dredging activities.</li><li>Maintain the marine environmental quality outside the predicted zones of influence as defined by dredge modelling (ZoHI, ZoMI and ZoI).</li></ul> <p><b>Environmental outcomes for operation of the proposal:</b></p> <ul style="list-style-type: none"><li>Marine environmental quality is maintained at a High Level of Ecological Protection within and adjacent to the project footprint.</li><li>No reported hydrocarbon spills or release of waste into the marine environment from operational activities associated with the proposal.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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Table 8: Summary of the potential impacts, proposed mitigation and outcomes – marine fauna

| Marine fauna                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
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| EPA environmental objective                     | To protect marine fauna so that biological diversity and ecological integrity are maintained.                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Relevant policy and guidance                    | <ul style="list-style-type: none"><li>Environment Protection and Biodiversity Conservation Act 1999</li><li>Biodiversity Conservation Act 2016</li><li>Environmental Factor Guideline: Marine Fauna (EPA, 2016j)</li><li>National Biofouling Management Guidelines for Non-trading Vessels (Commonwealth of Australia, 2009a)</li><li>National Biofouling Management Guidelines for Commercial Vessels (Commonwealth of Australia, 2009b).</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Supporting technical investigations and reports | <ul style="list-style-type: none"><li>South Thomson Barge Landing Development; Marine fauna and benthic habitat assessment (RPS, 2024a) (Appendix B)</li><li>South Thomson Barge Landing Development; Underwater Acoustic Assessment (Tetra Tech, 2024) (Appendix S).</li></ul>                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Potential environmental impacts                 | Direct impacts                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p><b>Loss of benthic habitats</b></p> <ul style="list-style-type: none"><li>Loss of marine fauna habitat, primarily the loss of seagrass species associated with construction of the proposal has the potential to result in impacts to marine fauna species through loss of foraging opportunities and changes to marine environmental quality.</li><li>The total predicted loss of marine fauna habitat from the proposal is summarised below:<ul style="list-style-type: none"><li>Direct (permanent) impacts to 2.06 ha of mixed seagrass and 1.26 ha of sand / sand with wrack within the development envelope and ZoHI. The permanent loss of 2.06 ha of mixed seagrass accounts for 0.52% of mixed seagrass within the LAU</li><li>Indirect (recoverable) impacts to:<ul style="list-style-type: none"><li>2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI. It is predicted that benthic communities and habitats that are impacted within the ZoMI will recover within a five-year period</li><li>5.13 ha of mixed seagrass, 1.13 ha macroalgae dominated community, 0.35 ha of limestone reef / pavement and 6.70 ha of sand / sand with wrack within the ZoI. Changes in environmental quality associated with dredge plumes in the ZoI are not predicted to result in a detectible impact on benthic biota.</li></ul></li></ul></li></ul> <p><b>Increased risk of entanglement and / or entrainment</b></p> <ul style="list-style-type: none"><li>Entanglement of marine fauna with equipment and waste during construction and operation of the proposal may lead to injury, death, displacement, adverse behavioural and physiological changes.</li><li>Entrainment, the direct uptake of aquatic organisms by suction, during activities such as dredging has the potential to cause mortality to marine fauna species during construction.</li></ul> <p><b>Elevated underwater noise</b></p> <ul style="list-style-type: none"><li>Elevated levels of anthropogenic underwater noise can have negative impacts, ranging from changes in acoustic communication, displacement from an area, and in more severe cases temporary hearing loss, physical injury or mortality (Richardson, 1995). The greatest source of noise from the proposal will be associated with piling during construction. Dredging is anticipated to emit similar, or lesser, levels of noise. Other construction noise generated, such as rock dumping and construction vessel movement, is likely to be considerably less than pile driving and the impact from these other sources would be very low.</li></ul> <p><b>Risk of vessel collision</b></p> <ul style="list-style-type: none"><li>An increased risk of collision could result from an increase in the number of vessels using the South Thomson Bay Barge Landing during operation and to a lesser degree during construction. However, as barge movements already occur between the mainland and existing jetty in Thomson Bay, the proposal will not result in any changes in risk of vessel strike during the operational phase.</li><li>The risk of vessel strike during construction activities is low as the construction vessels will operate slowly and within the development envelope only.</li></ul> <p><b>Risk of injury or death from rock dumping during breakwater construction</b></p> <ul style="list-style-type: none"><li>Increased risk of injury/mortality of marine fauna.</li></ul> <p><b>Potential impacts from artificial lighting</b></p> <ul style="list-style-type: none"><li>Increased light emissions during operation of the proposal could lead to disturbance to marine fauna in the vicinity, especially shorebirds and seabirds.</li><li>The potential for artificial light emissions to impact shorebirds and seabirds during construction is considered to be low, as construction works will be undertaken during nominated daylight hours, with lighting requirements limited to security / safety installations.</li></ul> |
|                                                 | Indirect impacts                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p><b>Increased risk of introduction of Introduced Marine Species (IMS)</b></p> <ul style="list-style-type: none"><li>There is a risk of IMS introduction or spread during construction and operation of the proposal from vessel ballast water and hull fouling. Marine pests may threaten biodiversity through a number of mechanisms such as predation, competition for habitat and altering ecosystems.</li><li>Implementation of the proposal would not result in a major change in the activities that already exist on Wadjemup / Rottnest Island as the proposal involves moving the barging facilities to the proposed location from the existing jetty, rather than introducing a new activity to the island.</li></ul> <p><b>Increased risk of pollution incidents</b></p> <ul style="list-style-type: none"><li>Increased boat numbers during operation, and to lesser degree construction, of the proposal has the potential to increase the risk of pollution, including from antifouling paints, anti-corrosion anodes, increased risk of accidental discharges (e.g. fuel spills, oils and greases) and sullage.</li><li>A fuel facility, including underground storage tanks is proposed as part of the proposal. There is a risk for fuel spills to occur during refuelling or from fuel storage facilities. Fuel spills from the fuel facility have the potential to impact marine environmental quality.</li><li>Likely effects of release of contaminants into the marine environment may result in direct impacts through ingestion, inhalation and absorption through the skin, and abandonment of polluted feeding habitat and potentially longer-term impacts from bioaccumulation in the food chain.</li></ul> <p><b>Loss of benthic habitats</b></p> <ul style="list-style-type: none"><li>Loss of marine fauna habitat, primarily the loss of seagrass species associated with construction of the proposal has the potential to result in impacts to marine fauna species through loss of foraging opportunities and changes to marine environmental quality. The temporary loss of 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI from an increase in TSS.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Mitigation                                      | Avoid                                                                                                                                                                                                                                                                                                                                                                                                                                                | <ul style="list-style-type: none"><li>Avoiding construction activities during known critical spatial and temporal windows of marine environmental sensitivity will avoid significant impacts to marine fauna species. These critical windows are outlined in Table 49. However, it is not anticipated that impacts to marine species can be fully avoided during construction activities.</li><li>Site selection includes an already disturbed area of 0.19 ha of seabed within the existing Army Groyne footprint. As benthic communities and habitats are widespread within South Thomson Bay, total avoidance of direct impacts is not possible.</li><li>RIA amended the project design to reduce the dredging requirements. By changing the berthing and barge turn pocket, the volume of required dredging was reduced from 26,000 m<sup>3</sup> to 16,050 m<sup>3</sup></li><li>Using vibro hammer piling methods (rather than hammer piling) will eliminate sources of impulsive underwater noise.</li><li>General construction work will be limited to daylight hours only, minimising potential disturbance from marine fauna from artificial light.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                                 | Minimise                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p><b>Temporary / permanent loss or degradation of benthic habitat</b></p> <ul style="list-style-type: none"><li>Management and mitigation proposed during construction to minimise impacts to marine fauna habitat such as benthic communities and habitats is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that:<ul style="list-style-type: none"><li>The area of benthic habitat affected by suspended sediments during dredging and construction will be limited (wherever possible) and will not extend past the modelled ZoHI, ZoMI and ZoI.</li><li>Marine environmental quality will be maintained at a moderate level of ecological protection during dredging and return to a High Level of Ecological Protection within two weeks following completion of dredging.</li></ul></li><li>Implementation of the CEMP and DEMMP provides the monitoring and management framework to address potential impacts to marine environmental quality during construction. Key management and monitoring measures include:<ul style="list-style-type: none"><li>Implementation of the Marine Water Quality Monitoring Program (MWQMP) provided in the DEMMP for suspended sediment.</li></ul></li><li>Operational management to minimise impacts to marine fauna is detailed in the OEMP (Emerge, 2024b) (Appendix Q).</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

Marine fauna

- Maintenance dredging (if required) will be undertaken in previously disturbed / sandy areas within the development envelope / project footprint where possible. Maintenance dredging frequency, volumes and disposal will be determined as required. Environmental management and monitoring will be undertaken in a manner that is consistent with the document Maintenance Dredging Environmental Management Framework (BMT Oceanica, 2016) prepared for Department of Transport for similar types of maintenance dredging activities.
- Increased risk of entanglement and / or entrainment**
- Implementation of the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to address increased risk of entanglement and entrainment during construction. Management measures to minimise the risk of injury to fauna during construction includes:
    - Dedicated MFOs during dredging will implement management measures to minimise the risk of injury to fauna. Where marine fauna are observed within an Exclusion Zone, dredging will cease immediately.
    - Prior to commencing dredging or excavating, dedicated MFOs will check for marine fauna within the exclusion and observation zones outlined in the CEMP.
    - Dredging activities will be undertaken during daylight hours only to improve visibility.
    - Measures to minimise the risk for entanglement of marine fauna with waste and equipment during construction.
  - Implementation of the OEMP (Emerge, 2024b) (Appendix Q) provides the monitoring and management framework to address increased risk of entanglement during operation.
  - During operation of the proposal, the risk of entanglement will be minimised through installation of information-boards to encourage appropriate disposal of litter and the inform of the dangers of entanglement.
- Elevated underwater noise**
- Implementation of the CEMP (Emerge, 2024a) (Appendix P) provides the monitoring and management framework to address elevated underwater noise generated from construction activities, such as dredging and piling. Implementation of this management plan will ensure that:
    - There is no injury or death of marine fauna associated with underwater noise generated during construction of the proposal.
    - There is no injury or death of marine fauna from underwater noise.
  - Key management and monitoring measures included in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). are:
    - Trained marine fauna observers (MFOs) will minimise the risk of injury to marine fauna during piling.
    - A reduction in underwater noise impacts to marine fauna will be achieved through the use of vibration piling rather than hammer piling during construction. The reduction in underwater noise levels can be seen in the comparison of the underwater noise modelling shown in Figure 35 and Figure 36.
    - Hammer piling will only be used as a contingency if there is a refusal during vibro-piling. Exclusion zones for this contingency are included in the CEMP.
    - Pre-start, soft-start, shut-down and low-visibility procedures will be implemented as outlined in the CEMP. These are summarised below and detailed in Appendix A of the CEMP:
    - Prior to piling works each day and for each pile the dedicated MFOs will commence continuous visual observation within the observation and exclusion zones for 30 minutes.
    - Soft-start procedures involve the commencement of piling at low vibro-hammer energy, gradually increasing to full energy over a 30-minute period. Where target marine fauna are not observed in the observation and exclusion zones during the soft-start procedures, then normal piling can commence.
    - Where marine fauna is observed by the MFO within the observation zone (but outside the exclusion zone) during piling activities (including soft-start procedures), then the shutdown procedures outlined in the CEMP will be implemented.
    - During periods of low visibility (i.e. where a distance of 500 m cannot be clearly viewed), then piling operations may commence with soft-start procedures, unless one of the triggers provided in the CEMP occurs.
    - Implementation of observation and exclusion zones. These zones have been based on the underwater received sound levels and distances from the underwater noise assessment (Appendix S) and are provided in the CEMP. The management zones are depicted in Appendix A (Marine Fauna Provisions) of the CEMP.
    - Piling will only be undertaken during daylight hours to ensure visibility of the observation and exclusion zones for the MFO.
  - Trained MFOs will be on duty (as outlined in Appendix A of the CEMP) on vessels during construction
- Risk of vessel collision**
- Implementation of the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to address increased vessel collision risk during construction. Implementation of this management plan will ensure that there is no death or injury to marine fauna from vessel strike. Management measures that will be implemented include:
    - Implementation of vessel speed limits
    - All vessels are to adhere to standards set in the National Whale Watching Guidelines
    - A MFO on all construction vessels when in transit
    - Implementation of vessel approach distances to marine fauna
    - Implementation of the marine fauna monitoring and management program provided in Appendix B.3 of the DEMMP.
  - Implementation of the OEMP (Emerge, 2024b) (Appendix Q) provides the monitoring and management framework to address increased vessel collision risk during operation. Implementation of this management plan will ensure that:
    - Marine users to comply with vessel operational restrictions required by DoT and RIA
- Risk of injury or death from rock dumping during breakwater construction**
- The CEMP (Emerge, 2024a) (Appendix P) outlines the management and monitoring measures to mitigate the potential impacts of rock dumping and excavation on conservation significant marine fauna. These measures include:
- Dedicated MFOs during rock dumping activities will implement management measures to minimise the risk of injury to fauna as outlined in Appendix A (Marine Fauna Provisions) of the CEMP, including:
  - Prior to rock dumping and excavation works, the dedicated MFOs will commence continuous visual observation within the specified Management Zones for 30 minutes. If target marine fauna is observed within the management zone during this time, rock dumping and excavation shall be delayed until the marine fauna has been observed exiting the Observation Zone or have not been seen for 30 minutes.
  - Once rock dumping has commenced, if the dedicated MFOs observe a target marine fauna species within the Exclusion Zones then shut-down procedures will be implemented.
  - During periods of low visibility (i.e. where a distance of 500 m cannot be clearly viewed), then rock dumping and excavation activities may commence with soft-start procedures.
  - Rock dumping, dredging and excavation activities will be undertaken during daylight hours only to improve visibility.
- Potential impacts from artificial lighting**
- Implementation of the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to minimise impacts to marine fauna from increased light emissions during construction. The key management measure to ensure no disturbance to marine fauna from artificial light during construction is:
    - Construction activities will be restricted to daylight hours.
  - Operational management to minimise impacts to marine fauna is detailed in the OEMP (Emerge, 2024b) (Appendix Q). Implementation of this management plan will ensure that:
    - Artificial lighting will be of lowest allowable intensity to meet legislative and regulatory requirements for human safety / navigational purposes.
  - Best practice lighting design consistent with the National Light Pollution Guidelines for Wildlife (DCCEEW 2023) will be employed to reduce light pollution on marine fauna during operation, including:
    - Only add light for specific purposes (e.g. navigational and safety).
    - Use adaptive light controls to manage light timing, intensity and colour.
    - Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill.
    - Use the lowest intensity lighting appropriate for the task.
    - Use non-reflective, dark-coloured surfaces.
    - Use lights with reduced or filtered blue, violet and ultra-violet wavelengths.

Marine fauna

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|------------------------|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        |              | <p><b>Increased risk of introduction of IMS</b></p> <ul style="list-style-type: none"><li>Implementation of the CEMP (Emerge, 2024a) (Appendix P), DEMMP (02 Environment, 2024) (Appendix O) and OEMP (Appendix Q) will minimise the risk of introduction of IMS.</li><li>The proposal will be primarily used for barge operations to transport bulk cargo to and from Wadjemup / Rottnest Island. As such, the likelihood of vessels visiting the facility from international or interstate waters is low. However, any vessels from interstate or international waters will comply with Commonwealth biosecurity requirements and complete the WA Department of Primary Industries and Regional Development 'Vessel Check' risk assessment (<a href="https://www.vessel-check.com/">https://www.vessel-check.com/</a>).</li><li>All vessels will have a ballast water management plan and ballast water exchanges will be in accordance with IMO requirements and the <i>Commonwealth Biosecurity Act 2015</i>.</li></ul> <p><b>Increased risk of pollution incidents</b></p> <ul style="list-style-type: none"><li>Construction management measures to minimise the risk of pollution incidents which may impact marine fauna is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that the risk for hydrocarbon spills to the marine environment is minimal so that there are no adverse impacts to marine fauna.</li><li>Key management and monitoring measures include:<ul style="list-style-type: none"><li>Implement industry standard hydrocarbon management practices (chemical handling, storage, segregation, and spill response).</li><li>Any construction vessels including piling vessels/barges is to establish a sewage and garbage disposal plan.</li><li>Undertake vessel maintenance and bunkering in accordance with contractors approved vessel management systems.</li><li>Hydrocarbon spills into the marine environment be immediately reported and appropriately remediated.</li></ul></li><li>Operational management to minimise impacts to the marine environment is detailed in the OEMP (Appendix Q). Implementation of this management plan will ensure that:<ul style="list-style-type: none"><li>Fuel / oil spill contingency plans are included in the OEMP, and includes the provision of clean-up equipment and appropriate disposal of contaminated water and sediment.</li><li>Pollution incidents will be reported to the DoT's MEER unit, with clean up managed and monitored in accordance with MEER's requirements.</li><li>Pollution incidents will be monitored during operation in accordance with the OEMP, with contingency actions implemented should pollution triggers be breached on a reoccurring basis.</li></ul></li><li>The underground fuel storage facility will be constructed in accordance with AS1940 and as outlined in the OEMP have safety and leak detection equipment installed.</li></ul> |
|                        | Rehabilitate | <ul style="list-style-type: none"><li>There is no opportunity to rehabilitate the impacted area due to operation and maintenance of the proposal. Construction effects (outside the development envelope and ZoHI) to marine fauna habitat (benthic communities and habitats) will be temporary and natural amelioration will mitigate or remove long-term impacts following cessation of construction activities.</li><li>Sick and/or injured fauna shall be managed by appropriately qualified personnel and any injury or death of marine fauna will be reported to the Department of Biodiversity, Conservation and Attractions (DBCA).</li><li>Fuel and oil spills to be cleaned up in accordance with the contingency actions outlined in the DEMMP, CEMP and OEMP.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                        | Offset       | Marine fauna offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Residual impacts       |              | <ul style="list-style-type: none"><li>Impacts to the following benthic communities and habitats within the ZoI, ZoMI and ZoHI from an increase in suspended sediments results in a decrease in potential marine fauna habitat available:<ul style="list-style-type: none"><li>Permanent impacts to 2.06 ha mixed seagrass and 1.26 ha sand with wrack</li><li>Temporary loss of 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI.</li></ul></li><li>Underwater noise emissions from construction activities such as piling and dredging operations causing temporary disturbance to marine fauna species.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Environmental outcomes |              | <p><b>Environmental outcomes for construction of the proposal</b></p> <ul style="list-style-type: none"><li>No irreversible loss of marine fauna habitat (e.g. benthic communities and habitats) from dredging and construction activities outside the development envelope and ZoHI</li><li>No reported introduction or establishment of IMS as a result of construction activities associated with the proposal</li><li>No reported impacts to marine fauna as a result of hydrocarbon spill or release of waste associated with construction activities including entanglement or ingestion of waste</li><li>No reported death or injury to marine fauna from vessel strike associated with construction activities</li><li>No reported death, injury or behavioural change to marine fauna as a result of underwater noise associated with construction activities</li><li>No reported negative impacts on marine fauna attributable to the construction lighting requirements of the proposal.</li></ul> <p><b>Environmental outcomes for operation of the proposal</b></p> <ul style="list-style-type: none"><li>No reported loss of marine fauna habitat outside of the approved project footprint attributable to the operation of the proposal</li><li>No reported introduction or establishment of IMS as a result of operational activities associated with the proposal</li><li>No reported impacts to marine fauna as a result of hydrocarbon spill or release of waste associated with operational activities including entanglement or ingestion of waste</li><li>No reported death or injury to marine fauna from vessel strike associated with operational activities</li><li>No reported negative impacts on marine fauna attributable to the lighting requirements of the proposal associated with operation of the proposal.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

Table 9: Summary of the potential impacts, proposed mitigation and outcomes – flora and vegetation

Flora and vegetation

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|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EPA environmental objective                     | To protect flora and vegetation so that biological diversity and ecological integrity is maintained.                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Relevant policy and guidance                    | <ul style="list-style-type: none"><li>Environmental Factor Guideline – Flora and Vegetation (EPA, 2016a)</li><li>Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b)</li><li><i>Environment Protection and Biodiversity Conservation Act 1999</i></li><li><i>Biodiversity Conservation Act 2016</i></li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Supporting technical investigations and reports | <ul style="list-style-type: none"><li>Flora and vegetation survey; South Thomson and Kingstown, Rottnest Island (FVC, 2023) (Appendix I)</li><li>South Thomson Barge Redevelopment Flora and Vegetation Survey (RPS, 2024d) (Appendix J)</li></ul>                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Potential environmental impacts                 | Direct impacts                                                                                                                                                                                                                                                                                                                                               | <p><b>Removal of native vegetation</b></p> <ul style="list-style-type: none"><li>Removal of 0.46 ha of native vegetation in Good to Degraded condition</li><li>Of the native vegetation being cleared, 0.23 ha is analogous with the threatened ecological community (TEC); <i>Callitris preissii</i> (or <i>Melaleuca lanceolata</i>) forests and woodlands of the Swan Coastal Plain.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                                 | Indirect impacts                                                                                                                                                                                                                                                                                                                                             | <p><b>Introduction of invasive species (pests and weeds)</b></p> <ul style="list-style-type: none"><li>There is potential for the movement of construction machinery to result in the introduction of weed and pest species.</li></ul> <p><b>Introduction of disease</b></p> <ul style="list-style-type: none"><li>There is potential for the movement of construction machinery to result in the introduction of disease.</li></ul> <p><b>Accidental clearing</b></p> <ul style="list-style-type: none"><li>During construction activities, there is a risk that native vegetation outside the areas directly impacted will be accidentally cleared.</li></ul> <p><b>Localised erosion</b></p> <ul style="list-style-type: none"><li>There is a risk for localised erosion to occur adjacent to cleared areas or due to surface water run-off. Localised erosion may impact vegetation adjacent to the development envelope.</li></ul> <p><b>Incorrect waste disposal</b></p> <ul style="list-style-type: none"><li>Potential vegetation degradation through the incorrect disposal of rubbish and waste.</li></ul> |



Flora and vegetation

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| Mitigation | Avoid        | <ul style="list-style-type: none"><li>Avoidance of impacts to the 0.8 ha of native vegetation analogous with the TEC (MIAp*Td) surveyed outside the development envelope.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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|            | Minimise     | <p><b>Removal of native vegetation</b></p> <ul style="list-style-type: none"><li>A CEMP (Emerge, 2024a) (Appendix P) will be implemented to ensure impacts to native vegetation is limited to the 0.46 ha within the development envelope. Management measures to limit impacts outside the development envelope include:<ul style="list-style-type: none"><li>Extent of authorised disturbance will be clearly defined and demarcated on appropriate plans. The demarcated terrestrial construction works area to be surveyed prior to the commencement of vegetation removal works. Movement of construction vehicles within vegetation outside this area will be limited to avoid accidental clearing or disturbance of surrounding vegetation</li><li>All identified populations of MIAp*Td will be delineated using highly visible flagging or similar around all identified populations to avoid impacts to the 0.8 ha of MIAp*Td surveyed outside the development envelope</li><li>Establishment of clearly delineated access points to prevent unauthorised disturbance and access</li><li>Installation of temporary fencing, inclusive of sediment controls, along the boundary of the terrestrial construction works area to restrict machinery access to be within the approved disturbance area</li><li>Daily inspections to visually check / review clearing boundaries and compliance during clearing activities</li><li>Photographic records of the clearing area pre- and post-clearing activities</li><li>Inspection to verify no degradation or disturbance beyond approved clearing boundary from erosion.</li></ul></li><li>Operational management to minimise impacts to flora and vegetation is detailed in the OEMP (Emerge, 2024b) (Appendix Q). Implementation of this management plan will ensure that:<ul style="list-style-type: none"><li>Vehicle access is controlled to designated roads and access.</li><li>There is no introduction of weed species to the site as a result of operation.</li></ul></li></ul> <p><b>Introduction of invasive species (pests and weeds)</b></p> <ul style="list-style-type: none"><li>Construction management and monitoring measures to minimise impacts to terrestrial flora and vegetation is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:<ul style="list-style-type: none"><li>Implementation of the weed management protocol as outlined in the CEMP</li><li>Weekly inspections and photographic records during clearing and construction activities</li><li>Inspections to verify no degradation or disturbance has occurred beyond the development envelope</li><li>Appropriate hygiene measures to minimise the risk of the spread and introduction of weed species, including:<ul style="list-style-type: none"><li>Weekly spot checks of mobile equipment and vehicles</li><li>hygiene points at key road entry points</li></ul></li><li>Implementation of the weed management protocol outlined in the CEMP</li><li>Stockpile management, including stockpile locations (within the development envelope), erosion and stabilisation techniques and height limits</li><li>Designated areas for the temporary placement of cleared vegetation (within the development envelope) to minimise the increased risk of weed and disease spread and bushfire</li><li>The contractor will supply weed and weed certificates prior to mobilising vehicles and machinery.</li></ul></li><li>Operational management to minimise impacts to flora and vegetation is detailed in the OEMP (Emerge, 2024b) (Appendix Q). Implementation of this management plan will ensure that:<ul style="list-style-type: none"><li>Vehicle access is controlled to designated roads and access</li><li>There is no introduction of weed species to the site as a result of operation.</li></ul></li></ul> <p><b>Introduction of disease</b></p> <ul style="list-style-type: none"><li>Construction management measures to minimise impacts to terrestrial flora and vegetation is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:<ul style="list-style-type: none"><li>Appropriate hygiene measures to minimise the risk of the spread and introduction of disease</li><li>Extent of authorised disturbance will be clearly defined and demarcated on appropriate plans. The demarcated terrestrial construction works area to be surveyed prior to the commencement of vegetation removal works. Movement of construction vehicles within vegetation outside this area will be limited to avoid the risk of disease spread</li></ul></li><li>Monitoring during construction to minimise impacts to terrestrial flora and vegetation is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:<ul style="list-style-type: none"><li>Daily inspections and photographic records during clearing and construction activities</li><li>Inspections to verify no degradation or disturbance has occurred beyond the development envelope</li></ul></li><li>Operational management to minimise impacts to flora and vegetation is detailed in the OEMP (Emerge, 2024b) (Appendix Q). Implementation of this management plan will ensure that:<ul style="list-style-type: none"><li>Vehicle access is controlled to designated roads and access</li><li>There is no introduction of disease to the site as a result of operation</li></ul></li></ul> <p><b>Accidental clearing</b></p> <ul style="list-style-type: none"><li>Construction management measures to minimise impacts to terrestrial flora and vegetation is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:<ul style="list-style-type: none"><li>Vehicles, plant, and equipment to be restricted within development envelope</li><li>The extent of authorised disturbance will be clearly defined and demarcated on appropriate plans. The demarcated terrestrial construction works area to be surveyed prior to the commencement of vegetation removal works</li><li>Installation of temporary fencing, inclusive of sediment controls, along the boundary of the terrestrial construction works area to restrict machinery access to be within the approved disturbance area</li></ul></li><li>Monitoring during construction to minimise impacts to terrestrial flora and vegetation is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:<ul style="list-style-type: none"><li>Daily inspections and photographic records during clearing and construction activities</li><li>Inspections to verify no degradation or disturbance has occurred beyond the development envelope.</li></ul></li></ul> <p><b>Localised erosion</b></p> <ul style="list-style-type: none"><li>Construction management measures to minimise impacts to terrestrial flora and vegetation is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:<ul style="list-style-type: none"><li>Installation of temporary fencing, inclusive of sediment controls, along the boundary of the terrestrial construction works will minimise localised erosion</li><li>Establishment of clearly delineated access points to prevent unauthorised disturbance and access</li></ul></li><li>Monitoring during construction to minimise impacts to terrestrial flora and vegetation is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:<ul style="list-style-type: none"><li>Daily inspections and photographic records during clearing and construction activities</li><li>Inspections to verify no degradation or disturbance has occurred beyond the development envelope.</li></ul></li></ul> <p><b>Degradation through incorrect waste disposal</b></p> <ul style="list-style-type: none"><li>A CEMP (Emerge, 2024a) (Appendix P) will be implemented to ensure impacts to native vegetation is limited to the 0.46 ha within the development envelope. Measures to manage waste disposal will be implemented as per the CEMP to minimise the risk for degradation of the surrounding vegetation.</li><li>Operational management to minimise impacts to flora and vegetation is detailed in the OEMP (Emerge, 2024b) (Appendix Q). Implementation of this management plan will ensure that waste disposal measures are implemented to prevent rubbish and litter degrading surrounding vegetation.</li></ul> |
|            | Rehabilitate | <ul style="list-style-type: none"><li>Should the proposal result in the introduction of weed species, appropriate management and control measures will be implemented.</li><li>Should the proposal result in the introduction of disease, appropriate management measures will be implemented.</li><li>There is no opportunity to rehabilitate the areas directly impacted by construction of the proposal. However, any accidental clearing will be rehabilitated.</li><li>If daily inspections during construction identifies areas of erosion outside the development envelope which impacts vegetation condition, these areas will be rehabilitated.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   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|            | Offset       | Terrestrial flora and vegetation offsets are not proposed for terrestrial flora and vegetation as only 0.52% of the TEC identified in the surrounding area will be directly impacted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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Flora and vegetation

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|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Residual impacts       | <ul style="list-style-type: none"><li>Removal of 0.46 ha of native vegetation in Good to Degraded condition. Of the native vegetation being cleared, 0.23 ha is analogous with the TEC, <i>Callitris preissii</i> (or <i>Melaleuca lanceolata</i>) forests and woodlands of the Swan Coastal Plain.</li></ul>                                                                                                                        |
| Environmental outcomes | <ul style="list-style-type: none"><li>Direct impacts to native vegetation resulting from the proposal will not exceed 0.46 ha.</li><li>Direct impacts to native vegetation (MIAp*Td) analogous with the TEC, <i>Callitris preissii</i> (or <i>Melaleuca lanceolata</i>) forests and woodlands of the Swan Coastal Plain does not exceed 0.23 ha.</li><li>No introduction of new weed species attributable to the proposal.</li></ul> |

Table 10: Summary of the potential impacts, proposed mitigation and outcomes – terrestrial fauna

| Terrestrial fauna                               |                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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| EPA environmental objective                     | To protect terrestrial fauna so that biological diversity and ecological integrity are protected (EPA, 2016d).                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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| Relevant policy and guidance                    | <ul style="list-style-type: none"><li>Environmental Factor Guideline: Terrestrial Fauna (EPA, 2016d)</li><li>Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2020)</li><li><i>Environment Protection and Biodiversity Conservation Act 1999</i></li><li><i>Biodiversity Conservation Act 2016</i>.</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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| Supporting technical investigations and reports | <ul style="list-style-type: none"><li>Rottnest Island Basic Fauna Survey (EcoLogical, 2024) (Appendix K).</li></ul>                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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| Potential environmental impacts                 | Direct impacts                                                                                                                                                                                                                                                                                                                                                  | <p><b>Loss of terrestrial fauna habitat</b></p> <ul style="list-style-type: none"><li>Construction of the proposal will result in the removal of 0.46 ha of potential terrestrial fauna habitat. Conservation significant species that may occur within this habitat includes:<ul style="list-style-type: none"><li><i>Lerista lineata</i> (Perth slider)</li><li><i>Pandion haliaetus</i> (osprey)</li><li><i>Pseudonaja affinis exilis</i> (Rottnest Island dugite)</li><li><i>Tiliqua rugosa konowi</i> (Rottnest Island bobtail)</li><li><i>Setonix brachyurus</i> (quokka).</li></ul></li></ul> <p><b>Injury and / or mortality of terrestrial fauna</b></p> <ul style="list-style-type: none"><li>Construction of the proposal may result in increased vehicle movements within the development envelope, resulting in vehicle strike.</li><li>It is unlikely operation of the proposal will significantly increase the potential for fauna strike, given the existing presence of roads within the area.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                                 | Indirect impacts                                                                                                                                                                                                                                                                                                                                                | <p><b>Alteration of fauna behaviour</b></p> <ul style="list-style-type: none"><li>During construction, there will be noise and vibration emissions due to vehicles movements and construction activities. Noise and vibration associated with construction of the proposal have the potential to result in short-term disturbance to fauna on a local scale.</li></ul> <p><b>Indirect loss or impact to terrestrial fauna habitat from habitat degradation</b></p> <ul style="list-style-type: none"><li>Indirect loss or impact to terrestrial fauna habitat from habitat degradation as a result of:<ul style="list-style-type: none"><li>The introduction or spread of invasive species (pests and weeds) due to construction machinery and vehicles</li><li>The introduction or spread of disease (for example, dieback) due to construction machinery and vehicles</li><li>Inappropriate disposal of waste.</li></ul></li></ul> <p><b>Accidental clearing of potential fauna habitat</b></p> <ul style="list-style-type: none"><li>During construction activities, there is a risk that terrestrial fauna habitat outside the areas directly impacted will be accidentally cleared.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Mitigation                                      | Avoid                                                                                                                                                                                                                                                                                                                                                           | Complete avoidance of impacts to terrestrial fauna and habitat cannot be achieved.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 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|                                                 | Minimise                                                                                                                                                                                                                                                                                                                                                        | <p><b>Loss of terrestrial fauna habitat</b></p> <ul style="list-style-type: none"><li>A CEMP (Emerge, 2024a) (Appendix P) will be implemented to ensure impacts to terrestrial fauna habitat is limited to the 0.46 ha within the development envelope. Management measures to minimise potential impacts outside the development envelope are discussed in this table.</li></ul> <p><b>Habitat degradation from the introduction and spread of weeds and disease and incorrect waste disposal</b></p> <ul style="list-style-type: none"><li>Construction management and monitoring measures to minimise impacts to terrestrial fauna habitat are detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:<ul style="list-style-type: none"><li>Appropriate hygiene measures to minimise the risk of the spread and introduction of weed species</li><li>Extent of authorised disturbance will be clearly defined and demarcated on appropriate plans. The demarcated terrestrial construction works area to be surveyed prior to the commencement of vegetation removal works. Movement of construction vehicles within vegetation outside this area will be limited to avoid the risk of weed spread</li><li>Daily inspections and photographic records during clearing and construction activities</li><li>Inspections to verify no degradation or disturbance has occurred beyond the development envelope</li><li>Appropriate hygiene measures to minimise the risk of the spread and introduction of weed species:</li><li>Weekly spot checks of mobile equipment and vehicles</li><li>Hygiene points at key road entry points</li><li>Implementation of the weed management protocol outlined in the CEMP</li><li>Stockpile management, including stockpile locations (within the development envelope), erosion and stabilisation techniques and height limits</li><li>Designated areas for the temporary placement of cleared vegetation (within the development envelope) to minimise the increased risk of weed and disease spread and bushfire</li></ul></li><li>Operational management to minimise impacts to flora and vegetation is detailed in the OEMP (Emerge, 2024b) (Appendix Q). Implementation of this management plan will ensure that:<ul style="list-style-type: none"><li>Vehicle access is controlled to designated roads and access</li><li>There is no introduction of weed species to the site as a result of operation.</li></ul></li></ul> <p><b>Accidental clearing of potential fauna habitat</b></p> <ul style="list-style-type: none"><li>Construction management measures to minimise impacts to terrestrial fauna habitat is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:<ul style="list-style-type: none"><li>Vehicles, plant, and equipment to be restricted within development envelope</li><li>The extent of authorised disturbance will be clearly defined and demarcated on appropriate plans. The demarcated terrestrial construction works area to be surveyed prior to the commencement of vegetation removal works</li><li>Installation of temporary fencing, inclusive of sediment controls, along the boundary of the terrestrial construction works area to restrict machinery access to be within the approved disturbance area</li></ul></li><li>Monitoring during construction to minimise impacts to terrestrial fauna is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:<ul style="list-style-type: none"><li>Daily inspections and photographic records during clearing and construction activities</li><li>Inspections to verify no degradation or disturbance has occurred beyond the development envelope.</li></ul></li></ul> <p><b>Injury and / or mortality of terrestrial fauna</b></p> <ul style="list-style-type: none"><li>Construction management measures to minimise impacts to terrestrial fauna is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:<ul style="list-style-type: none"><li>Vehicles, plant, and equipment to be restricted within development envelope</li><li>The extent of authorised disturbance will be clearly defined and demarcated on appropriate plans. The demarcated terrestrial construction works area to be surveyed prior to the commencement of vegetation removal works</li><li>Vegetation clearing will be undertaken progressively and towards retained vegetation</li><li>Vehicle speed limits will be implemented in accordance with the CEMP</li><li>If native fauna is encountered during clearing works it should, initially, be allowed to make its own way from the works area. However, if this is not possible or practicable, a qualified wildlife handler will be contacted to relocate it</li></ul></li><li>It is unlikely operation of the proposal will significantly increase the potential for fauna strike, given the existing presence of roads within the area. The OEMP (Appendix Q) outlines measures to minimise the risk of injury to terrestrial fauna during operation.</li></ul> |

Terrestrial fauna

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|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                        | Rehabilitate                                                                                                                                                                                                                                                                                                                                                                | <ul style="list-style-type: none"><li>Should the proposal result in the introduction of weed species, appropriate management and control measures will be implemented.</li><li>There is no opportunity to rehabilitate the areas directly impacted by construction of the proposal. Any accidental clearing outside the approved area will be rehabilitated.</li><li>Injured animals will be provided with first aid and handled on advice from the Wildcare Helpline and Rottnest Island Authority rangers.</li></ul> |
|                        | Offset                                                                                                                                                                                                                                                                                                                                                                      | Terrestrial fauna offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Residual impacts       | <ul style="list-style-type: none"><li>Removal of 0.46 ha of potential terrestrial fauna habitat in Good to Degraded condition.</li></ul>                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Environmental outcomes | <ul style="list-style-type: none"><li>Direct impacts to potential fauna habitat resulting from the proposal will not exceed 0.46 ha of native vegetation.</li><li>No introduction of new weed species attributable to the proposal.</li><li>No increase in incidents of terrestrial fauna injury or death during construction associated with the proposal works.</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

Table 11: Summary of the potential impacts, proposed mitigation and outcomes – social surroundings

Social surroundings

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| EPA environmental objective                     | To protect social surroundings from significant harm (EPA, 2023).                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Relevant policy and guidance                    | <ul style="list-style-type: none"><li><i>Aboriginal Heritage Act 1972</i></li><li>Environmental Factor Guideline – Social Surroundings (EPA, 2023)</li><li>Technical Guidance Environmental impact assessment of Social Surroundings – Aboriginal cultural heritage (EPA, 2023b)</li><li><i>Historic Shipwrecks Act 1976</i></li><li><i>Maritime Archaeology Act 1973</i></li><li><i>Heritage Act 2018.</i></li></ul>            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Supporting technical investigations and reports | <ul style="list-style-type: none"><li>Report of an Ethnographic Aboriginal Heritage Survey of the Army Jetty, Rottnest Island, Western Australia (Brad Goode and Associates, 2019) (Appendix M)</li><li>Marine Magnetic survey at proposed barge landing site, South Thomson Bay (Surrich, 2019) (Appendix T)</li><li>Acoustic assessment Rottnest Barge Facility Rottnest Island (Herring Storer, 2024) (Appendix U).</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Potential environmental impacts                 | Direct impacts                                                                                                                                                                                                                                                                                                                                                                                                                   | <p><b>Potential impacts to heritage</b></p> <ul style="list-style-type: none"><li>There are no registered Aboriginal Cultural Heritage (ACH) sites within or adjacent to the development envelope. However, there is a risk for previously unearthed artefacts or burials to be identified during ground disturbing activities.</li><li>Although not a registered heritage site, there are community concerns regarding impacts to potential heritage values of the existing Arm Groyne.</li></ul> <p><b>Impacts to recreational values</b></p> <ul style="list-style-type: none"><li>Construction and operation of the proposal will require the temporary and permanent relocation of some moorings during construction and operation as summarised below:<ul style="list-style-type: none"><li>Temporary relocation of eight moorings during construction of the proposal</li><li>Permanent relocation of four moorings during operation of the proposal.</li></ul></li></ul> <p><b>Potential disturbance of unexploded ordnance (UXO)</b></p> <ul style="list-style-type: none"><li>The marine component of the development envelope was not mapped as having a risk of UXO occurring. However, the marine environment approximately 3 km to the north-west of the site is at risk of UXO occurring.</li><li>Surrich Hydrographics (Surrich) undertook a magnetic field survey for UXO to delineate the risks within the development envelope. The survey identified 48 ferrous debris targets, six of which were confirmed to be debris and not UXO.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                                 | Indirect impacts                                                                                                                                                                                                                                                                                                                                                                                                                 | <p><b>Impacts to recreational values</b></p> <ul style="list-style-type: none"><li>Loss of marine habitat, primarily the loss of seagrass associated with construction of the proposal has the potential to result in indirect impacts to marine fauna species through loss of foraging opportunities and changes to marine environmental quality. This loss of marine habitat may impact recreational fisheries in the South Thomson Bay through the loss of potential feeding and spawning habitat.</li><li>Construction of the proposal has potential to impact public safety.</li></ul> <p><b>Impact to amenity</b></p> <ul style="list-style-type: none"><li>Construction and implementation of the proposal has the potential to impact amenity within vicinity of the development envelope from noise emissions.</li><li>Construction of the proposal has the potential to impact visual amenity within vicinity of the development envelope.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Mitigation                                      | Avoid                                                                                                                                                                                                                                                                                                                                                                                                                            | <ul style="list-style-type: none"><li>The proposed upgrades to the Army Groyne will reduce public safety risks and improve the overall visitor arrival experience.</li><li>The Department of Transport (DoT) determined that a navigational channel and markers were not required and that the risk to boating users from the relocation of barge traffic is not expected to be significant.</li><li>There are no registered Aboriginal cultural heritage (ACH) sites within the development envelope.</li><li>Consultation with representatives of the Whadjuk NTC group confirmed that the proposal can proceed without undue risk of breaching the <i>Aboriginal Heritage Act 1972</i> in relation to ethnographic sites and places.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                                 | Minimise                                                                                                                                                                                                                                                                                                                                                                                                                         | <p><b>Potential impacts to previously unidentified Aboriginal cultural heritage</b></p> <ul style="list-style-type: none"><li>To minimise potential impacts to any previously unidentified subsurface ACH, the following actions will be implemented as per the recommendations from the representatives of the Whadjuk NTC group:<ul style="list-style-type: none"><li>Archaeological monitors are present during all ground disturbing works and that archaeological techniques, such as test pitting and sieving, are employed if artefacts are found</li></ul></li><li>Ongoing consultation will be undertaken with traditional owners as required to determine additional Aboriginal heritage information about potential sites.</li></ul> <p><b>Impacts to recreational values (recreational fishing)</b></p> <ul style="list-style-type: none"><li>Management and mitigation proposed during construction to minimise impacts to benthic communities and habitats is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that the area of benthic communities and habitats permanently impacted by the proposal is limited to the development envelope and ZoHI.</li><li>Management and mitigation proposed during construction to minimise impacts to marine environmental quality, which may result in impacts to recreational fishing, is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that:<ul style="list-style-type: none"><li>The area affected by reduced water quality (suspended sediments) during dredging and construction will be limited (wherever possible) and will not extend past the modelled ZoHI, ZoMI and ZoI</li><li>Marine environmental quality will be maintained at a moderate level of ecological protection during dredging and return to a High Level of Ecological Protection within 2 weeks following completion of dredging</li></ul></li><li>Implementation of the CEMP and DEMMP provides the monitoring and management framework to address potential impacts to marine environmental quality during construction which may indirectly impact recreational fishing values. Key management and monitoring measures include:<ul style="list-style-type: none"><li>Implementation of the Marine Water Quality Monitoring Program (MWQMP) provided in the DEMMP for suspended sediment</li><li>Inspections of all dredge equipment to check for leaks or damage</li></ul></li><li>Operational management to minimise impacts to the marine environment is detailed in the OEMP (Emerge, 2024b) (Appendix Q).</li><li>Maintenance dredging (if required) will be undertaken in previously disturbed / sandy areas within the development envelope / project footprint where possible. Maintenance dredging frequency, volumes and disposal will be determined as required. Environmental management and monitoring will be undertaken in a manner that is consistent with the document Maintenance Dredging Environmental Management Framework (BMT Oceanica, 2016) prepared for Department of Transport for similar types of maintenance dredging activities.</li><li>Marine users to comply with vessel operational restrictions required by DoT and RIA.</li></ul> |

Social surroundings

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|                               | <p><b>Impacts to recreational values (public safety)</b></p> <ul style="list-style-type: none"><li>Implementation of the CEMP provides the monitoring and management framework to minimise risks to public safety during construction. Key management and monitoring measures include:<ul style="list-style-type: none"><li>Equipment will be fitted with noise control devices where possible and appropriate.</li><li>Implementation of vehicle speed limits.</li><li>Installation of floating markers and signs to limit access to the construction areas within both the marine and terrestrial environment.</li></ul></li><li>Operational management to minimise impacts to the marine environment is detailed in the OEMP (Emerge, 2024b) (Appendix Q). Implementation of this management plan will ensure that:<ul style="list-style-type: none"><li>Installation of floating markers and signs at the entrance to the barge landing (within development footprint) to prevent boat anchorage and swimming in peak season. This will ensure that an increase in vessel movements does not impact public safety</li><li>Physical inspections during operations</li><li>Maintenance of a complaints register</li><li>Public safety risk (i.e. traffic along Parker Point Rd) is addressed by policing and road regulations applicable to Wadjemup / Rottnest Island roads</li><li>Marine users to comply with vessel operational restrictions required by DoT and RIA.</li></ul></li></ul> <p><b>Relocation of moorings (permanent and temporary)</b></p> <ul style="list-style-type: none"><li>No moorings will be permanently removed and disruption to moorings users will be minimised through:<ul style="list-style-type: none"><li>Temporary relocation of eight moorings during construction of the proposal. The temporary relocation will be undertaken prior to construction commencing to minimise disruption to users. The relocation will be for the duration of construction, for approximately 18 months</li><li>The permanent relocation of four moorings will be undertaken prior to construction to minimise disruption to users.</li></ul></li><li>Ongoing stakeholder consultation with the local community regarding the proposal and potential impacts on social surroundings.</li></ul> <p><b>Impacts to amenity</b></p> <ul style="list-style-type: none"><li>Ongoing stakeholder consultation with the local community regarding the proposal and potential impacts on social surroundings.</li><li>As there is an existing groyne within the development envelope, extension of this groyne to support the proposal is unlikely to result in a significant change to visual amenity.</li><li>An airborne noise assessment was undertaken of the current barge operations (Appendix U). Noise emissions from the existing operations at the Rottnest Barge Facility comply with the criteria set out by the Environmental Protection (Noise) Regulations 1997 at all times (Herring Storer, 2024). As the existing barge operations comply with the criteria set out by the Environmental Protection (Noise) Regulations 1997, it is predicted that the relocated operations will also comply with the regulations and no significant noise impacts from the proposal are anticipated.</li><li>Management targets and actions to minimise potential impacts to amenity from increase in noise, lighting, odour and dust from construction of the proposal are outlined in the CEMP (Appendix P). The management targets include:<ul style="list-style-type: none"><li>Noise emissions do not exceed assigned noise levels as prescribed in the Environmental Protection (Noise) Regulations 1997</li><li>No fugitive dust emission outside of the development envelope</li><li>Zero incidences of fire resulting from the proposal.</li></ul></li><li>Key management measures outlined in the CEMP to achieve these targets include:<ul style="list-style-type: none"><li>Construction contractor specifications will require that all construction work will be carried out in accordance with control of noise practices set out in Section 4 of Australian Standard 2436 Guide to Noise Control on Construction, Maintenance and Demolition Sites</li><li>Vehicle operation will occur during prescribed hours (between 7.:00 am and 7.00 pm)</li><li>Equipment will be fitted with noise control devices where possible and appropriate</li><li>Implement dust suppression measures</li><li>Enforce speed limits</li><li>Provision of facilities to ensure waste is appropriately disposed of.</li></ul></li><li>Management targets and actions to minimise potential impacts to amenity from increase in noise, lighting, odour and dust from construction of the proposal are outlined in the OEMP (Emerge, 2024b) (Appendix Q). The management targets include:<ul style="list-style-type: none"><li>Limit the impact on social surroundings, including noise, dust and visual intrusion through controlled vehicle movement procedures, to avoid public and community issues.</li><li>Limit issues related to freight operations that may cause potential negative impacts on social surroundings.</li><li>Ensure waste disposal measures and prevent rubbish and litter impact on visual amenity.</li><li>Ensure local amenity is protected and public safety measures are undertaken.</li></ul></li><li>Key management measures outlined in the OEMP to achieve these targets include:<ul style="list-style-type: none"><li>Dust management measures:<ul style="list-style-type: none"><li>Vehicle movements will be restricted to the designated access roads to minimise dust impacts to surrounding users.</li><li>Vehicle speeds will be restricted to minimise the generation of dust.</li></ul></li><li>Waste management measures:<ul style="list-style-type: none"><li>Ensure all waste is either recycled or moved off site to the Island disposal facility.</li></ul></li><li>Noise management measures:<ul style="list-style-type: none"><li>Equipment will be fitted with noise control devices where possible and appropriate.</li></ul></li><li>Lighting management measures:<ul style="list-style-type: none"><li>The use of lighting at night will be for safety purposes only and will be designed to minimise impacts to surrounding users as much as possible.</li><li>Adaptive light controls to manage light timing, intensity and colour will be implemented to minimise impacts from lighting.</li><li>Only add light for specific purposes such as navigational and safety</li><li>Light only the object or area intended through lighting placement and design (e.g. placement of lights close to the ground, ensuring lights are directed and shielded to avoid light spill).</li><li>Use the lowest intensity lighting appropriate for the task.</li><li>Use non-reflective, dark-coloured surfaces.</li><li>Use lights with reduced or filtered blue, violet and ultra-violet wavelengths.</li></ul></li><li>Odour management measures:<ul style="list-style-type: none"><li>Odour generated from waste compactors will be managed through short transfer intervals, which are currently removed on Tuesdays and Thursdays between 11.00 am and 3.00 pm. The remainder of items transported through the new facility are inert with low potential for odour.</li></ul></li></ul></li></ul> <p><b>Disturbance of UXO</b></p> <ul style="list-style-type: none"><li>Surrich (2019) and TAMS Group (2019) undertook a magnetic field survey for UXO to delineate the risks of disturbing UXO. An additional UXO survey, prior to construction works, will be undertaken to further assess anomalies identified during the initial UXO survey</li><li>Management targets and actions to minimise potential impacts to social surroundings from the risk of disturbance to UXOs from construction of the proposal are outlined in the CEMP (Appendix P). The management targets include:<ul style="list-style-type: none"><li>Minimise risk of disturbance to UXO site.</li></ul></li></ul> |
|                               | <p><b>Rehabilitate</b></p> <ul style="list-style-type: none"><li>If the resurveyed ferrous debris targets are identified as UXO, appropriate remediation and management will be undertaken.</li><li>Construction effects (outside the development envelope and ZoHI) on recreational fishing will be temporary and natural amelioration will mitigate or remove long-term impacts following cessation of construction activities.</li><li>All impacted moorings are proposed for relocation (rather than removal).</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           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|                               | <p><b>Offset</b></p> <p>Social surroundings offsets are not considered applicable to the proposal.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 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| <b>Residual impacts</b>       | <ul style="list-style-type: none"><li>The permanent relocation of four moorings.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             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| <b>Environmental outcomes</b> | <ul style="list-style-type: none"><li>Noise emissions do not exceed assigned noise levels as prescribed in the Environmental Protection (Noise) Regulations 1997</li><li>Maintain recreational fishing values by ensuring there are no observable impacts to benthic communities and habitats outside the ZoMI.</li><li>Minimise risk of disturbance to UXO</li><li>No permanent loss or change to the total number of moorings as a result of implementation of the proposal.</li><li>No impacts to registered Aboriginal cultural heritage sites.</li><li>Maintain amenity values during construction and operation.</li></ul>                                                                                                                                                                                                                                                                                                                                                                       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# 1 INTRODUCTION

In 2019, Rottnest Island Authority (RIA) commenced technical investigations to support the proposed South Thomson Barge Landing Development (the proposal) Wadjemup / Rottnest Island. At the end of 2020, the project was paused and no further works were undertaken. RIA has now recommenced the South Thomson Barge Landing Development project.

Ferry berthing and barge operations currently occur at the Main Jetty, at central Thomson Bay, on Wadjemup / Rottnest Island. RIA is proposing to relocate the existing barge operations from the Main Jetty, at central Thomson Bay, to the proposed development envelope located at the existing Army Groyne, South Thomson Bay. This will separate barge operations from public passenger transfer activities and ease congestion at the ferry terminal at the Main Jetty.

Figure 4 provides an overview of the location of the proposed South Thomson Barge Landing Development and the location of the existing barge operations at the ferry terminal at central Thomson Bay.

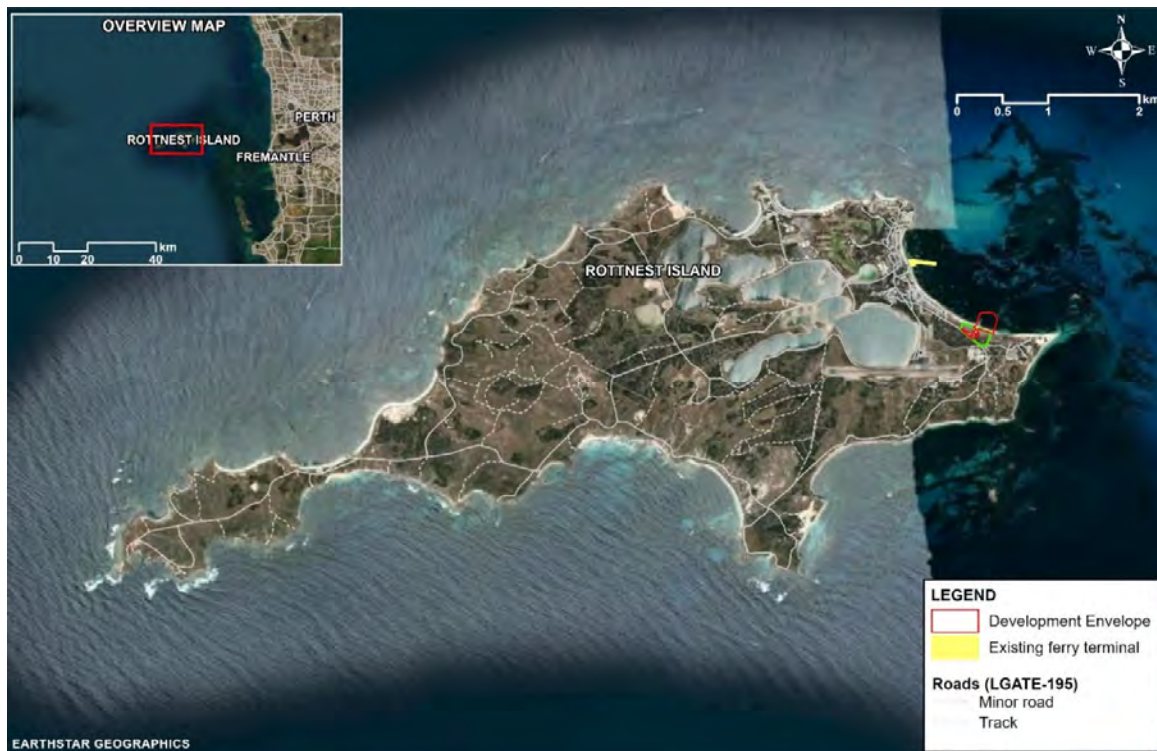


Figure 4: Regional overview

## 1.1 Purpose and scope of this document

The purpose of this Environmental Supporting Document is to describe and assess the significance of the environmental impacts to the environmental values associated with the implementation of the proposal. This report provides information on the proposal, local and regional setting, key stakeholders, potential environmental impacts, cumulative impacts and proposed mitigation measures associated with the construction and operation of the proposal.

This document has been prepared to provide a detailed description of the proposal to inform an environmental impact assessment and support the following environmental approvals:

- Referral of the proposal to the Environmental Protection Authority (EPA) under Section 38 of the *Environmental Protection Act 1986* (EP Act) to describe and assess the potential impacts to the EPA's environmental factors
- Referral of the proposal to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to address potential impacts to matters of national environmental significance (MNES).



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This supporting document has been prepared to reflect the state framework for environmental impact assessment under the *Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures 2016* and the associated *Procedures Manual (Part IV Divisions 1 and 2)*.

Section 14.2 addresses the potential for the proposal to have a significant impact on federal MNES in accordance with the Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (Department of the Environment, 2013).

## 1.2 Proponent information

Rottnest Island Authority is the proponent for the South Thomson Barge Landing Development, as summarised below.

Name: Rottnest Island Authority  
Postal address: PO Box 693, Fremantle WA 6959  
ABN: 38836160172

The key contact is:

Name: David Pond  
Position: Environment Compliance and Approvals Coordinator  
Phone: (08) 9432 9300  
Email: david.pond@dbca.wa.gov.au

Further information on the proponent can be sourced from RIA's website: <https://www.ria.wa.gov.au/projects-and-developments/significant-projects/marine-logistics-hub>.

## 2 PROPOSAL

### 2.1 Justification

#### 2.1.1 Key benefits

The key benefits that are anticipated from implementation of the proposal are summarised in Table 12. These benefits are discussed further in Sections 2.1.2.1 to 2.1.2.2.

**Table 12: Key benefits from implementation of the proposal**

| Benefit                                                                   | Description                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Enhanced visitor amenity from a ferry improvement, and barge improvement. | This benefit captures an improvement in visitor satisfaction over time, measured through an increase in visitor willingness to pay for enhanced amenity on the island. Enhanced amenity is achieved through the removal of the barge landing and ferry luggage operations from the Main Jetty to the South Thomson Development, and therefore captures a benefit from both a 'ferry improvement' and a 'barge improvement'. |
| Avoided future operations and maintenance costs.                          | This benefit captures the avoided future operations and maintenance costs incurred by RIA due to the requirement to maintain the current Army Groyne to a safe and workable standard.                                                                                                                                                                                                                                       |
| Avoided safety costs.                                                     | This benefit captures the avoided safety costs associated with near-miss and the risk of more serious incidents at the Main Jetty, associated with the conflicted uses of the Main Jetty in its current configuration.                                                                                                                                                                                                      |
| Avoided personal injury and death costs.                                  | This benefit captures the avoided personal injury and death costs associated with inappropriate use of the Army Groyne by visitors to Wadjemup / Rottnest Island, by converting the Army Groyne to an operational area with no public access.                                                                                                                                                                               |
| Cost savings from modifying the current barging operation.                | This benefit captures the cost savings from the modification of barging operations through the use of more efficient barge sizes, reducing the number of trips required between the island and Perth for a given level of activity at the island.                                                                                                                                                                           |

(ACIL Allen, 2024)

#### 2.1.2 Rottnest Island Management Plan 2023–2028

The *Rottnest Island Authority Act 1987* (Appendix V) and Rottnest Island Regulations 1988 (Appendix V) require that RIA manage the island in accordance with the Rottnest Island Management Plan 2023–2028 (Rottnest Island Authority, 2023) (Appendix V). The Rottnest Island Management Plan 2023–2028 is centred on the following five Strategic Focus Areas (ACIL Allen, 2024):

1. Diversify the visitor base and enhance visitor experience
2. Deliver sustainable infrastructure and services
3. Respect and engage with the island's cultural heritage
4. Explore and conserve the island's heritage
5. Foster strong partnerships.

Under Strategic Focus Areas, RIA has defined a number of Key Initiatives. Key Initiatives that relate directly to the proposal are discussed in Table 13 and Sections 2.1.2.1 and 2.1.2.2.

**Table 13: Rottnest Island Management Plan 2023–2028 Strategic Focus Areas**

| Strategic focus area                                         | Key initiatives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Relevance to proposal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Diversify the visitor base and enhance visitor experience | <b>1.1</b> Target new visitor segments<br><b>1.2</b> Enhance visitor experience<br><b>1.3</b> Facilitate new accommodation and hospitality developments<br><b>1.4</b> Renew and expand RIA visitor accommodation – Stay Rottnest<br><b>1.5</b> Improve RIA's affordable visitor accommodation – Stay Rottnest<br><b>1.6</b> Realise Kingstown Barracks' vision<br><b>1.7</b> Encourage new recreational offerings<br><b>1.8</b> Upgrade Pedal & Flipper Hire facility<br><b>1.9</b> Improve accessible tourism. | <b>1.2 Enhance visitor experience</b><br>RIA has plans to transition the island's barging operations away from the main jetty to the former Army Groyne in South Thomson Bay. This will help reduce visitor congestion, improve safety and improve the arrival experience.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 2. Deliver sustainable infrastructure and services           | <b>2.1</b> Support renewable energy and electrical infrastructure upgrades<br><b>2.2</b> Support drinking water production, supply, and retention<br><b>2.3</b> Support ablutions and wastewater upgrades<br><b>2.4</b> Assess and upgrade transport infrastructure<br><b>2.5</b> Maintain maritime infrastructure<br><b>2.6</b> Review moorings policies and management<br><b>2.7</b> Review the Facilities, Utilities and Support Services contract<br><b>2.8</b> Improve asset management.                   | <b>2.5 Maintain maritime infrastructure</b><br>Wadjemup / Rottnest Island is a favourite hotspot for Western Australia's boating and sailing community and caters for commercial and recreational marine vessels visiting the island for day trips or extended visits.<br>RIA is responsible for the construction, management, and operation of the island's maritime structures including a main operating commercial jetty, five recreational jetties, a commercial barge landing ramp, a rock groyne and associated boat ramp and the newly constructed limestone seawall at South Thomson Bay to minimise ongoing erosion of the dune area.<br>RIA has developed a Maritime Infrastructure Asset Management Plan to implement the following projects: <ol style="list-style-type: none"> <li>1. Main jetty berth 1–3 refurbishment</li> <li>2. Barge landing ramp refurbishment</li> <li>3. Hotel jetty refurbishment</li> <li>4. Geordie Bay jetty refurbishment</li> <li>5. Main jetty firefighting facility</li> <li>6. General maintenance.</li> </ol> |

### 2.1.2.1 Enhancing visitor experience

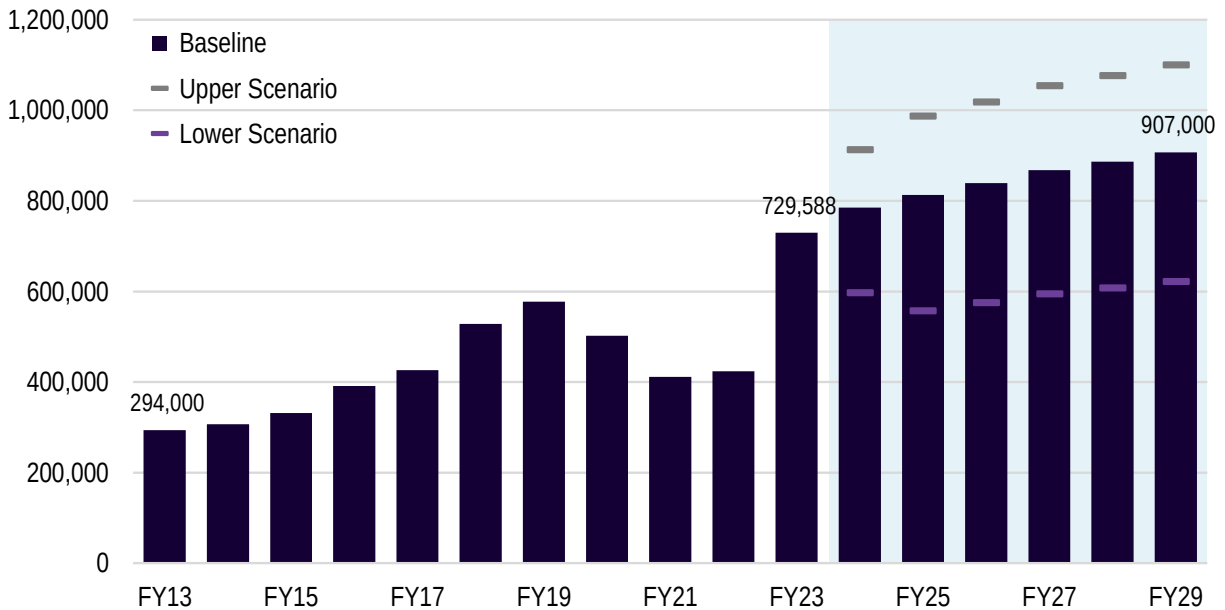
#### 2.1.2.1.1 Conflicts in use at the Main Jetty

The Main Jetty is the primary marine infrastructure asset on Wadjemup / Rottnest Island, providing both passenger and logistics services. There is an inherent conflict in this approach, as visitors to the island are required to walk past a busy logistics hub. This situation is compounded by the operating structure and contracts associated with the activities that occur on the Main Jetty, as detailed below:

- Movement of Wadjemup / Rottnest Island visitors (including their bicycles) and staff on and off the island by ferry operators including Rottnest Fast Ferries, Rottnest Express and SeaLink
- Movement of island accommodation guest luggage on to and off the island by Programmed Facilities Management
- Operations of the barge landing and logistics services for all island businesses including RIA by Pelagic Marine Services.

An increase in visitation to Wadjemup / Rottnest Island has resulted in increased utilisation of all marine assets, particularly the Main Jetty, which accommodates ferry arrivals and departures. Graph 1 provides the ferry-based visitation to Wadjemup / Rottnest Island under lower and upper scenarios.





**Graph 1: Total ferry-based visitation to Wadjemup / Rottnest Island, visitors by financial year, and lower and upper scenario (ACIL Allen, 2024)**

A significant increase in RIA's capital works program has also contributed to an increase in activity at the Main Jetty and current barge landing site. Future expenditure on capital works is also expected to contribute to an elevated level of activity at the Main Jetty and current barge landing site over the next three to five years (ACIL Allen, 2024).

Barging operations attributable to third party developments (e.g. The Lodge Wadjemup) have also contributed to congestion during construction activity. As detailed in the Rottnest Island Management Plan, there are a number of potential developments that are expected to result in further increases in congestion at the current barge landing and tourist receival site, including:

- Golf Course Precinct revitalisation and Mount Herschel provision for visitor accommodation
- Staff accommodation along Parker Point Road, north of Kingstown
- New and infill visitor accommodation at South Thomson Bay, North Thomson Bay and Bathurst.

#### 2.1.2.1.2 Safety issues

There are potential risks arising from the interaction of the barge servicing activities (servicing vehicles, which use Henderson Avenue to access the Barge Landing Area) and Wadjemup / Rottnest Island visitors (pedestrians and cyclists). This risk is due to the location of the barge landing area, which is at the base of the Main Jetty, where visitors embark and disembark the ferry. Over 23 safety incidents have been reported between 2017 and 2023 (ACIL Allen, 2024).

It is anticipated that relocating the existing barge operations away from the Main Jetty will reduce the frequency of these safety incidents.

#### 2.1.2.1.3 Inefficiencies associated with the current barging area

The current location of barging operations is constrained and there are limited means by which the existing operating envelope of barging operations can increase without impacting on other uses of the Main Jetty or without incurring higher costs.

An options assessment identified that the current barge landing infrastructure at the Main Jetty does not cater for any growth in vessel size over time. This is due to the depth of the berth pocket at the current barge landing, and the height of the barge ramp relative to the tidal range of the area around the Main Jetty. This eliminates the ability for growth in the demand for in-bound and out-bound logistics to be met by larger barge vessels; growth is instead met by the relatively less efficient method of an increase in the number of barge movements.

The proposal has been designed to allow for larger barge vessels than are currently accommodated at the Main Jetty.

### 2.1.2.2 Maintain maritime infrastructure

The key outcome in regard to maritime infrastructure, as outlined in the Rottnest Island Management Plan 2023–2028 (Rottnest Island Authority, 2023), is for the island's maritime infrastructure to be maintained to a high standard. RIA is responsible for the construction, management, and operation of the island's maritime structures, including a main operating commercial jetty, five recreational jetties, a commercial barge landing ramp, a rock groyne and associated boat ramp, and the newly constructed limestone seawall at South Thomson Bay (which is mitigating ongoing erosion of the dune area).

Since 2020, three jetties have been reconstructed or replaced, including the fuel jetty (2020), Stark and T jetty (2021), and Main Jetty berths 4/5 (December 2022).

Implementation of the proposal at the existing Army Groyne avoids the requirement for ongoing maintenance of the Army Groyne.

### 2.1.3 Rottnest Island Land Use Plan

The Rottnest Island Land Use Plan classifies the site as an infrastructure and support services zone, which is compatible with the proposal (Figure 5).

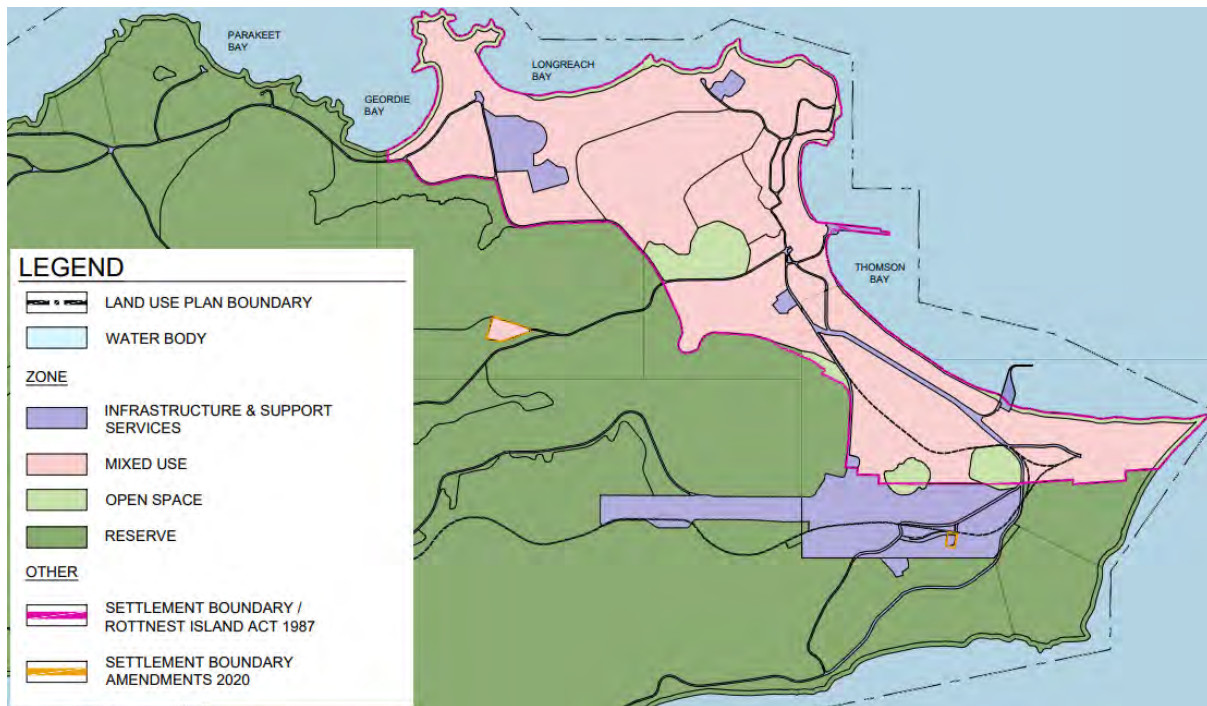


Figure 5: Rottnest Island Land Use Plan (RIA, 2024)

## 2.2 Proposal description

The South Thomson Barge Landing Development is proposed to be developed at the location of the existing Army Groyne in South Thomson Bay (Figure 4 and Figure 10).

The proposal will be primarily used for barge operations, which will be relocated from the existing ferry terminal at the Main Jetty in central Thomson Bay to the proposed location at the Army Groyne in South Thomson Bay. This will separate barge operations from public passenger transfer activities and ease congestion at the ferry terminal. The proposed development will improve the functionality and efficiency of transporting bulk cargo to and from Wadjemup / Rottnest Island and improve safety and amenities for visitors to the island.

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The proposed development will include the following key aspects, as depicted in Figure 6:

- The relocation of critical barging operations from the Main Jetty to the existing Army Groyne (Figure 4)
- Construction of the proposed facility, which will include both onshore and offshore components as summarised below:
  - Extension of the existing Army Groyne
  - Construction of maritime infrastructure including a barge landing ramp, ferry berth and small craft landing facility
  - The establishment of new fuelling facilities as back up vessel refuelling facilities
  - Construction of a storage facility
  - Construction of hardstand and roads
- Installation of services including water, firefighting, electrical, communications and fuel.



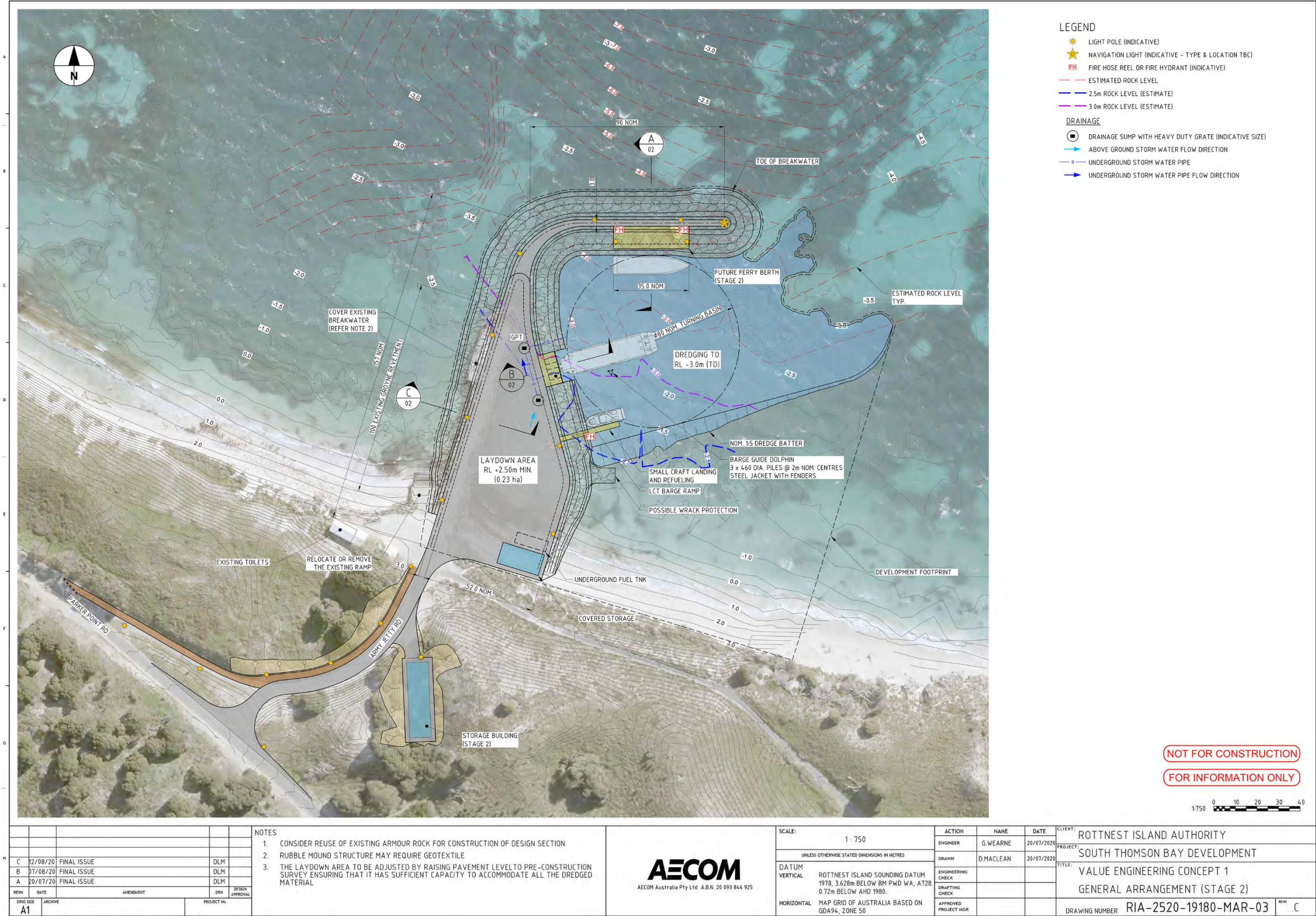


Figure 6: Barge Landing design concept



Construction of the above will be undertaken in two stages as described in Table 14 and shown Figure 7 and Figure 8. The proposed construction methods are described in further detail in Appendix A.

All construction activities will be undertaken within the development envelope shown in Figure 9.

**Table 14: Description of construction stages**

| Construction stage    | Construction method                   | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-----------------------|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Stage 1<br>(Figure 7) | Preliminary actions                   | This includes all planning, design and preparation works including plant and equipment and fabrication activities. This will also include verification of the site (seabed survey) as well as any underground service location.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                       | Mobilisation and site set up          | This includes installation of site sheds, preparation of laydown areas, erection of marine traffic management, site signage, public advertisements and mobilisation of equipment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|                       | Temporary works construction          | A temporary roll-on, roll-off (RORO) facility will be constructed to off load equipment and materials. The RORO will be constructed either through localised improvements to the Army Groyne or a bespoke structure and may be located on the western side of the Army Groyne.<br>The RORO will be suitable for unloading of large equipment and/or materials such as precast concrete, piles, earthmoving equipment, temporary structures, and also dredge spoil for use in reclamation.<br>The existing small boat landing may be utilised by the contractor during construction for launching small craft.                                                                                                                                                                                                                                                               |
|                       | Dredging                              | Dredging must be undertaken across the dredge footprint prior to construction of the wharf and new laydown area. Dredging methodologies are described in Table 17 and Appendix A of this report and summarised below: <ul style="list-style-type: none"> <li>An estimated 14,000 m<sup>3</sup> of sand and 2,017 m<sup>3</sup> of rock will be dredged. Once loosened or dislodged, these materials will be raised to the water's surface, to be undertaken mechanically via raising the bucket or grab of a backhoe dredge (BHD).</li> <li>Excavated material is placed onto a flat-top barge moored alongside the BHD. When the barge is filled to its safe working capacity, it will drive to the RORO facility to be unloaded.</li> <li>A silt curtain will be placed around the BHD to mitigate the potential environmental impact due to the dredge plume.</li> </ul> |
|                       | Reclamation                           | The laydown area shall incorporate reclaimed dredged fill material and shall be constructed as described in Table 17 and Appendix A of this report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                       | Extension of the existing Army Groyne | On completion of the reclamation processes, the existing Army Groyne will be upgraded and extended through: <ul style="list-style-type: none"> <li>Removal of excess rock and materials and reshaping the existing Army Groyne</li> <li>Placing core materials, a filter layer (geotextile) and rock armour to shape and extend the existing groyne.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                       | Maritime infrastructure               | Maritime infrastructure constructed in Stage 1 includes the Barge Landing Ramp. The Barge Landing Ramp works include: <ul style="list-style-type: none"> <li>Installation of a precast concrete gravity retaining wall below the water level at the dredge level</li> <li>Installation of the deck slab</li> <li>Installation of mooring piles using a vibro hammer (a contingency for the use of hammer piling has been allowed in the impact assessment undertaken in this document should the vibro hammer hit refusal. If the vibro hammer hits refusal, hammer piling will be undertaken).</li> </ul>                                                                                                                                                                                                                                                                  |
|                       | Services                              | Underground services will be installed and connected to onshore underground services. Services consist of: <ul style="list-style-type: none"> <li>Water</li> <li>Firefighting services</li> <li>Electrical services</li> <li>Communications</li> <li>Fuel tank. The fuel tank will be installed in the south-east corner of the reclamation zone and will be installed within the compacted dredge spoil. Installation of the fuel tank will be in accordance with all Dangerous Goods regulations (i.e. double lined tank, leak detection systems, tank pit/groundwater monitoring wells).</li> </ul>                                                                                                                                                                                                                                                                      |

| Construction stage    | Construction method | Details                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------|---------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                       | Storage shed        | These works consist of construction of the shed structure and hardstand in the south-east corner of the reclamation zone.                                                                                                                                                                                                                                                                                                                                                                           |
|                       | Road works          | Road work construction required to complete any sections of the new facility and the road section linking to the Army Jetty Road.                                                                                                                                                                                                                                                                                                                                                                   |
|                       | Demobilisation      | Demobilisation will be undertaken at completion of construction works as outlined in Appendix A.                                                                                                                                                                                                                                                                                                                                                                                                    |
| Stage 2<br>(Figure 8) | Ferry berth         | <p>The ferry berth will be constructed through:</p> <ul style="list-style-type: none"> <li>• Installation of piles using a vibro hammer. As outlined in Stage 1, a contingency for the use of a hammer pile has been allowed in the construction methodology and impact assessment should the vibro hammer meet refusal</li> <li>• Installation of a precast concrete deck and surface</li> <li>• Fit out of the wharf with fenders, fender chains, mooring bollards, signage, lighting.</li> </ul> |
|                       | Small craft landing | <p>The Small Craft Landing works include:</p> <ul style="list-style-type: none"> <li>• Installation of piles using a vibro hammer rig. A contingency for the use of a hammer pile has been allowed in the construction methodology and impact assessment should the vibro hammer meet refusal.</li> <li>• Installation of abutment</li> <li>• Installation of floating deck units</li> <li>• Installation of navigational aids.</li> </ul>                                                          |
|                       | Storage building    | Construction of the storage shed structure and hardstand to the east of Army Jetty Road.                                                                                                                                                                                                                                                                                                                                                                                                            |



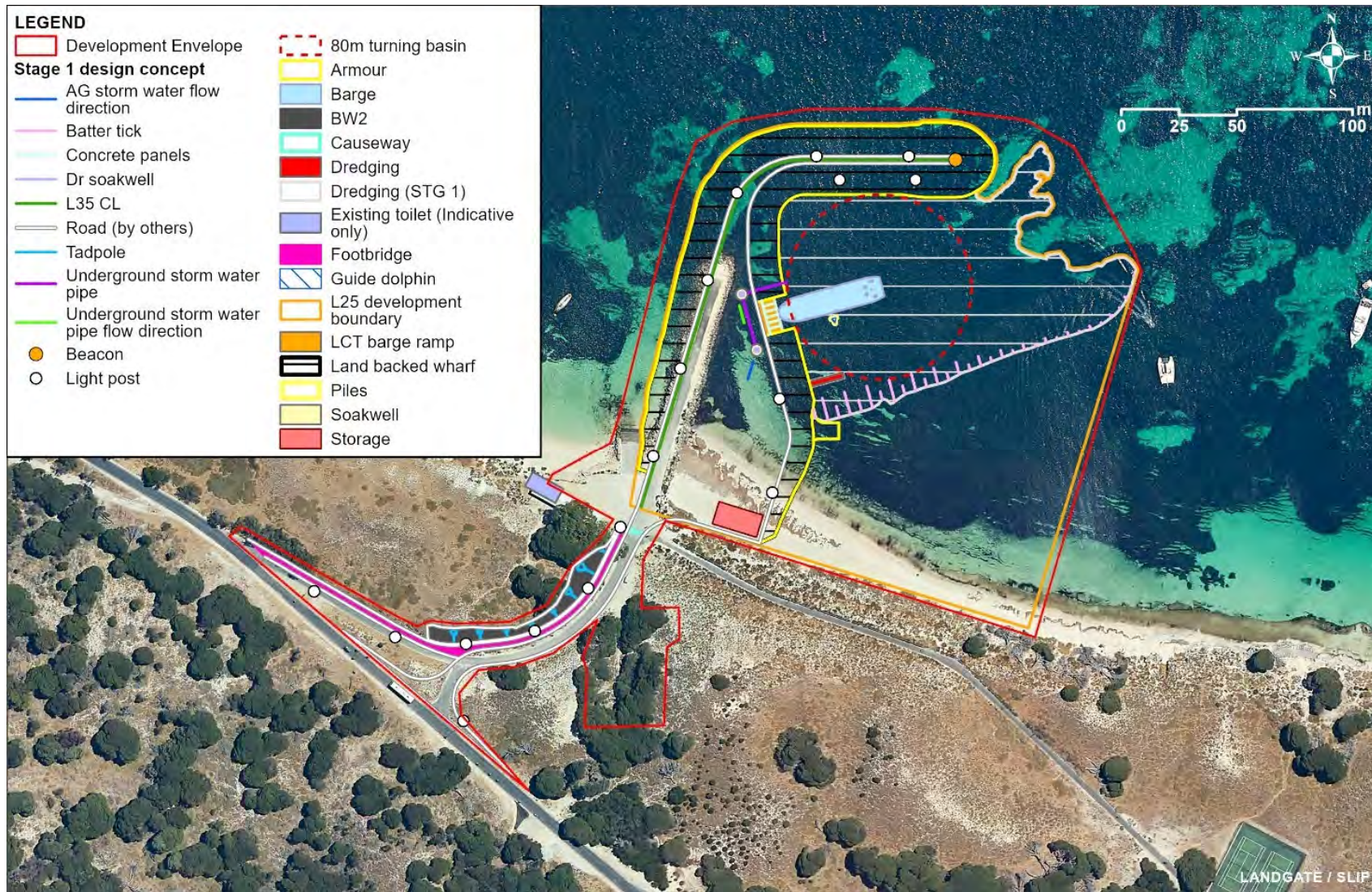


Figure 7: Proposal development plan (Stage 1)





Figure 8: Proposal development plan (Stage 2)



## 2.2.1 Proposal content

The proposal comprises an onshore component and offshore component (an area of reclamation and an extension of the existing Army Groyne to form the proposed wharf) as summarised below:

- **Indicative disturbance footprint:** The indicative disturbance footprint encompasses the onshore and offshore physical infrastructure associated with proposal and dredge areas (Figure 9).
  - The onshore component comprises approximately 1 hectare (ha).
  - The offshore component comprises a wharf area (extension of the existing Army Groyne) (1.13 ha) and a dredge area (1.02 ha) (Table 17), resulting in a combined indicative disturbance footprint of up to 3.15 ha.
- **Development envelope:** Comprises 4.6 ha and encompasses the indicative disturbance footprint and a buffer area (the majority of which comprises the dredge Zone of High Impact (ZoHI)) (Figure 9).



Figure 9: Development envelope

In addition to the development envelope, the environmental impact assessment presented in this report has also included the predicted zone of impact from the proposed dredging activities. A Dredge Plume Modelling Assessment was undertaken by Baird (2024b) that calculated the zones of impact, these are shown in Figure 10 and summarised in Table 15.

Table 15: Predicted zones of impact (Baird, 2024b)

| Zone of impact                 | Definition                                                                                                                                                                                                                                                                                                                                         |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Zone of High Impact (ZoHI)     | The area where impacts on benthic communities or habitats are predicted to be irreversible. The term irreversible means 'lacking a capacity to return or recover to a state resembling that prior to being impacted within a timeframe of five years or less'.                                                                                     |
| Zone of Moderate Impact (ZoMI) | The area within which predicted impacts on benthic communities or habitats are recoverable within a period of five years following completion of the dredging activities. This zone abuts, and lies immediately outside of, the ZoHI.                                                                                                              |
| Zone of Influence (Zol)        | The area within which changes in environmental quality associated with dredge plumes are predicted and anticipated during the dredging operations, but where these changes would not result in a detectable impact on benthic biota. At any point in time, the dredge plumes are likely to be restricted to a relatively small portion of the Zol. |



**Figure 10: Development envelope and predicted zones of impact**

A summary of the proposal is provided in Table 16 and a description and identification of the proposal elements is provided in Table 17.

**Table 16: Summary of the proposal**

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Proposal title</b>    | South Thomson Development Barge Landing Project                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Proponent name</b>    | Rottnest Island Authority                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Short description</b> | <p>Rottnest Island Authority is proposing to relocate the island's existing barging operations away from the Main Jetty to the existing Army Groyne in South Thomson Bay. This will help reduce congestion and improve the arrival experience to the island.</p> <p>To support the relocation of the barge operations, Rottnest Island Authority is proposing to extend and redevelop the existing Army Groyne.</p> |



Table 17: Description and identification of proposal elements

| Proposal element                         | Location / description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Maximum extent, capacity or range                                                                                                                                                                                                                                                            |
|------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Physical elements                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                              |
| Development envelope                     | Figure 10<br>Encompasses the indicative disturbance footprint and a buffer area, the majority of which comprises the dredge Zone of High Impact (ZoHI)).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4.6 ha                                                                                                                                                                                                                                                                                       |
| Indicative disturbance footprint         | Figure 10<br>The indicative disturbance footprint encompasses the onshore and offshore physical infrastructure associated with proposal and dredge areas.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Total area: 3.15 ha<br>Terrestrial disturbance footprint: 1 ha<br>Wharf and laydown area (marine footprint): 1.13 ha<br>Dredge area (marine footprint): 1.02 ha                                                                                                                              |
| Construction elements                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                              |
| Dredging                                 | Construction methodologies are provided as Appendix A.<br>Dredging and piling are likely to be undertaken in the winter months of 2026. Dredge plume modelling by Baird (2024b) estimates that dredging may take up to 7.5 weeks to complete.<br>The dredging methodology is summarised below: <ul style="list-style-type: none"><li>Dredging will be undertaken with the use of a Backhoe Dredge (BHD).</li><li>The BHD is positioned with a support tug and then using its spud piles and excavator arm it manoeuvres into the required dredging location.</li><li>The loosening or cutting process breaks the in-situ materials' cohesion, allowing these materials to be removed. The process will be carried out mechanically using the cutting edge of a bucket on a BHD. Once loosened or dislodged, these materials will be raised to the water's surface mechanically via raising the bucket or grab of a BHD.</li><li>Excavated material is placed onto a flat-top barge moored alongside the BHD. When the barge is filled to its safe working capacity, it will drive to the RORO facility to be unloaded.</li><li>A silt curtain around BHD will be installed to mitigate the potential environmental impact from the dredge plume.</li><li>The dredged material will be reused as fill material in the laydown/hardstand and reclamation area.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                        | The proposed dredge area is shown in Figure 10 and comprises 1.02 ha.<br>Dredging will be undertaken to a declared depth of – 3.0 m Chart Datum, which will include a turning basin with a nominal diameter of 80 m.<br>An estimated 14,000 m³ of sand and 2,017 m³ of rock will be dredged. |
| Reclamation                              | Construction methodologies are provided as Appendix A.<br>The reclamation methodology depicted in Figure 11 is summarised below: <ul style="list-style-type: none"><li>Existing armour from the eastern side of the Army Groyne will be removed and used for construction of bunding. Bunding will be constructed along the eastern and northern sides of the reclamation zone to allow dredge spoil to settle and remain in place. This bunding will prevent dredge spoil from being washed away into the marine environment. Figure 11 provides an indication of the bund wall location.</li><li>The bunding will be constructed using core materials, followed by a geotextile filter layer and an armour layer. Figure 12 provides a conceptual cross-section of the bunding, reclamation fill and then adjacent dredge zone.</li><li>As reclamation progresses, the bunding on the marine side of the reclamation zone will need to be progressively moved to the north to ensure that each successive round of dredge spoil placed will remain in place.</li><li>Using the dredged spoil, the contractor will establish a tip head to place the dredged material into the water in the south-west corner of the reclamation area. Dredge spoil will be placed and spread in a north and east direction.</li><li>Material will be tipped from the articulated dump truck and pushed out over the tip head using a wheel loader or similar.</li><li>Material will be compacted using a static pad foot roller.</li><li>Reclamation will continue until all dredge spoil has been placed. AECOM (2020) and PAEMAC (2024) estimated that the dredge spoil will be sufficient to complete the laydown area. There is not expected to be a requirement to import fill to complete the laydown area.</li></ul> | The proposed reclamation area is shown in Figure 10                                                                                                                                                                                                                                          |
| Construction of the wharf                | Construction methodologies are provided as Appendix A.<br>On completion of the reclamation works summarised above, the wharf will be constructed through extending the existing Army Groyne with rock armour as outlined below: <ul style="list-style-type: none"><li>Remove excess rock and materials and reshape the existing Army Groyne.</li><li>Import all rock and core materials from the mainland using a conventional barge converted for handling rock.</li><li>Place core materials along exposed batter.</li><li>Place filter layer (geotextile).</li><li>Place class 2 rock armour along exposed batter and class 1 rock armour along the northern breakwater. The proposed rock armour classes are shown in Figure 13.</li><li>Place a layer of crushed rock basecourse and asphalt along the Army Groyne extension to match that placed in the reclamation area.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | The proposed wharf area is shown in Figure 10                                                                                                                                                                                                                                                |
| Piling                                   | <ul style="list-style-type: none"><li>The barge landing ramp works will include Installation of mooring piles to a maximum depth of 10 m using a vibro hammer.</li><li>Construction of the ferry berth will require installation of piles using a vibro hammer rig operated from a barge located adjacent. The dimensions and number of piles is estimated at 16 × 610 mm that will be installed to a depth of 15 m. If the contractor does not install piles concurrently with construction of the breakwater, then 1200 mm sleeves will need to be installed in the rock armour so piles can be driven through the sleeves.</li><li>Construction of the small craft landing facility will include installation of piles using a vibro hammer rig operated from a barge located adjacent. The dimensions and number of piles is estimated at 6 × 500 mm that will be installed to a depth of 10 m. If the contractor does not install piles concurrently with construction of the breakwater, then 1200 mm sleeves will need to be installed in the rock armour so piles can be driven through the sleeves.</li></ul> As discussed in Table 14, all piling proposed will be undertaken using a vibro hammer. However, a contingency of using a hammer pile has been adopted should the vibro hammer meet refusal. Both the proposed piling method (vibro hammer) and contingency method (hammer piling) have been included in the impact assessment.                                                                                                                                                                                                                                                                                                                                                         | Piling locations will be determined during detailed engineering design                                                                                                                                                                                                                       |
| Other marine infrastructure and services | Hardstand and a shed structure will be constructed within the onshore component of the development envelope.<br>Services will be installed conventionally using a combination of on island and imported small plant. Services consist of water, fire service, power, CCTV and fuel provisions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | All works will occur within the development envelope shown in Figure 10.                                                                                                                                                                                                                     |
| Operational elements                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                              |
| Vessel movements                         | The proposed facility shall allow barge berthing, unloading and loading and departure for all conditions permitting safe transit across to Wadjemup / Rottnest Island. Typically barge and ferry operations are suspended when wind speed (ten-minute average) exceeds 40kn and/or Hs >4 m for waters inshore of Wadjemup / Rottnest Island.<br>The existing barge schedule, as per Pelagic Marine Services operations, is provided below. There may be exemptions to these times to accommodate for special deliveries.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                              |
|                                          | Current barge activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Time                                                                                                                                                                                                                                                                                         |
|                                          | Gates open (20 Rous Head Road, North Fremantle)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 5:30 am                                                                                                                                                                                                                                                                                      |
|                                          | Same day perishable deliveries                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 6:15 am                                                                                                                                                                                                                                                                                      |
|                                          | Scheduled vessel departure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 6:45 am                                                                                                                                                                                                                                                                                      |
|                                          | Scheduled arrival – Thomson Bay                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 8:30 am                                                                                                                                                                                                                                                                                      |
|                                          | Last time for arrival of vehicles and returning goods at the Thomson Bay wharf                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 10:30 am                                                                                                                                                                                                                                                                                     |
|                                          | Departure (Thomson Bay, depending on volumes, returning freight)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 12:00 am to 1.00 pm                                                                                                                                                                                                                                                                          |
|                                          | Gates close (16 Mews Road, Fremantle)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 4:00 pm                                                                                                                                                                                                                                                                                      |

| Proposal element                                                 | Location / description                                                                                                                                                                                                                                                                                      | Maximum extent, capacity or range                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ongoing maintenance                                              | There may be requirements for maintenance dredging during operations. Maintenance dredging (if required) will be undertaken in previously disturbed / sandy areas within the development envelope / project footprint. Maintenance dredging frequency, volumes and disposal will be determined as required. | This will be undertaken as required. Environmental management will be undertaken in a manner that is consistent with the document Maintenance Dredging Environmental Management Framework (BMT Oceanica, 2016) prepared for Department of Transport for similar types of maintenance dredging activities. |
| Other elements which affect extent of effects on the environment |                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                           |
| Proposal time                                                    | Maximum project life                                                                                                                                                                                                                                                                                        | Design life shall be 50 years in accordance with AS4997-2005 Normal commercial structure.                                                                                                                                                                                                                 |
|                                                                  | Construction phase                                                                                                                                                                                                                                                                                          | Construction is proposed to be undertaken between 2026 and 2027.                                                                                                                                                                                                                                          |
|                                                                  | Operations phase                                                                                                                                                                                                                                                                                            | 50 years.                                                                                                                                                                                                                                                                                                 |

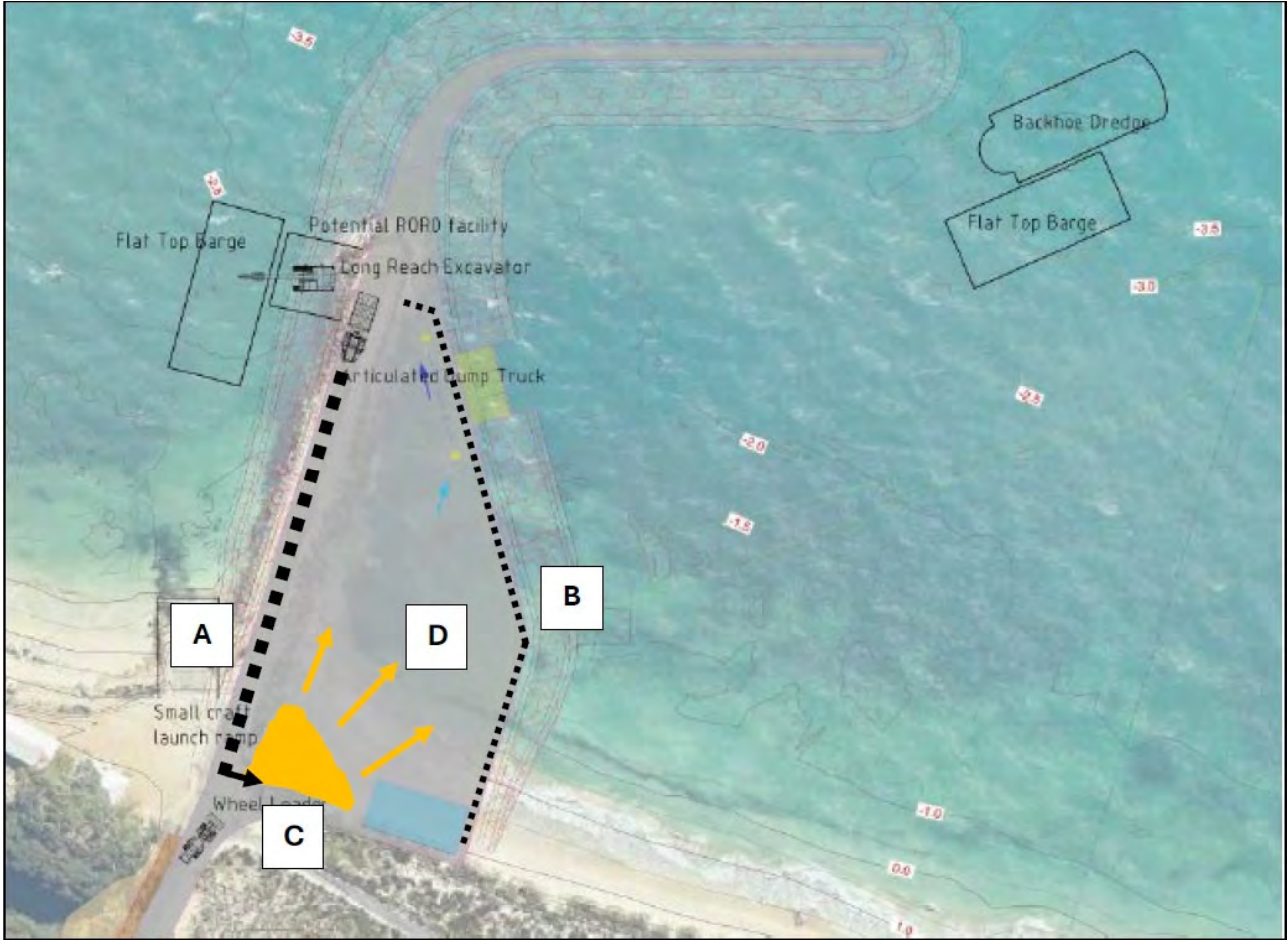


Figure 11: Indicative process for reclamation showing the Army Groyne (A), bund wall (B), placement of dredge spoil in the south-west corner of the area (C) and direction dredge spoil will be placed and spread (D) (PAEMAC, 2024)

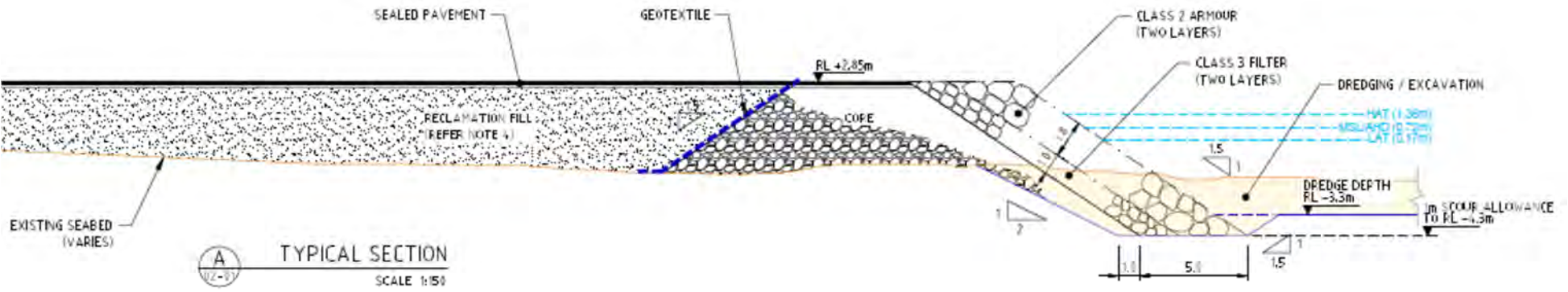
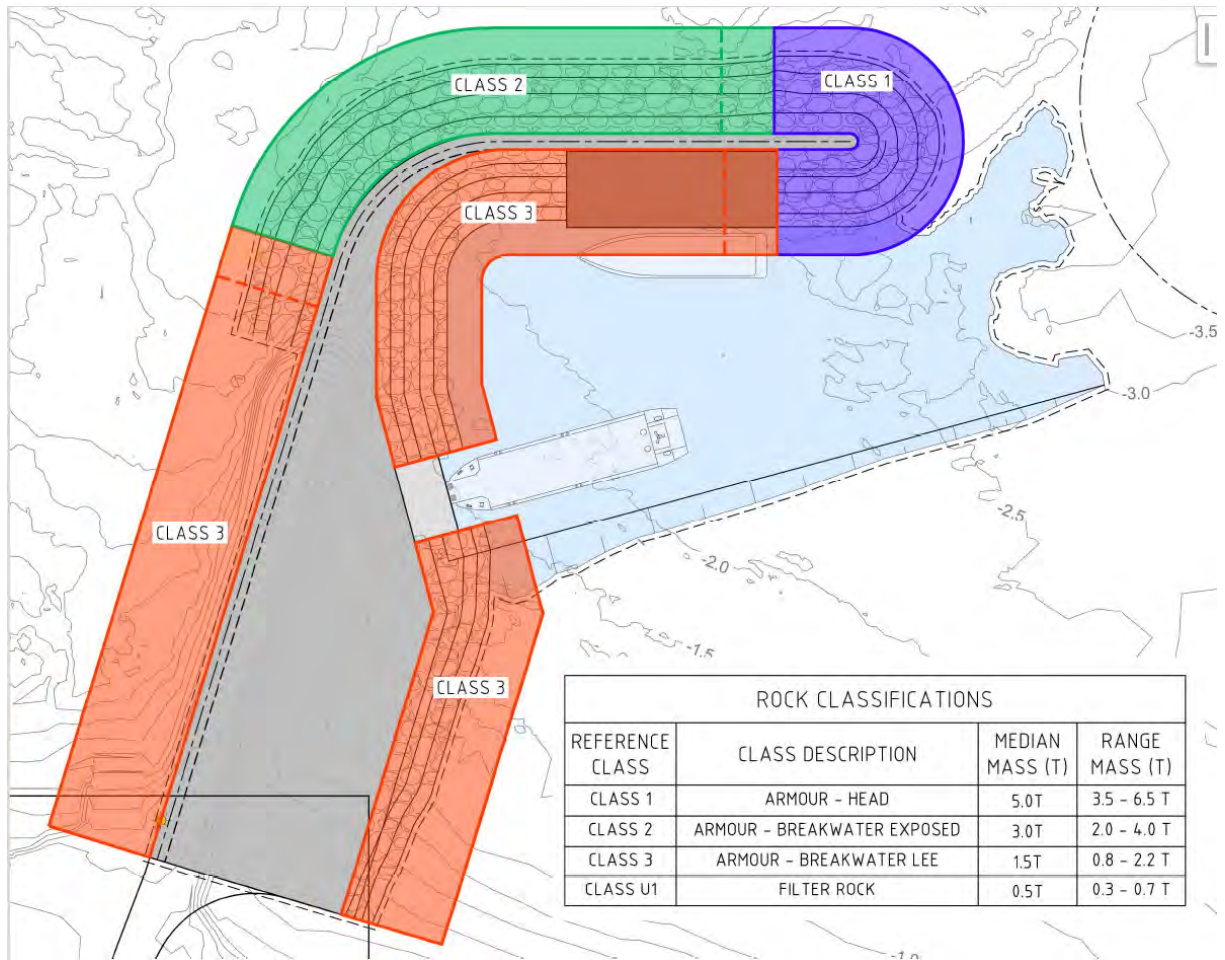


Figure 12: Conceptual cross-section of the reclamation fill, bunding and adjacent dredge zone





**Figure 13: Rock armour classes proposed for construction of the wharf (AECOM, 2020)**

## 2.3 Proposal alternatives

No acceptable alternatives to the proposal have been identified as discussed in Sections 2.3.1 to 2.3.3.

### 2.3.1 Not implementing the proposal

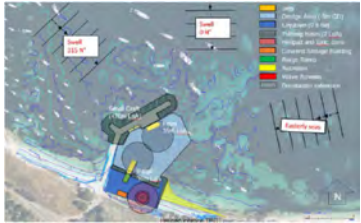
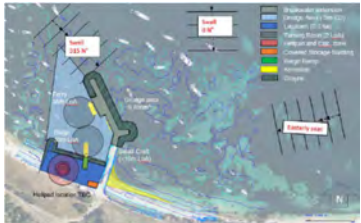
The current barge landing infrastructure at the Main Jetty does not cater for any growth in vessel size or movements over time. This is due to the depth of the berth pocket at the barge landing, and the height of the barge ramp relative to the tidal range of the area around the Main Jetty. This eliminates the ability for growth in the demand for in-bound and out-bound logistics to be met by larger barge vessels; growth is instead met by the relatively less efficient method of an increase in the number of barge movements. Due to the anticipated growth in visitors to the island, not upgrading the barge facilities is not an option.

The structural integrity of the Army Groyne in its current form is at risk in the event of a severe storm and it is likely that the Army Groyne would incur a level of damage that would require significant repair, or demolition. In addition to the potential repair costs from storm damage, the Army Groyne requires an existing level of operational maintenance. In 2022–2023, RIA incurred around \$50,000 in maintenance expenditure and have budgeted these costs at around \$60,000 per annum for the foreseeable future. Longer term, however, it is expected that the structural integrity of the groyne will be unable to be maintained and RIA will have to demolish the structure, which would result in a large one-off expense.

Redeveloping the Army Groyne and relocating the current barge operations provides a solution to both of the above issues.





| Option                            | Concept design                                                                    | Key strengths                                                                                                                                                                            | Key weaknesses                                                                                                                                                                                                                  |
|-----------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Option 6: Breakwater and dredging |  | <ul style="list-style-type: none"> <li>• High operability</li> <li>• Higher serviceability</li> <li>• Reduced landside environmental impacts</li> </ul>                                  | <ul style="list-style-type: none"> <li>• Impact on coastal processes</li> <li>• Capital and maintenance dredging required</li> <li>• High capital expenditure</li> <li>• Large site footprint</li> </ul>                        |
| Option 7: Western-facing facility |  | <ul style="list-style-type: none"> <li>• Low capital expenditure</li> <li>• Low impact on coastal processes</li> <li>• Low site footprint</li> <li>• Reduced landside impacts</li> </ul> | <ul style="list-style-type: none"> <li>• Dredging required</li> <li>• High operating costs</li> <li>• Impact on moorings</li> <li>• Replacement of Wadjemup / Rottnest Island boat ramp (to west of existing groyne)</li> </ul> |

Source: (ACIL Allen, 2024)

## 2.4 Local and regional context

### 2.4.1 Site history

The following site history has been sourced from *Maritime Archaeological Assessment of the Army Groyne Thomson Bay, Rottnest Island* (Department of Maritime Archaeology, Western Australian Museum, 2012).

The Thomson Bay South Development project covers the former the Army Groyne, an integral part of the island's military and recreational heritage. The original Army Groyne was built in 1906 and was used as a terminal for passengers arriving and departing the island, then referred to as the 'excursionist jetty'. The jetty was constructed to allow for horse-drawn trams to take passengers into Thomson Bay settlement and was the first public jetty on the island.



**Plate 1:** *Zephyr* ported at the 'excursionist jetty', 1924 (RIA 2012.239)



**Plate 2:** 'Excursionist jetty', 1930 (RIA 2012.96)

From 1914 to 1915, during World War I (WWI), the island was run by the military and all tourist activities ceased. The jetty, henceforth dubbed the 'Army Jetty', was used to unload troops and supplies and for prisoner transport to shore as the island was utilised as a Prisoner of War Camp. Following WWI the island was reopened to the public and the jetty returned to its original use.

During World War II (WWII), areas of the island were once again utilised for military activities. The island was developed as the primary defence for Fremantle and Perth by 1937, with works including the reinforcing and extension of the Army Jetty and a gantry being constructed just off the south end of the jetty. Between 1924 and 1945 the island was only used as a military base, with all recreational use ceased. The Army Jetty provided troop and provision movements to and from the island. In 1942 the jetty was further extended to allow for larger vessel access.



**Plate 3:** Original timber jetty with gantry on the right, facing west (RIA 2012.265)



**Plate 4:** Original timber jetty facing west to shore (National Archives Australia (NAA))

The end of WWII in 1945 returned the jetty to its primary tourist use until 1961, when the main jetty was built closer to the settlement. In 1969 the Army inspected the jetty and observed the jetty to be in poor condition, with vehicle access being banned. In 1970, plans were in place to demolish the original structure and reconstruct the jetty with rock fill and compacted limestone base, inclusive of a barge hardstand ramp. In 1972 the demolition and reconstruction had occurred. In 1984 all Army land holdings and buildings were bought back by the state government and the jetty remained for recreational uses such as snorkelling and fishing, however no boats were to dock along the jetty platform due to its fragility.



**Plate 5:** Reconstruction works, 1971 (NAA)



**Plate 6:** Reconstruction works, rockfill and barge hardstand (NAA)

It was observed in National Archives of Australia (NAA) and the State Library of Western Australia literature that much of the old materials were buried beneath the subsequent extensions of the rock fill. The structure was inspected by the Western Australia Maritime in 2012 and the jetty was measured at 120 m length and 1,700 m<sup>2</sup> in area. In October 2018, the jetty underwent platform removal and conversion into a rock groyne as a result of a partial collapse.

## 2.4.2 Historical photography

A review of online historic aerial photography held by Landgate was undertaken that yielded limited aerials of the site dating back to 1955. The historic development activities of the site and surrounds are summarised in Table 19.



**Table 19: Historic photography summary**

| Year | Site and surrounding area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Historical aerial                                                                    |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 1941 | <p>Site: The site is already developed with the former Army Jetty. Multiple tracks and trails are identified surrounding the site.</p> <p>South-east: Kingstown Barracks.</p> <p>South: Bickley Swamp.</p> <p>West: Rottnest Island Lakes.</p>                                                                                                                                                                                                                                                                                    |    |
| 1955 | <p>Site: The site is already developed with the former Army Jetty. Multiple tracks and trails are identified surrounding the site.</p> <p>South-east: Kingstown Barracks.</p> <p>South: Bickley Swamp and Rottnest Island aerodrome.</p> <p>West: Rottnest Island Lakes and the main settlement and tourist hub.</p>                                                                                                                                                                                                              |   |
| 2000 | <p>Site: The site is already developed with the former Army Jetty. Minor infrastructure appears to be located immediately south of the jetty. Multiple tracks and trails are identified surrounding the site. Moorings are located within the marine environment to the north.</p> <p>South-east: Kingstown Barracks.</p> <p>South: Bickley Swamp and Rottnest Island aerodrome.</p> <p>West: Rottnest Island Lakes and the main settlement and tourist hub.</p> <p>Surrounding marine environment: The presence of moorings.</p> |  |

| Year | Site and surrounding area                                                                                                                                                                                               | Historical aerial                                                                    |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 2002 | <p>Site: Infrastructure has been constructed adjacent to the south-west of the jetty, identified as public toilets and an undercover seating area.</p> <p>Surrounding marine environment: The presence of moorings.</p> |    |
| 2004 | <p>Site: The minor infrastructure to the south has been removed.</p> <p>Surrounding marine environment: The presence of moorings.</p>                                                                                   |   |
| 2017 | <p>West: The presence of a solar farm is observed 400 m from the site.</p> <p>Surrounding marine environment: The presence of moorings.</p>                                                                             |  |

### 3 LEGISLATIVE CONTEXT

#### 3.1 South Thomson Bay Barge environmental assessment process

This Environmental Supporting Document has been prepared to support both the state and federal environmental approvals required to implement the proposed South Thomson Bay Barge Development as outlined in Table 20.

**Table 20: Environmental assessment process summary**

| Relevant legislation |                      | Addressed in this report                                                                             |
|----------------------|----------------------|------------------------------------------------------------------------------------------------------|
| State                | Refer to Section 3.2 | The environmental impact assessment process under state legislation is outlined in Sections 7 to 13. |
| Federal              | Refer to Section 3.3 | The environmental impact assessment process under federal legislation is outlined in Section 14.2.   |

#### 3.2 Environmental impact assessment process – state legislation

##### 3.2.1 *Environmental Protection Act 1986*

The *Environmental Protection Act 1986* (EP Act) is the key legislative tool for environmental protection in Western Australia. The EP Act provides for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment. The EP Act is administered by the EPA and the Minister for the Environment.

##### 3.2.1.1 Part IV of the *Environmental Protection Act 1986*

The environmental impact assessment process is regulated under Part IV of the EP Act, with Divisions 1 and 2 dealing with proposals and Divisions 3 and 4 dealing with planning schemes. The EP Act sets out the essential requirements of environmental impact assessment, while the specific practices of environmental impact assessment are covered in the Environmental Impact Assessment (Part IV Divisions 1 and 2) Administrative Procedures (2021) (the Administrative Procedures) (EPA, 2021c).

The Administrative Procedures provide the overarching framework for the EPA to undertake environmental impact assessment. The Administrative Procedures are grouped according to the following key stages:

- Stage 1: Referral of a proposal to the EPA
- Stage 2: EPA to decide whether or not to assess a referred proposal
- Stage 3: Assessment of proposals
- Stage 4: EPA report on the assessment of proposal
- Stage 5: Deciding if proposal may be implemented and implementation of proposals.

The referral of this supporting document and accompanying Section 38 referral form to the EPA under Section 38 of the EP Act allows for the EPA to determine if the referral is valid under the EPA's Administrative Procedures and decide whether or not to assess the proposal.

If the EPA decide not to assess the proposal, any clearing of native vegetation and seagrass required for construction of the proposal will need a permit under Part V Division 2 of the EP Act except where:

- An exemption applies under Schedule 6 of the EP Act; or
- Is prescribed by regulation in the Environmental Protection (Clearing of Native Vegetation) Regulation 2004 and the proposed clearing area is not mapped as an Environmentally Sensitive Area (ESA); or
- Department of Water and Environmental Regulation (DWER) determines that a permit is not required because the proposed clearing satisfies all the referral criteria.



### 3.2.1.2 EPA guidance and technical reports

The proposal is subject to compliance with applicable guidelines and technical reports that have been developed to assist proponents and the general public, in understanding the minimum requirements for the protection of the environment that the EPA expects to be met during the assessment process.

Table 21 details the EPA's environmental factors and technical guidelines relevant to the proposal.

**Table 21: Applicable EPA guidance and technical reports**

#### EPA environmental factor guidelines

|                                                                                |
|--------------------------------------------------------------------------------|
| Environmental Factor Guideline: Benthic Communities and Habitats (EPA, 2016f)  |
| Environmental Factor Guideline: Coastal Processes (EPA, 2016i)                 |
| Environmental Factor Guideline: Marine Environmental Quality (EPA, 2016e)      |
| Environmental Factor Guideline: Marine Fauna (EPA, 2016j)                      |
| Environmental Factor Guideline: Flora and Vegetation (EPA, 2016a)              |
| Environmental Factor Guideline: Terrestrial Environmental Quality (EPA, 2016c) |
| Environmental Factor Guideline: Terrestrial Fauna (EPA, 2016d)                 |
| Environmental Factor Guideline: Inland Waters (EPA, 2018a)                     |
| Environmental Factor Guideline: Social Surroundings (EPA, 2023)                |

#### EPA technical guidance

|                                                                                                          |
|----------------------------------------------------------------------------------------------------------|
| Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b)        |
| Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2020) |
| Technical Guidance - Protecting the Quality of Western Australia's Marine Environment (EPA, 2016g)       |
| Technical Guidance - Protection of Benthic Communities and Habitats (EPA, 2016f)                         |
| Technical guidance - Environmental Impact Assessment of Marine Dredging Proposals (EPA, 2021a)           |

## 3.3 Other state approvals and regulations

The proposal is required to comply with the requirements of other relevant state legislation, regulation and policy. Table 22 provides an overview of other potential key state-based approval requirements relevant to the proposal.

**Table 22: Other approval requirements**

| Proposal activities                                                                                        | Type of approval                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Legislation regulating the activity                                                    | Approval agency                            |
|------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|--------------------------------------------|
| Potential impacts to Aboriginal heritage during vegetation clearing, construction and dredging activities. | <p>There are different types of approval under the <i>Aboriginal Heritage Act 1972</i> and in the Aboriginal Heritage Regulations 1974.</p> <p>Approval may be required from either the Minister for Aboriginal Affairs or the Registrar of Aboriginal Sites for any activity which may harm an Aboriginal site. There are four types of authorisations:</p> <ul style="list-style-type: none"> <li>• Section 18 consent – for more significant impacts and harm to Aboriginal sites</li> <li>• Section 16 authorisation – for excavation purposes (generally related to research)</li> <li>• Regulation 7 approval – to bring plant and equipment to an Aboriginal site</li> <li>• Regulation 10 consent – for more minor activities and impacts.</li> </ul> <p>If impact to an Aboriginal site is proposed, the proponent will, in consultation with traditional owners, determine the appropriate approvals pathway under the <i>Aboriginal Heritage Act 1972</i>. This process will meet the EPA's objective for Social Surroundings by protecting Aboriginal sites from significant harm.</p> | <p><i>Aboriginal Heritage Act 1972</i></p> <p>Aboriginal Heritage Regulations 1974</p> | Department of Planning, Lands and Heritage |

| Proposal activities                                                                     | Type of approval                                                                                                                                                                                                                                | Legislation regulating the activity       | Approval agency                                             |
|-----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|-------------------------------------------------------------|
| Storage and handling of hazardous materials may be required during / after construction | A Dangerous Goods Licence sets standards for the way in which dangerous goods are stored on-site. These standards are aimed at ensuring dangerous goods are stored safely and in such a way that will not result in impacts to the environment. | <i>Dangerous Goods Safety Act 2004</i>    | Department of Energy, Mines, Industry Regulation and Safety |
| Activities undertaken by RIA on Wadjemup / Rottnest Island.                             | Any activities undertaken will be in accordance with this environmental approval and the <i>Rottnest Island Authority Act 1987</i> .                                                                                                            | <i>Rottnest Island Authority Act 1987</i> | RIA                                                         |

### 3.4 Environmental impact assessment process – federal legislation

#### 3.4.1 *Environment Protection and Biodiversity Conservation Act 1999*

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) protects matters of national environmental significance (MNES) and is administered by the Commonwealth Minister of the Environment. If an action is likely to have a significant impact on any MNES a referral to the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCEEW) is required. MNES are defined as:

- Listed threatened species and ecological communities
- Migratory species protected under international agreements
- Ramsar wetlands of international importance
- The Commonwealth marine environment
- World Heritage properties
- The Great Barrier Reef Marine Park
- National heritage places
- Nuclear actions
- A water resource, in relation to coal seam gas development and large coal mining development.

A summary of MNES relevant to the proposed is provided in Table 23.

**Table 23: Matters of national environmental significance**

| EPBC matter                                    | Matters returned | Description                                                                                                                                                                                                                                                                                                                                                                                                  | Relevant to the proposal |
|------------------------------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| World heritage properties                      | None             | There are no world heritage properties located within or near the site.                                                                                                                                                                                                                                                                                                                                      | N/A                      |
| National heritage places                       | None             | There are no national heritage properties within or near the site.                                                                                                                                                                                                                                                                                                                                           | N/A                      |
| Wetlands of international significance         | None             | There are no wetlands of international significance within or near the site.                                                                                                                                                                                                                                                                                                                                 | N/A                      |
| Great Barrier Reef Marine Park (GBRMP)         | None             | Not relevant to the proposed action as the GBRMP is located off the east coast of Australia.                                                                                                                                                                                                                                                                                                                 | N/A                      |
| Commonwealth marine area                       | None             | The proposed action is not located within a Commonwealth marine area. The Commonwealth marine area is mapped over 7 km from the development envelope and the proposal is not considered likely to impact a Commonwealth marine area.                                                                                                                                                                         | N/A                      |
| Listed threatened ecological communities (TEC) | One              | The Protected Matters Search Tool (PMST) search identified the Banksia Woodlands of the Swan Coastal Plain ecological community within the search radius.<br>This ecological community is only recorded from the Western Australian mainland and vegetation present on Wadjemup / Rottnest Island is not associated with this TEC.<br>This TEC is not relevant to the proposal and is not discussed further. | N/A                      |

| EPBC matter                                                                    | Matters returned | Description                                                                                                                          | Relevant to the proposal         |
|--------------------------------------------------------------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Listed threatened species                                                      | 44               | Birds – 23<br>Fish – 1<br>Mammals – 4<br>Plants – 1<br>Reptiles – 4<br>Sharks – 5<br>Insect - 1                                      | Yes<br>Discussed in Section 14.2 |
| Listed migratory species                                                       | 102              | Migratory Marine Birds – 19<br>Migratory Marine Species – 17<br>Migratory Terrestrial Species – 1<br>Migratory Wetlands Species – 29 | Yes<br>Discussed in Section 14.2 |
| Nuclear actions                                                                | None             | The proposal does not relate to this MNES.                                                                                           | N/A                              |
| Water resources in relation to coal seam gas and large coal mining development | None             | The proposal does not relate to this MNES.                                                                                           | N/A                              |

Green – MNES not applicable to the proposal.

Orange – MNES considered relevant to the proposal and addressed in this report.

### 3.4.2 EPBC Act assessment context

#### 3.4.2.1 Accredited assessment

The intention to develop a bilateral agreement with Western Australia under Section 45 of the EP Act and EPBC Act was published in 2019. The draft bilateral agreement is intended to revoke and replace the current bilateral agreement (2014) between the Commonwealth of Australia and the State of Western Australia. Until the agreement is amended, the assessment of any new proposals that would otherwise have been assessed by the EPA under the agreement will be individually accredited by the Commonwealth Government. If significant impacts to a MNES are identified because of the proposal, a separate EPBC Act referral will be submitted to the Commonwealth DCCEEW to 'turn on' the accredited assessment process.

The environmental impact assessment of MNES is outlined in Section 14.2.



## 4 STAKEHOLDER ENGAGEMENT

### 4.1 Key stakeholders

RIA understands and acknowledges that any changes to the infrastructure on Wadjemup / Rottnest Island is of interest to the community. Engagement regarding the project commenced in 2019.

Key stakeholders for the proposal are summarised below:

- State government agencies and regulators
  - Department of Biodiversity, Conservation and Attractions (DBCA)
  - Department of Water and Environmental Regulation (DWER)
  - Department of Planning, Lands and Heritage (DPLH)
  - Department of Transport (DoT)
- Traditional owners
- Local community, local businesses and non-government organisations (NGOs).

### 4.2 Stakeholder engagement process

Consultation has occurred with the key stakeholders listed in Section 4.1. RIA has sought to engage on major issues through in-person briefings where possible, with written updates provided to support a timely flow of information to stakeholders (Table 24).

Engagement with government agencies and regulators and traditional owners will remain ongoing throughout the project.

**Table 24: Stakeholder engagement process**

| Issue for engagement                             | Level of engagement | Timing             | Scope                                                                                                                                                            |
|--------------------------------------------------|---------------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Justification for the proposal.                  | Inform              | Underway / ongoing | Consultation undertaken with the EPA and local community to provide information and justification for the need for the proposal.                                 |
| Foster community advocacy for the project.       | Inform              | March–April 2024   | Community engagement to understand community expectations for the proposal and any key concerns that may need to be addressed.                                   |
| Environmental referrals to support the proposal. | Consult             | Underway / ongoing | Ongoing liaison with key regulators to obtain input into project design and technical investigations to ensure that RIA is not unduly impacting the environment. |

### 4.3 Stakeholder consultation outcomes

Table 25 presents a summary of the key stakeholder consultation undertaken to date for the proposal.

Table 25: Summary of consultation with state government agencies and regulators, local government and the local community

| Stakeholder                                                         | Date               | Type of consultation        | Purpose of engagement / issues and topics raised                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Proponent response / outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------|--------------------|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DWER's EPA Services                                                 | October 2019       | Site Visit                  | RIA and EPA undertook a site visit at the site, with discussion on the plans and potential environmental issues. The investigations to be undertaken were outlined, including dredge plume modelling and jet probing.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | DWER EPA were satisfied with the update and the planned works and investigations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| DWER's EPA Services                                                 | 14/2/2020          | Email and meeting           | Advice was sought on management measures to be implemented for per- and poly-fluoroalkyl substances (PFAS) during dredging, based on elevated PFAS results in elutriate samples.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | DWER EPA was in agreement that the PFAS results in elutriate samples were a result of laboratory contamination.<br>Subsequently, RPS undertook further sediment and surface water sampling and did not identify PFAS at concentrations that would pose a risk to environment and human health. RPS then revised its report with the conclusion that no management measures needed to be considered during dredging.                                                                                                                                                                                                                                                                                                                              |
| EPA                                                                 | 12/6/2023          | Meeting                     | RIA and EPA discussed the recommencement of the project and outlined the baseline studies and management plans to be undertaken/developed as part of the progression to referral.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | DWER EPA was satisfied with the update and the proposed studies, management plans and timeframes. EPA noted that a Marine Environmental Quality Monitoring and Management Plan (MEQMMP) would be required in addition to the proposed suite of management plans. Further consultation regarding this requirement was undertaken on 19/02/2024 as outlined below.                                                                                                                                                                                                                                                                                                                                                                                 |
| EPA                                                                 | 13/6/2023          | Email                       | Advice sought on the <i>Aboriginal Heritage Act 1972</i> and the relationship with the EP Act.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | DWER EPA provided links to published guidance on Aboriginal Cultural Heritage (ACH) matters and the impacts that would be dealt with under <i>Aboriginal Heritage Act 1972</i> and EP Act.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| EPA                                                                 | 19/2/2024          | Email                       | O2 Marine proposed preparation of an Operational Environmental Management Plan (OMEP) instead of a Marine Environmental Quality Monitoring and Management Plan (MEQMMP) requested by EPA on 12/6/2023 based on the limited ongoing risk to water quality.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | The EPA agreed to the proposed change to the management plans supporting the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Rottneest Foundation                                                | 1/3/2024           | Email                       | Included a link to project information website page to inform of the proposal and request feedback.<br>No response received.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | No further action.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Fishing groups: BoatingWA / Recfishwest                             | 1/3/2024           | Email                       | Included a link to project information website page to inform of the proposal and request feedback.<br>No response received.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | No further action.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Marine groups: UWA/WADDI/ Reef life/AMCS /Pew Trust / Save Our Seas | 1/3/2024           | Email                       | Included a link to project information website page to inform of the proposal and request feedback.<br>No response received.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | No further action.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| DPLH                                                                | 1/3/2024           | Email                       | DPLH was issued a link to the South Thomson Barge Landing Consultation materials, with a note that if any potential impacts to the Kingstown Barracks (P525) registered place be identified during detailed planning for the site, formal referrals will be progressed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | DPLH acknowledged receipt of notification on 5/03/2024, stating that it appreciated the works do not directly affect a registered place, but it is of interest to the Council given that the island is on its assessment program                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| DPLH                                                                | 1/3/2024           | Email                       | Included a link to project information website to inform of the proposal and request feedback.<br>DPLH only requested to be informed of project updates.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | No further action.<br>Key project updates will be provided to DPLH as required.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| General public submission                                           | 1/3/2024–29/3/2024 | General public consultation | Completed via RIA website with feedback received via email.<br>The key submissions received from the public that were in opposition to the proposal included: <ul style="list-style-type: none"> <li>Potential impacts to the terrestrial and marine environment, such as seagrass loss, land clearing, impact on quokka population, noise, water, and light pollution.</li> <li>The impact to local boat users, island residents and local visitors.</li> <li>Impact to the built-heritage value of the Army Groyne.</li> <li>Concern for the loss of suitable anchoring grounds.</li> <li>Concern for the increase in traffic along Parker Point Rd and associated public safety risk.</li> <li>Support for refurbishment of the current jetty and barge landing instead of constructing new facility.</li> </ul> | <ul style="list-style-type: none"> <li>Project justification is included within this document.</li> <li>The impact assessment undertaken as part of this documents indicates that the residual impacts to the marine and terrestrial environment are unlikely to be at variance to the EPA's environmental objectives.</li> <li>Public amenity (noise, lighting, marine traffic and loss of anchoring grounds) context and mitigations are discussed in this document.</li> <li>Public safety risk (i.e. traffic along Parker Pt Rd) will be addressed by policing and road regulations applicable to Wadjemup / Rottneest Island roads.</li> <li>Built heritage context of the Army Groyne addressed in separate submission to DPLH.</li> </ul> |
| Rottneest Island Chamber of Commerce (RICC)                         | 6/3/2024           | Meeting                     | Presentation to RICC via a monthly meeting with all business representatives present.<br>Questions and comments were raised in relation to: <ul style="list-style-type: none"> <li>In general, there was support for the proposal.</li> <li>The logistics of ferry operations and luggage deliveries.</li> <li>General questions about the status of baseline environmental studies.</li> <li>General questions about project cost and timeframes.</li> <li>Impacts to moorings and anchorage.</li> <li>Upgrades to the access road.</li> </ul>                                                                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>Workshop to be held to discuss ferry operations and logistics once funding and detailed designs are known.</li> <li>RIA provided verbal responses to the other questions based on information known at the time.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Quokka coaches                                                      | 7/03/2024          | Email                       | Email received following general consultation: In support of the proposal stating: <ul style="list-style-type: none"> <li>Project will benefit the barge operators who currently work in a confined area.</li> <li>Project will enhance overall visitor impression on arrival.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Noted                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Pinnacle Travel Group                                               | 20/03/2024         | Email                       | Email received following general consultation. The Pinnacle Travel Group was support of the proposal stating: <ul style="list-style-type: none"> <li>Project will increase the experience and amenity for tourists and improve the ability of ferry companies to operate.</li> <li>Significantly reduce traffic around the jetty and main bus stop, easing congestion.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                   | Noted                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| EPA                                                                 | 21/3/2024          | Email                       | Advice was sought on the need to do underwater noise modelling or an underwater noise desktop assessment due to the reduced underwater noise impacts from utilisation of vibro hammer piling methodology as opposed to impact hammer.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | No response from EPA.<br>RIA decided to undertake the noise modelling instead of a desktop assessment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

| Stakeholder                                | Date               | Type of consultation  | Purpose of engagement / issues and topics raised                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Proponent response / outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------|--------------------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The Rottnest Society                       | 29/03/2024         | Meeting               | <p>Presentation to The Rottnest Society on the proposal and to request feedback.</p> <p>Questions and comments were raised in relation to:</p> <ul style="list-style-type: none"><li>• Concern for the terrestrial and marine environmental impact.</li><li>• Concern for lack of proposed revegetation and restoration.</li><li>• Recommendation that evaluation of current barge landing is undertaken to effectively reduce conflicts with pedestrians.</li><li>• Notes that information was difficult to source as a result of RIA website being upgraded.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                          | <ul style="list-style-type: none"><li>• Project justification is included within this document.</li><li>• The impact assessment undertaken as part of this documents indicates that the residual impacts to the marine and terrestrial environment are unlikely to be at variance to EPA's environmental objectives.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Wadjemup Aboriginal Reference Group (WARG) | 4/04/2024          | Meeting               | <p>Presentation to WARG to inform of the proposal and seek feedback.</p> <p>Questions and comments were raised in relation to:</p> <ul style="list-style-type: none"><li>• In general, there was support for the proposal.</li><li>• Concern for marine species impacted by the noise from piling, in particular whales.</li><li>• Enquiry about heritage values in the project area</li><li>• Works should stop should Aboriginal cultural material be disturbed.</li><li>• Enquiry about incorporation of renewable energy in the design.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"><li>• Cultural heritage (disturbance of Aboriginal heritage) is addressed in this document.</li><li>• Cultural heritage mitigations identified within the Report of an Ethnographic Aboriginal Heritage Survey of Army Jetty (provided in Appendix M).</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Mooring licensees                          | 9/4/2024–24/4/2024 | Targeted consultation | <p>Completed via letters and telephone calls to inform licensees about:</p> <ul style="list-style-type: none"><li>• Permanent and temporary relation of moorings (where applicable).</li><li>• General notification of the proposal.</li><li>• Overall, the responses were opposed to the proposal with general references to:<ul style="list-style-type: none"><li>– The impact to current vessel mooring licensees, local boat users, island residents and local visitors.</li><li>– Impact to the built-heritage value of the Army Groyne.</li><li>– Concerns about the increased risk/safety to swimmers as a result of increasing marine traffic and boat wash.</li><li>– Requests for relocation and clarification on the relocation process.</li><li>– Concern for the loss of suitable anchoring grounds.</li><li>– Potential impacts to the terrestrial and marine environment (seagrass loss, land clearing, impact on quokka population, noise, water, odour and light pollution).</li></ul></li></ul> | <ul style="list-style-type: none"><li>• Project justification is included within this document.</li><li>• The impact assessment undertaken as part of this documents indicates that the residual impacts to the marine and terrestrial environment are unlikely to be at variance to the EPA's environmental objectives.</li><li>• Public amenity (noise, lighting, marine traffic and loss of anchoring grounds) context and mitigations is discussed in this document.</li><li>• Public safety risk to swimmers and mitigations identified within this document.</li><li>• Public safety risk (i.e. traffic along Parker Pt Rd) is addressed by policing and road regulations applicable to Wadjemup / Rottnest Island roads.</li><li>• Built heritage context of the Army Groyne addressed in separate submission to DPLH.</li></ul> |
| DPLH                                       | 24/04/2024         | Email                 | <p>DPLH contacted RIA for an update on the project, including information on the potential heritage implications on built fabric and archaeology.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <ul style="list-style-type: none"><li>• RIA's project manager responded on 30/04/2024.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Department of Transport (DoT)              | 1/5/204            | Email                 | <p>Included a link to project information website to inform of the proposal and request feedback.</p> <p>DoT stated that:</p> <ul style="list-style-type: none"><li>• A navigational safety channel is not required.</li><li>• No additional navigational lights are required.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p>No changes to the marine safety infrastructure required.</p> <p>No further action.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |



## 5 OBJECT AND PRINCIPLES OF THE EP ACT

Section 4A of the EP Act establishes that the objective of the Act is to protect Western Australia's environment, having regard for the following principles:

1. The precautionary principle
2. The principle of intergenerational equity
3. Principles relating to improved valuation, pricing and incentive mechanisms
4. The principle of the conservation of biological diversity and ecological integrity
5. The principle of waste minimisation.

Table 26 identifies how these five EP Act principles have been considered for the proposal and provides a holistic description of how the objective of the EP Act has been met.

**Table 26: Object and principles of the EP Act**

| Principle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Consideration                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>The precautionary principle</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br>In application of this precautionary principle, decisions should be guided by: <ul style="list-style-type: none"> <li>Careful evaluation to avoid, where practicable, serious or irreversible damage to the environment</li> <li>An assessment of the risk-weighted consequences of various options</li> </ul> | Studies and investigations have been undertaken to assess the potential impacts to key environmental factors relevant to the proposal as summarised in Section 6 to ensure that full scientific certainty supports this impact assessment.<br>The proposal will not cause threat of serious or irreversible damage through avoidance of impacts where possible and the identification and implementation of management measures to address residual impacts.      |
| <b>The principle of intergenerational equity</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| The present generation should ensure that the health, diversity and productivity of the environment is maintained and enhanced for benefit of future generations.                                                                                                                                                                                                                                                                                                                                           | The proposal has been designed to meet the EPA's objectives for the relevant environmental factors, with mitigation measures to reduce residual environmental impacts, ensuring sensitive environmental values, their health, function and productivity are maintained for future generations.<br>The proposed relocation of the barge operations takes into consideration the proposed operation of the barge facilities for the life of the project (50 years). |
| <b>Principles relating to improved valuation, pricing and incentive mechanisms</b>                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 1. Environmental factors should be included in the valuation of assets and services.                                                                                                                                                                                                                                                                                                                                                                                                                        | The proponent accepts that any costs for environmental mitigation, management or offsets are part of the overall proposal costs. This includes residual impact management actions that will be addressed within corresponding management plans.                                                                                                                                                                                                                   |
| 2. The polluter pays principle – those who generate pollution and waste should bear the cost of containment, avoidance and abatement.                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 3. The users of goods and services should pay prices based on the full life cycle costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste.                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 4. Environmental goals, have been established, should be pursued in the most cost-effective way, by establishing incentive structure, including market mechanisms, which enable those best placed to maximise benefits and/or minimise costs to develop their own solution and response to environmental problems.                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

| Principle                                                                                                                           | Consideration                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>The principle of the conservation of biological diversity and ecological integrity</b>                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Conservation of biological diversity and ecological integrity should be a fundamental consideration.                                | Seven key environmental factors (benthic communities and habitats, coastal processes, marine environmental quality, marine fauna, flora and vegetation, terrestrial fauna and social surroundings) relevant to the proposal have been identified in this report.<br><br>Site investigations have been undertaken to identify potential impacts and mitigation options to minimise the impact of the proposal and align with the EPA's objective for each environmental factor. |
| <b>The principle of waste minimisation</b>                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| All reasonable and practicable measures should be taken to minimise the generation of waste and its discharge into the environment. | Waste will be minimised by adopting the hierarchy of waste controls; avoid, minimise, reuse, recycle and safe disposal during construction and operation of the proposal.                                                                                                                                                                                                                                                                                                      |

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## 6 ENVIRONMENTAL FACTORS AND OBJECTIVES

This Environmental Supporting Document has been prepared to address the EPA key environmental factors that are relevant to the proposal. Assessment of potential impacts to the environmental factors was undertaken based on the environmental investigations listed in Table 27.

Environmental factors that would potentially be impacted by the proposal are addressed in Sections 7 to 13, as outlined in Table 27.



Table 27: EPA key environmental factors and their relevance to the proposal

| Theme | EPA factor                       | Relevance to proposal                                                                                                                                                                               | Supporting technical investigations and reports                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                    |                                                                                                                                                                                |                         |
|-------|----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
|       |                                  |                                                                                                                                                                                                     | Survey summary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Report                                                                                             | Survey timing                                                                                                                                                                  | Appendix to this report |
| Sea   | Benthic communities and habitats | There are benthic communities and habitats present within South Thomson Bay.                                                                                                                        | RPS undertook a benthic habitat assessment to support a previous design of the project in 2019 (RPS, 2019). In 2023, RPS has reviewed and updated this benthic habitat mapping to support the current project design.<br>Sites surveyed in 2023 replicated those surveyed by RPS in 2019, except where habitat of specific interest for ground-truthing were identified in the aerial images.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | South Thomson Barge Landing Development; Marine fauna and benthic habitat assessment (RPS, 2024a). | The main field survey was completed between 0830 and 1630 hrs on 24 November 2023<br>The supplementary field survey was completed on 29 January 2024 between 0830 and 1330 hrs | Appendix B              |
|       |                                  |                                                                                                                                                                                                     | Habitat mapping was undertaken using aerial photography and information collected by Rottnest Island Authority, who visually surveyed the benthic habitat at six sites within the 2.54 ha survey extension area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | South Thomson Barge Landing; Benthic habitat assessment: Plume Extension Survey Area (RPS, 2023b). | 22 March 2024                                                                                                                                                                  | Appendix C              |
|       | Coastal processes                | Construction of the marine component of the proposal has the potential to result in changes to coastal processes.                                                                                   | Baird undertook a coastal processes assessment of the proposal to assess the potential impact the proposed marine infrastructure will have on coastal processes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | South Thomson Barge Landing Development; Coastal processes assessment (Baird, 2024a).              | NA                                                                                                                                                                             | Appendix D              |
|       |                                  |                                                                                                                                                                                                     | RPS' Ocean Science & Technology team undertook a peer review of the two reports prepared by Baird to support the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | RIA Peer Review of Dredge Plume Modelling and Coastal Processes Reports (RPS, 2024c)               | NA                                                                                                                                                                             | Appendix E              |
|       |                                  |                                                                                                                                                                                                     | A Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) has been prepared for Wadjemup / Rottnest Island to provide strategic guidance for coordinated, integrated and sustainable land use planning and management along the Wadjemup / Rottnest Island coastline. The CHRMAP will inform RIA's future decision-making with respect to areas and assets identified as being at risk of coastal hazards.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Rottnest Coastal Hazard and Risk Management and Adaptation Plan (Cardno, 2023).                    | NA                                                                                                                                                                             | -                       |
|       | Marine environmental quality     | Construction and operation of the proposal has potential to impact marine environmental quality.                                                                                                    | Baird undertook a dredge plume modelling assessment to identify the potential impacts from dredging activities associated with construction of the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | South Thomson Barge Landing Development; Dredge Plume Modelling Assessment (Baird, 2024b).         | NA                                                                                                                                                                             | Appendix F              |
|       |                                  |                                                                                                                                                                                                     | RPS' Ocean Science & Technology team undertook a peer review of the two reports prepared by Baird to support the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | RIA Peer Review of Dredge Plume Modelling and Coastal Processes Reports (RPS, 2024c)               | NA                                                                                                                                                                             | Appendix E              |
|       |                                  |                                                                                                                                                                                                     | Rottnest Island Authority has undertaken baseline water quality monitoring to support the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | The results from this monitoring are discussed in this report.                                     | Water quality sampling was undertaken in November and December 2023 and January 2024                                                                                           | Appendix G              |
|       |                                  |                                                                                                                                                                                                     | RPS undertook sediment sampling to support the project in 2020.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Rottnest Island Army Jetty Dredging; SAP Implementation report (RPS, 2020).                        | Sediment sampling was undertaken in November 2019                                                                                                                              | Appendix H              |
|       | Marine fauna                     | The proposal will result in direct and temporary impacts to marine fauna habitat, while construction and operational activities has the potential to impact marine fauna.                           | RPS prepared a desktop marine fauna assessment to support the proposal and identify conservation significant marine fauna species likely to occur within vicinity of the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | South Thomson Barge Landing Development; Marine fauna and benthic habitat assessment (RPS, 2024a). | NA                                                                                                                                                                             | Appendix B              |
|       |                                  |                                                                                                                                                                                                     | Tetra Tech prepared an underwater noise assessment to assess potential impacts to marine fauna from piling activities during construction of the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | South Thomson Barge Landing Development; Underwater Acoustic Assessment (Tetra Tech, 2024)         | NA                                                                                                                                                                             | Appendix S              |
| Land  | Flora and vegetation             | Approximately 0.46 ha of terrestrial vegetation will be directly impacted by the proposal.                                                                                                          | Focused Vision Consulting (FVC) undertook a flora and vegetation survey of the South Thomson and Kingstown, areas of Wadjemup / Rottnest Island (Figure 38). The FVC survey encompassed the development envelope and surrounding area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Flora and vegetation survey; South Thomson and Kingstown, Rottnest Island (FVC, 2023)              | Initial reconnaissance flora and vegetation survey – 2 May 2022<br>Secondary reconnaissance flora and vegetation survey – 30 August 2022                                       | Appendix I              |
|       |                                  |                                                                                                                                                                                                     | A reconnaissance survey was undertaken by RPS within the terrestrial survey area shown in Figure 37. EPA's Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016) states that 'a reconnaissance survey is required where flora and vegetation values are well defined, the area is not likely to support significant flora or vegetation and the scale and nature of the potential impacts are not likely to be significant.' RPS considered these criteria to be met and furthermore that the small size of the site precluded the implementation of a detailed survey using quadrats. As part of the reconnaissance survey, a review of the report Flora and Vegetation Survey South Thomson and Kingstown, Wadjemup / Rottnest Island (FVC, 2023) was undertaken. The FVC survey encompassed the development envelope and surrounding area. The flora and vegetation data collected by RPS during the reconnaissance survey has been used to support this Environmental Supporting Document. | South Thomson Barge Redevelopment Flora and Vegetation Survey (RPS, 2024d)                         | Reconnaissance flora and vegetation survey – 23 November 2023<br>Targeted flora survey – 23 to 27 November 2023                                                                | Appendix J              |
|       | Landforms                        | No significant landforms are located within or adjacent to the development envelope. Potential impacts to landforms from the proposal is discussed in Section 14.1.                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                    |                                                                                                                                                                                |                         |
|       | Subterranean fauna               | The proposal does not involve ongoing groundwater abstraction or dewatering activities. Potential impacts to subterranean fauna from the proposal are not anticipated as discussed in Section 14.1. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                    |                                                                                                                                                                                |                         |

| Theme  | EPA factor                        | Relevance to proposal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Supporting technical investigations and reports                                                                                                                                                                            |                                                                                                                                              |                                                                                                                                                                                                                                  |                         |
|--------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
|        |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Survey summary                                                                                                                                                                                                             | Report                                                                                                                                       | Survey timing                                                                                                                                                                                                                    | Appendix to this report |
|        | Terrestrial environmental quality | The site is not mapped as being at risk of acid sulfate soils.<br>The site is not a registered contaminated site. Terrestrial environmental quality is discussed in Section 14.1.                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                            |                                                                                                                                              |                                                                                                                                                                                                                                  |                         |
|        | Terrestrial fauna                 | Approximately 0.46 ha of terrestrial fauna habitat will be directly impacted by the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                 | Eco Logical undertook a basic terrestrial fauna survey within the terrestrial survey area (Figure 42) in accordance with EPA Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment. | Rottnest Island Basic Fauna Survey (EcoLogical, 2024)                                                                                        | 31 October 2023                                                                                                                                                                                                                  | Appendix K              |
| Water  | Inland waters                     | There are no surface water features within or directly adjacent to the development envelope.<br>The proposal does not involve ongoing groundwater abstraction or dewatering activities. Construction and operational activities will be managed to prevent potential impacts to groundwater.<br>The proposal is not considered likely to have a significant impact on inland waters. Potential minor impacts from the proposal are discussed in Section 14.1.                                                                 |                                                                                                                                                                                                                            |                                                                                                                                              |                                                                                                                                                                                                                                  |                         |
| Air    | Air quality                       | The proposal has the potential to temporarily impact air quality during construction activities from exhaust emissions from construction machinery and dust emissions. Operational activities have the potential to impact air quality through greenhouse gas emissions, which are discussed below.<br>The proposal is not considered likely to have a significant impact on air quality. Potential minor impacts to air quality from the proposal are discussed in Section 14.1.                                             |                                                                                                                                                                                                                            |                                                                                                                                              |                                                                                                                                                                                                                                  |                         |
|        | Greenhouse gas emissions          | A greenhouse gas assessment was undertaken by Kewan Bond Pty Ltd (Appendix L). This assessment identified that greenhouse gas emissions from construction and operation of the proposal will be below the 100,000 tCO <sub>2-e</sub> per year threshold where a proposal is required to prepare a greenhouse gas management plan as outlined in the Environmental Factor Guideline: Greenhouse Gas Emissions (EPA 2020). On this basis significant greenhouse gas emissions are not anticipated as discussed in Section 14.1. |                                                                                                                                                                                                                            |                                                                                                                                              |                                                                                                                                                                                                                                  |                         |
| People | Social Surroundings               | The proposal is at risk of impacting social surroundings (heritage, bushfire and amenity).                                                                                                                                                                                                                                                                                                                                                                                                                                    | A desktop assessment and stakeholder consultation has been undertaken to support the assessment of potential impacts to social surroundings.                                                                               | Report of an Ethnographic Aboriginal Heritage Survey of the Army Jetty, Rottnest Island, Western Australia (Brad Goode and Associates, 2019) | Undertaken in 2019. (Advice from the South West Aboriginal Land and Sea Council (SWALSC) confirmed that a more recent survey was not required). Relevant correspondence regarding the Activity Notice is provided in Appendix M. | Appendix M              |
|        |                                   | There is a slight risk for residual unexploded ordnance (UXO) within vicinity of the development envelope.                                                                                                                                                                                                                                                                                                                                                                                                                    | Surrich Hydrographics undertook a UXO survey over the previously proposed dredge area.                                                                                                                                     | Marine magnetic survey at proposed barge landing site, South Thomson Bay (Surrich, 2019)                                                     | November 2019                                                                                                                                                                                                                    | Appendix T              |
|        |                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | TAMS was engaged by Rottnest Island Authority to supply a vessel and dive team to complete geotechnical investigation at Thompsons Bay South, which included an UXO Assessment.                                            | Rottnest Island Authority - Geological Investigation - Thomson Bay South and UXO investigation / anomaly recovery (TAMS Group, 2019)         | December 2019                                                                                                                                                                                                                    | Appendix T              |
|        |                                   | There is a risk for the proposal to impact the amenity of South Thomson Bay.                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Herring Storer Acoustics undertook an acoustic assessment of noise emissions associated with the existing barge operations to ascertain the potential impacts from the proposal within South Thomson Bay.                  | Acoustic assessment Rottnest Barge Facility Rottnest Island (Herring Storer, 2024)                                                           | May 2024                                                                                                                                                                                                                         | Appendix U              |
|        | Human health                      | There are no known sources of radiation within the development envelope and there are no stages of the project where exposure to radiation is anticipated. Human health is discussed in Section 14.1.                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                            |                                                                                                                                              |                                                                                                                                                                                                                                  |                         |

## 7 BENTHIC COMMUNITIES AND HABITATS

### 7.1 EPA objective

To protect benthic communities and habitats so that biological diversity and ecological integrity are maintained.

### 7.2 Policy and guidance

The proposal will be subject to compliance with applicable policies and guidance developed by the EPA to assist proponents and the public to understand the minimum requirements for the protection of elements of the environment that the EPA expects to be met during the assessment process. Relevant guidance and policies which have been considered in preparation of this document are discussed in Table 28.

**Table 28: Relevant policy and guidance; benthic communities and habitats**

| Policy and guidance                                                                                                                                                         | Consideration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Factor Guideline: Benthic Communities and Habitats (EPA, 2016f)                                                                                               | The environmental factor guideline provides guidance on the area of assessment (i.e. Local Assessment Unit (LAU)), and the requirement for describing benthic communities and habitats, determining the cumulative loss of benthic communities and habitats including baseline characteristics, area of historic loss, current extent and areas of approved losses, and additional impacts associated with the proposal. A Benthic habitat assessment (RPS, 2024a) has been undertaken to support the proposal and an impact assessment, including discussion of the LAU and cumulative impact assessment have been undertaken in accordance with this guideline.                                                                                                                                                                |
| Technical Guidance: Protection of Benthic Communities and Habitats (EPA, 2016h)                                                                                             | The EPA's technical guidance is intended to encompass both the current benthic communities that live in or on the seabed and are important for primary or secondary production as well as recognised areas of benthic habitat that have the necessary attributes, such as substrate type, water depth and clarity, degree of exposure to wave energy, to support these communities in the future. When assessing potential impacts to benthic communities and habitats, the EPA focusses on the extent, severity and duration of impacts and requires that proponents use a spatial assessment framework to determine and describe recoverable impacts and cumulative losses of benthic communities and habitats within a defined area. This technical guidance has been considered in assessing impacts to benthic communities. |
| Technical Guidance: Environmental Impact Assessment of Marine Dredging Proposals (EPA, 2021a) and National Assessment Guidelines for Dredging (Australian Government, 2009) | The EPA's technical guidance focuses on describing the effects on benthic habitats caused by removal or burial at the sites of dredging and disposal, and the effects of suspended and deposited sediments further afield. The technical guidance provides a methodology for impact prediction, assessment and management of dredging proposal and marine biota – particularly benthic communities.                                                                                                                                                                                                                                                                                                                                                                                                                              |

### 7.3 Environmental investigations

RPS undertook a benthic habitat assessment to support a previous design of the project in 2019 (RPS, 2019). In 2023, RPS reviewed and updated the 2019 benthic habitat mapping to support the proposal. As part of the 2023 benthic communities and habitat mapping, RPS undertook the following:

- Confirmed the suitability of the LAU defined by RPS (2019) in assessment of benthic impacts from the proposal
- Confirmed the suitability of benthic habitat mapping by Harvey (2009) and its suitability for LAU-scale estimates
- Updated the South Thomson Bay area benthic habitat map previously developed by RPS (2019)
- Confirmed estimates of benthic habitat loss due to the proposed development
- Estimated the cumulative loss of benthic habitat as a consequence of historic activities.



The 2019 Assessment of Benthic Habitats report is provided in Appendix N and the updated Marine Fauna and Benthic Habitat Assessment (RPS, 2024a) is provided in Appendix B.

Baird (2024b) undertook a dredge plume modelling assessment and identified zones of impact from the proposed dredging activities. The eastern extent of the modelled zone of influence was outside the 2019 and 2023 survey area. Therefore, an additional benthic habitat assessment was undertaken of this previously unsurveyed area through an assessment of aerial photography and a visual assessment at six sites. This plume extension survey area comprised 2.54 ha. The Benthic Habitat Assessment: Plume Extension Survey Area (RPS, 2023b) is provided as Appendix C.

The benthic habitat survey areas are provided in Figure 14.

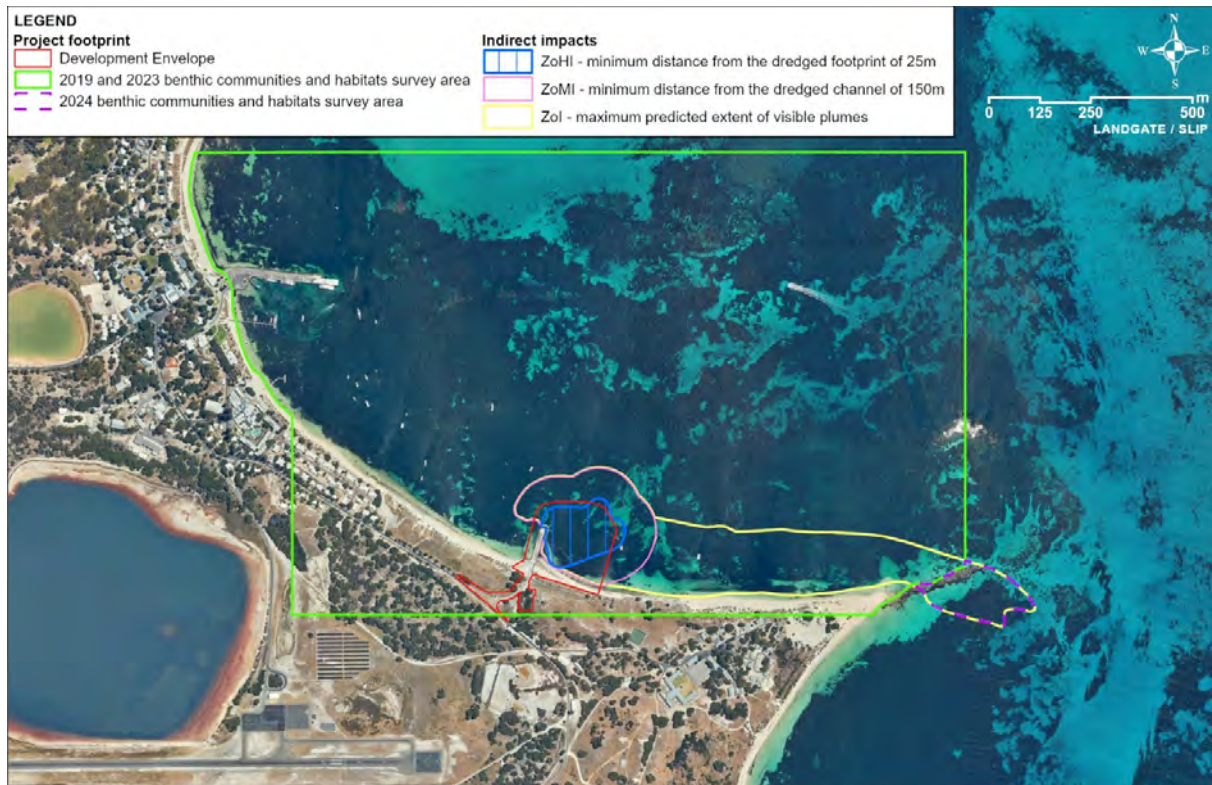


Figure 14: Benthic habitat survey area and plume extension survey area

## 7.4 Receiving environment

### 7.4.1 Benthic habitats

Benthic habitat within South Thomson Bay is varied and includes seagrass meadows (*Posidonia* spp.) that comprise approximately 30% of the total seagrass area within the Wadjemup / Rottnest Island / nearshore habitats (RIA, 2023; Harvey, 2009). These meadows, which include *P. sinuosa* and *P. australis*, are recognised as a Priority 3 Western Australian Priority Ecological Community (PEC) by the DBCA due to their importance as a climax community that can take decades to centuries to develop, and their vulnerability to climate change. Other benthic habitat within Thomson Bay includes macroalgae and bare sand, the latter which may be covered by wrack that accumulates seasonally (RPS, 2024a).

Ten species of seagrasses and 347 species of macroalgae have been recorded off Wadjemup / Rottnest Island. The seagrasses are largely restricted to sandy substrates and generally grow in sheltered bays and areas protected by reef. The dominant meadow-forming seagrass genera are *Amphibolis* spp. and *Posidonia* spp. (RPS, 2019). Seagrass meadows provide habitat, nursery areas, food and refuge from predation for fish and invertebrate populations. They also stabilise sediments.

Benthic habitats identified within the benthic habitat survey area (Figure 14) includes mixed seagrass, limestone reef / pavement, macro algae dominated and sand / sand with wrack. Seagrasses are dominated by *Posidonia* spp. with a minor component of *Amphibolis* spp. often in healthy meadows. An example of the benthic habitats present within the survey area are shown in Plate 7 and Plate 8.

Benthic habitats mapped within the plume extension survey area (Figure 14) comprised presumed mixed seagrass, limestone reef / pavement and sand / sand with wrack (Figure 15).

Table 29 and Figure 15 show that the dominant benthic communities within the development envelope comprise mixed seagrass and sand / sand with wrack.

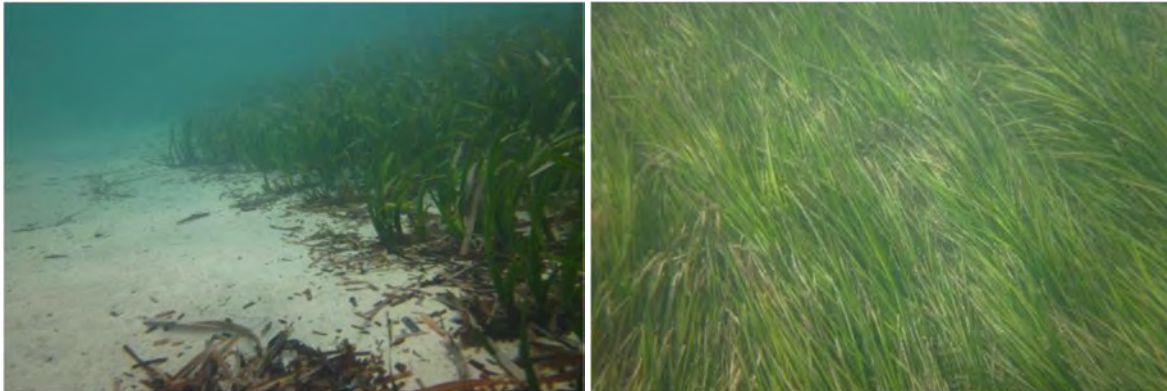
**Table 29: Benthic communities and habitats present within the survey area and development envelope**

|                                                              | Benthic habitats and communities (hectares) |                      |                      |                         |
|--------------------------------------------------------------|---------------------------------------------|----------------------|----------------------|-------------------------|
|                                                              | Mixed seagrass                              | Macroalgae dominated | Sand/sand with wrack | Limestone reef/pavement |
| Survey area (2019 / 2023 survey area)                        | 108.10                                      | 10.80                | 42.43                | 1.79                    |
| Survey area (2024 plume extension survey area)               | 0.92 <sup>1</sup>                           | 0                    | 1.27 <sup>1</sup>    | 0.35 <sup>2</sup>       |
| <b>Total survey area</b>                                     | <b>109.02</b>                               | <b>10.80</b>         | <b>43.70</b>         | <b>2.14</b>             |
| Development envelope                                         | 1.65                                        | 0                    | 1.44                 | 0                       |
| Development envelope and modelled Zone of High Impact (ZoHI) | 2.06                                        | 0                    | 1.26                 | 0                       |

<sup>1</sup>Presumed mixed seagrass and sand/sand with wrack identified by aerial image classification and RIA ground-truth data

<sup>2</sup>Limestone reef pavement identified by aerial image classification only

The areas of benthic communities and habitats within the overall survey area, zones of predicted indirect impact and development envelope are discussed further in Section 7.5.1.1.

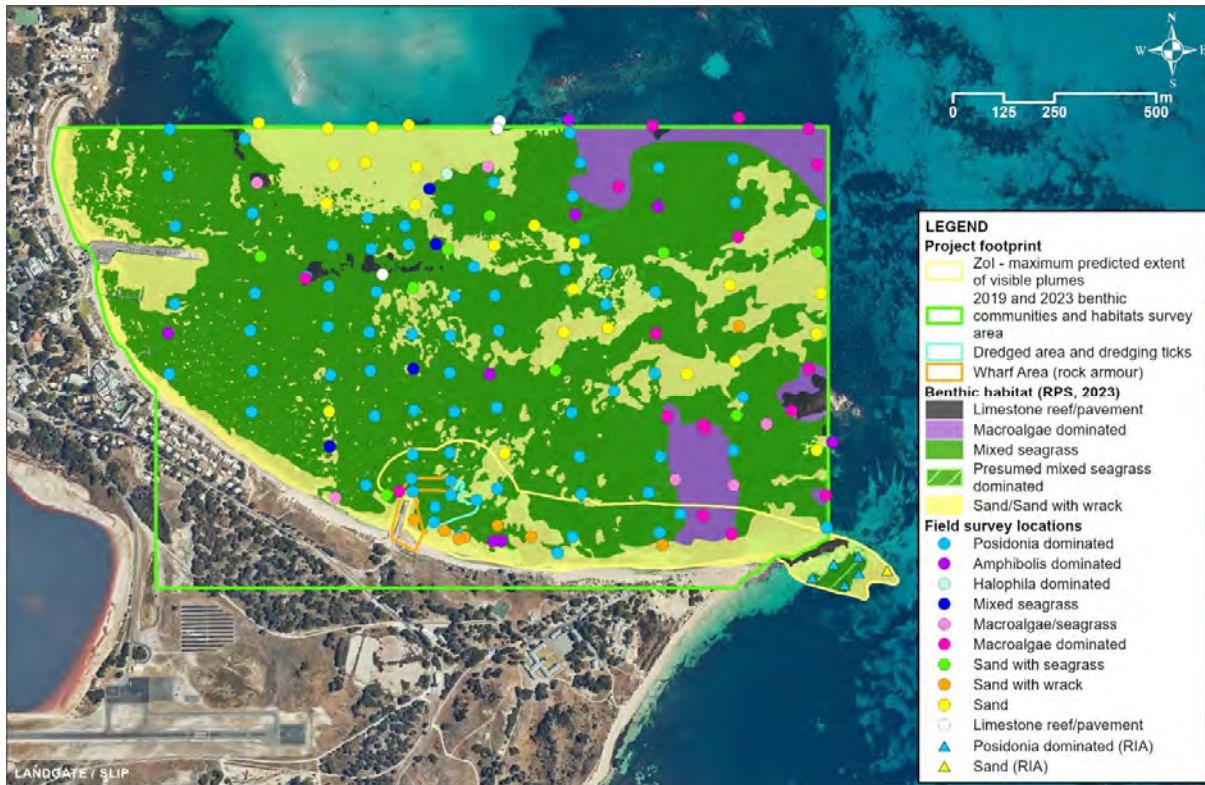


**Plate 7: Edge of *Posidonia* spp. seagrass meadow (first) and *Posidonia* spp. meadow (second)**



**Plate 8: Sea anemones on bare sandy sediment (first) and *Posidonia* and *Amphibolis* spp. epiphytic brown algae (second)**





**Figure 15: Benthic habitats within the development envelope and modelled dredge plume**

## 7.4.2 Local Assessment Unit

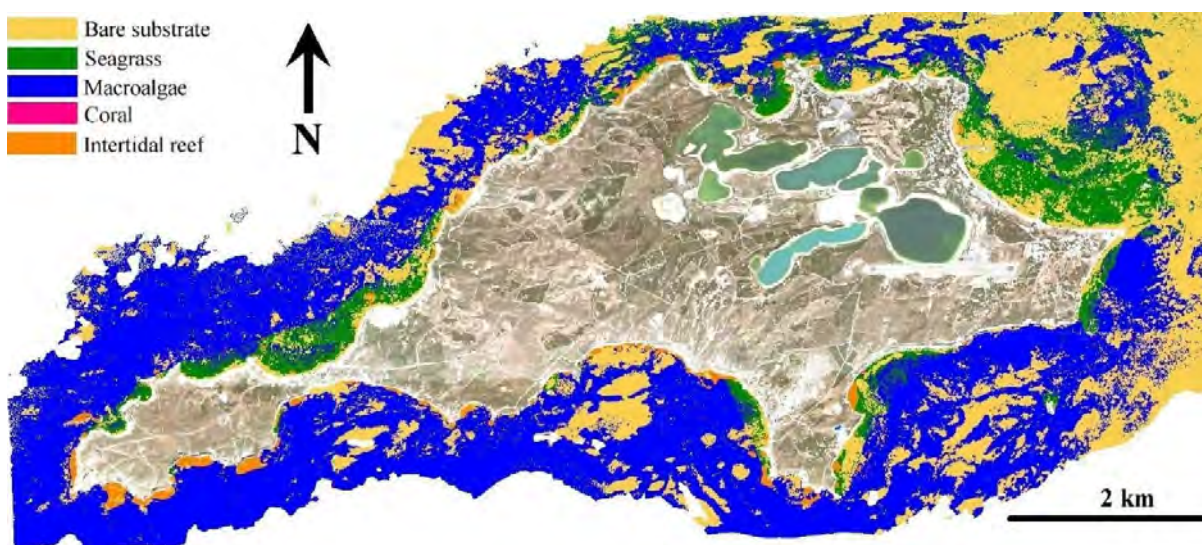
A LAU is a geographical area that establishes the spatial context for the calculation and assessment of recoverable impacts and cumulative losses. LAUs are location specific and should reflect local physical, ecological, administrative and jurisdictional considerations.

There is no standard size or shape to a LAU, and they need to be defined on a situation-specific basis (EPA 2016). Guidance on LAU size by the EPA (2016f) indicates that they are typically defined as a ten km stretch of coastline extending five km offshore, although other size LAUs will be considered if justified.

RPS has identified the most appropriate LAU for the proposal as the area mapped by Harvey (2009) (Figure 16) because this area:

- Comprises 2,746 ha of described habitat in which historic habitat loss from anthropogenic impacts have been estimated
- Represents a complete island ecosystem
- Is consistent with EPA (2016f) guidance on the size of an LAU.





**Figure 16: Benthic habitat map of Wadjemup / Rottnest Island (Harvey, 2009)**

The benthic habitat map of Wadjemup / Rottnest Island (Figure 16) was developed using hyperspectral imagery obtained in 2004 and based on spectral signatures of the dominant habitat components. At the broadest scale, areas of bio-substrate were separated from bare substrates in the image with an overall accuracy of 95%, whereas at the finest scale, bare substrates and dominant species or genera were separated with an accuracy of 70% (Harvey 2009). This benthic habitat modelling technique has the highest accuracy (84%; validated in field) and is able to identify small patches of habitats (RPS, 2024a).

When comparing the benthic habitat map by Harvey (2009) to aerial images taken in August 2014 and 2018 and observations from the site visit, RPS (2019) identified discrepancies in areas of seagrass and sand habitat, considered most likely to be due to fine-scale misclassification of habitats by Harvey (2009). In particular, RPS (2019) observed that misclassification of mobile wrack as seagrass by Harvey (2009) would result in an overestimate of the amount of seagrass loss within the development envelope.

Due to the potential for fine-scale misclassification of habitat, additional sites were added to the 2023 benthic habitat survey to further clarify high risk wrack accumulation areas, such as the shallows and habitat edges where misclassification is more likely, and supplementary observations were noted detailing when wrack was present, and if it occurred at the edge of a benthic habitat. This information assisted in the aerial footage comparisons to predict areas of benthic habitat and calculate benthic habitat losses more accurately.

A comparison of the habitat maps developed in 2019 and 2023 by RPS and the benthic habitat map developed by Harvey (2009) for the same area, indicates that the map by Harvey (2009) underestimates the amount of seagrass in south Thomson Bay and overestimates the macroalgae dominated habitat. The map by Harvey (2009) also indicates more areas of sand than the current study. The two RPS survey results (2019 and 2023) were more similar to each other than Harvey (2009), however there was an increase in macroalgae/limestone pavement and an increase in seagrass and sand / sand with wrack observed. These were relatively small differences though and may be accounted for with the alteration of site locations (and the additional sites) in the 2023 survey.

Based on RPS' assessment of the suitability of the LAU (Appendix B) and considering the guidance by EPA (2016f) that the understanding of benthic communities and their habitats should be proportional to the scale of the proposed development, it is considered reasonable that the habitat map developed by Harvey (2009) is satisfactory for description of habitat within the LAU defined for the proposed development. However, because the Harvey (2009) map underestimates the amount of seagrass habitat within the survey area it is more appropriate to base assessment of seagrass habitat loss due to the proposed development on the habitat map developed during the 2023 study.

## 7.5 Potential environmental impacts

Table 30 provides the potential key impacts to benthic communities and habitats from the proposal. For the purposes of the impact assessment, the following assumptions have been made:

Direct impacts:

- All benthic habitats and communities within the development envelope will be directly impacted. The development envelope encompasses:
  - The wharf area and a buffer of 7 m to 125 m around the proposed marine infrastructure to encompass potential impacts from the halo effect
  - Dredge area
  - A portion of the Zone of High Influence (ZoHI) and a portion of the Zone of Moderate Influence (ZoMI)
- All of the ZoHI (a portion of which occurs outside the development envelope) will be directly impacted.

Indirect impacts:

- Indirect impacts to the benthic habitats and communities within the ZoMI and Zone of Influence (Zol), which is located outside the development envelope and ZoHI.

**Table 30: Potential impacts on benthic communities and habitats**

| Phase        | Impact class | Works / operations                                                                                                                         | Potential impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction | Direct       | <ul style="list-style-type: none"> <li>• Dredging</li> <li>• Construction of the wharf</li> <li>• Reclamation</li> </ul>                   | <b>Loss of benthic habitats</b> <ul style="list-style-type: none"> <li>• Permanent loss of 3.32 ha of benthic communities and habitat, comprising:               <ul style="list-style-type: none"> <li>– 2.06 ha mixed seagrass. The loss of 2.06 ha of mixed seagrass represents 0.52% of seagrass within the Local Assessment Unit (LAU)).</li> <li>– 1.26 ha sand with wrack.</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|              | Indirect     | <ul style="list-style-type: none"> <li>• Dredging</li> </ul>                                                                               | <b>Reduced environmental quality</b> <ul style="list-style-type: none"> <li>• Temporary decrease in light availability resulting from increased turbidity in the water column within the Zol and ZoMI, leading to reduced primary productivity and potential increased mortality rates of primary producers under conditions of prolonged or acute exposure.</li> <li>• Increased sedimentation rates, or burial, resulting in stress or increased mortality rates (under extreme conditions).</li> <li>• Accidental fuel spills resulting in reduced water quality and impacts on benthic communities and habitats.</li> </ul> <b>Loss of benthic habitats</b> <ul style="list-style-type: none"> <li>• Recoverable loss of 3.71 ha of benthic habitats and communities within the ZoMI (the area within which predicted impacts on benthic organisms are recoverable within a period of five years following completion of the dredging activities):               <ul style="list-style-type: none"> <li>– Temporary loss of 2.62 ha mixed seagrass</li> <li>– Temporary loss of 1.09 ha sand with wrack</li> </ul> </li> </ul> <b>Introduction of invasive marine species</b> <ul style="list-style-type: none"> <li>• Alteration of the natural benthic communities in the area caused by the introduction of invasive marine species (IMS).</li> </ul> |
| Operation    | Direct       | No additional loss of benthic communities and habitats relative to the construction period are anticipated from operation of the proposal. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|              | Indirect     | <ul style="list-style-type: none"> <li>• Barge movements</li> <li>• Maintenance dredging (potential contingency)</li> </ul>                | <b>Introduction of invasive marine species</b> <ul style="list-style-type: none"> <li>• Alteration of the natural benthic communities in the area caused by the introduction of IMS.</li> </ul> <b>Impacts from marine infrastructure</b> <ul style="list-style-type: none"> <li>• Altered water flows and sediment transport caused by the presence of new marine infrastructure.</li> </ul> <b>Reduced environmental quality</b> <ul style="list-style-type: none"> <li>• Accidental fuel spills to water resulting in reduced water quality and impacts on benthic communities and habitats.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

## 7.5.1 Assessment of impacts

### 7.5.1.1 Loss of benthic habitat

Construction of the proposal will result in the direct removal of benthic communities and habitats comprising mixed seagrass and sand / sand with wrack through dredging activities and construction of the marine infrastructure. The generation of a suspended sediment plume from construction activities such as dredging will result in indirect impacts to benthic communities and habitats.

#### 7.5.1.1.1 Dredge plume modelling assessment

A Dredge Plume Modelling Assessment was undertaken by Baird (2024b) (Appendix F) for the project. The modelling assessment calculated the zones of impact which are expected to have an impact on benthic communities and habitats. The zones of impact are shown in Figure 15 and summarised in Table 31.

**Table 31: Predicted zones of impact (Baird, 2024b)**

| Zone of impact                 | Definition                                                                                                                                                                                                                                                                                                                                         | Boundary thresholds                                                                                                                                                |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Zone of High Impact (ZoHI)     | The area where impacts on benthic communities or habitats are predicted to be irreversible. The term irreversible means 'lacking a capacity to return or recover to a state resembling that prior to being impacted within a timeframe of five years or less'.                                                                                     | Boundary of the dredging and placement area.<br>Where sedimentation/burial is >10 cm or 10,000 g/m <sup>2</sup> .                                                  |
| Zone of Moderate Impact (ZoMI) | The area within which predicted impacts on benthic communities or habitats are recoverable within a period of five years following completion of the dredging activities. This zone abuts, and lies immediately outside of, the ZoHI.                                                                                                              | The 95th percentile of the area where a TSS concentration of >10 mg/L was exceeded.<br>Where sedimentation / burial is 5–10 cm or 5,000–10,000 g/m <sup>2</sup> .  |
| Zone of Influence (Zol)        | The area within which changes in environmental quality associated with dredge plumes are predicted and anticipated during the dredging operations, but where these changes would not result in a detectable impact on benthic biota. At any point in time, the dredge plumes are likely to be restricted to a relatively small portion of the Zol. | The 100th percentile of the area where a TSS concentration of >2 mg/L above background was exceeded (representing the maximum predicted extent of visible plumes). |

Consultation was undertaken with Baird regarding potential for increased suspended sediment resulting from other constructions activities proposed, such as the placement of dredge spoil in the reclamation area. Baird confirmed that proposed reclamation activities will not impact the modelled zones of impact.

#### 7.5.1.1.2 Impact assessment

Construction of the proposal will result in direct and indirect impacts to benthic communities and habitats comprising mixed seagrass and sand / sand with wrack through dredging activities and construction of the marine infrastructure. As indicated in Table 29, the following impacts to benthic communities and habitats are predicted as a result of construction of the proposal (Figure 17):

- Direct (permanent) impacts to 2.06 ha of mixed seagrass and 1.26 ha of sand / sand with wrack within the development envelope and ZoHI. The loss of 2.06 ha of mixed seagrass represents 0.52% of seagrass within the LAU.
- Indirect (recoverable) impacts to:
  - 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI. It is predicted that benthic communities and habitats that are impacted within the ZoMI will recover within a five-year period.
  - 5.13 ha of mixed seagrass, 1.13 ha macroalgae dominated community, 0.35 ha of limestone reef / pavement and 6.70 ha of sand / sand with wrack within the Zol. Changes in environmental quality associated with dredge plumes in the Zol are not predicted to result in a detectable impact on benthic biota.





**Figure 17:** Predicted indirect (within the ZoMI and Zol) and direct impacts (within the development envelope and ZoHI) to benthic communities and habitats

**Table 32:** Predicted direct and indirect impacts to benthic communities and habitats

| Area                                                        | Habitat (hectares) |                      |                      |                         |
|-------------------------------------------------------------|--------------------|----------------------|----------------------|-------------------------|
|                                                             | Mixed seagrass     | Macroalgae dominated | Sand/sand with wrack | Limestone reef/pavement |
| Survey area                                                 | 109.02             | 10.80                | 43.70                | 2.14                    |
| <b>Direct (permanent) impacts</b>                           |                    |                      |                      |                         |
| Development envelope                                        | 1.65               | 0                    | 1.44                 | 0                       |
| Development envelope and modelled Zone of High Impact (Zol) | 2.06               | 0                    | 1.26                 | 0                       |
| <b>Total area directly impacted</b>                         | <b>2.06</b>        | <b>0</b>             | <b>1.26</b>          | <b>0</b>                |
| <b>Indirect (recoverable) impacts</b>                       |                    |                      |                      |                         |
| Zone of Moderate Impact (ZoMI)                              | 2.62               | 0                    | 1.09                 | 0                       |
| Zone of Influence (Zol)                                     | 5.13               | 1.13                 | 6.70                 | 0.35                    |
| <b>Total area indirectly impacted</b>                       | <b>7.76</b>        | <b>1.13</b>          | <b>7.79</b>          | <b>0.35</b>             |

#### 7.5.1.1.3 Cumulative environmental effects

The spatial extent of the LAU is discussed in Section 7.4.2. Calculation of cumulative benthic habitat loss within a defined LAU requires the following estimates of the extent of benthic habitat (EPA, 2016). A summary of how these estimates were determined is provided below:

- Prior to all human-induced disturbance
- At the time of the proposed development
- Remaining after the development is completed.

Oceanica (2013) estimated the historic benthic habitat loss associated with vessel moorings (mooring scars) and jetties from a review of aerial imagery taken in March 2008 (RPS, 2024a). These estimates are only for seagrass because there was insufficient data for other habitat types such as coral and macroalgae, and because seagrass meadows typically occur within sheltered, shallow bays where this marine infrastructure is located. This is considered acceptable for the current study because seagrass is the key impacted habitat.

The estimates by Oceanica (2013) are considered conservative as it did not consider other potential sources of anthropogenic stressors such as eutrophication, propeller scour and sedimentation, and assumed that areas of bare sand around marine infrastructure and moorings were previously 100% seagrass. Oceanica's estimate also did not take into account the potential seagrass regrowth that was observed by RPS when comparing the 2019 and 2023 survey data.

These estimates use the data by Harvey (2009) to estimate the 'current' extent of seagrass habitat as 398.70 hectares which, when combined with the amount lost due to human-induced disturbance (7.95 hectares) results in an estimated 406.65 hectares of seagrass habitat within the LAU prior to impacts due to human activities (RPS, 2024a).

Based on the above estimates, the permanent loss of seagrass habitat as a consequence of the proposal (2.06 ha, 0.52% of the LAU) results in a cumulative (historical (1.95% of the LAU) and projected (0.52% of the LAU)) loss of seagrass within the LAU of 2.47%.

### 7.5.1.2 Reduced marine environmental quality

Increased suspended sediment from dredging and construction activities has the potential to result in the following indirect impacts to benthic communities and habitats.

- Decreased light availability, leading to reduced primary productivity and potential increased mortality rates of primary producers under conditions of prolonged or acute exposure.
- The increased turbidity has the potential to result in increased scour (abrasion) of membranes and/or blockage of breathing or filter feeding structures, resulting in stress or increased mortality rates.
- Increased sedimentation rates, or burial, resulting in stress or increased mortality rates (under extreme conditions).

Based on the dredge plume modelling assessment undertaken by Baird (2024b), these indirect impacts are expected within the ZoMI. However, a detectable impact on benthic communities and habitats from increased turbidity resulting from the project within the ZoI is not predicted (Baird, 2024b).

Benthic communities and habitats located within the ZoMI that may be impacted by changes in marine environmental quality include:

- 2.62 ha of mixed seagrass
- 1.09 ha of sand / sand with wrack.

Accidental fuel spills from fuel storage and refuelling, resulting in reduced water quality, may impact on benthic communities and habitats.

Impacts to marine environmental quality are discussed further in Section 9 of this document.

### 7.5.1.3 Impacts from marine infrastructure

Baird (2024a) undertook a coastal processes assessment to determine the effect of the proposed marine infrastructure on coastal processes. The assessment identified that due to the presence of the existing Army Groyne, which already influences the coastal processes within South Thomson Bay, it was predicted that changes to coastal processes as a result of the proposal would be minimal. Impacts to coastal processes from the proposal are discussed further in Section 8.

A five-metre buffer is notionally considered a reasonable estimate of the area surrounding marine infrastructure that may be subject to events causing additional habitat loss, including localised erosion, slumping of dredged area walls and backwash (the halo effect). The development envelope and ZoHI encompasses an area around the proposed marine infrastructure ranging from 7 m to 125 m. Consequently, the development envelope encompasses the area which may be affected by the halo effect and impacts outside the development envelope as a result of the halo effect are not anticipated.

Potential impacts to coastal processes from the proposed marine infrastructure is discussed in more detail in Section 8 of this report.

### 7.5.1.4 Introduction of invasive marine species

There is potential for vessels used during construction and implementation of the proposal to result in the introduction or spread of IMS. This impact is discussed further in Section 10.5.1.5.

7.6 Mitigation

Table 33 demonstrates how the EPA's mitigation hierarchy (avoid, minimise and rehabilitate) has been applied to the environmental factor of benthic communities and habitats to address the key potential impacts.

Table 33: Application of mitigation hierarchy to benthic communities and habitats

| Potential impacts                                                                                                | Impact class | Mitigation hierarchy | Proposed mitigation measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Residual impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|------------------------------------------------------------------------------------------------------------------|--------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Loss of benthic communities and habitat                                                                          | Direct       | Avoid                | <ul style="list-style-type: none"><li>Site selection includes an already disturbed area of 0.19 ha of disturbed seabed within the existing Army Groyne footprint. As benthic communities and habitats are widespread within South Thomson Bay, total avoidance of direct impacts is not possible</li><li>RIA amended the project design to reduce the dredging requirements. By changing the berthing and barge turn pocket, the volume of required dredging was reduced from 26,000 m³ to 16,050 m³.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Residual impacts to benthic communities and habitats include the permanent removal of 3.32 ha of benthic communities and habitats.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                  |              | Minimise             | <ul style="list-style-type: none"><li>The AECOM and PAEMAC value engineering works helped to not only reduce dredging requirements, but also reduce the footprint to the minimum possible to achieve the objectives of constructing a new barge landing.</li><li>Management and mitigation proposed during construction to minimise impacts to benthic communities and habitats is detailed in the Construction Environmental Management Plan (CEMP) (Emerge, 2024a) (Appendix P) and Dredging Environmental Monitoring and Management Plan (DEMMP) (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that the area of benthic communities and habitats permanently impacted by the proposal is limited to the development envelope and ZoHI. These measures include:<ul style="list-style-type: none"><li>Employing high-resolution positioning system to control dredge operations to ensure that they do not occur outside the proposed dredging area</li><li>Implementing the management measures to minimise impacts to marine environmental quality as outlined in Section 9.6 of this report.</li></ul></li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                  |              | Rehabilitate         | Areas of benthic communities and habitats within the development envelope and ZoHI which will be directly impacted are not proposed to be rehabilitated.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                  |              | Offset               | Benthic communities and habitat offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                  | Indirect     | Avoid                | Discussed under 'Reduced marine environmental quality (i.e. increased turbidity and sedimentation rates)'.<br><br>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                  |              | Minimise             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                  |              | Rehabilitate         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                  |              | Offset               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Reduced marine environmental quality (i.e. increased turbidity and sedimentation rates)                          | Indirect     | Avoid                | Total avoidance of indirect impacts to marine environmental quality and benthic communities and habitats is not possible.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>The temporary loss of 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI.</b><br>Baird (2024b) predicts that impacts to these benthic communities and habitats will be recoverable within a period of five years following completion of the dredging activities.<br>Implementation of the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to address a temporary increase in TSS / turbidity during construction.<br>Implementation of these management plans ensures that residual impacts to benthic habitats and communities from indirect impacts will not be significant. |
|                                                                                                                  |              | Minimise             | <ul style="list-style-type: none"><li>Management and mitigation proposed during construction to minimise impacts to benthic communities and habitats is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that:<ul style="list-style-type: none"><li>The area impacted by suspended sediments during dredging and construction will be limited (wherever possible) and will not extend past the modelled ZoHI, ZoMI and Zol shown in Figure 15</li><li>Implementation of the CEMP and DEMMP will ensure that permanent loss of benthic communities and habitats resulting from construction of the proposal does not exceed 3.32 ha</li><li>The potential for indirect water quality impacts to adjacent areas will be mitigated through implementation of the Marine Water Quality Monitoring Program provided in Appendix B.2 of the DEMMP. This program is discussed in further detail in Section 9.6</li></ul></li><li>Implementation of the CEMP and DEMMP provides the monitoring and management framework to address potential indirect impacts to benthic communities and habitats from impacts to marine environmental quality during construction. Key management and monitoring measures include:<ul style="list-style-type: none"><li>Implementation of the Marine Water Quality Monitoring Program (MWQMP) provided in the DEMMP for suspended sediment</li><li>Implementation of the tiered management framework provided in the DEMMP</li><li>Implement the Benthic Communities and Habitat Monitoring Program provided in the DEMMP, including:<ul style="list-style-type: none"><li>Pre-disturbance Survey Report</li><li>Post-dredging Survey Report</li><li>Reactive Survey Report (if the trigger levels specified in the DEMMP and summarised in Section 9.6 of this report are exceeded)</li><li>Monitoring Close-out Report</li></ul></li><li>Use of silt curtains which will minimise the potential impacts associated with increased suspended sediments</li><li>The placement of geofabric (such as Texcel 1200R) textile weave along the bund wall will ensure that the placement of dredge spoil during reclamation works will not impact or increase the dredge plume zones</li></ul></li><li>Maintenance dredging (if required) will be undertaken in previously disturbed / sandy areas within the development envelope / project footprint. Maintenance dredging frequency, volumes and disposal will be determined as required. Environmental management and monitoring will be undertaken in a manner that is consistent with the document Maintenance Dredging Environmental Management Framework (BMT Oceanica, 2016) prepared for Department of Transport for similar types of maintenance dredging activities.</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                  |              | Rehabilitate         | Construction effects will be temporary and natural amelioration will mitigate or remove long-term impacts following cessation of construction activities. It is predicted that the temporary impacts within the ZoMI are recoverable within a period of five years following completion of the dredging activities (Baird, 2024b).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                  |              | Offset               | Benthic communities and habitat offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                  |              |                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Alteration of the natural benthic communities in the area caused by the introduction of invasive marine species. | Indirect     | Avoid                | Total avoidance of vectors for the potential introduction and distribution of IMS is not possible. The construction and implementation of the proposal requires marine vessels to be used in the area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>No residual impacts expected.</b><br>Implementation of the CEMP (Emerge, 2024a) (Appendix P) and OEMP (Appendix Q) will ensure there is no introduction of IMS.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                                                                  |              | Minimise             | <ul style="list-style-type: none"><li>Implementation of the CEMP (Emerge, 2024a) (Appendix P), DEMMP (02 Environment, 2024) (Appendix O) and Operational Environmental Management Plan (OEMP) (Appendix Q) will minimise the risk of introduction of IMS</li><li>The proposal will be primarily used for barge operations to transport bulk cargo to and from Wadjemup / Rottnest Island. As such, the likelihood of vessels visiting the facility from international or interstate waters is low. However, any vessels from interstate or international waters will comply with Commonwealth biosecurity requirements and complete the WA Department of Primary Industries and Regional Development 'Vessel Check' risk assessment (<a href="https://www.vessel-check.com/">https://www.vessel-check.com/</a>)</li><li>All vessels will have a ballast water management plan and ballast water exchanges will be in accordance with IMS requirements and the Commonwealth <i>Biosecurity Act 2015</i>.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                  |              | Rehabilitate         | Rehabilitation is not considered applicable to this impact.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                  |              | Offset               | Benthic communities and habitat offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Altered water flows and sediment transport caused by the presence of new marine infrastructure                   | Indirect     | Avoid                | Complete avoidance of effects on coastal processes from the proposal is not avoidable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>Additional residual impacts from those discussed under 'loss of benthic communities and habitat' are not anticipated.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|                                                                                                                  |              | Minimise             | <ul style="list-style-type: none"><li>Baird (2024) identified that, due to the presence of existing infrastructure within the project footprint (Army Jetty), changes to coastal processes as a result of the proposal would be minimal</li><li>A five-metre buffer is notionally considered a reasonable estimate of the area surrounding marine infrastructure that may be subject to events causing additional habitat loss, including localised erosion, slumping of dredged area walls and backwash (the halo effect). The development envelope and ZoHI encompasses an area around the marine infrastructure ranging from 7 m to 125 m. Consequently, the development envelope encompasses the area that may be impacted by the halo effect and impacts outside the development envelope as a result of the halo effect are not anticipated.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                  |              | Rehabilitate         | The 'halo effect' from the proposed marine infrastructure is included in the calculated direct impacts (within the development envelope and ZoHI). Areas of benthic communities and habitats which will be directly impacted are not proposed to be rehabilitated.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                  |              | Offset               | Benthic communities and habitat offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |



## 7.7 Assessment and significance of residual impact

The residual impacts to benthic communities and habitats following the implementation of mitigation measures are summarised below:

- Permanent loss of mixed seagrass of up to 2.06 ha (or 0.52% of mixed seagrass within the LAU)
- Permanent loss of sand / sand with wrack of up to 1.26 ha. It should be noted, that post-dredging activities, sand / sand with wrack is likely to accumulate and therefore this impact is unlikely to be permanent.
- Temporary loss of 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI. Baird (2024b) predicts that impacts to these benthic communities and habitats will be recoverable within a period of five years following completion of the dredging activities.

Consideration of the significance of the residual impacts on benthic communities and habitats is discussed in Table 34.

**Table 34: Consideration of the significance of the residual impacts on benthic communities and habitats**

| Matters for consideration                                                                                                                                | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Object and principles of the EP Act                                                                                                                      | RPS undertook a benthic habitat assessment to support a previous design of the project in 2019 (RPS, 2019). In 2023, RPS reviewed and updated the 2019 benthic habitat mapping to support the proposal. These benthic communities and habitat assessments were undertaken to address the EPA's Benthic Communities and Habitat objective and the principles of the EP Act have been specifically addressed in relation to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Values, sensitivity and quality of the environment which is likely to be impacted                                                                        | <p>Baseline investigations have been undertaken to determine the existing benthic communities and habitat values and sensitivity of the receiving marine environment. Investigations identified the presence of seagrass within the development envelope, ZoHI, ZoMI and ZoI. Seagrass is sensitive to impacts from dredging activities, including the generation of suspended sediments in the water column which can result in smothering and reduce light reaching the seagrass meadows.</p> <p>Implementation of the CEMP, DEMMP and OEMP will avoid and minimise environmental impacts on the more sensitive benthic communities and habitats receptors (e.g. seagrass). With implementation of these management plans, the residual impacts are limited to:</p> <ul style="list-style-type: none"> <li>• Permanent loss of mixed seagrass of up to 2.06 ha (or 0.52% of mixed seagrass within the LAU)</li> <li>• Permanent loss of sand / sand with wrack of up to 1.26 ha. It should be noted, that after dredging activities, sand / sand with wrack is likely to accumulate and therefore this impact is unlikely to be permanent.</li> <li>• Temporary loss of 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI. Baird (2024b) predicts that impacts to these benthic communities and habitats will be recoverable within a period of five years following completion of the dredging activities.</li> </ul> |
| All stages and components of the proposal (such as any infrastructure required for the proposal to be practicably implemented, or a proposal life cycle) | All stages of the proposal (i.e. construction and operation) have been included in this impact assessment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Extent (intensity, duration, magnitude, and geographic footprint) of the likely impacts                                                                  | <p>Impacts to benthic communities and habitats from the proposal will be managed through implementation of the CEMP, DEMMP and OEMP. With implementation of these management plans, the residual impacts are limited to:</p> <ul style="list-style-type: none"> <li>• Permanent loss of mixed seagrass of up to 2.06 ha (or 0.52% of mixed seagrass within the LAU)</li> <li>• Permanent loss of sand / sand with wrack of up to 1.26 ha.</li> <li>• Temporary loss of 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI. Baird (2024b) predicts that impacts to these benthic communities and habitats will be recoverable within a period of five years following completion of the dredging activities.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

| Matters for consideration                                                                                                              | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Resilience of the environment                                                                                                          | <p>Benthic communities and habitats are susceptible to impacts from the proposal. Direct impacts will result in the permanent loss of 2.06 ha of seagrass within the development envelope and ZoHI.</p> <p>Indirect impacts within the ZoMI will be recoverable within a period of five years and impacts within the ZoI are not predicted to be observable. As such, it is considered that the marine environment is resilient to the indirect impacts from the proposal.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Consequence of the application of the mitigation hierarchy to the proposal.                                                            | <p>The construction and operation of the proposal will result in the removal or disturbance of benthic communities and habitats within South Thomson Bay. However, habitat removal will be limited to the development envelope and ZoHI, and it is considered a small proportion (2.06 ha) of the total habitat within the South Thomson survey area and the broader LAU (0.52% of the LAU). Additionally, the temporary disturbance of benthic habitats and communities during construction will not have lasting impacts from construction outside the development envelope and ZoHI.</p> <p>As such, there will be no significant consequences from the proposal on benthic communities and habitats in the LAU. Any changes to benthic community population dynamics are likely to be temporary and reversible and the habitat to be directly removed is a very small proportion of the habitat available in the broader LAU and is well represented in the area.</p> <p>Following the application of the mitigation hierarchy (Table 33) and taking into consideration the above significance of residual impacts, RPS considers that permanent impacts to 0.52% of the LAU will not result in a species or ecosystem requiring protection under statute or increase the cumulative impact to a critical level.</p> |
| Level of confidence in the prediction of residual impacts and the success of proposed mitigation                                       | The impact assessment has been completed with a high level of confidence and in accordance with relevant legislation and guidelines as per Table 28.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Public interest about the likely effect of the proposal or scheme, if implemented, on the environment, and relevant public information | RIA has facilitated regular meetings / dialogue with the local community and key stakeholders (Table 25) as part of the project.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |

Cumulative impacts from the proposal have been considered in relation to other proposals within 5 km of the proposal and are discussed in Section 18.

Holistic impacts are discussed in Section 17.

## 7.8 Environmental outcomes

In consideration of the proposed avoidance and management measures and likely residual impacts associated with the proposal, the environmental outcomes that apply to benthic communities and habitats are:

- Environmental outcomes for construction of the proposal:
  - Direct disturbance of benthic communities and habitats from construction activities is confined to the development envelope and ZoHI and will not exceed 2.06 ha mixed seagrass and 1.26 ha sand with wrack.
  - Irreversible impacts to benthic communities and habitats from dredging and construction activities is confined to the development envelope and ZoHI.
  - No irreversible impacts to benthic communities and habitats from dredging activities within the ZoMI.
  - No observable impacts to benthic communities and habitats outside the ZoMI.
- Environmental outcomes for operation of the proposal:
  - Maintain the health and cover of benthic communities and habitats outside the proposal footprint during operations associated with the proposal (excludes other RIA activities associated with other approvals, e.g. mooring installation).

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As the impact assessment identified low residual risks to benthic communities and habitats following the application of mitigation actions identified herein, it is considered that the proposal will successfully meet the EPA's objective for benthic communities and habitats (i.e. to protect benthic communities and habitats so that biological diversity and ecological integrity are maintained).



## 8 COASTAL PROCESSES

### 8.1 EPA objective

To maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected.

### 8.2 Policy and guidance

The proposal will be subject to compliance with applicable policies and guidance developed to assist proponents and the public to understand the minimum requirements for the protection of elements of the environment that the EPA expects to be met during the assessment process. Table 35 lists the relevant EPA guidance, other state policy and planning documents that have been considered in preparation of this document.

**Table 35: Relevant policy and guidance; coastal processes**

| Policy and guidance                                                                                                                                                                     | Consideration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |      |      |      |      |      |                        |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|------|------|------|------|------|------------------------|------|------|------|------|------|
| Environmental Factor Guideline: Coastal Processes (EPA, 2016i)                                                                                                                          | The environmental factor guideline identifies the dynamic nature of coastal processes and key linkage with benthic communities and habitats, influencing both community types and distribution. The guideline recognises that changes to coastal processes resulting from a proposal may not cause impacts at that location, but impacts may occur further along the coastline or offshore. These considerations have underpinned a holistic assessment of total potential impacts and cumulative environmental effects of the proposal on coastal processes.<br>A Coastal Processes Assessment (Baird, 2024a) has been undertaken to support the project and is summarised in Sections 8.3 and 8.4. |        |      |      |      |      |      |                        |      |      |      |      |      |
| SPP No. 2.6: State Coastal Planning Policy (Western Australian Planning Commission, 2013a) and State Coastal Planning Policy Guidelines (Western Australian Planning Commission, 2013b) | The objective of the SPP No. 2.6, and its associated guidelines that is most relevant to the proposal is 'to ensure that the location of coastal facilities takes into account coastal processes, landform stability, coastal hazards, climate change and biophysical criteria'.<br>SPP 2.6 has been addressed in the Coastal Processes Assessment (Baird, 2024a) and the Rottnest Island CHRMAP (Cardno, 2023).                                                                                                                                                                                                                                                                                     |        |      |      |      |      |      |                        |      |      |      |      |      |
| Coastal Hazard Risk Management and Adaptation Planning Guidelines (Department of Planning and Western Australian Planning Commission, 2014)                                             | The Rottnest Island CHRMAP (Cardno, 2023) addresses potential long-term impacts to coastal processes (including climate change) and has been used to inform this report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |        |      |      |      |      |      |                        |      |      |      |      |      |
| Sea Level Change in Western Australia, Application to Coastal Planning (Department of Transport, 2010)                                                                                  | <p>The Intergovernmental Panel on Climate Change (IPCC) has developed four representative concentration pathway scenarios for different population sizes, economic activity, lifestyle, energy use, land use patterns, technology and climate policy pathway trajectories and their possible resulting emissions.</p> <p>The sea level rise assessment for the Rottnest Island CHRMAP (Cardno, 2023) adopted the following sea level rise allowances (metres):</p> <table><tr><th>Source</th><th>2022</th><th>2030</th><th>2050</th><th>2080</th><th>2122</th></tr><tr><td>DoT 2010 and IPCC 2021</td><td>0.00</td><td>0.05</td><td>0.18</td><td>0.48</td><td>0.94</td></tr></table>                 | Source | 2022 | 2030 | 2050 | 2080 | 2122 | DoT 2010 and IPCC 2021 | 0.00 | 0.05 | 0.18 | 0.48 | 0.94 |
| Source                                                                                                                                                                                  | 2022                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2030   | 2050 | 2080 | 2122 |      |      |                        |      |      |      |      |      |
| DoT 2010 and IPCC 2021                                                                                                                                                                  | 0.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 0.05   | 0.18 | 0.48 | 0.94 |      |      |                        |      |      |      |      |      |

### 8.3 Environmental investigations

#### 8.3.1 Coastal processes assessment

A detailed Coastal Processes Assessment (Baird, 2024a) (Appendix D) has been prepared to predict the potential impacts of the new infrastructure on coastal processes within South Thomson Bay. Due to the dynamic nature of coastal processes and linked interdependencies associated with coastal variables, this section assesses the cumulative impacts to coastal processes from the barge development.

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## 8.4 Receiving environment

### 8.4.1 Regional setting

Wadjemup / Rottnest Island is located approximately 20 km west of the port of Fremantle. The island is 11 km long with 63 sheltered beaches and 20 bays and is the remnant of the Pleistocene dune ridges that is surrounded by large quantities of coral reefs and rock formations. The coastline contains cells that are spatially discrete sections of coastline that include the intersection of both marine and land-based structures that connect through the exchange of sediment (Stul T, 2015).

### 8.4.2 Wave climate

The wave climate of the coastline from Bunbury to Perth is dominated by deep-water waves that are generated by large-scale weather systems over the Indian and Southern oceans. Seasonal variability in the wave climate generally peaks during the winter months (Baird, 2024a). The wave conditions in Thomson Bay are generated by two principal sources:

- Long period swell waves (>8 seconds) that are generated in the Southern Ocean and which travel around the north side and south side of the island by diffraction and refraction to enter Thomson Bay as low amplitude swell.
- Short period (<8 seconds) wind sea waves approach the bay from an easterly direction. These short period waves are generated by easterly winds acting over the fetch between the Perth coastline and Wadjemup / Rottnest Island.

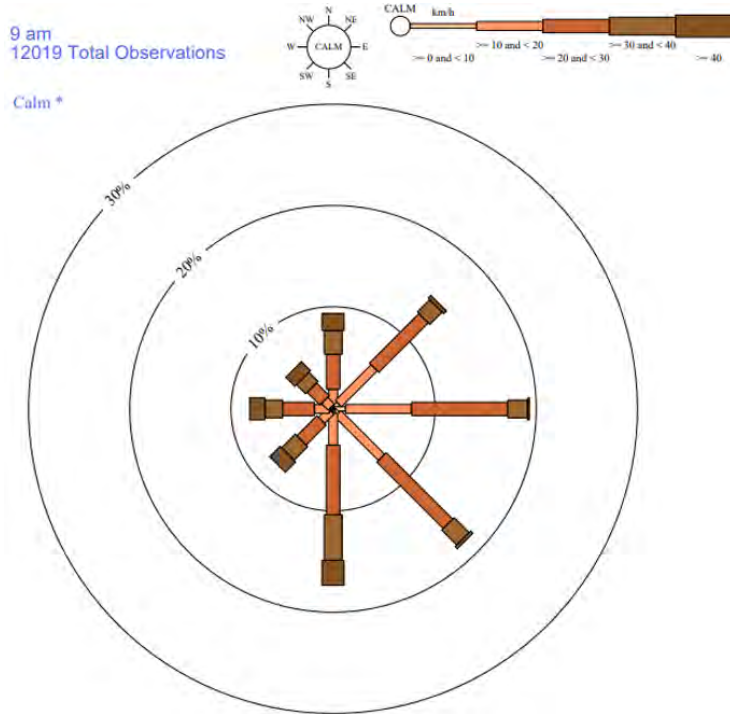
### 8.4.3 Water levels and tides

Seasonal variability of surges and mean sea level (peaking around June–July and May respectively) interacts with the twice annual tidal cycle (peaking in June and December) to cause a distinct seasonal peak to water levels around June, although high water levels are possible from frequent winter storms from May to September, or through rare impact of extratropical cyclones.

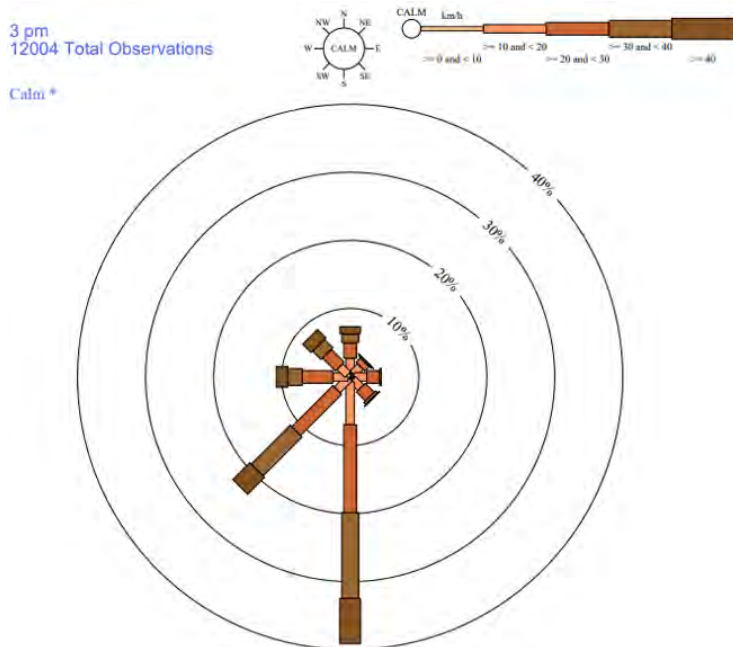
The tides at Wadjemup / Rottnest Island are mainly diurnal with a spring tide range of approximately 0.7 m and neap tide range of 0.5 m. The water level peaks during the June solstice. There is no tide gauge on Wadjemup / Rottnest Island with the nearest measured data location being the tide gauge at the Fremantle boat harbour, which is considered generally representative of the tidal regime on Wadjemup / Rottnest Island in Thomson Bay. Tidal planes are summarised in Baird (2024).

### 8.4.4 Wind conditions

The land – sea breeze cycle is a dominant local feature of the wind climate of the area, typically with easterly winds in the morning and southerly to westerly winds in the afternoon. Predominant wind patterns recorded at Rottnest Island weather station (009193) are shown in Graph 2 and Graph 3. Typical spring–summer wind patterns are predominantly south-easterly to south-westerly winds, while winter wind patterns are generally westerly with periods of elevated winds that correspond with storm fronts.



**Graph 2:** Rose of wind direction versus wind speed in km/h (29 Nov 1987 to 10 Aug 2023); 9.00 am conditions (Commonwealth of Australia, 2023)



**Graph 3:** Rose of wind direction versus wind speed in km/h (29 Nov 1987 to 10 Aug 2023); 3.00 pm conditions (Commonwealth of Australia, 2023)

### 8.4.5 Bathymetry and reefs

Bathymetric data has been captured in high resolution by the Department of Transport (DoT) from the shoreline out to approximately 30 m depth (Figure 18). There are high resolution local bathymetric surveys in Thomson Bay around the Army Groyne captured in 2017 and 2020 (Baird, 2024a) (Figure 18). Bathymetry data sourced from the Department of Transport within and adjacent to the development envelope indicates that the bathymetry ranges from approximately 0 m AHD to -5.8 m AHD (Figure 19).



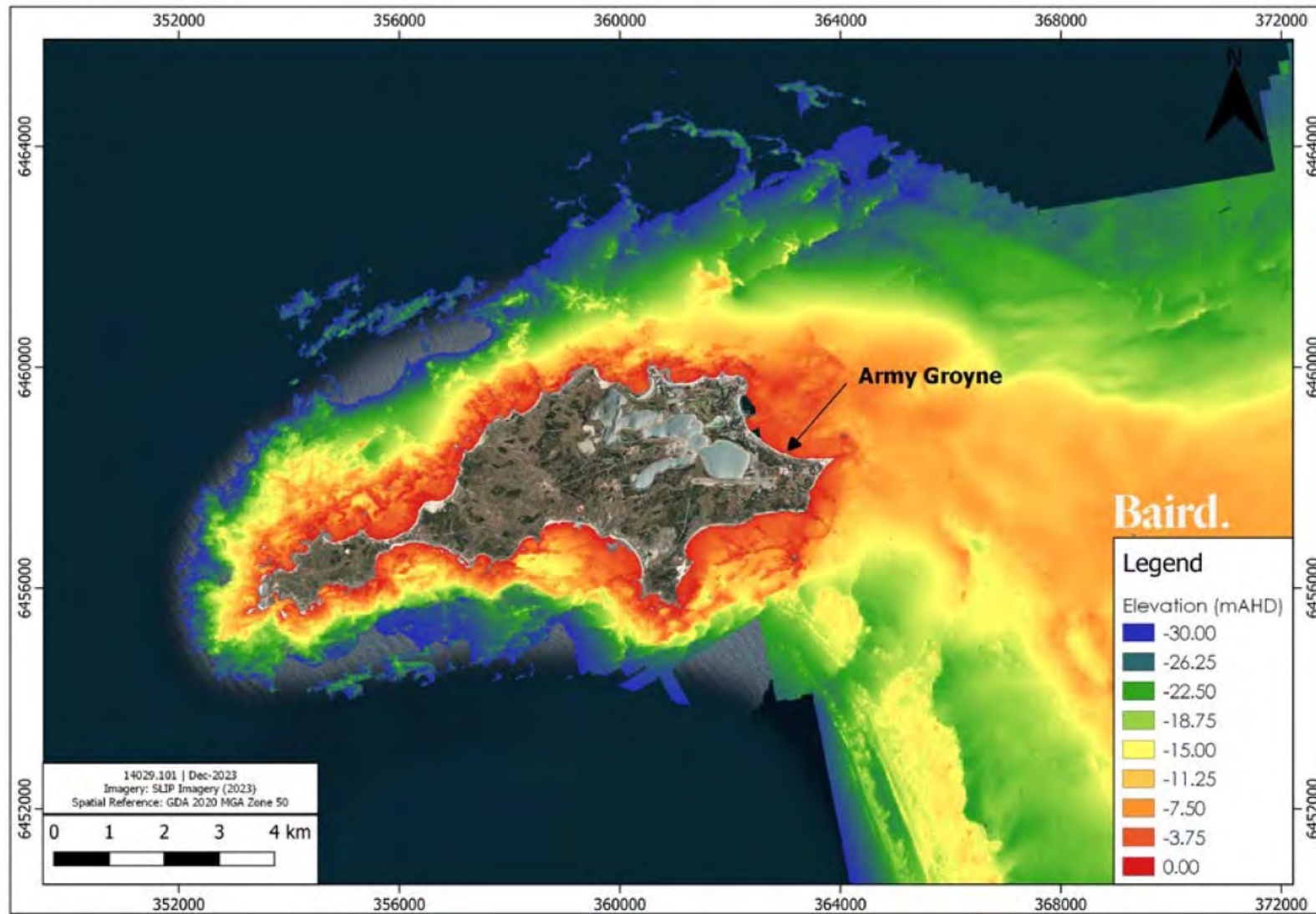


Figure 18: Bathymetry



**Figure 19: Bathymetry proximate to the development envelope**

#### 8.4.6 Sediment cells

Sediment cells are mapped by Stul et al. (2015) for three spatio-temporal scales along the coast between Cape Naturaliste and Moore River:

- **Primary Cells** – these relate to large landforms and consider potential changes to the coastline over timescales of more than 50 years.
- **Secondary Cells** – these incorporate contemporary sediment movement on the shoreline and potential landform responses to inter-decadal changes in coastal processes.
- **Tertiary Cells** – these are defined by the reworking and movement of sediment in the nearshore and are relevant for seasonal and inter-annual changes to the beach face.

The sediment cell most relevant to the proposed facility at South Thomson Bay is the R14b tertiary cell extending from Bathurst Point to Philip Point (Figure 20), with due consideration made to its position within the R14 and the secondary cell between North Point and Philip Point and the R06D Primary cell extending from Fremantle to Safety Bay and out to Wadjemup / Rottnest Island along the Garden island Ridge.



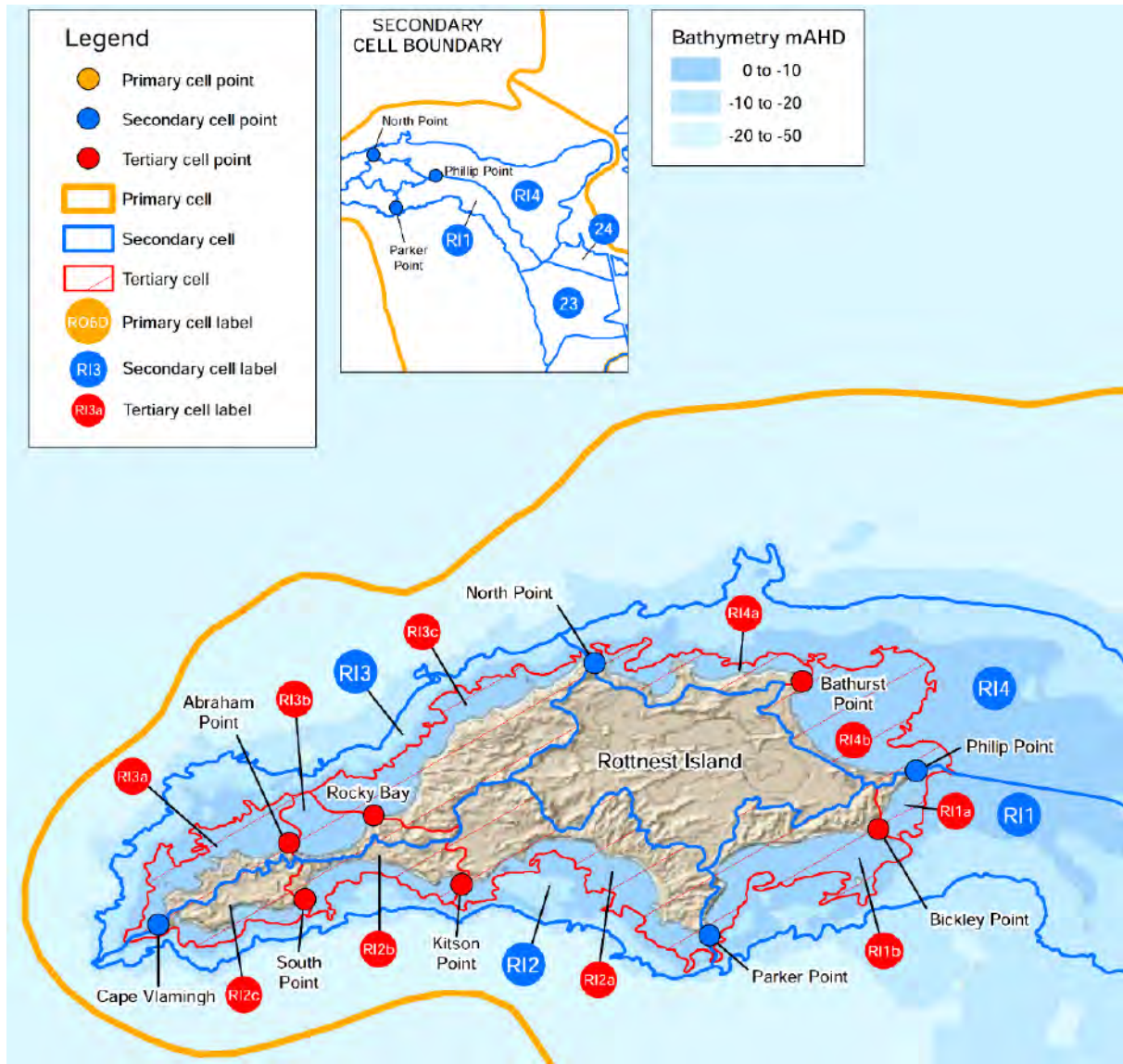


Figure 20: Secondary and Tertiary sediment cells around Wadjemup / Rottneest Island (Stul et al. 2015)

#### 8.4.7 Shoreline characteristics and coastal structures

The shoreline of Thomson Bay follows an arcuate shape between Bathurst Point and Philip Point, truncated in places by the construction of impermeable land attached structures including the Main Passenger Ferry Jetty and the Army Groyne (Plate 9 and Plate 10). The shoreline consists mainly of sandy perched beaches, with much of the beach sitting on top of rock platforms or pavements (Seashore Engineering, 2019) and interspersed with rocky outcrops and limestone cliffs (Short, 2005).





**Plate 9:** Public boat ramp at the Army Groyne



**Plate 10:** Army Groyne structure with a view of Thomson Bay to the west and view of the groyne from the eastern seaward side

#### 8.4.8 Wrack accumulation

Seagrass wrack is the accumulation of detached macrophytes and seagrass in the surf zone and on beaches and is primarily comprised of seagrasses and macroalgae in south-western Australia. The accumulation of seagrass wrack has the potential to impact the amenity of marinas, boat harbours and beaches due to physical obstruction, and decay. Historical imagery shows that wrack has and continues to accumulate primarily on the eastern side of the existing Army Groyne where the groyne meets the shoreline.

### 8.5 Potential environmental impacts

Construction processes are unlikely to result in impacts to coastal processes.

Engineered structures can influence coastal processes through interruption of currents, waves and sediment transport that can change the morphology of the seabed, beach and/or coast. The proposed wharf has potential to impact coastal processes during the operational phase.

Table 36 provides the potential key impacts to coastal processes from the proposal.

**Table 36: Potential impacts on coastal processes**

| Phase        | Impact class                                                                                | Works/ operations | Potential impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------|---------------------------------------------------------------------------------------------|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction | Construction activities are unlikely to result in significant impacts to coastal processes. |                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Operation    | Direct                                                                                      | Wharf             | <ul style="list-style-type: none"> <li>• Interruption to longshore currents</li> <li>• Interruption to longshore sediment transport</li> <li>• Interruption to seagrass wrack transport trajectories and deposition sites</li> <li>• Reduction of wave energy in lee of structures</li> <li>• Reflection of waves off structures resulting in increased wave energy in the structures vicinity. In the Coastal Processes Assessment (Baird, 2024a) (Appendix D), Baird noted that the reflection of waves off structures, potentially resulting in increased wave energy, was unlikely to impact adjacent moorings and this increase in energy is anticipated to be minimal.</li> </ul> |

## 8.5.1 Assessment of impacts

### 8.5.1.1 Interruption to longshore currents

#### 8.5.1.1.1 Interruption to longshore sediment transport

The existing Army Groyne comprises a limestone armoured groyne that is approximately 100 m in length and features a 7 m wide compacted limestone crest. The existing groyne compartmentalises the shoreline by interrupting longshore sediment transport within Thomson Bay. This is demonstrated by seasonal accretion and erosion of the shoreline on either side of the groyne (Cardno, 2023).

The majority of longshore sediment transport is currently blocked by the existing Army groyne, and it is predicted that the proposed wharf will block longshore sediment transport to a similar degree (Baird, 2024a). Therefore, due to the existing impacts to coastal processes, the proposal is not expected to result in a significant change in longshore sediment transport.

Based on existing coastal processes around the Army Groyne and the Coastal Processes Assessment undertaken by Baird, it is predicted that there may be some potential for build-up of sediment on the eastern side of the proposed wharf. This build up may be slightly greater than existing conditions, but this is not considered substantial enough to have a significant impact on the overall shoreline position along South Thomson Bay (Figure 21).

Considering the above analyses, it is unlikely that the proposed barge development would have a significant impact on the sediment dynamics along South Thomson Bay (Baird, 2024a) and therefore the proposal is not expected to result in a significant change in longshore sediment transport.

#### 8.5.1.1.2 Interruption to seagrass wrack transport trajectories and deposition sites

The proposed development of the South Thomson Barge Landing Development will not have a significant impact on the timing or volume of wrack accumulation across the beaches of Thomson Bay than the impact that the Army Groyne already has on the dynamics in South Thomson Bay (Baird, 2024a).

However, there is potential for the accumulation of seagrass to occur on the eastern side of the proposed development structure, which may lead to ingress of seagrass to the harbour footprint (Figure 22). A review of existing seagrass accumulation on the eastern side of the Army Groyne indicates that this predicted accumulation against the proposed structure will not be a significant change to that already experienced (Plate 11).



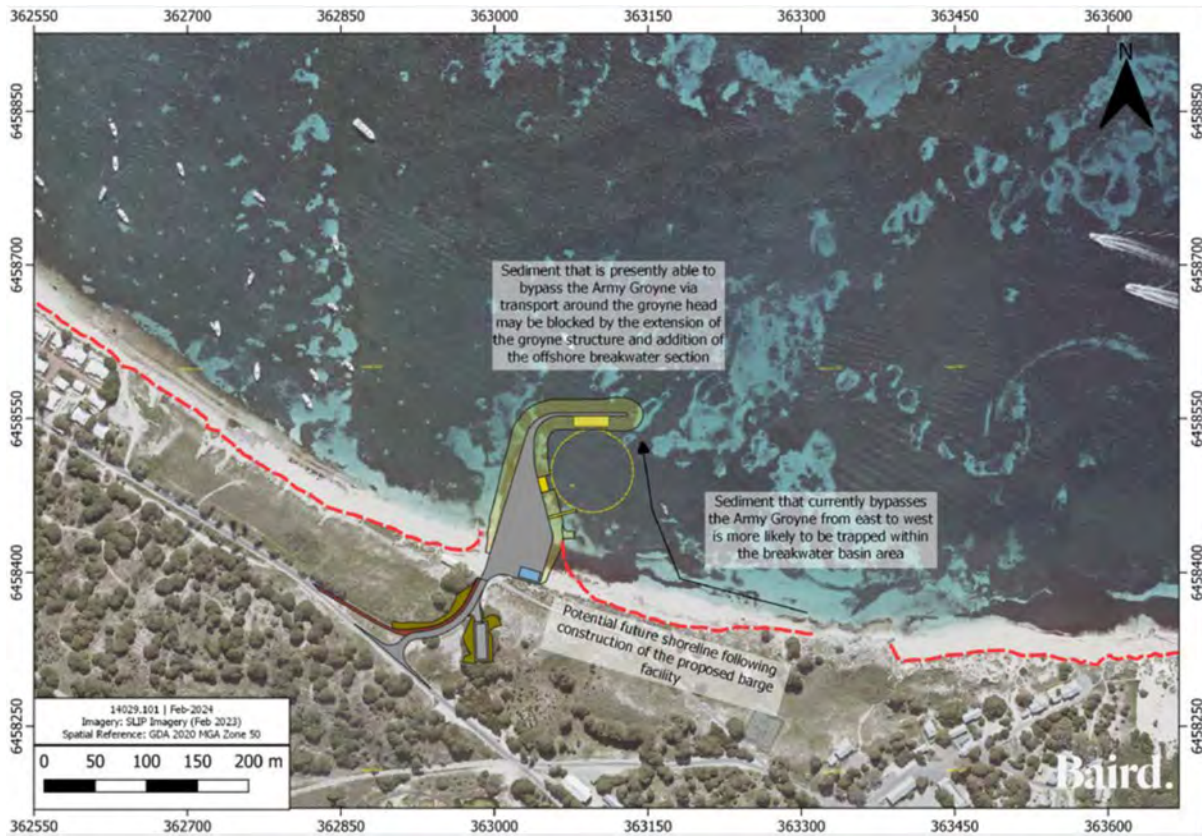


Figure 21: Potential impact of proposed facility on sediment dynamics in South Thomson Bay

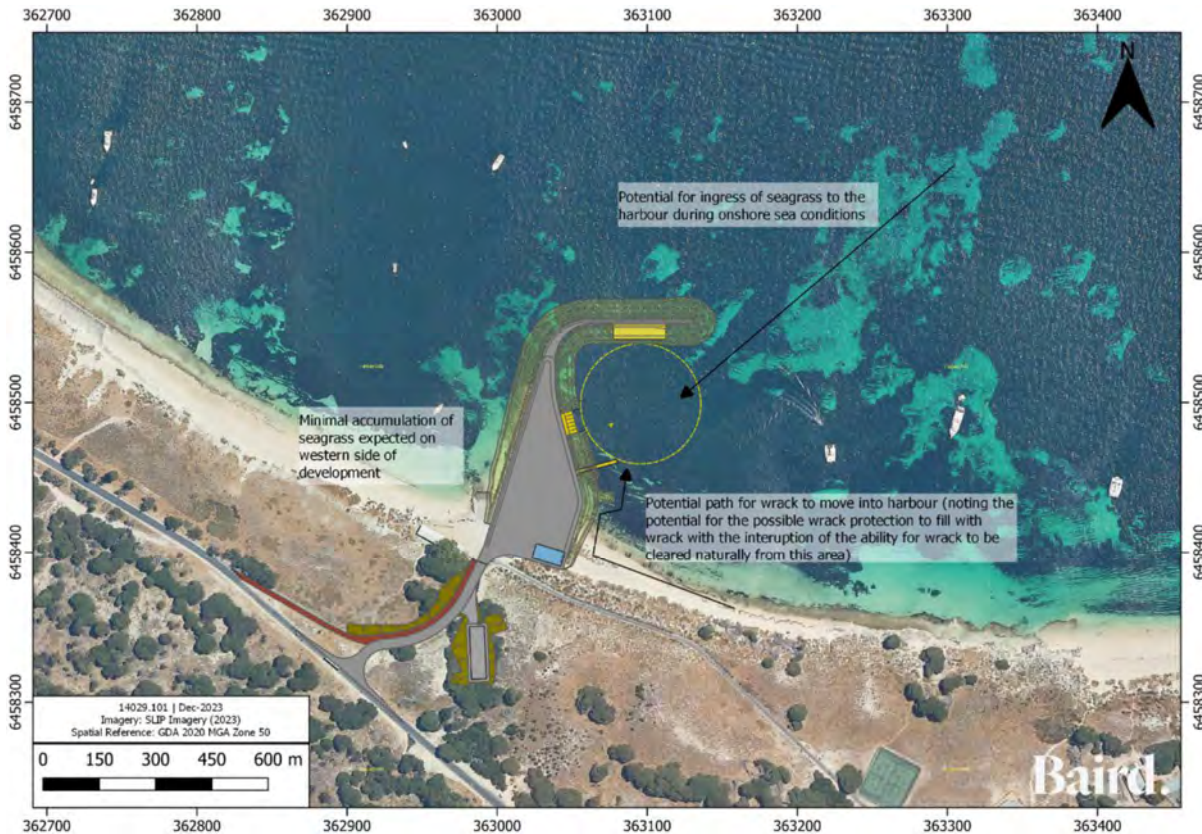


Figure 22: Potential wrack dynamic associated with the proposal





**Plate 11:** Existing wrack accumulation on the eastern side of the Army Groyne looking seaward (top, mid) and looking landward (bottom) (Baird, 2024a)

### 8.5.1.2 Reduction of wave energy in lee of structures

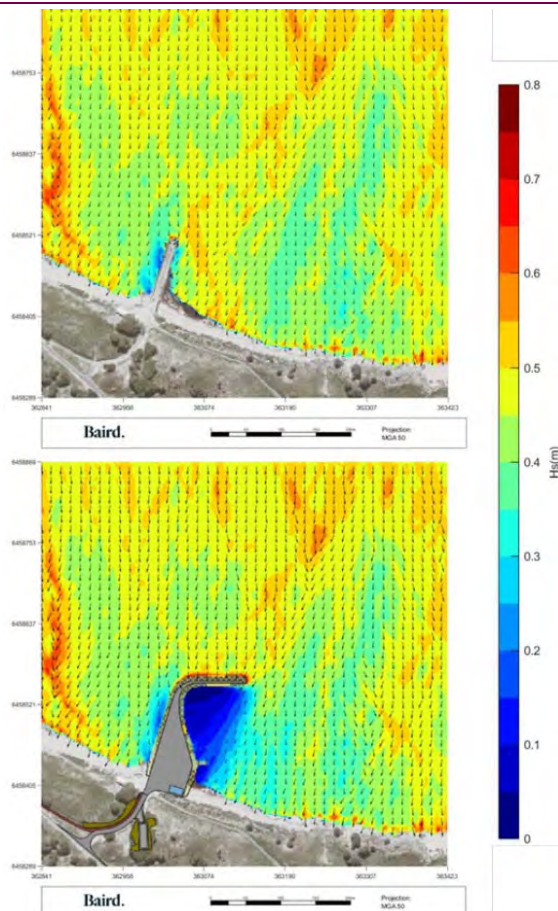
Baird plotted a number of different wave scenarios showing the change in the wave impacts with and without the proposed wharf (Table 37). Based on this, the following observations of changes to the wave impacts with and without the structures in place have been made (Baird, 2024a):

- The wave shadowing seen at the shoreline on the western side of the wharf is minimal, with a difference of <0.1 m in each wave case when compared to the existing condition. This is due to the impact that the existing Army Groyne structure has on waves on its western side when arriving at the structure from the predominant directions experienced at this location (i.e. from the northern to eastern sector).
- The greatest reduction in wave height, when compared to the existing conditions, is seen within the harbour basin area. Although, some reduction in wave height along the shoreline on the eastern side of the wharf is also evident, with wave shadowing increasing up to 0.4 m a short distance to the east from the wharf structure. This is most prominent, and has the greatest spatial impact, in the northerly wave cases.
- The wave shadowing seen within the harbour structure (most prominent with the northerly wave condition cases) creates a reduction between 0.1 m and 0.4 m across the scenarios considered, with the expectation that some wave direction conditions could produce a reduction in wave climate of up to 0.4 m within the harbour basin.

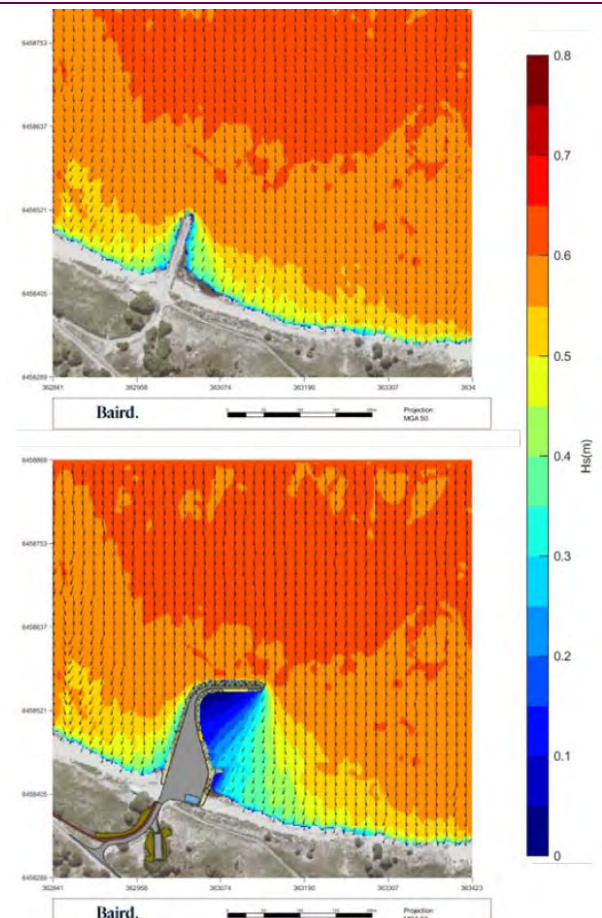
Overall, the main changes in wave energy as a result of the proposed wharf is the reduction in wave height (when compared to the existing conditions) within the harbour basin area and some reduction in wave height along the shoreline on the western side of the wharf.

**Table 37: Wave scenarios showing the change in the wave impacts with and without the proposed wharf**

**Northern swell event wave plots showing wave conditions at the Army Groyne (top) and at the proposed barge landing facility (bottom)**

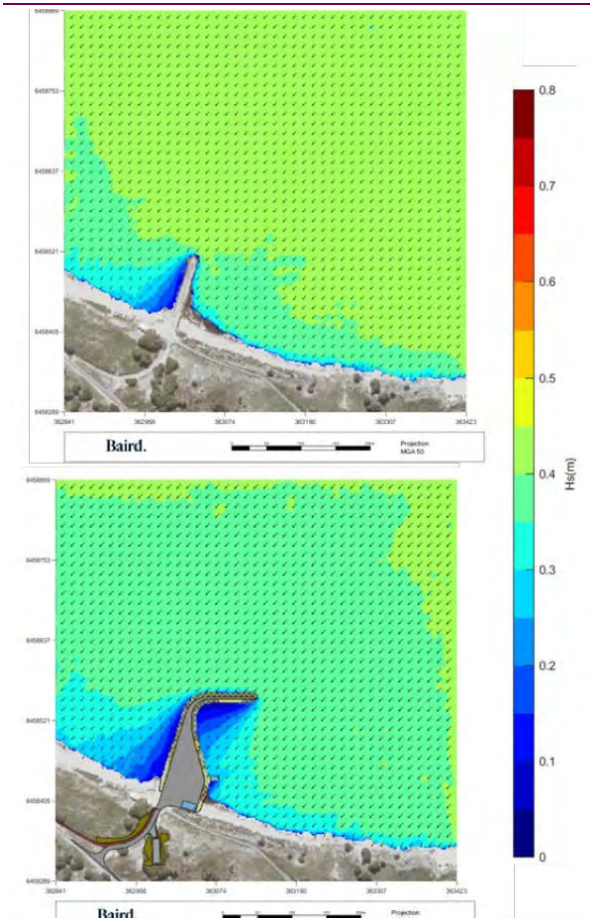


**Northern wind sea event wave plots showing wave conditions at the Army Groyne (top) and at the proposed barge landing facility (bottom)**

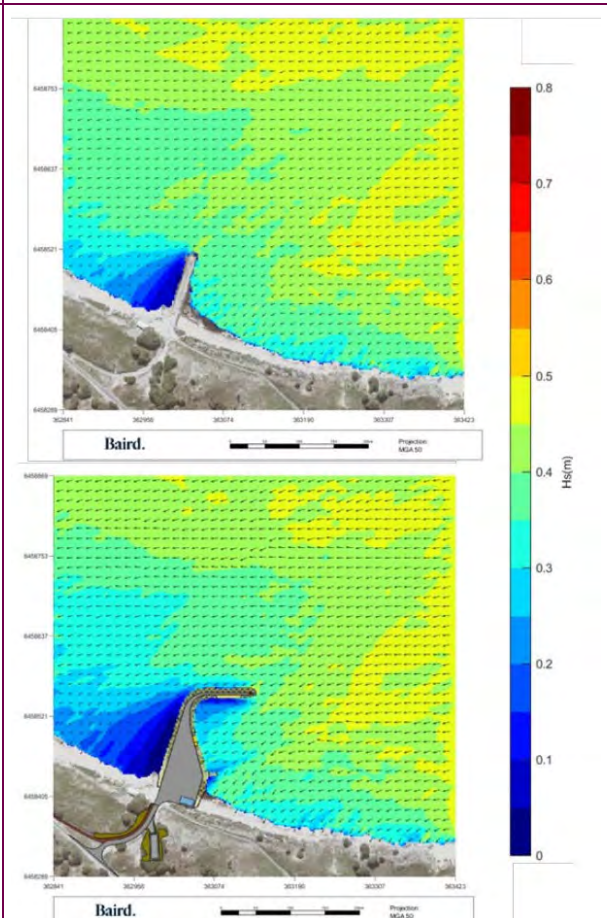




**North-eastern wind sea event wave plots showing wave conditions at the Army Groyne (top) and at the proposed barge landing facility (bottom)**



**Eastern wind sea event wave plots showing wave conditions at the Army Groyne (top) and at the proposed barge landing facility (top right)**



### 8.5.1.3 Reflection of waves off structures

An assessment of wave penetration into the harbour basin has been undertaken by Baird, the analysis indicates that the wave conditions are reduced by the proposed wharf structure for waves approaching from the north and northeast, which are the dominant wave conditions at the location. The outcomes of the assessment are summarised below:

- Waves approach the site from the north for approximately 50% of the year. The analysis of diffracted wave conditions indicate that the barge landing location is well sheltered from swell wave conditions that arrive from the north. The breakwater is effective at reducing the wave conditions at the barge ramp to approximately 40% of the incoming wave conditions, with the diffracted swell wave arriving at the stern of the vessel.
- Wind sea conditions arrive at the site from the northeast for approximately 30% of the year. These wave conditions cover waves that have wave periods of typically less than 4 seconds and are generated by local wind conditions. The assessment identified that the wharf structure reduces the incident waves by approximately 30%.
- Wave conditions from the east represent a small proportion of the annual sea state, at approximately 2% of the yearly record. The proposed wharf does not provide protection from waves from this direction and it is assumed these conditions would reach the barge ramp unchanged. The waves will approach the barge ramp approximately in line with the vessel stern at 0.44 m to 0.5 m significant wave height. It is noted these conditions are infrequent over the course of the annual record in the measured data and are concentrated in the winter months.



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The impact on wave conditions outside of the proposed wharf structure was determined to be minimal by Baird, with decreases in wave height being the main observation across each of the cases modelled. No detrimental increase in wave height caused by reflections from the breakwater structure is seen at the moorings managed by RIA (Baird, 2024a).

## 8.6 Mitigation

Table 38 demonstrates how the EPA's mitigation hierarchy (avoid, minimise and rehabilitate) has been applied to the environmental factor of coastal processes to address the key potential impacts.

**Table 38: Application of mitigation hierarchy to coastal processes**

| Potential impacts                             | Impact class | Mitigation hierarchy | Proposed mitigation measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Residual impacts                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------------------|--------------|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Interruption of longshore currents            | Direct       | Avoid                | The Army Groyne creates an existing barrier to longshore sediment transport. Therefore, as the proposed wharf will block longshore sediment transport to a similar degree to the existing Army Groyne, the proposal is not anticipated to result in a significant change in longshore sediment transport and significant impacts have been avoided.                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Sediment accretion and seagrass accumulating on the eastern side of the wharf</b><br><br>Due to the presence of the existing Army Groyne, changes to longshore currents due to the proposed wharf are not considered likely to be significant.<br><br>Any accumulation volume of wrack and the reshaping of the shoreline will be monitored and maintained as outlined in the OEMP. |
|                                               |              | Minimise             | <ul style="list-style-type: none"> <li>The proposed wharf structure has been subject to coastal processes modelling.</li> <li>Monitoring of shoreline accretion and seagrass accumulating on the eastern side of the wharf will be undertaken during the operational phase. As outlined in the Operational Environmental Management Plan (OEMP) (Appendix Q), a coastal monitoring program will be implemented as required in the Coastal Hazard Risk Management and Adaptation Plan (CHRMAP) (Cardno, 2023).</li> <li>Implementation of the Rottneest Island CHRMAP (Cardno, 2023).</li> </ul>                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                        |
|                                               |              | Rehabilitate         | Depending on the accumulation volume of wrack and the reshaping of the shoreline towards the protection nib on the eastern side of the wharf, the above maintenance and monitoring activities may need to be actioned (Baird, 2024a).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                        |
|                                               |              | Offset               | Coastal processes offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                        |
| Reduction of wave energy in lee of structures | Direct       | Avoid                | <ul style="list-style-type: none"> <li>Impacts on coastal process from marine structures cannot be completely avoided due to the nature of the proposal.</li> <li>Overall, the main changes in wave energy as a result of the proposed wharf is the reduction in wave height (when compared to the existing conditions) within the harbour basin area and some reduction in wave height along the shoreline on the western side of the wharf.</li> </ul>                                                                                                                                                                                                                                                                                                                                                       | <b>A reduction of wave energy in lee of the proposed wharf</b><br><br>This residual impact is not considered likely to have a significant impact on surrounding coastal process and the marine environment.                                                                                                                                                                            |
|                                               |              | Minimise             | <ul style="list-style-type: none"> <li>The proposed wharf structure has been subject to coastal processes modelling. This modelling identified that changes are likely to be limited to: <ul style="list-style-type: none"> <li>The reduction in wave height (when compared to the existing conditions) within the harbour basin area</li> <li>A small reduction in wave height along the shoreline on the western side of the wharf.</li> </ul> </li> <li>As the vessels manoeuvre into or away from the facility within the turning circle, the waves would be 90 degrees to the vessel and further investigation into potential implications of this on the barge will be investigated as part of future detailed design.</li> <li>Implementation of the Rottneest Island CHRMAP (Cardno, 2023).</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                        |
|                                               |              | Rehabilitate         | Rehabilitation activities due to a reduction in wave energy is not considered applicable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                        |
|                                               |              | Offset               | Coastal processes offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                        |
| Reflection of waves off structures            | Direct       | Avoid                | Impacts on coastal process from marine structures cannot be completely avoided due to the nature of the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>No residual impacts expected</b>                                                                                                                                                                                                                                                                                                                                                    |
|                                               |              | Minimise             | The proposed wharf structure has been subject to coastal processes modelling and the impact on wave conditions outside of the proposed wharf structure was determined to be minimal by Baird (2024).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                        |
|                                               |              | Rehabilitate         | Rehabilitation activities due to a reduction in wave energy is not considered applicable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                        |
|                                               |              | Offset               | Coastal processes offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                        |

## 8.7 Assessment and significance of residual impact

Following the application of the mitigation hierarchy (Table 38), RPS considers that there are no significant residual impacts to coastal processes from the proposal. The residual impacts are limited to:

- Sediment accretion and wrack accumulating on the eastern side of the wharf
- A reduction of wave energy in lee of the wharf.

The residual impacts are not considered significant as discussed in Table 39.

**Table 39: Consideration of the significance of the residual impacts on coastal processes**

| Matters for consideration                                                                                                                                | Response                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The object and principles of the EP Act                                                                                                                  | A Coastal Processes Assessment (Baird, 2024a) (Appendix D) was undertaken to address the EPA's Coastal Processes objective and the principles of the EP Act have been specifically addressed in relation to the proposal (Table 26).                                                                                                                                                                                                      |
| Values, sensitivity and quality of the environment which is likely to be impacted                                                                        | A Coastal Processes Assessment (Baird, 2024a) was undertaken to support the proposal to determine the potential impacts from the proposal on coastal processes. Due to the presence of the existing Army Groyne, changes to coastal processes due to the proposed wharf are not considered likely to be significant.                                                                                                                      |
| All stages and components of the proposal (such as any infrastructure required for the proposal to be practicably implemented, or a proposal life cycle) | All stages of the proposal (i.e. construction and operation) have been addressed in this report. However, as construction activities are unlikely to result in impacts to coastal processes, only impacts from the operational phase has been addressed in Sections 8.5 to 8.7.                                                                                                                                                           |
| Extent (intensity, duration, magnitude, and geographic footprint) of the likely impacts                                                                  | Due to the presence of the existing Army Groyne, changes to coastal processes due to the proposed wharf are not considered likely to be significant. Therefore, residual impacts from the proposal are limited to: <ul style="list-style-type: none"> <li>• Sediment accretion and wrack accumulating on the eastern side of the wharf</li> <li>• A reduction of wave energy in lee of structures.</li> </ul>                             |
| Resilience of the environment                                                                                                                            | The majority of longshore sediment transport is currently blocked by the existing Army Groyne, and the proposed wharf will block longshore sediment transport to a similar degree (Baird, 2024). As there are no significant changes to coastal processes, the coastal environment will not need to be resilient to changes resulting from the proposal.                                                                                  |
| Consequence of the application of the mitigation hierarchy to the proposal.                                                                              | Only minor changes to coastal process are predicted and these will be constrained to South Thomson Bay, in the immediate locale of the proposal. RPS considers that the residual impacts to coastal processes listed below are not significant: <ul style="list-style-type: none"> <li>• Sediment accretion and wrack accumulating on the eastern side of the wharf</li> <li>• A reduction of wave energy in lee of structures</li> </ul> |
| Level of confidence in the prediction of residual impacts and the success of proposed mitigation                                                         | The impact assessment has been based on a Coastal Processes Assessment (Baird 2024) which was peer reviewed by RPS to confirm that the modelling and assessment was fit for purposes. As such, the prediction of the residual impacts has been completed with a high level of confidence.                                                                                                                                                 |
| Public interest about the likely effect of the proposal or scheme, if implemented, on the environment, and relevant public information                   | RIA has facilitated regular meetings / dialogue with the local community and key stakeholders (Table 25) as part of the project.                                                                                                                                                                                                                                                                                                          |

Cumulative impacts from the proposal have been considered in relation to other proposals within 5 km of the proposal and are discussed in Section 18.

Holistic impacts are discussed in Section 17.

## 8.8 Environmental outcomes

In consideration of the proposed avoidance and management measures and likely residual impacts associated with the proposal, the environmental outcomes that apply to coastal processes are:



- Changes to coastal processes resulting from the proposal will be limited to the accumulation of sediment and seagrass against the wharf structure.

Based on the outcomes of the Coastal Processes Assessment (Baird 2024), it is considered that the implementation of the proposal will successfully meet the EPA's objective for coastal processes (i.e. to maintain the geophysical processes that shape coastal morphology so that the environmental values of the coast are protected).

Adaptive management measures will be implemented in accordance with the OEMP to ensure residual impacts are not significant and that the environmental outcomes are met.

## 9 MARINE ENVIRONMENTAL QUALITY

### 9.1 EPA objective

To maintain the quality of water, sediment and biota so that environmental values are protected.

### 9.2 Policy and guidance

The proposal will comply with applicable guidance developed by the EPA to assist proponents and the public to understand the minimum requirements for the protection of elements of the environment that the EPA expects to be met during the assessment process.

Table 40 lists relevant EPA guidance, other state and Commonwealth policy documents, and provides consideration for how these documents informed the proposal.

**Table 40: Relevant policy and guidance; marine environmental quality**

| Policy and guidance                                                                               | Consideration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Factor Guideline: Marine Environmental Quality (EPA, 2016e)                         | <p>The environmental factor guideline identifies the environmental values associated with marine environmental quality (i.e. ecosystem health, fishing and aquaculture, recreation and aesthetics, industrial water supply and cultural and spiritual) and their significance, identifies the level of ecological protection requirements and identifies development activities that have the potential to impact on marine environmental quality.</p> <p>Marine environmental quality studies undertaken to support the proposal include:</p> <ul style="list-style-type: none"> <li>• South Thomson Barge Landing Development; Dredge Plume Modelling Assessment (Baird, 2024b) (Appendix F)</li> <li>• Rottnest Island Army Jetty Dredging; SAP Implementation report (RPS, 2020) (Appendix H)</li> <li>• Baseline marine water quality sampling undertaken by RIA (Appendix G).</li> </ul>                                                                                                                                                                                                                                                                    |
| Environmental Factor Guideline: Benthic Communities and Habitats (EPA, 2016f)                     | <p>Changes in marine environmental quality have the potential to impact benthic communities and habitats. Potential impacts to benthic communities and habitats from the proposal are addressed in this Section (Section 9) and Section 7; Benthic communities and habitats.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Technical Guidance: Environmental Impact Assessment of Marine Dredging Proposals (EPA, 2021a)     | <p>The technical guidance provides the general approach for describing impacts from dredging proposals, generating predictions, describing impact zones and integrating predictions with monitoring and management requirements which has been applied to the proposal.</p> <p>As outlined in Section 2, dredging activities will be undertaken during the construction phase of the proposal. The following has been undertaken to support the project and assess potential impacts from the proposed dredging activities:</p> <ul style="list-style-type: none"> <li>• South Thomson Barge Landing Development; Dredge Plume Modelling Assessment (Baird, 2024b) (Appendix F)</li> <li>• Peer Review of Dredge Plume Modelling and Coastal Processes Reports (RPS, 2024c) (Appendix E)</li> <li>• Dredging Environmental Monitoring and Management Plan (DEMMP) (02 Environment, 2024) (Appendix O).</li> </ul> <p>During operations, maintenance dredging (of previously dredged areas) may also be undertaken (as a contingency / as required) consistent with the document Maintenance Dredging Environmental Management Framework (BMT Oceanica, 2016).</p> |
| Technical Guidance: Protecting the Quality of Western Australia's Marine Environment (EPA, 2016g) | <p>The technical guidance provides the environmental quality management frameworks for protecting the environmental values associated with marine environmental quality (i.e. ecosystem health, fishing and aquaculture, recreation and aesthetics, industrial water supply and cultural and spiritual) and provides the approach to setting levels of ecological protection and environmental quality criteria.</p> <p>The marine environmental quality technical studies prepared to inform the proposal have been underpinned by the technical guidance.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

| Policy and guidance                                                                                                                                                                                                            | Consideration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand., 2018) | The guidelines provide authoritative guidance on the management of water quality for natural and semi-natural water resources in Australia to inform impact predictions and assessments. The assessment of marine environmental quality undertaken to inform the proposal acknowledges and follows the guidelines' criteria and trigger values where applicable.                                                                                                                                                                                                     |
| National Assessment Guidelines for Dredging (Australian Government, 2009)                                                                                                                                                      | The guidelines set out the framework for the environmental impact assessment and permitting for the ocean disposal of dredged material. As no dredged material is proposed for disposal at sea, these guidelines are not applicable to the proposal and no Commonwealth <i>Environment Protection (Sea Dumping) Act 1981</i> permit is required. This is discussed further in Section 14.3.4.                                                                                                                                                                        |
| Perth's Coastal Waters, Environmental Values and Objectives (EPA, 2000)                                                                                                                                                        | The guidelines identify environmental values and environmental quality objectives for Perth's coastal water. Much of the information set out in this document has been incorporated into / superseded by the EPA's Marine Environmental Quality factor and technical guidance. The environmental quality criteria and trigger values for the proposal have considered this document.                                                                                                                                                                                 |
| State Water Quality Management Strategy No.2, Implementation Plan: Status Report (Government of Western Australia, 2004)                                                                                                       | The plan provides the overarching framework to inform the implementation of future water quality management plans. The following management plans have been prepared to broadly align with Government of Western Australia (2004): <ul style="list-style-type: none"> <li>• Dredging Environmental Monitoring and Management Plan (02 Environment, 2024) (Appendix O)</li> <li>• Construction Environmental Management Plan (CEMP) (Emerge, 2024a) (Appendix P)</li> <li>• Operational Environmental Management Plan (OEMP) (Emerge, 2024b) (Appendix Q).</li> </ul> |
| Background quality for coastal marine waters of Perth, Western Australia (Department of Environment, 2004)                                                                                                                     | This guidance details the findings of water quality surveys undertaken in Perth's coastal waters in 2003 to determine dissolved concentrations of a range of contaminants in the marine nearshore environments. It provides a broad overview of contaminant concentrations and ecological protection levels the findings of which are of relevance to the proposal.                                                                                                                                                                                                  |

## 9.3 Environmental investigations

Baseline marine water quality and sediment monitoring has been undertaken to support the proposal as summarised below:

- Rottnest Island Authority has undertaken baseline water quality monitoring in November and December 2023 and January 2024 (Appendix G).
- Sediment sampling was undertaken in November 2019 as part of the Rottnest Island Army Jetty Dredging; SAP Implementation report (RPS, 2020) (Appendix H).

These investigations are discussed in Sections 9.3.1 and 9.3.2. In addition to this, an unexploded ordnance (UXO) survey was conducted. The presence/absence of UXOs is discussed further in Section 13, Social surroundings.

### 9.3.1 Water quality monitoring

The baseline water quality monitoring locations have been situated within the ZoHI, ZoMI and ZoI as depicted in Figure 23 and summarised below:

- ST-01 is located within the ZoHI.
- ST-02 is located within the ZoMI
- ST-03 is located outside eastern edge of the ZoMI and within ZoI.
- ST-04 is located outside western edge of the ZoMI and down-gradient of any disturbance from the Main Jetty.



- ST-05 is located at the eastern end of the Zol.
- ST-06 is located outside the development envelope and zone of influence and provide background water quality levels.

Sampling was undertaken in December 2023 (suite A) and January 2024 (suite B). The two different suites of analytes that were collected are:

- **Suite A:** Metals, nutrients, total recoverable hydrocarbons (TRH), Benzene, toluene, ethylbenzene, xylenes (as BTEX), chlorophyll-a, major anions and cations, alkalinity and hardness, TSS, TDS, enterococci, *E. coli*, faecal coliforms, field parameters (temperature, pH, dissolved oxygen, electrical conductivity, salinity, turbidity, ORP, light attenuation coefficient/Secchi depth)
- **Suite B:** Chlorophyll-a, TSS, TDS, field parameters (temperature, pH, dissolved oxygen, electrical conductivity, salinity, turbidity, ORP, light attenuation coefficient/Secchi depth).



Figure 23: Baseline marine water quality monitoring locations

### 9.3.2 Sediment sampling

Sediments were sampled at seven locations across the proposed dredge area and ZoHI to a maximum depth of approximately 1.2 m or until refusal was reached. Sampling locations are presented in Figure 24.

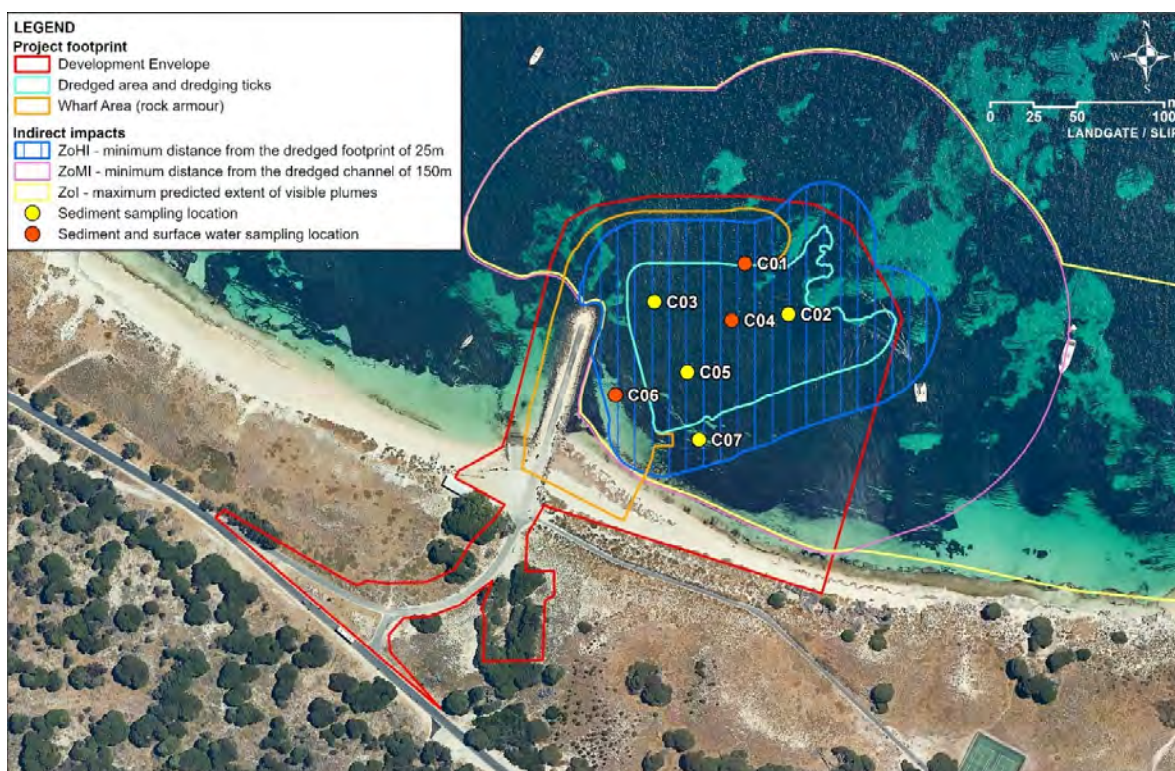


Figure 24: Baseline marine sediment sampling locations

## 9.4 Receiving environment

### 9.4.1 Historical land uses

With reference to the activities identified within the DWER *Contaminated Sites Management Series, Assessment and Management of Contaminated Sites* (DWER, 2014) the following surrounding site activities were considered potential sources of contamination:

- Port/wharf/dock activities and recreational boating activities have the potential to contaminate the marine environment through accidental fuel spills and boat sillage.
- Defence works and Defence establishments
- UXOs.

Based upon the aforementioned surrounding site activities, the following potential contaminants of concern have been identified:

- Metals (Ag, Cd, Se, Co, Sb, Cu, Pb, Zn, Cr, Ni, As, V, Mn and Hg)
- Organochlorine and organophosphate (OC/OP) pesticides
- TRH
- BTEX
- Polycyclic aromatic hydrocarbons (PAHs)
- Asbestos fibres
- Tributyl tin (TBT)
- Nutrients – total nitrogen, ammonia, nitrate, nitrite, total phosphorus and reactive phosphorus
- Per- and poly-fluoroalkyl substances (PFAS)
- Explosives.

Whilst PFAS is identified as a contaminant of potential concern due to historical land uses, the potential for significant use at the Army Groyne and nearby barracks is considered unlikely based upon the following (RPS, 2020):

- The island was essentially only used for training exercises after WWII.
- Given the location of the site (i.e. off the mainland) it is considered unlikely that significant training operations with firefighting foams would have been undertaken on the island.
- Firefighting training for Defence personnel was undertaken at other facilities in Perth including Garden Island and RAAF Base Pearce, with army training likely undertaken at Campbell, Irwin and Leeuwin barracks and or the Bindoon training area.
- The barracks were handed over to the state in 1984, essentially ending military operations on the island
- Vessels were not allowed to dock at the jetty.
- Firefighting foams containing PFAS (PFOS and PFOA) entered use in the Department of Defence in the 1970s (Department of Defence, <https://www.defence.gov.au/environment/pfas/>).

## 9.4.2 Sediment quality

### 9.4.2.1 Screening values

Analysis of the sediment results was undertaken relevant to reclamation activities. The assessment concluded that from a contamination perspective, the sediments are suitable for reclamation activities, with all results below the following assessment criteria:

- Ecological investigation levels (EILs) and ecological screening levels (ESLs) for areas of ecological significance and public open space (NEPM, 2013)
- Health Investigation Levels for residential soil access (HIL-A) (CRC CARE, 2011).

### 9.4.2.2 Analytical results

All results were reported below relevant Default Guideline Value (DGV) and the sediments are not considered to pose a significant risk during dredging and are considered suitable for reclamation activities.

Analysis of the sediment sampling results and laboratory reporting is provided in Appendix H. A summary of the results is provided below:

- All metals were below relevant interim sediment quality guidelines. Where sediments did not exceed DGV guidelines and or no guidelines exist concentrations were relatively consistent across the dredge area.
- All sediment samples were reported less than the limit of reporting (LOR) (0.5 µgSn/kg) and thus complied with the DGV (5 µgSn/kg).
- All polycyclic aromatic hydrocarbons (PAH), organochlorine and organophosphate (OC/OP) pesticides and explosives were reported as below relevant LORs and thus below relevant DGV.
- All benzene, toluene, ethyl benzene and xylenes (BTEX) and total recoverable hydrocarbons (TRH) results were below the relevant LORs in all samples with the exception of minor TPH detects in two samples. Samples C06S01 and C07S03 complied with the DGV (280 mg/kg) for the sum C10-C36, with non-normalised concentrations of 5 and 7 mg/kg, respectively.
- With the exception of PFOS in three samples during November 2019 and one sample in March 2020, no other PFAS was reported above the LOR within any of the samples during either sampling event. However, the concentrations of PFOS were:
  - Only marginally above the LOR
  - An order of magnitude below the lowest screening criteria
  - Consistent during both sampling events.



- No guidelines for nutrients (phosphorus or nitrogen) exist in Western Australia. Concentrations were predominately consistent across the sampling area. Phosphorus was predominantly in total forms (i.e. non-reactive forms) and as such was bound up with the sediment. Nitrogen is also predominantly bound to sediments and in organic forms (i.e. Kjeldahl nitrogen). Ammonia was the dominant inorganic form of nitrogen however inorganic concentrations are significantly lower than organic forms of nitrogen.

### 9.4.3 Water quality

#### 9.4.3.1 Screening values

To assist with monitoring of water quality, trigger values have been adopted from the following guidance documentation:

- Assessment and Management of Contaminated Sites* (DWER, 2021)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (WQA, 2024).

Trigger values used in Table 41 and Table 42 are colour coded to show where each trigger has been exceeded, using the following definitions:

- MWG-95; marine water guidelines for slightly–moderately disturbed lowland river systems, at the 95% species protection level
- MWG-99; marine water guidelines for high conservation/ecological value systems, at the 99% species protection level.

#### 9.4.3.2 Analytical results

Comprehensive analysis was undertaken in December 2023 and January 2024 by a National Association of Testing Authorities accredited laboratory on water samples collected from South Thomson Bay, with sampling locations and analytes discussed in Section 9.3.1.

The laboratory reports are provided in Appendix G with the results presented in Table 41 and Table 42.

**Table 41: Water quality within South Thomson Bay; metals**

| Parameter     | Dissolved metals |      |       |      |      |      |       |      |      |      |      |
|---------------|------------------|------|-------|------|------|------|-------|------|------|------|------|
|               | Al               | As   | Cd    | Cr   | Cu   | Fe   | Hg    | Mn   | Ni   | Pb   | Zn   |
| Units         | µg/L             | µg/L | µg/L  | µg/L | µg/L | µg/L | µg/L  | µg/L | µg/L | µg/L | µg/L |
| MWG-95        | -                | -    | 5.5   | 27   | 1.3  | -    | 0.4   | 80   | 70   | 4.4  | 8.0  |
| MWG-99        | -                | -    | 0.7   | 7.7  | 0.3  | -    | 0.1   | 80   | 7.0  | 2.2  | 3.3  |
| December 2023 |                  |      |       |      |      |      |       |      |      |      |      |
| ST-01         | ---              | 1.6  | <0.10 | <1.0 | <1.0 | ---  | <0.05 | <1.0 | <1.0 | <1.0 | <1.0 |
| ST-02         | ---              | 1.6  | <0.10 | 9.6  | <1.0 | ---  | <0.05 | <1.0 | <1.0 | <1.0 | 620  |
| ST-03         | ---              | 1.8  | <0.10 | <1.0 | <1.0 | ---  | <0.05 | <1.0 | <1.0 | <1.0 | <1.0 |
| ST-04         | ---              | 2.0  | <0.10 | <1.0 | <1.0 | ---  | <0.05 | <1.0 | <1.0 | <1.0 | 11   |
| ST-05         | ---              | 1.8  | <0.10 | <1.0 | <1.0 | ---  | <0.05 | <1.0 | <1.0 | <1.0 | <1.0 |
| ST-06         | ---              | 2.0  | <0.10 | <1.0 | <1.0 | ---  | <0.05 | <1.0 | <1.0 | <1.0 | <1.0 |

- denotes no guideline, --- denotes not tested.

**Table 42: Water quality within South Thomson Bay; other parameters**

| Parameter            | TSS  | Chl-a      | FRP      | TN         | TKN   | NOX-N    | Thermotol. coliforms | Enterococci | E. coli |
|----------------------|------|------------|----------|------------|-------|----------|----------------------|-------------|---------|
| Units                | mg/L | mg/L       | mg /L    | mg /L      | mg /L | mg /L    | cfu/mL               | cfu/mL      | cfu/mL  |
| <b>MWG-95</b>        | -    | <b>0.3</b> | <b>5</b> | <b>230</b> | -     | <b>5</b> | -                    | -           | -       |
| <b>MWG-99</b>        | -    | -          | -        | -          | -     | -        | -                    | -           | -       |
| <b>December 2023</b> |      |            |          |            |       |          |                      |             |         |
| ST-01                | <5.0 | <1.0       | <0.005   | 0.16       | 0.16  | <0.005   | 1                    | 1           | <1      |
| ST-02                | <5.0 | <1.0       | <0.005   | 0.12       | 0.12  | <0.005   | <1                   | <1          | <1      |
| ST-03                | <5.0 | <1.0       | <0.005   | 0.15       | 0.14  | <0.005   | <1                   | <1          | <1      |
| ST-04                | <5.0 | <1.0       | <0.005   | 0.13       | 0.13  | <0.005   | 1                    | <1          | 1       |
| ST-05                | <5.0 | <1.0       | <0.005   | 0.15       | 0.14  | <0.005   | <1                   | 1           | <1      |
| ST-06                | <5.0 | <1.0       | <0.005   | 0.15       | 0.15  | <0.005   | 1                    | <1          | <1      |
| <b>January 2024</b>  |      |            |          |            |       |          |                      |             |         |
| ST-01                | <5.0 | <1.0       | ---      | ---        | ---   | ---      | ---                  | ---         | ---     |
| ST-02                | <5.0 | <1.0       | ---      | ---        | ---   | ---      | ---                  | ---         | ---     |
| ST-03                | <5.0 | <1.0       | ---      | ---        | ---   | ---      | ---                  | ---         | ---     |
| ST-04                | <5.0 | <1.0       | ---      | ---        | ---   | ---      | ---                  | ---         | ---     |
| ST-05                | <5.0 | <1.0       | ---      | ---        | ---   | ---      | ---                  | ---         | ---     |
| ST-06                | <5.0 | <1.0       | ---      | ---        | ---   | ---      | ---                  | ---         | ---     |

- denotes no guideline, --- denotes not tested

The majority of the analytes were below practical quantitation limits set by the laboratories and typically below the adopted screening levels, with the exceptions discussed as follows:

- Chromium concentrations marginally exceeded the MWG-99 (7.7 µg/L) at ST-02 (9.6 µg/L).
- Zinc concentrations exceeded both the MWG-95 (8.0 µg/L) and MWG-99 (3.3 µg/L) at ST-02 (620 µg/L) and ST-03 (11 µg/L).
- The chlorophyll-a levels were below the LOR for all samples, noting however that the LOR was above the screening levels.
- Whilst no screening levels were adopted for microbiological parameters or total dissolved solids, concentrations are considered low.

The elevated concentration of chromium and zinc at ST-02 are considered an anomaly, and either represent an analysis error or sampling error where fine sediment was introduced into the sample. The latter is considered unlikely as the TSS values indicate that the sample contained little sediment.

## 9.5 Potential environmental impacts

Table 43 provides the potential key impacts to marine environmental quality from the proposal.

**Table 43: Potential impacts on marine environmental quality**

| <b>Phase</b> | <b>Impact class</b> | <b>Works / operations</b>                                                                                                                                                                             | <b>Potential impacts</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|--------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction | Direct              | <ul style="list-style-type: none"> <li>• Dredging</li> <li>• Breakwater construction</li> <li>• Reclamation (decant from reclamation area)</li> <li>• Piling</li> <li>• Vessel operations.</li> </ul> | <p><b>Increase in total suspended solids (TSS)</b></p> <ul style="list-style-type: none"> <li>• Mobilisation of sediment during dredging activities, construction of the breakwater, reclamation and piling will result in a temporary increase in TSS within the following modelled areas: <ul style="list-style-type: none"> <li>– ZoHI</li> <li>– ZoMI</li> <li>– Zol.</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                        |
|              | Indirect            | <ul style="list-style-type: none"> <li>• Dredging</li> <li>• Breakwater construction</li> <li>• Reclamation (decant from reclamation area)</li> <li>• Piling</li> <li>• Vessel operations.</li> </ul> | <p><b>Temporary release of contaminants from marine sediment during dredging and reclamation activities</b></p> <ul style="list-style-type: none"> <li>• The proposed dredging activities and resulting suspension of sediments have the potential to result in the temporary release of contaminants from sediments.</li> </ul> <p><b>Increased risk of pollution incidents</b></p> <ul style="list-style-type: none"> <li>• Accidental fuel spills to marine environment during construction resulting in hydrocarbon contamination of water, sediment and biota.</li> </ul> <p><b>Increase in total suspended solids</b></p> <ul style="list-style-type: none"> <li>• Temporary decrease in light availability for benthic communities and habitats due to increased TSS.</li> </ul> |
| Operation    | Indirect            | <ul style="list-style-type: none"> <li>• Vessel operations</li> <li>• Maintenance dredging (potential contingency).</li> </ul>                                                                        | <p><b>Increase in total suspended solids</b></p> <ul style="list-style-type: none"> <li>• Temporary increase in sedimentation</li> <li>• Temporary decrease in light availability for benthic communities and habitats due to increased TSS.</li> </ul> <p><b>Increased risk of pollution incidents</b></p> <ul style="list-style-type: none"> <li>• Increased risk of pollution incidents from vessels and fuel storage facilities leading to degradation of marine environmental quality.</li> </ul>                                                                                                                                                                                                                                                                                  |

## 9.5.1 Assessment of impacts

### 9.5.1.1 Increase in total suspended solids

#### 9.5.1.1.1 Predicted zones of impact

A dredge plume modelling assessment was undertaken by Baird (2024b) (Appendix F) to support the proposal. The dredge plume model simulated the dredge plume generation from the proposed dredging to determine the fate of fine sediments in suspension, as suspended sediment concentration (SSC) both spatially and vertically through the water column.

The calculation of the zones of impact defined by the dredge plume modelling determined nominal values of SSC that would have detrimental impact on local seagrass species. The calculated zones of impact were determined based on the complete winter dredging program and are shown in Figure 25. The zones of impact determined by Baird (2024b) and the predicted impacts on benthic communities and habitats are summarised below:

- **Zone of High Impact (ZoHI)** – The area where impacts on benthic communities or habitats are predicted to be irreversible. The term irreversible means 'lacking a capacity to return or recover to a state resembling that prior to being impacted within a timeframe of five years or less'. The ZoHI encompasses an area of 1.37 ha. The majority of the ZoHI is located within the development envelope.
- **Zone of Moderate Impact (ZoMI)** – The area within which predicted impacts on benthic communities or habitats are recoverable within a period of five years following completion of the dredging activities. This zone abuts, and lies immediately outside of, the ZoHI. The ZoMI encompasses an area of 4.5 ha.
- **Zone of Influence (Zol)** – The area within which changes in environmental quality associated with dredge plumes are predicted and anticipated during the dredging operations, but where these changes would not result in a detectable impact on benthic biota. At any point in time, the dredge plumes are likely to be restricted to a relatively small portion of the Zol. The Zol encompasses an area of 13.44 ha.





**Figure 25: Zones of influence from dredging activities**

#### 9.5.1.1.2 Predicted plume behaviour

The overall current direction within South Thomson Bay trends from west to east, resulting in the modelled plume being generally directed east along South Thomson Bay, away from the existing Army Groyne, with occasional periods of direction change causing the plume to move west and around the Army Groyne. This is demonstrated in the spatial plots taken from specific points in time shown in Figure 26, with plots shown at three hourly timesteps from 18:00 on 26 June 2020 to 03:00 on 27 June 2020. These plots show:

- The plume being directed strongly to the east away from the Army Groyne (top left plot)
- The plume being directed less strongly away from the Army Groyne in the middle of a flood tide (top right plot)
- The plume being directed weakly to the west around the Army Groyne as the flood tide gets closer to its peak water level (bottom left plot)
- As the flood tide is close to its peak water level and remaining close to the point of discharge in the peak of a tidal cycle as the tide turns from flood to ebb (bottom right plot).

These plots indicate that the suspended sediment plume from the proposed dredging activities is predicted to be localised to the area of South Thomson Bay around the development envelope.

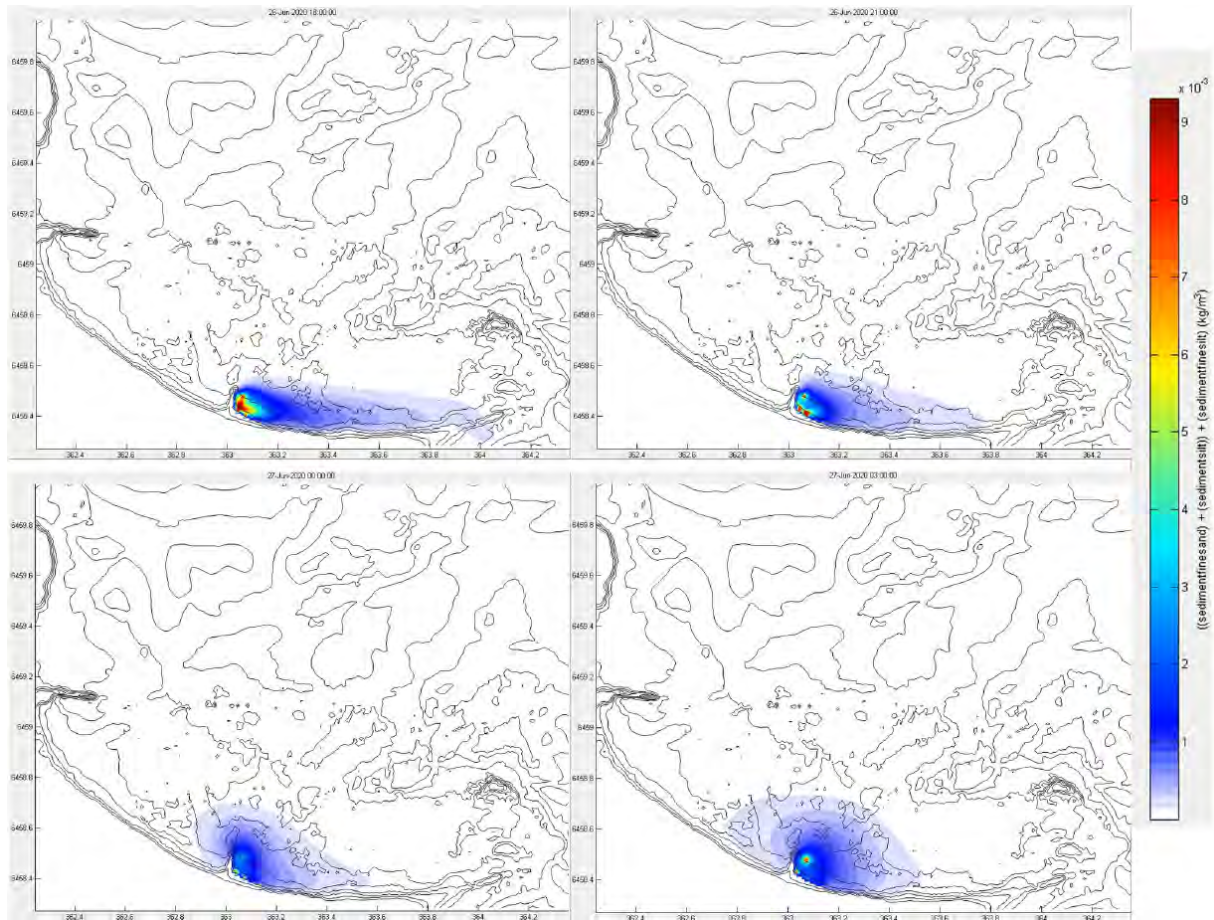
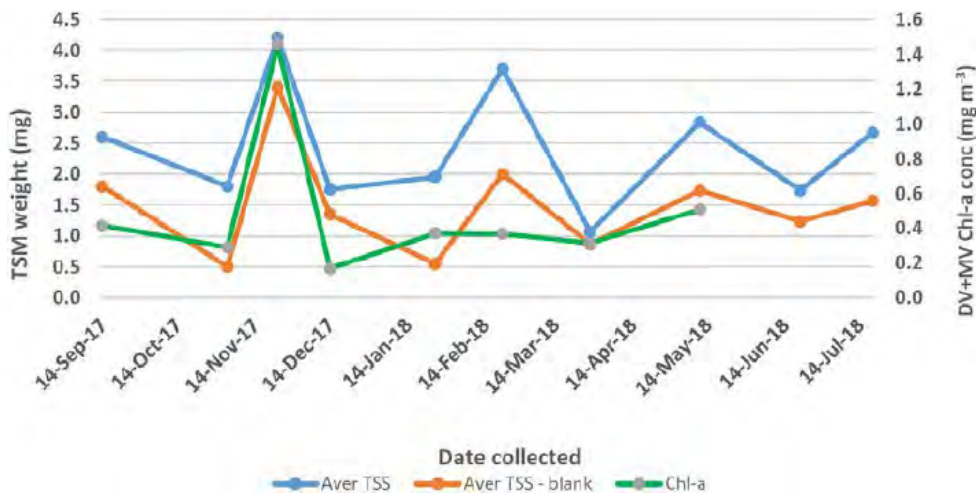


Figure 26: Spatial plots of the dredge plume model (Baird, 2024b)

### 9.5.1.1.3 Suspended sediment concentration

The dredge plume model simulations were executed with no background SSC and the model results represent excess above the adopted background SSC of 3 mg/L. Data from the Rottnest IMOS National Reference Station provides measured TSS offshore of Wadjemup / Rottnest Island (Graph 4). The TSS values measures ranged between 0.5 mg/L and 3.5 mg/L, indicating that the adopted background level of 3 mg/L is a conservative approach.



Graph 4: Average post-July 2017 TSM values with (orange line) and without (blue line) a data correction for the blank at Wadjemup / Rottnest Island between September 2017 and July 2018 (Baird, 2024b)



Examples of the analysis for winter of the total SSC and daily running mean SSC at the locations provided in Figure 27 against the following nominal thresholds adopted for the zones of impact are shown in Graphs 5 to 8.

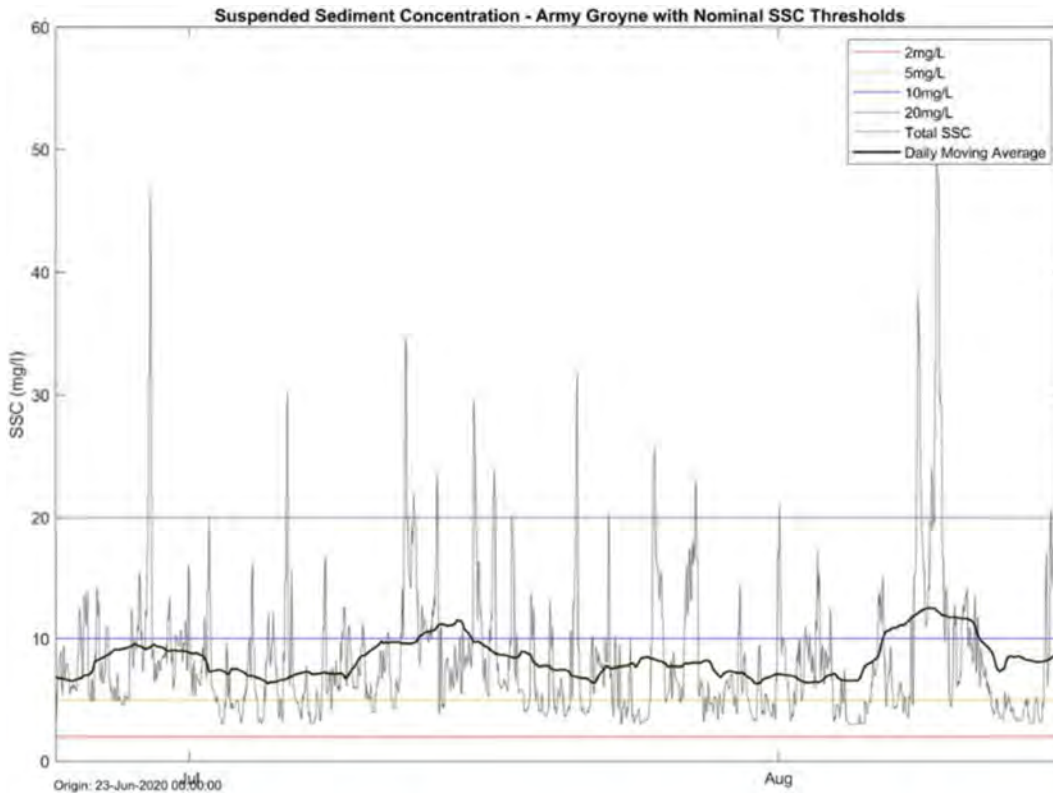
- ZoHI – where sedimentation/burial is  $>10$  cm or  $10,000$  g/m<sup>2</sup>
- ZoMI – where a TSS concentration of  $>10$  mg/L was exceeded and sedimentation burial is 5–10 cm or  $5,000$ – $10,000$  g/m<sup>2</sup>
- ZoI – where a TSS concentration of  $>2$  mg/L above background was exceeded (representing the maximum predicted extent of visible plumes).

Graph 5 demonstrates the relatively high level of SSC likely to be experienced at the dredge footprint, while Graph 6 indicates that there are likely to be occasional periods of exceedance of the nominal thresholds related to moderate risk (10 mg/L) and high risk (20 mg/L) at the South Thomson Bay 1 location (Figure 27). The Aquadopp profiler equipment location immediately north of the dredge footprint only experiences levels of SSC that would result in a visible sediment plume, but with no measurable impact on benthic communities and habitats.

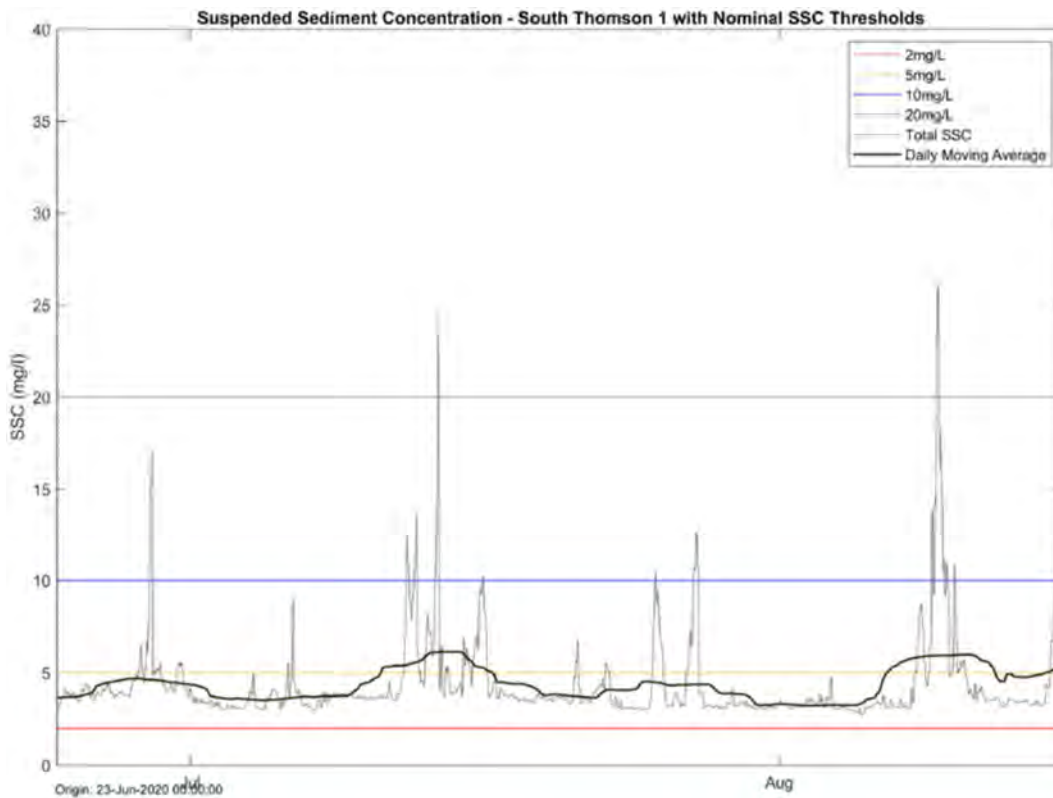


Figure 27: Locations where timeseries SSC data is presented (Baird, 2024b)

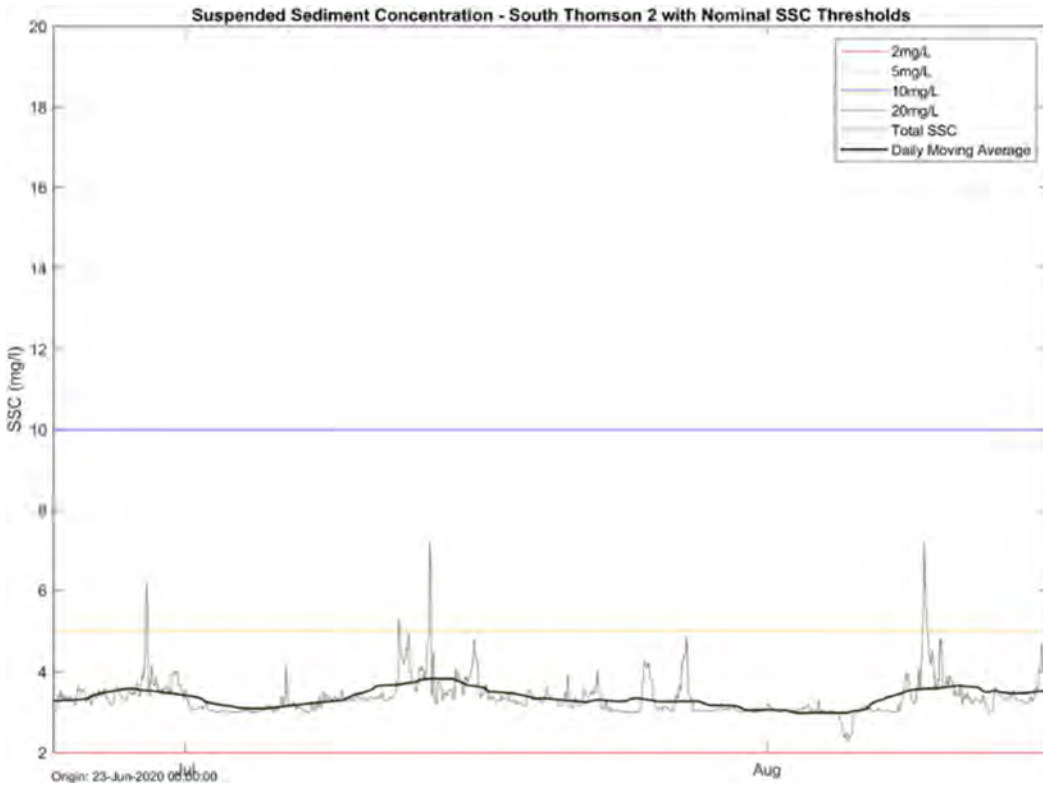




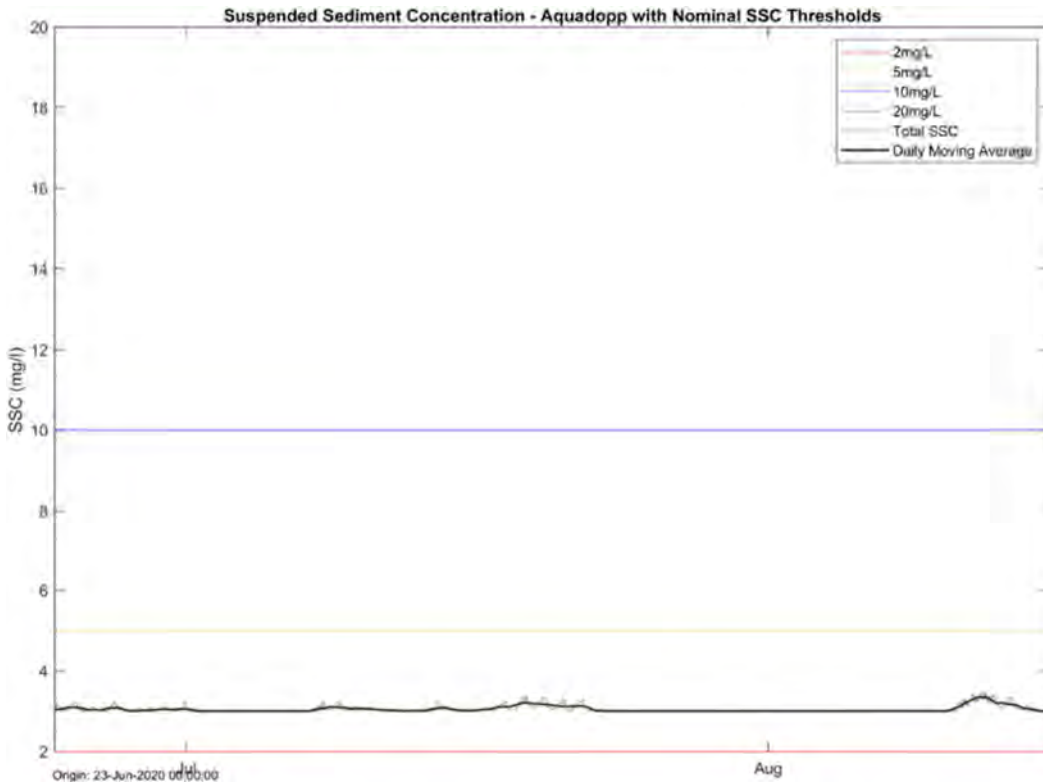
**Graph 5:** Calculation of total SSC and daily mean values of modelled SSC analysed against nominal seagrass impact thresholds at the Army Groyne location (Baird, 2024b)



**Graph 6:** Calculation of total SSC and daily mean values of modelled SSC analysed against nominal seagrass impact thresholds at the South Thomson Bay 1 location. Analysis shown for the background SSC of 3 mg/L (Baird, 2024b)



**Graph 7:** Calculation of total SSC and daily mean values of modelled SSC analysed against nominal seagrass impact thresholds at the South Thomson Bay 2 location. Analysis shown for the background SSC of 3 mg/L (Baird, 2024b)



**Graph 8:** Calculation of total SSC and daily mean values of modelled SSC analysed against nominal seagrass impact thresholds at the Aquadopp location. Analysis shown for the background SSC of 3 mg/L (Baird, 2024b)

#### 9.5.1.1.4 Potential release of contaminants from sediments

The proposed dredging activities and resulting suspension of sediments have the potential to result in the temporary release of contaminants from sediments. However, as discussed in Section 9.4.2, baseline sediment results were below the following assessment criteria.

- EILs and ESLs for areas of ecological significance and public open space (NEPM, 2013)
- Health Investigation Levels for residential soil access (HIL-A) (CRC CARE, 2011).

As all results were below the Default Guideline Value, the sediments are not considered to pose a significant risk to ecological receptors and human health during dredging and reclamation activities.

#### 9.5.1.2 Increased risk of pollution incidents

##### 9.5.1.2.1 Vessel operations

Increased boat numbers during operation, and to lesser degree construction, of the proposal has the potential to increase the risk of pollution, including from antifouling paints, anti-corrosion anodes, increased risk of accidental discharges (e.g. fuel spills, oils and greases) and sillage.

An increase in vessels using South Thomson Bay is expected during the operational phase. Quantities and types of material that might enter the marine environment are limited to spills relating to these vessels. The magnitude of this impact is dependent on the quantities and nature of the spillage, the dilution and dispersal properties of the waters and the bioavailability of the contaminant to species.

##### 9.5.1.2.2 Fuel storage

A fuel facility, including underground storage fuel storage is proposed as part of the proposal (Figure 28). There is a risk for fuel spills to occur during refuelling or from fuel storage facilities. Fuel spills from the fuel facility have the potential to impact marine environmental quality.

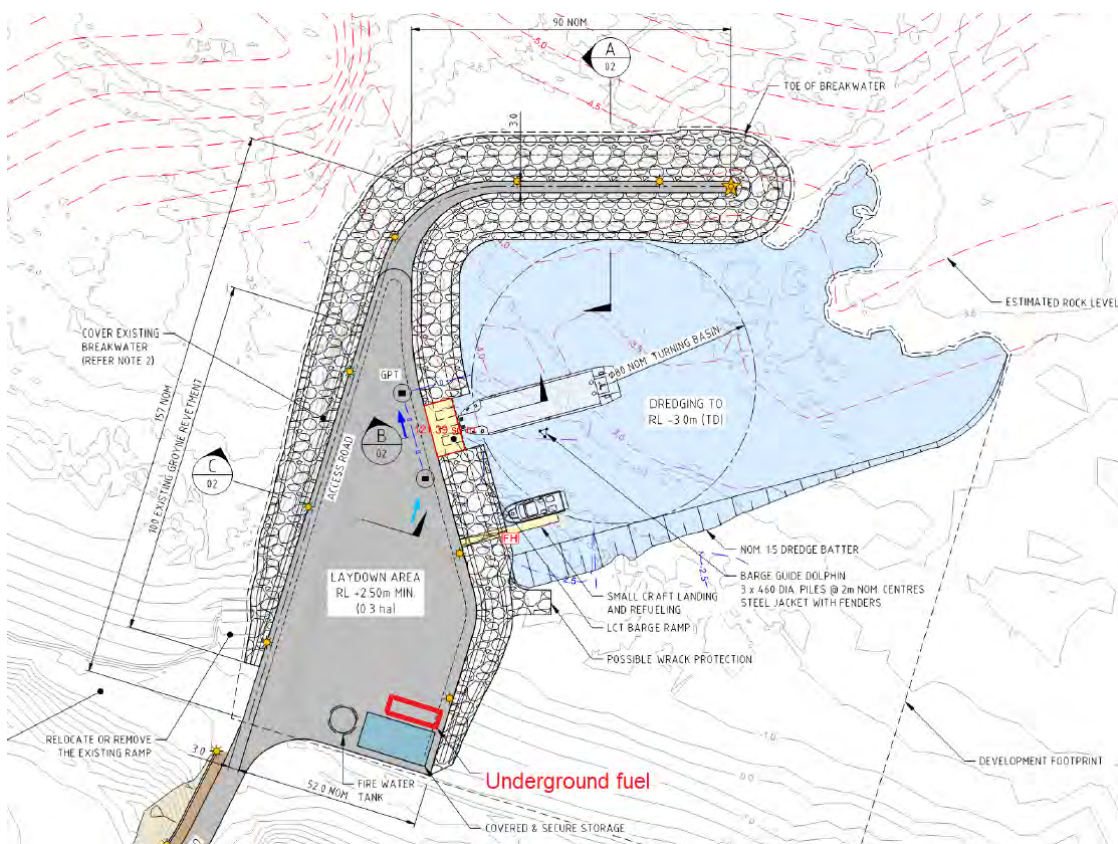


Figure 28: Location of underground fuel storage



9.6 Mitigation

Table 44 demonstrates how the EPA's mitigation hierarchy (avoid, minimise and rehabilitate) has been applied to the environmental factor of marine environmental quality to address the key potential impacts.

Table 44: Application of mitigation hierarchy to marine environmental quality

| Potential impacts                                                                                                                      | Impact class | Mitigation hierarchy | Proposed mitigation measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Residual impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
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| Temporary increase in suspended sediments during construction and dredging activities.                                                 | Direct       | Avoid                | As dredging activities are a requirement for construction of the proposal, an increase in suspended sediments during construction cannot be avoided.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>A temporary increase in suspended sediments within the ZoI, ZoMI and ZoHI</b><br>Implementation of the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to address a temporary increase in TSS / turbidity during construction. Implementation of these management plans ensures that significant impacts to marine environmental quality outside the ZoMI and ZoHI from a temporary increase in suspended sediments are unlikely. |
|                                                                                                                                        |              | Minimise             | <ul style="list-style-type: none"><li>RIA amended the project design to reduce the dredging requirements. By changing the berthing and barge turn pocket, the volume of required dredging was reduced from 26,000 m³ to 16,050 m³</li><li>Management and mitigation proposed during construction to minimise impacts to marine environmental quality is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that:<ul style="list-style-type: none"><li>The area affected by suspended sediments during dredging and construction will be limited (wherever possible) and will not extend past the modelled ZoHI, ZoMI and ZoI shown in Figure 23</li><li>Marine environmental quality will be maintained at a moderate level of ecological protection during dredging and return to a High Level of Ecological Protection within two weeks following completion of dredging</li></ul></li><li>Implementation of the CEMP and DEMMP provides the monitoring and management framework to address potential impacts to marine environmental quality during construction. Key management and monitoring measures include:<ul style="list-style-type: none"><li>Implementation of the Marine Water Quality Monitoring Program (MWQMP) provided in the DEMMP for suspended sediment. This program specifies that if the specified triggers are exceeded, then the following management actions will be implemented to ensure impacts to marine environmental quality do not extend past the modelled zone of influence:<ul style="list-style-type: none"><li>If trigger 1 has been exceeded:<ul style="list-style-type: none"><li>Investigate if Trigger 2 has been exceeded for any sites</li><li>Sample again at the exceeded monitoring site and associated reference site each day until turbidity has decreased</li></ul></li><li>If trigger 2 has been exceeded:<ul style="list-style-type: none"><li>Assess metocean and weather conditions</li><li>Investigate if dredging or disposal has been occurring and if that is likely to be attributable to the exceedance</li><li>Investigate results of the other parameters to determine if there is likely to be stress on the surrounding seagrass</li><li>Sample again at that monitoring site and associated reference site each day until turbidity has decreased</li></ul></li><li>If the trigger levels are exceeded (or indicate a progressive increase towards the Trigger Levels) then modifications to the dredging program are to be considered, and may include, but not necessarily be limited to:<ul style="list-style-type: none"><li>Reactive benthic communities and habitats survey</li><li>Temporary pause to dredging activities (e.g. if exceedance appears to be due to factors other than dredging vessel movements, then pausing dredging activities will minimise cumulative effects)</li><li>Relocate the dredge (e.g. to an area of coarser sediment)</li><li>Reduce the dredge cut depth, rate of swing-speed and/or increase the dredge pump flow</li><li>Reduce disposal of material if the plume is coming from the reclamation area</li></ul></li></ul></li><li>Implementation of the tiered management framework provided in the DEMMP</li><li>Use of silt curtains which will minimise the potential impacts associated with increased suspended sediments</li><li>The placement of geofabric (such as Texcel 1200R) textile weave along the bund wall will ensure that the placement of dredge spoil during reclamation works will not impact or increase the dredge plume zones</li></ul></li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                                                                                                        |              | Rehabilitate         | Impacts to marine water quality from an increase in TSS within the ZoMI and ZoI will be temporary only.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                                                                                                        |              | Offset               | Marine environmental quality offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Increased risk of pollution incidents from vessels and underground fuel storage leading to degradation of marine environmental quality | Indirect     | Avoid                | Construction and operation of the proposal includes vectors which have the potential to result in pollution incidents and risk of this impact cannot be avoided.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>No residual impacts expected</b><br>Implementation of the management and monitoring measures in the CEMP (Emerge, 2024a) (Appendix P), DEMMP (02 Environment, 2024) (Appendix O) and OEMP (Emerge, 2024b) (Appendix Q) will ensure that the residual pollution incident risk is low.                                                                                                                                                                                                                               |
|                                                                                                                                        |              | Minimise             | <ul style="list-style-type: none"><li>Construction management measures to minimise impacts to marine environmental quality is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that the risk for hydrocarbon spills to the marine environment is minimal so that there are no adverse impacts to the marine environment</li><li>Implementation of the CEMP and DEMMP provides the monitoring and management framework to address potential impacts to marine environmental quality during construction. Key management and monitoring measures include:<ul style="list-style-type: none"><li>Implement industry standard hydrocarbon management practices (chemical handling, storage, segregation, and spill response)</li><li>Any construction vessels including piling vessels/barges to establish a sewage and garbage disposal plan</li><li>Undertake vessel maintenance and bunkering in accordance with contractors approved vessel management systems</li><li>Hydrocarbon spills into the marine environment be immediately reported and appropriately remediated</li></ul></li><li>Operational management to minimise impacts to the marine environment is detailed in the OEMP (Appendix Q). Implementation of this management plan will ensure that:<ul style="list-style-type: none"><li>Fuel / oil spill contingency plans are included in the OEMP and includes the provision of clean-up equipment and appropriate disposal of contaminated water and sediment</li><li>Pollution incidents will be reported to the DoT's Marine Environmental Emergency Response (MEER) unit, with clean up managed and monitored in accordance with MEER's requirements</li><li>Pollution incidents will be monitored during operation in accordance with the OEMP, with contingency actions implemented should pollution triggers be breached on a reoccurring basis</li><li>The underground fuel storage facility will be constructed in accordance with AS1940 and as outlined in the OEMP have safety and leak detection equipment installed.</li></ul></li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                                                                                                        |              | Rehabilitate         | Fuel and oil spills to be cleaned up in accordance with the contingency actions outlined in the DEMMP, CEMP and OEMP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                                                                                                        |              | Offset               | Marine environmental quality offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

| Potential impacts                                                                                                                                   | Impact class | Mitigation hierarchy | Proposed mitigation measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Residual impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|--------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Disturbance of sediments from vessel operations (including propeller wash) in shallow water results in a temporary increase in suspended sediments. | Indirect     | Avoid                | Dredging to a depth of RL -3 m will significantly avoid vessel operations disturbing sediments.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>No residual impacts expected</b><br>The project design (proposed of the barge turning basin) and implementation of the OEMP (Appendix Q) ensures that residual impacts to marine environmental quality from a temporary increase in sediments during operation are unlikely.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                     |              | Minimise             | Operational management measures to minimise impacts to the marine environment are detailed in the OEMP (Appendix Q). Implementation of this management plan will ensure that marine users comply with vessel operational restrictions required by DoT and RIA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                     |              | Rehabilitate         | Impacts to marine water quality from operational activities will be temporary only (during vessel use) and due to the proposed design are considered unlikely to be significant. No rehabilitation is considered applicable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                     |              | Offset               | Marine environmental quality offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Temporary decrease in light availability for benthic communities and habitats due to suspended sediments.                                           | Indirect     | Avoid                | As dredging activities are a requirement for construction of the proposal, a decrease in light availability due to an increase in suspended sediments during construction cannot be avoided.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>A temporary decrease in light available to benthic communities and habitats due to an increase in suspended sediments is predicted within the ZoMI only</b><br>As impacts to benthic communities and habitats within the ZoMI will be recoverable within a period of five years following completion of the dredging activities, significant residual impacts are not considered likely. Implementation of the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to address a temporary increase in TSS / turbidity during construction. Implementation of these management plans ensures that impacts to marine environmental quality outside the zones of influence from a temporary increase in suspended sediments are unlikely. |
|                                                                                                                                                     |              | Minimise             | <ul style="list-style-type: none"><li>As discussed in Section 7, temporary impacts from suspended sediments on benthic communities are predicted in the ZoMI only. These impacts include temporary loss of 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack. Baird (2024b) predicts that impacts to these benthic communities and habitats within the ZoMI will be recoverable within a period of five years following completion of the dredging activities</li><li>Management and mitigation proposed during construction to minimise impacts to marine environmental quality is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that:<ul style="list-style-type: none"><li>The area affected by suspended sediments during dredging and construction will be limited (wherever possible) and will not extend past the modelled ZoHI, ZoMI and ZoI shown in Figure 23</li><li>Marine environmental quality will be maintained at a moderate level of ecological protection during dredging and return to a High Level of Ecological Protection within two weeks following completion of dredging</li></ul></li><li>Maintenance dredging (if required) will be undertaken in previously disturbed / sandy areas within the development envelope / project footprint. Maintenance dredging frequency, volumes and disposal will be determined as required. Environmental management and monitoring will be undertaken in a manner that is consistent with the document Maintenance Dredging Environmental Management Framework (BMT Oceanica, 2016) prepared for Department of Transport for similar types of maintenance dredging activities.</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                     |              | Rehabilitate         | Impacts to marine water quality from an increase in TSS within the ZoMI and ZoI will be temporary only.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                     |              | Offset               | Marine environmental quality offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Temporary release of contaminants from marine sediment during dredging and reclamation activities.                                                  | Indirect     | Avoid                | <ul style="list-style-type: none"><li>As dredging activities are a requirement for construction of the proposal, an increase in suspended sediments during construction cannot be avoided</li><li>RIA amended the project design to reduce the dredging requirements. By changing the berthing and barge turn pocket, the volume of required dredging was reduced from 26,000 m<sup>3</sup> to 16,050 m<sup>3</sup>.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>No residual impacts expected</b><br>As all baseline sediment results were below the assessment criteria, residual impacts from the temporary release of contaminants from suspended sediments is considered unlikely.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                                                                                                     |              | Minimise             | <ul style="list-style-type: none"><li>The risk of temporary release of contaminants from marine sediments during dredging and reclamation activities will be minimal as all baseline sediment results did not record contaminants above the assessment criteria</li><li>Management and mitigation proposed during construction to minimise impacts to marine environmental quality is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that the area affected by suspended sediments during dredging and construction will be limited (wherever possible) and will not extend past the modelled ZoHI, ZoMI and ZoI shown in Figure 23</li><li>The CEMP and DEMMP provides the monitoring and management framework to address potential impacts to marine environmental quality during construction.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                     |              | Rehabilitate         | Impacts to marine water quality from a potential release of contaminants from suspended sediments will be temporary only.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                     |              | Offset               | Marine environmental quality offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Disturbance of sediments from maintenance dredging during operation.                                                                                | Direct       | Avoid                | The requirement for maintenance dredging will only be undertaken when required.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>No residual impacts expected</b><br>Maintenance dredging will be undertaken in accordance with Maintenance Dredging Environmental Management Framework (BMT Oceanica, 2016) prepared for Department of Transport.<br>This will ensure that the residual risk of increased TSS from the disturbance of sediments from maintenance dredging is low.                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                                                                                                                                                     |              | Minimise             | <ul style="list-style-type: none"><li>Maintenance dredging (if required) will be undertaken in previously disturbed / sandy areas within the development envelope / project footprint. Maintenance dredging frequency, volumes and disposal will be determined as required. Environmental management and monitoring will be undertaken in a manner that is consistent with the document Maintenance Dredging Environmental Management Framework (BMT Oceanica, 2016) prepared for Department of Transport for similar types of maintenance dredging activities.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                     |              | Rehabilitate         | Impacts to marine water quality from an increase in TSS will be temporary only.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                                                                                                     |              | Offset               | Marine environmental quality offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

## 9.7 Assessment and significance of residual impact

The anticipated significance of the residual impacts from the proposal following the implementation of mitigation measures are low and the residual impacts are summarised below:

- Temporary suspended sediments within the ZoHI (1.37 ha), ZoMI (4.5 ha) and ZoI (13.44 ha)
- Temporary reduction in light due to suspended sediments in the water column within the ZoMI (4.5 ha) may impact benthic communities and habitats. As impacts to benthic communities and habitats within the ZoMI will be recoverable within a period of five years following completion of the dredging activities, these residual impacts are not considered significant.

The predicted residual impacts to marine environmental quality from the proposal is considered manageable through implementation of the CEMP, DEMMP and OEMP. With implementation of the mitigation measures proposed in these management plans, the residual impacts are not considered significant as discussed in Table 45.

**Table 45: Consideration of the significance of the residual impacts on marine environmental quality**

| Matters for consideration                                                                                                                                | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The object and principles of the EP Act                                                                                                                  | <p>The principles of the EP Act have been addressed in relation to the proposal (Table 26).</p> <p>Implementation of the CEMP, DEMMP and OEMP provides monitoring and management actions to identify and to address potential impacts during construction and operation.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Values, sensitivity and quality of the environment which is likely to be impacted                                                                        | <p>Baseline marine sediment and water quality investigations have been undertaken to determine the existing marine environmental quality values and sensitivity of the receiving marine environment.</p> <p>Given the low levels of contaminants of potential concern in the sediments, it is not expected that the suspension of contaminants within these sediments will have a significant impact on the marine environment.</p> <p>As discussed in Section 7, benthic communities and habitats may be sensitive to changes in marine environmental quality. This is discussed further in Section 7.</p> <p>With the proposed construction and operation mitigation management framework outlined in the CEMP, DEMMP and OEMP, the residual impact of the proposal is considered to be manageable.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| All stages and components of the proposal (such as any infrastructure required for the proposal to be practicably implemented, or a proposal life cycle) | <p>All stages of the proposal (i.e. construction and operation) have been included in this impact assessment</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Extent (intensity, duration, magnitude, and geographic footprint) of the likely impacts                                                                  | <p>During the construction phase of the proposal, the following activities and resulting impacts have the potential to adversely affect marine environmental quality:</p> <ul style="list-style-type: none"> <li>• Construction, dredging and reclamation activities have the potential to: <ul style="list-style-type: none"> <li>– Temporary increase in suspended solids, as discussed in Section 9.5.1.1.</li> <li>– Reduce light within the ZoHI and ZoMI. This impact is discussed further in Section 7, benthic communities and habitats.</li> <li>– Result in unplanned release of chemicals and / or hydrocarbons from fuel leaks from vessels, accidental vessel collision and ship grounds as discussed in Section 9.5.1.2.</li> </ul> </li> </ul> <p>During operation of the proposal, potential impacts to marine environmental quality are limited to the following activities:</p> <ul style="list-style-type: none"> <li>• Unplanned release of chemicals and / or hydrocarbons from onshore fuel storage, fuel leaks from vessels, accidental vessel collision and ship grounds as discussed in Section 9.5.1.2.</li> <li>• Vessel operations (including propeller wash) in shallow water may disturb sediments, resulting in a temporary decrease in light availability for benthic communities and habitats. This impact is discussed further in Section 7 Benthic communities and habitats.</li> </ul> |



| Matters for consideration                                                                                                              | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|----------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                        | <p>These impacts to marine environmental quality from the proposal are considered to be manageable through implementation of the CEMP, DEMMP and OEMP. With implementation of these management plans, the residual impacts are limited to:</p> <ul style="list-style-type: none"> <li>• Temporary suspended sediments within the ZoMI (4.5 ha) and Zol (13.44 ha)</li> <li>• Temporary reduction in light due to suspended sediments in the water column within the ZoMI (4.5 ha). As impacts to benthic communities and habitats within the ZoMI will be recoverable within a period of five years following completion of the dredging activities, these residual impacts are not considered significant.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Resilience of the environment                                                                                                          | <p>Existing boating facilities within Thomson Bay includes the existing jetty and moorings. Baseline marine sediment and water investigations indicate that these activities do not have a significant impact on the marine environment within Thomson Bay. Therefore, it is considered that the marine environment will be resilient to potential changes from implementation of the proposal</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Consequence of the application of the mitigation hierarchy to the proposal.                                                            | <p>The WA Offsets Guidelines (Government of Western Australia 2014) identifies four levels of significance for residual impacts:</p> <ul style="list-style-type: none"> <li>• Unacceptable impacts – those impacts that are environmentally unacceptable or where no offset can be applied to reduce the impact. Offsets are not appropriate in all circumstances, as some environmental values cannot be offset.</li> <li>• Significant impacts requiring an offset – any significant residual impact of this nature will require an offset. These generally relate to any impacts to species, ecosystems, or reserve areas protected by statute or where the cumulative impact is already determined to be at a critical level.</li> <li>• Potentially significant impact which may require an offset – the residual impact may be significant depending on the context and extent of the impact. These relate to impacts that are likely to result in a species or ecosystem requiring protection under statute or increasing the cumulative impact to a critical level. Whether these impacts require an offset will be determined by the decision-maker based on information provided by the proponent or applicant and expert judgement</li> <li>• Impacts which are not significant – impacts that do not trigger the above categories are not expected to have a significant impact on the environment and therefore do not require an offset</li> </ul> <p>Following the application of the mitigation hierarchy (Table 44) and taking into consideration the above significance of residual impacts model, RPS considers that there are no significant residual impacts to marine environmental quality from the proposal.</p> |
| Level of confidence in the prediction of residual impacts and the success of proposed mitigation                                       | <p>The impact assessment has been completed with a high level of confidence in the predictions of residual impacts on marine environmental quality with the required scientific assessments conducted (e.g. baseline marine sediment and water investigations) in accordance with relevant guidelines (Table 40).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Public interest about the likely effect of the proposal or scheme, if implemented, on the environment, and relevant public information | <p>RIA has facilitated regular meetings / dialogue with the local community and key stakeholders (Table 25) as part of the project.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |

Cumulative impacts from the proposal have been considered in relation to other proposals within 5 km of the proposal and are discussed in Section 18.

Holistic impacts are discussed in Section 17.

## 9.8 Environmental outcomes

In consideration of the proposed avoidance and management measures and likely residual impacts associated with the proposal, the environmental outcomes that apply to marine environmental quality are:

- Environmental outcomes for construction of the proposal:
  - Marine environmental quality will be temporarily reduced to a Moderate Level of Ecological Protection during construction but will return to a High Level of Ecological Protection two weeks after completion of dredging and construction activities.

- 
- No reported hydrocarbon spills or release of waste into the marine environment from construction and dredging activities.
  - Maintain the marine environmental quality outside the predicted zones of influence as defined by dredge modelling (ZoHI, ZoMI and ZoI).
  - Environmental outcomes for operation of the proposal:
    - Marine environmental quality is maintained at a High Level of Ecological Protection within and adjacent to the project footprint.
    - No reported hydrocarbon spills or release of waste into the marine environment from operational activities associated with the proposal.

As the impact assessment identified low residual risks to marine environmental quality following the application of mitigation actions identified herein, it is considered that the proposal will successfully meet the EPA's objective to maintain the quality of water, sediment and biota so that environmental values are protected.

## 10 MARINE FAUNA

### 10.1 EPA objective

To protect marine fauna so that biological diversity and ecological integrity are maintained.

### 10.2 Policy and guidance

The proposal will be subject to compliance with applicable policies and guidance developed to assist proponents and the public to understand the minimum requirements for the protection of elements of the environment that the EPA expects to be met during the assessment process.

Table 46 lists relevant EPA guidance, other state and Commonwealth legislation / policy, and provides consideration for how these documents informed the proposal.

**Table 46: Relevant legislation, policy and guidance**

| Legislation, policy and guidance                                                                        | Consideration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Environment Protection and Biodiversity Conservation Act 1999</i>                                    | A search of DCCEEW's PMST was undertaken within a 5 km radius of the proposal to determine the MNES that are either known or likely to occur proximate to the proposal (Appendix R).<br>Information contained in Commonwealth conservation advice, recovery plans and species profile and threats database records have been referenced to inform the assessment of impacts to marine species.<br>A discussion of potential impacts on MNES is discussed in Section 14.2.                                                                                                                                                                                |
| <i>Biodiversity Conservation Act 2016</i>                                                               | A search of the DBCA's NatureMap database was undertaken to determine a list of conservation significant fauna and flora species that have been recorded within 10 km of the proposal (Appendix R).                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Environmental Factor Guideline: Marine Fauna<br>(EPA, 2016j)                                            | The environmental factor guideline identifies the highly diversity of marine fauna and acknowledges the importance of protecting marine fauna for their ecological roles, iconic nature and importance society places on them. These considerations were underpinned as part of the marine fauna desktop analysis provided in Appendix B and summarised in Section 10 of this report. Implementation of the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to address an increase in threats from human interaction during construction and operation of the proposal. |
| National Biofouling Management Guidelines for Non-trading Vessels<br>(Commonwealth of Australia, 2009a) | Implementation of the CEMP (Emerge, 2024a) (Appendix P) and OEMP (Emerge, 2024b) (Appendix Q) provides the management framework to mitigate risks posed by accidental marine species introduction during construction and operation activities. The IMS mitigation measures outlined in the management plans are consistent with the guidelines.                                                                                                                                                                                                                                                                                                         |
| National Biofouling Management Guidelines for Commercial Vessels<br>(Commonwealth of Australia, 2009b)  | Implementation of the CEMP (Emerge, 2024a) (Appendix P) and OEMP (Emerge, 2024b) (Appendix Q) provides the management framework to mitigate risks posed by accidental marine species introduction during construction and operation activities. The IMS mitigation measures outlined in the management plans are consistent with the guidelines.                                                                                                                                                                                                                                                                                                         |

### 10.3 Environmental investigations

#### 10.3.1 Marine fauna

A desktop marine fauna assessment was undertaken as part of the South Thomson Barge Landing Development Marine Fauna and Benthic Habitat Assessment (RPS, 2024a) and included assessment of conservation (national and WA state listed species) and non-conservation important marine species, that may be present in the Thomson Bay area. Fauna protected under the EPBC Act and BC Act was identified via desktop searches, as described below:

- A desktop search of the DBCA Threatened, Specially Protected and priority fauna database (DBCA database) was undertaken on request of RPS by the DBCA on 3 November 2023



- A search of DCCEE's PMST
- The online literature search utilised the following resources to identify fish species recorded in the waters in and around Thomson Bay:
  - Hoschke, A. Whisson, G. & Moore, G. I. 2019. Complete list of fishes from Rottnest Island 2019. Compiled from a range of sources (including previous literature, ALA records and Reef Life Survey data)
  - iNaturalist citizen science observation platform: Fishes of Rottnest Island (iNaturalist, 2023), which compiles up-to-date citizen science observations of marine fishes around Wadjemup / Rottnest Island
  - Reef Life Survey (RLS) citizen science program data (AODN, 2023). Utilises trained scuba-divers to undertake standardised visual surveys in areas around Australia, including Wadjemup / Rottnest Island.

### 10.3.2 Marine fauna habitat

A benthic communities and habitat assessment was undertaken to support the proposal. Site investigations and results are discussed further in Section 7.3.

### 10.3.3 Underwater noise assessment

An underwater acoustic assessment was undertaken by Tetra Tech (2024) (Appendix S) for two piling methodologies at the piling locations shown in Figure 29.



**Figure 29: Underwater noise modelling – piling locations**

## 10.4 Receiving environment

### 10.4.1 Benthic communities and habitats

Benthic habitat within South Thomson Bay is varied and includes seagrass meadows that include *P. sinuosa* and *P. australis*. Other benthic habitat within Thomson Bay includes macroalgae and bare sand, the latter which may be covered by wrack that accumulates seasonally (RPS, 2024a).

Benthic habitats are discussed further in Section 7 of this report.

### 10.4.2 Biologically important areas

The development envelope is within the Biologically Important Areas (BIA) for the species listed below. BIAs are regions where aggregations of individuals of a particular species are known or likely to display behaviours such as breeding, foraging, nesting or migration. BIAs were created to inform decision making under the EPBC Act.

- Bridled tern (the development envelope is within the foraging BIA for this species)
- Caspian tern (the development envelope is within the foraging BIA for this species)
- Fairy tern (the development envelope is within the foraging BIA for this species)
- Flesh footed shearwater (the development envelope is within the aggregation BIA for this species)
- Little penguin (the development envelope is within the foraging BIA for this species)
- Little shearwater (the development envelope is within the foraging BIA for this species)
- Pacific gull (the development envelope is within the foraging BIA for this species)
- Roseate tern (the development envelope is within the foraging BIA for this species)
- Wedge-tailed shearwater (the development envelope is within the foraging BIA for this species)
- Australian sea lion (the development envelope is within the foraging BIA for this species)
- Pygmy blue whale (the development envelope is within the distribution BIA for this species)
- Southern right whale (the development envelope is within the migration BIA for this species).

The potential for these species to occur within or adjacent to the development envelope is discussed further in the following sections.

### 10.4.3 Conservation significant marine fauna species

Based on the database searches and literature review undertaken to support the proposal (Appendix B), the species listed in (Table 47) may occur within South Thomson Bay (RPS, 2024a). Those species considered most likely to occur proximate to the development envelope are discussed in the following sections.

Marine and migratory species listed under the EPBC Act are discussed in Section 14.2.

Table 47: Conservation significant marine fauna species (RPS, 2024a)

| Name                                             |                                          | Conservation status    |              | Distribution at Wadjemup / Rottnest Island and surrounding waters* | Habitat and seasonal preferences                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------|------------------------------------------|------------------------|--------------|--------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Species                                          | Common                                   | EPBC Act               | BC Act       |                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Fish                                             |                                          |                        |              |                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>Acentronura australe</i>                      | Southern pygmy pipehorse                 | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit algal reefs and seagrass beds, to depths of up to 30 m (Fishes of Australia (FoA), 2024).                                                                                                                                                                                                                                                                                                                                          |
| <i>Campichthys galei</i>                         | Gale's pipefish                          | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit shelly or rubble substrates and sparse seagrass beds, to depths of up to 18 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                         |
| <i>Choeroichthys suillus</i>                     | Pig-snouted pipefish                     | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit rubble habitats of inshore coral reefs, to depths of up to 15 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                                       |
| <i>Halicampus brocki</i>                         | Brock's pipefish                         | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit coral and algal reefs, to depths of up to 45 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                                                        |
| <i>Heraldia nocturna</i>                         | Upside-down pipefish                     | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit sheltered inshore rocky reefs, to depths of up to 30 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                                                |
| <i>Hippocampus angustus</i>                      | Western spiny seahorse                   | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit sheltered algal reefs and seagrass beds, to depths of up to 30 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                                      |
| <i>Hippocampus breviceps</i>                     | Short-head seahorse                      | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit shallow seagrass and macroalgal beds, to depths of up to 15 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                                         |
| <i>Hippocampus subelongatus</i>                  | West Australian seahorse                 | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit macroalgal beds, muddy substrates, jetty pylons and moorings to depths of up to 25 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                  |
| <i>Histiogamphelus cristatus</i>                 | Rhino pipefish                           | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit seagrass beds and adjacent sandy areas, to depths of up to 17 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                                       |
| <i>Lissocampus caudalis</i>                      | Australian smooth pipefish               | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit rubble habitats, macroalgal beds and seagrass beds and rocky reefs, to depths of up to 15 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                           |
| <i>Lissocampus fatiloquus</i>                    | Prophet's pipefish                       | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit rocky and sand habitats, and seagrass and macroalgal beds, to depths of up to 10 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                    |
| <i>Lissocampus runa</i>                          | Javelin pipefish                         | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit seagrass and macroalgal beds and rubble substrates, to depths of up to 20 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                           |
| <i>Maroubra perserrata</i>                       | Sawtooth pipefish                        | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit coral reefs, to depths of up to 25 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                                                                  |
| <i>Mitotichthys meraculus</i>                    | Western crested pipefish                 | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit seagrass beds to depths of up to 10 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>Nannocampus subosseus</i>                     | Bony-headed pipefish                     | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit a range of habitats including seagrass and macroalgal beds, sandy and coral reef habitats, to depths of up to 14 m (FoA, 2024).                                                                                                                                                                                                                                                                                                    |
| <i>Phycodurus eques</i>                          | Leafy seadragon                          | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit seagrass beds and algal reefs, to depths of up to 50 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                                                |
| <i>Phyllopteryx taeniolatus</i>                  | Common seadragon                         | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit seagrass beds and algal reefs, to depths of up to 50 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                                                |
| <i>Pugnaso curtirostris</i>                      | Pugnose pipefish                         | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit shallow seagrass and macroalgal beds, to depths of up to 11 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                                         |
| <i>Solegnathus lettiensis</i>                    | Gunther's pipefish                       | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Little is known about the habitat for this species.                                                                                                                                                                                                                                                                                                                                                                                        |
| <i>Stigmatopora argus</i>                        | Spotted pipefish                         | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit seagrass beds, to depths of up to 8 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>Stigmatopora nigra</i>                        | Widebody pipefish                        | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit sheltered seagrass and macroalgal beds, to depths of up to 35 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                                       |
| <i>Syngnathoides biaculeatus</i>                 | Double-end pipefish                      | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit seagrass and macroalgal beds, to depths of up to 10 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                                                 |
| <i>Urocampus carinirostris</i>                   | Hairy pipefish                           | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit seagrass beds, to depths of up to 6 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>Vanacampus margaritifer</i>                   | Mother-of-pearl pipefish                 | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit seagrass and macroalgal beds, rocky and sandy substrates, to depths of up to 15 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                     |
| <i>Vanacampus phillipi</i>                       | Port Phillip pipefish                    | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit seagrass and macroalgal beds, to depths of up to 25 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                                                 |
| <i>Vanacampus poecilolaemus</i>                  | Longsnout pipefish                       | Listed (Marine)        | Not included | Species or species habitat may occur within area                   | Inhabit shallow seagrass and macroalgal beds, to depths of up to 18 m (FoA, 2024).                                                                                                                                                                                                                                                                                                                                                         |
| Sharks                                           |                                          |                        |              |                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>Sphyrna lewini</i>                            | Scalloped hammerhead                     | Conservation Dependent | Not included | Species or species habitat likely to occur within area             | Undertake annual foraging and breeding migrations. Known to aggregate in the Shoalwater Islands Marine Park, where peak numbers are observed during January and February (López, 2023).                                                                                                                                                                                                                                                    |
| <i>Carcharias taurus</i> (west coast population) | Grey nurse shark (west coast population) | Vulnerable             | Vulnerable   | Congregation or aggregation known to occur within area             | Year-round presence. Seasonal migration patterns have not been observed (DCCEEW, 2023b).                                                                                                                                                                                                                                                                                                                                                   |
| <i>Carcharodon carcharias</i>                    | White shark                              | Vulnerable, Migratory  | Vulnerable   | Species or species habitat known to occur within area              | Have been shown to undertake migrations north along the WA coast during spring and return in summer; however, coastal movements are not synchronous. They are frequently recorded in waters around fur seal and sea lion colonies, including in the Perth region (DCCEEW, 2023b), where they are more likely to be present during spring and early summer and least likely to be present during late summer and autumn (SharkSmart, 2018). |



| Name                                    |                                     | Conservation status   |                                                | Distribution at Wadjemup / Rottnest Island and surrounding waters*                                                                                                                           | Habitat and seasonal preferences                                                                                                                                                                                                                                                                                                                                             |
|-----------------------------------------|-------------------------------------|-----------------------|------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Species                                 | Common                              | EPBC Act              | BC Act                                         |                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                              |
| Mammals                                 |                                     |                       |                                                |                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                              |
| <i>Neophoca cinerea</i>                 | Australian sea lion                 | Endangered            | Endangered                                     | Species or species habitat likely to occur within area. The development footprint is located within the foraging BIA for this species.                                                       | Has an asynchronous non-annual breeding cycle with cycles ranging from 16 to 20 months and pupping occurring at different times throughout the South-West Marine Region (DCCEEW, 2023b).                                                                                                                                                                                     |
| <i>Eubalaena australis</i>              | Southern right whale                | Endangered, Migratory | Vulnerable                                     | The development footprint is located within the migratory BIA for this species†                                                                                                              | Southern temperate to subpolar waters including marine areas of southern Australia from May to October. The migratory period within the migration BIA up the west coast of WA is April to October (National Conservation Values Atlas, 2023).                                                                                                                                |
| <i>Balaenoptera musculus brevicauda</i> | Pygmy blue whale                    | Endangered            | Endangered (as <i>Balaenopter a musculus</i> ) | Known to occur in the area. The development footprint is located within the distribution BIA for this species.                                                                               | The northbound migration past Perth Canyon occurs between April and July (peak May to June), with the return migration from October to January (peak November to early December.                                                                                                                                                                                             |
| <i>Megaptera novaeangliae</i>           | Humpback whale                      | Migratory             | Conservation Dependent, Migratory              | Species or species habitat known to occur within area. The development footprint is located within the migratory BIA for this species.                                                       | The annual peak northbound migration along the Jurien Bay to Carnarvon migration route occurs between June and July, while the southbound migration peak occurs between September and October (DCCEEW, 2023b).                                                                                                                                                               |
| <i>Orcinus orca</i>                     | Killer whale, orca                  | Migratory             | Migratory                                      | Species or species habitat may occur within area                                                                                                                                             | Mating is known to occur all year round, whilst the calving season spans several months. However, no areas of significance and no determined migration routes have been identified for this species within waters off WA (DCCEEW, 2023b). They are typically present on the south coast of WA between January to April.                                                      |
| <i>Arctocephalus forsteri</i>           | New Zealand fur seal                | Listed (Marine)       | Other Specially Protected                      | Species or species habitat may occur within area. The New Zealand fur seal colony on Wadjemup / Rottnest Island is located at Cathedral Rocks on the west end of Wadjemup / Rottnest Island. | Present year round (ALA, 2023)                                                                                                                                                                                                                                                                                                                                               |
| <i>Balaenoptera acutorostrata</i>       | Minke whale                         | Listed (Cetacean)     | Migratory                                      | Species or species habitat may occur within area                                                                                                                                             | May migrate from high latitude areas in the summer to low latitude areas in the winter. The detailed pattern of seasonal migration is generally poorly understood (ALA, 2023).                                                                                                                                                                                               |
| <i>Tursiops aduncus</i>                 | Indian Ocean bottlenose dolphin     | Listed (Cetacean)     | Not included                                   | Species or species habitat likely to occur within area                                                                                                                                       | Present year-round. Movement patterns in Australia are variable.                                                                                                                                                                                                                                                                                                             |
| <i>Tursiops truncatus s. str.</i>       | Bottlenose dolphin                  | Listed (Cetacean)     | Not included                                   | Species or species habitat may occur within area                                                                                                                                             | Seasonal movements are variable, and may include residency in small areas, long-range movements, and migration (DCCEEW, 2023b).                                                                                                                                                                                                                                              |
| <i>Stenella longirostris</i>            | Spinner dolphin                     | Listed (Cetacean)     | Priority 4, Migratory                          | Sighted in field survey in DBCA database data. Assumed species or species habitat may occur within area.                                                                                     | No seasonal differences, but mostly offshore species (ALA, 2023)                                                                                                                                                                                                                                                                                                             |
| Reptiles                                |                                     |                       |                                                |                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                              |
| <i>Caretta caretta</i>                  | Loggerhead turtle                   | Endangered, Migratory | Endangered                                     | Foraging, feeding or related behaviour known to occur within area                                                                                                                            | Generally nesting in summer at nesting grounds in northern WA (not necessarily every year; ALA, 2023).                                                                                                                                                                                                                                                                       |
| <i>Dermochelys coriacea</i>             | Leatherback turtle                  | Endangered, Migratory | Vulnerable                                     | Species or species habitat known to occur within area                                                                                                                                        | Migrates from foraging areas to nesting beaches in tropical and subtropical regions during summer (ALA, 2023; DCCEEW, 2023b).                                                                                                                                                                                                                                                |
| <i>Chelonia mydas</i>                   | Green turtle                        | Vulnerable, Migratory | Vulnerable                                     | Foraging, feeding or related behaviour known to occur within area                                                                                                                            | Migrates from foraging areas to nesting beaches in tropical regions during summer, typically between November and March (DCCEEW, 2023b).                                                                                                                                                                                                                                     |
| <i>Pelamis platurus</i>                 | Yellow-bellied sea snake            | Listed (Marine)       | Not included                                   | Species or species habitat may occur within area                                                                                                                                             | Seasonal movements have not been observed in Australia hence may be present year-round.                                                                                                                                                                                                                                                                                      |
| Birds                                   |                                     |                       |                                                |                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                              |
| <i>Limosa lapponica menzbieri</i>       | Northern Siberian bar-tailed godwit | Critically Endangered | Critically Endangered                          | Species or species habitat known to occur within area                                                                                                                                        | The northern Siberian bar-tailed godwit occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays (TSCC, 2016).                                                                                                                                                                           |
| <i>Calidris tenuirostris</i>            | Great knot                          | Critically Endangered | Critically Endangered                          | Roosting known to occur within area                                                                                                                                                          | The great knot has been recorded around the entirety of the Australian coast and is common on the coasts of the Pilbara and Kimberley, from the Dampier Archipelago to the Northern Territory border. Great knots prefer sheltered coastal habitats with large intertidal mudflats or sandflats. This includes inlets, bays, harbours, estuaries and lagoons (DCCEEW, 2023). |
| <i>Calidris ferruginea</i>              | Curlew sandpiper                    | Critically Endangered | Critically Endangered                          | Species or species habitat known to occur within area                                                                                                                                        | In Western Australia, the curlew sandpiper is widespread around coastal and subcoastal plains from Cape Arid to south-west Kimberley Division. They mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons.                                                                                                             |
| <i>Numenius madagascariensis</i>        | Eastern curlew                      | Critically Endangered | Critically Endangered                          | Species or species habitat likely to occur within area                                                                                                                                       | The eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (Cornel University 2023).                                                                                                                                   |
| <i>Charadrius mongolus</i>              | Lesser sand plover                  | Endangered            | Endangered                                     | Roosting known to occur within area                                                                                                                                                          | The lesser plover mainly occurs in northern and eastern Australia, rare in south-western Australia. The species is almost strictly coastal, preferring sandy beaches, mudflats of coastal bays and estuaries, sand flats and dunes near the coast (Cornell University, 2023).                                                                                                |

| Name                            |                          | Conservation status |            | Distribution at Wadjemup / Rottnest Island and surrounding waters*                                                             | Habitat and seasonal preferences                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|---------------------------------|--------------------------|---------------------|------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Species                         | Common                   | EPBC Act            | BC Act     |                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <i>Calidris canutus</i>         | Red knot                 | Endangered          | Endangered | Species or species habitat known to occur within area                                                                          | The red knot mainly inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts and sometimes on sandy ocean beaches or shallow pools on exposed rock platforms (Higgins, 1996)                                                                                                                                                                                                                                                                                                                       |
| <i>Rostratula australis</i>     | Australian painted snipe | Endangered          | Endangered | Species or species habitat may occur within area                                                                               | The Australian painted snipe lives in shallow freshwater (occasionally brackish) wetlands, both ephemeral and permanent, such as lakes, swamps, claypans, inundated or waterlogged grassland/saltmarsh (TSSC, 2013)                                                                                                                                                                                                                                                                                                     |
| <i>Charadrius leschenaultii</i> | Greater sand plover      | Vulnerable          | Vulnerable | Species or species habitat known to occur within area                                                                          | Mainly occurs on sheltered sandy, shelly or muddy beaches, large intertidal mudflats, sandbanks, salt marshes, estuaries, coral reefs, rocky islands rock platforms, tidal lagoons and dunes near the coast (Cornel University 2023).                                                                                                                                                                                                                                                                                   |
| <i>Sternula nereis nereis</i>   | Australian fairy tern    | Vulnerable          | Vulnerable | Foraging, feeding or related behaviour known to occur within area. Migrant breeding, breeding habitat present within the area. | In south-western Australia, the fairy tern breeds between October and March with peak breeding between December and January. The natural jetty at the end of Philip Point is an important roost site for fairy terns.                                                                                                                                                                                                                                                                                                   |
| <i>Eudyptula minor</i>          | Little penguin           | Marine              |            | Breeding known to occur within area.                                                                                           | In the Perth region, it breeds in seawalls, in limestone rock cavities and underneath vegetation. The closest known breeding colonies are Garden Island and Penguin Island. No known breeding occurs on Wadjemup / Rottnest Island; however South Thomson Bay is within the foraging BIA for this species                                                                                                                                                                                                               |
| <i>Onychoprion anaethetus</i>   | Bridled tern             | Marine Migratory    |            | Breeding known to occur within area.                                                                                           | The bridled tern is a common visitor to Rottnest to breed (Rottnest Island Authority, 2019). It forms small colonies and nests on the ground usually in areas sheltered by plants, ledges or caves. There are no known breeding colonies within the vicinity of the proposal and due to the high level of disturbances from recreational users at Thomson Bay, there are unlikely to be any significant roosting sites within vicinity of the proposal. Consequently, impacts as a result of the proposal are unlikely. |
| <i>Hydroprogne caspia</i>       | Caspian tern             | Marine Migratory    |            | Breeding known to occur within area.                                                                                           | The proposal is located within the foraging BIA for the Caspian tern and a small number of Caspian terns roost at Natural Jetty. As there are no known breeding colonies or roosting habitat for this species within the development envelope, significant direct impacts are unlikely.                                                                                                                                                                                                                                 |
| <i>Thalasseus bergii</i>        | Crested tern             | Marine Migratory    |            | Breeding known to occur within area.                                                                                           | The crested tern is the most common tern on the island, with the main nesting colonies located on Lake Baghdad and Herschel Lake (Rottnest Island Authority, 2019b). The crested tern may roost at the Natural Jetty. As there are no known breeding colonies or roosting habitat for this species within the development envelope, significant direct impacts are unlikely.                                                                                                                                            |
| <i>Sterna dougallii</i>         | Roseate tern             | Marine Migratory    |            | Breeding known to occur within area.                                                                                           | The proposal is located within the foraging BIA for the roseate tern. As there are no known breeding colonies or roosting habitat for this species within the development envelope, significant direct impacts are unlikely. However, as roseate terns roost at Natural Jetty, potential indirect impacts to this species have been considered.                                                                                                                                                                         |
| <i>Ardenna pacifica</i>         | Wedge-tailed shearwater  | Marine Migratory    |            | Breeding known to occur within area.                                                                                           | The wedge tailed shearwater is known to breed in burrows on Wadjemup / Rottnest Island between August to May (DCCEEW, 2023). Significant breeding habitat for this species is located on the west end of the island, such as on Cape Vlamingh, and impacts to this species or its habitat are unlikely as a result of the proposal.                                                                                                                                                                                     |
| <i>Pandion haliaetus</i>        | Osprey                   | Marine Migratory    |            | Breeding known to occur within area                                                                                            | The osprey is known to breed on stacks at the west end of the island (Holsworth, 1965) and is not known to breed within or proximate to the development envelope.                                                                                                                                                                                                                                                                                                                                                       |

\*As listed in the PMST search results and/or Atlas of Living Australia (ala.org.au)

<sup>†</sup> Although the PMST search indicates that breeding by *E. australis* may occur within the PMST search area, a review of the online National Conservation Values Atlas indicates that this is not the case and only the migration BIA for the species overlaps Thomson Bay

Definitions: BC Act = *Biodiversity Conservation Act 2016* (WA), BIA = Biologically Important Area, DBCA = Department of Biodiversity, Conservation and Attractions (WA), EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)

Priority 4 = Rare, Near Threatened and other species in need of monitoring (BC Act)

Other Specially Protected = Species otherwise in need of special protection (BC Act)

### 10.4.3.1 Marine mammals

#### 10.4.3.1.1 New Zealand fur seal

There is a colony of New Zealand fur seal located on the west end of Wadjemup / Rottnest Island. Therefore, although the development envelope is not located within vicinity of any important breeding habitat for this species, the New Zealand fur seal is likely to forage in the waters around the development envelope.

#### 10.4.3.1.2 Australia sea lion

The South West Marine Region is an important foraging and breeding region for Australian sea lions, with 99% of the population occurring within the SWMR (McClatchie, 2006).

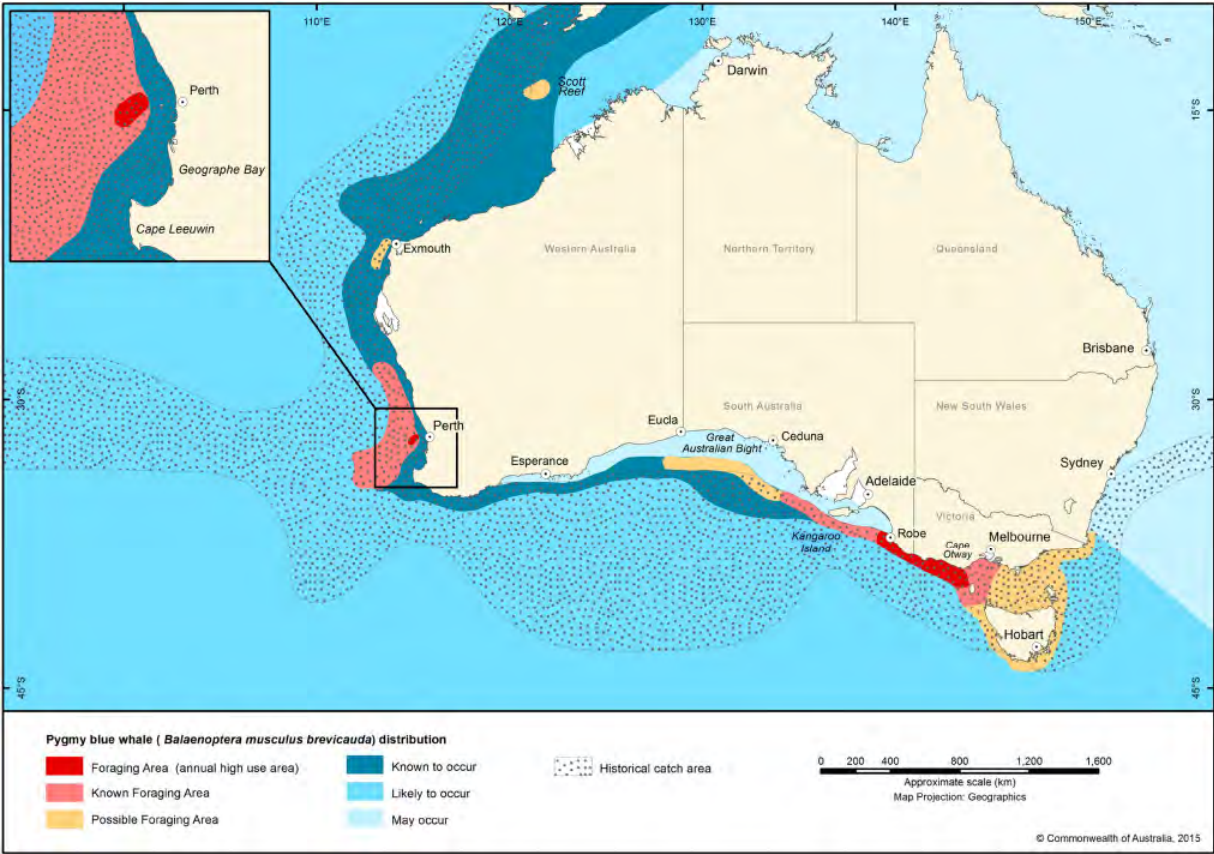
The Australia sea lion foraging BIA extends along the west coast of Australia, south of Geraldton down to Perth. The development envelope overlaps the foraging BIA for this species. As such, this species is likely to occasionally occur within or within vicinity of the development envelope. There are no known breeding or haul out sites on the island.

#### 10.4.3.1.3 Whales

Cetacean species, such as the pygmy blue whale (*Balaenoptera musculus brevicauda*), southern right whale (*Eubalaena australis*) and humpback whale (*Megaptera novaeangliae*), are known to transit between Southern Ocean feeding grounds and tropical water breeding grounds. Consideration of the important of critical habitats for whale species which may occur proximate to South Thomson Bay (Table 47):

- Humpback whale (Migratory)
  - The humpback whale migration, breeding, and calving BIA extend along the length of the WA coast, to its northernmost extent offshore of the Kimberley. The migration BIA overlaps the development envelope and this species may occur proximate to the development envelope.
- Pygmy blue whale (Endangered, Migratory)
  - Wadjemup / Rottnest Island is located within the known distribution of this species, but outside of the known foraging areas (Figure 30). Pygmy blue whale migration and known foraging area BIAs pass along the shelf edge at depths between 500 m and 1,000 m. Although the development envelope does not occur within the known foraging BIA or migration BIA for this species, the west end of Wadjemup / Rottnest Island is located within a BIA and it is therefore likely that this species occurs proximate to the development envelope during migration. The northern migration of the pygmy blue whale (from Augusta to Derby) occurs between April and July (peak periods in May and June), with a return southbound migration from October to January (peak periods in November and December) (McCauley R.D. and Jenner, 2010).
- Southern right whale (Endangered, Migratory).
  - The southern right whale migration BIA, which extends all the way up the west coast of WA as far north as Ningaloo Reef, overlaps the development envelope (Figure 31). The nearest reproductive BIA is over 1,000 km away.





|                                      |
|--------------------------------------|
| Foraging Area (Annual high use area) |
| Known Foraging Area                  |
| Possible Foraging Area               |

Blue whales are regularly observed feeding on a seasonal basis

Known foraging occurs in these areas but is highly variable both between and within seasons

Evidence for feeding is based on limited direct observations or through indirect evidence, such as occurrence of krill in close proximity of whales, or satellite tagged whales showing circling tracks. Blue whales travel through on a seasonal basis, possibly as part of their migratory route

|                       |
|-----------------------|
| Known to occur        |
| Likely to occur       |
| May occur             |
| Historical catch area |

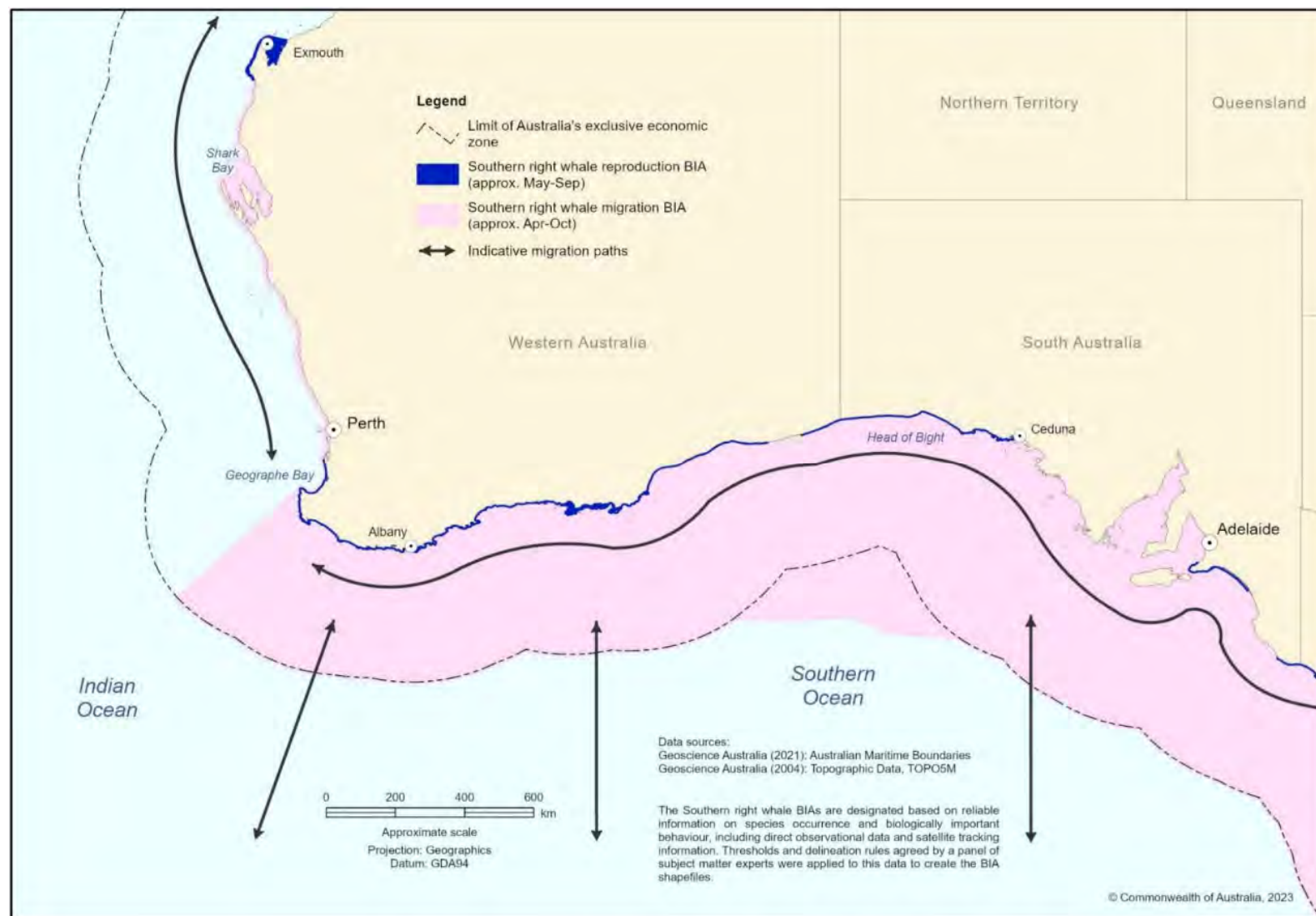
Blue whales are known to occur based on direct observations, satellite tagged whales or based on acoustic detections

Blue whales are likely to occur based on occasional observations in the area and nearby areas

Evidence for the presence of blue whales through strandings or rare observations

Blue whales were caught during the whaling period based on whaling data

Figure 30: Pygmy blue whale distribution (DoE, 2015)



**Figure 31: Southern right whale Biologically Important Areas and habitat critical to the survival (reproduction BIA) in Western Australia (DCCEEW, 2024)**

### 10.4.3.2 Shark species

The development envelope does not overlap with any known BIAs for shark or ray species. However, the following conservation significant shark species are considered likely to occasionally occur proximate to the development envelope:

- White shark
  - White sharks can be found from close inshore around rocky reefs, surf beaches and shallow coastal bays to outer continental shelf and slope areas. Areas where white shark observations are more frequent include waters in and around some fur seal and sea lion colonies (DSEWPC, 2012). It is likely that this species may occasionally occur proximate to the development envelope due to the presence of the New Zealand fur seal colony at the west end of the island
- Scalloped hammerhead
  - Scalloped hammerheads migrate yearly for foraging and breeding purposes and the closest aggregation area for the species to the development envelope is the Shoalwater Islands Marine Park, when peak numbers are observed during January and February (López, 2023)
- Grey nurse shark.
  - In Australia, the grey nurse shark has an inshore coastal distribution primarily in sub-tropical to cool temperate waters on the continental shelf. Grey nurse sharks are often observed aggregating around inshore rocky reefs or islands. At these locations they are typically found near the seabed (at depths of 10–40 m) in deep sandy or gravel filled gutters, or in rocky caves. These sites are considered habitat critical to the survival of the species. There are no confirmed aggregation sites in W.A. waters, however it is considered possible that this species may occasionally occur proximate to the development envelope (DoEE, 2014).

### 10.4.3.3 Marine bird species

Conservation significant marine bird species that may occur proximate to the development envelope are discussed below. There is potential for other marine bird species to opportunistically occur proximate to the site, these species are listed in Table 47:

- Little penguin (Marine)
  - The development envelope overlaps with a foraging BIA for this species. The little penguin is endemic to Australia and New Zealand and found along the southern coast of Australia from Carnac Island (WA) to Broughton Island (NSW), including Shoalwater Islands Marine Park, Penguin Island, and the Geographe Bay area (DoEE 2019). This species is known to breed at Garden Island and Penguin Island, over 20 km south of the development envelope, and may forage proximate to the development envelope. There is no known breeding habitat proximate to the development envelope, and although these species may occasionally occur within South Thomson Bay, the development envelope is not considered likely to provide critical habitat for this species
- Shearwaters. wedge-tailed shearwaters (*Ardenna pacifica*), little shearwaters (*Puffinus assimilis tunneyi*), flesh-footed shearwaters (*Ardenna caneipes*) and short-tailed shearwaters (*Ardenna tenuirostris*) are regularly found within the South-west Marine Region and breed in the south-west of WA.
  - Wedge-tailed shearwater
    - The wedge-tailed shearwater is known to breed on the west end of Wadjemup / Rottnest Island (DSEWPC, 2012). Although there are no known breeding colonies proximate to the development envelope, this species may forage in the water proximate to the development envelope
  - Little shearwater
    - The development envelope overlaps with a foraging BIA for this species. The little shearwater is found along the entire southern coast of Australia, including the Houtman Abrolhos Islands, the Recherche Archipelago, and the islands of the Dampier Archipelago in WA (DAWE 2020b). The species inhabits offshore waters and breed on small islands, in burrows or rocky



crevices. Little shearwaters spend most of their lives at sea but return to breeding colonies on islands to mate and raise their young. They are known for their long-distance migrations, with some individuals traveling from their breeding grounds in south-western WA to the north Pacific and Arctic oceans (Commonwealth of Australia, 2020). The fauna assessment undertaken by RPS (2024a) and EcoLogical (2024) did not identify any important habitat for this species within the development envelope, although it may occasionally forage within or proximate to South Thomson Bay

- Flesh footed shearwater
  - The development envelope overlaps with an aggregation BIA for this species. In Australia, the flesh-footed shearwater is commonly found along the southern continental shelf (south-west WA to south-east QLD). The species breed on islands off the coast of south-west WA and are nocturnally active at breeding grounds (Department of the Environment and Energy, 2024). The fauna assessment undertaken by RPS (2024a) and EcoLogical (2024) did not identify any important habitat for this species within the development envelope, although it may occasionally forage within or proximate to South Thomson Bay
- Short tailed shearwater
  - This species breeds on Tasmanian offshore islands and off the coast of southern Australia, with the bulk of the population in the south-east. Breeding occurs mainly on coastal islands, typically in areas of grassland or other vegetation, but sometimes cliffs or bare ground (Commonwealth of Australia, 2020). The fauna assessment undertaken by RPS (2024a) and EcoLogical (2024) did not identify any important habitat for this species within the development envelope, although it may occasionally forage within or proximate to South Thomson Bay
- Caspian tern (Marine, Migratory)
  - The development envelope overlaps with a foraging BIA for this species. In WA, the species is widespread along coastal regions, from the Great Australian Bight to the Dampier Peninsula. Breeding occurs along the entire south-west region (Higgins, 2003). The closest breeding populations are found on islands of the Turquoise Coast and Houtman Abrolhos. These birds are likely to be largely sedentary or make only short-range movements within the region. Caspian terns are a diurnal coastal foraging species that predominantly feed on whiting and mullets, and roost on land at night. This species may roost at the natural jetty, approximately 800 m to the east of the development envelope and may occasionally forage in the area. There is no critical habitat for this species present in the development envelope
- Bridled tern (Marine, Migratory)
  - The development envelope overlaps with a foraging BIA for this species. This species is known to breed on Penguin Island, over 20 km south of the development envelope and may forage proximate to the development envelope. This species may also roost at the natural jetty, approximately 800 m to the east of the development envelope. There is no critical habitat for this species present in the development envelope
- Crested tern (Marine, Migratory)
  - The species breeds in colonies or groups on offshore islands, low-lying coral reefs, sandy or rocky coastal islets and coastal spits (Commonwealth of Australia, 2020). The fauna assessment undertaken by RPS (2024a) and EcoLogical (2024) did not identify any important habitat for this species within the development envelope. However, this species may also roost at the natural jetty, approximately 800 m to the east of the development envelope. There is no critical habitat for this species present in the development envelope

- Roseate tern (Marine, Migratory)
  - The development envelope overlaps with a foraging BIA for this species. The roseate tern occurs in both coastal and marine subtropical/tropical areas. The species inhabits rocky and sandy beaches, coral reefs, sand cays and offshore islands (Department of Agriculture, Water and Environment, 2021). Roseate terns are a diurnal coastal foraging species that feed on small schooling bait fish, often brought to the surface by predatory fish, such as tuna. This species roosts on land at night. In WA, roseate terns are regularly recorded north from Mandurah to Eighty Mile Beach, in the Pilbara Region (DAWE 2021a). This species may roost at the natural jetty, approximately 800 m to the east of the development envelope and may occasionally forage in the area. There is no critical habitat for this species present in the development envelope
- Fairy tern (Vulnerable)
  - The development envelope overlaps with a foraging BIA for this species. Within Australia, fairy terns occur along the coasts of VIC, TAS, SA, and WA. In WA, there are two populations of fairy terns. The first is a semi-migratory population that breeds between Israelite Bay on the south-eastern coast and Northwest Cape, and overwinter at the Houtman Abrolhos. The second, probably sedentary population occurs on Pilbara islands, as far north as the Dampier Archipelago near Karratha (Dunlop, 2022). This species may roost at the natural jetty, approximately 800 m to the east of the development envelope and may occasionally forage in the area. There is no critical habitat for this species present in the development envelope.

#### 10.4.3.4 Turtles

Turtle species which may occur within or proximate to South Thomson Bay are discussed in Table 47 and include the green turtle, leatherback turtle and loggerhead turtle. As shown in Figure 32 to Figure 34, South Thomson Bay is within the known range of these species, however there are no nesting or internesting areas proximate to the site.

Turtles migrate to and from their nesting grounds in northern WA during summer (typically between November and March) and their common distribution is north of the development envelope. However, they are known to forage on and in seagrass meadows and may occasionally occur in the area.

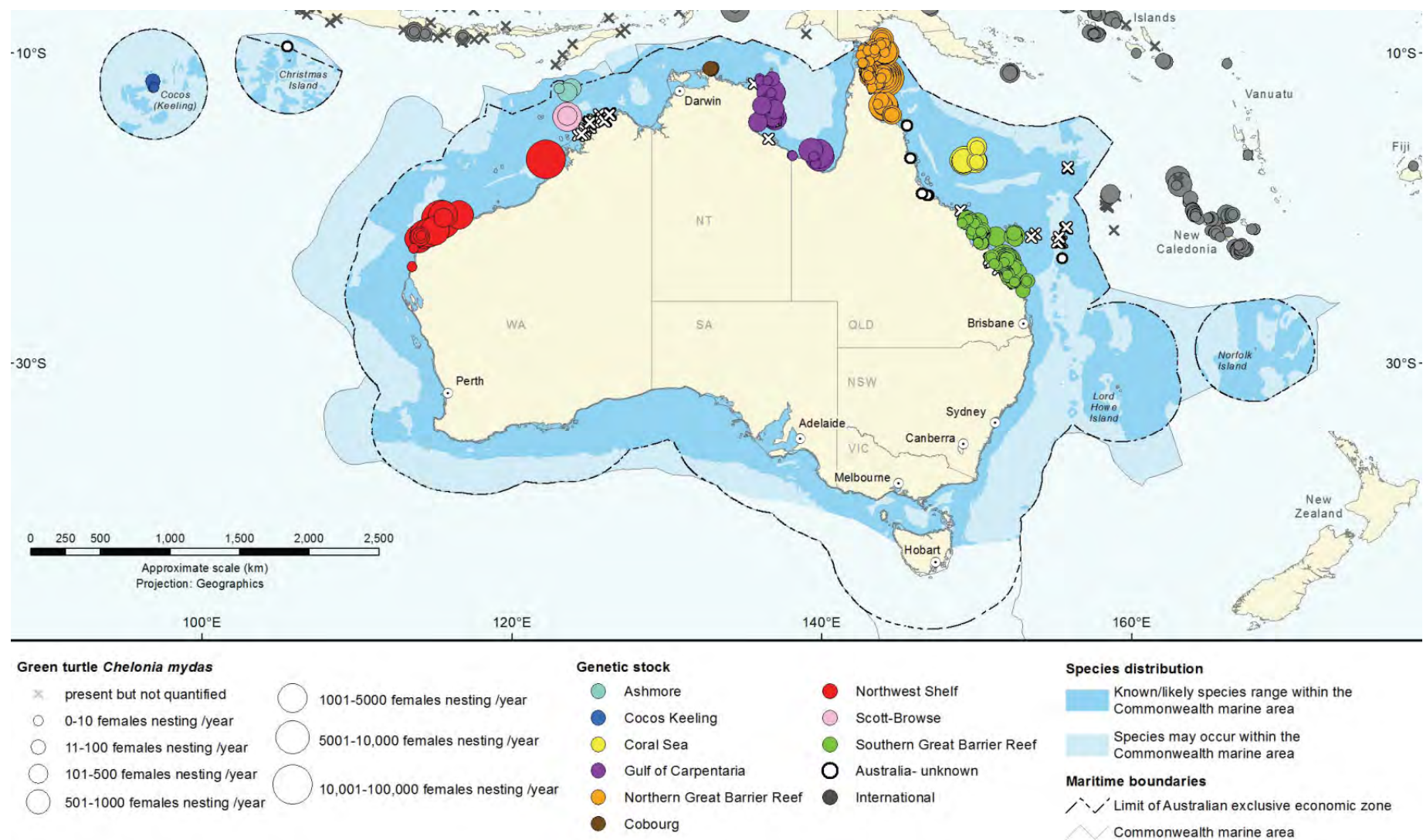
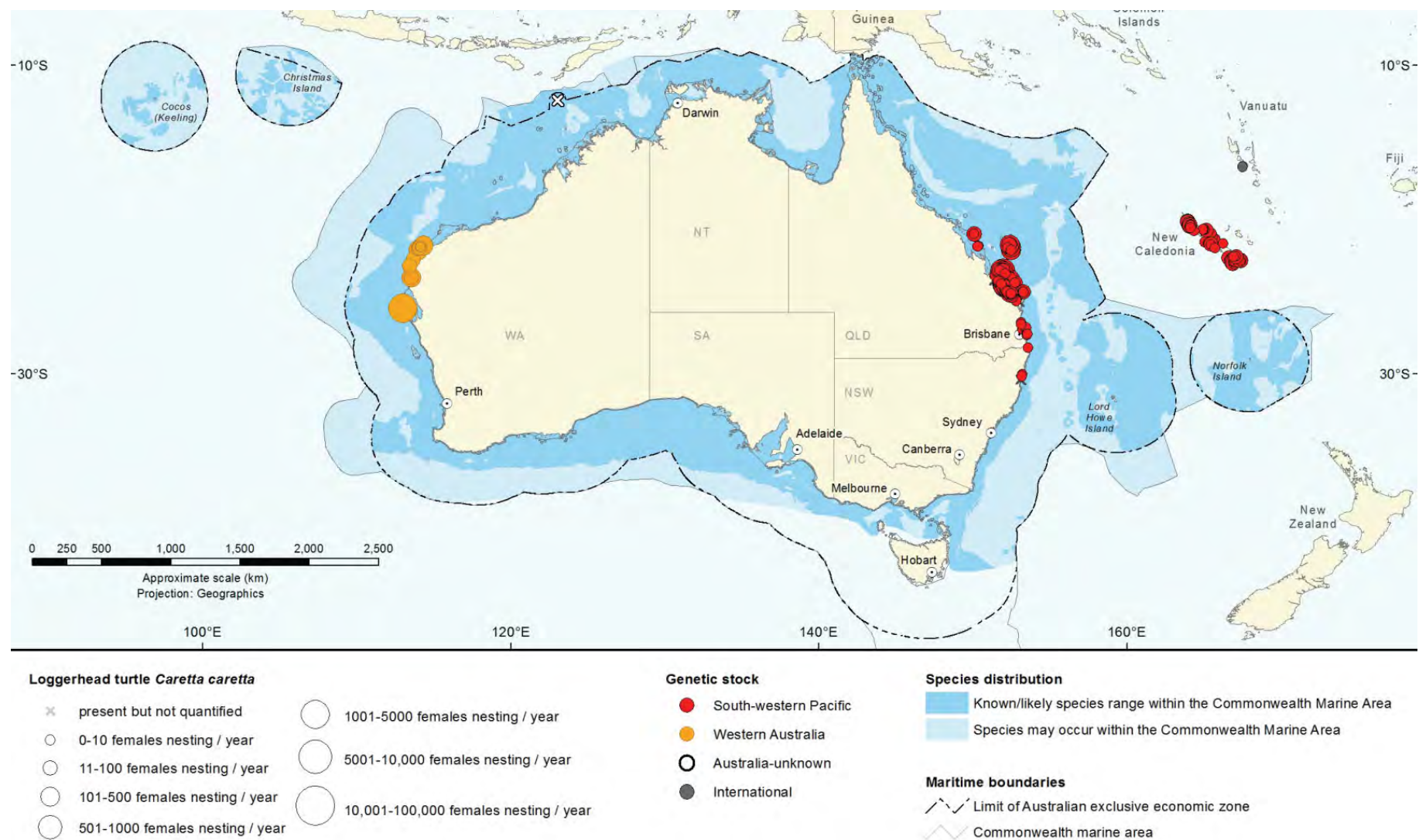
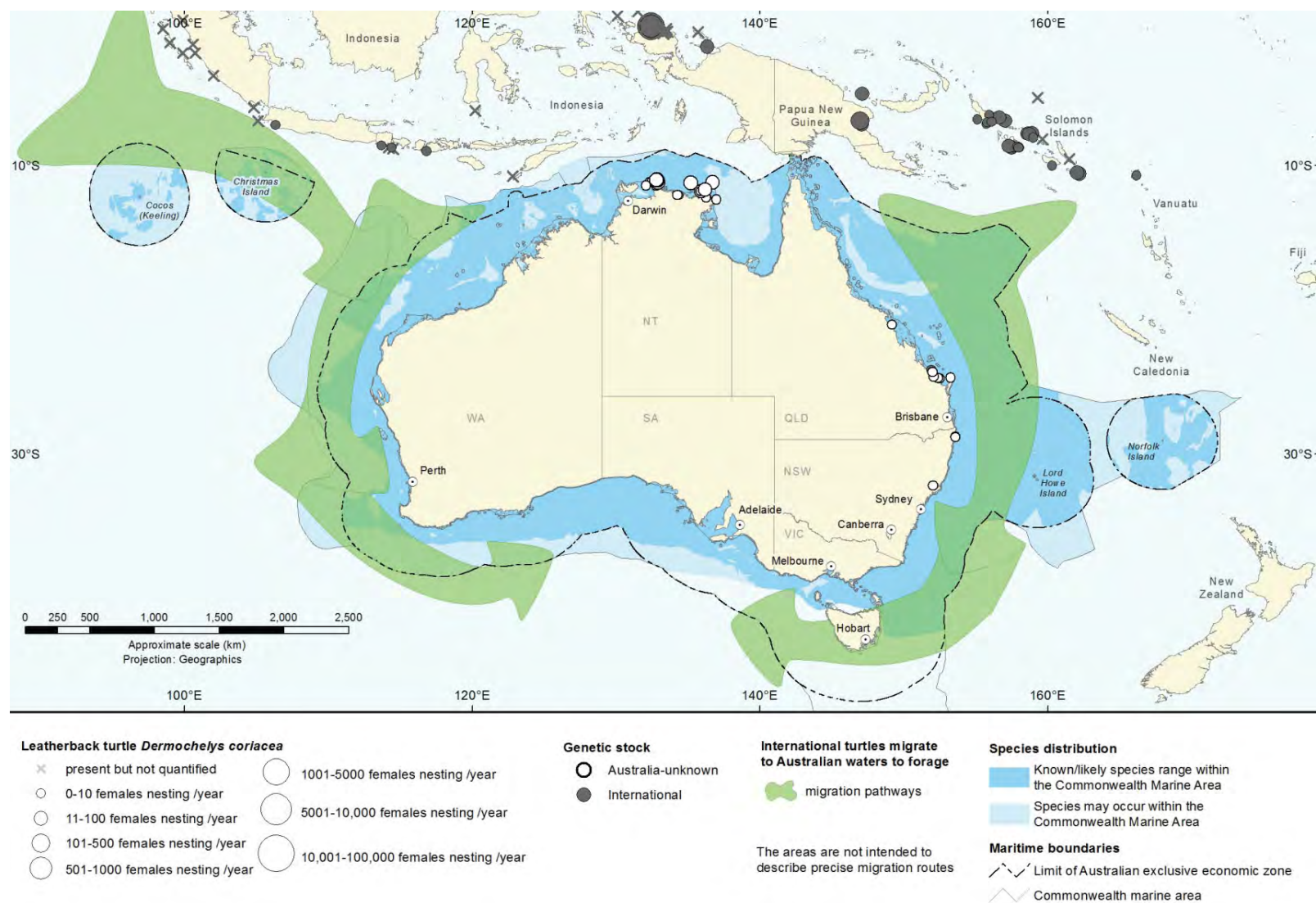


Figure 32: Green turtle habitat in Australia (DoEE, 2017)





**Figure 33: Loggerhead turtle habitat in Australia (DoEE, 2017)**



**Figure 34: Leatherback turtle habitat in Australia (DoEE, 2017)**

## 10.5 Potential environmental impacts

Table 48 provides the potential key impacts to marine fauna from the proposal. These impacts are discussed in further detail in Sections 10.5.1.1 to 10.5.1.7.

**Table 48: Potential impacts on marine fauna**

| Phase        | Impact class | Works / operations                                                                                                                                                                                                                                                      | Potential impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction | Direct       | <ul style="list-style-type: none"> <li>Dredging</li> <li>Breakwater construction</li> <li>Reclamation (decant from reclamation area)</li> </ul>                                                                                                                         | <b>Loss of benthic habitats</b> <ul style="list-style-type: none"> <li>Removal of 3.32 ha of potential marine fauna habitats as a result of the construction of the proposal (e.g. dredging). Indirect (and recoverable) impacts from dredging are discussed later in this table:               <ul style="list-style-type: none"> <li>Permanent loss of 2.06 ha mixed seagrass</li> <li>Permanent loss of 1.26 ha sand with wrack</li> </ul> </li> </ul>                            |
|              |              | <ul style="list-style-type: none"> <li>Piling</li> </ul>                                                                                                                                                                                                                | <b>Elevated underwater noise from activities such as piling and dredging</b>                                                                                                                                                                                                                                                                                                                                                                                                         |
|              |              | <ul style="list-style-type: none"> <li>Dredging (including the use of silt curtains).</li> </ul>                                                                                                                                                                        | <b>Increased risk of entanglement or entrainment</b> <ul style="list-style-type: none"> <li>Risk of entrainment during dredging with the potential to cause injury, death, displacement, adverse behavioural and physiological changes.</li> </ul>                                                                                                                                                                                                                                   |
|              |              | <ul style="list-style-type: none"> <li>Vessel operations</li> </ul>                                                                                                                                                                                                     | <b>Risk of vessel collision</b> <ul style="list-style-type: none"> <li>Increased collision risk leading to injury/mortality of marine fauna.</li> </ul>                                                                                                                                                                                                                                                                                                                              |
|              |              | <ul style="list-style-type: none"> <li>Breakwater construction</li> </ul>                                                                                                                                                                                               | <b>Risk of injury or death from rock dumping during breakwater construction</b> <ul style="list-style-type: none"> <li>Increased risk of injury/mortality of marine fauna.</li> </ul>                                                                                                                                                                                                                                                                                                |
|              |              | <ul style="list-style-type: none"> <li>Artificial lighting from moored/inactive construction vessels (low impact lighting for navigational safety).</li> <li>Artificial lighting from onshore construction areas (low impact lighting for security / safety)</li> </ul> | <b>Potential impacts from artificial lighting</b> <ul style="list-style-type: none"> <li>Potential temporary and localised impacts from artificial lighting on areas surrounding the moored vessels and adjacent to the construction area, affecting movements and behaviours of marine fauna.</li> </ul>                                                                                                                                                                            |
|              | Indirect     | <ul style="list-style-type: none"> <li>Construction vessels movement and activities</li> </ul>                                                                                                                                                                          | <b>Increased risk of introduction of Introduced Marine Species (IMS)</b> <ul style="list-style-type: none"> <li>Increased risk of introduction of IMS could change the local ecology, impacting marine fauna species.</li> </ul> <b>Increased risk of pollution incidents</b> <ul style="list-style-type: none"> <li>Increased risk of pollution incidents from vessels leading to degradation of marine environment has the potential to indirectly impact marine fauna.</li> </ul> |
|              |              | <ul style="list-style-type: none"> <li>Dredging</li> <li>Breakwater construction</li> <li>Reclamation (decant from reclamation area)</li> </ul>                                                                                                                         | <b>Loss of benthic habitats</b> <ul style="list-style-type: none"> <li>The temporary loss of 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI from an increase in TSS.</li> </ul> <b>Temporary increase in turbidity</b> <ul style="list-style-type: none"> <li>Reduction in marine environmental quality (e.g. increased suspended sediment / turbidity) may impact on marine fauna behaviours.</li> </ul>                                           |
| Operation    | Direct       | <ul style="list-style-type: none"> <li>Increase in vessel activity</li> </ul>                                                                                                                                                                                           | <b>Risk of vessel collision</b> <ul style="list-style-type: none"> <li>Increase collision risk with vessels leading to injury/mortality of marine fauna.</li> </ul>                                                                                                                                                                                                                                                                                                                  |
|              |              | <ul style="list-style-type: none"> <li>Maintenance dredging (if required)</li> </ul>                                                                                                                                                                                    | <b>Increased risk of entanglement or entrainment</b> <ul style="list-style-type: none"> <li>Risk of entrainment during dredging with the potential to cause injury, death, displacement, adverse behavioural and physiological changes.</li> </ul>                                                                                                                                                                                                                                   |



| Phase | Impact class | Works / operations                                                                                             | Potential impacts                                                                                                                                                                                                                                                                                                                                                    |
|-------|--------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|       | Indirect     | <ul style="list-style-type: none"> <li>Increase in vessel activity</li> </ul>                                  | <b>Increased risk of introduction of IMS</b> <ul style="list-style-type: none"> <li>Increased risk of introduction of IMS could change the local ecology.</li> </ul> <b>Increased risk of pollution incidents</b> <ul style="list-style-type: none"> <li>Increased risk of pollution incidents from vessels leading to degradation of marine environment.</li> </ul> |
|       |              | <ul style="list-style-type: none"> <li>Artificial and permanent lighting along the marine structure</li> </ul> | <b>Potential impacts from artificial lighting</b> <ul style="list-style-type: none"> <li>Localised, permanent source of potential disruption to marine fauna that alter behaviours / movements.</li> </ul>                                                                                                                                                           |

## 10.5.1 Assessment of impacts

### 10.5.1.1 Summary of key marine fauna receptors

Some marine fauna species are likely to occur with Thomson Bay year-round, while others are migratory visitors. There are critical times of the year where marine fauna species are undergoing key stages of their life cycle and are therefore more susceptible to disturbance. Table 49 summarises the conservation significant fauna species that may occur proximate to the proposal.

Key ecological windows for marine fauna species that may occur within or proximate to South Thomson Bay are provided in Table 49.

**Table 49: Key marine fauna receptors and associated ecological windows**

| Sensitivity                                     | January | February | March | April | May | June | July | August | September | October | November | December |
|-------------------------------------------------|---------|----------|-------|-------|-----|------|------|--------|-----------|---------|----------|----------|
| Humpback whale (north migration) <sup>1</sup>   |         |          |       |       |     |      |      |        |           |         |          |          |
| Humpback whale (south migration) <sup>1</sup>   |         |          |       |       |     |      |      |        |           |         |          |          |
| Pygmy blue whale (north migration) <sup>2</sup> |         |          |       |       |     |      |      |        |           |         |          |          |
| Pygmy blue whale (south migration) <sup>2</sup> |         |          |       |       |     |      |      |        |           |         |          |          |
| Southern right whale migration <sup>2</sup>     |         |          |       |       |     |      |      |        |           |         |          |          |
| Australian sea lion                             |         |          |       |       |     |      |      |        |           |         |          |          |
| New Zealand fur seal                            |         |          |       |       |     |      |      |        |           |         |          |          |
| White shark foraging BIA <sup>3</sup>           |         |          |       |       |     |      |      |        |           |         |          |          |
| Scalloped hammerhead migration <sup>4</sup>     |         |          |       |       |     |      |      |        |           |         |          |          |
| Little penguin foraging <sup>5</sup>            |         |          |       |       |     |      |      |        |           |         |          |          |
| Wedge-tailed shearwater foraging <sup>5</sup>   |         |          |       |       |     |      |      |        |           |         |          |          |
| Caspian tern foraging <sup>5</sup>              |         |          |       |       |     |      |      |        |           |         |          |          |
| Pacific gull foraging <sup>5</sup>              |         |          |       |       |     |      |      |        |           |         |          |          |
| Bridled tern foraging <sup>5</sup>              |         |          |       |       |     |      |      |        |           |         |          |          |
| Roseate tern foraging <sup>5</sup>              |         |          |       |       |     |      |      |        |           |         |          |          |
| Fairy tern foraging <sup>5</sup>                |         |          |       |       |     |      |      |        |           |         |          |          |
| Green turtle                                    |         |          |       |       |     |      |      |        |           |         |          |          |
| Leatherback turtle                              |         |          |       |       |     |      |      |        |           |         |          |          |
| Loggerhead turtle                               |         |          |       |       |     |      |      |        |           |         |          |          |

1 (Source: DoEE 2019), 2 (Source: McCauley & Jenner 2010; McCauley & Duncan 2011; Double et al. 2012; Double et al. 2014). 3 (DoE, 2019), 4 (Source: Lopez et al 2022), 5 (Source: DAWE 2021b, Higgins 2003, DoEE 2019).

Peak period Mammals Fish Birds Reptiles

### 10.5.1.1.1 Potential pressures to key marine fauna species

Although a number of conservation significant marine fauna species may occur in or proximate to South Thomson Bay, some of these species may either only occur within or within vicinity of the development envelope occasionally due to the lack of critical habitat for these species. While other species are unlikely to be susceptible to impacts or pressures from construction of the proposal.

Analysis of the potential pressures on selected protected species in the South-west Marine Region is provided in the Marine bioregional plan for the South-west Marine Region (DSEWPC, 2013). Of these species, those that potentially occur within vicinity of the development envelope are discussed in Table 50.

**Table 50: Summary of pressures on selected protected species in the South-west Marine Region (DSEWPC, 2013)**

| Species group   | Species addressed in Marine bioregional plan for the South-west Marine Region (DSEWPC, 2013) | Pressure relevant to the proposal |                        |                                 |                      |                 |                 |               |                                  |                      |                  |                  |
|-----------------|----------------------------------------------------------------------------------------------|-----------------------------------|------------------------|---------------------------------|----------------------|-----------------|-----------------|---------------|----------------------------------|----------------------|------------------|------------------|
|                 |                                                                                              | Physical habitat modification     | Change in oceanography | Chemical pollution/contaminants | Changes in turbidity | Noise pollution | Light pollution | Oil pollution | Entanglement with infrastructure | Changes in turbidity | Invasive species | Vessel collision |
|                 | Pressure of less or no concern                                                               |                                   |                        |                                 |                      |                 |                 |               |                                  |                      |                  |                  |
|                 | Pressure of potential concern                                                                |                                   |                        |                                 |                      |                 |                 |               |                                  |                      |                  |                  |
|                 | Pressure of concern                                                                          |                                   |                        |                                 |                      |                 |                 |               |                                  |                      |                  |                  |
| Cetaceans       | Humpback whale                                                                               |                                   |                        |                                 |                      |                 |                 |               |                                  |                      |                  |                  |
|                 | Pygmy blue whale                                                                             |                                   |                        |                                 |                      |                 |                 |               |                                  |                      |                  |                  |
|                 | Southern right whale                                                                         |                                   |                        |                                 |                      |                 |                 |               |                                  |                      |                  |                  |
| Marine reptiles | Green turtle                                                                                 |                                   |                        |                                 |                      |                 |                 |               |                                  |                      |                  |                  |
|                 | Leatherback turtle                                                                           |                                   |                        |                                 |                      |                 |                 |               |                                  |                      |                  |                  |
|                 | Loggerhead turtle                                                                            |                                   |                        |                                 |                      |                 |                 |               |                                  |                      |                  |                  |
| Pinnipeds       | Australian sea lion                                                                          |                                   |                        |                                 |                      |                 |                 |               |                                  |                      |                  |                  |
|                 | New Zealand fur seal                                                                         |                                   |                        |                                 |                      |                 |                 |               |                                  |                      |                  |                  |
| Seabirds        | Fairy tern, Caspian tern and crested tern*                                                   |                                   |                        |                                 |                      |                 |                 |               |                                  |                      |                  |                  |
|                 | Wedgetailed shearwater                                                                       |                                   |                        |                                 |                      |                 |                 |               |                                  |                      |                  |                  |
|                 | Little penguin                                                                               |                                   |                        |                                 |                      |                 |                 |               |                                  |                      |                  |                  |
| Sharks          | Grey nurse                                                                                   |                                   |                        |                                 |                      |                 |                 |               |                                  |                      |                  |                  |
|                 | White shark                                                                                  |                                   |                        |                                 |                      |                 |                 |               |                                  |                      |                  |                  |

\*It is considered likely, that although not included in the risk assessment, the Roseate tern is susceptible to similar pressures

DSEWPC 2013

### 10.5.1.2 Temporary / permanent loss or degradation of habitat

Loss of marine habitat, primarily the loss of seagrass species, associated with construction of the proposal has the potential to result in indirect impacts to marine fauna species through loss of foraging opportunities and changes to marine environmental quality. Loss of marine habitat may also impact recreational fisheries in the bay through the loss of potential feeding, spawning and predator avoidance habitat.

The total predicted loss of potential marine fauna habitat from implementation of the proposal is summarised below:

- Direct (permanent) impacts to 2.06 ha of mixed seagrass and 1.26 ha of sand / sand with wrack within the development envelope and ZoHI
- Indirect (recoverable) impacts to:

- 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI. It is predicted that benthic communities and habitats that are impacted within the ZoMI will recover within a five-year period
- 5.13 ha of mixed seagrass, 1.13 ha macroalgae dominated community, 0.35 ha of limestone reef / pavement and 6.70 ha of sand / sand with wrack within the ZoI. Changes in environmental quality associated with dredge plumes in the ZoI are not predicted to result in a detectable impact on benthic biota.

The permanent loss of 2.06 ha of mixed seagrass accounts for 0.52% of mixed seagrass within the LAU. Therefore, the overall change of marine fauna habitat resulting from the proposal is low in a regional context and the potential impacts to marine fauna species which use these benthic environments for habitat is also predicted to be low.

The ZoMI is the area within which predicted impacts on benthic organisms are recoverable within a period of five years following completion of the dredging activities. The mixed seagrass habitat within the ZoMI comprises 2.62 ha, which accounts for 0.65% of the LAU. Given the limited extent of the ZoMI in comparison to the LAU, the temporary changes to marine environmental quality within the ZoMI are unlikely to significantly reduce the abundance of marine fauna species regionally in the LAU.

The ZoI is associated with temporary changes in environmental quality from dredge plumes. Although marine fauna habitats within the modelled extent of the ZoI will be exposed to effects of dredging and construction, these will be minor and no observable impacts are predicted.

#### 10.5.1.3 Temporary increase in turbidity

In addition to the temporary and recoverable impacts to benthic communities and habitats discussed in Section 10.5.1.1, a temporary increase in TSS within the ZoMI and ZoI has the potential to result in behavioural changes to marine fauna. These behavioural changes may include avoidance behaviours and changes in foraging behaviour. As outlined in Section 10.5.1.1.1, this is considered a pressure of less or no concern for the key marine fauna species considered. As such, this is considered unlikely to comprise a significant impact.

#### 10.5.1.4 Risk of injury or death from rock dumping during breakwater construction

Rock dumping during the breakwater construction has the potential to result in the following impacts (EPA, 2016j):

- Rock dumping may impact marine fauna through increases in turbidity and the mobilisation of contaminants located within the sediment. These impacts are discussed further in Section 9 of this report and are not considered likely to have a significant impact on marine fauna.
- Underwater noise generated from rock dumping may negatively impact marine fauna either through physical injury or avoidance behaviours. Underwater noise generated from rock dumping is anticipated to be less than that generated by piling and dredging activities. Potential underwater noise impacts on marine fauna are discussed further in Section 10.5.1.5.

Further impacts to marine fauna from construction of the breakwater includes the potential for injury or death from rock dumping.

#### 10.5.1.5 Elevated underwater noise

Some marine fauna species use sound for foraging, orientation, communication, navigation, echo-location of prey and predator avoidance (Richardson, 1995) and therefore may be affected by high levels of underwater noise. High levels of anthropogenic underwater sound can have negative impacts, ranging from changes in acoustic communication, displacement from an area, and in more severe cases temporary hearing loss, physical injury or mortality (Richardson, 1995).

As outlined in Section 10.5.1.1.1, the Australian sea lion, whales (humpback whale, pygmy blue whale, southern right whale) and sea turtles (green turtle, leatherback turtle, loggerhead turtle) may be susceptible to underwater noise impacts. Other species that may occur within vicinity of the development envelope and which may be impacted by underwater noise but are not listed as conservation significant species includes dolphins and fish.



#### 10.5.1.5.1 Underwater noise sources from the proposal

The greatest source of noise from the proposal will be associated with piling during construction. Pile driving will be required as part of the construction of the proposal. Other construction activities proposed are expected to emit similar levels of underwater noise (e.g. dredging) or less (e.g. vessel movements and rock dumping) to that modelled for the piling activities. As such, the underwater noise assessment included assessment of the activities most likely to impact marine fauna.

It is estimated that approximately 20 piles will be driven into the seabed on the leeward side of the rock groyne. The piles will be driven using a vibro hammer with a ram weight of 2.06 tonnes and a maximum vibration frequency of 3,000/minute. The steel tubular piles are likely to be approximately 500 mm to 600 mm in diameter and the rate of installation is estimated to be one to two piles per day. The estimated duration of pile driving is approximately 15 days.

Piling is proposed to be undertaken using a vibro hammer rather than impact piling methods to minimise potential impacts to marine fauna. Piling noise varies depending on the piling method and size of the pile being installed. A summary of the vibro hammer and impact hammer methods is provided below:

- Impact hammer – impulsive in character with multiple pulses occurring at blow rates in the order of 30 to 60 impacts per minute. Typical source levels range from sound exposure level (SEL) 170–225 dB re 1  $\mu$ Pa2s for a single pulse, and peak level 190–245 dB re 1  $\mu$ Pa. Most of the sound energy usually occurs at lower frequencies between 100 Hz and 1 kHz. Factors that influence the source level include the size, shape, length and material of the pile, the weight and drop height of the hammer, and the seabed material and depth
- Vibro-hammer – continuous in character and usually of a much lower level than impact piling. Typical source levels range from sound pressure level (SPL) 160–200 dB re 1  $\mu$ Pa, with most of the sound energy occurring between 100 Hz and 2 kHz. Strong tones at the driving frequency and associated harmonics may occur with the driving frequency typically ranging between 10 and 60 Hz. Sound propagation at such low frequencies is often poor in shallow water environments, such that the tones may not be noticeable at greater distances from the source (Government of South Australia, 2012).

Although vibro-piling is proposed, there is contingency for conventional impact hammer pile driving of some piles if they reach the point of refusal before the target depth is achieved. The probability of needing conventional pile driving is very low given that the recent pile driving work conducted on Rottnest Island jetty (approximately 800 m north-west of this project) was successfully completed to similar target depths only using a vibro hammer pile driver.

Both the proposed vibro-piling (scenario 2) and contingency hammer piling (scenario 1) were modelled in the underwater acoustic assessment (Tetra Tech, 2024) (Appendix S) in case the contingency of hammer piling is required during construction of the proposal. The results from modelling these scenarios are discussed in Section 10.5.1.2.4.

As outlined in Section 10.5.1.1.1, the Australian sea lion, whales (humpback whale, pygmy blue whale, southern right whale) and sea turtles (green turtle, leatherback turtle, loggerhead turtle) may be susceptible to underwater noise impacts. Other species that may occur within vicinity of the development envelope and which may be impacted by underwater noise but are not listed as conservation significant species includes dolphins and fish.

#### 10.5.1.5.2 Assessment criteria

The assessment criteria used in this assessment includes:

- The National Oceanic and Atmospheric Administration's (NOAA's) 'Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing' (NOAA, 2018)
- Criteria and Thresholds for U.S. Navy Acoustics and Explosive Effect Analysis (Jenkins, 2017).

The assessment criteria for each fauna type are divided into noise levels that may result in Temporary Threshold Shift (TTS), Permanent Threshold Shift (PTS) and behavioural shifts. The noise levels at which TTS and PTS occur is dependent on whether the noise being generated is impulsive or non-impulsive. The definitions of these two categories are:

- 
- Impulsive – sounds produced are typically transient, brief (less than one second), broadband and consist of high peak pressure with rapid rise time and rapid decay. This noise source is associated with activities such as pile driving, seismic activities and underwater blasting and results in some of the most powerful sounds produced underwater.
  - Non-impulsive – sounds produced can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent and typically do not have the high peak sound pressure with rapid rise / decay times that impulsive sounds do. This noise is associated with activities such as dredging, vessel operations, drilling and some construction activities.

The assessment criteria used for the marine fauna likely to occur within vicinity of the proposal in the underwater noise assessment are summarised in Table 51 and Table 52.

Table 51:     Thresholds for non-impulsive and impulsive noise – marine mammals

| Marine fauna type           | Hearing group                                                                                                                                     | Hearing bandwidth  | Impulsive sounds                                                 |                                                                  |                          | Non-impulsive sounds              |                                   |                          |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------|------------------------------------------------------------------|------------------------------------------------------------------|--------------------------|-----------------------------------|-----------------------------------|--------------------------|
|                             |                                                                                                                                                   |                    | PTS onset                                                        | TTS onset                                                        | Behaviour                | PTS onset                         | TTS onset                         | Behaviour                |
| Whales                      | Low frequency (LF) cetaceans.<br>This group consists of the baleen whales (masticates).                                                           | 7 Hz to 35 kHz     | 219 dB (L <sub>p,pk</sub> )<br>183 (L <sub>E</sub> , LF, 24h)    | 213 dB (L <sub>p,pk</sub> )<br>168 dB (L <sub>E</sub> , LF, 24h) | 160 dB (L <sub>p</sub> ) | 199 dB (L <sub>E</sub> , LF, 24h) | 179 dB (L <sub>E</sub> , LF, 24h) | 120 dB (L <sub>p</sub> ) |
| Dolphins and toothed whales | Mid frequency cetaceans (MF)<br>Includes most of the dolphins, all toothed whales except for Kogia spp. and all the beaked and bottlenose whales. | 150 Hz to 160 kHz. | 230 dB (L <sub>p,pk</sub> )<br>185 dB (L <sub>E</sub> , MF, 24h) | 224 dB (L <sub>p,pk</sub> )<br>170 dB (L <sub>E</sub> , MF, 24h) |                          | 198 dB (L <sub>E</sub> , MF, 24h) | 178 dB (L <sub>E</sub> , MF, 24h) |                          |
| Sea lions                   | Otariids Underwater<br>Includes sea lions and fur seals.                                                                                          | 60 Hz to 39 kHz    | 232 dB (L <sub>p,pk</sub> )<br>203 dB (L <sub>E</sub> , OW, 24h) | 226 dB (L <sub>p,pk</sub> )<br>188 dB (L <sub>E</sub> , OW, 24h) |                          | 219 dB (L <sub>E</sub> , OW, 24h) | 199 dB (L <sub>E</sub> , OW, 24h) |                          |

L<sub>E</sub>, 24h = cumulative sound exposure over a 24-hour period (dB re 1 µPa<sup>2</sup>·s).

L<sub>p,pk</sub> = peak sound pressure (dB re 1 µPa).

L<sub>p</sub> = root mean square sound pressure (dB re 1 µPa)

(Tetra Tech, 2024)



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**Table 52: Thresholds for non-impulsive and impulsive noise – fish and sea turtles**

| Marine fauna type                                | Impulsive sounds                                                  |                                                                   | Non-impulsive sounds               |                                    |                          |
|--------------------------------------------------|-------------------------------------------------------------------|-------------------------------------------------------------------|------------------------------------|------------------------------------|--------------------------|
|                                                  | Injury                                                            | TTS onset                                                         | Injury                             | TTS onset                          | Behaviour                |
| Fishes                                           | 206 dB (L <sub>p,pk</sub> )<br>187 dB (L <sub>E</sub> , 24h)      | -                                                                 | -                                  | -                                  | 150 dB (L <sub>p</sub> ) |
| Sea turtles                                      | 232 dB (L <sub>p,pk</sub> )<br>204 dB (L <sub>E</sub> , TUW, 24h) | 226 dB (L <sub>p,pk</sub> )<br>189 dB (L <sub>E</sub> , TUW, 24h) | 220 dB (L <sub>E</sub> , TUW, 24h) | 200 dB (L <sub>E</sub> , TUW, 24h) | 175 dB (L <sub>p</sub> ) |
|                                                  | Impulsive sounds                                                  |                                                                   | Non-impulsive sounds               |                                    |                          |
|                                                  | Mortality and potential mortal injury                             | Recoverable injury                                                | TTS                                | Recoverable injury                 | TTS                      |
| Fishes without swim bladders                     | > 213 dB (L <sub>p,pk</sub> )<br>> 219 dB (L <sub>E</sub> , 24h)  | > 213 dB (L <sub>p,pk</sub> )<br>> 216 dB (L <sub>E</sub> , 24h)  | > 186 dB (L <sub>E</sub> , 24h)    | –                                  | –                        |
| Fishes with swim bladder not involved in hearing | 207 dB (L <sub>p,pk</sub> )<br>210 dB (L <sub>E</sub> , 24h)      | 207 dB (L <sub>p,pk</sub> )<br>203 dB (L <sub>E</sub> , 24h)      | >186 dB (L <sub>E</sub> , 24h)     | –                                  | –                        |
| Fishes with swim bladder involved in hearing     | 207 dB (L <sub>p,pk</sub> )<br>207 dB (L <sub>E</sub> , 24h)      | 207 dB (L <sub>p,pk</sub> )<br>203 dB (L <sub>E</sub> , 24h)      | 186 dB (L <sub>E</sub> , 24h)      | 170 dB (L <sub>p</sub> )           | 158 dB (L <sub>p</sub> ) |
| Eggs and larvae                                  | 207 dB (L <sub>p,pk</sub> )<br>210 dB (L <sub>E</sub> , 24h)      | (N) Moderate<br>(I) Low<br>(F) Low                                | (N) Moderate<br>(I) Low<br>(F) Low | –                                  | –                        |

L<sub>E</sub>, 24h = cumulative sound exposure over a 24-hour period (dB re 1 µPa<sup>2</sup>·s).

L<sub>p,pk</sub> = peak sound pressure (dB re 1 µPa).

L<sub>p</sub> = root mean square sound pressure (dB re 1 µPa)

PTS = permanent threshold shift.

N = near (10s of meters).

I = intermediate (100s of metres).

F = far (1000s of metres).

– = not applicable

(Tetra Tech, 2024)

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### 10.5.1.5.3 Underwater noise assessment

The underwater acoustic assessment was undertaken for two separate scenarios:

- **Proposed piling method:** Vibratory hammer installation for a 24-inch pile diameter
  - Vibratory piling reduces the potential underwater noise impacts to marine fauna species during the installation of piles when compared to using impact hammers. The type and classification of the sound that is generated with vibratory versus impact pile driving is different. The sound generated from vibratory pile driving is a more non-impulsive, continuous sound as opposed to the impulsive and sharp sounds produced from impact pile driving. A vibratory hammer will be used for the installation of new piles
- **Contingency piling method:** Impact pile driving installation for a 24-inch pile diameter
  - Impact pile-driving involves weighted hammers that pile drive foundations into the sea floor
  - The acoustic energy is created upon impact, where the energy travels into the water along different paths. Near the pile, acoustic energy arrives from different paths with different associated stage and time lags, which creates a pattern of destructive and constructive interference. Further away from the pile, the water- and sea floor-borne energy are the dominant pathways
    - From the top of the pile where the hammer hits, through the air, into the water
    - From the top of the pile, down the pile, radiating into the air while traveling down the pile, from air into water
    - From the top of the pile, down the pile, radiating directly into the water from the length of pile below the waterline
    - Down the pile radiating into the ground, traveling through the ground and radiating back into the water.

It is likely that the piling will be undertaken after construction of the proposed breakwater. As such, the underwater noise assessment provides a worst-case scenario, as it is likely that the underwater noise will be somewhat dampened by the infrastructure.

The outcomes from the underwater acoustic assessment are summarised in Table 53. Figure 35 and Figure 36 show the unweighted and unmitigated underwater received sound pressure levels for each scenario. Underwater sound pressure level ranges are displayed in 5 dB increments and sound propagation characteristics are shown, as applicable.

| Table 53: Injury and Behavioural Onset Criteria Threshold Distances (meters) for Vibratory Hammer Pile Installation (proposed method) and Impact Pile-Driving (contingency method) |                                      |                |                                                                                               |                |                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|----------------|-----------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| Hearing group                                                                                                                                                                      | Metric                               | PTS            |                                                                                               | TTS            |                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|                                                                                                                                                                                    |                                      | Threshold (dB) | Distance (m)                                                                                  | Threshold (dB) | Distance (m)                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Proposed piling method                                                                                                                                                             |                                      |                |                                                                                               |                |                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Vibratory hammer installation for a 24-inch pile diameter                                                                                                                          |                                      |                |                                                                                               |                |                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Low-frequency cetaceans                                                                                                                                                            | L <sub>E,24hr</sub> <sup>1,2</sup>   | 199            | The threshold level is greater than the source level; therefore, distances are not generated. | 179            | 19                                                                                            | For the PTS thresholds, the smallest distances to thresholds were observed for the SEL acoustic thresholds while the largest distances were observed for the 120 dB SPL Marine Mammal criteria. The largest distance was modelled to be 167 m corresponding to the 120 dB SPL criterion                                                                                                                                                    |  |
| Mid-frequency cetaceans                                                                                                                                                            | L <sub>E,24hr</sub> <sup>1,2</sup>   | 198            |                                                                                               | 178            | The threshold level is greater than the source level; therefore, distances are not generated. |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Otariid pinnipeds underwater                                                                                                                                                       | L <sub>E,24hr</sub> <sup>1,2</sup>   | 219            |                                                                                               | 199            |                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Marine mammal behaviour                                                                                                                                                            | L <sub>p</sub> <sup>1,3</sup>        | 120            | 167                                                                                           | -              | -                                                                                             | For the TTS thresholds, the largest distances were observed for the 179 dB SPL low frequency cetacean criteria. The largest distance was modelled to be 179 m.                                                                                                                                                                                                                                                                             |  |
| Sea turtle temporary threshold shift                                                                                                                                               | L <sub>E,24hr</sub> <sup>1/,2/</sup> | 200            | The threshold level is greater than the source level; therefore, distances are not generated. | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Sea turtle permanent threshold shift                                                                                                                                               | L <sub>E,24hr</sub> <sup>1/,2/</sup> | 220            |                                                                                               | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Sea turtle behavioural                                                                                                                                                             | L <sub>p</sub> <sup>2/</sup>         | 175            |                                                                                               | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Small fish                                                                                                                                                                         | L <sub>E,24hr</sub> <sup>3,4</sup>   | 183            | 16                                                                                            | -              | -                                                                                             | All distance to threshold values were low (i.e. less than 50 metres). The largest distance of 21 metres occurred for unmitigated distance to the 183 dB SEL acoustic threshold for the vibratory installation.                                                                                                                                                                                                                             |  |
|                                                                                                                                                                                    | L <sub>p</sub> <sup>5</sup>          | 150            | 6                                                                                             | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Large fish                                                                                                                                                                         | L <sub>E,24hr</sub> <sup>3,4</sup>   | 187            | 21                                                                                            | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|                                                                                                                                                                                    | L <sub>p</sub> <sup>5</sup>          | 150            | 6                                                                                             | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Contingency piling method                                                                                                                                                          |                                      |                |                                                                                               |                |                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Impact pile driving installation for a 24-inch pile diameter. Impact Hammer Energy: 70 kJ                                                                                          |                                      |                |                                                                                               |                |                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Low-frequency cetaceans                                                                                                                                                            | L <sub>E,24hr</sub> <sup>1,3</sup>   | 183            | 73                                                                                            | 168            | 404                                                                                           | For the PTS criteria, the smallest distances to thresholds were observed for the peak sound pressure (Lpk) acoustic thresholds while the largest distances were observed for the 160 dB SPL for the marine mammal behavioural criteria. The largest distance was modelled to be 84 metres corresponding to the 160 dB SPL marine mammal behavioural criterion without mitigation for the impact installation of the 24-inch pile diameter. |  |
|                                                                                                                                                                                    | L <sub>p,pk</sub> <sup>1,3</sup>     | 219            | The threshold level is greater than the source level; therefore, distances are not generated. | 213            | The threshold level is greater than the source level; therefore, distances are not generated. |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Mid-frequency cetaceans                                                                                                                                                            | L <sub>E,24hr</sub> <sup>1/,3/</sup> | 185            |                                                                                               | 170            | 36                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|                                                                                                                                                                                    | L <sub>p,pk</sub> <sup>1/,3/</sup>   | 230            |                                                                                               | 224            | The threshold level is greater than the source level; therefore, distances are not generated. |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Otariid pinnipeds underwater                                                                                                                                                       | L <sub>E,24hr</sub> <sup>1/,3/</sup> | 203            |                                                                                               | 188            | 25                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|                                                                                                                                                                                    | L <sub>p,pk</sub> <sup>1/,3/</sup>   | 232            |                                                                                               | 226            | The threshold level is greater than the source level; therefore, distances are not generated. |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Marine mammal behaviour                                                                                                                                                            | L <sub>p</sub> <sup>2,4</sup>        | 160            | 84                                                                                            | -              | -                                                                                             | All distance to threshold values were low (i.e. less than 50 metres). The largest distance was modelled to be 37 metres.                                                                                                                                                                                                                                                                                                                   |  |
| Sea turtle temporary threshold shift                                                                                                                                               | L <sub>E,24hr</sub> <sup>1/,2/</sup> | 189            | 30                                                                                            | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|                                                                                                                                                                                    | L <sub>p,pk</sub> <sup>1/,2/</sup>   | 226            | The threshold level is greater than the source level; therefore, distances are not generated. | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Sea turtle permanent threshold shift                                                                                                                                               | L <sub>E,24hr</sub> <sup>1/,2/</sup> | 204            | 3                                                                                             | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|                                                                                                                                                                                    | L <sub>p,pk</sub> <sup>1/,2/</sup>   | 232            | The threshold level is greater than the source level; therefore, distances are not generated. | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Sea turtle behavioural                                                                                                                                                             | L <sub>p</sub> <sup>2/</sup>         | 175            | 37                                                                                            | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Fish: no swim bladder                                                                                                                                                              | L <sub>E,24hr</sub> <sup>1,2</sup>   | 219            | The threshold level is greater than the source level; therefore, distances are not generated. | -              | -                                                                                             | All distance to threshold values were low (i.e. less than 100 metres) except for the distance to the 150 dB SPL behavioural threshold criteria. The largest distance was modelled to be 348 metres.                                                                                                                                                                                                                                        |  |
|                                                                                                                                                                                    | L <sub>p,pk</sub> <sup>1,2</sup>     | 213            |                                                                                               | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Fish: swim bladder is not involved in hearing                                                                                                                                      | L <sub>E,24hr</sub> <sup>1,2</sup>   | 210            |                                                                                               | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|                                                                                                                                                                                    | L <sub>p,pk</sub> <sup>1,2</sup>     | 207            |                                                                                               | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Fish: swim bladder involved in hearing                                                                                                                                             | L <sub>E,24hr</sub> <sup>1,2</sup>   | 207            | 4                                                                                             | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|                                                                                                                                                                                    | L <sub>p,pk</sub> <sup>1,2</sup>     | 207            | The threshold level is greater than the source level; therefore, distances are not generated. | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Eggs and larvae                                                                                                                                                                    | L <sub>E,24hr</sub> <sup>1,2</sup>   | 210            | The threshold level is greater than the source level; therefore, distances are not generated. | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|                                                                                                                                                                                    | L <sub>p,pk</sub> <sup>1,2</sup>     | 207            |                                                                                               | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Small fish                                                                                                                                                                         | L <sub>E,24hr</sub> <sup>3,4</sup>   | 183            |                                                                                               | 76             | -                                                                                             | -                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
|                                                                                                                                                                                    | L <sub>p,pk</sub> <sup>3,4</sup>     | 206            | 2                                                                                             | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|                                                                                                                                                                                    | L <sub>p</sub> <sup>5</sup>          | 150            | 348                                                                                           | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| Large fish                                                                                                                                                                         | L <sub>E,24hr</sub> <sup>3,4</sup>   | 187            | 52                                                                                            | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|                                                                                                                                                                                    | L <sub>p,pk</sub> <sup>3,4</sup>     | 206            | 2                                                                                             | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|                                                                                                                                                                                    | L <sub>p</sub> <sup>5</sup>          | 150            | 348                                                                                           | -              | -                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |



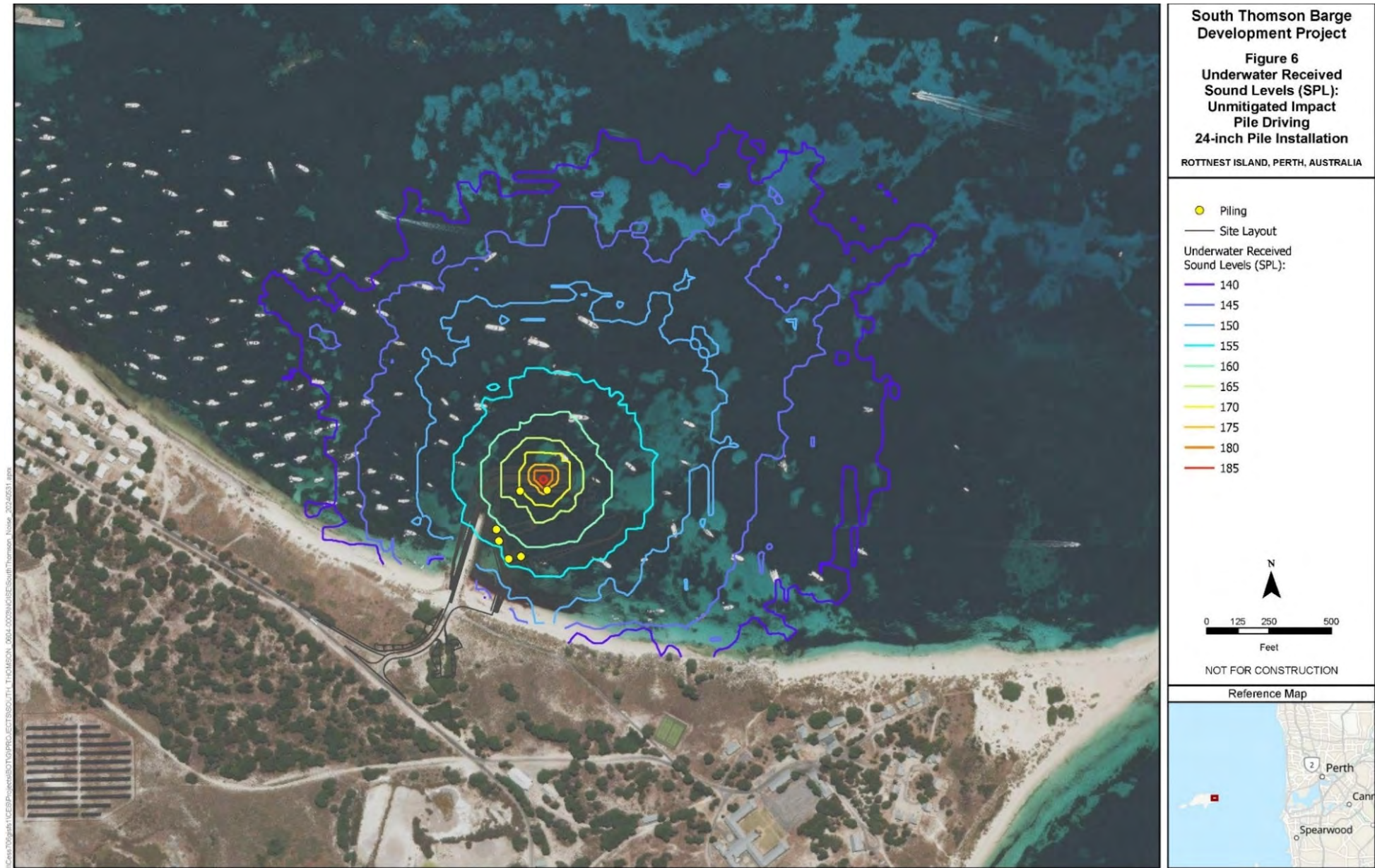


Figure 35: Underwater Received Sound Levels (SPL): Unmitigated impact pile driving 24-inch pile installation (contingency piling method)



Figure 36: Underwater Received Sound Levels (SPL): Unmitigated vibratory 24-inch pile installation (proposed piling method)



### 10.5.1.6 Increased vessel collision risk

An increased risk of collision could result from an increase in the number of vessels using the South Thomson Bay Barge Landing during operation and to a lesser degree during construction of the proposal. As outlined in Section 10.5.1.1.1, marine fauna species that may be susceptible to vessel strike includes turtle and whale species. As discussed previously, marine turtle species are considered likely to only occasionally occur within or proximate to the development envelope and the risk of whale species occurring in these shallow waters is low. As such, the risk of vessel strike impacting these species within the development envelope is low. There is however a risk of strikes between whales and vessels during vessel movements between the mainland and island.

The operation of the proposal will result in an increase in vessel activity within and within vicinity of the development envelope. Vessel collisions with marine fauna have the potential to result in injury or death to the affected animal. Vessels travelling at 14 knots or faster are those most likely to cause death or serious injury to marine mammals (Wilson, 2007). In addition, there is the potential for the increase in vessel activity to disturb marine fauna, potentially interrupting key activities (e.g. foraging) or displacing animals from preferred habitat.

The risk of vessel strike during construction activities is low as the construction vessels will operate slowly and within the development envelope only. The CEMP will outline speed limits and other management measures to ensure the risk of vessel strike during construction is minimised.

Barge movements already occur between the mainland and Main Jetty in Thomson Bay. Therefore, the proposal will not result in any increased risk of vessel strike. The OEMP outlines measures to further reduce this risk (Appendix Q).

### 10.5.1.7 Increased risk of entanglement or entrainment

Activities involved in the construction and operation of the proposal have the potential to cause both entanglement and entrainment to marine fauna. Entanglement may lead to injury, death, displacement, adverse behavioural and physiological changes. As outlined in Section 10.5.1.1.1, marine fauna species that may be susceptible to injury from entanglement includes the Australian sea lion and southern right whale. Sea turtles are likely to be susceptible to entrainment, however as discussed previously, marine turtles are unlikely to frequent the area.

Building materials and general litter associated with the construction and operational phases of the proposal have the potential to cause entanglement. Several factors including the visibility, dimensions, how important the location is for feeding or breeding and the extent of close-range evasion all interact to determine the likelihood of entanglement.

Entrainment, the direct uptake of aquatic organisms by suction, during activities such as dredging has the potential to cause mortality to marine fauna species (Dabble, 2012).

### 10.5.1.8 Increased risk of introduced marine species

There is a risk of introduced marine species (IMS) during construction and operation of the proposal from vessel ballast water and hull fouling. IMS may threaten biodiversity through a number of mechanisms such as predation, competition for habitat and altering ecosystems.

Implementation of the proposal would not result in a major change in the activities that already exist on Wadjemup / Rottnest Island as the proposal involves moving the barging facilities to the proposed location from the existing jetty, rather than introducing a new activity to the island. The CEMP and OEMP outlines management measures to ensure that the risk of IMS is minimised and as such there would not be any increase in the existing level of IMS occurring proximate to the proposal.

### 10.5.1.9 Increased light emissions

Increased light emissions during operation of the proposal could lead to disturbance to marine fauna in the vicinity, especially shorebirds and seabirds. Fairy terns roost at Phillip Point, approximately 800 m to the east of the proposal. Lighting has not been shown to impact fairy terns, however night-time lighting near fairy tern habitat can increase feeding opportunities for silver gulls, resulting in competition for food sources (DEWHA, 2011).

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The potential for artificial light emissions to impact shorebirds and seabirds during construction is considered to be low, as construction works will be undertaken during nominated daylight hours, with likely lighting requirements limited to security / safety installations.

The OEMP will ensure light emission impacts on shorebirds and seabirds is minimised and in accordance with the National Light Pollution Guidelines for Wildlife (DCEEW, 2023).

#### **10.5.1.10 Increased risk of pollution incidents**

Increased boat numbers during operation, and to lesser degree construction, of the proposal has the potential to increase the risk of pollution, including from antifouling paints, anti-corrosion anodes, increased risk of accidental discharges (e.g. fuel spills, oils and greases) and sullage.

An increase in vessels using South Thomson Bay is expected during the operational phase, and quantities and types of material that might enter the marine environment are limited to spills relating to these vessels. The magnitude of this impact is entirely dependent upon the quantities and nature of the spillage, the dilution and dispersal properties of the waters and the bioavailability of the contaminant to species. The more toxic components of fuel spills are volatile and relatively short-lived. Heavier hydrocarbons, while less toxic, may persist for longer in the marine environment.

Whilst marine fauna such as seabirds, marine mammals and elasmobranchs are likely to be able to detect and avoid pollutants, sessile species of shellfish are potentially more vulnerable. Likely effects of release of contaminants into the marine environment may result in direct impacts through ingestion, inhalation and absorption through the skin, and abandonment of polluted feeding habitat and potentially longer-term impacts from bioaccumulation in the food chain.

### **10.6 Mitigation**

Table 54 demonstrates how the EPA's mitigation hierarchy (avoid, minimise and rehabilitate) has been applied to the environmental factor of marine fauna to address the key potential impacts.

Table 54: Application of mitigation hierarchy to marine fauna

| Potential environmental impacts                              | Impact class        | Mitigation hierarchy | Proposed mitigation measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Residual impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|--------------------------------------------------------------|---------------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Temporary / permanent loss or degradation of benthic habitat | Direct and Indirect | Avoid                | <ul style="list-style-type: none"><li>Avoiding construction activities during known critical spatial and temporal windows of marine environmental sensitivity will avoid significant impacts to marine fauna species. These critical windows are outlined in Table 49. However, it is not anticipated that impacts to marine species can be fully avoided during construction activities.</li><li>Site selection includes an already disturbed area of 0.19 ha of seabed within the existing Army Groyne footprint. As benthic communities and habitats are widespread within South Thomson Bay, total avoidance of direct impacts is not possible.</li><li>RIA amended the project design to reduce the dredging requirements. By changing the berthing and barge turn pocket, the volume of required dredging was reduced from 26,000 m³ to 16,050 m³</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p><b>Permanent impacts to 2.06 ha mixed seagrass and 1.26 ha sand with wrack within the ZoI, ZoMI and ZoHI from an increase in suspended sediments</b></p> <p><b>The temporary loss of 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI</b></p> <p>Baird (2024b) predicts that temporary impacts to benthic communities and habitats will be recoverable within a period of five years following completion of the dredging activities.</p> <ul style="list-style-type: none"><li>Implementation of the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to address a temporary increase in TSS / turbidity during construction.</li><li>Implementation of these management plans ensures that impacts to marine environmental quality outside the ZoMI and ZoHI from a temporary increase in suspended sediments are unlikely.</li><li>Significant residual impacts to marine fauna from temporary/permanent loss of potential fauna habitat and from reduced marine environmental quality are considered unlikely.</li></ul> |
|                                                              |                     | Minimise             | <ul style="list-style-type: none"><li>Management and mitigation proposed during construction to minimise impacts to marine fauna habitat such as benthic communities and habitats is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that:<ul style="list-style-type: none"><li>The area of benthic habitat affected by suspended sediments during dredging and construction will be limited (wherever possible) and will not extend past the modelled ZoHI, ZoMI and ZoI.</li><li>Marine environmental quality will be maintained at a moderate level of ecological protection during dredging and return to a High Level of Ecological Protection within two weeks following completion of dredging.</li></ul></li><li>Implementation of the CEMP and DEMMP provides the monitoring and management framework to address potential impacts to marine environmental quality during construction. Key management and monitoring measures include:<ul style="list-style-type: none"><li>Implementation of the Marine Water Quality Monitoring Program (MWQMP) provided in the DEMMP for suspended sediment.</li></ul></li><li>The OEMP provides the monitoring and management framework to potential environmental impacts to marine fauna from the implementation of the proposal over the long-term operational life span of the marine structures.</li><li>Maintenance dredging (if required) will be undertaken in previously disturbed / sandy areas within the development envelope / project footprint. Maintenance dredging frequency, volumes and disposal will be determined as required. Environmental management and monitoring will be undertaken in a manner that is consistent with the document Maintenance Dredging Environmental Management Framework (BMT Oceanica, 2016) prepared for Department of Transport for similar types of maintenance dredging activities.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                                              |                     | Rehabilitate         | There is no opportunity to rehabilitate the impacted area due to operation and maintenance of the proposal. Construction effects (outside the development envelope and ZoHI) to marine fauna habitat (benthic communities and habitats) will be temporary and natural amelioration will mitigate or remove long-term impacts following cessation of construction activities.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                                              |                     | Offset               | Marine fauna offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Elevated underwater noise                                    | Direct              | Avoid                | <ul style="list-style-type: none"><li>Avoiding construction activities, such as dredging and piling, which generate underwater noise during known critical spatial and temporal windows of marine environmental sensitivity. Key windows of sensitivity, such as periods of whale migration, are discussed in Table 49.</li><li>Using vibro hammer piling methods (rather than hammer piling) will eliminate sources of impulsive noise.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p><b>Underwater noise emissions from activities such as piling and dredging causing temporary disturbance to marine fauna species</b></p> <ul style="list-style-type: none"><li>Potential for elevated underwater noise to impact marine fauna is limited to construction works.</li><li>Implementation of the CEMP provides the monitoring and management framework to address elevated underwater noise during piling. Significant residual impacts to marine fauna from elevated underwater noise are considered unlikely.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                              |                     | Minimise             | <ul style="list-style-type: none"><li>Implementation of the CEMP (Emerge, 2024a) (Appendix P) provides the monitoring and management framework to address elevated underwater noise generated from construction activities, such as dredging and piling. Implementation of this management plan will ensure that:<ul style="list-style-type: none"><li>There is no injury or death of marine fauna associated with underwater noise generated during construction of the proposal.</li><li>There is no injury or death of marine fauna from underwater noise.</li></ul></li><li>Key management and monitoring measures included in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). are:<ul style="list-style-type: none"><li>Trained marine fauna observers (MFOs) will minimise the risk of injury to marine fauna during piling.</li><li>A reduction in underwater noise impacts to marine fauna will be achieved through the use of vibration piling rather than hammer piling during construction. The reduction in underwater noise levels can be seen in the comparison of the underwater noise modelling shown in Figure 35 and Figure 36.</li><li>Hammer piling will only be used as a contingency if there is a refusal during vibro-piling. Exclusion zones for this contingency are included in the CEMP.</li><li>Pre-start, soft-start, shut-down and low-visibility procedures will be implemented as outlined in the CEMP. These are summarised below and detailed in Appendix A of the CEMP:<ul style="list-style-type: none"><li>Prior to piling works each day and for each pile the dedicated MFOs will commence continuous visual observation within the observation and exclusion zones for 30-minutes.</li><li>Soft-start procedures involve the commencement of piling at low vibro-hammer energy, gradually increasing to full energy over a 30-minute period. Where target marine fauna are not observed in the observation and exclusion zones during the soft-start procedures, then normal piling can commence.</li><li>Where marine fauna is observed by the MFO within the observation zone (but outside the exclusion zone) during piling activities (including soft-start procedures), then the shutdown procedures outlined in the CEMP will be implemented.</li><li>During periods of low visibility (i.e. where a distance of 500 m cannot be clearly viewed), then piling operations may commence with soft-start procedures, unless one of the triggers provided in the CEMP occurs.</li></ul></li><li>Implementation of observation and exclusion zones. These zones have been based on the underwater received sound levels and distances from the underwater noise assessment (Appendix S) and are provided in the CEMP. The management zones are depicted in Appendix A (Marine Fauna Provisions) of the CEMP.</li><li>Piling will only be undertaken during daylight hours to ensure visibility of the observation and exclusion zones for the MFO.</li><li>Trained MFOs will be on duty (as outlined in Appendix A of the CEMP) on vessels during construction.</li></ul></li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |



| Potential environmental impacts                                           | Impact class | Mitigation hierarchy | Proposed mitigation measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Residual impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|---------------------------------------------------------------------------|--------------|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Increased vessel collision risk                                           | Direct       | Rehabilitate         | There is no opportunity to rehabilitate underwater noise impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>No residual impacts expected</b> <ul style="list-style-type: none"> <li>Implementation of the CEMP provides the monitoring and management framework to minimise the risk of increased vessel collision risk during construction.</li> <li>Implementation of the OEMP provides the monitoring and management framework to address increased vessel collision risk during operation.</li> <li>There is a low residual risk to marine fauna from vessel collision during construction and operation.</li> </ul>                                                               |
|                                                                           |              | Offset               | Marine fauna offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                           |              | Avoid                | Marine vessels will be used during the construction and operation of the proposal. As such, there is no opportunity to completely avoid the risk of vessel collision.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                           |              | Minimise             | <ul style="list-style-type: none"> <li>Implementation of the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to address increased vessel collision risk during construction. Implementation of this management plan will ensure that there is no death or injury to marine fauna from vessel strike. Management measures that will be implemented include: <ul style="list-style-type: none"> <li>Implementation of vessel speed limits.</li> <li>All vessels are to adhere to standards set in the National Whale Watching Guidelines.</li> <li>A MFO on all construction vessels when in transit.</li> <li>Implementation of vessel approach distances to marine fauna.</li> <li>Implementation of the marine fauna monitoring and management program provided in Appendix B.3 of the DEMMP.</li> </ul> </li> <li>Implementation of the OEMP (Emerge, 2024b) (Appendix Q) provides the monitoring and management framework to address increased vessel collision risk during operation. Implementation of this management plan will ensure that marine users to comply with vessel operational restrictions required by DoT and RIA.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                           |              | Rehabilitate         | There is no opportunity to rehabilitate increased vessel collision risks.<br>Sick and/or injured fauna shall be managed by appropriately qualified personnel and any injury or death of marine fauna will be reported to DBCA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Increased risk of entanglement and entrainment                            | Direct       | Offset               | Marine fauna offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>No residual impacts expected</b> <ul style="list-style-type: none"> <li>Potential for increased risk of entrapment to impact marine fauna limited to construction and maintenance dredging during operation.</li> <li>Potential for increased risk of entanglement to impact marine fauna during construction and operations will be minimised through implementation of the CEMP, DEMMP and OEMP.</li> <li>With implementation of the CEMP and OEMP, residual impacts to marine fauna from increased risk of entanglement and entrainment are not anticipated.</li> </ul> |
|                                                                           |              | Avoid                | Dredging will be undertaken during construction and may also be required during operation. There is no opportunity to completely avoid increased risk of entrainment.<br>Dredging will be undertaken during construction and may also be required during operation. Silt curtain will be used during dredging to manage sediment plumes. There is the potential for entanglement of marine fauna in silt curtains and as such, there is no opportunity to completely avoid increased risk of entanglement.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                           |              | Minimise             | <ul style="list-style-type: none"> <li>Implementation of the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to address increased risk of entanglement and entrainment during construction. Management measures to minimise the risk of injury to fauna during construction includes: <ul style="list-style-type: none"> <li>Dedicated MFOs during dredging will implement management measures to minimise the risk of injury to fauna. Where marine fauna are observed within an Exclusion Zone, dredging will cease immediately.</li> <li>Prior to commencing dredging or excavating, dedicated MFOs will check for marine fauna within the exclusion and observation zones outlined in the CEMP.</li> <li>Dredging activities will be undertaken during daylight hours only to improve visibility.</li> <li>Measures to minimise the risk for entanglement of marine fauna with waste during construction.</li> <li>Measures to minimise the risk for entanglement of marine fauna with construction equipment.</li> </ul> </li> <li>Implementation of the OEMP (Emerge, 2024b) (Appendix Q) provides the monitoring and management framework to address increased risk of entanglement during operation. During operation of the proposal, the risk of entanglement will be minimised through: <ul style="list-style-type: none"> <li>Installation of information-boards to encourage appropriate disposal of litter and the inform of the dangers of entanglement.</li> <li>Waste disposal measures and prevent rubbish and litter.</li> </ul> </li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                           |              | Rehabilitate         | There is no opportunity to rehabilitate increased risk of entanglement and entrainment.<br>Sick and/or injured fauna shall be managed by appropriately qualified personnel and any injury or death of marine fauna will be reported to DBCA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                           |              | Offset               | Marine fauna offsets are not considered applicable to the proposal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Risk of injury or death from rock dumping during breakwater construction. | Direct       | Avoid                | The risk for injury or mortality during rock dumping activities cannot be completely avoided.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>No residual impacts expected</b> <ul style="list-style-type: none"> <li>Potential for injury or mortality of marine fauna from rock dumping is limited to the construction phase.</li> <li>With implementation of the CEMP, residual impacts to marine fauna from rock dumping are not anticipated.</li> </ul>                                                                                                                                                                                                                                                             |
|                                                                           |              | Minimise             | <ul style="list-style-type: none"> <li>The CEMP (Emerge, 2024a) (Appendix P) outlines the management and monitoring measures to mitigate the potential impacts of rock dumping and excavation on conservation significant marine fauna. These measures include: <ul style="list-style-type: none"> <li>Dedicated MFOs during rock dumping activities will implement management measures to minimise the risk of injury to fauna as outlined in Appendix A (Marine Fauna Provisions) of the CEMP, including: <ul style="list-style-type: none"> <li>Prior to rock dumping and excavation works, the dedicated MFOs will commence continuous visual observation within the specified Management Zones for 30 minutes. If target marine fauna is observed within the management zone during this time, rock dumping and excavation shall be delayed until the marine fauna has been observed exiting the Observation Zone or have not been seen for 30 minutes.</li> <li>Once rock dumping has commenced, if the dedicated MFOs observe a target marine fauna species within the Exclusion Zones then shut-down procedures will be implemented.</li> <li>During periods of low visibility (i.e. where a distance of 500 m cannot be clearly viewed), then rock dumping and excavation activities may commence with soft-start procedures.</li> </ul> </li> <li>Rock dumping, dredging and excavation activities will be undertaken during daylight hours only to improve visibility.</li> </ul> </li> </ul>                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                           |              | Rehabilitate         | There is no opportunity to rehabilitate increased risk of injury or mortality from rock dumping. However, sick and/or injured fauna shall be managed by appropriately qualified personnel and any injury or death of marine fauna will be reported to DBCA.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                           |              | Offset               | Marine fauna offsets are not considered applicable to the proposal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Increased risk of introduced marine species                               | Indirect     | Avoid                | Marine vessels will be used during the construction and operation of the proposal and the risk of IMS cannot be completely avoided.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>No residual impacts expected</b> <ul style="list-style-type: none"> <li>With implementation of the CEMP and OEMP, residual impacts to marine fauna from increased risk of IMS are not anticipated.</li> </ul>                                                                                                                                                                                                                                                                                                                                                              |
|                                                                           |              | Minimise             | <ul style="list-style-type: none"> <li>Implementation of the CEMP (Emerge, 2024a) (Appendix P), DEMMP (02 Environment, 2024) (Appendix O) and OEMP (Appendix Q) will minimise the risk of introduction of IMS.</li> <li>The proposal will be primarily used for barge operations to transport bulk cargo to and from Wadjemup / Rottnest Island. As such, the likelihood of vessels visiting the facility from international or interstate waters is low. However, any vessels from interstate or international waters will comply with Commonwealth biosecurity requirements and complete the WA Department of Primary Industries and Regional Development 'Vessel Check' risk assessment (<a href="https://www.vessel-check.com/">https://www.vessel-check.com/</a>).</li> <li>All vessels will have a ballast water management plan and ballast water exchanges will be in accordance with IMS requirements and the <i>Commonwealth Biosecurity Act 2015</i>.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                           |              | Rehabilitate         | There is no opportunity to rehabilitate increased risk of introduced marine species                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                           |              | Offset               | Marine fauna offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

| Potential environmental impacts       | Impact class | Mitigation hierarchy | Proposed mitigation measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Residual impacts                                                                                                                                                                                                                                                                                               |
|---------------------------------------|--------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Increased risk of pollution incidents | Indirect     | Avoid                | Construction and operation of the proposal includes vectors which have the potential to result in pollution incidents and risk of this impact cannot be avoided.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>No residual impacts expected</b> <ul style="list-style-type: none"><li>Management and monitoring measures in the CEMP (Emerge, 2024a) (Appendix P), DEMMP (02 Environment, 2024) (Appendix O) and OEMP (Emerge, 2024b) (Appendix Q) will ensure that the residual pollution incident risk is low.</li></ul> |
|                                       |              | Minimise             | <ul style="list-style-type: none"><li>Construction management measures to minimise the risk of pollution incidents which may impact marine fauna is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that the risk for hydrocarbon spills to the marine environment is minimal so that there are no adverse impacts to marine fauna.</li><li>Key management and monitoring measures include:<ul style="list-style-type: none"><li>Implement industry standard hydrocarbon management practices (chemical handling, storage, segregation, and spill response)</li><li>Any construction vessels including piling vessels/barges to establish a sewage and garbage disposal plan</li><li>Undertake vessel maintenance and bunkering in accordance with contractors approved vessel management systems</li><li>Hydrocarbon spills into the marine environment be immediately reported and appropriately remediated.</li></ul></li><li>Operational management to minimise impacts to the marine environment is detailed in the OEMP (Appendix Q). Implementation of this management plan will ensure that:<ul style="list-style-type: none"><li>Fuel / oil spill contingency plans are included in the OEMP and includes the provision of clean-up equipment and appropriate disposal of contaminated water and sediment</li><li>Pollution incidents will be reported to the DoT's MEER unit, with clean up managed and monitored in accordance with MEER's requirements</li><li>Pollution incidents will be monitored during operation in accordance with the OEMP, with contingency actions implemented should pollution triggers be breached on a reoccurring basis.</li></ul></li><li>The underground fuel storage facility will be constructed in accordance with AS1940 and as outlined in the OEMP have safety and leak detection equipment installed.</li></ul> |                                                                                                                                                                                                                                                                                                                |
|                                       |              | Rehabilitate         | Fuel and oil spills to be cleaned up in accordance with the contingency actions outlined in the DEMMP, CEMP and OEMP (Emerge, 2024b) (Appendix Q).<br>Sick and/or injured fauna shall be managed by appropriately qualified personnel.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                |
|                                       |              | Offset               | Marine fauna offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                |
| Increased light emissions             | Indirect     | Avoid                | <ul style="list-style-type: none"><li>General construction work will be limited to daylight hours only.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>No residual impacts expected</b> <ul style="list-style-type: none"><li>With implementation of the CEMP and OEMP, residual impacts to marine fauna from increased light emissions are considered low.</li></ul>                                                                                              |
|                                       |              | Minimise             | <ul style="list-style-type: none"><li>Implementation of the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to minimise impacts to marine fauna from increased light emissions during construction. The key management measure to ensure no disturbance to marine fauna from artificial light during construction is:<ul style="list-style-type: none"><li>Construction activities will be restricted to daylight hours.</li></ul></li><li>Operational management to minimise impacts to marine fauna is detailed in the OEMP (Emerge, 2024b) (Appendix Q). Implementation of this management plan will ensure that:<ul style="list-style-type: none"><li>Artificial lighting will be of lowest allowable intensity to meet legislative and regulatory requirements for human safety / navigational purposes.</li></ul></li><li>Best practice lighting design consistent with the National Light Pollution Guidelines for Wildlife (DCCEEW 2023) will be employed to reduce light pollution on marine fauna during operation, including:<ul style="list-style-type: none"><li>Only add light for specific purposes (e.g. navigational and safety)</li><li>Use adaptive light controls to manage light timing, intensity and colour</li><li>Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill</li><li>Use the lowest intensity lighting appropriate for the task</li><li>Use non-reflective, dark-coloured surfaces</li><li>Use lights with reduced or filtered blue, violet and ultra-violet wavelengths.</li></ul></li></ul>                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                |
|                                       |              | Rehabilitate         | There is no opportunity to rehabilitate increased light emissions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                |
|                                       |              | Offset               | Marine fauna offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                |

## 10.7 Assessment and significance of residual impact

The predicted residual impacts to marine fauna from the proposal are considered manageable through implementation of the CEMP, DEMMP and OEMP. With implementation of these management plans, the residual impacts are not considered significant and are limited to:

- Impacts to the following benthic communities and habitats within the ZoI, ZoMI and ZoHI from an increase in suspended sediments results in a decrease in potential marine fauna habitat available:
  - Permanent impacts to 2.06 ha mixed seagrass and 1.26 ha sand with wrack
  - Temporary loss of 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI
- Underwater noise emissions from construction activities such as piling and dredging causing temporary disturbance to marine fauna species.

These residual impacts are not considered significant as discussed in Table 55.

**Table 55: Consideration of the significance of the residual impacts on marine fauna**

| Matters for consideration                                                                                                                                | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The object and principles of the EP Act                                                                                                                  | A Marine Fauna and Benthic Habitat Assessment (RPS, 2024a) was undertaken to address the EPA's marine fauna objective and the principles of the EP Act have been specifically addressed in relation to the proposal (Table 26).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Values, sensitivity and quality of the environment which is likely to be impacted                                                                        | <p>Sensitive receptors include marine fauna species, such as whales, which are known to transit through the marine environment during important breeding periods as discussed further in the Marine Fauna Desktop Study (Appendix B).</p> <p>Loss of 3.32 ha of marine fauna habitat (benthic communities and habitats) will occur from construction of the proposal. This impact is considered small scale when considered regionally (loss of mixed seagrass of 2.06 ha accounts for 0.52% of mixed seagrass within the LAU).</p> <p>Implementation of the CEMP, DEMMP and OEMP will avoid and minimise environmental impacts on the more sensitive benthic communities and habitats receptors (e.g. seagrass). With the proposed mitigation and management framework outlined in these management plans, the residual impact from the proposal is considered manageable.</p>                                                                                                                                                                                                                                |
| All stages and components of the proposal (such as any infrastructure required for the proposal to be practicably implemented, or a proposal life cycle) | All stages of the proposal (i.e. construction and operation) have been included in this impact assessment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Extent (intensity, duration, magnitude, and geographic footprint) of the likely impacts                                                                  | The predicted residual impacts to marine fauna from the proposal are considered to be manageable through implementation of the CEMP, DEMMP and OEMP.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Resilience of the environment                                                                                                                            | <p>The impact assessment identified that the marine fauna populations within vicinity of the proposal will be resilient to any changes as:</p> <ul style="list-style-type: none"> <li>• Best practice lighting design consistent with the National Light Pollution Guidelines for Wildlife (DCCEEW 2023) will be employed to reduce light pollution on marine fauna.</li> <li>• Potential underwater noise impacts from piling are restricted to temporary behavioural responses of individuals, such as avoidance. This avoidance is not expected to displace individuals from critical habitat and therefore, impacts are not considered likely to be significant and marine fauna will be resilient to potential impacts from the proposal.</li> <li>• With implementation of the CEMP, no significant impacts are expected from entanglement or entrainment and therefore the environment is considered resilient.</li> <li>• Significant impacts from IMS are not predicted, due to the management measures outlined in the CEMP and OEMP. Therefore, the environment is considered resilient.</li> </ul> |



| Matters for consideration                                                                                                              | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                        | <ul style="list-style-type: none"> <li>Direct impacts to benthic communities and habitats are limited to 0.52% of mixed seagrass within the LAU. Indirect impacts within the ZoMI will be recoverable within a period of five years and impacts within the ZoI are not predicted to be observable. As such, it is considered that the marine environment is resilient to the indirect impacts from the proposal.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Consequence of the application of the mitigation hierarchy to the proposal.                                                            | <p>The WA Offsets Guidelines (Government of Western Australia 2014) identifies four levels of significance for residual impacts:</p> <ul style="list-style-type: none"> <li>Unacceptable impacts – those impacts which are environmentally unacceptable or where no offset can be applied to reduce the impact. Offsets are not appropriate in all circumstances, as some environmental values cannot be offset.</li> <li>Significant impacts requiring an offset – any significant residual impact of this nature will require an offset. These generally relate to any impacts to species, ecosystems, or reserve areas protected by statute or where the cumulative impact is already determined to be at a critical level.</li> <li>Potentially significant impact which may require an offset – the residual impact may be significant depending on the context and extent of the impact. These relate to impacts that are likely to result in a species or ecosystem requiring protection under statute or increasing the cumulative impact to a critical level. Whether these impacts require an offset will be determined by the decision-maker based on information provided by the proponent or applicant and expert judgement</li> <li>Impacts which are not significant – impacts which do not trigger the above categories are not expected to have a significant impact on the environment and therefore do not require an offset</li> </ul> <p>Following the application of the mitigation hierarchy (Table 54) and taking into consideration the above significance of residual impacts model, RPS considers that there are no significant residual impacts to marine fauna from the proposal.</p> |
| Level of confidence in the prediction of residual impacts and the success of proposed mitigation                                       | The impact assessment and investigations relevant to marine fauna has been undertaken in accordance with relevant legislation and guidelines as per Table 46. As such, there is a high level of confidence in the predictions of residual impacts on marine fauna.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| Public interest about the likely effect of the proposal or scheme, if implemented, on the environment, and relevant public information | RIA has facilitated regular meetings / dialogue with the local community and key stakeholders (Table 25) as part of the project.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

Cumulative impacts from the proposal have been considered in relation to other proposals within 5 km of the proposal and are discussed in Section 18.

Holistic impacts are discussed in Section 17.

## 10.8 Environmental outcomes

In consideration of the proposed avoidance and management measures and likely residual impacts associated with the proposal, the environmental outcomes that apply to marine fauna are:

- Environmental outcomes for construction of the proposal:
  - No irreversible loss of marine fauna habitat (e.g. benthic communities and habitats) from dredging and construction activities outside the development envelope and ZoHI
  - No reported introduction or establishment of IMS as a result of construction activities associated with the proposal
  - No reported impacts to marine fauna as a result of hydrocarbon spill or release of waste associated with construction activities including entanglement or ingestion of waste
  - No reported death or injury to marine fauna from vessel strike associated with construction activities

- 
- No reported death, injury or behavioural change to marine fauna as a result of underwater noise associated with construction activities
  - No reported negative impacts on marine fauna attributable to the construction lighting requirements of the proposal.
  - Environmental outcomes for operation of the proposal:
    - No reported loss of marine fauna habitat outside of the approved project footprint attributable to the operation of the proposal
    - No reported introduction or establishment of IMS as a result of operational activities associated with the proposal
    - No reported impacts to marine fauna as a result of hydrocarbon spill or release of waste associated with operational activities including entanglement or ingestion of waste
    - No reported death or injury to marine fauna from vessel strike associated with operational activities
    - No reported negative impacts on marine fauna attributable to the lighting requirements of the proposal associated with operation of the proposal.

Monitoring will be undertaken, and adaptive management measures implemented in accordance with the CEMP, DEMMP and OEMP to ensure these environmental outcomes are met.

As the impact assessment identified low residual risks to marine fauna following the application of mitigation actions identified herein, it is considered that the proposal will successfully meet this the EPA's objective to protect marine fauna so that biological diversity and ecological integrity are maintained.

## 11 FLORA AND VEGETATION

### 11.1 EPA objective

To protect flora and vegetation so that biological diversity and ecological integrity is maintained.

### 11.2 Policy and guidance

The proposal will be subject to compliance with applicable policies and guidance developed to assist proponents and the public to understand the minimum requirements for the protection of elements of the environment that the EPA expects to be met during the assessment process.

Table 56 lists relevant EPA guidance, other state and Commonwealth legislation / policy, and provides consideration for how these documents informed the proposal.

**Table 56: Relevant legislation, policy and guidance**

| <b>Legislation, policy and guidance</b>                                                            | <b>Consideration</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Factor Guideline – Flora and Vegetation (EPA, 2016a)                                 | The environmental factor guideline identifies the environmental values of flora and vegetation, and their significance. These considerations were underpinned as part of the impact assessment on terrestrial flora and vegetation summarised in Section 11 of this report. Implementation of the CEMP (Emerge, 2024a) (Appendix P) and OEMP (Emerge, 2024b) (Appendix Q) provides the monitoring and management framework to address potential impacts to flora and vegetation from construction and operation of the proposal.                                                                                                                                                                                                                       |
| Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b) | Flora and vegetation surveys, as summarised in Section 11.3, have been undertaken within the development in accordance with Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b).<br>The EPA's Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016) states that 'a reconnaissance survey is required where flora and vegetation values are well defined, the area is not likely to support significant flora or vegetation and the scale and nature of the potential impacts are not likely to be significant'. RPS considered these criteria to be met and that the small size of the site precluded the implementation of a detailed survey using quadrats. |
| <i>Environment Protection and Biodiversity Conservation Act 1999</i>                               | A search of DCCEEW's PMST was undertaken within a 5 km radius of the proposal to determine the MNES that are either known or likely to occur proximate to the proposal (Appendix R).<br>A discussion of potential impacts on MNES is discussed in Section 14.2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <i>Biodiversity Conservation Act 2016</i>                                                          | A search of the DBCA's NatureMap database was undertaken to determine a list of conservation significant terrestrial flora species and ecological communities that have been recorded within 10 km of the proposal (Appendix R).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

### 11.3 Environmental investigations

A reconnaissance survey was undertaken by RPS within the terrestrial survey area shown in Figure 37 (Appendix J). As part of the reconnaissance survey, a review of the Focused Vision Consulting (FVC, 2023) report; Flora and Vegetation Survey South Thomson and Kingstown, Wadjemup / Rottne Island (Appendix I) was undertaken. The FVC survey encompassed the development envelope and surrounding areas as shown in Figure 38.

The flora and vegetation data collected by RPS during the reconnaissance survey has been used to support this referral document and Section 11.5 provides a summary of this information.





Figure 37: Terrestrial flora and vegetation survey area

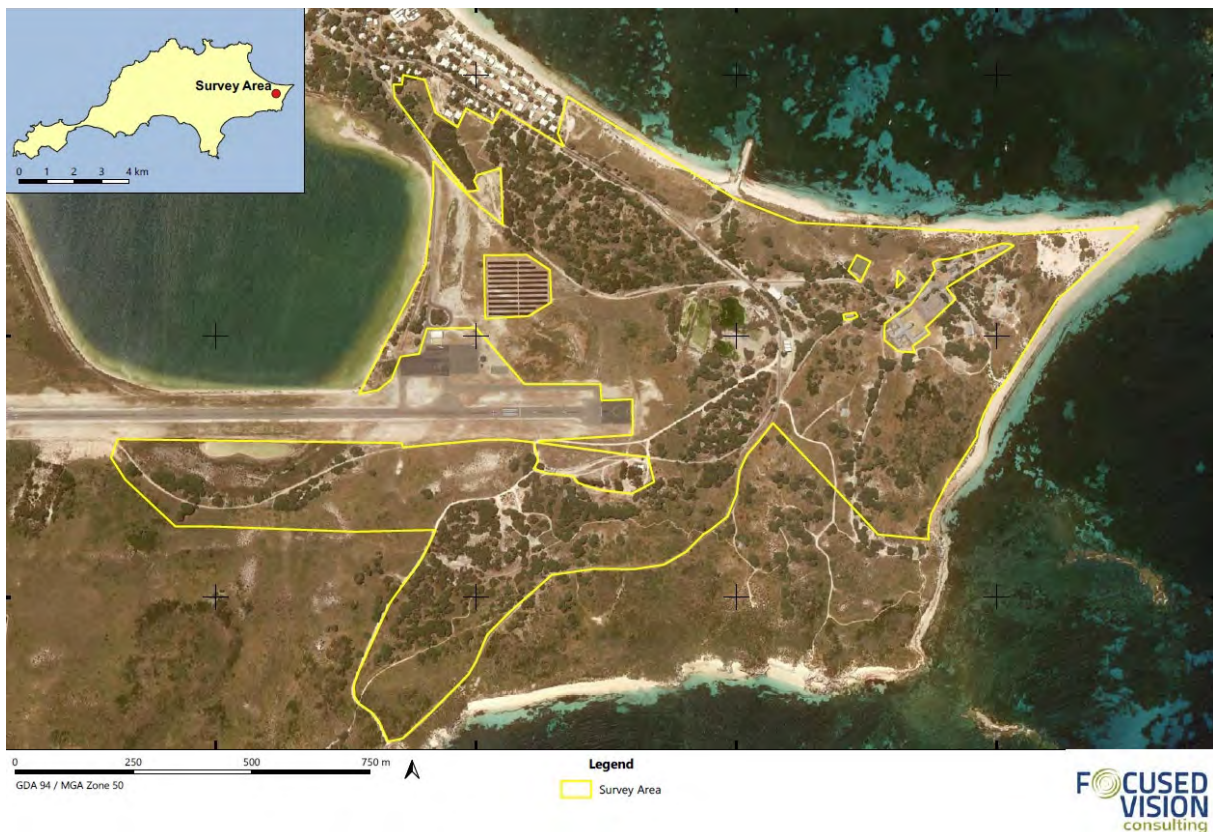


Figure 38: Terrestrial flora and vegetation surveys undertaken within vicinity of the proposal (Focused Vision Consulting survey area)



## 11.4 Receiving environment

### 11.4.1 Regional vegetation

Vegetation complexes within the terrestrial survey have defined by Heddle et al. (1980) as the Quindalup Complex. This complex is described as coastal dune consisting of two alliances: the strand and fore-dune alliance and the mobile and stable dune alliance. Local variations include the low, closed forest of *Melaleuca lanceolata* (Rottneest teatree) – *Callitris preissii* (Rottneest Island pine), the closed scrub of *Acacia rostellifera* (summer-scented wattle) and the low, closed *Agonis flexuosa* (peppermint) forest of Geographe Bay (FVC, 2023).

The pre-European extent and current known extent of this complex is summarised in Table 57. In the absence of specific data for Wadjemup / Rottneest, information relevant to the Swan Coastal Plain and the City of Cockburn, as the island falls within the district of the City of Cockburn

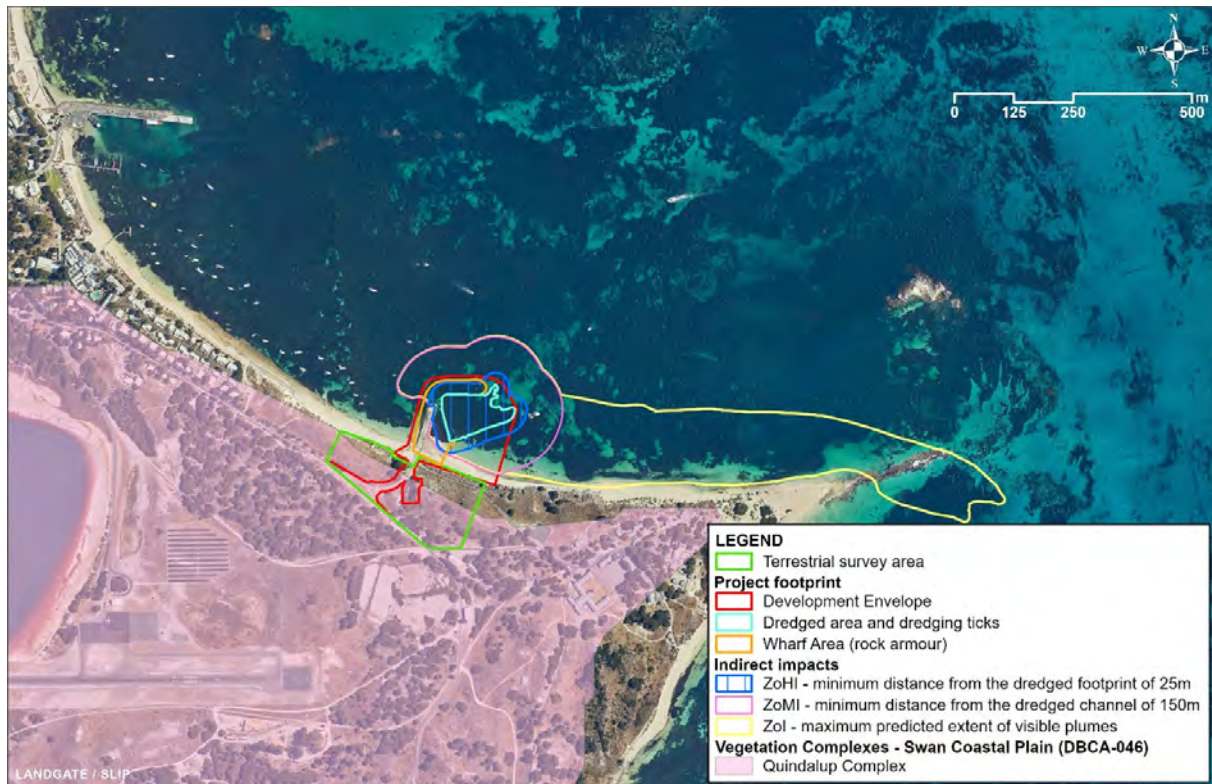


Figure 39: Vegetation complexes

Table 57: Extent of vegetation complexes within the terrestrial survey area

| Regional extent    | Vegetation complex | Pre-European extent | Current extent | Pre-European extent remaining |
|--------------------|--------------------|---------------------|----------------|-------------------------------|
| Swan Coastal Plain | Quindalup Complex  | 54,573.87 ha        | 33,011.64 ha   | 60.49%                        |
| City of Cockburn   | Quindalup Complex  | 1,021.62 ha         | 728.23 ha      | 71.28%                        |

(FVC, 2023)

The Commonwealth's National Targets and Objectives for Biodiversity Conservation (Environment Australia 2001) recognises that the retention of 30%, or more, of the preclearing extent of each ecological community is necessary if Australia's biological diversity is to be protected. The EPA uses vegetation complexes as the basis for regional representation of biodiversity and has an objective to seek to retain at least 30% of the pre-clearing extent of each vegetation community (EPA 2015). Due to extensive clearing this target is not achievable for many of the vegetation complexes on the Swan Coastal Plain, making the remaining remnants regionally significant (EPA 2015).

The remaining extent for the Heddle et al. (1980) Quindalup complex exceeds 30% threshold for the Swan Coastal Plain IBRA region and City of Cockburn extents (Table 57).

### 11.4.2 Vegetation units

Three vegetation units were described over the terrestrial survey area. These vegetation units are shown in Figure 40 and described in Table 58.

**Table 58: Vegetation units**

| Vegetation unit code | Description                                                                                                                                                                                                                                                                                                                                                                                        | Plate                                                                                |
|----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| ApAf*Td              | <i>Acanthocarpus preissii</i> ,<br><i>Scaevola crassifolia</i> low-mid shrubland/open shrubland over <i>Austrostipa flavescens</i> mid grassland/open grassland over<br>* <i>Trachyandra divaricata</i> ,<br><i>Conostylis candicans</i> subsp. <i>calicicola</i> low forbland/open forbland.                                                                                                      |    |
| MIAp*Td              | <i>Melaleuca lanceolata</i> ( <i>Callitris preissii</i> ) open woodland over<br><i>Acanthocarpus preissii</i> ,<br><i>Rhagodia baccata</i> shrubland/low shrubland over * <i>Trachyandra divaricata</i> , <i>Conostylis candicans</i> subsp. <i>calicicola</i> low very open forbland.<br>NB Some of the <i>Melaleuca lanceolata</i> and <i>Callitris preissii</i> in this unit have been planted. |   |
| Sc*TdSI              | <i>Scaevola crassifolia</i> low open shrubland over<br>* <i>Trachyandra divaricata</i> low forbland over <i>Spinifex longifolius</i> , <i>Austrostipa flavescens</i> low-mid open grassland.                                                                                                                                                                                                       |  |





Figure 40: Vegetation units

The areas of vegetation units present within the terrestrial survey area and development envelope are provided in Table 59.

Table 59: Areas of vegetation units within the development envelope

| Vegetation unit code | Condition           | Area of vegetation unit within survey area | Area of vegetation unit within development envelope |
|----------------------|---------------------|--------------------------------------------|-----------------------------------------------------|
| ApA*Td               | Good to Degraded    | 2.35 ha                                    | 0.17 ha                                             |
| MIAp*Td              | Degraded to Good    | 1.03 ha                                    | 0.23 ha                                             |
| Sc*TdSI              | Good to Degraded    | 0.38 ha                                    | 0.06 ha                                             |
| cleared              | Completely Degraded | 0.40 ha                                    | 0.22 ha                                             |
| <b>Total area</b>    |                     | <b>4.16 ha</b>                             | <b>0.68 ha</b>                                      |

### 11.4.3 Vegetation condition

Vegetation condition was assessed by the scale of Keighery (1996) as largely Good, mixed with patches of Degraded vegetation. In areas around taller shrubs and trees condition was assessed as Degraded with patches of Good condition (Figure 41).

The condition of the vegetation units described in Section 11.4.2 is provided in Table 59.



Figure 41: Vegetation condition

#### 11.4.4 Flora species

Seventeen taxa were recorded in the survey area, 13 of these species were endemic taxa and the remaining four species were introduced. The endemic taxa belong to ten different families and thirteen different genera (Table 60).

Table 60 Endemic taxa in the survey area

| Family         | Taxon                                               |
|----------------|-----------------------------------------------------|
| Asparagaceae   | <i>Acanthocarpus preissii</i>                       |
| Asteraceae     | <i>Olearia axillaris</i>                            |
| Chenopodiaceae | <i>Rhagodia baccata</i>                             |
| Cupressaceae   | <i>Callitris preissii</i>                           |
| Cyperaceae     | <i>Ficinia nodosa</i>                               |
| Cyperaceae     | <i>Gahnia trifida</i>                               |
| Goodeniaceae   | <i>Scaevola crassifolia</i>                         |
| Haemodoraceae  | <i>Conostylis candicans</i> subsp. <i>candicans</i> |
| Malvaceae      | <i>Guichenotia ledifolia</i>                        |
| Myrtaceae      | <i>Melaleuca lanceolata</i>                         |
| Poaceae        | <i>Austrostipa flavescens</i>                       |
| Poaceae        | <i>Spinifex longifolia</i>                          |
| Poaceae        | <i>Sporobolus virginicus</i>                        |

##### 11.4.4.1 Weed species

Introduced flora species identified within the terrestrial survey area are listed in Table 61.

None of these introduced taxa are Declared Pests under the *Biosecurity and Agriculture Management Act 2007* (BAM Act) or Weeds of National Significance (RPS, 2024d).

**Table 61: Introduced taxa in the survey area**

| Family        | Introduced taxon              | Common name       |
|---------------|-------------------------------|-------------------|
| Poaceae       | <i>Avena barbata</i>          | Bearded oat       |
| Poaceae       | <i>Bromus diandrus</i>        | Great brome       |
| Poaceae       | <i>Lagurus ovatus</i>         | Hare's tail grass |
| Asphodelaceae | <i>Trachyandra divaricata</i> | Onion weed        |

#### 11.4.4.2 Conservation significant flora

All of the flora species identified within the terrestrial survey area are relatively common in similar habitats (RPS, 2024d).

No conservation significant taxa were recorded within the terrestrial survey area or development envelope.

#### 11.4.5 Ecological communities

The vegetation unit MIAp\*Td is analogous to the Threatened Ecological Community (TEC) *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands of the Swan Coastal Plain (floristic community type 30c as originally described by Gibson *et. al.* 1994). This TEC is listed as Critically Endangered under the state BC Act but is not listed under the EPBC Act.

1.03 ha of this vegetation unit was recorded within the survey area, of which 0.23 ha is located within the development envelope.

### 11.5 Potential environmental impacts

Table 62 provides the potential key impacts to terrestrial flora and vegetation from the proposal. These impacts are discussed in further detail in Sections 11.5.1.1 to 11.5.1.4.

**Table 62: Potential impacts on terrestrial flora and vegetation**

| Phase        | Impact class | Works / operations                                                                                | Potential impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------|--------------|---------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction | Direct       | <ul style="list-style-type: none"> <li>Construction of the onshore project components.</li> </ul> | <b>Removal of native vegetation</b> <ul style="list-style-type: none"> <li>Removal of 0.46 ha of native vegetation in Good to Degraded condition.</li> <li>Of the native vegetation being cleared, 0.23 ha is analogous to the TEC; <i>Callitris preissii</i> (or <i>Melaleuca lanceolata</i>) forests and woodlands of the Swan Coastal Plain.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|              | Indirect     | <ul style="list-style-type: none"> <li>Construction of the onshore project components.</li> </ul> | <b>Introduction of invasive species (pests and weeds)</b> <ul style="list-style-type: none"> <li>Indirect loss or impact to flora and vegetation as a result of the introduction or spread of invasive species (pests and weeds) due to construction machinery and vehicles.</li> </ul> <b>Introduction of disease</b> <ul style="list-style-type: none"> <li>Indirect loss or impact to flora and vegetation as a result of the introduction or spread of disease (for example, <i>Phytophthora</i> dieback) due to construction machinery and vehicles.</li> </ul> <b>Accidental clearing</b> <ul style="list-style-type: none"> <li>During construction activities, there is a risk that native vegetation outside the areas directly impacted will be accidentally cleared.</li> </ul> <b>Localised erosion</b> <ul style="list-style-type: none"> <li>During construction activities, there is for localised erosion to occur adjacent to cleared areas.</li> </ul> |



| Phase     | Impact class | Works / operations                                                             | Potential impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|-----------|--------------|--------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Operation | Indirect     | <ul style="list-style-type: none"> <li>Vehicle / personnel movement</li> </ul> | <p><b>Introduction of invasive species (pests and weeds)</b></p> <ul style="list-style-type: none"> <li>Indirect loss or impact to flora and vegetation as a result of the introduction or spread of invasive species (pests and weeds) due to vehicle and personnel movement during operation.</li> </ul> <p><b>Introduction of disease</b></p> <ul style="list-style-type: none"> <li>Indirect loss or impact to flora and vegetation from the introduction or spread of disease due to vehicle and personnel movement during operation.</li> </ul> <p><b>Degradation through incorrect waste disposal</b></p> |

### 11.5.1 Assessment of impacts

#### 11.5.1.1 Direct loss of native vegetation

Construction of the proposal will result in the removal of 0.46 ha of native vegetation. Conservation flora and vegetation values within this vegetation is summarised below:

- No conservation significant flora is present within the vegetation proposed to be cleared.
- Vegetation impacted comprises 0.23 ha of vegetation, which is analogous with the TEC, *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands of the Swan Coastal Plain.

The Commonwealth's National Targets and Objectives for Biodiversity Conservation (Environment Australia 2001) recognises that the retention of 30%, or more, of the pre-clearing extent of each ecological community is necessary if Australia's biological diversity is to be protected. Section 11.4.1 identifies that the vegetation present within the development envelope is above the 30% threshold.

##### 11.5.1.1.1 Assessment against the ten clearing principles

Clearing principles against which proposals to clear vegetation are assessed are listed under Schedule 5 of the EP Act. An assessment of the proposal against the ten clearing principles is provided in

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Table 63.

Table 63: Assessment against the clearing principles for native vegetation under Schedule 5 of the EP Act

| Principle                                                                                                                                                                                               | Assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Variance                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Principle (a) – native vegetation should not be cleared if it comprises a high level of biological diversity                                                                                            | Seventeen taxa were recorded in the survey area, thirteen of these species were endemic taxa and the remaining four species were introduced. All of the flora species identified within the terrestrial survey area are relatively common in similar habitats (RPS, 2024d). Therefore, vegetation within the site does not comprise a high level of biological diversity and is well represented elsewhere on the island.<br>Biological diversity is considered likely to be reduced from the condition of the site. Vegetation assessments within the site identified the vegetation condition as Good to Degraded, mixed with patches of Degraded vegetation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Not at variance</b><br>Clearing of vegetation at this site is not at variance with this Principle                                                                                                                                                                                                                                                                                   |
| Principle (b) – Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a significant habitat for, fauna indigenous to Western Australia | The fauna survey undertaken by EcoLogical (2024) recorded 14 native vertebrate fauna species within the site. One conservation significant fauna species was recorded within the site, the Quokka ( <i>Setonix brachyurus</i> ), listed as Vulnerable (VU) under the EPBC Act and BC Act.<br>EcoLogical (2024) undertook a post survey likelihood of occurrence assessment and determined that of the conservation significant species identified from the desktop assessment, two are considered as having the potential to occur within the site; <i>Pandion haliaetus</i> (Osprey) and <i>Lerista lineata</i> (Perth slider).<br><b>Quokka</b><br>The Quokka was observed foraging under <i>Melaleuca lanceolata</i> and adjacent to <i>Acanthocarpus preissii</i> within the site. It is considered likely that the Quokka would use both habitat types within the site (Table 67). The Quokka is widespread across the island and the site does not comprise critical habitat for this species.<br><b>Osprey</b><br>The Osprey exhibits a preference for coastal cliffs and elevated islands but have also been known to occur over atypical habitats such as heath, woodland or forest when travelling to and from foraging sites. The Osprey is considered as having the potential to occur within the survey area as a vagrant visitor, due to the availability of adjacent foraging habitat (saline water, beaches). However, the site is not necessary for the maintenance of significant habitat for this species.<br><b>Perth slider</b><br>This species occurs on sandy, coastal heath and shrubland and has the potential to occur within the site based on availability of suitable habitat. However, as sandy, coastal heath and shrubland is widespread across the island, the site is not necessary for the maintenance of significant habitat for this species. | <b>Not at variance</b><br>While these conservation significant species may occur within the site, the site is not considered likely to comprise habitat critical to the species survival. As such, clearing 0.46 ha of vegetation is unlikely to have a significant impact on these species.                                                                                           |
| Principle (c) Native vegetation should not be cleared if it includes or is necessary for the continued existence of rare flora                                                                          | No conservation significant taxa were recorded within the terrestrial survey area or development envelope.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Not at variance</b><br>The proposal is not at variance with this Principle                                                                                                                                                                                                                                                                                                          |
| Principle (d) – Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a Threatened Ecological Community (TEC)                           | The vegetation unit MIAp*Td is analogous to the TEC <i>Callitris preissii</i> (or <i>Melaleuca lanceolata</i> ) forests and woodlands of the Swan Coastal Plain (floristic community type 30c as originally described by Gibson et. al. 1994). This TEC is listed as Critically Endangered under the state BC Act but is not listed under the EPBC Act.<br>1.03 ha of this TEC was recorded within the survey area, of which 0.23 ha is located within the development envelope.<br>Focused Vision Consulting also identified this TEC in the area surrounding the development envelope, considering vegetation units MIAp and CpMI to be representative of the TEC (Appendix I). Focused Vision Consulting identified 44.39 ha of MIAp and 0.6 ha of CpMI within vicinity of the development envelope.<br>As the proposed clearing of 0.23 ha of the TEC will result in a loss of 0.52% of the TEC identified in the Focused Vision survey area, impacts to vegetation analogous with this TEC are not considered significant. It should also be noted that this vegetation type is likely to be more widespread across the island that the survey area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>May be at variance</b><br>The proposal will result in the clearing of 0.23 ha of vegetation that is analogous with the TEC.<br>However, as this only comprises 0.52% of the TEC identified in the area, the vegetation within the site is unlikely to be necessary for the maintenance of the TEC. Especially as the vegetation within the site is in a Good to Degraded condition. |
| Principle (e) – Native vegetation should not be cleared if it is significant as a remnant of native vegetation in an area that has been extensively cleared                                             | The Commonwealth's National Targets and Objectives for Biodiversity Conservation (Environment Australia 2001) recognises that the retention of 30%, or more, of the preclearing extent of each ecological community is necessary if Australia's biological diversity is to be protected. The EPA uses vegetation complexes as the basis for regional representation of biodiversity and has an objective to seek to retain at least 30% of the pre-clearing extent of each vegetation community (EPA 2015). Due to extensive clearing this target is not achievable for many of the vegetation complexes on the Swan Coastal Plain, making the remaining remnants regionally significant (EPA 2015).<br>Section 11.4.1 identifies that the vegetation present within the development envelope is above the 30% threshold.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Not at variance</b><br>The remaining extent for the Heddle et al. (1980) Quindalup complex exceeds 30% threshold for the Swan Coastal Plain IBRA region and City of Cockburn extents.                                                                                                                                                                                               |
| Principle (f) – Native vegetation should not be cleared if it is growing in, or in association with, an environment associated with a watercourse or wetland.                                           | There are no wetlands or watercourses within or adjacent to the site. As such, the 0.46 ha of vegetation proposed to be cleared is not growing in association with a watercourse or wetland.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Not at variance</b><br>The 0.46 ha of vegetation proposed to be cleared is not growing in association with a watercourse or wetland.                                                                                                                                                                                                                                                |
| Principle (g) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation                                                               | The substrate of the site is unconsolidated sand formed into a dune. Sandy soils are prone to wind erosion, however as the site is proposed to be developed and will be managed as outlined in the CEMP, it will not contribute to land degradation on or adjacent to the site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Not at variance</b><br>The potential for erosion will be managed as outlined in the CEMP.                                                                                                                                                                                                                                                                                           |
| Principle (h) – Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation areas          | There are no significant environmental or conservation values adjacent to the site which will be impacted by the proposed clearing. Implementation of the CEMP will minimise potential impacts to surrounding vegetation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>Not at variance</b><br>The proposal is not at variance with this Principle.                                                                                                                                                                                                                                                                                                         |
| Principle (i) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water                               | The small area of the proposed clearing would not be expected to contribute towards or cause deterioration in the quality of underground or surface water. Implementation of the CEMP and OEMP will minimise the risk of impacts to surface and groundwater quality.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Not at variance</b><br>The proposal is not at variance with this Principle.                                                                                                                                                                                                                                                                                                         |
| Principle (j) – Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the incidence of flooding                                                  | Wadjemup / Rottnest Island receives a mean rainfall of 564.6 mm per annum, with the local climate consisting of cool wet winters and warm dry summers. Maximum mean rainfall occurs in July, with 111.5 mm. Flooding is not an issue as the soil is sandy and porous, and given the small area subject to this proposal this is not likely to change.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Not at variance</b><br>The proposal is not at variance with this Principle.                                                                                                                                                                                                                                                                                                         |



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#### **11.5.1.2 Accidental clearing**

During construction activities, there is a risk that native vegetation outside the areas directly impacted will be accidentally cleared. The implementation of the CEMP will reduce the risk of this occurring.

#### **11.5.1.3 Localised erosion**

There is a risk for localised erosion to occur adjacent to cleared areas or due to surface water run-off. Localised erosion may impact vegetation adjacent to the development envelope.

#### **11.5.1.4 Introduction and spread of weeds**

Four introduced flora species were identified within the terrestrial survey area. None of these species were listed as Declared Pests under the BAM Act or Weeds of National Significance. The presence of weeds adjacent to the development envelope has the potential to increase as a result of construction activities.

The implementation of the weed hygiene management measures outlined in the CEMP is expected to reduce the risk of spread as a result of the proposal. The proposal is not expected to result in the spread of weeds that could result in significant vegetation and flora impacts.

#### **11.5.1.5 Introduction and spread of disease**

There is potential for the movement of construction machinery to result in the introduction of disease (e.g. *Phytophthora* dieback). The implementation of the hygiene management measures outlined in the CEMP is expected to reduce the risk of disease introduction or spread as a result of the proposal.

#### **11.5.1.6 Degradation through incorrect waste disposal**

An increase in litter due to incorrect waste disposal has the potential to impact the surrounding vegetation.

## 11.6 Mitigation

Table 64 demonstrates how the EPA's mitigation hierarchy (avoid, minimise and rehabilitate) has been applied to the environmental factor of terrestrial flora and vegetation to address the key potential impacts.

**Table 64: Application of mitigation hierarchy to terrestrial flora and vegetation**

| Potential environmental impacts    | Impact class | Mitigation hierarchy | Proposed mitigation measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Residual impacts                                                                                                                                                                                                                                                             |
|------------------------------------|--------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Removal of native vegetation       | Direct       | Avoid                | Avoidance of impacts to the 0.8 ha of the TEC (MIAp*Td) surveyed outside the development envelope.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Removal of 0.46 ha of native vegetation in Good to Degraded condition</b><br>Of the native vegetation being cleared, 0.23 ha comprises the state listed TEC; <i>Callitris preissii</i> (or <i>Melaleuca lanceolata</i> ) forests and woodlands of the Swan Coastal Plain. |
|                                    |              | Minimise             | <ul style="list-style-type: none"> <li>A CEMP (Emerge, 2024a) (Appendix P) will be implemented to ensure impacts to native vegetation is limited to the 0.46 ha within the development envelope. Management measures to limit impacts outside the development envelope include:               <ul style="list-style-type: none"> <li>Extent of authorised disturbance will be clearly defined and demarcated on appropriate plans. The demarcated terrestrial construction works area to be surveyed prior to the commencement of vegetation removal works. Movement of construction vehicles within vegetation outside this area will be limited to avoid accidental clearing or disturbance of surrounding vegetation</li> <li>All identified populations of MIAp*Td will be delineated using highly visible flagging or similar around all identified populations to avoid impacts to the 0.8 ha of MIAp*Td surveyed outside the development envelope</li> <li>Establishment of clearly delineated access points to prevent unauthorised disturbance and access</li> <li>Installation of temporary fencing, inclusive of sediment controls, along the boundary of the terrestrial construction works area to restrict machinery access to be within the approved disturbance area</li> <li>Daily inspections to visually check / review clearing boundaries and compliance during clearing activities</li> <li>Photographic records of the clearing area pre- and post-clearing activities</li> <li>Inspection to verify no degradation or disturbance beyond approved clearing boundary from erosion</li> </ul> </li> <li>Operational management to minimise impacts to flora and vegetation is detailed in the OEMP (Emerge, 2024b) (Appendix Q). Implementation of this management plan will ensure that:               <ul style="list-style-type: none"> <li>Vehicle access is controlled to designated roads and access</li> <li>There is no introduction of weed species to the site as a result of operation.</li> </ul> </li> </ul> |                                                                                                                                                                                                                                                                              |
|                                    |              | Rehabilitate         | There is no opportunity to rehabilitate the areas directly impacted by construction of the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                              |
|                                    |              | Offset               | Terrestrial flora and vegetation offsets are not proposed for terrestrial flora and vegetation as only 0.52% of the TEC identified in the surrounding area will be directly impacted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                              |
| Introduction and spread of weeds   | Indirect     | Avoid                | There is no opportunity to avoid the movement of construction vehicles within the area, as such the risk for the spread and introduction of weed species cannot be completely avoided.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>No residual impacts expected</b><br>With the implementation of the CEMP and OEMP, residual impacts to terrestrial flora and vegetation resulting from the spread and introduction of weeds during construction are not considered significant.                            |
|                                    |              | Minimise             | <ul style="list-style-type: none"> <li>Construction management and monitoring measures to minimise impacts to terrestrial flora and vegetation is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:               <ul style="list-style-type: none"> <li>Implementation of the weed management protocol as outlined in the CEMP</li> <li>Weekly inspections and photographic records during clearing and construction activities</li> <li>Inspections to verify no degradation or disturbance has occurred beyond the development envelope</li> <li>Appropriate hygiene measures to minimise the risk of the spread and introduction of weed species, including:                   <ul style="list-style-type: none"> <li>Weekly spot checks of mobile equipment and vehicles</li> <li>hygiene points at key road entry points</li> <li>Implementation of the weed management protocol outlined in the CEMP</li> </ul> </li> <li>Stockpile management, including stockpile locations (within the development envelope), erosion and stabilisation techniques and height limits</li> <li>Designated areas for the temporary placement of cleared vegetation (within the development envelope) to minimise the increased risk of weed and disease spread and bushfire</li> <li>The contractor will supply weed and weed certificates prior to mobilising vehicles and machinery</li> </ul> </li> <li>Operational management to minimise impacts to flora and vegetation is detailed in the OEMP (Emerge, 2024b) (Appendix Q). Implementation of this management plan will ensure that:               <ul style="list-style-type: none"> <li>Vehicle access is controlled to designated roads and access</li> <li>There is no introduction of weed species to the site as a result of operation.</li> </ul> </li> </ul>                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                              |
|                                    |              | Rehabilitate         | Should the proposal result in the introduction of weed species, appropriate management and control measures will be implemented.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                              |
|                                    |              | Offset               | Terrestrial flora and vegetation offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                              |
| Introduction and spread of disease | Indirect     | Avoid                | There is no opportunity to avoid the movement of construction vehicles within the area, as such the risk for the spread and introduction of disease cannot be completely avoided.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>No residual impacts expected</b><br>With the implementation of the CEMP and OEMP, residual impacts to terrestrial flora and vegetation resulting from the spread and introduction of disease during construction are not considered significant.                          |
|                                    |              | Minimise             | <ul style="list-style-type: none"> <li>Construction management measures to minimise impacts to terrestrial flora and vegetation is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:               <ul style="list-style-type: none"> <li>Appropriate hygiene measures to minimise the risk of the spread and introduction of disease</li> <li>Extent of authorised disturbance will be clearly defined and demarcated on appropriate plans. The demarcated terrestrial construction works area to be surveyed prior to the commencement of vegetation removal works. Movement of construction vehicles within vegetation outside this area will be limited to avoid the risk of disease spread</li> </ul> </li> <li>Monitoring during construction to minimise impacts to terrestrial flora and vegetation is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:               <ul style="list-style-type: none"> <li>Daily inspections and photographic records during clearing and construction activities</li> <li>Inspections to verify no degradation or disturbance has occurred beyond the development envelope</li> </ul> </li> <li>Operational management to minimise impacts to flora and vegetation is detailed in the OEMP (Emerge, 2024b) (Appendix Q). Implementation of this management plan will ensure that:               <ul style="list-style-type: none"> <li>Vehicle access is controlled to designated roads and access</li> <li>There is no introduction of disease to the site as a result of operation.</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                              |
|                                    |              | Rehabilitate         | Should the proposal result in the introduction of disease, appropriate management measures will be implemented.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                              |
|                                    |              | Offset               | Terrestrial flora and vegetation offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                              |

| Potential environmental impacts               | Impact class | Mitigation hierarchy | Proposed mitigation measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Residual impacts                                                                                                                                                                                                           |
|-----------------------------------------------|--------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Accidental clearing                           | Indirect     | Avoid                | The risk for accidental vegetation clearing cannot be completely avoided.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>No residual impacts expected</b><br>With the implementation of the CEMP, residual impacts to terrestrial flora and vegetation resulting from accidental clearing are not considered significant.                        |
|                                               |              | Minimise             | <ul style="list-style-type: none"><li>Construction management measures to minimise impacts to terrestrial flora and vegetation is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:<ul style="list-style-type: none"><li>Vehicles, plant, and equipment to be restricted within development envelope</li><li>The extent of authorised disturbance will be clearly defined and demarcated on appropriate plans. The demarcated terrestrial construction works area to be surveyed prior to the commencement of vegetation removal works</li><li>Installation of temporary fencing, inclusive of sediment controls, along the boundary of the terrestrial construction works area to restrict machinery access to be within the approved disturbance area</li></ul></li><li>Monitoring during construction to minimise impacts to terrestrial flora and vegetation is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:<ul style="list-style-type: none"><li>Daily inspections and photographic records during clearing and construction activities</li><li>Inspections to verify no degradation or disturbance has occurred beyond the development envelope.</li></ul></li></ul> |                                                                                                                                                                                                                            |
|                                               |              | Rehabilitate         | There is no opportunity to rehabilitate the areas directly impacted by construction of the proposal. Any accidental clearing will be rehabilitated.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                            |
|                                               |              | Offset               | Terrestrial flora and vegetation offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                            |
| Localised erosion                             | Indirect     | Avoid                | The risk for erosion cannot be completely avoided.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>No residual impacts expected</b><br>With the implementation of the CEMP, residual impacts to terrestrial flora and vegetation resulting from accidental clearing are not considered significant.                        |
|                                               |              | Minimise             | <ul style="list-style-type: none"><li>Construction management measures to minimise impacts to terrestrial flora and vegetation is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:<ul style="list-style-type: none"><li>Installation of temporary fencing, inclusive of sediment controls, along the boundary of the terrestrial construction works will minimise localised erosion</li><li>Establishment of clearly delineated access points to prevent unauthorised disturbance and access</li></ul></li><li>Monitoring during construction to minimise impacts to terrestrial flora and vegetation is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes:<ul style="list-style-type: none"><li>Daily inspections and photographic records during clearing and construction activities</li><li>Inspections to verify no degradation or disturbance has occurred beyond the development envelope.</li></ul></li></ul>                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                            |
|                                               |              | Rehabilitate         | Any areas of erosion outside the development envelope which impacts vegetation condition will be rehabilitated.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                            |
|                                               |              | Offset               | Terrestrial flora and vegetation offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                            |
| Degradation through incorrect waste disposal. | Indirect     | Avoid                | Complete avoidance for the risk of litter is unavoidable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>No residual impacts expected</b><br>With the implementation of the CEMP and OEMP, residual impacts to terrestrial flora and vegetation resulting from degradation from waste and litter are not considered significant. |
|                                               |              | Minimise             | <ul style="list-style-type: none"><li>A CEMP (Emerge, 2024a) (Appendix P) will be implemented to ensure impacts to native vegetation is limited to the 0.46 ha within the development envelope. Measures to manage waste disposal will be implemented as per the CEMP to minimise the risk for degradation of the surrounding vegetation</li><li>Operational management to minimise impacts to flora and vegetation is detailed in the OEMP (Emerge, 2024b) (Appendix Q). Implementation of this management plan will ensure that waste disposal measures are implemented to prevent rubbish and litter degrading surrounding vegetation.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                            |
|                                               |              | Rehabilitate         | As outlined in the OEMP, litter cleanup will be undertaken if required to prevent an increase in litter impact on surrounding vegetation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                            |
|                                               |              | Offset               | Terrestrial flora and vegetation offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                            |



## 11.7 Assessment and significance of residual impact

The residual impacts to flora and vegetation after the application of the mitigation hierarchy outlined in Table 64 are summarised below:

- Removal of 0.46 ha of native vegetation in Good to Degraded condition. Of the native vegetation being cleared, 0.23 ha is analogous with the TEC, *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands of the Swan Coastal Plain.

The predicted residual impacts to flora and vegetation from the proposal are not considered significant as discussed in Table 65.

**Table 65: Consideration of the significance of the residual impacts on terrestrial flora and vegetation**

| Matters for consideration                                                                                                                                | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The object and principles of the EP Act                                                                                                                  | A reconnaissance survey was undertaken by RPS within the terrestrial survey area shown in Figure 37 (Appendix J) in accordance with Technical Guidance – Flora and Vegetation Surveys for Environmental Impact Assessment (EPA, 2016b).<br>The principles of the EP Act have been specifically addressed in relation to the proposal (Table 26).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Values, sensitivity and quality of the environment which is likely to be impacted                                                                        | All of the flora species identified within the terrestrial survey area are relatively common in similar habitats (RPS, 2024d) and no conservation significant flora species were identified within the development envelope. Therefore, impacts to flora from implementation of the proposal are not considered significant.<br>0.23 ha of the vegetation within the development envelope is analogous with the TEC, <i>Callitris preissii</i> (or <i>Melaleuca lanceolata</i> ) forests and woodlands of the Swan Coastal Plain. This TEC is listed as Critically Endangered under the BC Act.<br>Focused Vision Consulting identified this TEC in the area surrounding the development envelope, considering vegetation units MIAp and CpMI to be representative of the TEC (Appendix I). Focused Vision Consulting identified 44.39 ha of MIAp and 0.6 ha of CpMI within vicinity of the development envelope.<br>As the proposed clearing of 0.23 ha of the TEC will result in a loss of 0.52% of the TEC identified in the area, impacts to vegetation from implementation of the proposal are not considered significant. |
| All stages and components of the proposal (such as any infrastructure required for the proposal to be practicably implemented, or a proposal life cycle) | All stages of the proposal (i.e. construction and operation) have been included in this impact assessment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Extent (intensity, duration, magnitude, and geographic footprint) of the likely impacts                                                                  | Construction of the proposal will result in the removal of 0.46 ha of native vegetation in Good to Degraded condition. Of the native vegetation being cleared, 0.23 ha comprises the TEC; <i>Callitris preissii</i> (or <i>Melaleuca lanceolata</i> ) forests and woodlands of the Swan Coastal Plain.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Resilience of the environment                                                                                                                            | All of the flora species identified within the terrestrial survey area are relatively common in similar habitats (RPS, 2024d).<br>The vegetation within the development envelope ranges from Degraded (32.2% of vegetation in the development envelope) to Good to Degraded (67.8% of vegetation in the development envelope). As there is vegetation in better condition outside the development envelope and flora species present are relatively common on the island, the environment is considered resilient to the clearing proposed as part of this Proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Consequence of the application of the mitigation hierarchy to the proposal.                                                                              | The WA Offsets Guidelines (Government of Western Australia 2014) identifies four levels of significance for residual impacts:<br><ul style="list-style-type: none"> <li>Unacceptable impacts – those impacts which are environmentally unacceptable or where no offset can be applied to reduce the impact. Offsets are not appropriate in all circumstances, as some environmental values cannot be offset.</li> <li>Significant impacts requiring an offset – any significant residual impact of this nature will require an offset. These generally relate to any impacts to species, ecosystems, or reserve areas protected by statute or where the cumulative impact is already determined to be at a critical level.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                           |

| Matters for consideration                                                                                                              | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                        | <ul style="list-style-type: none"> <li>Potentially significant impact which may require an offset – the residual impact may be significant depending on the context and extent of the impact. These relate to impacts that are likely to result in a species or ecosystem requiring protection under statute or increasing the cumulative impact to a critical level. Whether these impacts require an offset will be determined by the decision-maker based on information provided by the proponent or applicant and expert judgement</li> <li>Impacts which are not significant – impacts which do not trigger the above categories are not expected to have a significant impact on the environment and therefore do not require an offset.</li> </ul> <p>Following the application of the mitigation hierarchy outlined in Table 64 and taking into consideration the above significance of residual impacts model, RPS considers that there are no significant residual impacts to terrestrial flora and vegetation from the proposal.</p> |
| Level of confidence in the prediction of residual impacts and the success of proposed mitigation                                       | <p>The impact assessment has been completed with a high level of confidence in the predictions of residual impacts on terrestrial flora and vegetation, with the required scientific assessments conducted as discussed in Section 11.3.</p> <p>The EPA's Technical Guidance: Flora and Vegetation Surveys for Environmental Impact Assessment (EPA 2016) states that 'a reconnaissance survey is required where flora and vegetation values are well defined, the area is not likely to support significant flora or vegetation and the scale and nature of the potential impacts are not likely to be significant'. RPS considered these criteria to be met and that the small size of the site precluded the implementation of a detailed survey using quadrats.</p>                                                                                                                                                                                                                                                                          |
| Public interest about the likely effect of the proposal or scheme, if implemented, on the environment, and relevant public information | <p>RIA has facilitated regular meetings / dialogue with the local community and key stakeholders (Table 25) as part of the project.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

Cumulative impacts from the proposal have been considered in relation to other proposals within 5 km of the proposal and are discussed in Section 18.

Holistic impacts are discussed in Section 17.

## 11.8 Environmental outcomes

In consideration of the proposed avoidance and management measures and likely residual impacts associated with the proposal, the environmental outcomes that apply to terrestrial flora and vegetation are:

- Direct impacts to native vegetation resulting from the proposal will not exceed 0.46 ha
- Direct impacts to native vegetation (MIAp\*Td) analogous with the TEC, *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands of the Swan Coastal Plain does not exceed 0.23 ha
- No introduction of new weed species attributable to the proposal.

Adaptive management measures will be implemented in accordance with the CEMP to ensure this environmental outcome is met. As the impact assessment identified low residual risks to terrestrial flora and vegetation following the application of mitigation actions identified herein, it is considered that the proposal will successfully meet this the EPA's objective to protect terrestrial flora and vegetation.

## 12 TERRESTRIAL FAUNA

### 12.1 EPA objective

To protect terrestrial fauna so that biological diversity and ecological integrity are protected.

### 12.2 Policy and guidance

The proposal will be subject to compliance with applicable policies and guidance developed to assist proponents and the public to understand the minimum requirements for the protection of elements of the environment that the EPA expects to be met during the assessment process.

Table 66 lists relevant EPA guidance, other state and Commonwealth legislation / policy, and provides consideration for how these documents informed the proposal.

**Table 66: Relevant legislation, policy and guidance**

| Legislation, policy and guidance                                                                         | Consideration                                                                                                                                                                                                                                                                     |
|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Environmental Factor Guideline: Terrestrial Fauna (EPA, 2016d)                                           | The environmental factor guideline identifies the environmental values of terrestrial fauna. These considerations were underpinned as part of the impact assessment on terrestrial fauna summarised in Section 12.5 of this report.                                               |
| Technical Guidance: Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA, 2020) | This technical guidance guides the appropriate obtainment and collation of terrestrial fauna data to be used for environmental impact assessments. The Rottneest Island Basic Fauna Survey (Eco Logical 2024) (Appendix K) was undertaken with regard for this guidance document. |
| <i>Environment Protection and Biodiversity Conservation Act 1999</i>                                     | A search of DCCEE's PMST was undertaken within a 5 km radius of the proposal to determine the MNES that are either known or likely to occur proximate to the proposal (Appendix R).<br>A discussion of potential impacts on MNES is discussed in Section 14.2.                    |
| <i>Biodiversity Conservation Act 2016</i>                                                                | A search of the DBCA's NatureMap database was undertaken to determine a list of conservation significant terrestrial fauna species that have been recorded within 10 km of the proposal (Appendix R).                                                                             |

### 12.3 Environmental investigations

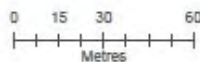
Eco Logical (2024) undertook a basic terrestrial fauna survey within the terrestrial survey area (Figure 42) in accordance with EPA Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020). The Basic terrestrial fauna survey report is provided in Appendix K and included:

- A desktop assessment
- A site survey undertaken on 31 October 2023 to delineate and map fauna habitats and record opportunistic sightings of fauna.





- ▭ Survey area
- Traverses
- Fauna habitat points



Datum/Projection:  
GDA 1994 MGA Zone 50  
23PER6686-JP Date: 8/11/2023



Figure 42: Terrestrial fauna survey area and survey effort

## 12.4 Receiving environment

### 12.4.1 Fauna habitat

Two fauna habitat types were recorded within the survey area, as described in Table 67.

Table 67: Fauna habitat

| Fauna habitat description                                                                  | Conservation significant fauna species potentially utilising the habitat                                                                                                                                                                                                                                                     | Area surveyed | Plate                                                                               |
|--------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-------------------------------------------------------------------------------------|
| Habitat type 1:<br>Trees and tall shrubs over low shrubs, grasses and herbs on sand dunes. | <ul style="list-style-type: none"> <li>• <i>Lerista lineata</i> (Perth slider)</li> <li>• <i>Pandion haliaetus</i> (osprey)</li> <li>• <i>Pseudonaja affinis exilis</i> (Rottnest Island dugite)</li> <li>• <i>Tiliqua rugosa konowi</i> (Rottnest Island bobtail)</li> <li>• <i>Setonix brachyurus</i> (quokka).</li> </ul> | 0.87 ha       |   |
| Habitat type 2:<br>Low shrubs over grasses and herbs on sand dunes.                        | <ul style="list-style-type: none"> <li>• <i>Lerista lineata</i> (Perth slider)</li> <li>• <i>Pandion haliaetus</i> (osprey)</li> <li>• <i>Pseudonaja affinis exilis</i> (Rottnest Island dugite)</li> <li>• <i>Tiliqua rugosa konowi</i> (Rottnest Island bobtail)</li> <li>• <i>Setonix brachyurus</i> (quokka).</li> </ul> | 3.00 ha       |  |

(Eco Logical Australia, 2024)

### 12.4.2 Fauna species

A total of 14 native vertebrate fauna species were recorded within the survey area during the field survey undertaken by Eco Logical (2024). No introduced (feral) fauna species were recorded within the survey area.

#### 12.4.2.1 Conservation significant fauna species

A likelihood of occurrence assessment was undertaken by Eco Logical (2024) as part of the fauna assessment. Those species that have been recorded within the survey area or were identified as having the potential to occur within the survey area based on species distributions and habitat present are summarised in Table 68.

Species considered unlikely to occur within the development envelope are not discussed in Table 68, however are discussed in the Basic fauna survey report provided in Appendix K.

Refer to Section 10 for marine fauna species.

**Table 68: Conservation significant fauna species with the potential to occur within the development envelope**

| Species                          | Common name               | Conservation status |               | Habitat description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Likelihood assessment                                                                                                                                                                                                                                        |
|----------------------------------|---------------------------|---------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                  |                           | EPBC Act            | BC Act / DBCA |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                              |
| <i>Setonix brachyurus</i>        | Quokka                    | Vulnerable          | Vulnerable    | The quokka is a habitat specialist. In the north of its range it prefers dense understorey, less than ten years since fire, adjacent vegetation age that is greater than 25 years and the absence of feral predators. The understorey structure of the habitats currently inhabited by the quokka consist of dense, low vegetation that provides refuge from predation by owls, the fox ( <i>Vulpes vulpes</i> ) and the cat ( <i>Felis catus</i> ). These covered/shady microhabitats may also be important during the hotter months, particularly on Wadjemup / Rottnest Island, where animals converge in dense thickets of <i>Gahnia</i> spp. and <i>Acanthocarpus</i> spp. The main habitat for mainland populations of the quokka is dense riparian vegetation, but the species also uses a range of other habitat, including heath and shrubland on the mainland coast and offshore islands, swampy shrublands, swordgrass dominated understorey, paperbark ( <i>Melaleuca</i> spp.) swamp. | <b>Recorded</b><br>Suitable habitat is present within development envelope.                                                                                                                                                                                  |
| <i>Pandion haliaetus</i>         | Osprey                    | Migratory           | Migratory     | Eastern ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They require extensive areas of open fresh, brackish or saline water for foraging.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Potential</b><br>Marginal habitat for this species is present within the development envelope (coastal areas, trees for perching, adjacent ocean for foraging). Species is highly mobile and may utilise the development envelope as a transient visitor. |
| <i>Tiliqua rugosa konowi</i>     | Rottnest Island bobtail   | -                   | Vulnerable    | Rottnest Island bobtails are common around limestone rocks and prefer limestone heath, woodland, and coastal habitats, but also be found around the Settlement Area.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Recorded</b><br>Previously recorded by RIA (RIA; pers comms 5 January 2024)                                                                                                                                                                               |
| <i>Lerista lineata</i>           | Perth slider, lined skink | -                   | P3            | The species was found in summer-scented wattle ( <i>Acacia rostellifera</i> ) scrub on Wadjemup / Rottnest Island in 2016. Occurs in white sand.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Potential</b><br>Suitable habitat is present within development envelope.                                                                                                                                                                                 |
| <i>Pseudonaja affinis exilis</i> | Rottnest Island dugite    | -                   | P4            | Dugites live in abandoned burrows or hollow logs and prefer coastal habitat, limestone heath, woodland, and the Settlement areas of the island.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Recorded</b><br>Previously recorded by RIA (RIA; pers comms 5 January 2024)                                                                                                                                                                               |

(Eco Logical Australia, 2024)



## 12.5 Potential environmental impacts

Table 69 provides the potential key impacts to terrestrial fauna from the proposal. These impacts are discussed in further detail in Sections 12.5.1 to 12.5.4.

**Table 69: Potential impacts on terrestrial fauna**

| Phase        | Impact class | Works / operations                                                                                | Potential impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------|--------------|---------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction | Direct       | <ul style="list-style-type: none"> <li>Construction of the onshore project components</li> </ul>  | <b>Loss of terrestrial fauna habitat</b> <ul style="list-style-type: none"> <li>Removal of 0.46 ha of potential terrestrial fauna habitat.</li> </ul> <b>Injury and / or mortality of terrestrial fauna</b> <ul style="list-style-type: none"> <li>Risk of injury of terrestrial fauna during vegetation clearing and ground disturbing activities.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|              |              | <ul style="list-style-type: none"> <li>Construction machinery and vehicles.</li> </ul>            | <b>Injury and / or mortality of terrestrial fauna</b> <ul style="list-style-type: none"> <li>Risk of collision risk with construction vehicles leading to injury/mortality of terrestrial fauna.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|              | Indirect     | <ul style="list-style-type: none"> <li>Construction of the onshore project components.</li> </ul> | <b>Alteration of fauna behaviour</b> <ul style="list-style-type: none"> <li>Altered fauna behaviour due to noise, lighting and increased human presence during construction of the proposal.</li> </ul> <b>Indirect loss or impact to terrestrial fauna habitat from habitat degradation</b> <ul style="list-style-type: none"> <li>Indirect loss or impact to terrestrial fauna habitat from habitat degradation as a result of: <ul style="list-style-type: none"> <li>The introduction or spread of invasive species (pests and weeds) due to construction machinery and vehicles</li> <li>The introduction or spread of disease (for example, dieback) due to construction machinery and vehicles.</li> <li>Inappropriate disposal of waste.</li> </ul> </li> </ul> <b>Loss of terrestrial fauna habitat</b> <ul style="list-style-type: none"> <li>During construction activities, there is a risk that terrestrial fauna habitat outside the areas directly impacted will be accidentally cleared.</li> </ul> <b>Localised erosion</b> <ul style="list-style-type: none"> <li>During construction activities, there is potential for localised erosion to occur adjacent to cleared areas.</li> </ul> |
| Operation    | Indirect     | <ul style="list-style-type: none"> <li>Operation</li> </ul>                                       | <b>Indirect loss or impact to terrestrial fauna habitat from habitat degradation</b> <ul style="list-style-type: none"> <li>Indirect loss or impact to terrestrial fauna habitat from habitat degradation as a result of: <ul style="list-style-type: none"> <li>The introduction or spread of invasive species (pests and weeds) due to construction machinery and vehicles</li> <li>The introduction or spread of disease (for example, <i>Phytophthora</i> dieback) due to construction machinery and vehicles.</li> <li>Inappropriate disposal of waste.</li> </ul> </li> </ul> <b>Injury and / or mortality of terrestrial fauna</b> <ul style="list-style-type: none"> <li>Risk of collision risk with construction vehicles leading to injury/mortality of terrestrial fauna.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                             |

### 12.5.1 Assessment of impacts

#### 12.5.1.1 Direct loss of terrestrial fauna habitat

Construction of the proposal will result in the removal of 0.46 ha of potential terrestrial fauna habitat. Conservation significant species which may occur within this habitat includes:

- Lerista lineata* (Perth slider)

- *Pandion haliaetus* (osprey)
- *Pseudonaja affinis exilis* (Rottnest Island dugite)
- *Tiliqua rugosa konowi* (Rottnest Island bobtail)
- *Setonix brachyurus* (quokka).

### 12.5.1.2 Habitat degradation

Four introduced flora species were identified within the terrestrial survey area. None of these species were listed as Declared Pests under the BAM Act or Weeds of National Significance. The presence of weeds adjacent to the development envelope has the potential to increase as a result of construction activities. The presence of weeds has the potential to impact and degrade the terrestrial fauna habitat present.

The implementation of the weed hygiene management measures outlined in the CEMP is expected to reduce the risk of spread as a result of the proposal. The proposal is not expected to result in the spread of weeds that could have a significant vegetation and flora impacts.

There is potential for the movement of construction machinery to result in the introduction of disease (e.g. *Phytophthora dieback*). The implementation of the hygiene management measures outlined in the CEMP is expected to reduce the risk of disease introduction or spread as a result of the proposal.

An increase in litter due to incorrect waste disposal has the potential to impact the surrounding vegetation.

### 12.5.1.3 Injury and mortality of fauna species

Construction of the proposal may result in increased vehicle movements within the development envelope, which would increase the risk associated with vehicle strike. There is also potential for injury or mortality of displaced fauna during vegetation clearing activities. Construction activities will be undertaken in accordance with measures identified in the CEMP to ensure that the risk of these impacts is minimised.

It is unlikely operation of the proposal will significantly increase the potential for fauna strike, given the existing presence of roads within the area.

### 12.5.1.4 Altered fauna behaviour

During construction, there will be noise and vibration emissions due to vehicles movements and construction activities. Noise and vibration associated with construction of the proposal have the potential to result in short-term disturbance to fauna on a local scale. It is unlikely operation of the proposal will significantly alter fauna behaviour.

## 12.6 Mitigation

Table 70 demonstrates how the EPA's mitigation hierarchy (avoid, minimise and rehabilitate) has been applied to the environmental factor of terrestrial fauna to address the key potential impacts.

Table 70: Application of mitigation hierarchy to terrestrial fauna

| Potential environmental impacts                                                                         | Impact class | Mitigation hierarchy | Proposed mitigation measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Residual impacts                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------------------------------------|--------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Removal of potential terrestrial fauna habitat                                                          | Direct       | Avoid                | Complete avoidance of direct impacts to fauna habitat is not possible.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Removal of 0.46 ha of potential fauna habitat</b>                                                                                                                                                                                       |
|                                                                                                         |              | Minimise             | A CEMP (Emerge, 2024a) (Appendix P) will be implemented to ensure impacts to terrestrial fauna habitat is limited to the 0.46 ha within the development envelope. Management measures to minimise potential impacts outside the development envelope are discussed in this table.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                            |
|                                                                                                         |              | Rehabilitate         | There is no opportunity to rehabilitate the areas directly impacted by construction of the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                            |
|                                                                                                         |              | Offset               | Terrestrial fauna offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                            |
| Habitat degradation from the introduction and spread of weeds and disease and incorrect waste disposal. | Indirect     | Avoid                | There is no opportunity to avoid the movement of construction vehicles within the area, as such the risk for the spread and introduction of weed species cannot be completely avoided.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>No residual impacts expected</b><br>With the implementation of the CEMP and OEMP, residual impacts to terrestrial fauna habitat resulting from the spread and introduction of weeds during construction are not considered significant. |
|                                                                                                         |              | Minimise             | <ul style="list-style-type: none"> <li>Construction management and monitoring measures to minimise impacts to terrestrial fauna habitat are detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes: <ul style="list-style-type: none"> <li>Appropriate hygiene measures to minimise the risk of the spread and introduction of weed species</li> <li>Extent of authorised disturbance will be clearly defined and demarcated on appropriate plans. The demarcated terrestrial construction works area to be surveyed prior to the commencement of vegetation removal works. Movement of construction vehicles within vegetation outside this area will be limited to avoid the risk of weed spread</li> <li>Daily inspections and photographic records during clearing and construction activities</li> <li>Inspections to verify no degradation or disturbance has occurred beyond the development envelope</li> <li>Appropriate hygiene measures to minimise the risk of the spread and introduction of weed species: <ul style="list-style-type: none"> <li>Weekly spot checks of mobile equipment and vehicles</li> <li>hygiene points at key road entry points</li> <li>Implementation of the weed management protocol outlined in the CEMP</li> </ul> </li> <li>Stockpile management, including stockpile locations (within the development envelope), erosion and stabilisation techniques and height limits</li> <li>Designated areas for the temporary placement of cleared vegetation (within the development envelope) to minimise the increased risk of weed and disease spread and bushfire</li> </ul> </li> <li>Operational management to minimise impacts to flora and vegetation is detailed in the OEMP (Emerge, 2024b) (Appendix Q). Implementation of this management plan will ensure that: <ul style="list-style-type: none"> <li>Vehicle access is controlled to designated roads and access</li> <li>There is no introduction of weed species to the site as a result of operation.</li> </ul> </li> </ul> |                                                                                                                                                                                                                                            |
|                                                                                                         |              | Rehabilitate         | Should the proposal result in the introduction of weed species, appropriate management and control measures will be implemented.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                            |
|                                                                                                         |              | Offset               | Terrestrial flora and vegetation offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                            |
| Accidental clearing of potential fauna habitat                                                          | Indirect     | Avoid                | The risk for accidental vegetation clearing cannot be completely avoided.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>No residual impacts expected</b><br>With the implementation of the CEMP, residual impacts to terrestrial fauna habitat resulting from accidental clearing are not considered significant.                                               |
|                                                                                                         |              | Minimise             | <ul style="list-style-type: none"> <li>Construction management measures to minimise impacts to terrestrial fauna habitat is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes: <ul style="list-style-type: none"> <li>Vehicles, plant, and equipment to be restricted within development envelope</li> <li>The extent of authorised disturbance will be clearly defined and demarcated on appropriate plans. The demarcated terrestrial construction works area to be surveyed prior to the commencement of vegetation removal works</li> <li>Installation of temporary fencing, inclusive of sediment controls, along the boundary of the terrestrial construction works area to restrict machinery access to be within the approved disturbance area</li> </ul> </li> <li>Monitoring during construction to minimise impacts to terrestrial fauna is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes: <ul style="list-style-type: none"> <li>Daily inspections and photographic records during clearing and construction activities</li> <li>Inspections to verify no degradation or disturbance has occurred beyond the development envelope.</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                            |
|                                                                                                         |              | Rehabilitate         | There is no opportunity to rehabilitate the areas directly impacted by construction of the proposal. Any accidental clearing outside the approved area will be rehabilitated.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                            |
|                                                                                                         |              | Offset               | Terrestrial fauna offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                            |
| Injury and mortality of fauna species                                                                   | Direct       | Avoid                | The risk for injury and / or mortality of fauna cannot be completely avoided.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>No residual impacts expected</b><br>With the implementation of the CEMP and OEMP, residual impacts to the injury or mortality of terrestrial fauna are not considered significant.                                                      |
|                                                                                                         |              | Minimise             | <ul style="list-style-type: none"> <li>Construction management measures to minimise impacts to terrestrial fauna is detailed in the CEMP (Emerge, 2024a) (Appendix P) and includes: <ul style="list-style-type: none"> <li>Vehicles, plant, and equipment to be restricted within development envelope</li> <li>The extent of authorised disturbance will be clearly defined and demarcated on appropriate plans. The demarcated terrestrial construction works area to be surveyed prior to the commencement of vegetation removal works</li> <li>Vegetation clearing will be undertaken progressively and towards retained vegetation</li> <li>Vehicle speed limits will be implemented in accordance with the CEMP</li> <li>If native fauna is encountered during clearing works it should, initially, be allowed to make its own way from the works area. However, if this is not possible or practicable, a qualified wildlife handler will be contacted to relocate it</li> </ul> </li> <li>It is unlikely operation of the proposal will significantly increase the potential for fauna strike, given the existing presence of roads within the area. The OEMP (Appendix Q) outlines measures to minimise the risk of injury to terrestrial fauna during operation.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                            |
|                                                                                                         |              | Rehabilitate         | Injured animals will be provided with first aid and handled on advice from the Wildcare Helpline and Rottnest Island Authority rangers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                            |
|                                                                                                         |              | Offset               | Terrestrial fauna offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                            |



## 12.7 Assessment and significance of residual impact

The anticipated significance of the residual impacts of the proposal on terrestrial fauna following the implementation of mitigation measures are low as detailed in Table 71. The residual impacts are summarised below:

- Removal of 0.46 ha of potential terrestrial fauna habitat in Good to Degraded condition.

**Table 71: Consideration of the significance of the residual impacts on terrestrial fauna**

| Matters for consideration                                                                                                                                | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The object and principles of the EP Act                                                                                                                  | Eco Logical (2024) undertook a basic terrestrial fauna survey within the terrestrial survey area (Figure 34) in accordance with EPA Technical Guidance: Terrestrial vertebrate fauna surveys for environmental impact assessment (EPA, 2020). The Basic terrestrial fauna survey report is provided in Appendix K.<br>The principles of the EP Act have been specifically addressed in relation to the proposal (Table 26).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Values, sensitivity and quality of the environment which is likely to be impacted                                                                        | Conservation significant fauna species which were identified within the site or are likely to utilise the habitat present include: <ul style="list-style-type: none"> <li>• <i>Lerista lineata</i> (Perth slider)</li> <li>• <i>Pandion haliaetus</i> (osprey)</li> <li>• <i>Pseudonaja affinis exilis</i> (Rottnest Island dugite)</li> <li>• <i>Tiliqua rugosa konowi</i> (Rottnest Island bobtail)</li> <li>• <i>Setonix brachyurus</i> (quokka).</li> </ul> <p>Focused Vision Consulting undertook flora and vegetation surveys within the area shown in Figure 38. The vegetation surveyed by Focused Vision Consulting that was most analogous to the vegetation present within the development envelope comprised the vegetation units MIAp and MIGI with a combined area of 67.39 ha. As such, it has been assumed that there is approximately 67.39 ha of similar fauna habitat to the 0.46 ha being directly impacted within vicinity of the proposal. It is also considered likely that the vegetation and associated fauna habitat is not restricted locally to the FVC and RPS survey areas and is more widespread on the island.</p> <p>The direct impacts to 0.46 ha of potential fauna habitat comprises 0.68% of the larger area surveyed by Focused Vision Consulting.</p> <p>Wadjemup / Rottnest Island encompasses approximately 1,800 ha, most of which is vegetated. If a conservative estimate is adopted, with an assumption that half of the island remains vegetated, clearing 0.46 ha of vegetation comprising potential fauna habitat would comprise 0.05% of the vegetation present on the island.</p> <p>Direct impacts to habitat suitable for these species are limited to 0.46 ha and is not considered significant when considering the terrestrial fauna habitat present outside the development envelope.</p> |
| All stages and components of the proposal (such as any infrastructure required for the proposal to be practicably implemented, or a proposal life cycle) | All stages of the proposal (i.e. construction and operation) have been included in this impact assessment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Extent (intensity, duration, magnitude, and geographic footprint) of the likely impacts                                                                  | Construction of the proposal will result in the removal of 0.46 ha of potential fauna habitat in Good to Degraded condition.<br>Implementation of the CEMP will ensure that indirect impacts to terrestrial fauna species will be minimal and localised to the development envelope.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Resilience of the environment                                                                                                                            | The vegetation comprising potential habitat for terrestrial fauna species within the development envelope ranges from Degraded (32.2% of vegetation in the development envelope) to Good to Degraded (67.8% of vegetation in the development envelope). As there is vegetation in better condition outside the development envelope, the environment is considered resilient to the clearing proposed as part of this proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

| Matters for consideration                                                                                                              | Response                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Consequence of the application of the mitigation hierarchy to the proposal.                                                            | <p>The WA Offsets Guidelines (Government of Western Australia 2014) identifies four levels of significance for residual impacts:</p> <ul style="list-style-type: none"> <li>• Unacceptable impacts – those impacts which are environmentally unacceptable or where no offset can be applied to reduce the impact. Offsets are not appropriate in all circumstances, as some environmental values cannot be offset.</li> <li>• Significant impacts requiring an offset – any significant residual impact of this nature will require an offset. These generally relate to any impacts to species, ecosystems, or reserve areas protected by statute or where the cumulative impact is already determined to be at a critical level.</li> <li>• Potentially significant impact which may require an offset – the residual impact may be significant depending on the context and extent of the impact. These relate to impacts that are likely to result in a species or ecosystem requiring protection under statute or increasing the cumulative impact to a critical level. Whether these impacts require an offset will be determined by the decision-maker based on information provided by the proponent or applicant and expert judgement</li> <li>• Impacts which are not significant – impacts which do not trigger the above categories are not expected to have a significant impact on the environment and therefore do not require an offset.</li> </ul> <p>Following the application of the mitigation hierarchy outlined in Table 70 and taking into consideration the above significance of residual impacts model, RPS considers that there are no significant residual impacts to terrestrial fauna from the proposal.</p> |
| Level of confidence in the prediction of residual impacts and the success of proposed mitigation                                       | The impact assessment has been completed with a high level of confidence in the predictions of residual impacts on terrestrial fauna, with the required scientific assessments conducted in accordance with relevant guidance and legislation (Table 66).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Public interest about the likely effect of the proposal or scheme, if implemented, on the environment, and relevant public information | RIA has facilitated regular meetings / dialogue with the local community and key stakeholders (Table 25) as part of the project.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

Cumulative impacts from the proposal have been considered in relation to other proposals within 5 km of the proposal and are discussed in Section 18.

Holistic impacts are discussed in Section 17.

## 12.8 Environmental outcomes

In consideration of the proposed avoidance and management measures and likely residual impacts associated with the proposal, the environmental outcomes that apply to terrestrial fauna are:

- Direct impacts to potential fauna habitat resulting from the proposal will not exceed 0.46 ha of native vegetation.
- No introduction of new weed species attributable to the proposal.
- No increase in incidents of terrestrial fauna injury or death during construction associated with the proposal works.

Adaptive management measures will be implemented in accordance with the CEMP to ensure this environmental outcome is met. As the impact assessment identified low residual risks to terrestrial fauna following the application of mitigation actions identified herein, it is considered that the proposal will successfully meet this the EPA's objective to protect terrestrial fauna.

## 13 SOCIAL SURROUNDINGS

### 13.1 EPA objective

To protect social surroundings from significant harm.

### 13.2 Policy and guidance

The proposal will be subject to compliance with applicable policies and guidance developed to assist proponents and the public to understand the minimum requirements for the protection of elements of the environment that the EPA expects to be met during the assessment process.

Table 72 lists relevant EPA guidance, other state and Commonwealth legislation / policy, and provides consideration for how these documents informed the proposal.

**Table 72: Relevant legislation, policy and guidance**

| Legislation, policy and guidance                                                                                      | Consideration                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Aboriginal Heritage Act 1972</i>                                                                                   | <p>The <i>Aboriginal Cultural Heritage Act 2021</i> superseded the <i>Aboriginal Heritage Act 1972</i> on 1 July 2023 but was repealed and the 1972 Act reinstated on 15 November 2023. The <i>Aboriginal Heritage Act 1972</i> is the legislation that manages Aboriginal cultural heritage (ACH) in Western Australia. Approval is required where there is potential for any harm to an Aboriginal site. Approval may be required from either the Minister for Aboriginal Affairs or the Registrar of Aboriginal Sites for any activity which may harm ACH. There are four types of authorisations:</p> <ul style="list-style-type: none"> <li>• Section 18 consent – for more significant impacts and harm to Aboriginal sites</li> <li>• Section 16 authorisation – for excavation purposes (generally related to research)</li> <li>• Regulation 7 approval – to bring plant and equipment to an Aboriginal site</li> <li>• Regulation 10 consent – for more minor activities and impacts.</li> </ul> <p>Brad Goode and Associates Pty Ltd conducted a Site Identification Ethnographic Aboriginal Heritage Survey to determine potential impacts to any sites or places of Aboriginal heritage significance as defined by section 5 of the <i>Aboriginal Heritage Act 1972</i> (Brad Goode and Associates, 2019).</p> |
| Environmental Factor Guideline – Social Surroundings (EPA, 2023)                                                      | <p>The purpose of this guideline is to identify how the factor social surroundings is considered by the EPA in the environmental impact. The proposal considers the mitigation hierarchy; direct and indirect impacts; implications of cumulative impacts; predicted residual impacts associated within social surroundings.</p> <p>Section 13.4 provides a detailed review of social surrounding aspects likely to be impacted by the proposal, including Aboriginal heritage, natural and historical heritage (including shipwrecks), and recreational values. The environmental factor guideline identifies the key social surrounding aspects and their significance, provides an overview of the key issues and identifies development activities likely to impacts social surroundings values.</p> <p>The EPA considers that many impacts to ACH may be mitigated by the <i>Aboriginal Heritage Act 1972</i> processes, provided those processes are likely to result in avoidance or minimisation of harm to those sites. Where <i>Aboriginal Heritage Act 1972</i> processes are not reasonably likely to meet the EPA's objectives for social surrounding and ACH values, an EPA assessment may still be required.</p>                                                                                             |
| Technical Guidance Environmental impact assessment of Social Surroundings – Aboriginal cultural heritage (EPA, 2023b) | <p>The EPA acknowledges the repealed <i>Aboriginal Cultural Heritage Act 2021</i> and has adjusted its Environmental Factor Guideline - Social Surroundings and related Technical Guidance to reflect the role of the amended and restored <i>Aboriginal Heritage Act 1972</i>. The Technical Guidance provides additional information on procedures and the EPA's environmental impact assessment process for Social Surroundings under the <i>Environmental Protection Act 1986</i> (EPA, 2023b).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <i>Underwater Cultural Heritage Act 2018</i>                                                                          | <p>Provides for the protection of Australia's shipwrecks and has broadened protection to sunken aircraft and other types of underwater cultural heritage including Australia's Aboriginal and Torres Strait Islander Underwater Cultural Heritage in Commonwealth waters.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <i>Maritime Archaeology Act 1973</i>                                                                                  | <p>The state <i>Maritime Archaeology Act 1973</i> protects pre-1900 maritime archaeological sites on state lands and in state waters. Maritime archaeological site types include shipwrecks and relics associated with historic ships</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |



| Legislation, policy and guidance | Consideration                                                                                                                                                                                                                                                                                                                 |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <i>Heritage Act 2018</i>         | State legislation that recognises and promotes historic heritage by defining principles for conservation, use, development or adaptation for heritage places. A search of the Heritage Council's Inherit database was undertaken to identify any state and local government listed heritage places proximate to the proposal. |

## 13.3 Environmental investigations

### 13.3.1 Ethnographic Aboriginal Heritage Survey

Brad Goode and Associates undertook an Ethnographic Aboriginal Heritage Survey of the area shown in Figure 43 to support the proposal (a previous project design) in 2019 (Appendix W). As part of the survey, Brad Goode and Associates undertook the following:

- A search of the DPLH Aboriginal Heritage Inquiry System conducted on 22 January 2019
- Archival research
- Consultations with seven representatives of the Whadjuk NTC group on 5 February 2019.

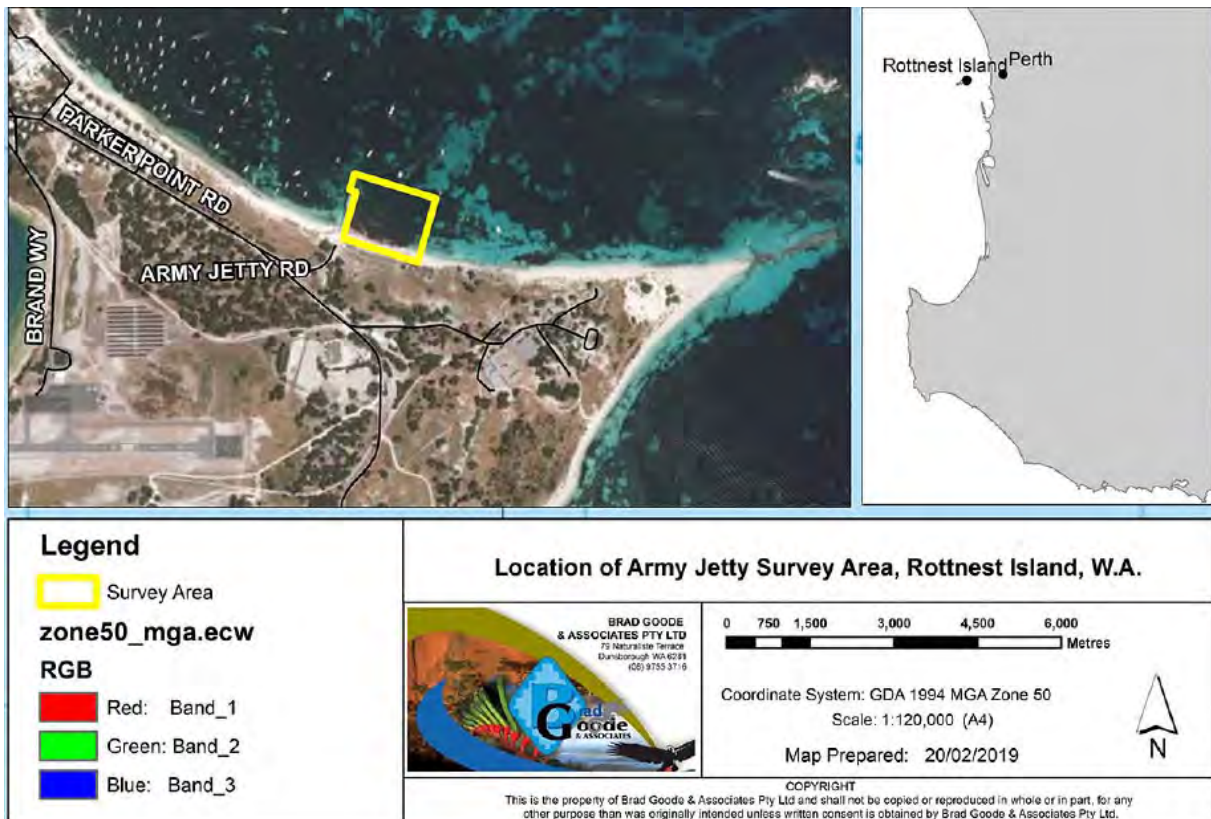


Figure 43: Ethnographic Aboriginal heritage survey area

### 13.3.2 UXO survey

Surrich Hydrographics undertook a UXO survey in November 2019 over the previously proposed dredge area. The survey area is shown in Figure 44. The survey used the marine magnetic method, which responds to artificial ferrous objects above and below the seabed, as well as magnetic minerals in the seabed geology.

Based on the outcomes of the survey undertaken by Surrich, a follow up survey was undertaken in December 2019 by TAMS Group to resolve the anomalies identified by Surrich.

The South Thomson Bay Magnetic Survey (Surrich, 2019) and Rottnest Island Authority – Geological Investigation – Thomson Bay South and UXO investigation/anomaly recovery report (TAMS Group, 2019) are provided as Appendix T.



Figure 44: UXO survey area (red boundary)

### 13.3.3 Stakeholder engagement

Stakeholder engagement undertaken to support the proposal is discussed in Section 4 and has included potential impacts to social surroundings such as tourism and recreational values.



### 13.3.4 Airborne noise assessment

Herring Storer Acoustics undertook an acoustical assessment of noise emissions associated with the existing barge operations at the Main Jetty to ascertain the noise impact that operations at the facility have on surrounding commercial and residential premises. As the only change proposed to the existing barge operations is relocation, the noise assessment can be used to address potential airborne noise impacts from barge activities at the new location.

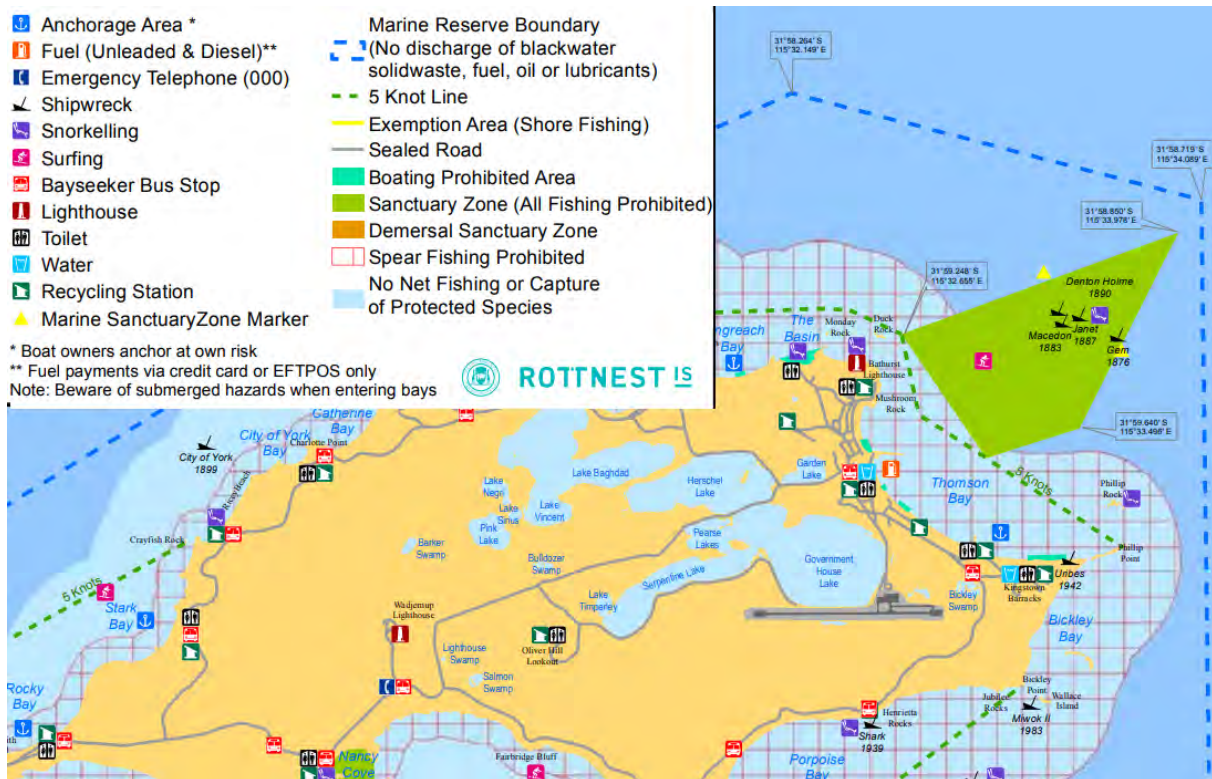
The criteria considered in the assessment are the Environmental Protection (Noise) Regulations 1997 requirements. These regulations stipulate maximum allowable external noise levels at various types of premises. The baseline assigned outdoor noise levels are provided in the noise assessment report provided in Appendix U.

## 13.4 Receiving environment

### 13.4.1 Tourism, recreation and fishing

Wadjemup / Rottnest Island is a popular tourist destination and the Wadjemup / Rottnest Island marine environment is widely used for swimming, boating and fishing. Although swimming is prohibited between the Main Jetty and the Fuel Jetty in South Thomson Bay, recreational swimming occurs elsewhere in the bay, including the development envelope.

Wadjemup / Rottnest Island and the surrounding marine waters are protected by a reserve for public recreation and conservation. The marine waters within the development envelope are within the Rottnest Island Marine Reserve boundary and can be used for recreational fishing, however it is closed to spear fishing and commercial or amateur net fishing (Figure 45). Recreational fishing undertaken in the area (depending on the season) includes rock lobster, abalone, squid, cuttlefish and octopus fishing, crabbing and line fishing.



**Figure 45: Rottnest Island marine and boating guide reserve map (Rottnest Island Authority 2023)**

Recreational boating is a popular activity with the Wadjemup / Rottnest Island marine waters. There are no designated water ski areas within the Rottnest Island Marine Reserve. However, a five-knot speed limit applies in most bays around the island, including South Thomson Bay (Figure 46).

Rottnest Island Authority provides 37 beach anchoring points, 27 of which are located within Thomson Bay. There are also private mooring buoys, which are privately leased and part of the Shared Mooring System and emergency mooring buoys. The location of moorings within vicinity of the site are shown in Figure 51.

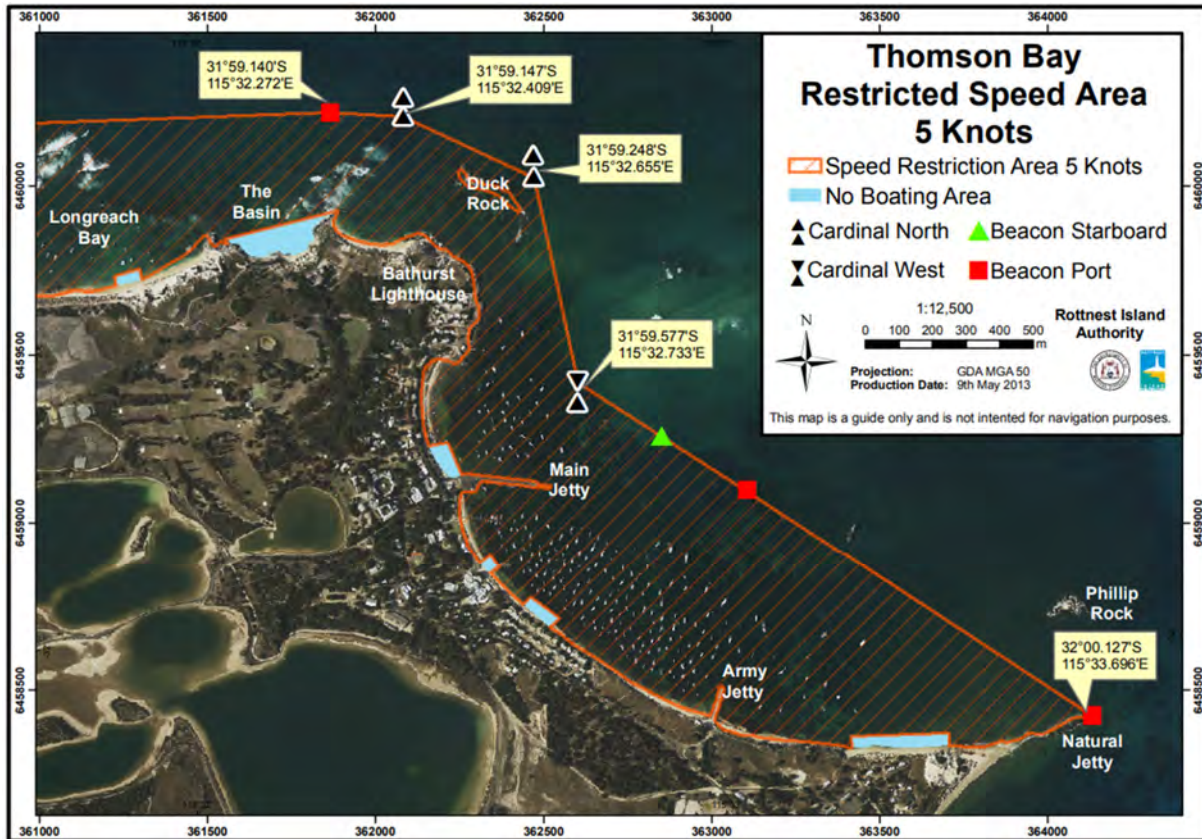


Figure 46: Restricted speed area within Thomson Bay (Rottneest Island Authority, 2013)

### 13.4.2 Aboriginal heritage

Wadjemup / Rottnest Island is an exceptionally significant and unique cultural heritage landscape. The Traditional Owners of Wadjemup / Rottnest Island are the Whadjuk Noongar people, who hold significant cultural value on the island through its association to several Dreamtime stories concerning death, the 'after life' and the creation of offshore islands. 'Wadjemup' in the Whadjuk Noongar language refers to 'place across the water where the spirits are'. Consequently, the island holds significance in intangible (ethnographic) cultural values. Oral histories and archaeological evidence indicate that Whadjuk occupation of the island dates to over 40,000 years ago, when lower sea levels meant the island was connected to the mainland and formed a low ridge on the pre-inundation Swan Coastal Plain. Chert artefacts found in several locations across the island hold proof of visitation to Wadjemup / Rottnest Island by Aboriginal people.

Approximately 7000 years ago, following sea level rise, Wadjemup / Rottnest Island became an island and visitation by Aboriginal people ultimately ceased. It remained a significant spiritual place in its relation to ancestors and the journey to afterlife. Wadjemup / Rottnest Island was used as an Aboriginal prison between 1838 and 1931, where Aboriginal people were forced to quarry limestone, construct many buildings in the settlement, farm and mill grain, and mine salt from the saline lakes. State records indicate that 4,000 Aboriginal men and boys from Western Australia were imprisoned on the island. At least 373 of these prisoners died in custody and were buried in an area currently referred to as the Wadjemup Aboriginal Burial Ground.

A search of the DPLH's Aboriginal Heritage Inquiry System database was undertaken in April 2024 and did not identify any Aboriginal cultural heritage (ACH) within or adjacent to the development envelope. The closest registered ACH to the development envelope is Aboriginal Cultural Heritage Register Place 39697. This ACH Place is located over 400 m from the development envelope and will not be impacted by the proposal.



During the Ethnographic Aboriginal Heritage Survey undertaken by Brad Goode and Associates (2019), consultation was undertaken with seven representatives of the Whadjuk NTC group, the outcomes of this consultation are summarised below (Brad Goode and Associates, 2019):

- No new ethnographic sites, as defined by section 5 of the *Aboriginal Heritage Act 1972* were identified. However, the group representatives identified the potential for artefacts to occur in the subsurface and potential burials could be located in the dunes close to the development envelope.
- As no ethnographic sites of significance as defined by section 5 of the *Aboriginal Heritage Act 1972* were identified, it is recommended that Rottnest Island Authority can proceed with the proposal without undue risk of breaching the *Aboriginal Heritage Act 1972* in relation to ethnographic sites and places.

Additional consultation was undertaken in March 2024 with SWALSC and the Whadjuk Cultural Advice Committee (WCAC) to confirm whether a more recent survey was required. SWALSC and WCAC recommended that as long as the actions outlined in Section 13.5.1.2.1 are implemented, then additional heritage surveys are not necessary.

### 13.4.3 Natural and historic heritage

A search of the Heritage Council's Inherit database was undertaken in April 2024, the results are shown in Figure 47.

Wadjemup / Rottnest Island is mapped as a heritage place (place number 03650) by the Heritage Council and is also listed as a heritage place by the Register of the National Estate (indicative place) and National Trust. The values of this heritage place are summarised below:

- The place is rare as a whole island significant for its role in the early establishment of farming, Defence, and imprisonment of Indigenous.
- Significant role in history of contact with Aboriginals and imprisonment.
- The place plays a significant role in Western Australia's early pioneer history and pastoral industry.
- The place has aesthetic value as it contributes to Perth's Sense of place and it is visible from a large portion of Western Australia's coastline.

Kingstown Barracks (Place Number 00525) is located east of the site, although the barracks are not located within or adjacent to the development envelope, the heritage place mapping is located along the eastern boundary of the development envelope as shown in Figure 47. Any impacts to infrastructure and buildings associated with this heritage place have been avoided.

The Commonwealth Heritage List is a list of Indigenous, historic and natural heritage places owned or controlled by the Commonwealth Government that are of significant heritage value. There are no world, national or Commonwealth heritage places within vicinity of the proposal.

Although not a registered heritage site, the Army Groyne was built in 1906 and stakeholder consultation indicates potential community concerns over protection of the heritage values of the jetty (refer to Section 4).



Figure 47: Historic heritage

#### 13.4.4 Shipwrecks

Australia protects its shipwrecks, sunken aircraft and other types of underwater heritage and their associated artefacts through the *Underwater Cultural Heritage Act 2018*. A search of the Australasian Underwater Cultural Heritage Database (DCCEEW, 2023b) identified no historic shipwrecks within or adjacent to the development envelope listed under the Commonwealth *Underwater Cultural Heritage Act 2018*.

Furthermore, a search of the Western Australia Shipwrecks Database did not identify any shipwrecks within or adjacent to the development envelope. The closest shipwreck is the *Uribes* (1942/07), which is located approximately 500 m from the eastern edge of the development envelope, and within the Zol (Figure 48).

As there are no shipwrecks occurring within the development envelope and potential impacts within the Zol includes temporary increased suspended sediments, impacts to the *Uribes* are not likely to significant and no further mitigation or management is considered necessary.



Figure 48: Social surroundings

### 13.4.5 Unexploded ordnance

As a result of military training and live firing undertaken by Australian and Allied forces, there are areas throughout Australia (outside Commonwealth land) that may be subject to residual UXO contamination. The Department of Defence has mapped areas at risk of UXO contamination. A review of this mapping indicates that the terrestrial component of the development envelope is mapped as having a slight potential for UXO to occur, while there is a defence sea dumping site approximately 3 km north of the development envelope (Figure 49).

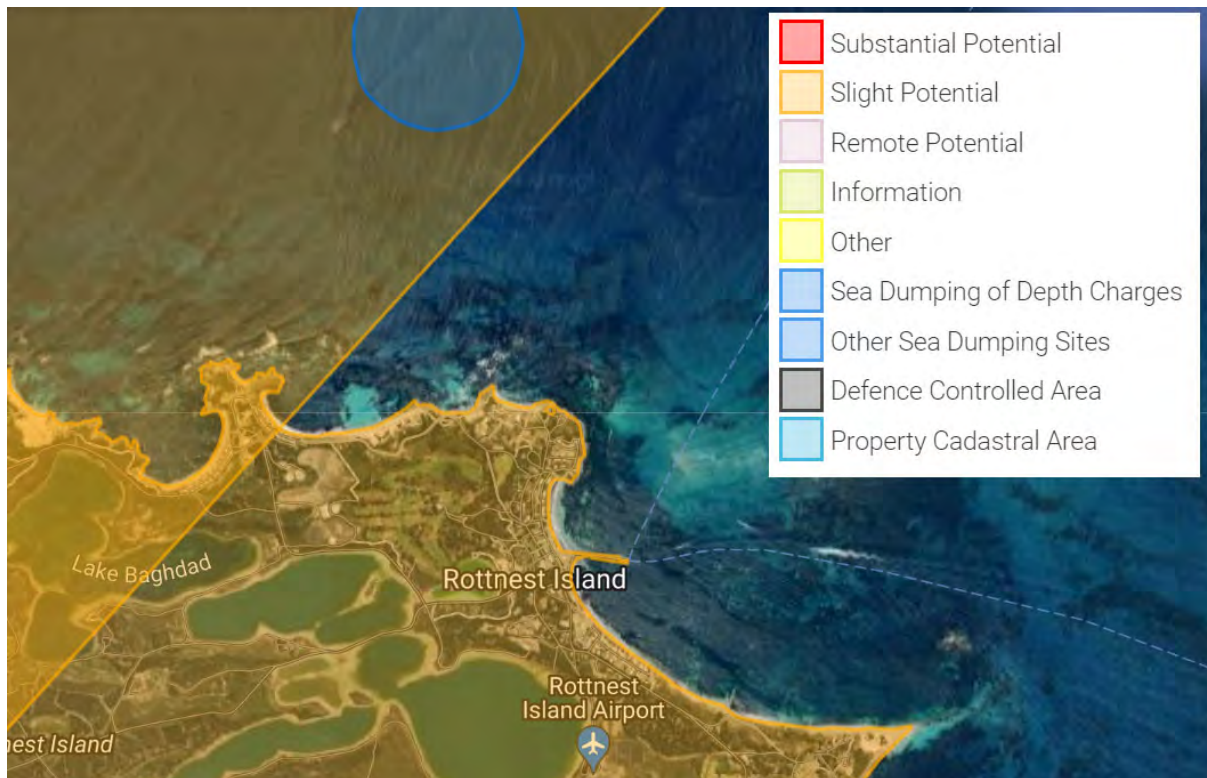
Sites categorised as having a slight potential for UXO to occur are those that have a confirmed history of military activities that often results in numerous residual hazardous munitions, components or constituents; but where confirmed UXO affected areas cannot be defined. Alternatively, sites categorised as slight may have a confirmed history of military activities of a type that sometimes results in occasional residual UXO.

The Department of Defence recommends that, although current land use may continue without further UXO investigation or remediation, consideration should be given to obtaining specialist advice and undertaking a detailed UXO Risk Assessment and developing a UXO Management Plan, as necessary. Consequently, due to the risk for UXOs to occur in the area (Figure 49), Surrich (2019) undertook a magnetic field survey for UXO.

The survey identified 48 ferrous debris targets, six of which were confirmed to be debris and not UXO. Further assessment undertaken by TAMS Group identified that at least ten anomalies require revisits for further confirmation of the UXO risk.

Liaison with RIA has been undertaken to further identify the ferrous targets. Historical photography indicates that the rectangular area to the east of the proposal is likely to be a historical mooring area or enclosed swimming area (Plate 12). The results of the magnetic field survey are provided in Appendix U and shown in Figure 50.





**Figure 49: UXO risk mapping**



**Plate 12: Historical mooring area or enclosed swimming area to the east of the proposal**

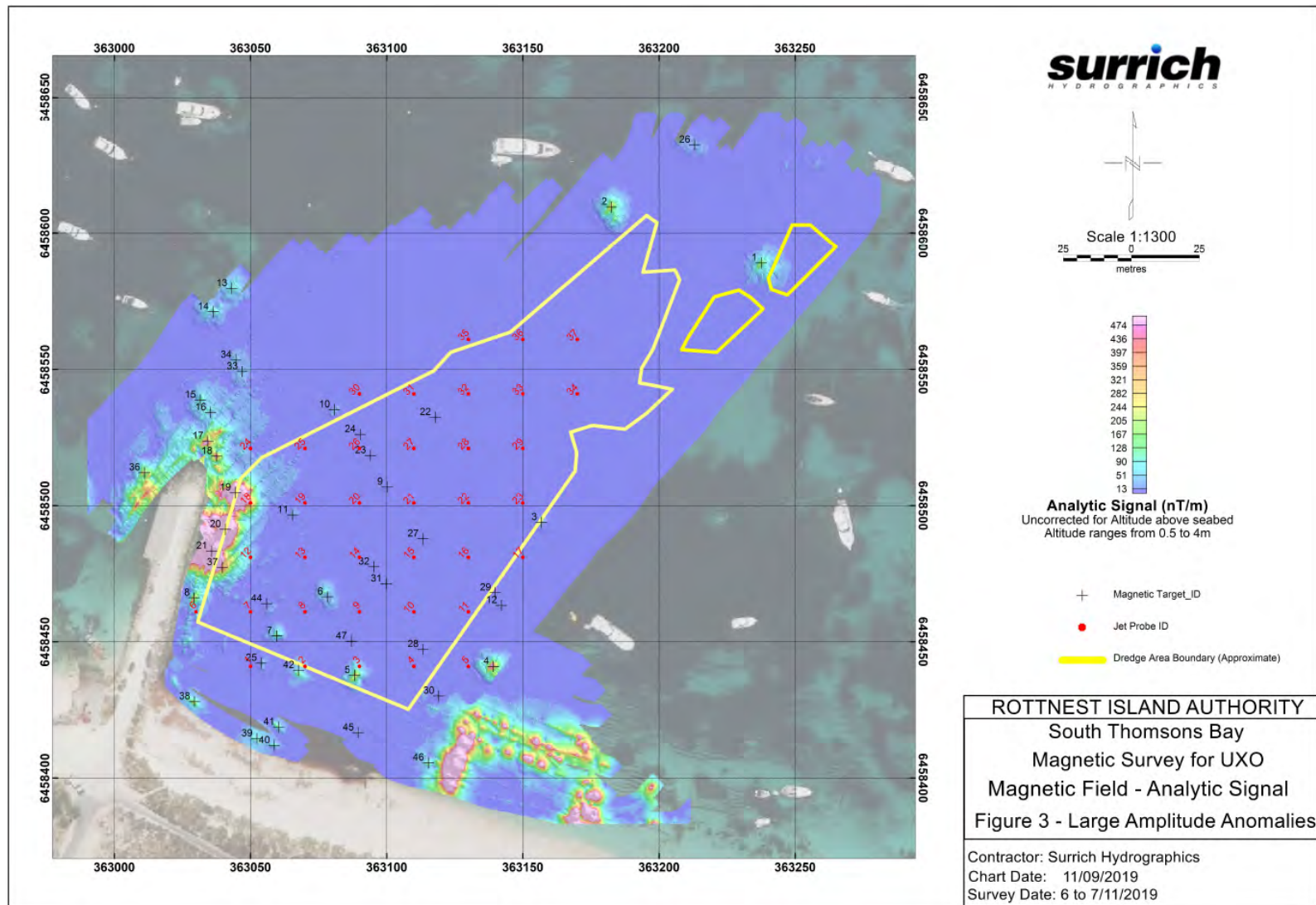


Figure 50: Magnetic field survey for UXO

## 13.5 Potential environmental impacts

Table 73 provides the potential key impacts to social surroundings from the proposal.

**Table 73: Potential impacts on social surroundings**

| Phase        | Impact class | Works/operations                                                                                            | Potential impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------|--------------|-------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Construction | Direct       | <ul style="list-style-type: none"> <li>Ground disturbing activities</li> <li>Dredging activities</li> </ul> | <p><b>Potential impacts heritage</b></p> <ul style="list-style-type: none"> <li>Potential impacts to previously unidentified ACH</li> <li>Community concerns regarding heritage values of the Army Groyne</li> </ul> <p><b>Impacts to recreational values</b></p> <ul style="list-style-type: none"> <li>Construction of the proposal will require the temporary relocation of some moorings</li> </ul> <p><b>Potential disturbance of UXO</b></p> <ul style="list-style-type: none"> <li>There is a risk for dredging and ground disturbing activities to disturb UXO.</li> </ul> |
|              | Indirect     | <ul style="list-style-type: none"> <li>Construction of the offshore project components</li> </ul>           | <p><b>Impacts to recreational values</b></p> <ul style="list-style-type: none"> <li>The minor loss of marine habitat may have consequences for recreational fisheries in the South Thomson Bay through the loss of potential feeding and spawning habitat</li> <li>Construction of the proposal has potential to impact public safety, such as swimmers and recreational beach users</li> </ul> <p><b>Impact to amenity</b></p> <ul style="list-style-type: none"> <li>Construction of the proposal has the potential to impact amenity.</li> </ul>                                |
| Operation    | Indirect     | <ul style="list-style-type: none"> <li>Offshore project components</li> </ul>                               | <p><b>Impacts to recreational values</b></p> <ul style="list-style-type: none"> <li>Implementation of the proposal will result in the relocation of some moorings and loss of informal moorings</li> <li>Operation of the proposal has potential to impact public safety, such as swimmers and recreational beach users</li> </ul> <p><b>Impact to amenity</b></p> <ul style="list-style-type: none"> <li>The proposal has the potential to impact amenity.</li> </ul>                                                                                                             |

### 13.5.1 Assessment of impacts

#### 13.5.1.1 Impacts to recreational values

##### 13.5.1.1.1 Relocation of moorings

Construction and operation of the proposal will require the temporary and permanent relocation of some moorings during construction and operation as summarised below and shown in Figure 51:

- Temporary relocation of eight moorings during construction of the proposal. The temporary relocation will be undertaken prior to construction commencing to minimise disruption to users. The relocation will be for the duration of construction, for approximately 18 months.
- The permanent relocation of four moorings will be undertaken prior to construction to minimise disruption to users.
- No moorings will be permanently removed.

Rottneest Island Authority has undertaken consultation with the mooring licensees regarding the proposal and will work with the impacted mooring licensees. Consultation undertaken to date regarding relocation of moorings is provided in Section 4.



### 13.5.1.1.2 Impacts to recreational fishing

Loss of marine habitat, primarily the loss of seagrass associated with construction of the proposal has the potential to result in indirect impacts to marine fauna species through loss of foraging opportunities and changes to marine environmental quality. This minor loss of marine habitat may have consequences for recreational fisheries in the bay through the loss of potential feeding and spawning habitat.

Potential impacts to marine fauna and habitat as a result of changes in water quality are discussed in more detail in Sections 7.5.1.1, 9.5.1.1 and 10.5.1.1 and is summarised below:

- Direct (permanent) impacts to 2.06 ha of mixed seagrass and 1.26 ha of sand / sand with wrack within the development envelope and ZoHI
- 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI. It is predicted that benthic communities and habitats that are impacted within the ZoMI will recover within a five-year period
- 5.13 ha of mixed seagrass, 1.13 ha macroalgae dominated community, 0.35 ha of limestone reef / pavement and 6.70 ha of sand / sand with wrack within the ZoI. Changes in environmental quality associated with dredge plumes in the ZoI are not predicted to result in a detectable impact on benthic biota.

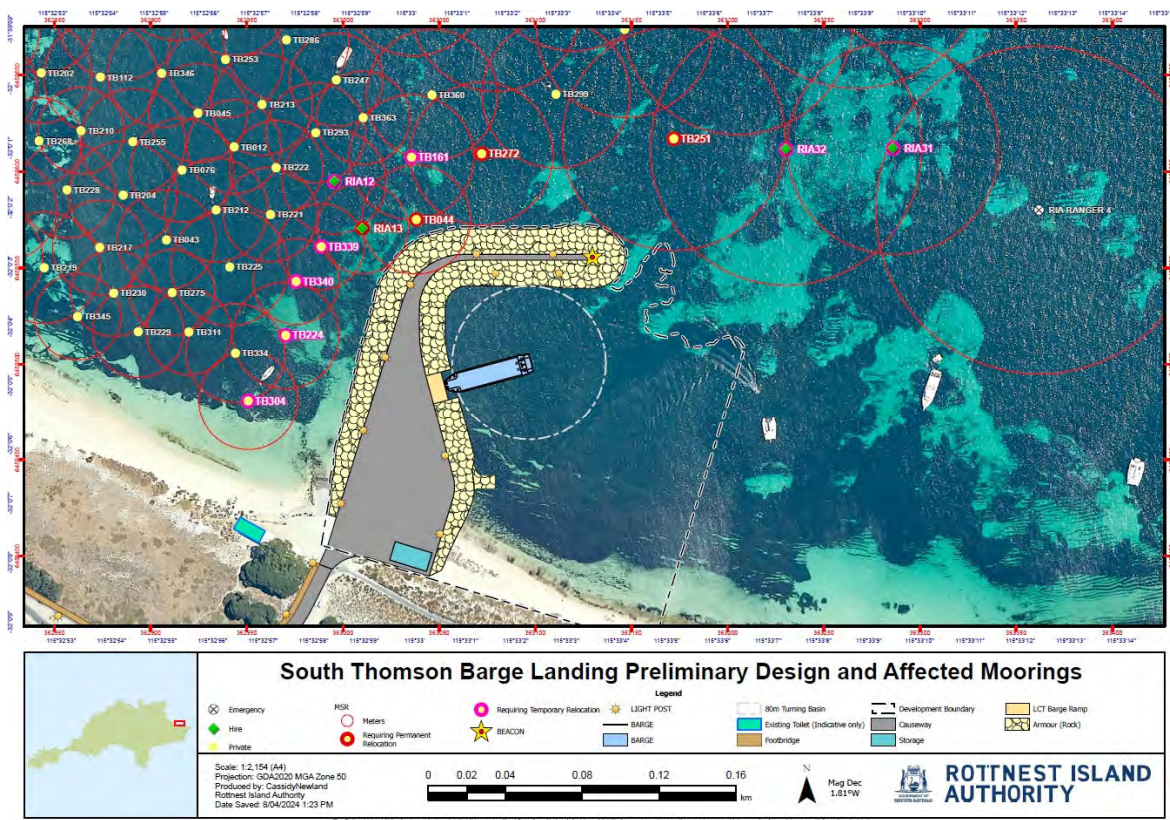


Figure 51: Location of impacted moorings

### 13.5.1.1.3 Impacts to public safety

There is potential for impacts to public safety during construction and operation of the proposal as summarised below:

- There is a risk to marine traffic during construction and operation of the proposal. However, as the Department of Transport (DoT) determined that a navigational channel and markers were not required, the risk to boating users from the relocation of barge traffic is not expected to be significant.
- Potential safety risks to swimmers within vicinity of the proposal. However, as RIA will install floating markers and signs at the entrance to the barge landing (within the development envelope) to prevent boat anchorage and swimming in peak season, this risk is unlikely to be significant.

### 13.5.1.2 Heritage

#### 13.5.1.2.1 Aboriginal heritage

There are no registered ACH sites within the development envelope and the consultation was undertaken with seven representatives of the Whadjuk NTC group confirmed that Rottnest Island Authority can proceed with the proposal without undue risk of breaching the *Aboriginal Heritage Act 1972* in relation to ethnographic sites and places.

There is risk for previously unearthed artefacts or burials to be identified during ground disturbing activities. The risk of this will be managed through implementation of the CEMP which includes the requirement for archaeological monitors to be present during all ground disturbing works.

Consultation undertaken with representatives of the Whadjuk NTC group recommended the following:

- Archaeological monitors are present during all ground disturbing works and that archaeological techniques, such as test pitting and sieving, are employed if artefacts are found. The WCAC have selected the monitors to take part and have forwarded to RIA heritage team.
- Due to the spiritual sentiment associated with the area, the Whadjuk NTC group representatives requested that a proprietary ritual be performed prior to the works occurring.
- The Whadjuk NTC group representatives requested that interpretative signage be installed at the site to provide people visiting the island with more information about Aboriginal history of the area.

#### 13.5.1.2.2 Historic heritage

There are no registered cultural heritage sites within the development envelope and the Army Groyne is not registered as a heritage site. Therefore, there will be no significant impacts to registered cultural heritage as a result of implementing the proposal. However, the Army Groyne was constructed in 1906 and there are community concerns regarding impacts to the heritage values of the site. These concerns will be addressed in ongoing consultation regarding the proposal.

Ongoing stakeholder engagement has been undertaken with the Heritage Council as summarised in Section 4. This engagement indicates that the Heritage Council has no significant concerns regarding the proposal, as long as impacts to the Kingstown Barracks are avoided (David Pond, personal communication, 12 July 2024).

### 13.5.1.3 Impacts to amenity

Potential impacts to amenity resulting from the proposal are summarised below:

- Potential noise emissions to air from construction and operation of the proposal.
  - Kingston Barracks and the South Thomson Bay units are located approximately 500 m from the proposal. The construction and operation of the proposal will generate noise emissions that may result in a reduction of amenity in the immediate area of the source.
  - An airborne noise assessment was undertaken of the current barge operations (Appendix U). Noise emissions from the existing operations at the Rottnest Barge Facility comply with the criteria set out by the Environmental Protection (Noise) Regulations 1997 at all times (Herring Storer, 2024).
  - As the existing barge operations comply with the criteria set out by the Environmental Protection (Noise) Regulations 1997, it is predicted that the relocated operations will also comply with the regulations and no significant noise impacts from the proposal are anticipated.
- Changes to visual amenity within the vicinity of the proposal.
  - As there is an existing groyne within the development envelope, extension of this groyne to support the proposal is unlikely to result in a significant change to visual amenity.
- Potential for items or materials (e.g. waste) to be transported through the proposed facility during operations which may result in odour emissions. The risk of significant impacts from odour emissions is low as the majority of materials transported through the new facility are inert with low potential for odour.

The transport of waste compactors through the facility will be limited to set times to further reduce the risk of impacts to amenity.

- Potential visual amenity impacts from artificial lighting will be minimised where safety allows. Lighting will be limited to specific purposes such as to ensure the safety of vessels and public at night and will be in accordance with the following:
  - Australian Standard DR AS/NZS 1158.3.1:2018 Lighting for roads and public spaces pedestrian area (Category P) lighting
  - Australian Standard AS/NZS 4282:2019 Control of the obtrusive effects of outdoor lighting
  - National light pollution guidelines for wildlife (DCEEW, 2023).

#### 13.5.1.4 Disturbance of UXOs

As discussed in Section 13.4.5, Wadjemup / Rottnest Island has been categorised by the Department of Defence with a residual UXO potential as slight.

Although the marine component of the development envelope was not mapped as having a risk of UXO occurring, the marine environment approximately 3 km to the north-west of the site is at risk of UXO occurring. Due to the risk of UXO in the area, Surrich (2019) undertook a magnetic field survey for UXO to further delineate the risks. The survey identified 48 ferrous debris targets, six of which were confirmed to be debris and not UXO.

As there are ferrous debris targets within the development envelope that may be UXO, there is a risk for dredging and ground disturbing activities to disturb UXO.

### 13.6 Mitigation

Table 74 demonstrates how the EPA's mitigation hierarchy (avoid, minimise and rehabilitate) has been applied to the environmental factor of social surroundings to address the key potential impacts.



Table 74: Application of mitigation hierarchy to social surroundings

| Potential environmental impacts                       | Impact class | Mitigation hierarchy | Proposed mitigation measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Residual impacts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------|--------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Impacts to recreational values (recreational fishing) | Indirect     | Avoid                | <ul style="list-style-type: none"> <li>Complete avoidance of indirect impacts to potential marine fauna habitat is not avoidable.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>No residual impacts expected</b><br>Implementation of the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to address potential impacts to marine fauna habitat that may indirectly impact recreational fishing. Implementation of these management plans ensures that impacts to marine environmental quality outside the ZoI, ZoMI and ZoHI from a temporary increase in suspended sediments are unlikely and residual impacts to recreational fishing are not considered significant. |
|                                                       |              | Minimise             | <ul style="list-style-type: none"> <li>Management and mitigation proposed during construction to minimise impacts to benthic communities and habitats is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that the area of benthic communities and habitats permanently impacted by the proposal is limited to the development envelope and ZoHI</li> <li>Management and mitigation proposed during construction to minimise impacts to marine environmental quality, which may result in impacts to recreational fishing, is detailed in the CEMP (Emerge, 2024a) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O). Implementation of these management plans will ensure that:               <ul style="list-style-type: none"> <li>The area affected by reduced water quality (suspended sediments) during dredging and construction will be limited (wherever possible) and will not extend past the modelled ZoHI, ZoMI and ZoI</li> <li>Marine environmental quality will be maintained at a moderate level of ecological protection during dredging and return to a High Level of Ecological Protection within two weeks following completion of dredging</li> </ul> </li> <li>Implementation of the CEMP and DEMMP provides the monitoring and management framework to address potential impacts to marine environmental quality during construction that may indirectly impact recreational fishing values. Key management and monitoring measures include:               <ul style="list-style-type: none"> <li>Implementation of the Marine Water Quality Monitoring Program (MWQMP) provided in the DEMMP for suspended sediment</li> <li>Inspections of all dredge equipment to check for leaks or damage</li> </ul> </li> <li>Operational management to minimise impacts to the marine environment is detailed in the OEMP (Emerge, 2024b) (Appendix Q).</li> <li>Maintenance dredging (if required) will be undertaken in previously disturbed / sandy areas within the development envelope / project footprint where possible. Maintenance dredging frequency, volumes and disposal will be determined as required. Environmental management and monitoring will be undertaken in a manner that is consistent with the document Maintenance Dredging Environmental Management Framework (BMT Oceanica, 2016) prepared for Department of Transport for similar types of maintenance dredging activities.</li> <li>Marine users to comply with vessel operational restrictions required by DoT and RIA.</li> </ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                                       |              | Rehabilitate         | Construction effects (outside the development envelope and ZoHI) on recreational fishing will be temporary and natural amelioration will mitigate or remove long-term impacts following cessation of construction activities.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                                       |              | Offset               | Social surroundings offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Impacts to recreational values (public safety)        | Direct       | Avoid                | <ul style="list-style-type: none"> <li>The proposed upgrades to the Army Groyne will reduce public safety risks and improve the overall visitor arrival experience</li> <li>The Department of Transport (DoT) determined that a navigational channel and markers were not required and that the risk to boating users from the relocation of barge traffic is not expected to be significant</li> <li>Complete avoidance of impacts to recreational values during construction and operation of the project cannot be achieved.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>No residual impacts expected</b><br>Significant residual impacts to social surroundings (recreational values; public safety) from implementation of the proposal are considered unlikely and will be minimised through implementation of the CEMP and OEMP                                                                                                                                                                                                                                                                                                               |
|                                                       |              | Minimise             | <ul style="list-style-type: none"> <li>Implementation of the CEMP provides the monitoring and management framework to minimise risks to public safety during construction. Key management and monitoring measures include:               <ul style="list-style-type: none"> <li>Equipment will be fitted with noise control devices where possible and appropriate</li> <li>Implementation of vehicle speed limits</li> <li>Installation of floating markers and signs to limit access to the construction areas within both the marine and terrestrial environment</li> </ul> </li> <li>Operational management to minimise impacts to the marine environment is detailed in the OEMP (Emerge, 2024b) (Appendix Q). Implementation of this management plan will ensure that:               <ul style="list-style-type: none"> <li>Installation of floating markers and signs at the entrance to the barge landing (within development footprint) to prevent boat anchorage and swimming in peak season. This will ensure that an increase in vessel movements does not impact public safety</li> <li>Physical inspections during operations</li> <li>Maintenance of a complaints register</li> <li>Public safety risk (i.e. traffic along Parker Point Rd) is addressed by policing and road regulations applicable to Wadjemup's / Rottnest Island's roads</li> <li>Marine users to comply with vessel operational restrictions required by DoT and RIA.</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                                       |              | Rehabilitate         | Rehabilitation is not considered applicable to social surroundings.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                                       |              | Offset               | Social surroundings offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Relocation of moorings                                | Direct       | Avoid                | Complete avoidance of disruption to mooring users is not possible.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Permanent relocation of four moorings</b><br>Disruption to moorings users has been minimised through relocating all impacted moorings, rather than removing them. Significant residual impacts to social surroundings (impacts to moorings) from implementation of the proposal are considered unlikely.                                                                                                                                                                                                                                                                 |
|                                                       |              | Minimise             | <ul style="list-style-type: none"> <li>No moorings will be permanently removed and disruption to moorings users will be minimised through:               <ul style="list-style-type: none"> <li>Temporary relocation of eight moorings during construction of the proposal. The temporary relocation will be undertaken prior to construction commencing to minimise disruption to users. The relocation will be for the duration of construction, for approximately 18 months</li> <li>The permanent relocation of four moorings will be undertaken prior to construction to minimise disruption to users</li> </ul> </li> <li>Ongoing stakeholder consultation with the local community regarding the proposal and potential impacts on social surroundings.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                                       |              | Rehabilitate         | All impacted moorings are proposed for relocation (rather than removal).                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                                       |              | Offset               | Social surroundings offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Impacts to previously unidentified ACH                | Direct       | Avoid                | <ul style="list-style-type: none"> <li>There are no registered ACH sites within the development envelope</li> <li>Consultation with representatives of the Whadjuk NTC group confirmed that the proposal can proceed without undue risk of breaching the <i>Aboriginal Heritage Act 1972</i> in relation to ethnographic sites and places.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>No residual impacts expected</b><br>Significant residual impacts to social surroundings (ACH) from implementation of the proposal are considered unlikely.                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                       |              | Minimise             | <ul style="list-style-type: none"> <li>To minimise potential impacts to any previously unidentified subsurface ACH, the following actions will be implemented as per the recommendations from the representatives of the Whadjuk NTC group:               <ul style="list-style-type: none"> <li>Archaeological monitors are present during all ground disturbing works and that archaeological techniques, such as test pitting and sieving, are employed if artefacts are found</li> </ul> </li> <li>Ongoing consultation will be undertaken with traditional owners as required to determine additional Aboriginal heritage information about potential sites.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                                       |              | Rehabilitate         | Rehabilitation is not considered applicable to social surroundings.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                                       |              | Offset               | Social surroundings offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

| Potential environmental impacts | Impact class | Mitigation hierarchy | Proposed mitigation measures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Residual impacts                                                                                                                                                                                                             |
|---------------------------------|--------------|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Impacts to amenity              | Indirect     | Avoid                | Complete avoidance of impacts to amenity is not possible.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>No residual impacts expected</b><br>Significant residual impacts to social surroundings (amenity) from implementation of the proposal are considered unlikely to be significant with implementation of the CEMP and OEMP. |
|                                 |              | Minimise             | <ul style="list-style-type: none"><li>• Ongoing stakeholder consultation with the local community regarding the proposal and potential impacts on social surroundings</li><li>• As there is an existing groyne within the development envelope, extension of this groyne to support the proposal is unlikely to result in a significant change to visual amenity</li><li>• An airborne noise assessment was undertaken of the current barge operations (Appendix U). Noise emissions from the existing operations at the Rottnest Barge Facility comply with the criteria set out by the Environmental Protection (Noise) Regulations 1997 at all times (Herring Storer, 2024). As the existing barge operations comply with the criteria set out by the Environmental Protection (Noise) Regulations 1997, it is predicted that the relocated operations will also comply with the regulations and no significant noise impacts from the proposal are anticipated</li><li>• Management targets and actions to minimise potential impacts to amenity from increase in noise, lighting, odour and dust from construction of the proposal are outlined in the CEMP (Appendix P). The management targets include:<ul style="list-style-type: none"><li>– Noise emissions do not exceed assigned noise levels as prescribed in the Environmental Protection (Noise) Regulations 1997</li><li>– No fugitive dust emission outside of the development envelope</li><li>– Zero incidences of fire resulting from the proposal</li></ul></li><li>• Key management measures outlined in the CEMP to achieve these targets include:<ul style="list-style-type: none"><li>– Construction contractor specifications will require that all construction work will be carried out in accordance with control of noise practices set out in Section 4 of Australian Standard 2436 Guide to Noise Control on Construction, Maintenance and Demolition Sites</li><li>– Vehicle operation will occur during prescribed hours (between 07:00 and 19:00)</li><li>– Equipment will be fitted with noise control devices where possible and appropriate</li><li>– Implement dust suppression measures</li><li>– Enforce speed limits</li><li>– Provision of facilities to ensure waste is appropriately disposed</li></ul></li><li>• Management targets and actions to minimise potential impacts to amenity from increase in noise, lighting, waste and odour and dust from construction of the proposal are outlined in the OEMP (Emerge, 2024b) (Appendix Q). The management targets include:<ul style="list-style-type: none"><li>– Limit the impact on social surroundings, including noise, dust and visual intrusion through controlled vehicle movement procedures, to avoid public and community issues</li><li>– Limit issues related to freight operations that may cause potential negative impacts on social surroundings</li><li>– Ensure waste disposal measures and prevent rubbish and litter impact on visual amenity</li><li>– Ensure local amenity is protected and public safety measures are undertaken</li></ul></li><li>• Key management measures outlined in the OEMP to achieve these targets include:<ul style="list-style-type: none"><li>– Dust management measures:<ul style="list-style-type: none"><li>○ Vehicle movements will be restricted to the designated access roads to minimise dust impacts to surrounding users</li><li>○ Vehicle speeds will be restricted to minimise the generation of dust</li></ul></li><li>– Waste management measures:<ul style="list-style-type: none"><li>○ Ensure all waste is either recycled or moved off site to the Island disposal facility</li></ul></li><li>– Noise management measures:<ul style="list-style-type: none"><li>○ Equipment will be fitted with noise control devices where possible and appropriate</li></ul></li><li>– Lighting management measures:<ul style="list-style-type: none"><li>○ The use of lighting at night will be for safety purposes only and will be designed to minimise impacts to surrounding users as much as possible</li><li>○ Adaptive light controls to manage light timing, intensity and colour will be implemented to minimise impacts from lighting</li><li>○ Only add light for specific purposes such as navigational and safety</li><li>○ Light only the object or area intended through lighting placement and design (e.g. placement of lights close to the ground, ensuring lights are directed and shielded to avoid light spill)</li><li>○ Use the lowest intensity lighting appropriate for the task</li><li>○ Use non-reflective, dark-coloured surfaces</li><li>○ Use lights with reduced or filtered blue, violet and ultra-violet wavelengths</li></ul></li><li>– Odour management measures:<ul style="list-style-type: none"><li>○ Odour generated from waste compactors will be managed through short transfer intervals, which are currently removed on Tuesdays and Thursdays between 11.00 am and 3.00 pm. The remainder of items transported through the new facility are inert with low potential for odour.</li></ul></li></ul></li></ul> |                                                                                                                                                                                                                              |
|                                 |              | Rehabilitate         | Rehabilitation is not considered applicable to social surroundings.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                              |
|                                 |              | Offset               | Social surroundings offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                              |
| Disturbance of UXO              | Direct       | Avoid                | As dredging and ground disturbing activities are required as part of the proposal, complete avoidance of risks is not possible.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>No residual impacts expected</b><br>With implementation of the measures in the CEMP, significant residual impacts to social surroundings (UXO risk) are considered unlikely.                                              |
|                                 |              | Minimise             | <ul style="list-style-type: none"><li>• Surrich (2019) and TAMS Group (2019) undertook a magnetic field survey for UXO to delineate the risks of disturbing UXO. An additional UXO survey, prior to construction works, will be undertaken to further assess anomalies identified during the initial UXO survey</li><li>• Management targets and actions to minimise potential impacts to social surroundings from the risk of disturbance to UXOs from construction of the proposal are outlined in the CEMP (Appendix P). The management targets include:<ul style="list-style-type: none"><li>– Minimise risk of disturbance to UXO site.</li></ul></li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                              |
|                                 |              | Rehabilitate         | If the resurveyed ferrous debris targets are identified as UXO, appropriate remediation and management will be undertaken.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                              |
|                                 |              | Offset               | Social surroundings offsets are not considered applicable to the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                              |

### 13.7 Assessment and significance of residual impact

The residual impacts to social surroundings after the application of the mitigation hierarchy outlined in Table 74 are summarised below:

- The permanent relocation of four moorings.

The predicted residual impacts to social surroundings from the proposal are not considered significant as discussed in Table 75.

**Table 75: Consideration of the significance of the residual impacts on social surroundings**

| <b>Matters for consideration</b>                                                                                                                         | <b>Response</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The object and principles of the EP Act                                                                                                                  | <p>Ongoing stakeholder consultation has been undertaken to address potential impacts to social surroundings and the following technical investigations undertaken:</p> <ul style="list-style-type: none"> <li>• Report of an Ethnographic Aboriginal Heritage Survey of the Army Jetty, Rottnest Island, Western Australia (Brad Goode and Associates, 2019)</li> <li>• Marine magnetic survey at proposed barge landing site, South Thomson Bay (Surrich, 2019) and Rottnest Island Authority – Geological Investigation – Thomson Bay South and UXO investigation/anomaly recovery (TAMS Group, 2019)</li> <li>• Acoustic assessment Rottnest Barge Facility Rottnest Island (Herring Storer, 2024).</li> </ul> <p>The principles of the EP Act have been specifically addressed in relation to the proposal (Table 26).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Values, sensitivity and quality of the environment which is likely to be impacted                                                                        | <p>Direct impacts to social surroundings include the relocation of four moorings. There will be no loss or removal of any moorings.</p> <p>Apart from the recreational values (boating and fishing), there are no other significant social surroundings within or directly adjacent to the development envelope.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| All stages and components of the proposal (such as any infrastructure required for the proposal to be practicably implemented, or a proposal life cycle) | <p>All stages of the proposal (i.e. construction and operation) have been included in this impact assessment.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Extent (intensity, duration, magnitude, and geographic footprint) of the likely impacts                                                                  | <p>Construction of the proposal will result in the relocation of four moorings.</p> <p>Implementation of the CEMP and OEMP will ensure that indirect impacts to social surroundings will be minimal and localised to the development envelope.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Resilience of the environment                                                                                                                            | <p>There are no ACH or registered heritage sites within or adjacent to the development envelope. Apart from the recreational values, there are no other significant social values within or directly adjacent to the development envelope.</p> <p>Given no significant impacts to social values are expected, the environment is expected to be resilient to change. Therefore, the social values within and adjacent to the development envelope are considered resilient to potential impacts and changes.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Consequence of the application of the mitigation hierarchy to the proposal.                                                                              | <p>The WA Offsets Guidelines (Government of Western Australia 2014) identifies four levels of significance for residual impacts:</p> <ul style="list-style-type: none"> <li>• Unacceptable impacts – those impacts which are environmentally unacceptable or where no offset can be applied to reduce the impact. Offsets are not appropriate in all circumstances, as some environmental values cannot be offset.</li> <li>• Significant impacts requiring an offset – any significant residual impact of this nature will require an offset. These generally relate to any impacts to species, ecosystems, or reserve areas protected by statute or where the cumulative impact is already determined to be at a critical level.</li> <li>• Potentially significant impact which may require an offset – the residual impact may be significant depending on the context and extent of the impact. These relate to impacts that are likely to result in a species or ecosystem requiring protection under statute or increasing the cumulative impact to a critical level. Whether these impacts require an offset will be determined by the decision-maker based on information provided by the proponent or applicant and expert judgement</li> <li>• Impacts which are not significant – impacts which do not trigger the above categories are not expected to have a significant impact on the environment and therefore do not require an offset.</li> </ul> <p>Following the application of the mitigation hierarchy outlined in Table 74 and taking into consideration the above significance of residual impacts model, RPS considers that there are no significant residual impacts to social surroundings from the proposal.</p> |



| Matters for consideration                                                                                                              | Response                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Level of confidence in the prediction of residual impacts and the success of proposed mitigation                                       | Stakeholder consultation will be ongoing to ensure the success of the proposed mitigation, resulting in a high level of confidence in the prediction of residual impacts. |
| Public interest about the likely effect of the proposal or scheme, if implemented, on the environment, and relevant public information | RIA has facilitated regular meetings / dialogue with the local community and key stakeholders (Table 25) as part of the project.                                          |

Cumulative impacts from the proposal have been considered in relation to other proposals within 5 km of the proposal and are discussed in Section 18.

Holistic impacts are discussed in Section 17.

### 13.8 Environmental outcomes

In consideration of the proposed avoidance and management measures and likely residual impacts associated with the proposal, the environmental outcomes that apply to social surroundings are:

- Noise emissions do not exceed assigned noise levels as prescribed in the Environmental Protection (Noise) Regulations 1997
- Maintain recreational fishing values by ensuring there are no observable impacts to benthic communities and habitats outside the ZoMI
- Minimise risk of disturbance to UXO
- No permanent loss or change to the total number of moorings as a result of implementation of the proposal
- No impacts to registered Aboriginal cultural heritage sites
- Maintain amenity values during construction and operation.

Adaptive management measures will be implemented in accordance with the CEMP, DEMMP and OEMP to ensure these environmental outcomes are met.

As the impact assessment identified no significant residual risks to social surroundings following the application of mitigation actions identified herein, it is considered that the proposal will successfully meet the EPA's objective to protect social surroundings from significant harm.

## 14 OTHER ENVIRONMENTAL FACTORS OR MATTERS

### 14.1 EPA environmental factors

This Environmental Supporting Report addresses the following key environmental factors in Sections 7 to 13:

- Benthic communities and habitats (Section 7 of this document)
- Coastal processes (Section 8 of this document)
- Marine environmental quality (Section 9 of this document)
- Marine fauna (Section 10 of this document)
- Terrestrial flora and vegetation (Section 11 of this document)
- Terrestrial fauna (Section 12 of this document)
- Social surroundings (Section 13 of this document).

Other environmental factors which are unlikely to be significantly impacted by the proposal, and how they relate to the proposal, is discussed in Table 76.

**Table 76: Overview of other environmental factors**

| Environmental factor              | Objective                                                                                                           | Relevance to the proposal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Land</b>                       |                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Landforms                         | To maintain the variety and integrity of significant physical landforms so that environmental values are protected. | No significant landforms are present within the development envelope that would be impacted by the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Subterranean fauna                | To protect subterranean fauna so that biological diversity and ecological integrity are maintained.                 | The proposal will not involve the abstraction of groundwater or significant excavations. Impacts on subterranean fauna are unlikely.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Terrestrial environmental quality | To maintain the quality of land and soils so that environmental values are protected.                               | <p>A search of DWER's Contaminated Sites Database identified that no known contaminated sites are within the development envelope. The closest registered contaminated site is located approximately 0.9 km west of the development envelope and is described below:</p> <ul style="list-style-type: none"> <li>• Site ID 39676 (portion of Lot 10976 on Deposited Plan 216860); hydrocarbons are present in groundwater below the registered contaminated site.</li> <li>• Marine water in Thomson Bay has been sampled between August 2000 and July 2005, and in the majority of these sampling events no contaminants were detected. Minor concentrations of hydrocarbons were detected during three sampling events in June 2002, June 2004 and December 2004. However, contaminants have never been detected in Thomson Bay at concentrations exceeding marine water guidelines.</li> <li>• The registered site has been remediated such that it is suitable for public open space and public roads but may not be suitable for the construction of enclosed buildings, as such, the site is classified as 'remediated for restricted use'.</li> </ul> <p>As no groundwater abstraction will occur as part of the proposal and hydrocarbons were not detected in Thomson Bay at concentrations exceeding marine water guidelines, this contaminated site is unlikely to impact the proposal.</p> <p>Implementation of the CEMP, DEMMP and OEMP will minimise risk to terrestrial environmental quality resulting from construction and operation of the proposal.</p> |

| Environmental factor     | Objective                                                                                                                     | Relevance to the proposal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                          |                                                                                                                               | <p>Acid sulfate soils (ASS) are naturally occurring soils containing iron sulfide minerals formed under saturated anoxic conditions. In an undisturbed state below the water table, these soils are benign and non-acidic. However, if the soils are exposed to the atmosphere through activities such as drainage, excavation or dewatering, the sulfides may react with oxygen to form sulfuric acid.</p> <p>A review of DWER's ASS mapping indicates that there is a low risk of ASS occurring within the development envelope.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Water</b>             |                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Inland waters            | To maintain the hydrological regimes and quality of groundwater and surface water so that environmental values are protected. | <p>There are no surface water features within the development envelope. Surface water features within vicinity of the proposal includes:</p> <ul style="list-style-type: none"> <li>• Bickley Swamp, approximately 180 m to the south, across Parker Point Road and Kingstown Road</li> <li>• Government House Lake is approximately 500 m to the west across Parker Point Road and Brand Way.</li> </ul> <p>As no groundwater abstraction will occur as part of the proposal and there are no surface water features within or directly adjacent to the development envelope, impacts to inland waters are unlikely. Impacts will be further minimised through implementation of the CEMP, DEMMP and OEMP.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Air</b>               |                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Air quality              | To maintain air quality and minimise emissions so that environmental values are protected                                     | <p>The proposal is unlikely to significantly impact air quality as summarised below:</p> <ul style="list-style-type: none"> <li>• As the barge operations are already undertaken at the Main Jetty and are proposed to be relocated to the development envelope, the proposal will not result in a change in emissions and air quality within the area.</li> <li>• Implementation of the CEMP will ensure impacts to air quality are minimised during construction.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Greenhouse gas emissions | To reduce net greenhouse gas emissions in order to minimise the risk of environmental harm associated with climate change     | <p>A greenhouse gas assessment was undertaken by Kewan Bond (2024) (Appendix L) to support the proposal. The findings of the assessment are summarised below:</p> <ul style="list-style-type: none"> <li>• As the proposal is for the relocation of existing barge operations, rather than new operations and activities, only minimal changes to the existing operational greenhouse gas emissions are anticipated.</li> <li>• A minor increase in operational emissions is expected due to the additional distance of the proposed barge landing from the main island settlement and the expected future increase in barge activities, which would involve an increase in fuel consumption and greenhouse gas emissions. However, the increase in barge activities would occur at the existing barge facilities and therefore, these increased emissions would occur even if the proposal were not implemented.</li> <li>• The EPA considers greenhouse gas emissions a significant factor if Scope 1 or Scope 2 emissions are reasonably likely to exceed 100,000 tonnes CO<sub>2</sub>-e of emissions in any year (EPA, 2023d).</li> <li>• A summary of the scope 1, 2 and 3 emissions estimated from construction and operation of the proposal are summarised below. <ul style="list-style-type: none"> <li>– Construction of the proposal will result in a temporary increase of greenhouse gas emissions as outlined in Appendix L. These temporary emissions are broken down as follows: <ul style="list-style-type: none"> <li>– Scope 1 emissions: 2,328 tonnes CO<sub>2</sub>-e</li> <li>– There are no Scope 2 emissions associated with the project because there is no consumption of electricity from the WA state grid supply.</li> <li>– Scope 3 emissions: 713 tonnes CO<sub>2</sub>-e.</li> </ul> </li> <li>– The total emissions from operation of the proposal over a 50-year period (the estimated life of the project) are estimated as 23,446 tonnes CO<sub>2</sub>-e. This equates to 469 tonnes CO<sub>2</sub>-e per annum from operation of the proposal. These emissions are broken down as follows: <ul style="list-style-type: none"> <li>– Scope 1 emissions: 392 tonnes CO<sub>2</sub>-e per annum</li> </ul> </li> </ul> </li> </ul> |



| Environmental factor | Objective                                     | Relevance to the proposal                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------|-----------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      |                                               | <ul style="list-style-type: none"> <li>– There are no Scope 2 emissions associated with the project because there is no consumption of electricity from the WA state grid supply</li> <li>– Scope 3 emissions: 77 tonnes CO2-e.</li> <li>• Based on the above emission estimates, the overall emissions from construction (3,041.51 CO2-e) and the annual emissions from operation (469.51 tonnes CO2-e) are below the EPAs trigger of 100,000 tonnes CO2-e of emissions in any year.</li> </ul> |
| <b>People</b>        |                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Human health         | To protect human health from significant harm | This factor primarily relates to projects where radiation occurs within materials in a manner that could pose a risk to human health. The proposal is not expected to present any human health risk.                                                                                                                                                                                                                                                                                             |

## 14.2 Matters of national environmental significance

Under the EPBC Act, if a proposal involves an action that is likely to result in a significant impact on a MNES, the proposal must be referred to the DCCEEW. The DCCEEW defines a significant impact as an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of the Environment, 2013).

A desktop search of the PMST for MNES was undertaken on 14 September 2023 to identify any MNES with the potential to occur within 10 km of the proposal (Appendix R). A summary of the search results is provided in Table 23, identifying the number of matters returned and the relevance of the search results to the proposal.

As outlined in Table 23, the proposal has potential to impact listed threatened species and listed migratory species. The proposal has been assessed against the significant impact criteria for these MNES in the sections below.

### 14.2.1 Listed threatened species

#### 14.2.1.1 Flora

The PMST search of the area within a 10 km radius of the proposal identified that the dwarf bee-orchid (*Diuris micrantha*) is recorded within the area. The dwarf bee-orchid is generally associated with Banksia woodlands and other vegetation communities that occur on the mainland. It is not associated with the vegetation units identified within the development envelope (Section 11.4.2 of this report) and is unlikely to occur within the development envelope.

The flora and vegetation surveys undertaken by RPS (2024) and Focused Vision Consulting (FVC) (2023) did not identify any conservation significant flora species within the development envelope.

As the dwarf bee-orchid does not occur within the development envelope, significant impacts as a result of the proposal are highly unlikely.

#### 14.2.1.2 Fauna

The PMST search identified 43 threatened fauna species within a 10 km radius of the development envelope. Results of the search are provided in Appendix R and Table 23.

##### 14.2.1.2.1 Terrestrial fauna species

A likelihood of occurrence assessment was undertaken by Eco Logical (2024) as part of the fauna assessment. Fauna species listed under the EPBC Act that were considered likely to occur within the development envelope was the quokka.

#### 14.2.1.2.1.1 Significant impact assessment

An assessment of the proposal against the significant impact criteria for the quokka (Vulnerable, EPBC Act) is provided in Table 77.

**Table 77: Significant impact criteria – Listed threatened species (terrestrial fauna)**

| Significant impact guidelines                                  | Summary of impacts on MNES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Variance to guidelines                                                                                                                                |
|----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Lead to a long-term decrease in the size of a population       | <p>Construction of the terrestrial components of the proposal will result in removal of 0.46 ha of native vegetation providing potential habitat to the quokka.</p> <p>Vegetation clearing and habitat fragmentation have been identified as potential threats to the survival and recovery of quokka populations. Although the quokka populations present on Wadjemup / Rottnest Island are resilient to the current levels of disturbance (DCCEEW, 2024).</p> <p>Focused Vision Consulting undertook flora and vegetation surveys within the area shown in Figure 38. The vegetation surveyed by Focused Vision Consulting that was most analogous to the vegetation present within the development envelope comprised the vegetation units MIAp and MIGI with a combined area of 67.39 ha. As such, it has been assumed that there is approximately 67.39 ha of similar fauna habitat to the 0.46 ha being directly impacted within vicinity of the proposal. The direct impacts to 0.46 ha of potential fauna habitat comprises 0.68% of the larger area surveyed by Focused Vision Consulting.</p> <p>Wadjemup / Rottnest Island encompasses approximately 1,800 ha, most of which is vegetated. If a conservative estimate is adopted, with an assumption that half of the island remains vegetated, clearing 0.46 ha of vegetation comprising potential fauna habitat would comprise 0.05% of the vegetation present on the island.</p> <p>As the total loss of terrestrial fauna habitat resulting from the proposal is low in a regional context, the proposal is considered unlikely to lead to a long-term decrease in the size of a population.</p> | <p><b>Not at variance</b></p> <p>The proposal will not lead to a long-term decrease in the size of the quokka population.</p>                         |
| Reduce the area of occupancy of the species                    | <p>As discussed above, direct impacts to 0.46 ha of potential fauna habitat comprises 0.68% of that present in the surrounding area surveyed by Focused Vision Consulting. As the total loss of terrestrial fauna habitat resulting from the proposal is low in a regional context, the proposal is considered unlikely to reduce the area of occupancy of the quokka. Furthermore, none of the vegetation within the development envelope was considered to have a limited local extent or distribution (Focused Vision, 2023) and is not considered to comprise habitat critical to the survival of the quokka or any other terrestrial species.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <p><b>Not at variance</b></p> <p>The proposal will not lead to reduction in the area of occupancy of the quokka.</p>                                  |
| Fragment an existing population into two or more populations   | <p>The terrestrial component of the development envelope comprises the existing Army Jetty Road. Consequently, the proposal will not result in further fragmentation of an existing population into two or more populations.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p><b>Not at variance</b></p> <p>The proposal will not result in the fragmentation of an existing quokka population into two or more populations.</p> |
| Adversely affect habitat critical to the survival of a species | <p>None of the vegetation within the development envelope was considered to have a limited local extent or distribution (Focused Vision, 2023) and is not considered to comprise habitat critical to the survival of the quokka or any other terrestrial species.</p> <p>Clearing 0.46 ha of potential habitat will not adversely affect habitat critical to the survival of the quokka.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p><b>Not at variance</b></p> <p>The proposal will not adversely affect habitat critical to the survival of the quokka.</p>                           |
| Disrupt the breeding cycle of a population                     | <p>The vegetation within the development envelope is not considered to comprise habitat critical for the quokka. Clearing 0.46 ha of this vegetation will not disrupt the breeding cycle of the population.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p><b>Not at variance</b></p> <p>The proposal will not disrupt the breeding cycle of the quokka.</p>                                                  |

| Significant impact guidelines                                                                                                                         | Summary of impacts on MNES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Variance to guidelines                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.              | The proposal will result in clearing 0.46 ha of potential habitat within the development envelope. Focused Vision Consulting (2023) identified 67.39 ha of habitat similar to that present within the development envelope in the Focused Vision Consulting survey area (Figure 38). Consequently, direct impacts to 0.46 ha of potential fauna habitat comprises 0.68% of the larger area surveyed by Focused Vision Consulting and is unlikely to result in a decrease in the availability or quality of habitat to the extent that the species is likely to decline. | <b>Not at variance</b><br>The proposal will not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline                                                                                             |
| Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the vulnerable species' habitat. | The CEMP details hygiene protocols to ensure the proposal does not result in the introduction of an invasive species during construction.                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Not at variance</b><br>Implementation of the CEMP and OEMP will ensure that the proposal will not result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat. |
| Introduce disease that may cause the species to decline                                                                                               | The CEMP details hygiene protocols and will ensure no diseases are introduced to the proposal area as a result of the proposal.                                                                                                                                                                                                                                                                                                                                                                                                                                         | <b>Not at variance</b><br>Implementation of the CEMP and OEMP will ensure that the proposal will not introduce disease that may cause the species to decline.                                                                                                                       |
| Interfere with the recovery of the species                                                                                                            | The vegetation within the development envelope is not considered to comprise habitat critical for the quokka. Clearing 0.46 ha of this vegetation will not interfere with the recovery of the quokka.                                                                                                                                                                                                                                                                                                                                                                   | <b>Not at variance</b><br>The proposal is unlikely to interfere with the recovery of the quokka.                                                                                                                                                                                    |

#### 14.2.1.2.2 Marine fauna species

Based on the database searches and literature review undertaken to support the proposal (Appendix B), the listed threatened marine fauna species listed in Table 78 may occur within South Thomson Bay (RPS, 2024a).



Table 78: Listed threatened marine fauna species (RPS, 2024a)

| Name                                             |                                          | Conservation status    |                                               | Distribution at Wadjemup/<br>Rottnest Island and<br>surrounding waters*                                                                | Habitat and seasonal preferences                                                                                                                                                                                                                                                                                                                                                                                                           |
|--------------------------------------------------|------------------------------------------|------------------------|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Species                                          | Common                                   | EPBC Act               | BC Act                                        |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Sharks                                           |                                          |                        |                                               |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>Sphyrna lewini</i>                            | Scalloped hammerhead                     | Conservation Dependent | Not included                                  | Species or species habitat likely to occur within area                                                                                 | Undertake annual foraging and breeding migrations. Known to aggregate in the Shoalwater islands Marine Park, where peak numbers are observed during January and February (López, 2023).                                                                                                                                                                                                                                                    |
| <i>Carcharias taurus</i> (west coast population) | Grey nurse shark (west coast population) | Vulnerable             | Vulnerable                                    | Congregation or aggregation known to occur within area                                                                                 | Year-round presence. Seasonal migration patterns have not been observed (DCCEEW, 2023b).                                                                                                                                                                                                                                                                                                                                                   |
| <i>Carcharodon carcharias</i>                    | White shark                              | Vulnerable, Migratory  | Vulnerable                                    | Species or species habitat known to occur within area                                                                                  | Have been shown to undertake migrations north along the WA coast during spring and return in summer; however, coastal movements are not synchronous. They are frequently recorded in waters around fur seal and sea lion colonies, including in the Perth region (DCCEEW, 2023b), where they are more likely to be present during spring and early summer and least likely to be present during late summer and autumn (SharkSmart, 2018). |
| Mammals                                          |                                          |                        |                                               |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>Neophoca cinerea</i>                          | Australian sea lion                      | Endangered             | Endangered                                    | Species or species habitat likely to occur within area. The development footprint is located within the foraging BIA for this species. | Has an asynchronous non-annual breeding cycle with cycles ranging from 16 to 20 months and pupping occurring at different times throughout the South-West Marine Region (DCCEEW, 2023b).                                                                                                                                                                                                                                                   |
| <i>Eubalaena australis</i>                       | Southern right whale                     | Endangered, Migratory  | Vulnerable                                    | The development footprint is located within the migratory BIA for this species <sup>†</sup>                                            | Southern temperate to subpolar waters including marine areas of southern Australia from May to October. The migratory period within the migration BIA up the west coast of WA is April to October (National Conservation Values Atlas, 2023).                                                                                                                                                                                              |
| <i>Balaenoptera musculus brevicauda</i>          | Pygmy blue whale                         | Endangered             | Endangered (as <i>Balaenoptera musculus</i> ) | Known to occur in the area. The development footprint is located within the distribution BIA for this species.                         | The northbound migration past Perth Canyon occurs between April and July (peak May to June), with the return migration from October to January (peak November to early December).                                                                                                                                                                                                                                                          |
| Reptiles                                         |                                          |                        |                                               |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>Caretta caretta</i>                           | Loggerhead turtle                        | Endangered, Migratory  | Endangered                                    | Foraging, feeding or related behaviour known to occur within area                                                                      | Generally nesting in summer at nesting grounds in northern WA (not necessarily every year; ALA, 2023).                                                                                                                                                                                                                                                                                                                                     |
| <i>Dermochelys coriacea</i>                      | Leatherback turtle                       | Endangered, Migratory  | Vulnerable                                    | Species or species habitat known to occur within area                                                                                  | Migrates from foraging areas to nesting beaches in tropical and subtropical regions during summer (ALA, 2023; DCCEEW, 2023b).                                                                                                                                                                                                                                                                                                              |
| <i>Chelonia mydas</i>                            | Green turtle                             | Vulnerable, Migratory  | Vulnerable                                    | Foraging, feeding or related behaviour known to occur within area                                                                      | Migrates from foraging areas to nesting beaches in tropical regions during summer, typically between November and March (DCCEEW, 2023b).                                                                                                                                                                                                                                                                                                   |
| Birds                                            |                                          |                        |                                               |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <i>Limosa lapponica menzbieri</i>                | Northern Siberian bar-tailed godwit      | Critically Endangered  | Critically Endangered                         | Species or species habitat known to occur within area                                                                                  | The northern Siberian bar-tailed godwit occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays (TSCC, 2016).                                                                                                                                                                                                                                         |
| <i>Calidris tenuirostris</i>                     | Great knot                               | Critically Endangered  | Critically Endangered                         | Roosting known to occur within area                                                                                                    | The great knot has been recorded around the entirety of the Australian coast and is common on the coasts of the Pilbara and Kimberley, from the Dampier Archipelago to the Northern Territory border. Great knots prefer sheltered coastal habitats with large intertidal mudflats or sandflats. This includes inlets, bays, harbours, estuaries and lagoons (DCCEEW, 2023).                                                               |
| <i>Calidris ferruginea</i>                       | Curlew sandpiper                         | Critically Endangered  | Critically Endangered                         | Species or species habitat known to occur within area                                                                                  | In Western Australia, the curlew sandpiper is widespread around coastal and subcoastal plains from Cape Arid to south-west Kimberley Division. They mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons.                                                                                                                                                                           |
| <i>Numenius madagascariensis</i>                 | Eastern curlew                           | Critically Endangered  | Critically Endangered                         | Species or species habitat likely to occur within area                                                                                 | The eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (Cornel University 2023).                                                                                                                                                                                                 |
| <i>Charadrius mongolus</i>                       | Lesser sand plover                       | Endangered             | Endangered                                    | Roosting known to occur within area                                                                                                    | The lesser plover mainly occurs in northern and eastern Australia, rare in south-western Australia. The species is almost strictly coastal, preferring sandy beaches, mudflats of coastal bays and estuaries, sand flats and dunes near the coast (Cornell University, 2023).                                                                                                                                                              |
| <i>Calidris canutus</i>                          | Red knot                                 | Endangered             | Endangered                                    | Species or species habitat known to occur within area                                                                                  | The red knot mainly inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts and sometimes on sandy ocean beaches or shallow pools on exposed rock platforms (Higgins, 1996)                                                                                                                                                                                                                                          |
| <i>Rostratula australis</i>                      | Australian painted snipe                 | Endangered             | Endangered                                    | Species or species habitat may occur within area                                                                                       | The Australian painted snipe lives in shallow freshwater (occasionally brackish) wetlands, both ephemeral and permanent, such as lakes, swamps, claypans, inundated or waterlogged grassland/saltmarsh (TSSC, 2013)                                                                                                                                                                                                                        |
| <i>Charadrius leschenaultii</i>                  | Greater sand plover                      | Vulnerable             | Vulnerable                                    | Species or species habitat known to occur within area                                                                                  | Mainly occurs on sheltered sandy, shelly or muddy beaches, large intertidal mudflats, sandbanks, salt marshes, estuaries, coral reefs, rocky islands rock platforms, tidal lagoons and dunes near the coast (Cornel University 2023).                                                                                                                                                                                                      |
| <i>Sternula nereis nereis</i>                    | Australian fairy tern                    | Vulnerable             | Vulnerable                                    | Foraging, feeding or related behaviour known to occur within area. Migrant breeding, breeding habitat present within the area.         | In south-western Australia, the fairy tern breeds between October and March with peak breeding between December and January. The Natural Jetty at the end of Philip Point is an important roost site for fairy terns.                                                                                                                                                                                                                      |

\*As listed in the PMST search results and/or Atlas of Living Australia (ala.org.au)

<sup>†</sup>Although the PMST search indicates that breeding by *E. australis* may occur within the PMST search area, a review of the online National Conservation Values Atlas indicates that this is not the case and only the migration BIA for the species overlaps Thomson Bay

Definitions: BC Act = *Biodiversity Conservation Act 2016* (WA), BIA = Biologically Important Area, DBCA = Department of Biodiversity, Conservation and Attractions (WA), EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)

Priority 4 = Rare, Near Threatened and other species in need of monitoring (BC Act)

Other Specially Protected = Species otherwise in need of special protection (BC Act)

14.2.1.2.2.1 Significant impact assessment

An assessment of the potential impacts to these species from implementation of the proposal against the significant impact criteria in Table 79.

Table 79: Significant impact criteria – Listed threatened species (marine fauna)

| Significant impact guidelines                            | Summary of impacts on MNES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Variance to guidelines                                                                                                                                         |
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| Lead to a long-term decrease in the size of a population | <p>The proposal will result in the following potential impacts to listed threatened marine fauna species:</p> <ul style="list-style-type: none"><li>Predicted loss of 3.32 ha of habitat for marine fauna, which includes:<ul style="list-style-type: none"><li>2.06 ha mixed seagrass</li><li>1.26 ha sand with wrack.</li></ul></li><li>Reduction in marine environmental quality. The area affected by suspended sediments during dredging and construction will be limited to the modelled zones of impact. Silt curtains will be used for dredging and rock-dumping for breakwater construction, thereby limiting the impact from increased suspended sediments and minimising the indirect impact to marine fauna behaviours and potential habitat. With implementation of the CEMP, DEMP and OEMP, residual impacts to marine fauna from changes to marine environmental quality are considered low.</li><li>Underwater noise emissions from piling operations causing temporary disturbance to marine fauna species.</li></ul> <p>The potential for these impacts to result in a long-term decrease in the size of a population of a listed threatened marine fauna species is discussed below.</p> <p><b>Shark species</b></p> <p>Three threatened shark species may occur within vicinity of the proposal. Scalloped hammerheads (EPBC Act listed conservation dependent) and white sharks (vulnerable) are typically seasonal and use the area for foraging and/or migration; however, may be present year-round. Scalloped hammerheads aggregate in the Shoalwater Islands Marine Park (approximately 30 km from the proposal), peaking during January and February. White sharks are more likely to be present in the Perth region during spring and early summer, and least likely to be present during late summer and autumn. The grey nurse shark (vulnerable) is known to congregate or aggregate in the area year-round.</p> <p>These shark species are known to utilise the following habitat types:</p> <ul style="list-style-type: none"><li>Grey nurse sharks (western population) are found in inshore waters, particularly sub-tropical to temperate waters. Grey nurse sharks are often observed aggregating around inshore rocky reefs or islands (Department of the Environment, 2014). There is likely to be habitat suitable for this species around the island, however the development envelope is unlikely to provide significant habitat for this species.</li><li>The scalloped hammerhead is predominately found along coastal shelves, though will occasionally travel into intertidal zones and inshore habitats may be important for immature hammerheads (DCCEEW, 2024).</li><li>Great white sharks are frequently recorded in waters around fur seal and sea lion colonies such as those to the west end of the island. There is likely to be habitat suitable for this species around the island, however the development envelope is unlikely to provide significant habitat for this species.</li></ul> <p>The benthic communities and habitats within the development envelope is unlikely to provide critical habitat for these shark species. However, the benthic communities and habitats is likely to provide habitat for prey species for the shark species. An assessment of the shark species pressure analysis for the South-west Marine Region indicates that most of the shark species addressed in the species report group card for sharks are not susceptible to the pressure of habitat modification (DSEWPC, 2012). As such the proposed dredging and removal of benthic communities and habitats is unlikely to have a significant impact on the shark species present in South Thomson Bay.</p> <p>As the proposal will only result in the removal of 3.32 ha of benthic communities and habitats, including 2.06 ha of seagrass (0.52% of the LAU), direct impacts to potential habitat for these species are unlikely to result in a long-term decrease in the size of a population.</p> <p>Indirect impacts to marine habitats and environmental quality will be managed and mitigated through implementation of the CEMP, DEMP and OEMP. Implementation of these plans will ensure that indirect impacts are limited to 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI. It is predicted that benthic communities and habitats that are impacted within the ZoMI will recover within five years.</p> <p>As such, indirect impacts to potential habitat for these species is unlikely to result in a long-term decrease in the size of a population of the above shark species.</p> <p><b>Marine mammals</b></p> <p>Seasonal migration of listed threatened whale species along the WA coast includes the southern right whale (endangered; migration April to October), pygmy blue whale (endangered; migration April to January), and the minke whale (may be present over winter). Other listed marine mammals that may be present year-round includes the Australian sea lion (endangered). The development envelope is within the following BIAs for these species:</p> <ul style="list-style-type: none"><li>Australian sea lion (the development envelope is within the foraging BIA for this species)</li><li>Pygmy blue whale (the development envelope is within the distribution BIA for this species)</li><li>Southern right whale (the development envelope is within the migration BIA for this species).</li></ul> <p>The development envelope is located within the foraging BIA for the Australian sea lion. The closest known haul out area for these species is on Carnac Island and there is potential that these species forage within the development envelope.</p> <p>As the proposal will only result in the removal of 3.32 ha of benthic communities and habitats, including 2.06 ha of seagrass (0.52% of the LAU), direct impacts to potential habitat for these species are unlikely to result in a long-term decrease in the size of a population.</p> <p>Construction of the proposal will not result in impacts that lead to a long-term decrease in the size of a whale population. Potential behavioural impacts to whale species during construction from underwater noise are discussed later in this table.</p> <p>The proposed development envelope is located within the coastal area of South Thomson Bay and the infrastructure is unlikely to impact the migratory pathways of the whale species. Barge movements may traverse the migration route, however as these barge movements are existing, no additional impacts from operation of the proposal are anticipated.</p> <p>Construction and operation of this proposal will not result in a long-term decrease in the size of a marine mammal population.</p> <p><b>Turtles</b></p> <p>The site is not within a BIA for any turtle species and there are no nesting or internesting areas identified as habitat critical to the survival of marine turtle species (DoEE, 2017). However, seagrass meadows do provide the following habitat for turtle species and as such, there is potential that the loggerhead turtle (endangered), leatherback turtle (endangered), and green turtle (vulnerable) may occasionally occur in the area (DoEE, 2017):</p> <ul style="list-style-type: none"><li>The green turtle forages on algae and seagrass.</li><li>Juvenile and adult sea turtle species are known to forage where there are seagrass meadows present.</li></ul> <p>Turtles migrate to/from their nesting grounds in northern WA during summer (typically between November and March); however, their common distribution is north of the development envelope and these species are not anticipated to frequent the area.</p> <p>As the development envelope is not located within a BIA for turtle species does not comprise any significant or critical habitat for these species, the impacts listed above are unlikely to result in a long-term decrease in the size of a population of the above turtle species.</p> <p><b>Marine bird species</b></p> <p>Listed threatened marine bird species which are known to occur within vicinity of the development envelope includes the Australian fairy tern. Other marine bird species, in particular the Caspian tern and crested tern, may occasionally occur within vicinity of the proposal. However, as there is no critical or significant habitat (such as roosting or breeding sites) present within or proximate to the development envelope, significant impacts from the proposal are unlikely.</p> <p>The Australian fairy tern is known to roost at the Natural Jetty at the end of Philip Point, approximately 900 m east of the proposal and may forage within the development envelope. Implementation of the proposal is unlikely to have significant direct impacts on the Australian fairy tern that would result in a long-term decrease in the size of the population.</p> <p>A coastal processes assessment has been undertaken to identify potential impacts of the proposal on coastal processes. This assessment identified that the proposal is unlikely to result in significant erosion of the roosting habitat present at Philip Point. Therefore, the proposal will not result in a long-term decrease in the size of this population.</p> | <p><b>Not at variance</b></p> <p>The proposal will not lead to a long-term decrease in the size of a population of listed threatened marine fauna species.</p> |



| Significant impact guidelines                                                                                                                                                 | Summary of impacts on MNES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Variance to guidelines                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Reduce the area of occupancy of the species                                                                                                                                   | <p><b>Shark species</b></p> <p>There is potential for the three threatened shark species listed above to occur within South Thomson Bay. However, as discussed above, it is considered unlikely that the development envelope comprises critical habitat for these species. The proposal will result in the removal of 3.32 ha of benthic communities and habitats, including 2.06 ha of seagrass. As the predicted loss of seagrass is only 0.52% of the LAU, direct impacts to potential habitat for these species is unlikely to result in a long-term decrease in the size of a population.</p> <p>With implementation of the CEMP and OEMP, indirect impacts to habitat for these species is unlikely to be significant.</p> <p><b>Marine mammals</b></p> <p>There is potential for the southern right whale, pygmy blue whale and minke whale to occur within or within vicinity of the development envelope. The proposal will not significantly reduce the area of occupancy of the wide-ranging migratory whale species.</p> <p>There is potential for the Australia sea lion to forage within and adjacent to the development envelope. The proposal will result in the removal of 3.32 ha of benthic communities and habitats, including 2.06 ha of seagrass that may be used by the Australia sea lion. As the loss predicted loss of seagrass is only 0.52% of the LAU, direct impacts to potential habitat for these species is unlikely to result in a long-term decrease in the size of a population.</p> <p>Underwater noise from piling activities has the potential to result in avoidance behaviours, thereby reducing the area of occupancy of marine fauna species. Implementation of the CEMP (Emerge, 2024) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to address potential impacts to marine fauna during construction. Implementation of the measures outlined in these management plans will ensure there are no significant residual impacts to marine fauna from underwater noise (see Section 10.6 for further details).</p> <p><b>Turtles</b></p> <p>Turtle species that may forage in the area include the loggerhead turtle, leatherback turtle and green turtle. The development envelope is not within a BIA for these turtle species and their common distribution is north of the development envelope. Therefore, the proposal is unlikely to reduce the area of occupancy of these species.</p> <p>Underwater noise from piling activities has the potential to result in avoidance behaviours, thereby reducing the area of occupancy of marine fauna species. Implementation of the CEMP (Emerge, 2024) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to address potential impacts to marine fauna during construction. Implementation of the measures outlined in these management plans will ensure there are no significant residual impacts to marine fauna from underwater noise (see Section 10.6 for further details).</p> <p><b>Marine bird species</b></p> <p>Listed threatened marine bird species that are known to occur within vicinity of the development envelope includes the Australian fairy tern. Other marine bird species may occasionally occur within vicinity of the development, however, are unlikely to be impacted by the proposal.</p> <p>The Australian fairy tern is known to roost at the Natural Jetty at the end of Philip Point, approximately 900 m east of the proposal and may forage within the development envelope. Implementation of the proposal is unlikely to have significant direct impacts on the area of occupancy of this species.</p> <p>A coastal processes assessment has been undertaken to identify potential impacts of the proposal on coastal processes. This assessment identified that the proposal is unlikely to result in significant erosion of the roosting habitat present at Philip Point. Therefore, the proposal will not result in a decrease in the area of occupancy of this species.</p> | <p><b>Not at variance</b></p> <p>The proposal will not lead to reduction in the area of occupancy of any listed threatened marine fauna species.</p>                                                                                                                                           |
| Fragment an existing population into two or more populations                                                                                                                  | <p>The existing Army Groyne encompasses 2,527 m<sup>2</sup> and the proposed breakwater that will be constructed over the existing groyne, encompasses 4,357 m<sup>2</sup>. The proposed breakwater extends approximately 130 m from the shoreline.</p> <p>Due to the small scale of the proposal and the fact that it is being constructed over an existing structure, the proposal does not result in a significant increase in barriers to marine fauna movements within the bay.</p> <p>Furthermore, the development envelope comprises a small part of the larger South Thomson Bay area that is the broader ecosystem, which may be used by marine fauna species. Therefore, it is not considered likely for the proposal to result in fragmentation of the local population of any protected marine fauna.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p><b>Not at variance</b></p> <p>The proposal will not result in the fragmentation of an existing population into two or more populations.</p>                                                                                                                                                 |
| Adversely affect habitat critical to the survival of a species                                                                                                                | <p>The development envelope is within the BIA of the following threatened marine fauna species:</p> <ul style="list-style-type: none"><li>Fairy tern (the development envelope is within the foraging BIA for this species)</li><li>Australian sea lion (the development envelope is within the foraging BIA for this species)</li><li>Pygmy blue whale (the development envelope is within the distribution BIA for this species)</li><li>Southern right whale (the development envelope is within the migration BIA for this species).</li></ul> <p>Loss of benthic habitats due to construction of the proposal may impact foraging habitat of the Australian fairy tern and Australian sea lion. However, as the proposal will result in the removal of 3.32 ha of benthic communities and habitats, including 2.06 ha of seagrass (0.52% of the LAU), direct impacts to potential foraging habitat for these species is not considered significant.</p> <p>Construction of the proposal is unlikely to adversely impact critical habitat to the wide-ranging migratory whale species which may occur in the area. Implementation of the CEMP and OEMP will ensure indirect impacts to habitat for these species is unlikely to be significant.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p><b>Not at variance</b></p> <p>The proposal will not adversely affect habitat critical to the survival of a species</p>                                                                                                                                                                      |
| Disrupt the breeding cycle of a population                                                                                                                                    | <p>The development envelope is not within a breeding BIA for any threatened marine species and is not known to provide critical breeding habitat for these species.</p> <p>Loss of 2.06 ha of seagrass (0.52% of the LAU) is not considered likely to disrupt the breeding cycle of a population.</p> <p>Underwater noise from piling activities has the potential to result in injury and changes in behaviours of marine fauna species. Implementation of the CEMP (Emerge, 2024) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to address potential impacts to marine fauna during construction. Implementation of the measures outlined in these management plans will ensure there are no significant residual impacts to marine fauna from underwater noise (see Section 10.6 for further details).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p><b>Not at variance</b></p> <p>The proposal will not disrupt the breeding cycle of a population.</p>                                                                                                                                                                                         |
| Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline                                       | <p>The proposal will result in the permanent loss of 2.06 ha of seagrass. This loss of seagrass comprises 0.52% of the LAU. As the proposal will not result in the loss of significant amounts of benthic communities and habitats when compared to that present in the larger area, nor result in a significant increase of barriers to free movement of marine fauna, the proposal is not considered likely to result in the decline of a threatened marine species.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p><b>Not at variance</b></p> <p>The proposal will not modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</p>                                                                                             |
| Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat | <p>The proposal will result in the relocation of existing barge movements from the Main Jetty to the development envelope. As no new activities are proposed during operation of the proposal, the introduction of IMS is unlikely.</p> <p>There is potential for the introduction of IMS during construction of the proposal. Measures outlined in the CEMP and DEMMP will ensure that the risk for the introduction of IMS is low.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p><b>Not at variance</b></p> <p>Implementation of the CEMP and OEMP will ensure that the proposal will not result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.</p> |
| Introduce disease that may cause the species to decline                                                                                                                       | <p>Ballast water is a recognised potential vector for introduction of disease organisms in the marine environment. However, as indicated above, no new marine activities are proposed during operation and construction activities will be management in accordance with the CEMP.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p><b>Not at variance</b></p> <p>Implementation of the CEMP and OEMP will ensure that the proposal will not introduce disease that may cause the species to decline.</p>                                                                                                                       |
| Interfere with the recovery of the species                                                                                                                                    | <p>Due to the small scale of the direct impacts anticipated from the proposal and the mitigations and management measures outlined in the CEMP and OEMP to minimise the risk of disturbance from spills and underwater noise, the proposal is unlikely to interfere with the recovery of any threatened marine species.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <p><b>Not at variance</b></p> <p>The proposal is unlikely to interfere with the recovery of any threatened marine species.</p>                                                                                                                                                                 |

14.2.2 Migratory species

Based on the database searches and desktop marine fauna assessment to support the proposal (Appendix B), the migratory species listed in Table 80 may occur within South Thomson Bay (RPS, 2024a).

Table 80: Migratory species

| Name                                    |                                     | Conservation status             |                                   | Distribution at Wadjemup / Rottnest Island and surrounding waters*                                                                     | Habitat and seasonal preferences                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------------------|-------------------------------------|---------------------------------|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Species                                 | Common                              | EPBC Act                        | BC Act                            |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Sharks                                  |                                     |                                 |                                   |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <i>Carcharodon carcharias</i>           | White shark                         | Vulnerable, Migratory           | Vulnerable                        | Species or species habitat known to occur within area                                                                                  | Have been shown to undertake migrations north along the WA coast during spring and return in summer; however, coastal movements are not synchronous. They are frequently recorded in waters around fur seal and sea lion colonies, including in the Perth region (DCCEEW, 2023b), where they are more likely to be present during spring and early summer and least likely to be present during late summer and autumn (SharkSmart, 2018).                                                                              |
| Mammals                                 |                                     |                                 |                                   |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <i>Eubalaena australis</i>              | Southern right whale                | Endangered, Migratory           | Vulnerable                        | The development footprint is located within the migratory BIA for this species†                                                        | Southern temperate to subpolar waters including marine areas of southern Australia from May to October. The migratory period within the migration BIA up the west coast of WA is April to October (National Conservation Values Atlas, 2023).                                                                                                                                                                                                                                                                           |
| <i>Megaptera novaeangliae</i>           | Humpback whale                      | Migratory                       | Conservation Dependent, Migratory | Species or species habitat known to occur within area. The development footprint is located within the migratory BIA for this species. | The annual peak northbound migration along the Jurien Bay to Carnarvon migration route occurs between June and July, while the southbound migration peak occurs between September and October (DCCEEW, 2023b).                                                                                                                                                                                                                                                                                                          |
| <i>Orcinus orca</i>                     | Killer whale, Orca                  | Migratory                       | Migratory                         | Species or species habitat may occur within area                                                                                       | Mating is known to occur all year round, whilst the calving season spans several months. However, no areas of significance and no determined migration routes have been identified for this species within waters off WA (DCCEEW, 2023b). They are typically present on the south coast of WA between January to April.                                                                                                                                                                                                 |
| <i>Balaenoptera musculus brevicauda</i> | Pygmy blue whale                    | Endangered Migratory            |                                   | Known to occur in the area. The development envelope is located within the distribution BIA for this species.                          | The northbound migration past Perth Canyon occurs between April and July (peak May to June), with the return migration from October to January (peak November to early December).                                                                                                                                                                                                                                                                                                                                       |
| Reptiles                                |                                     |                                 |                                   |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <i>Caretta caretta</i>                  | Loggerhead turtle                   | Endangered, Migratory           | Endangered                        | Foraging, feeding or related behaviour known to occur within area                                                                      | Generally nesting in summer at nesting grounds in northern WA (not necessarily every year; ALA, 2023).                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <i>Dermochelys coriacea</i>             | Leatherback turtle                  | Endangered, Migratory           | Vulnerable                        | Species or species habitat known to occur within area                                                                                  | Migrates from foraging areas to nesting beaches in tropical and subtropical regions during summer (ALA, 2023; DCCEEW, 2023b).                                                                                                                                                                                                                                                                                                                                                                                           |
| <i>Chelonia mydas</i>                   | Green turtle                        | Vulnerable, Migratory           | Vulnerable                        | Foraging, feeding or related behaviour known to occur within area                                                                      | Migrates from foraging areas to nesting beaches in tropical regions during summer, typically between November and March (DCCEEW, 2023b).                                                                                                                                                                                                                                                                                                                                                                                |
| Birds                                   |                                     |                                 |                                   |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <i>Limosa lapponica menzbieri</i>       | Northern Siberian bar-tailed godwit | Critically Endangered Migratory | Critically Endangered             | Species or species habitat known to occur within area                                                                                  | The northern Siberian bar-tailed godwit occurs mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays (TSCC, 2016).                                                                                                                                                                                                                                                                                                                      |
| <i>Calidris tenuirostris</i>            | Great knot                          | Critically Endangered Migratory | Critically Endangered             | Roosting known to occur within area                                                                                                    | The great knot has been recorded around the entirety of the Australian coast and is common on the coasts of the Pilbara and Kimberley, from the Dampier Archipelago to the Northern Territory border. Great knots prefer sheltered coastal habitats with large intertidal mudflats or sandflats. This includes inlets, bays, harbours, estuaries and lagoons. (DCCEEW, 2023).                                                                                                                                           |
| <i>Calidris ferruginea</i>              | Curlew sandpiper                    | Critically Endangered Migratory | Critically Endangered             | Species or species habitat known to occur within area                                                                                  | In Western Australia, the curlew sandpiper is widespread around coastal and subcoastal plains from Cape Arid to south-west Kimberley Division. They mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons.                                                                                                                                                                                                                                                        |
| <i>Numenius madagascariensis</i>        | Eastern curlew                      | Critically Endangered Migratory | Critically Endangered             | Species or species habitat likely to occur within area                                                                                 | The eastern curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass (Cornel University 2023).                                                                                                                                                                                                                                                                              |
| <i>Charadrius mongolus</i>              | Lesser sand plover                  | Endangered Migratory            | Endangered                        | Roosting known to occur within area                                                                                                    | The lesser plover mainly occurs in northern and eastern Australia, rare in south-western Australia. The species is almost strictly coastal, preferring sandy beaches, mudflats of coastal bays and estuaries, sand flats and dunes near the coast (Cornell University, 2023).                                                                                                                                                                                                                                           |
| <i>Calidris canutus</i>                 | Red knot                            | Endangered Migratory            | Endangered                        | Species or species habitat known to occur within area                                                                                  | The red knot mainly inhabits intertidal mudflats, sandflats and sandy beaches of sheltered coasts and sometimes on sandy ocean beaches or shallow pools on exposed rock platforms (Higgins, 1996)                                                                                                                                                                                                                                                                                                                       |
| <i>Charadrius leschenaultii</i>         | Greater sand plover                 | Vulnerable Migratory            | Vulnerable                        | Species or species habitat known to occur within area                                                                                  | Mainly occurs on sheltered sandy, shelly or muddy beaches, large intertidal mudflats, sandbanks, salt marshes, estuaries, coral reefs, rocky islands rock platforms, tidal lagoons and dunes near the coast (Cornel University 2023).                                                                                                                                                                                                                                                                                   |
| <i>Sternula nereis nereis</i>           | Australian fairy tern               | Vulnerable Migratory            | Vulnerable                        | Foraging, feeding or related behaviour known to occur within area. Migrant breeding, breeding habitat present within the area.         | In south-western Australia, the fairy tern breeds between October and March with peak breeding between December and January. The Natural Jetty at the end of Philip Point is an important roost site for fairy terns.                                                                                                                                                                                                                                                                                                   |
| <i>Ardenna pacifica</i>                 | Wedge-tailed shearwater             | Marine Migratory                |                                   | Breeding known to occur within area.                                                                                                   | The wedge tailed shearwater is known to breed in burrows on Wadjemup/Rottnest Island between August to May (DCCEEW, 2023). Significant breeding habitat for this species is located on the west end of the island, such as on Cape Vlamingh, and impacts to this species or its habitat are unlikely as a result of the proposal.                                                                                                                                                                                       |
| <i>Onychoprion anaethetus</i>           | Bridled tern                        | Marine Migratory                |                                   | Breeding known to occur within area.                                                                                                   | The bridled tern is a common visitor to Rottnest to breed (Rottnest Island Authority, 2019). It forms small colonies and nests on the ground usually in areas sheltered by plants, ledges or caves. There are no known breeding colonies within the vicinity of the proposal and due to the high level of disturbances from recreational users at Thomson Bay, there are unlikely to be any significant roosting sites within vicinity of the proposal. Consequently, impacts as a result of the proposal are unlikely. |
| <i>Hydroprogne caspia</i>               | Caspian tern                        | Marine Migratory                |                                   | Breeding known to occur within area.                                                                                                   | The proposal is located within the foraging BIA for the Caspian tern and a small number of Caspian terns roost at Natural Jetty. As there are no known breeding colonies or roosting habitat for this species within the development envelope, significant direct impacts are unlikely.                                                                                                                                                                                                                                 |
| <i>Thalasseus bergii</i>                | Crested tern                        | Marine Migratory                |                                   | Breeding known to occur within area.                                                                                                   | The crested tern is the most common tern on the island, with the main nesting colonies located on Lake Baghdad and Herschel Lake (Rottnest Island Authority, 2019b). The crested tern may roost at the Natural Jetty. As there are no known breeding colonies or roosting habitat for this species within the development envelope, significant direct impacts are unlikely.                                                                                                                                            |



| Name                    |              | Conservation status |        | Distribution at Wadjemup / Rottnest Island and surrounding waters* | Habitat and seasonal preferences                                                                                                                                                                                                                                                                                                                |
|-------------------------|--------------|---------------------|--------|--------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Species                 | Common       | EPBC Act            | BC Act |                                                                    |                                                                                                                                                                                                                                                                                                                                                 |
| <i>Sterna dougallii</i> | Roseate tern | Marine Migratory    |        | Breeding known to occur within area.                               | The proposal is located within the foraging BIA for the roseate tern. As there are no known breeding colonies or roosting habitat for this species within the development envelope, significant direct impacts are unlikely. However, as roseate terns roost at Natural Jetty, potential indirect impacts to this species have been considered. |

\*As listed in the PMST search results and/or Atlas of Living Australia (ala.org.au)

<sup>†</sup> Although the PMST search indicates that breeding by *E. australis* may occur within the PMST search area, a review of the online National Conservation Values Atlas indicates that this is not the case and only the migration BIA for the species overlaps Thomson Bay

Definitions: BC Act = *Biodiversity Conservation Act 2016* (WA), BIA = Biologically Important Area, DBCA = Department of Biodiversity, Conservation and Attractions (WA), EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)

Priority 4 = Rare, Near Threatened and other species in need of monitoring (BC Act)

Other Specially Protected = Species otherwise in need of special protection (BC Act)

14.2.2.1 Significant impact assessment

Assessment of the proposal against the significant impact criteria for listed migratory species is provided in Table 81.

Table 81: Significant impact criteria - Migratory species

| Significant impact guidelines                                                                                                                                                                              | Summary of impacts on MNES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Variance to guidelines                                                                                                                                    |
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| Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species. | <p><b>Migratory bird species</b></p> <p>The development envelope is within the foraging BIA of a number of migratory bird species. Of these, the wedgetail shearwater, roseate tern, crested tern, Caspian tern, Australian fairy tern and bridled tern are considered likely to forage within the development envelope. Other migratory bird species may occasionally occur within vicinity of the development envelope, however, are unlikely to be impacted by the proposal.</p> <p>As the proposal will only result in the removal of 3.32 ha of benthic communities and habitats, including 2.06 ha of seagrass (0.52% of the LAU). Direct impacts to the foraging potential within the development envelope is unlikely to be significant. Potential habitat for these species is unlikely to result in a long-term decrease in the size of a population.</p> <p>A number of the tern species are known to roost at the Natural Jetty at the end of Philip Point, approximately 900 m east of the proposal and may forage within the development envelope.</p> <p>A coastal processes assessment has been undertaken to identify potential impacts of the proposal on coastal processes. This assessment identified that the proposal is unlikely to result in significant erosion of the roosting habitat present at Philip Point. Therefore, the proposal will not result in a significant modification of this roosting habitat.</p> <p><b>Shark species</b></p> <p>Three threatened shark species may occur within vicinity of the proposal. Scalloped hammerheads (EPBC Act listed conservation dependent) and white sharks (vulnerable) are typically seasonal and use the area for foraging and/or migration; however, may be present year-round. Scalloped hammerheads aggregate in the Shoalwater Islands Marine Park (approximately 30 km from the proposal), peaking during January and February. White sharks are more likely to be present in the Perth region during spring and early summer, and least likely to be present during late summer and autumn. The grey nurse shark (vulnerable) is known to congregate or aggregate in the area year-round.</p> <p>These shark species are known to utilise the following habitat types:</p> <ul style="list-style-type: none"><li>• Grey nurse sharks (western population) are found in inshore waters, particularly sub-tropical to temperate waters. Grey nurse sharks are often observed aggregating around inshore rocky reefs or islands (Department of the Environment, 2014). There is likely to be habitat suitable for this species around the island, however the development envelope is unlikely to provide significant habitat for this species.</li><li>• The scalloped hammerhead is predominately found along coastal shelves, though will occasionally travel into intertidal zones and inshore habitats may be important for immature hammerheads (DCCEEW, 2024).</li><li>• Great white sharks are frequently recorded in waters around fur seal and sea lion colonies such as those to the west end of the island. There is likely to be habitat suitable for this species around the island, however the development envelope is unlikely to provide significant habitat for this species.</li></ul> <p>The benthic communities and habitats within the development envelope is unlikely to provide critical habitat for these shark species. However, the benthic communities and habitats is likely to provide habitat for prey species for the shark species. An assessment of the shark species pressure analysis for the South-west Marine Region indicates that most of the shark species addressed in the species report group card for sharks are not susceptible to the pressure of habitat modification (DSEWPC, 2012). As such the proposed dredging and removal of benthic communities and habitats is unlikely to have a significant impact on the shark species present in South Thomson Bay.</p> <p>As the proposal will only result in the removal of 3.32 ha of benthic communities and habitats, including 2.06 ha of seagrass (0.52% of the LAU), direct impacts to potential habitat for these species are unlikely to result in a long-term decrease in the size of a population.</p> <p>Indirect impacts to marine habitats and environmental quality will be managed and mitigated through implementation of the CEMP, DEMP and OEMP. Implementation of these plans will ensure that indirect impacts are limited to 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI. It is predicted that benthic communities and habitats that are impacted within the ZoMI will recover within five years.</p> <p>As such, indirect impacts to potential habitat for these species is unlikely to result in a long-term decrease in the size of a population of the above shark species.</p> <p><b>Marine mammals</b></p> <p>Seasonal migration whale species along the WA coast includes the southern right whale, pygmy blue whale, humpback whale and orca.</p> <p>Construction and implementation of the proposal will not result in the significant modification, destruction or isolation of important habitat for these species.</p> <p>Underwater noise from piling activities has the potential to result in avoidance behaviours, thereby reducing the area of occupancy of marine fauna species. Implementation of the CEMP (Emerge, 2024) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to address potential impacts to marine fauna during construction. Implementation of the measures outlined in these management plans will ensure there are no significant residual impacts to marine fauna from underwater noise (see Section 10.6 for further details).</p> <p><b>Turtles</b></p> <p>Turtle species that may forage in the area include the loggerhead turtle, leatherback turtle and green turtle. The development envelope is not within a BIA for these turtle species and their common distribution is north of the development envelope. Therefore, the proposal is unlikely to reduce the area of occupancy of these species.</p> <p>Underwater noise from piling activities has the potential to result in avoidance behaviours, thereby reducing the area of occupancy of marine fauna species. Implementation of the CEMP (Emerge, 2024) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to address potential impacts to marine fauna during construction. Implementation of the measures outlined in these management plans will ensure there are no significant residual impacts to marine fauna from underwater noise (see Section 10.6 for further details).</p> | <p><b>Not at variance</b></p> <p>The proposal will not substantially modify, destroy or isolate an area of important habitat for a migratory species.</p> |

| Significant impact guidelines                                                                                                                                            | Summary of impacts on MNES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Variance to guidelines                                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.                   | <p>The proposal will result in the relocation of existing barge movements from the Main Jetty to the development envelope. As no new activities are proposed during operation of the proposal, the introduction of IMS is unlikely.</p> <p>There is potential for the introduction of IMS during construction of the proposal. Measures outlined in the CEMP will ensure that the risk for the introduction of IMS is low.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <p><b>Not at variance</b></p> <p>Implementation of the CEMP and OEMP will ensure that the proposal will not result in invasive species that are harmful to a migratory species becoming established in an area of important habitat for the migratory species.</p> |
| Seriously disrupt the life cycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species. | <p><b>Migratory bird species</b></p> <p>The development envelope is within the foraging BIA of a number of migratory bird species. Of these, the wedgetail shearwater, roseate tern, crested tern, Caspian tern, Australian fairy tern and bridled tern are considered likely to forage within the development envelope. These tern species are also known to roost at the Natural Jetty at the end of Philip Point, approximately 900 m east of the proposal.</p> <p>There is no important breeding habitat for these species within the development envelope.</p> <p>As the proposal will only result in the removal of 3.32 ha of benthic communities and habitats, including 2.06 ha of seagrass (0.52% of the LAU). Direct impacts to the foraging potential within the development envelope is unlikely to be significant and will therefore not seriously disrupt the life cycle of an ecologically significant proportion of these populations.</p> <p>A coastal processes assessment has been undertaken to identify potential impacts of the proposal on coastal processes. This assessment identified that the proposal is unlikely to result in significant erosion of the roosting habitat present at Philip Point. Therefore, the proposal will not result in a significant modification of this roosting habitat.</p> <p><b>Shark species</b></p> <p>There is no habitat important to the breeding, feeding, migration or resting behaviours of the white shark within the development envelope and the proposal is considered unlikely to seriously disrupt the life cycle of this species.</p> <p><b>Marine mammals</b></p> <p>The proposed development envelope is located within the shallower waters of the coastal area of South Thomson Bay and the proposed infrastructure is unlikely to extend into the migratory pathways of the whale species. As such, the proposed infrastructure will not disrupt any existing migratory pathways.</p> <p>Barge movements may traverse the migration route, however as these barge movements are existing, no additional impacts from operation of the proposal are anticipated. Therefore, construction and implementation of the proposal will not significantly impact the migratory pathways of these species.</p> <p>Underwater noise from piling activities has the potential to result in injury or changes in behaviour of marine fauna. Implementation of the CEMP (Emerge, 2024) (Appendix P) and DEMMP (02 Environment, 2024) (Appendix O) provides the monitoring and management framework to address potential impacts to marine fauna during construction. Implementation of the measures outlined in these management plans will ensure there are no significant residual impacts to marine fauna from underwater noise (see Section 10.6 for further details).</p> <p><b>Turtles</b></p> <p>Turtle species that may forage in the area include the loggerhead turtle, leatherback turtle and green turtle. The development envelope is not within a BIA for these turtle species and their common distribution is north of the development envelope. Therefore, the proposal is unlikely to seriously disrupt the life cycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of a marine turtle population.</p> | <p><b>Not at variance</b></p> <p>The proposal will not seriously disrupt the life cycle of an ecologically significant proportion of the population of a migratory species.</p>                                                                                    |

## 14.3 Other Commonwealth obligations under the EPBC Act

### 14.3.1 Critical habitat

There is no critical habitat to the survival of a species within the range of predicted impacts from the proposal.

### 14.3.2 Recovery and threat abatement plans

The applicable Recovery and Threat Abatement Plans and their objectives relevant to the proposal are provided in Table 82.

**Table 82: Compliance with recovery and threat abatement plans**

| Plan                                                                                                                            | Objectives relevant to proposal                                                                                                                                                                                                                                                    | Compliance                                                                                                                                                                                                     |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Conservation Management Plan for the Southern Right Whale (DSEWPC, 2012)                                                        | <ul style="list-style-type: none"> <li>Assessing and addressing the threat of anthropogenic noise on southern right whale.</li> <li>Addressing infrastructure and coastal development impacts.</li> </ul>                                                                          | Implementation of the CEMP and OEMP ensures that the proposal is not inconsistent with the Conservation Management Plan for the Southern Right Whale.                                                          |
| Conservation Management Plan for the Blue Whale (DoE, 2015)                                                                     | Anthropogenic noise in biologically important areas will be managed such that any blue whale continues to utilise the area without injury and is not displaced from the foraging area.                                                                                             | Implementation of the CEMP and OEMP ensures that the proposal is not inconsistent with the Conservation Management Plan for the Blue Whale.                                                                    |
| Recovery Plan for the Australian Sea Lion ( <i>Neophoca cinerea</i> ) (DSEWPC, 2013)                                            | <ul style="list-style-type: none"> <li>Mitigate the impacts of marine debris on Australian sea lion populations.</li> <li>Investigate and mitigate other potential threats to Australian sea lion populations, including disease, vessel strike, pollution and tourism.</li> </ul> | Implementation of the CEMP and OEMP ensures that the proposal is not inconsistent with the Recovery Plan for the Australian Sea Lion.                                                                          |
| National Recovery Plan for the Australian Fairy Tern ( <i>Sternula nereis nereis</i> ) (DAWE, 2022)                             | <ul style="list-style-type: none"> <li>Manage and protect known Australian fairy tern breeding populations at the landscape scale</li> <li>Reduce, or eliminate threats at breeding, non-breeding and foraging sites</li> </ul>                                                    | Implementation of the CEMP and OEMP ensures that the proposal is not inconsistent with the Recovery Plan for the Australian Fairy Tern.                                                                        |
| Threat abatement plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018) | Mitigate the impacts of harmful marine debris on marine species                                                                                                                                                                                                                    | Implementation of the CEMP and OEMP ensures that the proposal is not inconsistent with the Threat abatement plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans. |
| Quokka ( <i>Setonix brachyurus</i> ) Recovery Plan (DEC, 2013)                                                                  | The overall long-term objective of the recovery program is to at least maintain their current distribution and abundance.                                                                                                                                                          | Implementation of the CEMP and OEMP ensures that the proposal is not inconsistent with the Recovery Plan for the Quokka.                                                                                       |

### 14.3.3 Wildlife Conservation Plans

The applicable Wildlife Conservation Plans and their objectives relevant to the proposal are discussed in Table 83.



**Table 83: Wildlife Conservation Plans**

| <b>Wildlife Conservation Plan</b>                                | <b>Objectives relevant to this report</b>                                                                                                                                                                                                                                                                                                                                                                                   | <b>Compliance</b>                                                                                                                               |
|------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| Wildlife Conservation Plan for Migratory Shorebirds (2015, 2015) | <ul style="list-style-type: none"> <li>Protection of important habitats for migratory shorebirds has occurred throughout the East Asian-Australasian Flyway.</li> <li>Anthropogenic threats to migratory shorebirds in Australia are minimised or, where possible, eliminated.</li> </ul>                                                                                                                                   | Implementation of the CEMP and OEMP ensures that the proposal is not inconsistent with the Wildlife Conservation Plan for Migratory Shorebirds. |
| Wildlife Conservation Plan for Seabirds (DAWE, 2022)             | <ul style="list-style-type: none"> <li>Seabirds and their habitats are identified, protected and managed in Australia.</li> <li>The long-term survival of seabirds and their habitats is achieved through supporting priority research programs, coordinated monitoring, on-ground management and conservation.</li> <li>Manage the effects of anthropogenic disturbance to seabird breeding and roosting areas.</li> </ul> | Implementation of the CEMP and OEMP ensures that the proposal is not inconsistent with the Wildlife Conservation Plan for Seabirds.             |

#### 14.3.4 Offshore dredge disposal

No offshore dredge disposal will be undertaken as part of the proposal, with all dredged material used for reclamation purposes within state waters. Activities that include the placement of matter for a purpose other than the disposal of material are not regulated under the *Environment Protection (Sea Dumping) Act 1981*.

Liaison with the Wildlife, Waste and Environmental Permits Branch of DCCEEW confirms that the utilisation of dredge material for land reclamation is considered placement for a purpose and therefore, does not require a sea dumping permit.

## 15 OFFSETS

The following policy and guidance have been reviewed as part of this assessment:

- WA Environmental Offsets Policy (Government of Western Australia, 2011)
- WA Environmental Offsets Guidelines (Government of Western Australia , 2014)
- EPBC Act environmental offsets policy (DSEWPC, 2012)
- Environmental Impact Assessment (Part IV Divisions 1 and 2) Procedures Manual (EPA, 2020b).

Consistent with Principle 1 of the WA Environmental Offsets Policy (Government of Western Australia 2011) Rottnest Island Authority has applied the mitigation hierarchy by identifying measures to avoid and minimise environmental impacts, as outlined in Sections 7 to 13 this report.

As discussed in Section 16, the environmental impacts from the proposal as a whole includes:

- Impacts to benthic communities and habitats and marine fauna habitats:
  - Permanent loss of mixed seagrass of up to 2.06 ha (or 0.52% of mixed seagrass within the LAU)
  - Permanent loss of sand / sand with wrack of up to 1.26 ha
  - Temporary loss of 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI. Baird (2024b) predicts that impacts to these benthic communities and habitats will be recoverable within a period of five years following completion of the dredging activities
- Interruption to longshore currents may result in minor sediment accretion and seagrass accumulating on the eastern side of the wharf
- Temporary suspended sediments within the ZoMI (4.5 ha) and ZoI (13.44 ha)
- Temporary reduction in light due to suspended sediments in the water column within the ZoMI (4.5 ha). As impacts to benthic communities and habitats within the ZoMI will be recoverable within a period of five years following completion of the dredging activities, these residual impacts are not considered significant
- Underwater noise emissions from piling operations causing temporary disturbance to marine fauna species
- Removal of 0.46 ha of native vegetation and potential fauna habitat. Of the native vegetation being cleared, 0.23 ha comprises the TEC, *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands of the Swan Coastal Plain.

As the assessment of these residual impacts concluded that they are not significant, no environmental offsets are proposed as part of this proposal.

## 16 HOLISTIC IMPACT ASSESSMENT

This report provides an assessment of the potential environmental impacts associated with the proposal and the proposed mitigation measures and management strategies for each key environmental factor. This section provides an assessment of the connections and interactions between impacts, and the overall impact of the proposal on the environment as a whole.

RPS acknowledges the relationships between the key environmental factors addressed in this report and that those interrelationships may require synergistic consideration and management to achieve the proposed environmental outcomes. The key environmental factors that relate, to varying degrees, are demonstrated in Figure 52 and the combined impacts are summarised in Table 84.

Although social surroundings are only linked with coastal processes in this assessment, due to the community perception and social values of Wadjemup / Rottnest Island, it is recognised that all key environmental factors are linked to social surroundings to a lesser degree.

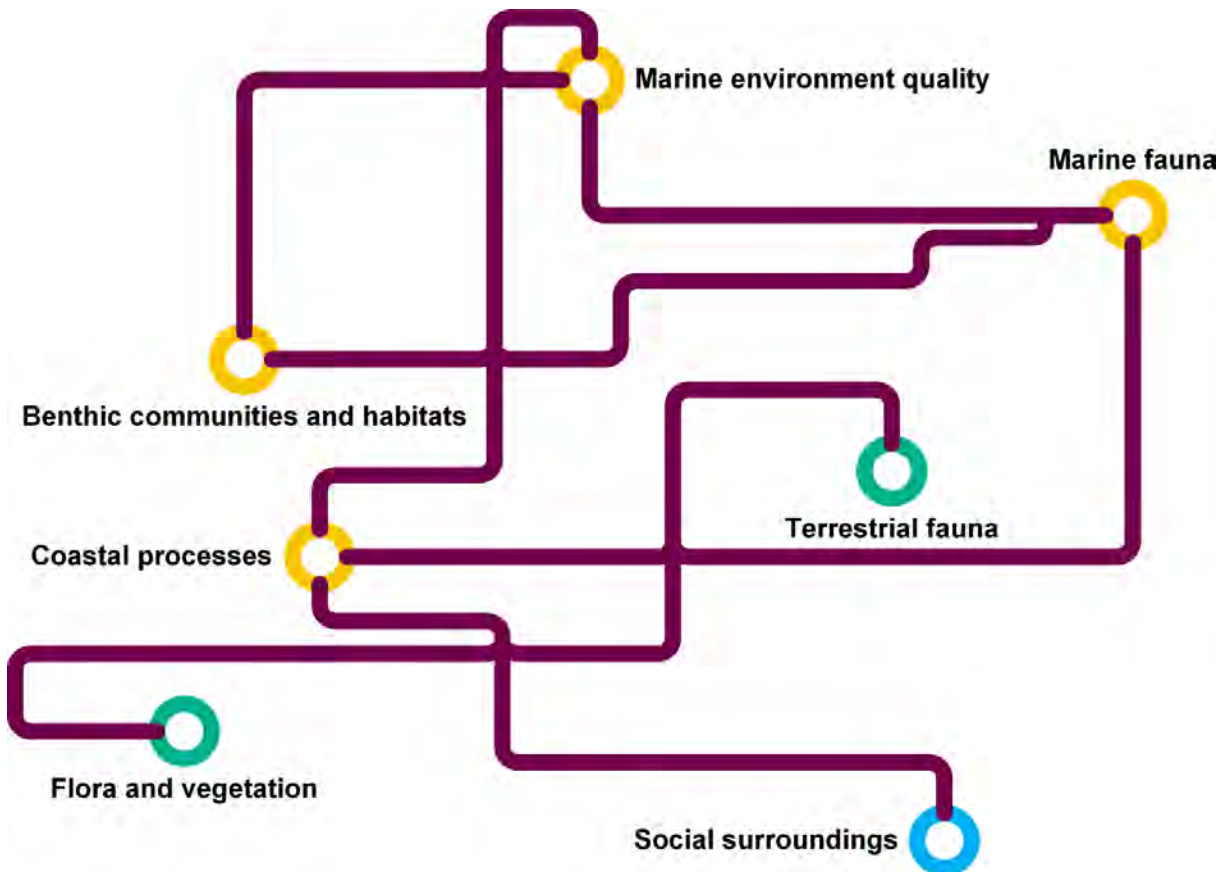


Figure 52: Relationship between key environmental factors



**Table 84: Connections and interactions between key environmental factors relevant to the proposal**

| <b>Environmental factor</b>                                                                                                                                                                            | <b>Connection / interaction pathway</b>                                                                          | <b>Combined impact</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"> <li>Benthic communities and habitats</li> <li>Marine environmental quality</li> <li>Marine fauna</li> <li>Coastal processes</li> <li>Social surroundings</li> </ul> | Construction of the proposal will result in a temporary increase in total suspended sediments.                   | <ul style="list-style-type: none"> <li>Reduced marine environmental quality</li> <li>Decrease in light availability resulting from increased turbidity leading to reduced primary productivity.</li> <li>Permanent and temporary (recoverable) loss benthic communities and habitat and marine fauna habitat.</li> <li>Increased sedimentation rates, or burial, resulting in stress or increased mortality rates (under extreme conditions).</li> </ul>                                                                                                                                                                                            |
|                                                                                                                                                                                                        | Construction and operation of the proposal may result in the introduction of IMS                                 | <ul style="list-style-type: none"> <li>Alteration of the natural benthic communities</li> <li>Marine pests may threaten biodiversity through a number of mechanisms such as predation, competition for habitat and altering ecosystems.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                  |
|                                                                                                                                                                                                        | Impacts from marine infrastructure                                                                               | <ul style="list-style-type: none"> <li>Altered water flows and sediment transport caused by the presence of new marine infrastructure potentially impacting marine bird roosting habitat.</li> <li>Interruptions of longshore currents</li> <li>Reduction of wave energy.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                |
|                                                                                                                                                                                                        | Construction of the proposal may result in pollution incidents.                                                  | <ul style="list-style-type: none"> <li>Increased boat numbers during operation, and to lesser degree construction, of the proposal has the potential to increase the risk of pollution, including from antifouling paints, anti-corrosion anodes, increased risk of accidental discharges (e.g. fuel spills, oils and greases) and sillage.</li> <li>A fuel facility, including underground storage tanks is proposed as part of the proposal. There is a risk for fuel spills to occur during refuelling or from fuel storage facilities. Fuel spills from the fuel facility have the potential to impact marine environmental quality.</li> </ul> |
|                                                                                                                                                                                                        | Construction and operation of the proposal.                                                                      | <ul style="list-style-type: none"> <li>Impacts to amenity from noise, artificial lighting and odour.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <ul style="list-style-type: none"> <li>Flora and vegetation</li> <li>Terrestrial fauna</li> </ul>                                                                                                      | Implementation of the proposal will result in clearing of native vegetation.                                     | <ul style="list-style-type: none"> <li>Removal of native vegetation.</li> <li>Loss of terrestrial fauna habitat.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                                                                                                                                                                        | Implementation of the proposal will result in an increased risk of the spread or introduction of weeds and pests | <ul style="list-style-type: none"> <li>Degradation of native vegetation</li> <li>Degradation of fauna habitat</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                                                                                                                                                        | Implementation of the proposal will result in an increased risk of the spread or introduction of disease.        | <ul style="list-style-type: none"> <li>Degradation of native vegetation</li> <li>Degradation of fauna habitat</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

## 16.1 Residual impacts from the proposal as a whole

Overall, the residual impacts on these environmental factors are low due to the implementation of avoidance and mitigation measures.

The residual environmental impacts from the proposal as a whole include:

- Impacts to benthic communities and habitats and marine fauna habitats:
  - Permanent loss of mixed seagrass of up to 2.06 ha (or 0.52% of mixed seagrass within the LAU)
  - Permanent loss of sand / sand with wrack of up to 1.26 ha (including this as a residual impact is a conservative approach, as sand with wrack is likely to be present post dredging, resulting in only temporary unavailability of sand with wrack)
  - Temporary loss of 2.62 ha of mixed seagrass and 1.09 ha of sand / sand with wrack within the ZoMI. Baird (2024b) predicts that impacts to these benthic communities and habitats will be recoverable within a period of five years following completion of the dredging activities

- 
- Interruption to longshore currents may result in minor sediment accretion and seagrass accumulating on the eastern side of the wharf
  - A reduction of wave energy in lee of the wharf
  - Temporary suspended sediments within the ZoHI (1.37 ha), ZoMI (4.5 ha) and ZoI (13.44 ha)
  - Temporary reduction in light due to suspended sediments in the water column within the ZoMI (4.5 ha). As impacts to benthic communities and habitats within the ZoMI will be recoverable within a period of five years following completion of the dredging activities, these residual impacts are not considered significant
  - Underwater noise emissions from construction activities such as piling operations and dredging causing temporary disturbance to marine fauna species
  - Removal of 0.46 ha of native vegetation and potential fauna habitat. Of the native vegetation being cleared, 0.23 ha of vegetation that is analogous with the TEC, *Callitris preissii* (or *Melaleuca lanceolata*) forests and woodlands of the Swan Coastal Plain.
  - The permanent relocation of four moorings.

## 17 CUMULATIVE ENVIRONMENTAL IMPACT ASSESSMENT

Cumulative environmental impacts are the successive, incremental and interactive impacts on the environment of a proposal with one or more past, present and reasonably foreseeable future activities. RPS has undertaken a cumulative impact assessment that considers impacts to environmental factors relevant to the proposal from previous, current, and potential future projects that have been approved within 5 km of the proposal.

Cumulative impacts to benthic communities and habitats are discussed in Section 7.5.1.1.3 of this report. A summary of the predicted cumulative impacts to benthic communities and habitats is summarised below:

- Conservative estimates of seagrass loss undertaken by Oceanica (2013) estimated a human-induced disturbance of 7.95 hectares of seagrass.
- The 'current' extent of seagrass habitat is estimated as 398.70 hectare.
- Based on the above estimates, the permanent loss of seagrass habitat as a consequence of the proposal (2.06 ha, 0.52% of the LAU) results in a cumulative (historical (1.95% of the LAU) and projected (0.52% of the LAU)) loss of seagrass within the LAU of 2.47%.

Previously approved projects within 5 km of the proposal are shown in Figure 53. Those projects that impact environmental factors relevant to this proposal are discussed further in Table 85 and a summary of the cumulative impacts within 5 km of the proposal is provided below:

- **Marine fauna**
  - The underwater noise impacts from the Seismic Survey, Bremer Basin, Mentelle Basin and Zeewyck Sub-basin project has been completed. As the construction of the proposal and seismic survey will not be undertaken consecutively, cumulative impacts on marine fauna from underwater noise from these two projects will be limited to the individual proposal and not be significant.
- **Flora and vegetation**
  - Approximately 49.96 ha of native vegetation has been approved to be cleared within 5 km of the development envelope. The proposal, combined with this area comprises 50.42 ha of vegetation.
  - Wadjemup / Rottnest Island encompasses approximately 1,800 ha, most of which is vegetated. If a conservative estimate is adopted, with an assumption that half of the island remains vegetated, cumulative impacts from clearing 50.42 ha of vegetation would comprise 5.6% of the vegetation present on the island.
- **Terrestrial fauna**
  - Approximately 49.96 ha of native vegetation, providing potential terrestrial fauna habitat, has been approved to be cleared within 5 km of the development envelope. The proposal, combined with this area comprises 50.42 ha of potential terrestrial fauna habitat. Based on the above conservative estimate, this would comprise a cumulative impact of 5.6% of the potential terrestrial fauna habitat present on the island.

Overall, the proposal is unlikely to contribute to significant cumulative impacts combined with existing and reasonably foreseeable future activities.

**Table 85: Assessment of cumulative impacts**

| Projects within 5 km of the proposal      | Relevant environmental factor | Details and impact summary             | Status         |
|-------------------------------------------|-------------------------------|----------------------------------------|----------------|
| <b>Native vegetation clearing permits</b> |                               |                                        |                |
| 7759/1                                    | Flora and vegetation          | Vegetation clearing of up to 1.99 ha.  | Complete       |
| 9883/1                                    | Flora and vegetation          | Vegetation clearing of up to 2.78 ha.  | Pending        |
| 7981/1                                    | Flora and vegetation          | Vegetation clearing of up to 3.35 ha.  | Complete       |
| 8135/1                                    | Flora and vegetation          | Vegetation clearing of up to 1.27 ha.  | Complete       |
| 5568/1                                    | Flora and vegetation          | Vegetation clearing of up to 0.002 ha. | Not progressed |
| 5456/1                                    | Flora and vegetation          | Vegetation clearing of up to 0.23 ha.  | Not progressed |
| 5448/1                                    | Flora and vegetation          | Vegetation clearing of up to 0.90 ha.  | Not progressed |

| Projects within 5 km of the proposal                                           | Relevant environmental factor                                                                     | Details and impact summary                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Status                                |
|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| 5641/4                                                                         | Flora and vegetation                                                                              | Vegetation clearing of up to 34.44 ha.                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Completed as multiple walking trails. |
| 6775/1                                                                         | Flora and vegetation                                                                              | Vegetation clearing of up to 2.59 ha.                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Complete                              |
| 8778/1                                                                         | Flora and vegetation                                                                              | Vegetation clearing of up to 0.40 ha.                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Complete                              |
| 7019/1                                                                         | Flora and vegetation                                                                              | Vegetation clearing of up to 0.46 ha.                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Complete                              |
| <b>Referral to the EPA and EPBC referrals</b>                                  |                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                       |
| Rottneest Island Golf Course Upgrade                                           | <ul style="list-style-type: none"> <li>Flora and vegetation</li> <li>Terrestrial fauna</li> </ul> | <p>Upgrade of golf course involving treatment of wastewater for irrigation of fairways and the construction and irrigation of greens (previously sand only). Residual impacts include:</p> <ul style="list-style-type: none"> <li>Clearing up to 0.38 ha of vegetation</li> <li>Clearing up to 0.38 ha of potential habitat for terrestrial fauna.</li> </ul> <p>The EPA assessed the proposal as 'Scheme Not Assessed – Public Advice Given'.</p>                                            | Complete                              |
| Pinky's Beach Eco Retreat                                                      | <ul style="list-style-type: none"> <li>Flora and vegetation</li> <li>Terrestrial fauna</li> </ul> | <p>The Eco-Retreat is located west of the existing campground and directly adjacent to an existing Wastewater Treatment Plant (WWTP) to the east. Residual impacts include:</p> <ul style="list-style-type: none"> <li>Clearing of 1.8 ha native coastal vegetation</li> <li>Clearing up to 1.8 ha of potential habitat for terrestrial fauna</li> <li>Increased human activity on the coastal area.</li> </ul> <p>The EPA assessed the proposal as 'Not Assessed - Public Advice Given'.</p> | Complete                              |
| Rottneest Lodge Development                                                    | <ul style="list-style-type: none"> <li>Flora and vegetation</li> <li>Terrestrial fauna</li> </ul> | <p>The proposal involves the demolition and/or refurbishment of existing accommodation, the construction of new accommodation and associated infrastructure.</p> <p>Residual impacts include:</p> <ul style="list-style-type: none"> <li>Clearing of up to 0.5 ha of native vegetation</li> <li>Clearing up to 0.5 ha of potential habitat for terrestrial fauna.</li> </ul>                                                                                                                  | Complete                              |
| INDIGO Marine Cable Route Survey (2017/7996)                                   | <ul style="list-style-type: none"> <li>NA</li> </ul>                                              | <p>A cable route survey from the beach utility hole in the Dunningham Reserve north Coogee to the beach utility hole at Floreat Beach in Perth.</p> <p>No significant impacts were identified as part of the impact assessment.</p>                                                                                                                                                                                                                                                           | Complete                              |
| Seismic Survey, Bremer Basin, Mentelle Basin and Zeewyck Sub-basin (2004/1700) | <ul style="list-style-type: none"> <li>Marine fauna</li> </ul>                                    | <p>The proposed action was to conduct a marine acoustic survey from Coogee Beach, NSW, to Floreat Beach, WA, to the seaward boundary of the Australian Exclusive Economic Zone north of Christmas Island. Potential impacts include underwater noise impacts to marine fauna.</p>                                                                                                                                                                                                             | Complete                              |
| INDIGO Central Submarine Telecommunications Cable (2017/8127)                  | <ul style="list-style-type: none"> <li>NA</li> </ul>                                              | <p>Installation of a submarine fibre optic cable from Perth to Sydney.</p> <p>No significant impacts were identified as part of the impact assessment.</p>                                                                                                                                                                                                                                                                                                                                    | Complete                              |





Figure 53: Projects and approvals within 5 km of the proposal

## 18 CONCLUSION

This Environmental Supporting Document provides an environmental impact assessment of the proposal in accordance with relevant state and federal policies and guidance. Cumulative impacts have been considered and assessed.

Significant baseline monitoring and site-specific studies have been undertaken. The footprint of the project (development envelope) is relatively small and replaces and expands an existing maritime infrastructure facility (Army Groyne) that cannot be adequately repaired or maintained.

There is a clear current and escalating future demand for the South Thomson Barge Landing Development, which will have demonstrated benefits for the wider community.

There has been significant consultation with relevant stakeholders, including traditional owners, which commenced in 2019.

### 18.1 Section 38 referral

The assessment has concluded that the proposal is expected to be able to meet EPA's objectives for all environmental factors, subject to the implementation of the management and mitigations measures outlined in the following management plans:

- Dredging Environmental Monitoring and Management Plan (02 Environment, 2024) (Appendix O)
- Construction Environmental Management Plan (Emerge, 2024a) (Appendix P)
- Operational Environmental Management Plan (Emerge, 2024b) (Appendix Q).

### 18.2 EPBC referral

MNES with the potential to occur within or proximate to the development envelope includes the following listed threatened species and migratory species:

- Listed threatened species:
  - Terrestrial fauna (quokka)
  - Marine fauna (scalloped hammerheads, white sharks and grey nurse shark, southern right whale, pygmy blue whale minke whale, Australian sea lion, loggerhead turtle, leatherback turtle and green turtle and marine bird species (in particular the Australian fairy tern, Caspian tern and crested tern)).
- Migratory species:
  - Marine fauna (scalloped hammerheads, white sharks and grey nurse shark, southern right whale, pygmy blue whale minke whale, Australian sea lion, loggerhead turtle, leatherback turtle and green turtle and migratory bird species (wedgetail shearwater, roseate tern, crested tern, Caspian tern, Australian fairy tern and bridled tern)).

No other MNES are considered relevant to the proposal. The assessment of potential impacts to MNES from the proposal identified the following:

- An assessment of the proposal against the Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (Department of the Environment, 2013) for the Quokka identified that the proposal was not at variance to the guidelines.
- Assessment of the proposal against the Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (Department of the Environment, 2013) for listed migratory species (including migratory marine birds, marine turtles and whale species) identified that the proposal was not at variance to the guidelines.

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## Appendix A

### Construction methodology



# South Thomson Barge Development Landing

## Construction Method and Sequence

The following information is based on the following documents:

- PAEMAC (2024) *Rottneest Island Authority South Thomson Bay Barge Facility, Basis of Estimate*.
- In2Dredging (2023) *South Thomson Bay Development, Dredging Budget and Schedule Estimates*.
- PAEMAC (2020) *South Thomson Bay Development - Value Engineering Assessment*.
- AECOM (2020) *South Thomson Bay Barge Facility, Value Engineering of Concept Design*.

In addition, further detail on construction methods and sequencing was provided by the RIA Infrastructure team.

Figures and cross-sections have been included in this document for ease of understanding the construction methods and sequence. Please refer to the above-mentioned reports for more figures and cross-sections.

The construction method and sequencing will consist of:

### 1.0 Stage 1 – Maritime Infrastructure

#### 1.1 Preliminaries:

This includes all planning, design and preparation works including plant/ equipment and fabrication activities. This will also include verification of the site (seabed survey) as well as any underground service location.

#### 1.2 Mobilisation and site setup:

This includes installation of site sheds, preparation of laydown areas A and B (see **Figure 4**), erection of marine traffic management, site signage, public advertisements and mobilisation of equipment. The preparation of laydown area B will require mechanical clearing of vegetation and cut and fill of the adjacent dune to level this area. It is noted Laydown area B is located in the footprint of the onshore storage shed in Stage 2 of the project.

#### 1.3 Temporary Works Construction:

A temporary Roll On Roll Off (RORO) facility will be constructed to off load equipment and materials. The RORO:

- Will be constructed either through localised improvements to the Army Jetty groyne or a bespoke structure (see Figure 5 in PAEMAC (2024)).
- The RORO could be located on the western side of the Army Groyne, see **Figure 1** below.
- The RORO will be suitable for unloading of large equipment and/or materials such as precast concrete, piles, earthmoving equipment, temporary structures, and also dredge spoil for use in reclamation.
- The existing small boat landing may be utilised by the Contractor during construction for launching small craft.



#### 1.4 Dredging:

Advice regarding the dredging methodology and equipment has been provided by In2Dredging (2023), who propose using a Backhoe Dredge (BHD). The process is outlined below:

- As per In2Dredging (2023) advice, dredging must be undertaken across the dredge footprint prior to construction of the breakwater and new laydown area.
- The BHD is positioned with a support tug and then using its spud piles and excavator arm it manoeuvres into the required dredging location.
- The loosening or cutting process breaks the in-situ materials' cohesion, allowing these materials to be removed. The process will be carried out mechanically using the cutting edge of a bucket on a BHD. In2Dredging (2023) indicate that both sand and rock can be removed using a BHD.
- An estimated 14,000 m<sup>3</sup> of sand and 2,017 m<sup>3</sup> of rock will be dredged.
- Once loosened or dislodged, these materials will be raised to the water's surface, to be undertaken mechanically via raising the bucket or grab of a BHD.
- Excavated material is placed onto a flat-top barge moored alongside the BHD. When the barge is filled to its safe working capacity, it will drive to the RORO facility to be unloaded.
- A silt curtain placed around the BHD may be required (pending the preparation of Dredge Management Plan) to mitigate the potential environmental impact due to the dredge plume (due to the disturbance of fine sediment fractions).
- The dredged material will be reused as fill material in the laydown/hardstand area.
- The dredging and disposal process will be repeated until the areas have been dredged completely to the required design depths.
- A dual function Survey/Crew Transfer Vessel will form part of the BHD dredging spread. The survey vessel will provide regular survey update to the BHD dredging operator and will also be used as crew transfer vessel to transport personnel from shore to vessel and vice versa.
- The excavated material will be transferred to Army Groyne via the barge at the RORO. The barge will be unloaded using a long reach excavator and loaded into 45t Articulated Dump Trucks (ADT).
- The sequence of dredging beneath future infrastructure areas (i.e. beneath the breakwater and reclamation area) will be determined by the contractor, but it is likely that dredging will occur in these area prior to construction of the new breakwater and new laydown area.

**Figure 1** shows the indicative position of dredging equipment.



**Figure 1:** Indicative location of dredging equipment and barge for loading of dredge spoil (A), and location of barge and excavator on RORO facility for unloading dredge spoil into a ATD (B).

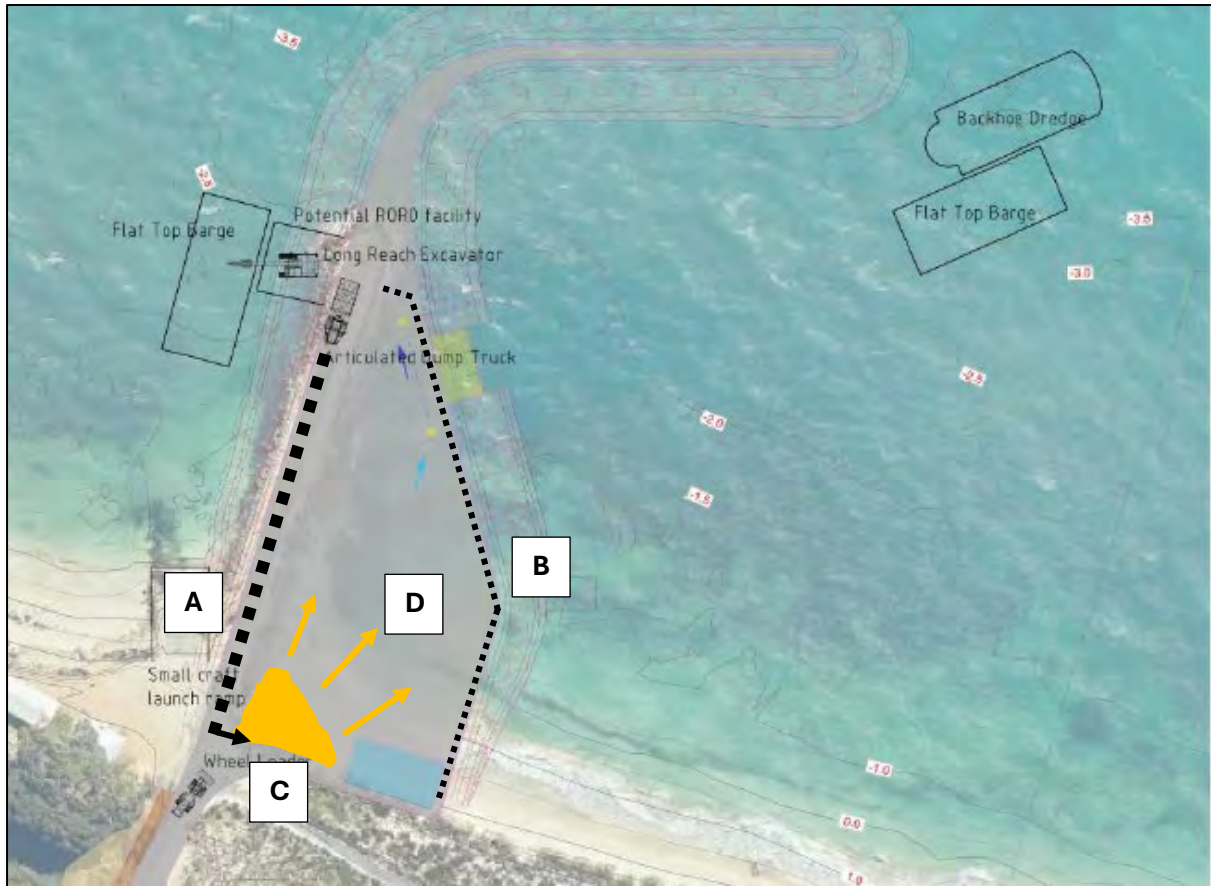
### 1.5 Reclamation:

The laydown area shall incorporate reclaimed dredged fill material and shall be constructed as per the process below:

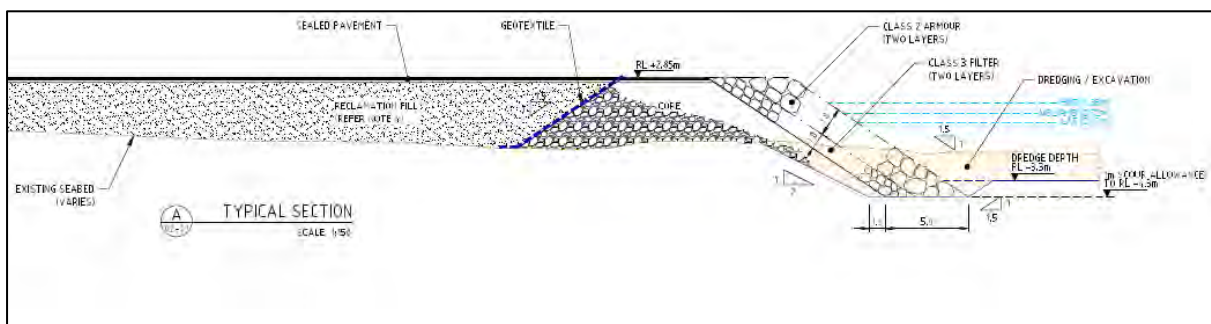
- Existing armour from the eastern side of the Army Groyne will be removed and used for construction of bunding (see next step).
- Bunding will be constructed along the eastern and northern sides of the reclamation zone to allow dredge spoil to settle and remain in place. The bunding is to prevent dredge spoil from being washed away into the marine environment by waves or during high tides. **Figure 2** shows the bunding extent.
- The bunding will be constructed using core materials, followed by a geotextile filter layer and an armour layer. **Figure 3** shows a conceptual cross-section of the bunding, reclamation fill and then adjacent dredge zone.
- Using the dredged spoil, the Contractor will establish a tip head to place the dredged fill material onto the beach/into the water in the southwest corner.
- Dredge spoil will be unloaded from the ADT and pushed out over the tip head using a wheel loader or similar.
- Dredge spoil will be placed and spread in a north and east direction.
- Consistent with the progression of reclamation, the bunding on the marine side of the reclamation zone will need to progressively moved to the north to ensure that each successive round of dredge spoil placed will remain in place.
- Reclamation will continue until all dredge spoil has been placed. AECOM (2020) and PAEMAC (2024) estimated that the dredge spoil will be sufficient to complete the laydown area. There is not expected to be a requirement to import fill to complete the laydown area.

- Material will be compacted using a static pad foot roller until a pavement level of +2.5m CD is achieved. If required, the wheel loader will assist with material placement and wheel rolling.
- Stormwater drainage will be installed followed by a layer of crushed rock basecourse and asphalt.

**Figure 2** shows the process of reclamation using the dredge spoil.



**Figure 2:** Indicative process for reclamation showing the Army Groyne (A), bund wall (B), placement of dredge spoil in the southwest corner of the area (C) and the direction that dredge spoil will be placed and spread (D).



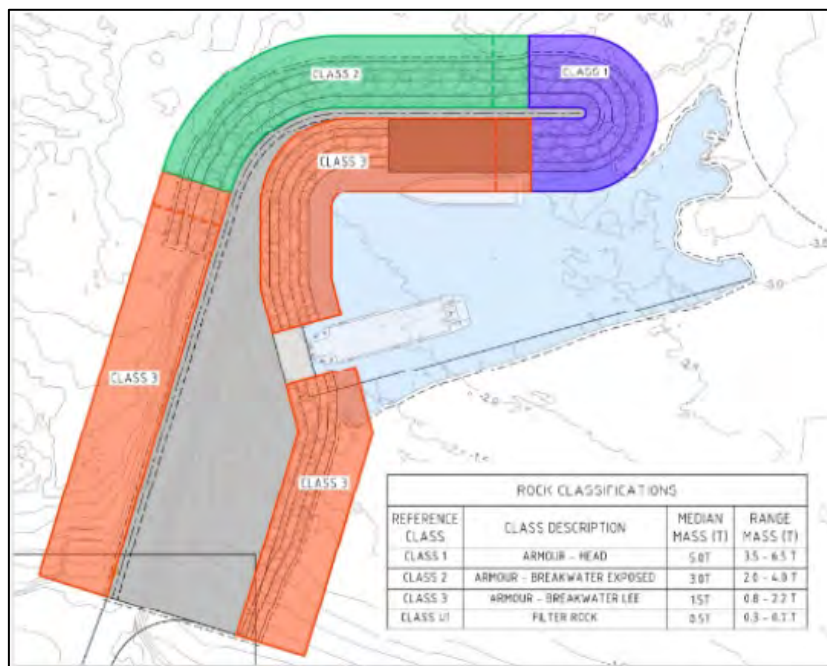
**Figure 3:** Conceptual cross-section of the reclamation fill, bunding and adjacent dredge zone.

### 1.6 Army Groyne Extension:

On completion of the reclamation works, the Army Groyne will be upgraded as per the following process:

- Remove excess rock/materials and reshape existing groyne.
- Import all rock and core materials from the mainland using a conventional barge converted for handling rock.
- Place core materials along exposed batter.
- Place filter layer (geotextile).
- Place rock armour (Class 2) along exposed batter.
- Place rock armour (Class 1) along northern breakwater.
- Place a layer of crushed rock basecourse and asphalt along the Army Groyne extension to match that placed in the reclamation area.
- The placement of rock will be largely undertaken from the marine side whereby rock is picked from an adjacent barge and put into place. Some rock may be placed from the land side (i.e. rock temporarily stored in the laydown area from the original Army Groyne wall). It is expected that other materials (crushed rock, bitumen) will also be loaded from the marine side onto the facility alleviating the need for use of the barge landing at the Main Jetty.

The various rock armour classes to be used in the structure are shown in **Figure 4**.



**Figure 4:** Conceptual cross-section of the reclamation fill, bunding and adjacent dredge zone.

### 1.7 Maritime Infrastructure:

Includes the Barge Landing Ramp. PAEMAC (2024) expected that these works would occur concurrently with construction of the rock armour revetments to allow piles to be installed prior to revetments being built. Should a staged approach be followed by the Contractor, 1200mm sleeves will need to be installed in the armour so the Stage 2 piles can be installed through the armour.



The Barge Landing Ramp works include:

- Installation of a precast concrete gravity retaining wall below the water level at the dredge level.
- Installation of the deck slab.
- Installation of No.4 (TBC) mooring piles to a maximum depth of 10 m (TBC) using a Vibro-Hammer.
- It is expected that the installation of the above-mentioned items will be undertaken either from the marine side or reclaimed area.

#### **1.8 Services:**

Underground services will be installed and connected to onshore underground services using small excavators/small plant via excavation of shallow trenches that will be backfilled. Services consist of:

- Water
- Firefighting services
- Electrical services
- Communications
- Fuel tank. The fuel tank will be installed in the south-east corner of the reclamation zone and will be installed within the compacted dredge spoil. Installation of the fuel tank will be in accordance with all Dangerous Goods regulations (i.e. double lined tank, leak detection systems, tank pit/groundwater monitoring wells).

#### **1.9 Storage shed:**

These works consist of construction of the shed structure and hardstand in the south-east corner of the reclamation zone. The extent of intrusive works for this scope of work is expected to be minimal.

#### **1.10 Road works:**

These works consist of road work construction including:

- Cut and fill of the Army Jetty Road using mechanical means
- Kerbing
- Signage
- Asphalt paving
- Line marking
- Drainage
- These works includes completing any sections of the new facility and the road section that links to the Army Jetty Road.

#### **1.11 Demobilisation:**

On completion of the works, a hydrographic survey of the site will be undertaken to ensure any debris on the seabed has been removed. Other activities include:

- Removal of site offices
- Dismantling RORO and equipment
- Removing all equipment from site.

## **2.0 Stage 2 – Onshore infrastructure and ferry berth**

### **2.1 Ferry berth:**

This structure is intended to be constructed during Stage 2 of the project and will comprise:

- Installation of piles using a Vibro-Hammer rig operated from a barge located adjacent. The dimensions and number of piles is estimated at 16 X 610mm (TBC) that will be installed to a depth of 15 m (TBC). As noted previously, if the Contractor does not install piles concurrently with construction of the breakwater, then 1200mm sleeves will need to be installed in the rock armour so piles can be driven through the sleeves.
- Installation of a precast concrete deck and surface.
- Fit out of the wharf with fenders, fender chains, mooring bollards, signage, lighting.
- It is expected that the installation of the above-mentioned items will be undertaken from the marine side.

### **2.2 Small Craft Landing:**

The Small Craft Landing works include:

- Installation of piles using a Vibro-Hammer rig operated from a barge located adjacent. The dimensions and number of piles is estimated at 6 X 500mm (TBC) that will be installed to a depth of 10 m (TBC). As noted above, if the Contractor does not install piles concurrently with construction of the breakwater, then 1200mm sleeves will need to be installed in the rock armour so piles can be driven through the sleeves.
- Installation of abutment.
- Installation of floating deck units.
- Installation of navigational aids.
- It is expected that the installation of the above-mentioned items will be undertaken from the marine side or reclaimed area.

### **2.3 Storage building:**

These works consist of construction of the storage shed structure and hardstand to the east of Army Jetty Road. Vegetation clearance, cut/fill and levelling of this area will have already been completed during the mobilisation phase in Stage 1. The extent of intrusive works for this scope of work is expected to be minimal.

## **3.0 Works schedule**

Appendix C of PAEMAC (2024) provides an indicative works schedule.

## **4.0 Equipment**

Please refer to PAEMAC (2024) for an indication of the equipment to be used.

## 5.0 Disturbance footprints

### 5.1 Laydown Areas:

It is proposed that two laydown areas will be required as shown in **Figure 5**. One laydown area will be located in the onshore storage shed that will be constructed in Stage 2 of the project. Shapefiles of the footprint can be provided.



**Figure 5:** Proposed laydown areas 'A' and 'B'.

### 5.2 Proposed disturbance footprint:

The proposed disturbance footprint is shown below in **Figure 6**. Shapefiles of the footprint can be provided.



**Figure 6:** Proposed total disturbance footprint (Red line).



## **Appendix B**

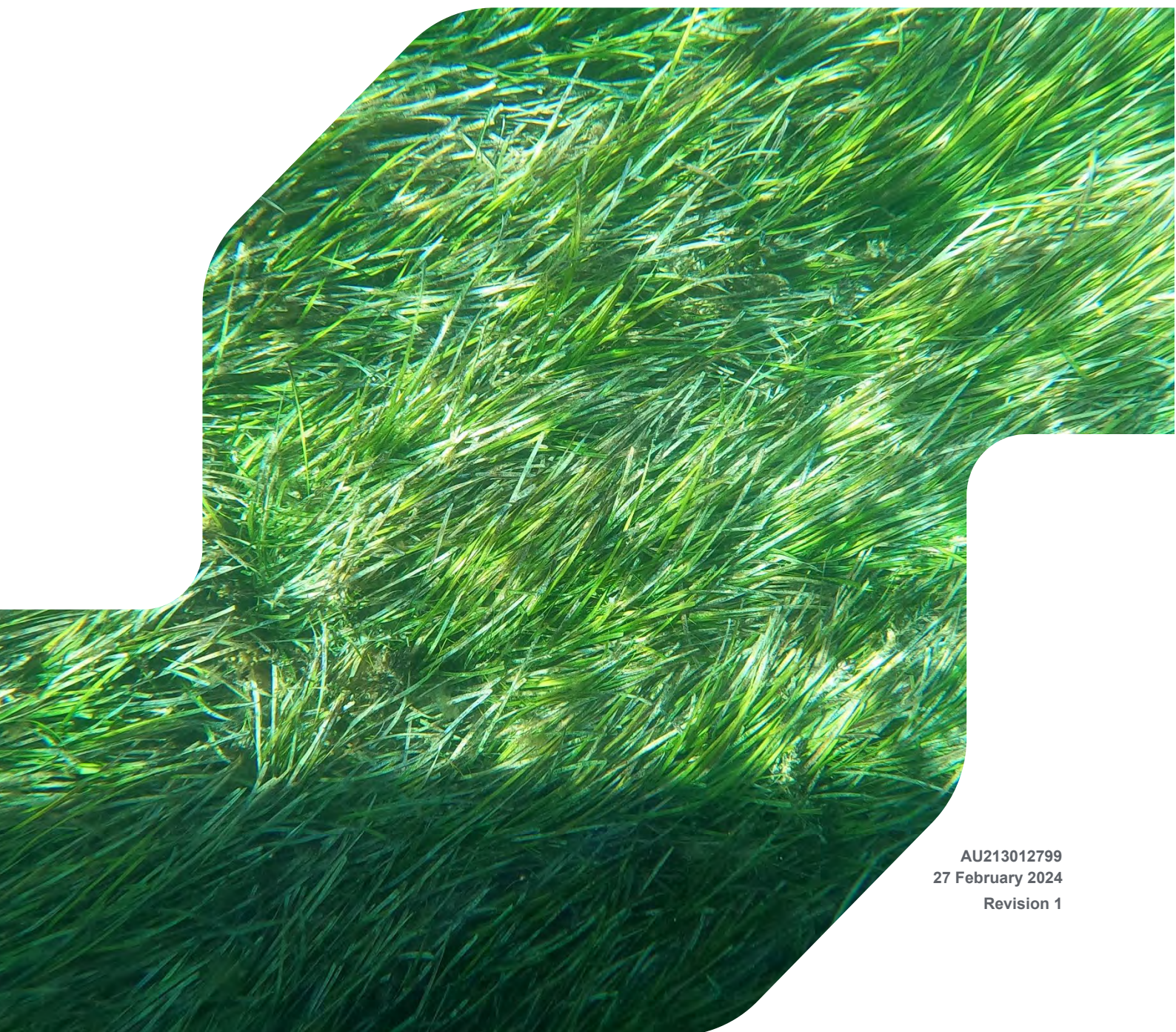
### **Marine fauna and benthic habitat assessment, South Thomson Barge Landing Development (RPS 2024)**





# **SOUTH THOMSON BARGE LANDING DEVELOPMENT**

## **Marine Fauna and Benthic Habitat Assessment**



AU213012799  
27 February 2024  
Revision 1



# ACKNOWLEDGEMENT

Rottnest Island Authority kaadatj Wadjak Noongar moort. Baalap Wadjemup kaaradjiny, baalabang malayin nakolak-ngat wer wirn kalyakoorl noyinand koort boodja-k wer kep-ak.

Ngalak kaadatj nedingar, birdiya wer boordakan Noongar moort. Ngalak karnadjil kaadatj maaman wer noba wirn Ali kalka Nino noyiyang Wadjemup ngardak boodja-k.

Baalabang moort maambart-boort, ngooni-boort, kongk-boort wer Birdiya-boort.

Rottnest Island Authority acknowledge Whadjuk Noongar families. They Wadjemup caring, their culture and spirits always connected Island-to and water-to.

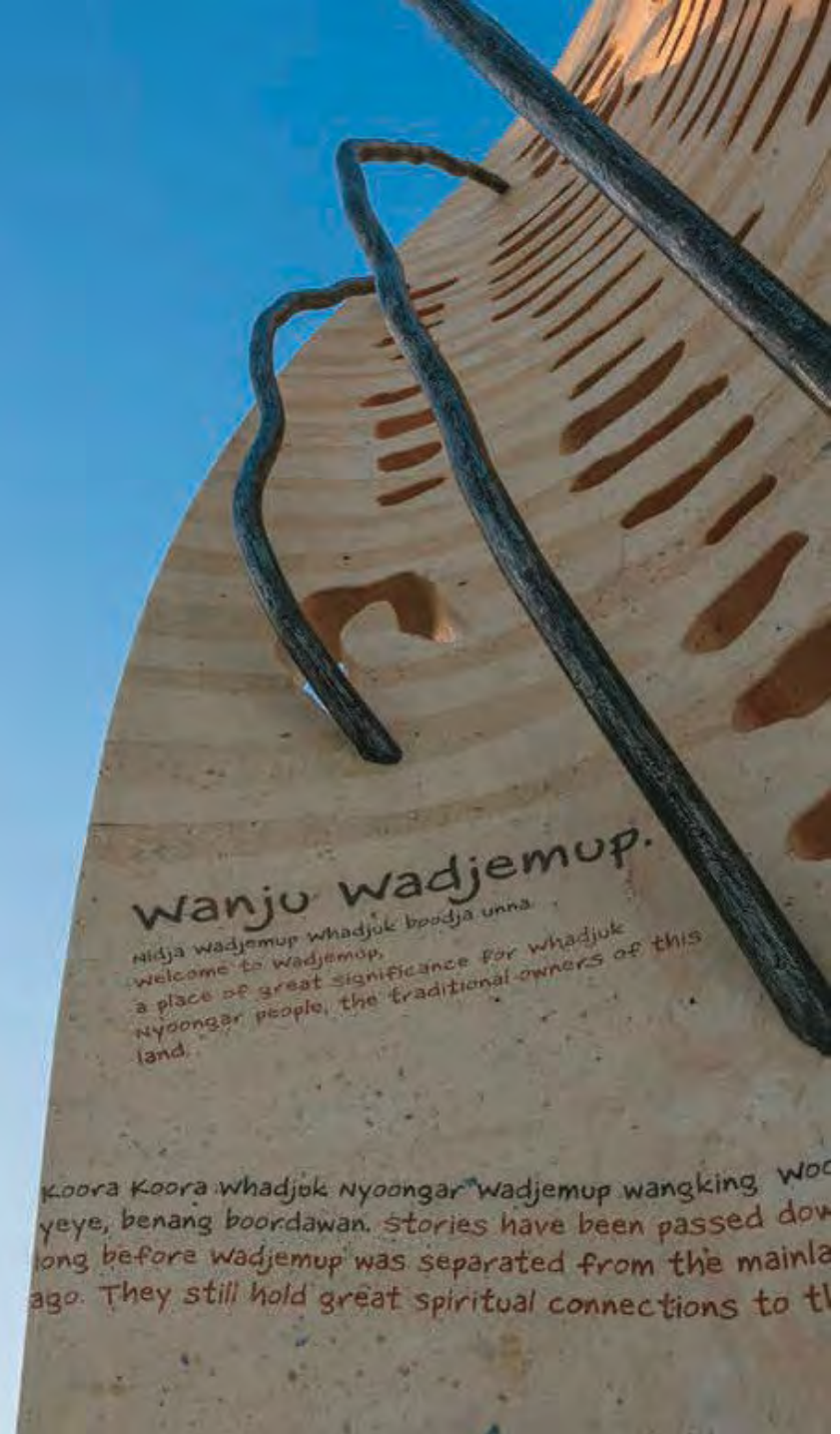
We acknowledge ancestors, Elders and future Noongar families. We truly acknowledge men and boys' spirits who still remain connected Wadjemup under ground-in.

Their family's father-without, brother-without, uncle-without and Elder-without.

Translation courtesy of  
Sharon Gregory, Noongar  
Language Consultant.

Koora-Yeye-Boordawan-Kalyakoorl

(Past-Present-Future-Forever)  
sculpture, Thomson Bay



## REPORT

### Document status

| Version | Purpose of document                       | Authored by               | Reviewed by | Approved by | Review date |
|---------|-------------------------------------------|---------------------------|-------------|-------------|-------------|
| Rev A   | Internal Review                           | JamBri, RosMcC,<br>EvaRob | LibHow      | MicMac      | 21/12/2023  |
| Rev B   | Client Review                             | JamBri, RosMcC,<br>EvaRob | Client      |             | 10/01/2024  |
| Rev 0   | Final for Distribution                    | RosMcC                    | MicMac      | MicMac      | 17/01/2024  |
| Rev 1   | Update to include<br>Supplementary Survey | RosMcC                    | MicMac      | MicMac      | 16/02/2024  |

### Approval for issue

Mike Mackie



16/02/2024

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#### Prepared by:

##### RPS

Mike Mackie  
Senior Principal Scientist

Level 3, 500 Hay Street  
Subiaco, WA 6008

T +61 8 9211 1111  
E mike.mackie@rpsgroup.com.au

#### Prepared for:

##### Rottnest Island Authority

David Pond  
Environment Compliance and Approvals  
Coordinator

Rottnest Island Authority, 1 Mews Road,  
Fremantle, WA 6160

T +61 451 154 505  
E david.pond@dbca.wa.gov.au



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## ABBREVIATIONS – KEY TERMS AND LEGISLATION

| Term          | Definition                                                                          |
|---------------|-------------------------------------------------------------------------------------|
| ALA           | Atlas of Living Australia                                                           |
| BC Act        | <i>Biodiversity Conservation Act 2016 (WA)</i>                                      |
| BCH           | Benthic marine communities and habitats                                             |
| BIA           | Biologically Important Area                                                         |
| DBCA          | Department of Biodiversity, Conservation and Attractions                            |
| DBCA database | DBCA Threatened, Specially Protected and Priority fauna database                    |
| DCCEEW        | Department of Climate Change, Energy, the Environment and Water (Commonwealth)      |
| EP Act        | <i>Environmental Protection Act 1986 (WA)</i>                                       |
| EPA           | Environment Protection Authority (WA)                                               |
| EPBC Act      | <i>Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)</i> |
| FSA           | Field survey area                                                                   |
| ha            | Hectare                                                                             |
| hrs           | Hours                                                                               |
| km            | Kilometre                                                                           |
| kn            | Knot                                                                                |
| LAU           | Local assessment unit                                                               |
| m             | Metre                                                                               |
| MNES          | Matters of National Environmental Significance (Commonwealth)                       |
| PMST          | Protected Matters Search Tool                                                       |
| QAQC          | Quality assurance and quality control                                               |
| RIA           | Rottnest Island Authority                                                           |
| RIMP          | Rottnest Island Management Plan                                                     |
| RLS           | Reef Life Survey                                                                    |
| RPS           | RPS AAP Consulting Pty Ltd                                                          |
| WA            | Western Australia                                                                   |

# 1 INTRODUCTION

## 1.1 Background and location

Wadjemup/ Rottnest Island, Western Australia (WA) is an A-class reserve with significant ecological, cultural, and social values (RIA, 2023). The marine reserve is characterised by a unique blend of tropical and temperate species, and a diverse range of habitats and communities including coral reefs, macroalgal reefs and extensive seagrass meadows. These habitats support over 400 species of fish and are highly valued by the many visitors to the island each year. Conservation of this unique environment in the face of increasing visitor pressure is one of five strategic focus areas highlighted by the Rottnest Island Authority (RIA), the body incorporated within the Department of Biodiversity, Conservation and Attractions (DBCA) which is responsible for the management of Rottnest Island (RIA, 2023).

Thomson Bay, located on the northeastern corner of the island, is designated a multi-use area with a range of facilities including the main ferry jetty, old army jetty and over 200 private moorings. A marine sanctuary zone is also located in the north of the bay. Benthic habitat within the bay is varied and includes seagrass meadows (*Posidonia* spp.) that comprise approximately 30% of the total seagrass area within Rottnest Island's nearshore habitats (RIA, 2023; Harvey, 2009). These meadows, which include *P. sinuosa* and *P. australis* are recognised as a Priority 3 Western Australian Priority Ecological Community by the DBCA due to their importance as a climax community that can take decades to centuries to develop, and their vulnerability to climate change (DBCA, 2023a). Other benthic habitat within Thomson Bay includes macroalgae and bare sand, the latter which may be covered by wrack that accumulates seasonally (RIA, 2023).

The *Rottnest Island Management Plan (RIMP) 2023 – 2028* (RIA, 2023) identifies the need to redevelop the old army groyne, jetty, and associated shore facilities in south Thomson Bay to alleviate increasing demand for commercial marine and barge services at the main jetty. Initially introduced in the 20-year master plan for Rottnest Island (RIA, 2014), the RIA now intends to progress with this development, known as the South Thomson Bay Maritime Facilities Redevelopment, which comprises a barge landing area, breakwater and groyne constructed from limestone boulders, with seabed spoil from associated dredging operations used as infill (RIA, 2023, Figure 1-1).

The RIA previously contracted RPS in 2018 to undertake preliminary assessment of the environmental impacts anticipated from the proposed development (RPS, 2019a). These impacts were primarily associated with dredging operations and the development footprint on marine benthic communities and habitats (BCH), in particular seagrass meadows, and the marine fauna which inhabit these areas. RPS conducted a desktop fauna survey and baseline benthic habitat surveys in Thomson Bay, delivering a draft report to the RIA in 2019 (RPS, 2019b). Findings of the survey, based on the previous design, determined that there was estimated to be a 1.43 ha direct loss of seagrass at that time. RIA has re-initiated actions towards the redevelopment in 2023, contracting RPS to compile up-to-date information on the Thomson Bay area to determine the potential impacts of the development on the benthic habitats and associated marine fauna.

## 1.2 Scope of Work

In accordance with the *South Thomson Barge Development – Baseline Study Updates – Scope of Work* and associated clarifications received from the RIA, the scope of marine work included:

- Desktop assessment of conservation (national and WA State listed species) and non-conservation important marine species, that may be present in the Thomson Bay area
- Update the benthic habitat assessment undertaken by RPS in 2019 for the calculation of habitat loss and cumulative habitat loss as a consequence of the proposed development
- Separate description of benthic habitat in the vicinity of the main and fuel jetties, adjacent to and west of the main survey area.

These scopes are addressed below in Sections 2 and 3.



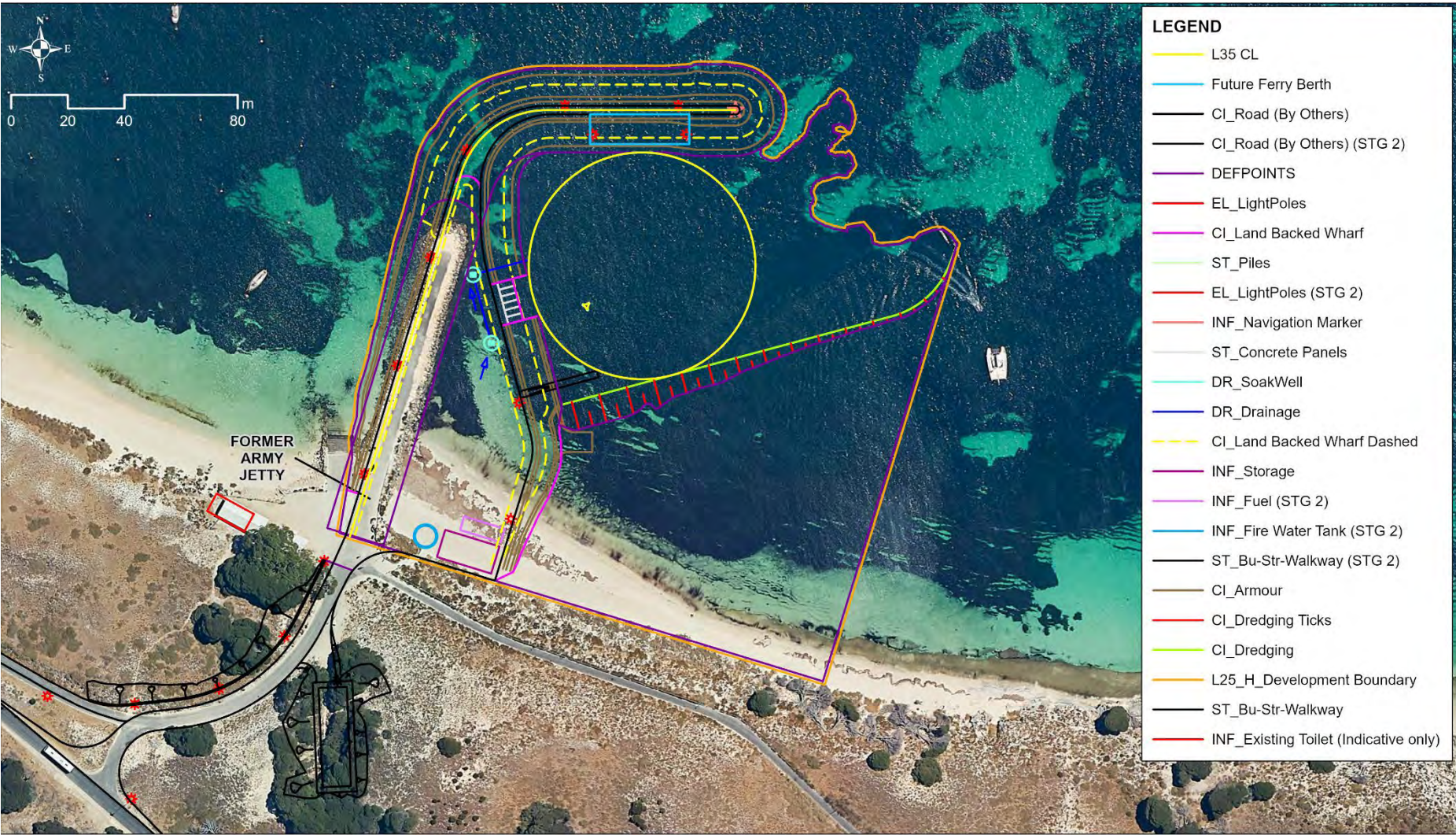


Figure 1-1: Detail of the proposed South Thomson Bay Maritime Facilities Redevelopment

## 2 MARINE FAUNA DESKTOP ANALYSIS

### 2.1 Objectives

Specific objectives of the marine fauna assessment were to:

- Identify and describe the seasonal presence of species that are protected under Commonwealth and WA legislation and likely to occur within a five kilometre (km) radius of the proposed development (noting this was revised to a 10 kilometre radius for species protected under WA legislation on advice from the DBCA)
- Identify non-conservation important fish species that have been recorded within or require habitat present in Thomson Bay, including description of habitat preferences and distribution of these species in Australian waters.

### 2.2 Commonwealth legislation

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the Australian Government's central piece of environmental legislation that provides a legal framework to protect and manage Matters of National Environmental Significance (MNES). Under the EPBC Act, an action requires approval from the minister if it has, will have, or is likely to have, a significant impact on MNES. The *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (DoE 2013) outlines a self-assessment process to assist in determining whether the proposed action may have a 'significant' impact on MNES. If a proposal is likely to have a significant impact on MNES, then it must be referred for assessment under the EPBC Act.

MNES are defined as:

- Listed threatened species and ecological communities
- Migratory species protected under international agreements
- Ramsar wetlands of international importance
- The Commonwealth marine environment
- World Heritage properties
- The Great Barrier Reef Marine Park
- National Heritage places
- Nuclear actions
- A water resource, in relation to coal seam gas development and large coal mining development
- Protected marine species include species listed nationally as marine, threatened (Critically Endangered, Endangered, Vulnerable, Conservation Dependent), migratory, and all cetaceans (DCCEEW, 2023a).

### 2.3 State legislation

The *Biodiversity Conservation Act 2016* (BC Act) is the WA legislation that informs the environmental regulation process through providing a legal framework for protecting biodiversity, with an emphasis on threatened species and threatened ecological communities. The BC Act provides for species, subspecies, or populations of native animals (fauna) to be listed as Specially Protected, Threatened (Critically Endangered, Endangered or Vulnerable) or Extinct in WA, based on the national distribution of species that have been adequately searched for and are deemed to be, in the wild, threatened, extinct or in need of special protection, and have been gazetted as such (DBCA, 2023b).

Under the BC Act, a species or ecological community may be listed as threatened by the Minister for Environment. This gives special protection to the threatened species or threatened ecological community. Activities which may result in the taking or disturbance of all fauna requires lawful authority under the BC Act. Ministerial Authorisation under Section 40 of the BC Act is required to take or disturb threatened species.



## 2.4 Methods

### 2.4.1 Conservation important species

Fauna protected under the EPBC Act and BC Act was identified via desktop searches, as described below.

#### 2.4.1.1 Commonwealth

A desktop search of the Department of Climate Change, Energy, the Environment and Water (DCCEEW) Protected Matters Search Tool (PMST) was undertaken on 26 October 2023, to identify MNES and other matters protected by the EPBC Act that may occur within a five-kilometre radius of the proposed development site (Appendix A).

#### 2.4.1.2 State

A desktop search of the DBCA Threatened, Specially Protected and priority fauna database (DBCA database) was undertaken on request of RPS by the DBCA on 3 November 2023 (Appendix A). For this purpose, the DBCA recommended a 10 km 'buffer size' for waters around Rottnest Island, based on the number of records available in the general area and the range of local species. In data-rich areas, buffer sizes are reduced, whereas in data-deficient areas, buffer sizes are increased. This flexibility caters for complexity and ensure more meaningful results.

While originally stated in the scope of works (RPS DBCARIAQ1524, proposal to deliver the survey and assessment), the DBCA NatureMap search intended to supplement the above was not conducted because this online service is no longer available.

#### 2.4.1.3 Determining likelihood of occurrence

The PMST and DBCA database reports were initially filtered to remove terrestrial and wetland species. For the remaining species the criteria for identifying those likely to occur within Thomson Bay and the development area were:

- Record of occurrence within five kilometres of Thomson Bay in the Atlas of Living Australia (ALA)
- Overlap with a Biologically Important Area (BIA).

Noting that all syngnathids listed in the PMST and/or DBCA database reports were considered likely to be present within Thomson Bay due to their cryptic nature and reduced likelihood of detection. Whilst seabirds and shorebirds were included in the list of species identified by the database reports (Appendix A) they were not assessed for likelihood of occurrence within Thomson Bay due to their mobility and capacity to move away from disturbance caused by development activities.

To provide further context for both the likelihood of the species being present and the potential impact of the proposed development on the population (if any), the distribution and/or habitat of each species within the search radius of Thomson Bay is described (as listed in the PMST results), together with their seasonal presence.

### 2.4.2 Non-conservation important species

The identity of non-conservation important species was achieved via a search of online literature. As described on the Wadjemup Rottnest Island website (<https://www.rottnestisland.com/learn/sustainability/marine-sanctuary-zones>), a large diversity of species is found in marine waters of Rottnest Island. Therefore, the online search focussed on marine species of fish that have been recorded or require habitat present in Thomson Bay (noting that marine mammals and reptiles are covered under the search of conservation-important species, and habitat forming species covered in the next section).

The online literature search utilised the following resources to identify fish species recorded in the waters in and around Thomson Bay:

- Hoschke, A., Whisson, G., & Moore, G. I. 2019. *Complete list of fishes from Rottnest Island 2019*. Compiled from a range of sources (including previous literature, ALA records and Reef Life Survey data)

- iNaturalist citizen science observation platform: *Fishes of Rottnest Island* (iNaturalist, 2023), which compiles up-to-date citizen science observations of marine fishes around Rottnest Island
- Reef Life Survey (RLS) citizen science program data (AODN, 2023). Utilises trained SCUBA divers to undertake standardised visual surveys in areas around Australia, including Rottnest Island.

Hoschke et al. (2019) compiled a list of 440 fish species recorded within the waters surrounding Rottnest Island. To refine this list to species that have been recorded in or that require habitat found within the development footprint or wider Thomson Bay, the iNaturalist resource was first searched, to identify all citizen science observations within this area. Then, the Reef Life Survey data, which utilises techniques that aim to capture both fish swimming within the water column as well as cryptobenthic fishes, were downloaded from across all survey years (2008 – 2023), for three nearshore sites in close proximity to Thomson Bay (Duck Rock South, Kingston Reef, The Count; Figure 2-1), in the absence of surveys occurring within the bay itself.

To provide further context for both the likelihood of the fish species being present, and the potential impact of the development on the population (if any), the habitat for which each species is typically associated and their broader distribution within Australian waters was described, using the Atlas of Living Australia (ALA, 2023), Fishes of Australia (FoA, 2024) and FishBase (Froese & Pauly, 2023) online resources.



**Figure 2-1: Reef Life Survey sites in close proximity to Thomson Bay**

## 2.5 Results and Discussion

A summary of the search results is provided below, identifying the conservation and non-conservation important matters returned and the relevance of the search results to the proposed development.

### 2.5.1 Conservation important species

Full results of the PMST and DBCA database searches are provided in Appendix A. These searches identified 41 threatened marine fauna species and 92 listed marine or migratory marine fauna species that may occur within Thomson Bay, including various marine megafauna (i.e., sharks, turtles, cetaceans), fish and seabirds. These species have diverse habitat preferences and lifestyles including highly mobile species (e.g., southern bluefin tuna), transient species that are not dependent on the habitat within Thomson Bay (e.g., cetaceans), and site-attached species such as syngnathids.



Based on criteria described in Section 2.4.1.3 and descriptions provided in the search results, 43 of those species listed in Appendix A are considered more likely to occur (conservatively at least) within Thomson Bay (Table 2-1), including the following species with overlapping BIAs:

- Australian sea lion (the development is within the foraging BIA for this species)
- Humpback whale (the development is within the migration BIA for this species)
- Pygmy blue whale (the development is within the distribution BIA for this species)
- Southern right whale (the development is within the migration BIA for this species.).

Of note is the potential presence of 26 syngnathid species, which are of relatively low (listed) conservation status but conservatively expected to be in the area due to their habitat preferences. Of these species, 20 may utilise seagrass habitats, during some of or all of their life history stages (Table 2-1). These species may also be more susceptible to impacts associated with development activities due to their small size and limited mobility.

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**Table 2-1: Species of conservation importance identified in the PMST and DBCA database reports that may occur in Thomspson Bay**

| Name                             |                            | Conservation status |              | Distribution at Rottnest Island and surrounding waters* | Habitat and seasonal preferences                                                                                 |
|----------------------------------|----------------------------|---------------------|--------------|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| Species                          | Common                     | EPBC Act            | BC Act       |                                                         |                                                                                                                  |
| <b>Fish</b>                      |                            |                     |              |                                                         |                                                                                                                  |
| <i>Acentronura australe</i>      | Southern pygmy pipehorse   | Listed              | Not included | Species or species habitat may occur within area        | Inhabit algal reefs and seagrass beds, to depths of up to 30 m (FoA, 2024).                                      |
| <i>Campichthys galei</i>         | Gale's pipefish            | Listed              | Not included | Species or species habitat may occur within area        | Inhabit shelly or rubble substrates and sparse seagrass beds, to depths of up to 18 m (FoA, 2024).               |
| <i>Choeroichthys suillus</i>     | Pig-snouted pipefish       | Listed              | Not included | Species or species habitat may occur within area        | Inhabit rubble habitats of inshore coral reefs, to depths of up to 15 m (FoA, 2024).                             |
| <i>Halicampus brocki</i>         | Brock's pipefish           | Listed              | Not included | Species or species habitat may occur within area        | Inhabit coral and algal reefs, to depths of up to 45 m (FoA, 2024).                                              |
| <i>Heraldia nocturna</i>         | Upside-down pipefish       | Listed              | Not included | Species or species habitat may occur within area        | Inhabit sheltered inshore rocky reefs, to depths of up to 30 m (FoA, 2024).                                      |
| <i>Hippocampus angustus</i>      | Western spiny seahorse     | Listed              | Not included | Species or species habitat may occur within area        | Inhabit sheltered algal reefs and seagrass beds, to depths of up to 30 m (FoA, 2024).                            |
| <i>Hippocampus breviceps</i>     | Short-head seahorse        | Listed              | Not included | Species or species habitat may occur within area        | Inhabit shallow seagrass and macroalgal beds, to depths of up to 15 m (FoA, 2024).                               |
| <i>Hippocampus subelongatus</i>  | West Australian seahorse   | Listed              | Not included | Species or species habitat may occur within area        | Inhabit macroalgal beds, muddy substrates, jetty pylons and moorings to depths of up to 25 m (FoA, 2024).        |
| <i>Histiogamphelus cristatus</i> | Rhino pipefish             | Listed              | Not included | Species or species habitat may occur within area        | Inhabit seagrass beds and adjacent sandy areas, to depths of up to 17 m (FoA, 2024).                             |
| <i>Lissocampus caudalis</i>      | Australian smooth pipefish | Listed              | Not included | Species or species habitat may occur within area        | Inhabit rubble habitats, macroalgal beds and seagrass beds and rocky reefs, to depths of up to 15 m (FoA, 2024). |
| <i>Lissocampus fatiloquus</i>    | Prophet's pipefish         | Listed              | Not included | Species or species habitat may occur within area        | Inhabit rocky and sand habitats, and seagrass and macroalgal beds, to depths of up to 10 m (FoA, 2024).          |
| <i>Lissocampus runa</i>          | Javelin pipefish           | Listed              | Not included | Species or species habitat may occur within area        | Inhabit seagrass and macroalgal beds and rubble substrates, to depths of up to 20 m (FoA, 2024).                 |

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| Name                             |                          | Conservation status    |              | Distribution at Rottnest Island and surrounding waters* | Habitat and seasonal preferences                                                                                                        |
|----------------------------------|--------------------------|------------------------|--------------|---------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| <i>Maroubra perserrata</i>       | Sawtooth pipefish        | Listed                 | Not included | Species or species habitat may occur within area        | Inhabit coral reefs, to depths of up to 25 m (FoA, 2024).                                                                               |
| <i>Mitotichthys meraculus</i>    | Western crested pipefish | Listed                 | Not included | Species or species habitat may occur within area        | Inhabit seagrass beds to depths of up to 10 m (FoA, 2024).                                                                              |
| <i>Nannocampus subosseus</i>     | Bonyhead pipefish        | Listed                 | Not included | Species or species habitat may occur within area        | Inhabit a range of habitats including seagrass and macroalgal beds, sandy and coral reef habitats, to depths of up to 14 m (FoA, 2024). |
| <i>Phycodurus eques</i>          | Leafy seadragon          | Listed                 | Not included | Species or species habitat may occur within area        | Inhabit seagrass beds and algal reefs, to depths of up to 50 m (FoA, 2024).                                                             |
| <i>Phyllopteryx taeniolatus</i>  | Common seadragon         | Listed                 | Not included | Species or species habitat may occur within area        | Inhabit seagrass beds and algal reefs, to depths of up to 50 m (FoA, 2024).                                                             |
| <i>Pugnaso curtirostris</i>      | Pugnose pipefish         | Listed                 | Not included | Species or species habitat may occur within area        | Inhabit shallow seagrass and macroalgal beds, to depths of up to 11 m (FoA, 2024).                                                      |
| <i>Solegnathus lettiensis</i>    | Gunther's pipefish       | Listed                 | Not included | Species or species habitat may occur within area        | Little is known about the habitat for this species.                                                                                     |
| <i>Stigmatopora argus</i>        | Spotted pipefish         | Listed                 | Not included | Species or species habitat may occur within area        | Inhabit seagrass beds, to depths of up to 8 m (FoA, 2024).                                                                              |
| <i>Stigmatopora nigra</i>        | Widebody pipefish        | Listed                 | Not included | Species or species habitat may occur within area        | Inhabit sheltered seagrass and macroalgal beds, to depths of up to 35 m (FoA, 2024).                                                    |
| <i>Syngnathoides biaculeatus</i> | Double-end pipefish      | Listed                 | Not included | Species or species habitat may occur within area        | Inhabit seagrass and macroalgal beds, to depths of up to 10 m (FoA, 2024).                                                              |
| <i>Urocampus carinirostris</i>   | Hairy pipefish           | Listed                 | Not included | Species or species habitat may occur within area        | Inhabit seagrass beds, to depths of up to 6 m (FoA, 2024).                                                                              |
| <i>Vanacampus margaritifer</i>   | Mother-of-pearl pipefish | Listed                 | Not included | Species or species habitat may occur within area        | Inhabit seagrass and macroalgal beds, rocky and sandy substrates, to depths of up to 15 m (FoA, 2024).                                  |
| <i>Vanacampus phillipi</i>       | Port Phillip pipefish    | Listed                 | Not included | Species or species habitat may occur within area        | Inhabit seagrass and macroalgal beds, to depths of up to 25 m (FoA, 2024).                                                              |
| <i>Vanacampus poecilolaemus</i>  | Longsnout pipefish       | Listed                 | Not included | Species or species habitat may occur within area        | Inhabit shallow seagrass and macroalgal beds, to depths of up to 18 m (FoA, 2024).                                                      |
| <b>Sharks</b>                    |                          |                        |              |                                                         |                                                                                                                                         |
| <i>Sphyrna lewini</i>            | Scalloped hammerhead     | Conservation Dependent | Not included | Species or species habitat likely to occur within area  | Undertake annual foraging and breeding migrations. Known to aggregate in the                                                            |

## REPORT

| Name                                             | Conservation status                      |                       | Distribution at Rottnest Island and surrounding waters* |                                                                                                                                        | Habitat and seasonal preferences                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------------------|------------------------------------------|-----------------------|---------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                  |                                          |                       |                                                         |                                                                                                                                        | Shoalwater Islands Marine Park, where peak numbers are observed during January and February (López et al. 2022; 2023).                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <i>Carcharias taurus</i> (west coast population) | Grey nurse shark (west coast population) | Vulnerable            | Not included                                            | Congregation or aggregation known to occur within area                                                                                 | Year-round presence. Seasonal migration patterns have not been observed (Last & Stevens 2009, DCCEEW, 2023b).                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <i>Carcharodon carcharias</i>                    | White shark                              | Vulnerable, Migratory | Vulnerable                                              | Species or species habitat known to occur within area                                                                                  | Have been shown to undertake migrations north along the WA coast during spring and return in summer; however, coastal movements are not synchronous i.e., some sharks move north while others move south during the same period (McAuley et al. 2016). They are frequently recorded in waters around fur seal and sea lion colonies, including in the Perth region (ALA, 2023; DCCEEW, 2023b), where they are more likely to be present during spring and early summer and least likely to be present during late summer and autumn (SharkSmart 2018). |
| <b>Mammals</b>                                   |                                          |                       |                                                         |                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <i>Neophoca cinerea</i>                          | Australian sea lion                      | Endangered            | Endangered                                              | Species or species habitat likely to occur within area. The development footprint is located within the foraging BIA for this species. | Has an asynchronous non-annual breeding cycle with cycles ranging from 16 to 20 months and pupping occurring at different times throughout the South-West Marine Region (DCCEEW, 2023b).                                                                                                                                                                                                                                                                                                                                                               |
| <i>Eubalaena Australis</i>                       | Southern right whale                     | Endangered, Migratory | Vulnerable                                              | The development footprint is located within the migratory BIA for this species**                                                       | Southern temperate to subpolar waters including marine areas of southern Australia from May to October. The migratory period within the migration BIA up the west coast of WA is April to October (ALA; NCVA, 2023).                                                                                                                                                                                                                                                                                                                                   |
| <i>Balaenoptera musculus brevicauda</i>          | Pygmy blue whale                         | Endangered            | Not included                                            | Known to occur in the area. The development footprint is located within the distribution BIA for this species.                         | The northbound migration past Perth Canyon occurs between April and July (peak May to June), with the return migration from October to January (peak                                                                                                                                                                                                                                                                                                                                                                                                   |



## REPORT

| Name                              | Conservation status             |              | Distribution at Rottnest Island and surrounding waters* |                                                                                                                                                                        | Habitat and seasonal preferences                                                                                                                                                                                                                                                                                        |
|-----------------------------------|---------------------------------|--------------|---------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                   |                                 |              |                                                         |                                                                                                                                                                        | November to early December; Thums et al. 2022).                                                                                                                                                                                                                                                                         |
| <i>Megaptera novaeangliae</i>     | Humpback whale                  | Migratory    | Conservation Dependent, Migratory                       | Species or species habitat known to occur within area.<br>The development footprint is located within the migratory BIA for this species.                              | The annual peak northbound migration along the Jurien Bay to Carnarvon migration route occurs between June and July, while the southbound migration peak occurs between September and October (ALA, 2023; DCCEEW, 2023b; Jenner et al. 2001).                                                                           |
| <i>Orcinus orca</i>               | Killer whale, Orca              | Migratory    | Not included                                            | Species or species habitat may occur within area                                                                                                                       | Mating is known to occur all year round, whilst the calving season spans several months. However, no areas of significance and no determined migration routes have been identified for this species within waters off WA (DCCEEW, 2023b). They are typically present on the south coast of WA between January to April. |
| <i>Arctocephalus forsteri</i>     | New Zealand fur seal            | Listed       | Other Specially Protected                               | Species or species habitat may occur within area. The New Zealand fur seal colony on Rottnest Island is located at Cathedral Rocks on the west end of Rottnest Island. | Present year round (ALA, 2023).                                                                                                                                                                                                                                                                                         |
| <i>Balaenoptera acutorostrata</i> | Minke whale                     | Listed       | Not included                                            | Species or species habitat may occur within area                                                                                                                       | May migrate from high latitude areas in the summer to low latitude areas in the winter. The detailed pattern of seasonal migration is generally poorly understood (ALA, 2023).                                                                                                                                          |
| <i>Tursiops aduncus</i>           | Indian ocean bottlenose dolphin | Listed       | Not included                                            | Species or species habitat likely to occur within area                                                                                                                 | Present year-round. Movement patterns in Australia are variable.                                                                                                                                                                                                                                                        |
| <i>Tursiops truncatus s. str.</i> | Bottlenose dolphin              | Listed       | Not included                                            | Species or species habitat may occur within area                                                                                                                       | Seasonal movements are variable, and may include residency in small areas, long-range movements, and migration (DCCEEW, 2023b).                                                                                                                                                                                         |
| <i>Stenella longirostris</i>      | Spinner dolphin                 | Not included | Priority 4, Migratory                                   | Sighted in field survey in DBCA database data. Assumed species or species habitat may occur within area.                                                               | No seasonal differences, but mostly offshore species (ALA)                                                                                                                                                                                                                                                              |

## REPORT

| Name                        |                         | Conservation status   |              | Distribution at Rottnest Island and surrounding waters*           | Habitat and seasonal preferences                                                                                                         |
|-----------------------------|-------------------------|-----------------------|--------------|-------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Reptiles                    |                         |                       |              |                                                                   |                                                                                                                                          |
| <i>Caretta caretta</i>      | Loggerhead turtle       | Endangered, Migratory | Not included | Foraging, feeding or related behaviour known to occur within area | Generally nesting in summer at nesting grounds in northern WA (not necessarily every year; ALA, 2023).                                   |
| <i>Dermochelys coriacea</i> | Leatherback turtle      | Endangered, Migratory | Vulnerable   | Species or species habitat known to occur within area             | Migrates from foraging areas to nesting beaches in tropical and subtropical regions during summer (ALA, 2023; DCCEEW, 2023b).            |
| <i>Chelonia mydas</i>       | Green turtle            | Vulnerable, Migratory | Vulnerable   | Foraging, feeding or related behaviour known to occur within area | Migrates from foraging areas to nesting beaches in tropical regions during summer, typically between November and March (DCCEEW, 2023b). |
| <i>Pelamis platurus</i>     | Yellow-bellied seasnake | Listed                | Not included | Species or species habitat may occur within area                  | Seasonal movements have not been observed in Australia hence may be present year-round.                                                  |

\*As listed in the PMST search results and/or Atlas of Living Australia (ala.org.au)

\*\* Although the PMST search indicates that breeding by *E. australis* may occur within the PMST search area, a review of the online National Conservation Values Atlas indicates that this is not the case and only the migration BIA for the species overlaps Thomson Bay

Definitions: BC Act = *Biodiversity Conservation Act 2016* (WA), BIA = Biologically Important Area, DBCA = Department of Biodiversity, Conservation and Attractions (WA), EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)

Priority 4 = Rare, Near Threatened and other species in need of monitoring (BC Act)

Other Specially Protected = Species otherwise in need of special protection (BC Act)

## 2.5.2 Non-conservation important species

The online literature review identified 440 species of fish species that are considered to have been reliably recorded within the waters surrounding Rottnest Island (Hoschke, et al., 2019). Of these species, recent surveys (2008 - 2023, RLS) and citizen science observations (2017 - 2022, iNaturalist) refined this number to 137 species that have been recorded in the vicinity of Thomson Bay and may occur or utilise habitat within the development footprint (Table 2-2). No species identified in the PMST were included in this list.

The fish listed in Table 2-2 include both cartilaginous fishes (benthic sharks and rays), as well as a broad suite of bony fishes, which encompass highly diverse habitat preferences and uses. These range from species that may occasionally pass through the bay but are unlikely to depend upon habitat within the development footprint (e.g., West Australian dhufish), to more site-attached species that are commonly found in habitat present in the development footprint (e.g., Germain's blenny). Many of the latter species are more strongly associated with hard substrate habitat such as reef which comprise only a small proportion of the Thomson Bay survey area. However, as shown in Section 3, the proposed development overlaps seagrass habitat with which 26 non-conservation important fish species are associated (Table 2-2). Of these, several utilise seagrass meadows primarily as a nursery habitat as juveniles, whilst others are associated with a broader range of habitats throughout their life history stages.

## REPORT

**Table 2-2: Non-conservation important fish species that may occur in Thomson Bay**

| Name                              |                              | Habitat*                                                                                    | Australian Distribution*                                                                                               |
|-----------------------------------|------------------------------|---------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|
| Species                           | Common                       |                                                                                             |                                                                                                                        |
| <i>Abudefduf sexfasciatus</i>     | Scissortail sergeant         | Inhabit reefs, to depths of up to 15 m                                                      | Temperate to tropical waters Australia-wide                                                                            |
| <i>Abudefduf vaigiensis</i>       | Indo-Pacific sergeant        | Inhabit reefs, to depths of up to 15 m                                                      | Temperate to tropical waters Australia-wide                                                                            |
| <i>Acanthaluteres brownii</i>     | Spinytail leatherjacket      | Inhabit inshore reefs and adjacent seagrass beds, to depths up to 25 m                      | Endemic to southern Australia (Shark Bay, WA to Rapid Head, SA)                                                        |
| <i>Acanthaluteres vittiger</i>    | Toothbrush leatherjacket     | Inhabit shallow sheltered seagrass beds and rocky reefs, to depths up to 45 m               | Endemic to southern Australia (Coffs Harbour, NSW to north of Leeman, WA)                                              |
| <i>Acanthistius serratus</i>      | Western wirrah               | Inhabit reefs of coastal waters, often sheltering in caves, to depths of up to 40 m         | Temperate to tropical waters (Ceduna, SA to Shark Bay, WA)                                                             |
| <i>Achoerodus gouldii</i>         | Western blue groper          | Inhabit coastal and offshore reefs, usually at depths of 5 to 40 m                          | Endemic to temperate coastal waters of southern Australia (Inverlock, VIC to Houtman Abrolhos Islands, WA)             |
| <i>Anampses caeruleopunctatus</i> | Diamond wrasse               | Inhabit reefs, to depths of up to 30 m                                                      | Temperate to tropical waters Australia-wide                                                                            |
| <i>Anampses geographicus</i>      | Scribbled wrasse             | Inhabit shallow reefs                                                                       | Temperate to tropical waters Australia-wide                                                                            |
| <i>Anampses meleagrides</i>       | Speckled wrasse              | Inhabit areas of mixed coral rubble and sand on seaward reefs, to depths of up to 30 m      | Temperate to tropical waters Australia-wide                                                                            |
| <i>Anoplocapros amygdaloides</i>  | Western smooth boxfish       | Inhabit offshore reef and seagrass beds, to depths of up to 100 m                           | Endemic to temperate waters of southern and southwestern Australia (Shark Bay, WA to Great Australian Bight, SA)       |
| <i>Anoplocapros lenticularis</i>  | Whitebarred boxfish          | Inhabit offshore reefs and jetty pylons, to depths of up to 250 m                           | Endemic to temperate waters of southern and southwestern Australia (Houtman Abrolhos Islands, WA to Western Port, VIC) |
| <i>Aplodactylus westralis</i>     | Western seacarp              | Inhabit rocky reefs with abundant macroalgae, to depths of up to 20 m                       | Temperate waters (Yorke Peninsula, SA to Rottnest Island, WA)                                                          |
| <i>Apogon victoriae</i>           | Western striped cardinalfish | Nocturnal, inhabiting caves and ledges of shallow reefs                                     | Endemic to Western Australia (Cape Leeuwin, WA to the Cobourg Peninsula, NT)                                           |
| <i>Arripis georgianus</i>         | Australian herring           | Inhabit seagrass and macroalgal beds in inshore bays and estuaries, to depths of up to 50 m | Endemic to southern Australia (Forster, NSW to Swan River, WA, including Tasmania)                                     |
| <i>Aspidontus taeniatus</i>       | False cleanerfish            | Inhabit reef flats and lagoons, to depths of up to 25 m                                     | Temperate to tropical waters Australia-wide                                                                            |
| <i>Aulohalaelurus labiosus</i>    | Blackspotted catshark        | Nocturnal, inhabiting reefs, to depths of up to 10 m                                        | Endemic to south-western WA (Recherche Archipelago to the Houtman Abrolhos Islands)                                    |
| <i>Austrolabrus maculatus</i>     | Blackspotted wrasse          | Inhabit exposed reefs, to depths of up to 40 m                                              | Endemic to southern Australia (Fraser Island, QLD to Shark Bay, WA)                                                    |



## REPORT

| Name                             |                           | Habitat*                                                                                                             | Australian Distribution*                                                                   |
|----------------------------------|---------------------------|----------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|
| <i>Bathytoshia brevicaudata</i>  | Smooth stingray           | Inhabit sandy areas in coastal bays and reefs, to depths of up to 150 m                                              | Temperate waters of southern Australia                                                     |
| <i>Bodianus frenchii</i>         | Foxfish                   | Inhabit caves and ledges of deeper offshore reefs, to depths of up to 82 m                                           | Temperate waters of southern Australia                                                     |
| <i>Caesiocorpius theagenes</i>   | Blowhole perch            | Inhabit offshore reefs, to depths of up to 30 m                                                                      | Endemic to WA (Albany to Shark Bay)                                                        |
| <i>Chaetodon assarius</i>        | Western butterflyfish     | Inhabit reefs, to depths of up to 40 m                                                                               | Endemic to WA (Israelite Bay to Northwest Shelf)                                           |
| <i>Chelmonops curiusus</i>       | Western talma             | Inhabit coastal rocky reefs, to depths of up to 60 m                                                                 | Endemic to south-western Australia (Victor Harbor, SA to Shark Bay, WA)                    |
| <i>Chironemus maculosus</i>      | Silver spot               | Inhabit rocky reefs, to depths of up to 10 m                                                                         | Temperate waters of southern Australia (Jervis Bay, NSW to Rottnest Island, WA)            |
| <i>Chlorurus sordidus</i>        | Bullethead parrotfish     | Inhabit reefs and lagoons, to depths of up to 50 m                                                                   | Temperate to tropical waters Australia-wide                                                |
| <i>Choerodon rubescens</i>       | Baldchin groper           | Inhabit coastal and offshore reefs and adjacent weedy areas, to depths of up to 30 m                                 | Endemic to WA (Cape Leeuwin to Ningaloo Reef)                                              |
| <i>Chromis klunzingeri</i>       | Blackhead puller          | Inhabit inshore and offshore reefs, to depths of up to 40 m                                                          | Endemic to southern WA (Recherche Archipelago to the Houtman Abrolhos Islands)             |
| <i>Chromis westAustralis</i>     | West Australian puller    | Inhabit reefs, to depths of up to 75 m                                                                               | Endemic to western and northern Australia (Recherche Archipelago, WA to Evans Shoal, NT)   |
| <i>Cirripectes hutchinsi</i>     | Hutchins' blenny          | Inhabit shallow reefs, to depths of up to 22 m                                                                       | Endemic to WA (Rottnest Island to North West Cape)                                         |
| <i>Cnidogobius macrocephalus</i> | Estuary cobbler           | Nocturnal, inhabit sandy and muddy bottoms often amongst rocks, algae and wrack, to depths of up to 30 m             | Endemic to temperate southern Australia (Moreton Bay, QLD to Houtman Abrolhos Islands, WA) |
| <i>Cochleocephalus bicolor</i>   | Western cleaner clingfish | Inhabit rocky reefs, to depths of up to 40 m                                                                         | Endemic to southern Australia (Port Phillip, VIC to Lancelin, WA)                          |
| <i>Coris auricularis</i>         | Western king wrasse       | Inhabit sandy areas and seagrass beds around offshore reefs, to depths of up to 45 m                                 | Temperate to subtropical waters of south-western Australia                                 |
| <i>Cristiceps aurantiacus</i>    | Yellow crested weedfish   | Inhabit rock pools, subtidal rocky reefs, macroalgal beds and wrack on adjacent sandy areas, to depths of up to 30 m | Temperate to subtropical waters on Australia's east and west coasts                        |
| <i>Dactylophora nigricans</i>    | Dusky morwong             | Inhabit rocky reefs, seagrass beds and sandy lagoons, to depths of up to 20 m                                        | Endemic to southern Australia (Clarence River, NSW to Houtman Abrolhos Islands, WA)        |
| <i>Dinolestes lewini</i>         | Longfin pike              | Inhabit seagrass beds, reefs and bays, to depths of up to 65 m                                                       | Endemic to southern Australia (Newcastle, NSW to Perth region, WA)                         |
| <i>Diodon nictemerus</i>         | Globefish                 | Inhabit sheltered reefs and weedy habitats, to depths of up to 85 m                                                  | Endemic to southern Australia (Seal Rocks, NSW to Houtman Abrolhos Islands, WA)            |
| <i>Dotalabrus allenii</i>        | Little rainbow wrasse     | Inhabit shallow rocky reefs, to depths of up to 15 m                                                                 | Endemic to southern WA (Recherche Archipelago to the Houtman Abrolhos Islands)             |

## REPORT

| Name                            |                         | Habitat*                                                                        | Australian Distribution*                                                                      |
|---------------------------------|-------------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|
| <i>Dotalabrus aurantiacus</i>   | Castelnau's wrasse      | Inhabit seagrass beds, reefs and sheltered bays, to depths of up to 47 m        | Endemic to southern Australia (Point Hicks, VIC to Rottnest Island, WA)                       |
| <i>Enoplosus armatus</i>        | Old wife                | Inhabit inshore reefs and macroalgal beds, to depths of up to 100 m             | Endemic to southern Australia (Fraser Island, QLD to South Passage, WA)                       |
| <i>Eocallionymus papilio</i>    | Painted stinkfish       | Inhabit muddy and shelly bays, to depths of up to 50 m                          | Temperate and sub-tropical waters (Mudjimba Island, QLD to Kalbarri, WA)                      |
| <i>Epinephelides armatus</i>    | Breaksea cod            | Inhabit offshore reefs, to depths of up to 100 m                                | Endemic to WA (Recherche Archipelago to Shark Bay)                                            |
| <i>Eubalichthys cyanoura</i>    | Bluetail leatherjacket  | Inhabit coastal reefs, to depths of up to 30 m                                  | Endemic to southern Australia (York Peninsula, SA to Dongara, WA)                             |
| <i>Eubalichthys gunnii</i>      | Gunn's leatherjacket    | Inhabit bays and coastal reefs, to depths of up to 55 m                         | Temperate coastal waters                                                                      |
| <i>Eubalichthys mosaicus</i>    | Mosaic leatherjacket    | Inhabit offshore and coastal reefs, to depths of up to 150 m                    | Endemic to southern Australia (Noosa, QLD to Dongara, WA)                                     |
| <i>Eupetrichthys angustipes</i> | Snakeskin wrasse        | Inhabit sheltered sandy areas adjacent to reefs, to depths of up to 40 m        | Endemic to southern Australia (northern NSW to Houtman Abrolhos Islands, WA)                  |
| <i>Eviota bimaculata</i>        | Twospot eviota          | Inhabit rocky and coral reefs, to depths of up to 10 m                          | Temperate to subtropical waters of southwestern Australia (Ceduna, SA to North West Cape, WA) |
| <i>Girella tephraeops</i>       | Western rock blackfish  | Inhabit coastal reefs, to depths of up to 20 m                                  | Endemic to WA (Israelite Bay to north of Shark Bay)                                           |
| <i>Girella zebra</i>            | Zebrafish               | Inhabit bays and coastal reefs, to depths of up to 20 m                         | Endemic to southern Australia (Clarence River, NSW to Port Denison, WA)                       |
| <i>Glaucosoma hebraicum</i>     | West Australian dhufish | Inhabit rocky outcrops and ledges, to depths of up to 200 m                     | Endemic to WA (Esperance to Shark Bay)                                                        |
| <i>Goniistius gibbosus</i>      | Magpie morwong          | Inhabit shallow protected reefs and sandy areas, to depths of up to 20 m        | Endemic to WA (Recherche Archipelago to Shark Bay)                                            |
| <i>Goniistius rubrolabiatus</i> | Redlip morwong          | Inhabit inshore rocky reefs, to depths of up to 30 m                            | Endemic to WA (Recherche Archipelago to Coral Bay)                                            |
| <i>Halichoeres brownfieldi</i>  | Brownfield's wrasse     | Inhabit macroalgal reefs and adjacent seagrass beds, to depths of up to 30 m    | Endemic to WA (Israelite Bay to Exmouth Gulf)                                                 |
| <i>Halichoeres nigrescens</i>   | Bubblefin wrasse        | Inhabit shallow reefs, to depths of up to 10 m                                  | Tropical waters (Dampier Archipelago, WA to Hervey Bay, QLD)                                  |
| <i>Helcogramma decurrens</i>    | Blackthroat threefin    | Inhabit intertidal and subtidal macroalgal rocky reefs, to depths of up to 13 m | Temperate coastal waters of southern Australia                                                |
| <i>Heteroscarus acroptilus</i>  | Rainbow cale            | Inhabit exposed rocky reefs and seagrass beds, to depths of up to 60 m          | Endemic to southern Australia (Seal Rocks, NSW to Point Gregory, WA)                          |
| <i>Hyperlophus vittatus</i>     | Sandy sprat             | Inhabit shallow sandy areas and seagrass beds, to depths of up to 29 m          | Temperate waters of southern Australia (Moreton Bay, QLD to Kalbarri, WA)                     |

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| Name                             |                              | Habitat*                                                                                    | Australian Distribution*                                                                        |
|----------------------------------|------------------------------|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| <i>Hypoplectrodes nigroruber</i> | Banded seaperch              | Inhabit rocky reefs, to depths of up to 30 m                                                | Endemic to southern Australia (Solitary Islands, NSW to Houtman Abrolhos Islands, WA)           |
| <i>Kyphosus cornelii</i>         | Western buffalo bream        | Inhabit coral and rocky reefs, to depths of up to 20 m                                      | Endemic to WA (Cape Naturaliste to Shark Bay)                                                   |
| <i>Kyphosus gladius</i>          | Gladius drummer              | Inhabit rocky substrates, to depths of up to 20 m                                           | Endemic to temperate WA (Albany to Houtman Abrolhos Islands)                                    |
| <i>Kyphosus sydneyanus</i>       | Silver drummer               | Inhabit exposed rocky reefs, to depths of up to 30 m                                        | Temperate waters of southern Australia (Fraser Island, QLD to Houtman Abrolhos Islands, WA)     |
| <i>Labroides dimidiatus</i>      | Common cleanerfish           | Inhabit coral reefs, to depths of up to 40 m                                                | Temperate to tropical waters across northern Australia (Perth, WA to Sydney, NSW)               |
| <i>Latropiscis purpurissatus</i> | Sergeant baker               | Inhabit soft bottom habitats, rocky and coral reefs, to depths of up to 250 m               | Endemic to southern Australia (Double Island Point, QLD to Shark Bay, WA)                       |
| <i>Lethrinus genivittatus</i>    | Threadfin emperor            | Inhabit outer reef slopes and shallow sandy and seagrass bed areas, to depths of up to 25 m | Temperate to tropical waters across northern Australia                                          |
| <i>Leviprora inops</i>           | Longhead flathead            | Inhabit rocky reefs with abundant vegetation, to depths of up to 20 m                       | Southern Australia (Gulf St. Vincent, SA to Swan River, WA)                                     |
| <i>Lotella rhacina</i>           | Large-tooth beardie          | Nocturnal, inhabiting bays, harbours and exposed reefs, to depths of up to 90 m             | Temperate waters of southern Australia (Coolangatta, QLD to Houtman Abrolhos Islands, WA)       |
| <i>Meuschenia flavolineata</i>   | Yellow-striped leatherjacket | Inhabit macroalgal reefs, to depths of up to 50 m                                           | Endemic to southern Australia (Broughton Island, NSW to Dongara, WA)                            |
| <i>Meuschenia freycineti</i>     | Six-spine leatherjacket      | Inhabit reefs and seagrass beds, to depths of up to 45 m                                    | Endemic to southern Australia (Coffs Harbour, NSW to Jurien Bay, WA)                            |
| <i>Meuschenia galii</i>          | Bluelined leatherjacket      | Inhabit coastal reefs, to depths of up to 30 m                                              | Temperate waters of southern Australia (Inverloch, VIC to Shark Bay, WA)                        |
| <i>Meuschenia hippocrepis</i>    | Horseshoe leatherjacket      | Inhabit macroalgal rocky reefs, to depths of up to 120 m                                    | Endemic to southern Australia (Wilsons Promontory, VIC to Shark Bay, WA)                        |
| <i>Neatypus obliquus</i>         | Footballer sweep             | Inhabit rocky reefs, to depths of up to 30 m                                                | Endemic to southern Australia (Flinders Island, SA to Shark Bay, WA)                            |
| <i>Notolabrus parilus</i>        | Brown-spotted wrasse         | Inhabit shallow algal-covered rocky reefs and seagrass beds, to depths of up to 20 m        | Endemic to southern Australia (Port Phillip, VIC to Dirk Hartog Island, WA)                     |
| <i>Olisthops cyanomelas</i>      | Herring cale                 | Inhabit rocky reefs and seagrass beds, to depths of up to 30 m                              | Temperate waters of southern Australia (Angourie Point, NSW to Houtman Abrolhos Islands, WA)    |
| <i>Omobranchus germaini</i>      | Germain's blenny             | Inhabit shallow reefs and tide pools, to depths of up to 3 m                                | Temperate to tropical waters across northern Australia (One Tree Island, QLD to Rockingham, WA) |
| <i>Ophthalmolepis lineolata</i>  | Southern maori wrasse        | Inhabit exposed rocky reefs, to depths of up to 60 m                                        | Endemic to southern Australia (Sunshine Coast, QLD to Houtman Abrolhos Islands, WA)             |

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| Name                                   |                        | Habitat*                                                                                                                   | Australian Distribution*                                                                                       |
|----------------------------------------|------------------------|----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| <i>Ostorhinchus cookii</i>             | Cook's cardinalfish    | Nocturnal, inhabiting rocky and coral reefs, to depths of up to 10 m                                                       | Temperate to tropical waters across northern Australia (Solitary Islands, NSW to Houtman Abrolhos Islands, WA) |
| <i>Ostorhinchus doederleini</i>        | Fourline cardinalfish  | Inhabit lagoons and reef slopes, to depths of up to 20 m                                                                   | Temperate to tropical waters across northern Australia (Sydney, NSW to Perth, WA)                              |
| <i>Ostorhinchus rueppellii</i>         | Western gobbleguts     | Inhabit estuaries, inshore reefs and weedy areas, to depths of up to 10 m                                                  | Temperate to tropical waters across north-western Australia (Torres Strait, QLD to Albany, WA)                 |
| <i>Othos dentex</i>                    | Harlequin fish         | Inhabit exposed reefs, drop-offs and caves, to depths of up to 30 m. Site-attached with relatively small home range        | Southern Australia (Port Phillip Bay, VIC to Houtman Abrolhos Islands, WA)                                     |
| <i>Pagrus auratus</i>                  | Snapper                | Inhabit bays, inlets (juveniles) and offshore rocky reefs (adults), to depths of up to 200 m. Exhibit strong site fidelity | Temperate to tropical waters Australia across southern Australia (Townsville, QLD to Cape Cuvier, WA)          |
| <i>Parablennius postoculomaculatus</i> | False Tasmanian blenny | Inhabit hard substrates in rocky regions and bays, including jetty pylons, to depths of up to 10 m                         | Endemic to WA (Two Peoples Bay to Muiron Islands)                                                              |
| <i>Parapercis haackei</i>              | Wavy grubfish          | Inhabit protected soft bottomed habitats near reefs, outcrops and jetties, to depths of up to 35 m                         | Endemic to south-western Australia (Kangaroo Island, SA to Shark Bay, WA)                                      |
| <i>Paraplesiops meleagris</i>          | Southern blue devil    | Inhabit reefs and drop-offs, to depths of up to 45 m                                                                       | Endemic to southern Australia (Port Phillip, VIC to Exmouth, WA)                                               |
| <i>Parapriacanthus elongatus</i>       | Elongate bullseye      | Inhabit rocky reefs and jetties, to depths of up to 60 m                                                                   | Endemic to southern Australia (Disaster Bay, NSW to Houtman Abrolhos Islands, WA)                              |
| <i>Parascyllium variolatum</i>         | Varied carpetshark     | Inhabit rocky reefs, seagrass beds and sandy areas, to depths of up to 180 m                                               | Endemic to southern Australia (East Sister Island, VIC to Dongara, WA)                                         |
| <i>Parma bicolor</i>                   | Bicolor scalyfin       | Inhabit rocky reefs, to depths of up to 40 m                                                                               | Temperate south-western WA (Recherche Archipelago to Rottnest Island)                                          |
| <i>Parma mccullochi</i>                | McCulloch's scalyfin   | Inhabit rocky reefs, to depths of up to 25 m                                                                               | Temperate south-western WA (Recherche Archipelago to Kalbarri)                                                 |
| <i>Parma occidentalis</i>              | Western scalyfin       | Inhabit rocky reefs, to depths of up to 15 m                                                                               | Temperate WA (Cape Leeuwin to Coral Bay)                                                                       |
| <i>Parupeneus chrysopleuron</i>        | Rosy goatfish          | Inhabit soft bottom habitats adjacent to reefs, to depths of up to 200 m                                                   | Temperate to tropical waters across western Australia                                                          |
| <i>Parupeneus spilurus</i>             | Blacksaddle goatfish   | Inhabit sandy habitats and rocky reefs, to depths of up to 80 m                                                            | Temperate to tropical waters Australia-wide                                                                    |
| <i>Pempheris klunzingeri</i>           | Rough bullseye         | Inhabit rocky reefs, to depths of up to 40 m                                                                               | Endemic to south-western Australia (Kangaroo Island, SA to Shark Bay, WA)                                      |
| <i>Pempheris multiradiata</i>          | Bigscale bullseye      | Inhabit rocky reefs, to depths of up to 70 m                                                                               | Temperate waters of southern Australia (Newcastle, NSW to Jurien Bay, WA)                                      |
| <i>Pictilabrus laticlavius</i>         | Senator wrasse         | Inhabit coastal reefs and algal beds, to depths of up to 40 m                                                              | Endemic to southern Australia (Byron Bay, NSW to Houtman Abrolhos Islands, WA)                                 |



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| Name                                 |                          | Habitat*                                                                                                              | Australian Distribution*                                                                                         |
|--------------------------------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| <i>Pictilabrus viridis</i>           | False senator wrasse     | Inhabit rocky reefs, to depths of up to 15 m                                                                          | Endemic to southern WA (Recherche Archipelago to Jurien Bay)                                                     |
| <i>Plagiotremus rhinorhynchus</i>    | Bluestriped fangblenny   | Inhabit coral and rocky reefs, to depths of up to 40 m                                                                | Temperate to tropical waters across northern Australia (southern NSW to Albany, WA)                              |
| <i>Plectorhinchus flavomaculatus</i> | Goldspotted sweetlips    | Inhabit sheltered reefs and lagoons, to depths of up to 25 m                                                          | Temperate to tropical waters across northern Australia (southern NSW to Perth, WA)                               |
| <i>Pomacentrus coelestis</i>         | Neon damsel              | Inhabit reefs and lagoons, to depths of up to 20 m                                                                    | Temperate to tropical waters across northern Australia (Merimbula, NSW to Rottnest Island, WA)                   |
| <i>Pomacentrus milleri</i>           | Miller's damsel          | Inhabit shallow inshore reefs, to depths of up to 6 m                                                                 | Temperate to tropical waters across northern Australia (Gulf of Carpentaria, QLD to Rottnest Island, WA)         |
| <i>Psammoperca waigiensis</i>        | Black sand bass          | Inhabit coral reefs and vegetated rocky reefs, to depths of up to 12 m                                                | Temperate to tropical waters across northern Australia (Moreton Bay, QLD to Busselton, WA)                       |
| <i>Pseudocaranx georgianus</i>       | Silver trevally          | Pelagic species. School over reefs and adjacent sandy areas. Juveniles more reef-associated. To depths of up to 240 m | Temperate southern Australia (north of Sydney, NSW to north of Perth, WA)                                        |
| <i>Pseudodax moluccanus</i>          | Chiseltooth wrasse       | Inhabit coral reefs, to depths of up to 60 m                                                                          | Temperate to tropical waters across northern Australia                                                           |
| <i>Pseudolabrus biserialis</i>       | Redband wrasse           | Inhabit macroalgal rocky reefs, to depths of up to 20 m                                                               | Temperate southern Australia (Port Lincoln, SA to Houtman Abrolhos Islands, WA)                                  |
| <i>Ptereleotris evides</i>           | Arrow dartgoby           | Inhabit outer reef slopes and lagoons, to depths of up to 15 m                                                        | Temperate to tropical waters across northern Australia (Sydney, NSW to Rottnest Island, WA)                      |
| <i>Rhabdosargus sarba</i>            | Tarwhine                 | Inhabit coastal waters, to depths of up to 60 m                                                                       | Temperate to tropical waters on Australia's east and west coasts                                                 |
| <i>Scarus ghobban</i>                | Bluebarred parrotfish    | Inhabit lagoon reefs and sandy areas, to depths of up to 30 m                                                         | Temperate to tropical waters across northern Australia (Jervis Bay, NSW to Rottnest Island, WA)                  |
| <i>Scarus prasiognathos</i>          | Greencheek parrotfish    | Inhabit reefs and lagoons, to depths of up to 25 m                                                                    | Temperate to tropical waters across northern Australia                                                           |
| <i>Scarus schlegeli</i>              | Schlegel's parrotfish    | Inhabit reefs and lagoons, to depths of up to 50 m                                                                    | Temperate to tropical waters across northern Australia (southern Great Barrier Reef, QLD to Rottnest Island, WA) |
| <i>Schuettea woodwardi</i>           | Western pomfred          | Inhabit rocky reefs, to depths of up to 30 m                                                                          | Endemic to southwestern Australia (Victor Harbor, SA to Shark Bay, WA)                                           |
| <i>Scobinichthys granulatus</i>      | Rough leatherjacket      | Inhabit seagrass beds, to depths of up to 30 m                                                                        | Temperate southern Australia (Maroochydore, QLD to Shark Bay, WA)                                                |
| <i>Scorpaena sumptuosa</i>           | Western red scorpionfish | Inhabit coastal reefs, to depths of up to 60 m                                                                        | Endemic to WA (Albany to North West Cape)                                                                        |
| <i>Scorpius aequipinnis</i>          | Sea sweep                | Inhabit rocky reefs, to depths of up to 25 m                                                                          | Endemic to southern Australia (Currarong, NSW to Shark Bay, WA)                                                  |

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| Name                             |                           | Habitat*                                                                                                                                         | Australian Distribution*                                                                                    |
|----------------------------------|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| <i>Scorpius georgiana</i>        | Banded sweep              | Inhabit rocky reefs, to depths of up to 35 m                                                                                                     | Temperate southern Australia (Kangaroo Island, SA to Kalbarri, WA)                                          |
| <i>Seriola lalandi</i>           | Yellowtail kingfish       | Pelagic/benthopelagic species. Inhabit reefs and adjacent sandy areas, rocky outcrops, bays and around jetties. Usually to depths of up to 50 m. | Temperate to subtropical waters across southern Australia (Capricorn Group, QLD to Shark Bay, WA)           |
| <i>Siganus fuscescens</i>        | Black rabbitfish          | Inhabit lagoons, rocky reefs and algal and seagrass flats, to depths of up to 50 m                                                               | Temperate to tropical waters across northern Australia (Nadgee, NSW to Busselton, WA)                       |
| <i>Sillaginodes punctatus</i>    | King George whiting       | Inhabit sandy habitats, algal areas and seagrass beds, to depths of up to 200 m                                                                  | Endemic to southern Australia (Sydney, NSW to north of Rottnest Island, WA)                                 |
| <i>Siphamia cephalotes</i>       | Wood's siphonfish         | Inhabit shallow coastal reefs and seagrass and algal beds, to depths of up to 30 m                                                               | Temperate to subtropical waters across southern Australia (Byron Bay, NSW to Exmouth Gulf, WA)              |
| <i>Siphonognathus attenuatus</i> | Slender weed whiting      | Inhabit rocky reefs and sandy areas adjacent to macroalgal and seagrass beds, to depths of up to 45 m                                            | Endemic to southern Australia (Cape Conran, VIC to Rottnest Island, WA)                                     |
| <i>Siphonognathus beddomei</i>   | Pencil weed whiting       | Inhabit kelp beds, to depths of up to 20 m                                                                                                       | Endemic to southern Australia (Gippsland Lakes region, VIC to Rottnest Island, WA)                          |
| <i>Siphonognathus caninis</i>    | Sharpnose weed whiting    | Inhabit rocky reefs and algal-covered areas, to depths of up to 35 m                                                                             | Endemic to southern Australia (Bass Strait, VIC to Port Denison, WA)                                        |
| <i>Siphonognathus radius</i>     | Long-rayed weed whiting   | Inhabit seagrass and macroalgal beds, to depths of up to 18 m                                                                                    | Endemic to southern Australia (Port Phillip, VIC to Green Head, WA)                                         |
| <i>Sphyaena obtusata</i>         | Striped barracuda         | Inhabit seagrass beds (juveniles), rocky reefs and bays, to depths of up to 200 m                                                                | Temperate to tropical waters across northern Australia.                                                     |
| <i>Spratelloides gracilis</i>    | Slender sprat             | Inhabit coastal reefs and lagoons, to depths of up to 40 m                                                                                       | Temperate to tropical waters across northern Australia.                                                     |
| <i>Stegastes lacrymatus</i>      | Whitespotted damselfish   | Inhabit coastal reefs and lagoons, to depths of up to 40 m                                                                                       | Temperate to tropical waters across northern Australia                                                      |
| <i>Stegastes obreptus</i>        | Western gregory           | Inhabit coastal reefs, to depths of up to 10 m                                                                                                   | Temperate to tropical waters across northern Australia (Bountiful Island, QLD to Rottnest Island, WA)       |
| <i>Stethojulis bandanensis</i>   | Redspot wrasse            | Inhabit reefs and lagoons, to depths of up to 30 m                                                                                               | Temperate to tropical waters across northern Australia (Merimbula, NSW to Rottnest Island, WA)              |
| <i>Stethojulis strigiventer</i>  | Silverstreak wrasse       | Inhabit seagrass beds, inner reefs and lagoons, to depths of up to 20 m                                                                          | Temperate to tropical waters across northern Australia                                                      |
| <i>Suezichthys cyanolaemus</i>   | Bluethroat rainbow wrasse | Inhabit seagrass beds adjacent to reefs and rubble areas, to depths of up to 40 m                                                                | Endemic to WA (Albany to Ningaloo Reef)                                                                     |
| <i>Sutorectus tentaculatus</i>   | Cobbler wobbegong         | Inhabit rocky and coral reefs, to depths of up to 35 m                                                                                           | Temperate to subtropical waters of southern Australia (Gulf St Vincent, SA to Houtman Abrolhos Islands, WA) |
| <i>Thalassoma lunare</i>         | Moon wrasse               | Inhabit reefs, to depths of up to 20 m                                                                                                           | Temperate to tropical waters across northern Australia                                                      |
| <i>Thalassoma lutescens</i>      | Green moon wrasse         | Inhabit reefs and lagoons, to depths of up to 30 m                                                                                               | Temperate to tropical waters on Australia's east and west coasts                                            |

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| Name                              |                      | Habitat*                                                                            | Australian Distribution*                                                            |
|-----------------------------------|----------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <i>Thalassoma septemfasciatum</i> | Sevenband wrasse     | Inhabit shallow coral, rocky and macroalgal reefs, to depths of up to 20 m          | Endemic to WA (Point Samson to Rottnest Island)                                     |
| <i>Tilodon sexfasciatus</i>       | Moonlighter          | Inhabit rocky reefs and areas around jetties, to depths of up to 30 m               | Endemic to southern Australia (Wilson's Promontory, VIC to Jurien Bay, WA)          |
| <i>Trachinops brauni</i>          | Bluelined hula fish  | Inhabit coastal reefs, to depths of up to 10 m                                      | Endemic to south-western WA                                                         |
| <i>Trachinops noarlungae</i>      | Yellowhead hula fish | Inhabit coastal reefs, to depths of up to 30 m                                      | Endemic to southern Australia (Gulf St Vincent, SA to Houtman Abrolhos Islands, WA) |
| <i>Trachurus novaezelandiae</i>   | Yellowtail scad      | Inhabit rocky reefs and shallow, soft bottom habitats, to depths up to 500 m        | Temperate to subtropical waters across southern Australia                           |
| <i>Trinorfolkia clarkei</i>       | Clark's threefin     | Inhabit coastal reefs and jetty pylons, to depths of up to 30 m                     | Endemic to southern Australia (Minnie Waters, NSW to Rottnest Island, WA)           |
| <i>Trygonoptera ovalis</i>        | Striped stingaree    | Inhabit seagrass beds and adjacent sandy areas, to depths up to 88 m                | Endemic to WA (Eucla to Houtman Abrolhos Islands)                                   |
| <i>Trygonoptera personata</i>     | Masked stingaree     | Inhabit sandy areas and seagrass beds, typically offshore, to depths of up to 115 m | Endemic to WA (Geographe Bay to Shark Bay)                                          |

\*Source: Atlas of Living Australia (2023); Fishes of Australia (2023); FishBase (Froese & Pauly, 2023)

## 2.6 Conclusions

A desktop study was conducted to identify and describe the seasonal presence of species protected under the Commonwealth EPBC Act and WA State BC Act that may be present in the vicinity of the proposed development.

26 listed syngnathid species (seahorses, seadragons, pipefishes, and pipehorses) may occur within a 5 km radius of the proposed development. These species are not listed as threatened under the EPBC and BC Acts but occupy diverse habitats including those found in Thomson Bay. Syngnathids are small, cryptic, and site-attached species that are likely to be present in the area year-round.

Three threatened shark species may occur within a 5 km radius of the proposed development. Scalloped hammerheads (EPBC Act listed conservation dependent) and white sharks (vulnerable) are typically seasonal and use the area for foraging and/or migration; however, may be present year-round. Scalloped hammerheads aggregate in the nearby Shoalwater Islands Marine Park, peaking during January and February. White sharks are more likely to be present in the Perth region during spring and early summer, and least likely to be present during late summer and autumn. The grey nurse shark (vulnerable) is known to congregate or aggregate in the area year-round.

10 listed marine mammal species may occur within a 5 km radius of the proposed development. Seasonal migration of whales along the WA coast includes the southern right whale (endangered; migration April to October), humpback whale (migration May to November), pygmy blue whale (endangered; migration April to January), and the minke whale (may be present over winter). Orcas may be present year-round but are more common on the south coast of WA between January and April. Other listed marine mammals that may be present year-round include the Australian sea lion (endangered), New Zealand fur seal, bottlenose dolphin, Indian ocean bottlenose dolphin, and the spinner dolphin.

Four listed marine reptile species may occur within a 5 km radius of the proposed development. Turtle species that may forage in the area include the loggerhead turtle (endangered), leatherback turtle (endangered), and green turtle (vulnerable). Turtles migrate to/from their nesting grounds in northern WA during summer (typically between November and March); however, their common distribution is north of the proposed development area. The yellow-bellied sea snake may be present year-round.

A second desktop study was conducted to identify non-conservation important fish species that have been recorded within the vicinity of the proposed development. 137 species of fish, sharks and rays were identified that may use habitats within Thomson Bay year-round. Most of these species are associated with hard substrate; however, several use seagrass meadows as nursery grounds (e.g., wrasse, barracuda, pike, herring and stingaree). As Thomson Bay has extensive seagrass meadows, these species may be more vulnerable to impacts from development activities.



### 3 DESCRIPTION OF BENTHIC HABITAT

The Rottneest Island Marine Reserve is characterised by a unique blend of tropical and temperate species and a diverse range of habitats and communities, including coral reef and extensive seagrass meadows. Protection of this unique environment is a strategic focus area for the RIA, with particular focus on seagrass meadows within Thomson Bay (RIA, 2014, 2020).

#### 3.1 Objectives

The main objective of the benthic marine habitat mapping scope was to review and update the benthic habitat assessment undertaken by RPS in 2019, including:

- Confirm the suitability of the Local Assessment Unit (LAU) defined by RPS (2019b) in assessment of benthic impacts from the proposed development, and its update if required.
- Confirm the suitability of benthic habitat mapping by Harvey (2009) and its suitability for LAU-scale estimates.
- Update the south Thomson Bay area benthic habitat map previously developed by RPS (2019b).
- Confirm estimates of benthic habitat loss due to the proposed development.
- Estimate cumulative loss of benthic habitat as a consequence of historic activities.

An additional objective of the study was to describe benthic habitat adjacent the area previously surveyed by RPS (2019b), extending to the shoreline in the vicinity of the main and fuel jetties.

#### 3.2 Methods

##### 3.2.1 Field surveys

Two surveys were completed for this scope – the main survey which replicated the survey by RPS 2019b, and a supplementary survey of adjacent benthic habitat (Figure 3-2).

The purpose of the main field survey was to describe the benthic habitat present at specific sites within an area of south Thomson Bay that encompassed the proposed development. This area, referred to as the 'Field Survey Area' (FSA) measured 2.6 x 1.0 kilometres and was the same as that surveyed by RPS (2019b; Appendix B). Data obtained from the survey were then used to ground-truth habitat identified in recent aerial images so as to develop a habitat map used to meet objectives described in Section 3.1.

The main field survey was completed between 0830 and 1630 hrs on the 24 November 2023. Weather was fine with light cloud cover with five knot northerly winds in the morning and 15 knot south-westerly winds in the afternoon. Water visibility was good, with detailed benthic habitat classification (i.e., distinguish between elements of the habitat) reliable to a depth of approximately five metres and general classification (i.e., identify dominant habitat) to approximately seven metres. Tides on the day were: low tide (0322 hrs/0.11 m) and high tide (1740 hrs/0.59 m). The survey was conducted using an RIA vessel skippered by an RIA Ranger who navigated to pre-determined survey sites within the FSA (Appendix B). These sites replicated those surveyed by RPS in 2019, except where habitat of specific interest for ground-truthing were identified in the aerial images. Note that survey activities near the main jetty were restricted by ferry and barge activities on the day.

At each site an RPS field scientist experienced in benthic habitat identification lowered a glass bottomed viewing tube into the water and made a point assessment of the habitat type vertically below the viewing location near the rear of the vessel. The assessment area was approximately two by two metres. Data recorded were percent cover of seagrass (to genus), macroalgae, bare substrate (sand or limestone reef/platform) and wrack (unattached macroalgal thalli and dead seagrass leaves) (Appendix C). Data were recorded by a second RPS field scientist along with the GPS position, time, and relevant notes. The initial eight sites were independently assessed through the viewing tube by each RPS scientist, and the results compared and discussed to ensure consistency between habitat identification and percent cover estimations (Appendix C). The survey conditions (water clarity, shallow depth, and low wind) allowed for clear viewing of the benthic habitat from the vessel.

Both scientists undertaking the two field surveys were experienced in marine benthic habitat surveys. For quality control purposes the description of habitat at specific locations was compared between scientists prior to and regularly during the survey (Appendix C).

The supplementary field survey was completed on the 29 January 2024 between 0830 and 1330 hrs. The objective of this field survey was to describe benthic habitat in the near-shore area west of the FSA where vessel moorings and jetties (including the main jetty) are located (Figure 3-2; referred to as the 'Main Jetty Survey Area'). The additional field survey area was assessed in the same way as the FSA. The tides on the day were: low tides (0623 hrs/ 0.56 m and 1554 hrs/ 0.75 m) and high tide (1330 hrs/ 0.76 m). Independent assessment of habitat at the first site was again undertaken by the two RPS field scientists for quality control purposes. Snorkelling was used for this purpose and for assessment of sites close to the shoreline which were too shallow to be accessed via the RIA vessel. The benthic assessment followed the same protocols as outlined above for the November 2023 survey.

### 3.2.2 Data processing

Sampling locations recorded during the field survey were downloaded into GIS and correlated with habitat classes. These classes were derived from percent cover of biota and bare substrate obtained during the field survey, as described in Section 3.2.1. A map of benthic communities and habitat was subsequently developed using methods described in Section 3.2.2.1.

#### 3.2.2.1 Habitat classification

The classification scheme used in the field component of this study was based on that developed for Seamap Australia (Butler et al., 2017). This is a dominance-based scheme, i.e., the classes are defined based on the dominant biota, or a mixture of one or more dominant species (Table 3-1). In this study the criterion for dominance is >50% cover. A mixed class is identified where the percentage cover of the two or more dominant classes are separated by  $\leq 30\%$  (relative to the percentage cover of the most dominant class). For example, a sampling location consisting of 25% macroalgae and 60% *Posidonia* spp., would be classed as *Posidonia*-dominated, whereas a location consisting of 40% macroalgae and 60% *Posidonia* spp., would be classed as mixed *Posidonia* / macroalgae habitat. The classification scheme was also designed to be compatible with the hierarchical scheme developed by Harvey (2009) for classifying marine benthic habitats of Rottnest Island, to enable extrapolation to broader spatial scales.

**Table 3-1: Classification scheme used in analysis of benthic habitat**

| Habitat Class               | Description                                                                                     |
|-----------------------------|-------------------------------------------------------------------------------------------------|
| Sand                        | 71 – 100% bare sand                                                                             |
| Sand with seagrass          | 20 - 50% seagrass                                                                               |
| Sand with wrack             | > 30% wrack (note: wrack present with other biota is not classified)                            |
| <i>Halophila</i> dominated  | > 50% <i>Halophila</i> (note: <i>Halophila</i> morphology allows for a high percentage of sand) |
| <i>Posidonia</i> dominated  | > 50% <i>Posidonia</i>                                                                          |
| <i>Amphibolis</i> dominated | > 50% <i>Amphibolis</i>                                                                         |
| Macroalgae dominated        | > 50% macroalgae                                                                                |
| Mixed seagrass              | % cover of dominant seagrasses separated by $\leq 30\%$                                         |
| Mixed algae / seagrass      | % cover of dominant seagrass/algae separated by $\leq 30\%$                                     |
| Limestone reef / pavement   | Limestone reef or platform with minor (< 30%) attached seagrass/macroalgae                      |

#### 3.2.2.2 Development of the benthic habitat map

Habitat mapping was undertaken using Esri's ArcGIS Pro to create a digitised image in vector shapefile format using select Landgate Web Map Service aerial photographs. For this purpose the February 2023 photograph was selected as the 'base map' due to its superior clarity of seabed features compared to other images available since August 2022 (Appendix D, Figure 3). Note that August would have been a preferred option for compatibility with the previous habitat mapping process by RPS (2019b), however whilst the August 2022 photograph provided good clarity of offshore seabed features compared to other recent aerial photographs the nearshore areas of this photograph were largely hidden by a plume (Appendix D, Figure 4). The August 2022 photograph nevertheless provided good comparison against the 'base map' for

identification of areas of wrack in these offshore areas (i.e., areas of dark seabed not common between the two images), so that these could be removed from the benthic habitat map, with other photographs used for comparison of nearshore areas. Noting also that the August 2023 aerial photograph was not available for initial mapping of the habitat within the FSA but subsequently became available for use during the mapping of habitat for the Main Jetty Survey Area. This photograph was therefore used to confirm the accuracy of the habitat map developed earlier for the FSA (Appendix D, Figure 5).

After completion of the habitat digitisation process and removal of wrack as described above, areas of habitat on the digitised image were classified into habitat classes (Table 3-1) using data from the RPS field surveys that was pooled where necessary to provide a more reliable description of habitat across the FSA. Note that isolated areas of habitat less than a few metres in diameter were generally too small for effective digitisation and mapping. It is also possible that minor errors in habitat description have been made due to limitations posed by photograph clarity, habitat complexity (for example mixing of wrack with live seagrass) and vessel/barge traffic near the main wharf (i.e., restricting site surveys). These are not expected to have meaningful effect on the results and conclusions, however.

### 3.3 Results and Discussion

#### 3.3.1 Review of the Local Assessment Unit and habitat mapping by Harvey (2009)

A local assessment unit (LAU) is a geographical area that establishes the spatial context for the calculation and assessment of recoverable impacts and cumulative losses. LAUs are location specific and should reflect local physical, ecological, administrative and jurisdictional considerations. There is no standard size or shape to a LAU, and they need to be defined on a situation-specific basis (EPA 2016). Guidance on LAU size by the EPA (2016) indicates that they are typically defined as a ten kilometre stretch of coastline extending five kilometres offshore (i.e., 50 km<sup>2</sup>), although other size LAUs will be considered if justified.

RPS (2019b) previously suggested that the most appropriate LAU for the proposed development in Thomson Bay is the area mapped by Harvey (2009) because this area:

- Comprises 2,746 ha of described habitat in which historic habitat loss from anthropogenic impacts have been estimated (Oceanica 2013; as explained further in RPS (2019b))
- Represents a complete island ecosystem
- Is consistent with EPA (2016) guidance on the size of an LAU.

Furthermore, there have been no further updates to the benthic habitat map of Rottnest Island by Harvey (2009; Figure 3-1). This map was developed using hyperspectral imagery obtained in 2004 and based on spectral signatures of the dominant habitat components. At the broadest scale, areas of bio-substrate were separated from bare substrates in the image with an overall accuracy of 95%, whereas at the finest scale, bare substrates and dominant species or genera were separated with an accuracy of 70% (Harvey 2009). In their comparison of benthic habitat modelling techniques, Davis (2011) concluded that the habitat modelling used by Harvey (2009) had the highest accuracy (84%; validated in field) and was able to identify small patches of habitats, providing additional technical review to support using the habitat map by Harvey (2009) to define the LAU for the proposed development.

In developing their habitat map, Harvey (2009), noted that a reason for the decrease in accuracy at the finer scale was the inherent spatial inaccuracy of the geo-location of both the image and the validation data collected in the field. Similarly, when comparing the benthic habitat map by Harvey (2009) to aerial images taken in August 2014/2018 and observations from the site visit, RPS (2019b) identified discrepancies in areas of seagrass and sand habitat, considered most likely to be due to fine-scale misclassification of habitats by Harvey (2009). In particular, RPS (2019b) observed that misclassification of mobile wrack as seagrass by Harvey (2009) would result in an overestimate of the amount of seagrass loss within the planned development footprint. Because of the potential for fine-scale misclassification of habitat, additional sites were added to the 2023 survey to further clarify high risk wrack accumulation areas, such as the shallows and habitat edges where misclassification is more likely, and supplementary observations were noted detailing when wrack was present, and if it occurred at the edge of a benthic habitat. This information assisted in the aerial footage comparisons (Section 3.3.2) to predict areas of benthic habitat and calculate benthic habitat losses more accurately.

The spatial scale of analysis is therefore critical in determining the accuracy of habitat maps - and in assessing the impacts associated with the proposed development. Table 3-2 highlights broad similarities

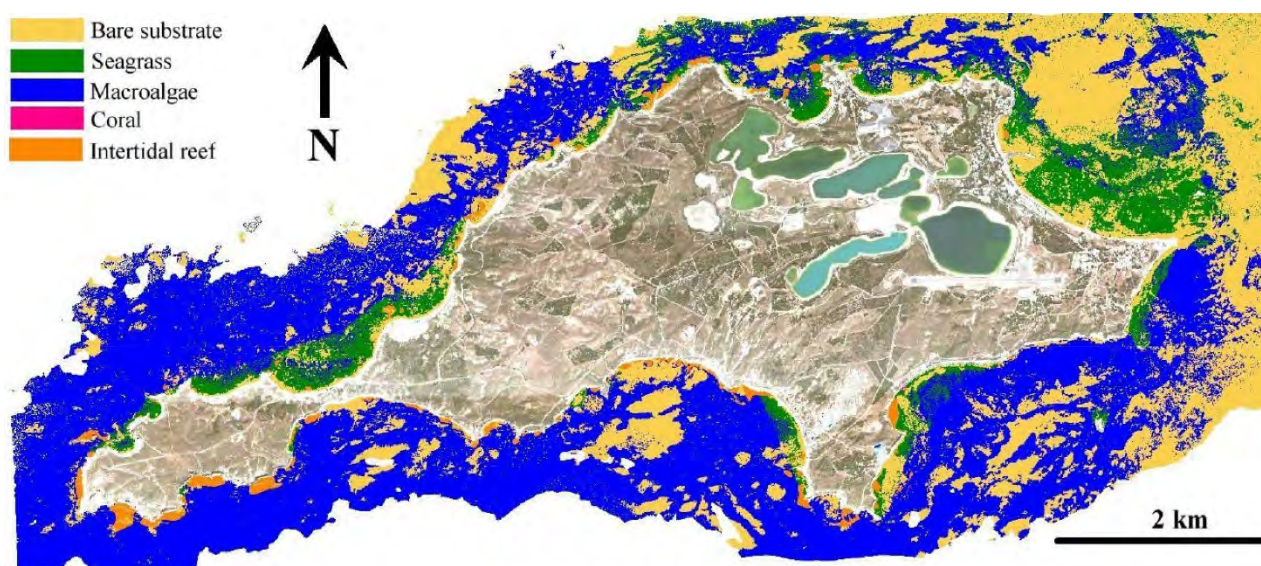


between the habitat map developed in 2019 and in this study for the FSA, and the Level 2 habitat map developed by Harvey (2009) for the same area. However, it also indicates that the map by Harvey (2009) underestimates the amount of seagrass in south Thomson Bay and overestimates the macroalgae dominated habitat, particularly in the area identified during the current study as comprising a mix of algae and seagrass (see Section 3.2). The map by Harvey (2009) also indicates more areas of sand than the current study. These findings remained true when comparing the Harvey (2009) habitat map to the 2023 survey. The two RPS surveys results (2019b and current) were more similar to each other than Harvey (2009), however there was an increase in macroalgae/ limestone pavement and an increase in seagrass and sand/ sand with wrack observed. These were relatively small differences though and may be accounted for with the alteration of site locations (and the additional sites) in the 2023 survey. Further, variation between images in the clarity of seabed features (e.g. Appendix D) is another source of discrepancy between habitat maps.

Based on the above and considering the guidance by EPA (2016) that the understanding of benthic communities and their habitats should be proportional to the scale of the proposed development, it is considered reasonable that the habitat map developed by Harvey (2009) is satisfactory for description of habitat within the LAU defined for the proposed development. However, because the Harvey (2009) map underestimates the amount of seagrass habitat within the FSA it is more appropriate to base assessment of seagrass habitat loss due to the proposed development on the habitat map developed during the current study (described in following sections).

**Table 3-2: Comparison of habitat area estimates within the FSA by RPS (2019 and current) and Harvey (2009), using habitat types described by Harvey (2009)**

| Harvey (2009) category  | RPS category                                     | Harvey (2009) hectares | RPS (2019) hectares | Difference (Harvey & RPS 2019) | RPS hectares (2023) | Difference (Harvey & RPS 2023) | Difference RPS 2019 & 2023 |
|-------------------------|--------------------------------------------------|------------------------|---------------------|--------------------------------|---------------------|--------------------------------|----------------------------|
| Macroalgae / intertidal | Limestone reef / pavement & Macroalgae dominated | 16.04                  | 7.09                | 8.95                           | 12.59               | 3.45                           | 5.5                        |
| Seagrass                | Mixed seagrass                                   | 91.69                  | 110.28              | -18.59                         | 108.10              | -16.41                         | -2.18                      |
| Sand                    | Sand / sand with wrack                           | 55.12                  | 46.09               | 9.03                           | 42.43               | 12.69                          | -3.66                      |
| Unclassified            | NA                                               | 0.56                   | NA                  | 0.56                           | NA                  | NA                             | NA                         |



**Figure 3-1: Habitat map of Rottnest Island by Harvey (2009)**



### 3.3.2 Development of a benthic habitat map within the FSA

A benthic habitat map is required for estimating historic habitat loss and predicting additional losses from planned developments (EPA, 2016). The benthic habitats of Rottnest Island were mapped by Harvey (2009) using a combination of *in situ* observation and aerial hyperspectral imagery. Benthic habitats were classified at four levels by Harvey (2009), where Level 2 identified seagrass, macroalgae, coral, intertidal reef, sand and unclassified (typically beach). Approximately 399 ha or 14.5 % of the total mapped area of Rottnest Island (2,746 ha) was classified as seagrass meadows, with 119 ha located within Thomson Bay.

The benthic habitat map developed by RPS in 2023 for assessment of the south Thomson Bay development shows the distribution of seagrass in the vicinity of the proposed development and more broadly across southern Thomson Bay (Figure 3-2, Figure 3-3). The relative cover of the different habitat types shown in Table 3-2 and Table 3-3 confirms the dominance of seagrass, in particular *Posidonia* spp. which comprise the priority ecological community *Posidonia australis* complex meadows (DBCA 2023a). 'Bare' sand habitat (15% of sites; approximately 26 % of the FSA) also occupies a substantial part of the FSA, followed by macroalgae dominated habitat/ limestone reef/pavement recorded at 13 % of the sampling sites and covering 8 % of the FSA. Areas of mobile wrack over sand that might otherwise have been classified as seagrass or other habitat were identified by comparison of the August 2022 and February 2023 aerial images. These areas can be seen as darker areas of sand in aerial photos (Appendix D) and are common across the FSA, particularly around habitat edges and along the shoreline as confirmed by in-field ground-truthing in 2023. Areas of wrack are also evidenced in Figure 3-2 by its accumulation into parallel lines visible on the aerial image (Appendix C).

The Harvey (2009) benthic habitat map shown in Figure 3-1 also indicates an area dominated by macroalgae in the southeast part of the FSA. This was verified by several of the survey locations and the habitat edges were confirmed using the February 2023 aerial image, which was particularly clear (Appendix D). Similarly, a broad area in the northern part of the FSA appears to comprise a mix of seagrass and algae that could not be clearly defined from the aerial images.

There were some notable differences in the percentage of habitat cover identified between the 2019 and 2023 surveys, in particular an 8 % decrease in the number of sites classified as "Sand with wrack" and an 8 % increase in "Macroalgae dominated" habitat classification. However, because the location of additional sites of interest differed between surveys a difference in habitat percentages recorded at sites is to be expected. Nevertheless, as shown in Table 3-2 these differences at the site level are not reflected in the broader benthic habitat classification. The proportion of the FSA that was classified as Seagrass dominated decreased by 2.18 % from 2019 to 2023, Macroalgae dominated increased by 5.5 % and Sand/Sand with Wrack decreased by 3.66 % indicating that the FSA benthic habitat has remained relatively stable since the 2019 survey.

**Table 3-3: Habitat class across sites in FSA and expressed as a percentage from the 2023 and 2019 surveys (RPS, 2019b) and the percentage difference between the two surveys.**

| Habitat class               | Number of sites (2023) | Percentage of total sites (2023) | Percentage of total sites (2019) | Percentage difference (2019 to 2023) |
|-----------------------------|------------------------|----------------------------------|----------------------------------|--------------------------------------|
| <i>Amphibolis</i> dominated | 8                      | 5%                               | 3%                               | +2%                                  |
| <i>Halophila</i> dominated  | 1                      | 1%                               | NA                               | +1                                   |
| Limestone reef / pavement   | 3                      | 2%                               | 4%                               | -2%                                  |
| Macroalgae dominated        | 17                     | 11%                              | 3%                               | +8%                                  |
| Mixed algae / seagrass      | 7                      | 4%                               | 2%                               | +2%                                  |
| Mixed seagrass              | 4                      | 3%                               | 6%                               | -3%                                  |
| <i>Posidonia</i> dominated  | 76                     | 48%                              | 54%                              | -6%                                  |
| Sand                        | 24                     | 15%                              | 14%                              | +1%                                  |
| Sand with seagrass          | 8                      | 5%                               | 2%                               | +3%                                  |
| Sand with wrack             | 9                      | 6%                               | 14%                              | -8%                                  |
| <b>Grand Total</b>          | <b>157</b>             | <b>100%</b>                      | <b>100%</b>                      |                                      |

### 3.3.3 Development of a benthic habitat map within the Main Jetty Survey Area

Thirty-two sites in a 10 ha area west of the FSA were assessed for the development of a benthic habitat map. The sites spanned the main ferry terminal and fuel jetty within Thomson Bay (Figure 3-2). *Posidonia* seagrass dominated 50 % of the survey sites and 57 % of the area (5.71 ha). The remaining sites and area were bare sand patches, and sand patches with wrack accumulations (4.27 ha; Figure 3-4, Table 3-4).

A significant amount of wrack was present along the shoreline and within the adjacent shallow waters (22 %, Table 3-4). There was a very low tide recorded the previous week (e.g., Friday 26 January 2024: low tide at 0632 hrs/0.46 m) and seagrass showed signs of stress (sunburn) including brown leaves with green (living) leaf near the thallus. There were also areas of live seagrass present underneath wrack e.g., *Posidonia* at site Extra 13 surrounded by wrack at sites Extra 11 and Extra 12 (Appendix B). Closer to the shoreline, small sand patches exist within the seagrass meadows (e.g., S13); however, the area of these sand patches was generally too small for effective digitisation and mapping (Appendix B). Observations near the ferry terminal (e.g., S10) were challenging due to high vessel traffic resuspending sediments and reducing water clarity. Visual confirmation of the edge of the seagrass meadow was attained near S11, and observations at site Extra 07 indicate there is not a substantial seagrass meadow located immediately south of the ferry terminal (Appendix B).

**Table 3-4: Habitat class across sites in the area west of the FSA and expressed as a percentage from the 2024 survey.**

| Habitat class               | Number of sites (2024) | Percentage of total sites (2024) |
|-----------------------------|------------------------|----------------------------------|
| <i>Amphibolis</i> dominated | 0                      | 0%                               |
| <i>Halophila</i> dominated  | 0                      | 0%                               |
| Limestone reef / pavement   | 0                      | 0%                               |
| Macroalgae dominated        | 0                      | 0%                               |
| Mixed algae / seagrass      | 0                      | 0%                               |
| Mixed seagrass              | 0                      | 0%                               |
| <i>Posidonia</i> dominated  | 16                     | 50%                              |
| Sand                        | 7                      | 22%                              |
| Sand with seagrass          | 2                      | 6%                               |
| Sand with wrack             | 7                      | 22%                              |
| <b>Grand Total</b>          | <b>32</b>              | <b>100%</b>                      |



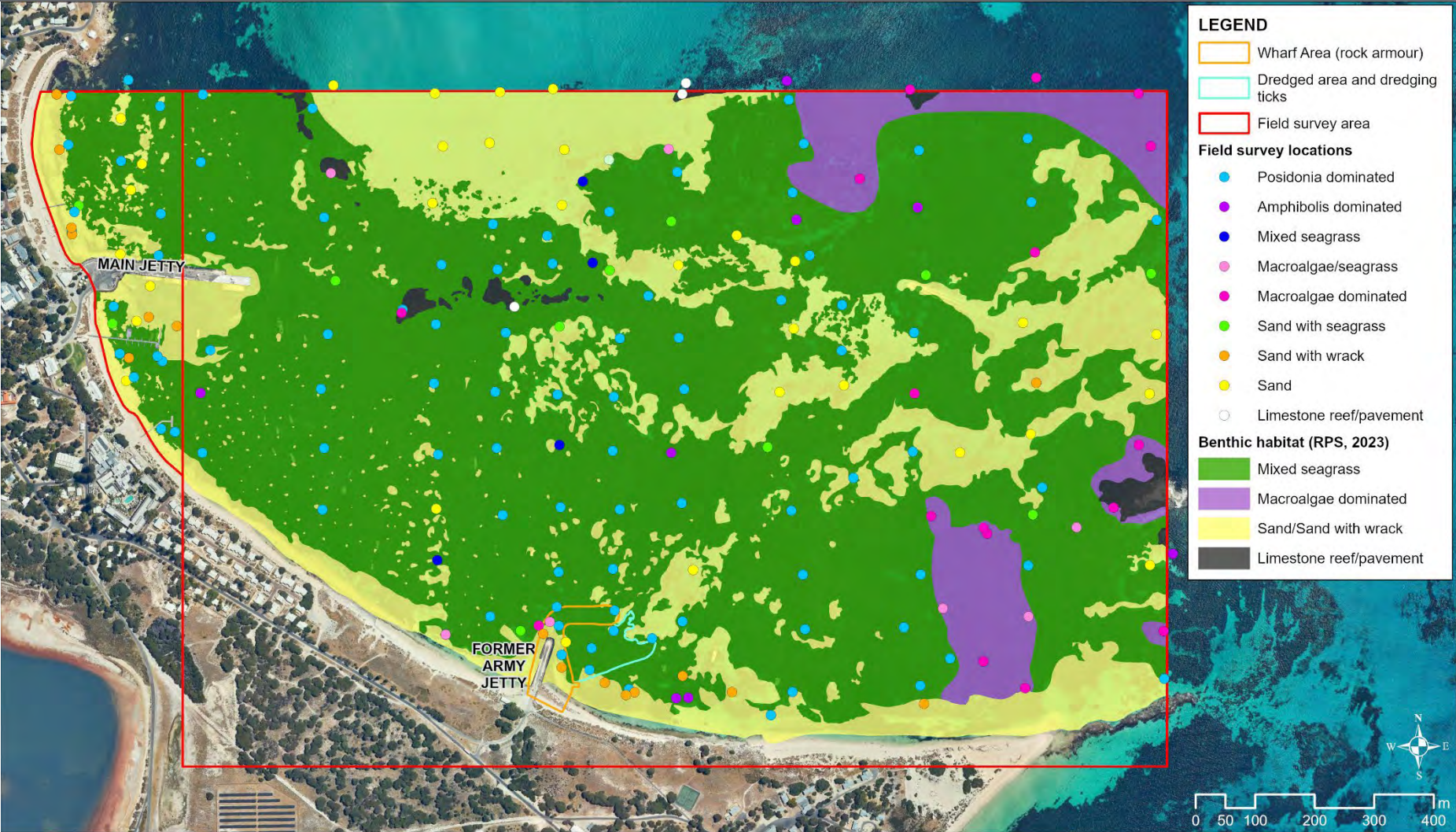


Figure 3-2: Benthic habitat map of the Field Survey Area and Main Jetty Survey Area within Thomson Bay, Rottne Island



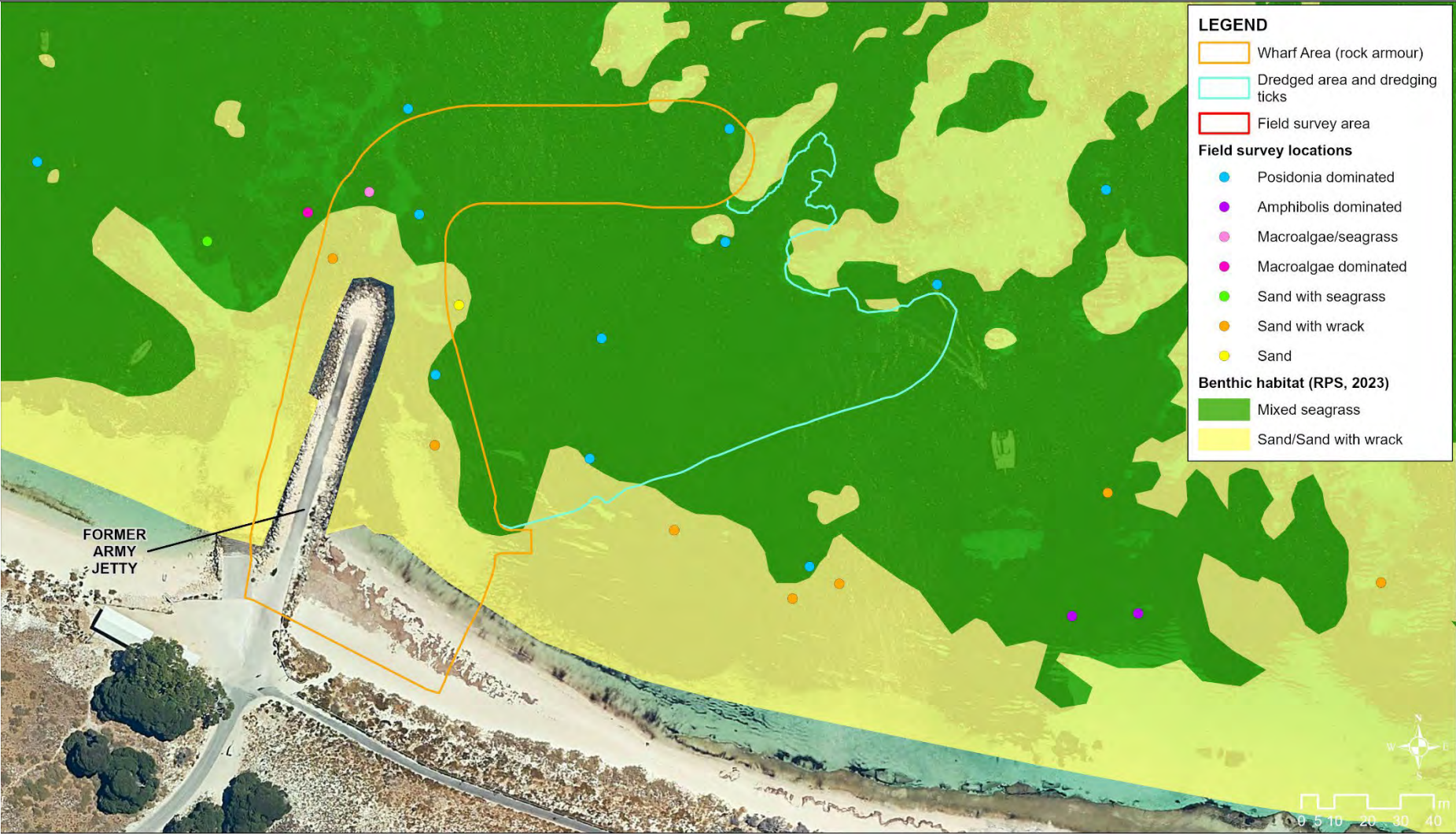


Figure 3-3: Detail of the benthic habitat map within the proposed development area





Figure 3-4: Benthic habitat map within the Main Jetty Survey Area, west of the FSA

### 3.3.4 Habitat loss due to the proposed development

Overlay of the proposed South Thomson Bay Maritime Facilities Redevelopment (Figure 1-1) on the benthic habitat map shown in Figure 3-2 indicates that installation of the wharf may result in the loss of 0.34 hectares (2,900 m<sup>2</sup>) of *Posidonia* dominated seagrass (Table 3-5). Associated dredging of seabed may result in the loss of a further 0.96 hectares (9,200 m<sup>2</sup>) of *Posidonia* dominated seagrass. As noted by the EPA (2016) assessment of direct impacts from activities such as dredging is relatively straightforward as these impacts are generally closely linked to the dredge area and immediate surrounding area. A five-metre buffer is notionally considered a reasonable estimate of the area surrounding the wharf and dredged area footprints that may be subject to events causing additional habitat loss, including localised erosion, slumping of dredged area walls and backwash. Addition of this buffer to the overall footprint (wharf and dredged areas combined) indicates that a total of 1.55 hectares (14,200 m<sup>2</sup>) of *Posidonia* dominated seagrass may be directly lost by the proposed development (Table 3-5). The only other habitat lost by construction of the proposed development would be sand or sand with wrack (Table 3-5).

**Table 3-5: Area of habitats within development-related footprints using data collected by RPS in 2023**

| Area                                                                                                | Habitat (hectares) |                      |                      |                         |
|-----------------------------------------------------------------------------------------------------|--------------------|----------------------|----------------------|-------------------------|
|                                                                                                     | Mixed seagrass     | Macroalgae dominated | Sand/Sand with wrack | Limestone reef/pavement |
| Field survey area                                                                                   | 108.10             | 10.80                | 42.43                | 1.79                    |
| Wharf area                                                                                          | 0.34               | 0                    | 0.18                 | 0                       |
| Dredged area                                                                                        | 0.96               | 0                    | 0.06                 | 0                       |
| Development footprint (wharf area plus dredged area)                                                | 1.30               | 0                    | 0.24                 | 0                       |
| Development footprint + 5 m buffer                                                                  | 1.55               | 0                    | 0.44                 | 0                       |
| Total habitat remaining (field survey area minus development footprint)                             | 106.80             | 10.80                | 42.19                | 1.79                    |
| Total habitat remaining inc. buffer (field survey area minus development footprint with 5 m buffer) | 106.55             | 10.80                | 41.99                | 1.79                    |

### 3.3.5 Cumulative habitat loss

Calculation of cumulative benthic habitat loss within a defined LAU requires estimates of the extent of benthic habitat (EPA, 2016):

- prior to all human-induced disturbance
- at the time of the proposed development
- remaining after the development is completed.

Oceanica (2013) provided estimates for the first two points above through calculations of historic benthic habitat loss within the defined LAU for Rottnest Island. These are reviewed below (Section 3.3.5.1). Preliminary estimates for the third point above (habitat loss due to the proposed development) are described in Section 3.3.5, with a combined calculation of cumulative benthic habitat (seagrass) loss described below.

#### 3.3.5.1 Historic benthic habitat loss

Oceanica (2013) estimated historic benthic habitat loss associated with vessel moorings (mooring scars) and jetties from a review of aerial imagery taken in March 2008. These estimates are only for seagrass because there was insufficient data for other habitat types such as coral and macroalgae, and because seagrass meadows typically occur within sheltered, shallow bays where this marine infrastructure is located. This is acceptable for the current study because seagrass is the key impacted habitat. The estimates by Oceanica (2013) did not consider other potential sources of anthropogenic stressors such as eutrophication, propeller scour and sedimentation, and assumed that areas of bare sand around marine infrastructure and moorings were previously 100% seagrass. The latter may result in an over-estimate of seagrass loss as some areas may have historically been bare sand (RPS, 2019b). Further, there appears to have been some recovery of cleared seagrass due to the change to environmentally friendly mooring designs which has allowed some



seagrass regrowth (Oceanica 2013). RPS (2019b) found evidence of both degradation and regrowth of seagrass habitat to the east and west of Main Jetty in Thomson Bay, respectively, and noted that regrowth may be associated with a change in the species composition of seagrass. The 2023 survey also noted potential seagrass regrowth in the northwest of the FSA (Plate 3-1). Ultimately, estimations of historic anthropogenic losses are inherently difficult due to a lack of reliable baseline data and lack of understanding of loss due to natural events such as storms and alongshore sediment transport (RPS, 2019b). A conservative approach is therefore taken in this report by not accounting for areas of regrowth.

In considering the above, the estimate of seagrass loss around Rottnest Island by Oceanica (2013) is acceptable for LAU-scale calculations. These estimates use the data by Harvey (2009) to estimate the 'current' extent of seagrass habitat as 398.70 hectares which, when combined with the amount lost due to human-induced disturbance (7.95 hectares) results in an estimated 406.65 hectares of seagrass habitat within the LAU prior to impacts due to human activities. This represents a 1.95% loss of seagrass habitat within the LAU prior to the proposed development.



**Plate 3-1:** Individual living *Posidonia* shoots (site number T10A) (left); accumulation of *Posidonia* wrack and new growth of seagrass at edge of *Posidonia* meadow (site number T10D) (right) in the northwest of the FSA

### 3.3.5.2 Increase in cumulative benthic habitat loss due to the proposed development

Based on calculations described in Section 3.3.4 the loss of seagrass habitat as a consequence of the proposed development (1.55 ha) represents a 1.22 % loss of this habitat from the FSA (Table 3-5). In terms of the broader LAU, the development (wharf and dredged areas plus five m buffer) may decrease the amount of seagrass habitat estimated to be within the LAU (398.7 ha) by a further 0.39 %, resulting in a cumulative (projected plus historical) loss of 2.34 % seagrass habitat across the LAU.

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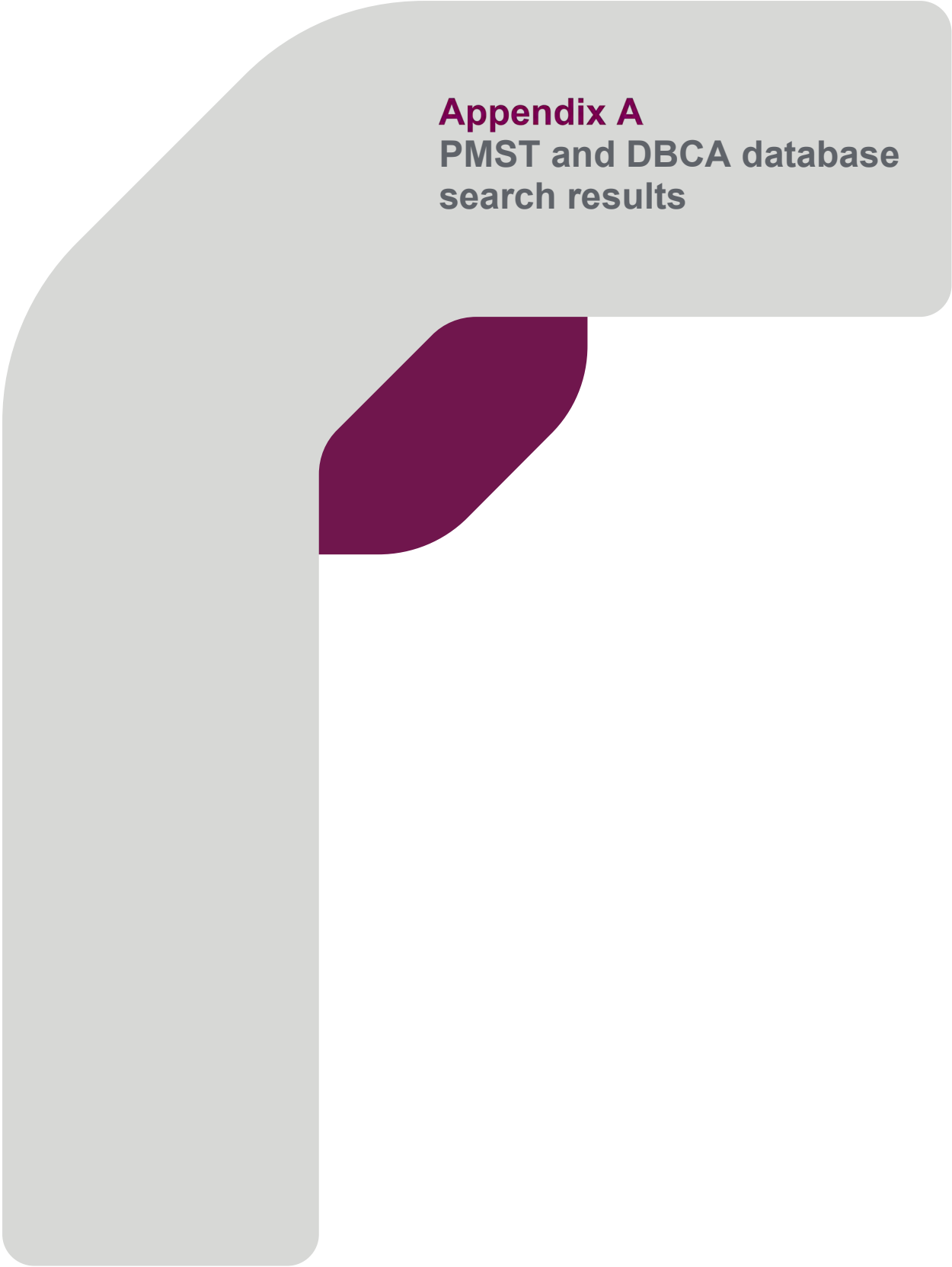
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## **Appendix A**

### **PMST and DBCA database search results**

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**Appendix Table 1: EPBC Act (PMST) and BC Act (DBCA database) listed threatened, marine or migratory marine species in the search radius around Thomson Bay**

| Name                                   |                                     | Conservation status              |                       |
|----------------------------------------|-------------------------------------|----------------------------------|-----------------------|
| Species                                | Common                              | EPBC Act                         | BC Act                |
| <b>Birds</b>                           |                                     |                                  |                       |
| <i>Limosa lapponica menzbieri</i>      | Northern Siberian bar-tailed godwit | Critically Endangered            | Not included          |
| <i>Calidris ferruginea</i>             | Curlew sandpiper                    | Critically Endangered, Migratory | Critically Endangered |
| <i>Calidris tenuirostris</i>           | Great knot                          | Critically Endangered, Migratory | Critically Endangered |
| <i>Numenius madagascariensis</i>       | Eastern curlew                      | Critically Endangered, Migratory | Not included          |
| <i>Rostratula Australis</i>            | Australian painted snipe            | Endangered                       | Not included          |
| <i>Calidris canutus</i>                | Red knot                            | Endangered, Migratory            | Endangered            |
| <i>Charadrius mongolus</i>             | Lesser sand plover                  | Endangered, Migratory            | Endangered            |
| <i>Diomedea amsterdamensis</i>         | Amsterdam albatross                 | Endangered, Migratory            | Not included          |
| <i>Diomedea dabbenena</i>              | Tristan albatross                   | Endangered, Migratory            | Not included          |
| <i>Diomedea sanfordi</i>               | Northern royal albatross            | Endangered, Migratory            | Not included          |
| <i>Macronectes giganteus</i>           | Southern giant-petrel               | Endangered, Migratory            | Not included          |
| <i>Thalassarche cauta</i>              | Shy albatross                       | Endangered, Migratory            | Not included          |
| <i>Anous tenuirostris melanops</i>     | Australian lesser noddy             | Vulnerable                       | Not included          |
| <i>Halobaena caerulea</i>              | Blue petrel                         | Vulnerable                       | Not included          |
| <i>Pachyptila turtur subantarctica</i> | Fairy prion (southern)              | Vulnerable                       | Not included          |
| <i>Pterodroma mollis</i>               | Soft-plumaged petrel                | Vulnerable                       | Not included          |
| <i>Sternula nereis</i>                 | Fairy tern                          | Vulnerable                       | Vulnerable            |
| <i>Sternula nereis nereis</i>          | Australian fairy tern               | Vulnerable                       | Vulnerable            |
| <i>Charadrius leschenaultii</i>        | Greater sand plover                 | Vulnerable, Migratory            | Vulnerable            |
| <i>Diomedea epomophora</i>             | Southern royal albatross            | Vulnerable, Migratory            | Not included          |
| <i>Diomedea exulans</i>                | Wandering albatross                 | Vulnerable, Migratory            | Vulnerable            |
| <i>Macronectes halli</i>               | Northern giant petrel               | Vulnerable, Migratory            | Not included          |
| <i>Phoebastria fusca</i>               | Sooty albatross                     | Vulnerable, Migratory            | Not included          |
| <i>Thalassarche carteri</i>            | Indian yellow-nosed albatross       | Vulnerable, Migratory            | Not included          |
| <i>Thalassarche impavida</i>           | Campbell albatross                  | Vulnerable, Migratory            | Not included          |
| <i>Thalassarche melanophris</i>        | Black-browed albatross              | Vulnerable, Migratory            | Not included          |
| <i>Thalassarche steadi</i>             | White-capped albatross              | Vulnerable, Migratory            | Not included          |
| <i>Anous stolidus</i>                  | Common noddy                        | Migratory                        | Migratory             |
| <i>Ardenna carneipes</i>               | Flesh-footed shearwater             | Migratory                        | Not included          |
| <i>Ardenna grisea</i>                  | Sooty shearwater                    | Migratory                        | Not included          |
| <i>Ardenna pacifica</i>                | Wedge-tailed shearwater             | Migratory                        | Migratory             |
| <i>Arenaria interpres</i>              | Ruddy turnstone                     | Migratory                        | Migratory             |
| <i>Calidris acuminata</i>              | Sharp-tailed sandpiper              | Migratory                        | Migratory             |
| <i>Calidris alba</i>                   | Sanderling                          | Migratory                        | Migratory             |
| <i>Calidris melanotos</i>              | Pectoral sandpiper                  | Migratory                        | Migratory             |
| <i>Calidris ruficollis</i>             | Red-necked stint                    | Migratory                        | Migratory             |
| <i>Hydroprogne caspia</i>              | Caspian tern                        | Migratory                        | Migratory             |
| <i>Limosa lapponica</i>                | Bar-tailed godwit                   | Migratory                        | Migratory             |

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|                                                                        |                                    |                        |                       |
|------------------------------------------------------------------------|------------------------------------|------------------------|-----------------------|
| <i>Numenius phaeopus</i>                                               | Whimbrel                           | Migratory              | Migratory             |
| <i>Onychoprion anaethetus</i>                                          | Bridled tern                       | Migratory              | Not included          |
| <i>Phaethon rubricauda</i>                                             | Red-tailed tropicbird              | Migratory              | Priority 4, Migratory |
| <i>Phalaropus lobatus</i>                                              | Red-necked phalarope               | Migratory              | Migratory             |
| <i>Pluvialis fulva</i>                                                 | Pacific golden plover              | Migratory              | Migratory             |
| <i>Pluvialis squatarola</i>                                            | Grey plover                        | Migratory              | Migratory             |
| <i>Sterna dougallii</i>                                                | Roseate tern                       | Migratory              | Migratory             |
| <i>Thalasseus bergii</i> as <i>Sterna bergii</i>                       | Crested tern, Greater crested tern | Migratory              | Migratory             |
| <i>Tringa nebularia</i>                                                | Common greenshank                  | Migratory              | Migratory             |
| <i>Tringa stagnatilis</i>                                              | Marsh sandpiper                    | Migratory              | Migratory             |
| <i>Actitis hypoleucos</i>                                              | Common sandpiper                   | Listed                 | Not included          |
| <i>Charadrius bicinctus</i>                                            | Double-banded plover               | Listed                 | Not included          |
| <i>Charadrius ruficapillus</i>                                         | Red-capped plover                  | Listed                 | Not included          |
| <i>Chroicocephalus novaehollandiae</i> as <i>Larus novaehollandiae</i> | Silver gull                        | Listed                 | Not included          |
| <i>Eudyptula minor</i>                                                 | Little penguin                     | Listed                 | Not included          |
| <i>Gallinago megala</i>                                                | Swinhoe's snipe                    | Listed                 | Not included          |
| <i>Gallinago stenura</i>                                               | Pin-tailed snipe                   | Listed                 | Not included          |
| <i>Haliaeetus leucogaster</i>                                          | White-bellied sea-eagle            | Listed                 | Not included          |
| <i>Halobaena caerulea</i>                                              | Pied stilt                         | Listed                 | Not included          |
| <i>Larus pacificus</i>                                                 | Pacific gull                       | Listed                 | Not included          |
| <i>Limosa limosa</i>                                                   | Black-tailed godwit                | Listed                 | Not included          |
| <i>Motacilla cinerea</i>                                               | Grey wagtail                       | Listed                 | Not included          |
| <i>Numenius minutus</i>                                                | Little curlew                      | Listed                 | Not included          |
| <i>Onychoprion fuscatus</i> as <i>Sterna fuscata</i>                   | Sooty tern                         | Listed                 | Not included          |
| <i>Pachyptila turtur</i>                                               | Fairy prion                        | Listed                 | Not included          |
| <i>Pandion haliaetus</i>                                               | Osprey                             | Listed                 | Not included          |
| <i>Puffinus assimilis</i>                                              | Little shearwater                  | Listed                 | Not included          |
| <i>Recurvirostra novaehollandiae</i>                                   | Red-necked avocet                  | Listed                 | Not included          |
| <i>Stercorarius antarcticus</i> as <i>Catharacta skua</i>              | Brown suka                         | Listed                 | Not included          |
| <i>Thinornis cucullatus</i>                                            | Hooded plover                      | Listed                 | Priority 4            |
| <i>Tringa brevipes</i> as <i>Heteroscelus brevipes</i>                 | Grey-tailed tattler                | Listed                 | Not included          |
| <i>Tringa totanus</i>                                                  | Common redshank                    | Listed                 | Not included          |
| <i>Xenus cinereus</i>                                                  | Terek sandpiper                    | Listed                 | Not included          |
| <i>Apus pacificus</i>                                                  | Fork-tailed swift                  | Not included           | Migratory             |
| <i>Charadrius dubius</i>                                               | Little ringed plover               | Not included           | Migratory             |
| <b>Fish</b>                                                            |                                    |                        |                       |
| <i>Thunnus maccoyii</i>                                                | Southern bluefin tuna              | Conservation Dependent | Not included          |
| <i>Mobula alfredi</i> as <i>Manta alfredi</i>                          | Reef manta ray                     | Migratory              | Not included          |
| <i>Mobula birostris</i> as <i>Manta birostris</i>                      | Giant manta ray                    | Migratory              | Not included          |
| <i>Acentronura australe</i>                                            | Southern pygmy pipehorse           | Listed                 | Not included          |
| <i>Campichthys galei</i>                                               | Gale's pipefish                    | Listed                 | Not included          |
| <i>Choeroichthys suillus</i>                                           | Pig-snouted pipefish               | Listed                 | Not included          |
| <i>Halicampus brocki</i>                                               | Brock's pipefish                   | Listed                 | Not included          |

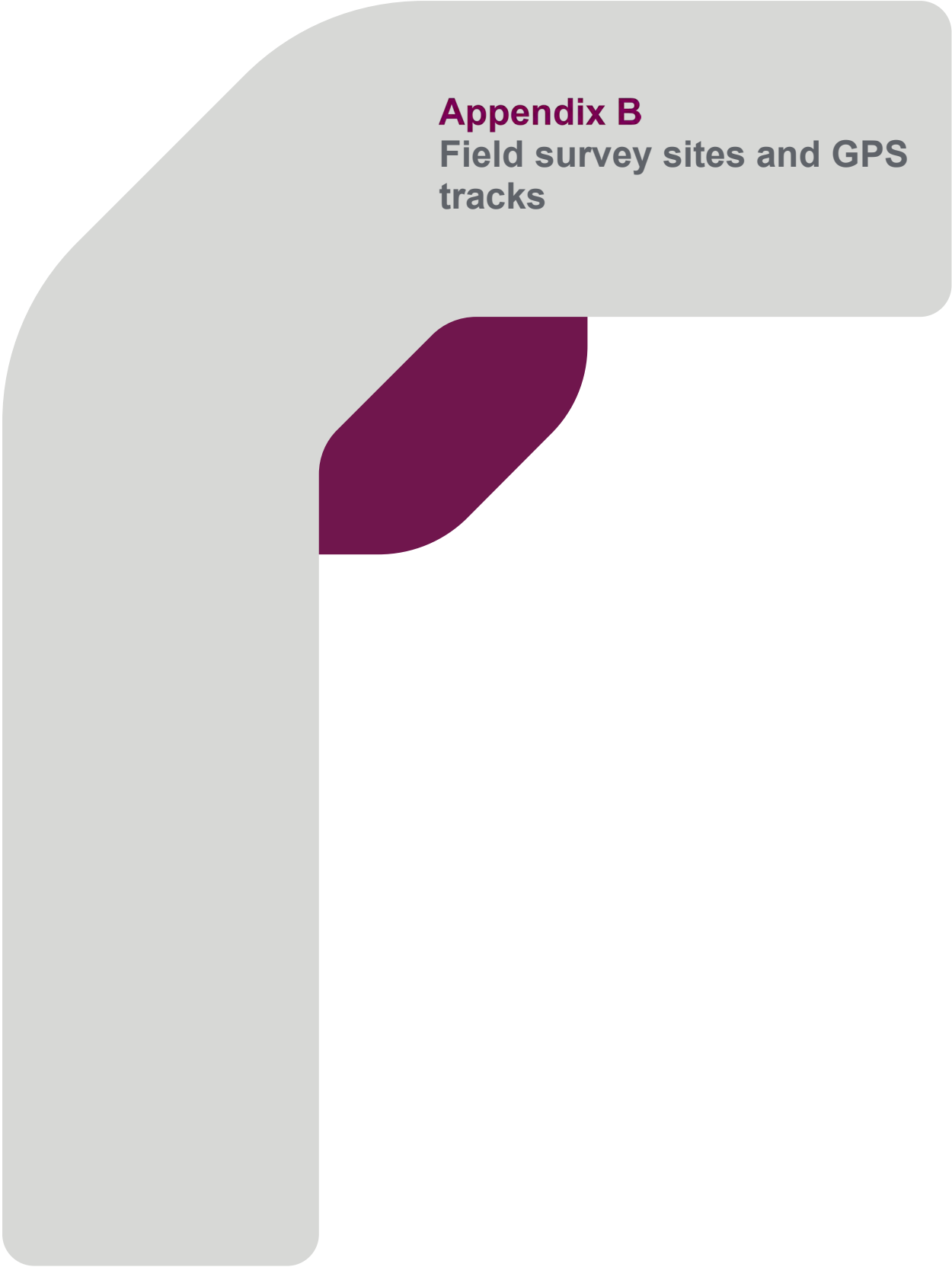


## REPORT

|                                                                  |                                          |                        |                                   |
|------------------------------------------------------------------|------------------------------------------|------------------------|-----------------------------------|
| <i>Heraldia nocturna</i>                                         | Upside-down pipefish                     | Listed                 | Not included                      |
| <i>Hippocampus angustus</i>                                      | Western spiny seahorse                   | Listed                 | Not included                      |
| <i>Hippocampus breviceps</i>                                     | Short-head seahorse                      | Listed                 | Not included                      |
| <i>Hippocampus subelongatus</i>                                  | West Australian seahorse                 | Listed                 | Not included                      |
| <i>Histiogamphelus cristatus</i>                                 | Rhino pipefish                           | Listed                 | Not included                      |
| <i>Lissocampus caudalis</i>                                      | Australian smooth pipefish               | Listed                 | Not included                      |
| <i>Lissocampus fatiloquus</i>                                    | Prophet's pipefish                       | Listed                 | Not included                      |
| <i>Lissocampus runa</i>                                          | Javelin pipefish                         | Listed                 | Not included                      |
| <i>Maroubra perserrata</i>                                       | Sawtooth pipefish                        | Listed                 | Not included                      |
| <i>Mitotichthys meraculus</i>                                    | Western crested pipefish                 | Listed                 | Not included                      |
| <i>Nannocampus subosseus</i>                                     | Bonyhead pipefish                        | Listed                 | Not included                      |
| <i>Phycodurus eques</i>                                          | Leafy seadragon                          | Listed                 | Not included                      |
| <i>Phyllopteryx taeniolatus</i>                                  | Common seadragon                         | Listed                 | Not included                      |
| <i>Pugnaso curtirostris</i>                                      | Pugnose pipefish                         | Listed                 | Not included                      |
| <i>Solegnathus lettiensis</i>                                    | Gunther's pipefish                       | Listed                 | Not included                      |
| <i>Stigmatopora argus</i>                                        | Spotted pipefish                         | Listed                 | Not included                      |
| <i>Stigmatopora nigra</i>                                        | Widebody pipefish                        | Listed                 | Not included                      |
| <i>Syngnathoides biaculeatus</i>                                 | Double-end pipefish                      | Listed                 | Not included                      |
| <i>Urocampus carinirostris</i>                                   | Hairy pipefish                           | Listed                 | Not included                      |
| <i>Vanacampus margaritifer</i>                                   | Mother-of-pearl pipefish                 | Listed                 | Not included                      |
| <i>Vanacampus phillipi</i>                                       | Port Phillip pipefish                    | Listed                 | Not included                      |
| <i>Vanacampus poecilolaemus</i>                                  | Longsnout pipefish                       | Listed                 | Not included                      |
| <b>Sharks</b>                                                    |                                          |                        |                                   |
| <i>Galeorhinus galeus</i>                                        | School shark                             | Conservation Dependent | Not included                      |
| <i>Sphyrna lewini</i>                                            | Scalloped hammerhead                     | Conservation Dependent | Not included                      |
| <i>Carcharias taurus</i> (west coast population)                 | Grey nurse shark (west coast population) | Vulnerable             | Not included                      |
| <i>Carcharodon carcharias</i>                                    | White shark                              | Vulnerable, Migratory  | Vulnerable                        |
| <i>Pristis pristis</i>                                           | Freshwater sawfish                       | Vulnerable, Migratory  | Not included                      |
| <i>Rhincodon typus</i>                                           | Whale shark                              | Vulnerable, Migratory  | Not included                      |
| <i>Carcharhinus longimanus</i>                                   | Oceanic whitetip shark                   | Migratory              | Not included                      |
| <i>Lamna nasus</i>                                               | Porbeagle, Mackerel shark                | Migratory              | Not included                      |
| <b>Mammals</b>                                                   |                                          |                        |                                   |
| <i>Neophoca cinerea</i>                                          | Australian sea lion                      | Endangered             | Endangered                        |
| <i>Balaenoptera musculus</i>                                     | Blue whale                               | Endangered, Migratory  | Endangered, Migratory             |
| <i>Eubalaena Australis</i> as <i>Balaena glacialis Australis</i> | Southern right whale                     | Endangered, Migratory  | Vulnerable                        |
| <i>Balaenoptera musculus brevicauda</i>                          | Pygmy blue whale                         | Endangered             | Not included                      |
| <i>Balaenoptera edeni</i>                                        | Bryde's whale                            | Migratory              | Not included                      |
| <i>Caperea marginata</i>                                         | Pygmy right whale                        | Migratory              | Not included                      |
| <i>Megaptera novaeangliae</i>                                    | Humpback whale                           | Migratory              | Conservation Dependent, Migratory |
| <i>Orcinus orca</i>                                              | Killer whale, Orca                       | Migratory              | Not included                      |
| <i>Arctocephalus forsteri</i>                                    | New Zealand fur seal                     | Listed                 | Other Specially Protected         |
| <i>Balaenoptera acutorostrata</i>                                | Minke whale                              | Listed                 | Not included                      |
| <i>Delphinus delphis</i>                                         | Common dolphin                           | Listed                 | Not included                      |
| <i>Grampus griseus</i>                                           | Risso's dolphin                          | Listed                 | Not included                      |

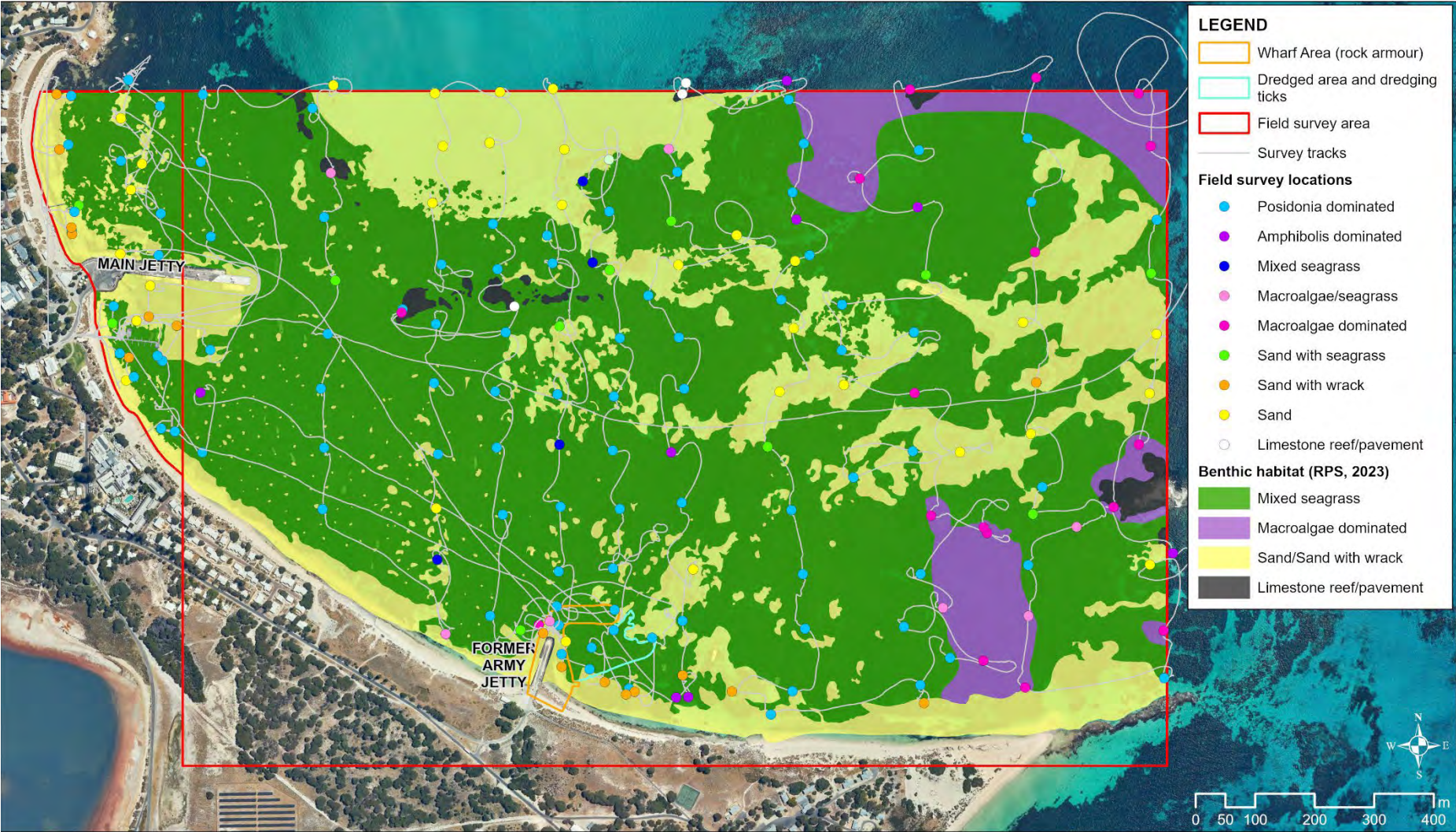
## REPORT

|                                   |                                 |                       |                       |
|-----------------------------------|---------------------------------|-----------------------|-----------------------|
| <i>Stenella attenuata</i>         | Spotted dolphin                 | Listed                | Not included          |
| <i>Tursiops aduncus</i>           | Indian ocean bottlenose dolphin | Listed                | Not included          |
| <i>Tursiops truncatus s. str.</i> | Bottlenose dolphin              | Listed                | Not included          |
| <i>Stenella longirostris</i>      | Spinner dolphin                 | Not included          | Priority 4, Migratory |
| <b>Reptiles</b>                   |                                 |                       |                       |
| <i>Caretta caretta</i>            | Loggerhead turtle               | Endangered, Migratory | Not included          |
| <i>Dermochelys coriacea</i>       | Leatherback turtle              | Endangered, Migratory | Vulnerable            |
| <i>Chelonia mydas</i>             | Green turtle                    | Vulnerable, Migratory | Vulnerable            |
| <i>Natator depressus</i>          | Flatback turtle                 | Vulnerable, Migratory | Not included          |
| <i>Aipysurus pooleorum</i>        | Shark Bay seasnake              | Listed                | Not included          |
| <i>Disteira kingii</i>            | Spectacled seasnake             | Listed                | Not included          |
| <i>Pelamis platurus</i>           | Yellow-bellied seasnake         | Listed                | Not included          |



## **Appendix B**

### **Field survey sites and GPS tracks**

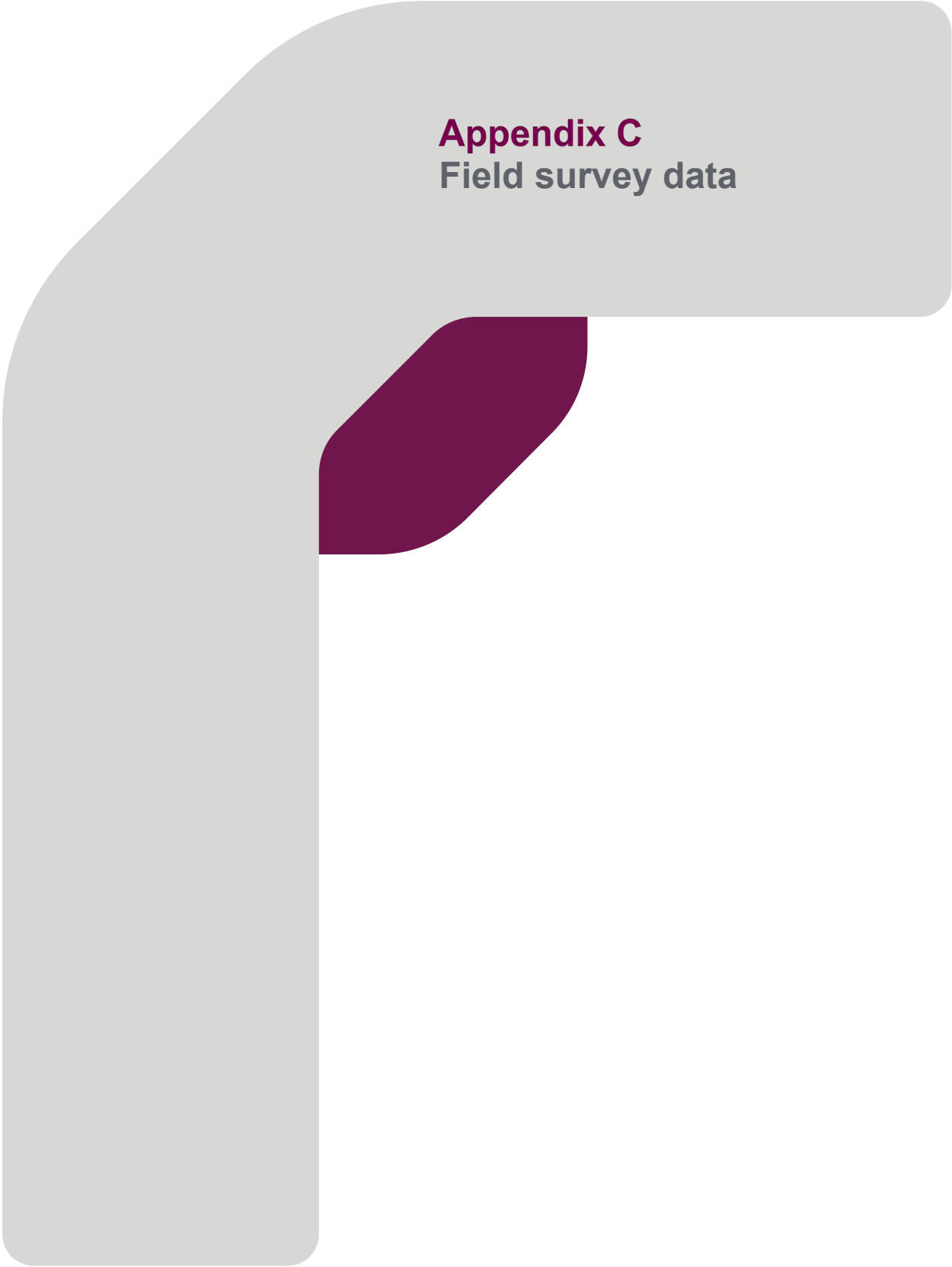


Appendix Figure 1: Field survey sites and GPS tracks within the two survey areas





Appendix Figure 2: Field survey sites within the Main Jetty Survey Area west of the FSA



## Appendix C

### Field survey data

## REPORT

**Appendix Table 2: Field survey data 24th November 2023 (FSA)**

| Site ID | Wpt  | Lat          | Long       | Time | Depth (m) | Observer | Benthic Habitat Description                                                                                                          | Notes                                  | Classification         |
|---------|------|--------------|------------|------|-----------|----------|--------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|------------------------|
| T11C    | 1671 | -31.99674499 | 115.543965 | 8:56 | 2.9       | JB/RM    | JB - 80% Posidonia australis, 20% Sargassum<br>RM - 80% Posidonia australis, 20% Sargassum                                           | QAQC check                             | Posidonia dominated    |
| T11D    | 1672 | -31.99502897 | 115.544003 | 9:07 | 1.4       | JB/RM    | JB - 100% Posidonia sinuosa<br>RM - 100% Posidonia sinuosa                                                                           | QAQC                                   | Posidonia dominated    |
| T11E    | 1673 | -31.99389397 | 115.54384  | 9:12 | 1.4       | JB/RM    | JB - 100% Posidonia sinuosa<br>RM - 100% Posidonia sinuosa                                                                           | QAQC                                   | Posidonia dominated    |
| T11F    | 1674 | -31.99287096 | 115.543895 | 9:15 | 1.7       | JB/RM    | JB - 90% Posidonia sinuosa, 10% Sargassum<br>RM - 90% Posidonia sinuosa, 10% Sargassum                                               | QAQC                                   | Posidonia dominated    |
| T10A    | 1675 | -31.99275898 | 115.546217 | 9:20 | 2.7       | JB/RM    | JB - 100% sand<br>RM - 100% sand                                                                                                     | QAQC<br>Individual shoots of Posidonia | Sand                   |
| S01     | 1676 | -31.99310197 | 115.545841 | 9:24 | 3.3       | JB/RM    | JB - 100% Posidonia sinuosa<br>RM - 100% Posidonia sinuosa                                                                           | QAQC<br>No visible wrack               | Posidonia dominated    |
| T10B    | 1677 | -31.99408801 | 115.546151 | 9:27 | 2.6       | JB/RM    | JB - 40% limestone, 40% Posidonia sinuosa, 20% Sargassum<br>RM - 40% limestone, 40% Posidonia sinuosa, 20% Sargassum                 | QAQC<br>Drifted for photo              | Mixed algae / seagrass |
| T10C    | 1678 | -31.99475798 | 115.546023 | 9:30 | 2.1       | JB/RM    | JB - 100% Posidonia sinuosa<br>RM - 100% Posidonia sinuosa                                                                           | QAQC                                   | Posidonia dominated    |
| T10D    | 1679 | -31.99571997 | 115.54621  | 9:34 | 2.5       | JB/RM    | JB - 20% Posidonia sinuosa, 20% wrack, 10% brown algae, 50% sand<br>RM - 20% Posidonia sinuosa, 20% wrack, 10% brown algae, 50% sand | QAQC                                   | Sand with seagrass     |
| T10E    | 1680 | -31.99652798 | 115.546061 | 9:39 | 2.1       | RM       | 95% Posidonia sinuosa, 5% Brown algae                                                                                                |                                        | Posidonia dominated    |
| T10F    | 1681 | -31.99735503 | 115.545924 | 9:41 | 2.5       | JB       | 100% Posidonia sinuosa                                                                                                               |                                        | Posidonia dominated    |

## REPORT

|      |      |              |            |       |     |    |                                                                                  |                                                                                                                      |                        |
|------|------|--------------|------------|-------|-----|----|----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------|------------------------|
| T10G | 1682 | -31.99825298 | 115.545968 | 9:43  | 2   | JB | 20% Amphibolis, 80% Posidonia sinuosa                                            |                                                                                                                      | Posidonia dominated    |
| T10H | 1683 | -31.99918396 | 115.545924 | 9:46  | 1.6 | RM | 20% sand, 80% Posidonia sinuosa                                                  |                                                                                                                      | Posidonia dominated    |
| T9A  | 1684 | -32.00110199 | 115.548084 | 9:50  | 1.7 | RM | 20% sand, 30% wrack, 30% Posidonia australis, 20% brown algae (likely Sargassum) |                                                                                                                      | Mixed algae / seagrass |
| T9B  | 1685 | -31.99997404 | 115.547952 | 9:54  | 2.3 | RM | 50% Posidonia australis/sinuosa, 20% Amphibolis, 20% sand, 10% brown algae       | Photo reassessed.<br>In field estimation: 30% Posidonia australis/sinuosa, 20% Amphibolis, 30% sand, 20% brown algae | Mixed seagrass         |
| T9C  | 1686 | -31.99919502 | 115.547946 | 9:57  | 2.6 | RM | 98% sand, 2% wrack                                                               |                                                                                                                      | Sand                   |
| T9D  | 1687 | -31.99837402 | 115.547992 | 9:59  | 2.7 | RM | 100% Posidonia sinuosa                                                           |                                                                                                                      | Posidonia dominated    |
| T9E  | 1688 | -31.99729401 | 115.547939 | 10:01 | 2.5 | JB | 100% Posidonia sinuosa                                                           |                                                                                                                      | Posidonia dominated    |
| T9F  | 1689 | -31.99639899 | 115.547983 | 10:03 | 2.8 | JB | 100% Posidonia sinuosa                                                           | Near reef                                                                                                            | Posidonia dominated    |
| T9G  | 1690 | -31.99549701 | 115.548096 | 10:07 | 3.8 | JB | 100% Posidonia sinuosa                                                           | Only 2 photos                                                                                                        | Posidonia dominated    |
| T9H  | 1691 | -31.99456402 | 115.547953 | 10:11 | 4.3 | JB | 100% sand                                                                        |                                                                                                                      | Sand                   |
| T9I  | 1692 | -31.99370404 | 115.548152 | 10:12 | 4.4 | RM | 100% sand                                                                        |                                                                                                                      | Sand                   |
| T9J  | 1693 | -31.99290097 | 115.548021 | 10:13 | 3   | JB | 100% sand                                                                        |                                                                                                                      | Sand                   |
| T1J  | 1694 | -31.99289502 | 115.549179 | 10:15 | 3.3 | RM | 100% sand                                                                        |                                                                                                                      | Sand                   |



## REPORT

|       |      |              |            |       |     |    |                                                                     |                                                                                                        |                           |
|-------|------|--------------|------------|-------|-----|----|---------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|---------------------------|
| T1I   | 1695 | -31.99366297 | 115.548982 | 10:17 | 4.7 | JB | 100% sand                                                           |                                                                                                        | Sand                      |
| T1H   | 1696 | -31.99489502 | 115.549022 | 10:20 | 4.1 | JB | 70% Posidonia sinuosa/australis, 30% brown algae                    |                                                                                                        | Posidonia dominated       |
| T1G   | 1697 | -31.995581   | 115.549095 | 10:23 | 4.1 | JB | 100% Posidonia sinuosa                                              |                                                                                                        | Posidonia dominated       |
| S02   | 1698 | -31.99614996 | 115.549387 | 10:25 | 4   | RM | 50% Posidonia sinuosa/australis, 50% limestone                      | Photo may show 100% Posidonia ** edge of habitat** have marked as limestone to pick up that reef area. | Limestone reef / pavement |
| A06   | 1699 | -31.99616999 | 115.547395 | 10:29 | 2.8 | JB | 100% Posidonia sinuosa                                              |                                                                                                        | Posidonia dominated       |
| Extra | 1700 | -31.99621802 | 115.547378 |       |     | RM | 100% Sargassum on limestone reef                                    |                                                                                                        | Macroalgae dominated      |
| T1F   | 1701 | -31.99653997 | 115.549226 | 10:32 | 3.7 | RM | 100% Posidonia sinuosa                                              |                                                                                                        | Posidonia dominated       |
| T1E   | 1702 | -31.99743398 | 115.549022 | 10:35 | 2.6 | RM | 95% Posidonia sinuosa, 5% brown algae                               |                                                                                                        | Posidonia dominated       |
| T1D   | 1703 | -31.99828601 | 115.549036 | 10:36 | 2.6 | JB | 90% Posidonia sinuosa, 10% Amphibolis                               |                                                                                                        | Posidonia dominated       |
| T1B   | 1704 | -31.99930298 | 115.549127 | 10:40 | 2.7 | RM | 100% Posidonia sinuosa                                              |                                                                                                        | Posidonia dominated       |
| T1A   | 1705 | -32.00083603 | 115.548879 | 10:42 | 2.2 | JB | 100% Posidonia sinuosa                                              |                                                                                                        | Posidonia dominated       |
| A19   | 1706 | -32.00077099 | 115.551096 | 10:46 | 3.6 | RM | 95% Posidonia sinuosa, 5% Amphibolis                                |                                                                                                        | Posidonia dominated       |
| A20   | 1707 | -32.00070502 | 115.550068 | 10:49 | 2.6 | RM | 5% Amphibolis, 95% Posidonia sinuosa                                | Wrack present around sand edges                                                                        | Posidonia dominated       |
| A21   | 1708 | -32.00098397 | 115.549743 | 10:52 | 3.3 | RM | 95% brown algae (80% Sargassum, 15% Ecklonia), 5% Posidonia sinuosa |                                                                                                        | Macroalgae dominated      |

## REPORT

|       |      |              |            |       |     |    |                                                                                      |                                                      |                     |
|-------|------|--------------|------------|-------|-----|----|--------------------------------------------------------------------------------------|------------------------------------------------------|---------------------|
| A22   | 1709 | -32.00105899 | 115.549419 | 10:55 | 2.6 | RM | 50% sand, 40% Posidonia australis, 10% wrack                                         |                                                      | Sand with seagrass  |
| A26   | 1710 | -32.00162301 | 115.550139 | 10:58 | 1.2 | RM | 100% wrack                                                                           | Mix seagrass and brown algae<br>**sand under wrack** | Sand with wrack     |
| A25   | 1711 | -32.001665   | 115.550635 | 11:00 | 1.5 | JB | 90% Posidonia sinuosa, 10% Amphibolis                                                |                                                      | Posidonia dominated |
| A24   | 1712 | -32.00133802 | 115.550678 | 11:03 | 2.5 | RM | 100% Posidonia sinuosa                                                               |                                                      | Posidonia dominated |
| A27   | 1713 | -32.001967   | 115.551334 | 11:05 | 1.9 | JB | 100% Posidonia sinuosa                                                               |                                                      | Posidonia dominated |
| Extra | 1714 | -32.00201503 | 115.551429 |       |     | RM | 50% wrack, 50% sand                                                                  |                                                      | Sand with wrack     |
| A23   | 1715 | -32.00120299 | 115.551755 | 11:09 | 3.1 | JB | 80% Posidonia sinuosa, 20% mixed algae                                               |                                                      | Posidonia dominated |
| T2J   | 1716 | -32.00099302 | 115.550099 | 11:20 | 2   | RM | 100% Posidonia sinuosa                                                               |                                                      | Posidonia dominated |
| T2I   | 1717 | -32.00017797 | 115.550109 | 11:23 | 2.7 | RM | 100% Posidonia sinuosa                                                               |                                                      | Posidonia dominated |
| T2H   | 1718 | -31.99919703 | 115.550157 | 11:25 | 2.9 | RM | 100% Posidonia sinuosa                                                               |                                                      | Posidonia dominated |
| T2G   | 1719 | -31.99825298 | 115.550154 | 11:26 | 2.7 | JB | 60% Posidonia sinuosa, 30% Amphibolis, 10% brown algae                               |                                                      | Mixed seagrass      |
| T2F   | 1720 | -31.99748998 | 115.550132 | 11:30 | 4   | RM | 90% Posidonia sinuosa, 10% Amphibolis                                                |                                                      | Posidonia dominated |
| T2E   | 1721 | -31.996458   | 115.55018  | 11:30 | 4.7 | RM | 20% Halophila ovalis, 10% Posidonia sinuosa, 10% mixed seagrass, 30% wrack, 30% sand |                                                      | Sand with seagrass  |
| T2D   | 1722 | -31.99550296 | 115.550072 | 11:38 | 3.9 | RM | 80% Posidonia sinuosa, 20% Amphibolis                                                | Camera changed - GoPro 3                             | Posidonia dominated |

## REPORT

|     |      |              |            |       |     |    |                                                                           |                                                                                                     |                     |
|-----|------|--------------|------------|-------|-----|----|---------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|---------------------|
| A04 | 1723 | -31.99508102 | 115.549986 | 11:41 | 3.8 | RM | 90% Posidonia sinuosa/australis, 5% Amphibolis, 5% mixed seagrass         |                                                                                                     | Posidonia dominated |
| T2C | 1724 | -31.99462102 | 115.550255 | 11:43 | 5.3 | RM | 100% sand                                                                 | Individual shoots of Posidonia                                                                      | Sand                |
| T2B | 1725 | -31.99377897 | 115.55031  | 11:46 | 5   | RM | 80% sand, 15% wrack, 5% Halophila ovalis                                  |                                                                                                     | Sand                |
| T2A | 1726 | -31.99285696 | 115.550124 | 11:48 | 3.4 | RM | 80% sand, 20% Sargassum                                                   | Mostly bare sediment with algae patch                                                               | Sand                |
| T3J | 1727 | -31.99394301 | 115.551103 | 11:51 | 5.4 | RM | 80% Halophila ovalis, 20% brown algae                                     | Posidonia wrack floating around photo not useful.<br>Sand with seagrass due to Halophila morphology | Halophila dominated |
| A02 | 1728 | -31.99426504 | 115.550633 | 11:54 | 4.7 | RM | 60% Posidonia sinuosa, 40% Amphibolis                                     |                                                                                                     | Mixed seagrass      |
| T3I | 1729 | -31.99472898 | 115.551097 | 11:57 | 4.9 | JB | 90% Posidonia sinuosa, 10% Amphibolis                                     |                                                                                                     | Posidonia dominated |
| A05 | 1730 | -31.99550003 | 115.550789 | 11:59 | 3.5 | JB | 90% mixed seagrass, 10% sand                                              |                                                                                                     | Mixed seagrass      |
| T3H | 1731 | -31.99561704 | 115.551089 | 12:01 | 4.6 | JB | 40% sand, 40% Posidonia sinuosa, 10% Halophila ovalis, 10% mixed seagrass |                                                                                                     | Sand with seagrass  |
| T3G | 1732 | -31.99665103 | 115.551255 | 12:05 | 3.4 | JB | 90% Posidonia sinuosa, 10% Amphibolis                                     |                                                                                                     | Posidonia dominated |
| T3F | 1733 | -31.99753398 | 115.551133 | 12:07 | 3.3 | JB | 80% Posidonia sinuosa, 20% Amphibolis                                     |                                                                                                     | Posidonia dominated |
| T3E | 1734 | -31.99835298 | 115.551099 | 12:09 | 2.9 | JB | 100% Posidonia sinuosa                                                    |                                                                                                     | Posidonia dominated |
| T3D | 1735 | -31.99924104 | 115.551212 | 12:11 | 3.6 | JB | 100% Posidonia sinuosa                                                    |                                                                                                     | Posidonia dominated |
| T3C | 1736 | -32.00014201 | 115.551075 | 12:13 | 3.4 | JB | 95% Posidonia sinuosa, 5% sand                                            | Slight drift for photo                                                                              | Posidonia dominated |

## REPORT

|      |      |              |            |       |     |    |                                                |                                                                   |                      |
|------|------|--------------|------------|-------|-----|----|------------------------------------------------|-------------------------------------------------------------------|----------------------|
|      | 1737 | -32.00017897 | 115.551114 |       |     |    |                                                | Additional waypoint taken at T3C - unnecessary can ignore         |                      |
| T3B  | 1738 | -32.00108003 | 115.551078 | 12:23 | 3.1 | JB | 70% Posidonia sinuosa, 30% Posidonia australis | Bare sand next to meadow with wrack. Australis on edge of meadow. | Posidonia dominated  |
| T3A  | 1739 | -32.00205401 | 115.551278 | 12:27 | 1.8 | RM | 70% sand, 30% wrack                            |                                                                   | Sand with wrack      |
| T11B | 1740 | -31.99739199 | 115.543782 | 12:34 | 1.5 | RM | 80% Amphibolis, 20% sand                       | Bits of wrack throughout                                          | Amphibolis dominated |
| T11A | 1741 | -31.998299   | 115.5438   | 12:37 | 0.8 | RM | 100% Posidonia sinuosa                         |                                                                   | Posidonia dominated  |
| T8A  | 1742 | -31.99304497 | 115.56054  | 13:45 | 6.2 | RM | 20% Posidonia, 10% sand, 70% brown algae       |                                                                   | Macroalgae dominated |
| T8B  | 1743 | -31.99384603 | 115.560744 | 13:48 | 6.4 | RM | 70% brown algae, 20% Posidonia, 10% sand       |                                                                   | Macroalgae dominated |
| T8C  | 1744 | -31.99496602 | 115.56083  | 13:50 | 6.2 | RM | 100% Posidonia sinuosa                         |                                                                   | Posidonia dominated  |
| T8D  | 1745 | -31.99577697 | 115.56072  | 13:51 | 8.2 | RM | 80% sand, 20% Posidonia                        | Patches of Posidonia wrack                                        | Sand with seagrass   |
| T8E  | 1746 | -31.99669898 | 115.560799 | 13:53 | 9.1 | RM | 10% wrack, 90% sand                            |                                                                   | Sand                 |
| T8F  | 1747 | -31.99759802 | 115.560664 | 13:54 | 9.6 | RM | 10% Posidonia, 20% Posidonia wrack, 70% sand   |                                                                   | Sand                 |
| T8G  | 1748 | -31.99836899 | 115.56046  | 13:57 | 5.9 | RM | 80% Sargassum, 10% Posidonia sinuosa, 10% sand |                                                                   | Macroalgae dominated |
| A13  | 1749 | -31.99931304 | 115.559995 | 13:59 | 4.6 | RM | 40% Sargassum, 20% Ecklonia, 40% wrack         |                                                                   | Macroalgae dominated |
| S20  | 1750 | -32.000025   | 115.561038 | 14:02 | 2.2 | RM | 100% Amphibolis                                |                                                                   | Amphibolis dominated |



## REPORT

|     |      |              |            |       |     |    |                                                                                          |                                 |                        |
|-----|------|--------------|------------|-------|-----|----|------------------------------------------------------------------------------------------|---------------------------------|------------------------|
| T8H | 1751 | -32.00019297 | 115.560629 | 14:04 | 3.1 | RM | 100% sand                                                                                |                                 | Sand                   |
| T8I | 1752 | -32.00119603 | 115.560857 | 14:06 | 5.8 | RM | 10% sand, 70% brown algae, 20% Posidonia                                                 | Edge of Posidonia meadow        | Macroalgae dominated   |
| T8J | 1753 | -32.00191604 | 115.560858 | 14:08 | 2.4 | RM | 100% Posidonia                                                                           |                                 | Posidonia dominated    |
| T7A | 1754 | -32.00203104 | 115.55838  | 14:10 | 3.9 | RM | 60% brown algae (5% is Ecklonia), 40% Posidonia wrack                                    | Edge of Posidonia meadow        | Macroalgae dominated   |
| T7B | 1755 | -32.00094701 | 115.558457 | 14:12 | 3.8 | RM | 50% Posidonia sinuosa, 30% wrack, 20% brown algae                                        |                                 | Mixed algae / seagrass |
| T7C | 1756 | -32.00017604 | 115.558462 | 14:13 | 3.8 | RM | 90% Posidonia, 5% sand, 5% brown algae                                                   |                                 | Posidonia dominated    |
| A15 | 1757 | -31.99960599 | 115.559334 | 14:15 | 4   | RM | 10% Sargassum on limestone, 40% Posidonia, 50% brown algae (50% Ecklonia, 50% Sargassum) |                                 | Mixed algae / seagrass |
| T7D | 1758 | -31.99940398 | 115.55856  | 14:19 | 4.7 | RM | 30% Amphibolis, 20% Posidonia, 50% sand with wrack                                       |                                 | Sand with seagrass     |
| S19 | 1759 | -31.99899402 | 115.558731 | 14:21 | 4.9 | RM | 100% Posidonia sinuosa                                                                   |                                 | Posidonia dominated    |
| T7E | 1760 | -31.998185   | 115.558541 | 14:23 | 6.6 | RM | 100% sand                                                                                | Posidonia wrack outside quadrat | Sand                   |
| T7F | 1761 | -31.99740901 | 115.558648 | 14:24 | 7.3 | RM | 50% sand, 50% wrack (Posidonia and Ecklonia)                                             |                                 | Sand with wrack        |
| T7G | 1762 | -31.99649496 | 115.558428 | 14:26 | 6.3 | RM | 90% sand, 10% Halophila ovalis                                                           |                                 | Sand                   |
| T7H | 1763 | -31.99543096 | 115.558657 | 14:28 | 7   | RM | 100% Sargassum                                                                           |                                 | Macroalgae dominated   |
| T7I | 1764 | -31.99466896 | 115.558607 | 14:29 | 5.3 | RM | 100% Posidonia                                                                           | Edge of meadow                  | Posidonia dominated    |

## REPORT

|     |      |              |            |       |     |    |                                        |                                                        |                      |
|-----|------|--------------|------------|-------|-----|----|----------------------------------------|--------------------------------------------------------|----------------------|
| T7J | 1765 | -31.99370404 | 115.558555 | 14:31 | 4.4 | RM | 100% Posidonia                         |                                                        | Posidonia dominated  |
| T7K | 1766 | -31.99278496 | 115.558722 | 14:32 | 3.8 | RM | 70% Sargassum, 20% sand, 10% Posidonia |                                                        | Macroalgae dominated |
| T6A | 1767 | -31.99294103 | 115.556474 | 14:35 | 2.7 | RM | 80% Sargassum, 10% limestone, 10% sand |                                                        | Macroalgae dominated |
| T6B | 1768 | -31.99386296 | 115.556619 | 14:37 | 3.4 | RM | 100% Posidonia sinuosa                 |                                                        | Posidonia dominated  |
| A01 | 1769 | -31.99428096 | 115.555559 | 14:39 | 2.3 | RM | 10% Posidonia, 70% Sargassum, 20% sand |                                                        | Macroalgae dominated |
| T6C | 1770 | -31.99472596 | 115.556583 | 14:40 | 3.9 | RM | 100% Amphibolis                        | Posidonia wrack accumulated around Amphibolis meadow   | Amphibolis dominated |
| T6D | 1771 | -31.995754   | 115.556711 | 14:42 | 4.5 | RM | 50% Posidonia, 50% sand with wrack     |                                                        | Sand with seagrass   |
| A08 | 1772 | -31.99618701 | 115.555212 | 14:45 | 4   | RM | 80% Posidonia, 20% Amphibolis          | Not much wrack accumulated at edge of meadow           | Posidonia dominated  |
| A09 | 1773 | -31.99688103 | 115.555194 | 14:46 | 4.7 | RM | 80% Posidonia, 20% Sargassum           |                                                        | Posidonia dominated  |
| T6E | 1774 | -31.99662002 | 115.556488 | 14:48 | 4.3 | RM | 95% Posidonia sinuosa, 5% Amphibolis   |                                                        | Posidonia dominated  |
| A10 | 1775 | -31.99740498 | 115.555229 | 14:50 | 5   | RM | 100% sand                              |                                                        | Sand                 |
| T6F | 1776 | -31.99754404 | 115.556483 | 14:52 | 4.7 | RM | 95% Sargassum, 5% Posidonia            |                                                        | Macroalgae dominated |
| A11 | 1777 | -31.99844903 | 115.557278 | 14:54 | 8.3 | RM | 100% sand                              | Minor bits of Ecklonia and Posidonia wrack             | Sand                 |
| A12 | 1778 | -31.99881096 | 115.555377 | 14:57 | 5.9 | RM | 100% Posidonia                         | Edge of meadow - Posidonia wrack around edge of meadow | Posidonia dominated  |

## REPORT

|       |      |              |            |       |     |    |                                                |                                |                        |
|-------|------|--------------|------------|-------|-----|----|------------------------------------------------|--------------------------------|------------------------|
| T6G   | 1779 | -31.99842598 | 115.556438 | 14:59 | 7.4 | RM | 100% Posidonia                                 | Edge of meadow - minimal wrack | Posidonia dominated    |
| T6H   | 1780 | -31.999406   | 115.556746 | 15:02 | 3.9 | RM | 80% Sargassum, 10% Posidonia, 10% sand         |                                | Macroalgae dominated   |
| S16   | 1781 | -31.99968201 | 115.557738 | 15:04 | 4.1 | RM | 80% Sargassum, 20% Posidonia                   |                                | Macroalgae dominated   |
| A16   | 1782 | -31.99959601 | 115.557681 | 15:05 | 2.9 | RM | 80% Sargassum on limestone reef, 20% limestone | Corals present                 | Macroalgae dominated   |
| T6I   | 1783 | -32.00028903 | 115.556549 | 15:08 | 3.9 | RM | 100% Posidonia                                 |                                | Posidonia dominated    |
| A17   | 1784 | -32.00080703 | 115.556935 | 15:10 | 3.7 | RM | 60% Posidonia, 30% brown algae, 10% sand       | Some wrack                     | Mixed algae / seagrass |
| T6J   | 1785 | -32.00108497 | 115.556239 | 15:13 | 3.9 | RM | 100% Posidonia                                 |                                | Posidonia dominated    |
| A18   | 1786 | -32.00161697 | 115.557645 | 15:15 | 3.8 | RM | 70% brown algae, 30% sand                      | Patchy                         | Macroalgae dominated   |
| S17   | 1787 | -32.00156702 | 115.557051 | 15:17 | 3.4 | RM | 70% Posidonia, 20% Sargassum, 10% sand         |                                | Posidonia dominated    |
| T6K   | 1788 | -32.00197203 | 115.556517 | 15:19 | 2.8 | RM | 100% Posidonia                                 |                                | Posidonia dominated    |
| Extra | 1789 | -32.00224604 | 115.556578 | 15:20 | 2.8 | RM | 100% wrack - Posidonia & Ecklonia              |                                | Sand with wrack        |
| A28   | 1790 | -32.00238903 | 115.55385  | 15:24 | 3.2 | RM | 90% Posidonia australis, 10% Amphibolis        | Sandy edge has Posidonia wrack | Posidonia dominated    |
| S11   | 1791 | -32.00203196 | 115.553163 | 15:26 | 2.7 | RM | 90% wrack (Posidonia & Ecklonia), 10% sand     |                                | Sand with wrack        |
| T5A   | 1792 | -32.00204101 | 115.554239 | 15:28 | 2.5 | RM | 100% Posidonia                                 |                                | Posidonia dominated    |

## REPORT

|       |      |              |            |       |     |    |                                                      |                                            |                      |
|-------|------|--------------|------------|-------|-----|----|------------------------------------------------------|--------------------------------------------|----------------------|
| T5B   | 1793 | -32.00109403 | 115.55448  | 15:29 | 3.5 | RM | 100% Posidonia                                       |                                            | Posidonia dominated  |
| T5C   | 1794 | -32.00026799 | 115.554453 | 15:32 | 3.9 | RM | 100% Posidonia                                       |                                            | Posidonia dominated  |
| T5D   | 1795 | -31.99929401 | 115.554263 | 15:33 | 3.6 | RM | 70% Posidonia, 30% Amphibolis                        |                                            | Posidonia dominated  |
| T5E   | 1796 | -31.998329   | 115.553854 | 15:35 | 4.1 | RM | 60% Posidonia, 40% sand with Posidonia wrack         |                                            | Sand with seagrass   |
| T5F   | 1797 | -31.997495   | 115.554083 | 15:36 | 5.8 | RM | 100% sand                                            | Around Posidonia meadow is Posidonia wrack | Sand                 |
| T5G   | 1798 | -31.99653796 | 115.55435  | 15:37 | 4.9 | RM | 95% sand, 5% Posidonia                               | No wrack                                   | Sand                 |
| S12   | 1799 | -31.99610302 | 115.554135 | 15:39 | 3.1 | RM | 95% Posidonia, 5% Amphibolis                         |                                            | Posidonia dominated  |
| T5H   | 1800 | -31.99551797 | 115.554389 | 15:40 | 3.1 | RM | 100% sand                                            |                                            | Sand                 |
| Extra | 1801 | -31.99543197 | 115.554649 |       |     |    | 100% Posidonia                                       | No wrack on edge                           | Posidonia dominated  |
| T5I   | 1802 | -31.99488798 | 115.554422 | 15:41 | 2.3 | RM | 90% Amphibolis, 10% sand with minor Amphibolis wrack |                                            | Amphibolis dominated |
| S13   | 1803 | -31.99447601 | 115.554359 | 15:43 | 2.3 | RM | 90% Posidonia, 10% Amphibolis                        |                                            | Posidonia dominated  |
| T5J   | 1804 | -31.99373798 | 115.554572 | 15:44 | 3.2 | RM | 100% Posidonia                                       |                                            | Posidonia dominated  |
| T5K   | 1805 | -31.99307003 | 115.554314 | 15:45 | 3.9 | RM | 100% Posidonia                                       | No wrack on edge of meadow                 | Posidonia dominated  |
| S14   | 1806 | -31.99278203 | 115.554286 | 15:47 | 3.6 | RM | 80% Amphibolis, 10% sand, 10% Sargassum              |                                            | Amphibolis dominated |



## REPORT

|     |      |              |            |       |     |    |                                                  |                                                 |                           |
|-----|------|--------------|------------|-------|-----|----|--------------------------------------------------|-------------------------------------------------|---------------------------|
| S09 | 1807 | -31.99279502 | 115.55249  | 15:49 | 3.9 | RM | 40% limestone reef, 40% sand, 20% brown algae    |                                                 | Limestone reef / pavement |
| T4A | 1808 | -31.99296199 | 115.552423 | 15:51 | 3.2 | RM | 20% Amphibolis, 80% rubble with brown turf algae | Rubble is limestone reef                        | Limestone reef / pavement |
| T4B | 1809 | -31.99379297 | 115.552165 | 15:52 | 4.1 | RM | 50% Amphibolis, 40% brown algae, 10% sand        |                                                 | Mixed algae / seagrass    |
| S10 | 1810 | -31.994143   | 115.552313 | 15:53 | 4   | RM | 70% Posidonia, 30% Amphibolis                    |                                                 | Posidonia dominated       |
| T4C | 1811 | -31.99488899 | 115.552197 | 15:55 | 4   | RM | 50% Posidonia, 30% sand, 20% brown algae         |                                                 | Sand with seagrass        |
| A3  | 1812 | -31.99511496 | 115.553358 | 15:57 | 3.9 | RM | 100% sand with brown turf algae & wrack          | 100% Posidonia surrounding                      | Sand                      |
| T4D | 1813 | -31.995552   | 115.552314 | 15:59 | 4.8 | RM | 100% sand                                        |                                                 | Sand                      |
| A7  | 1814 | -31.99601199 | 115.55177  | 16:01 | 3.2 | RM | 90% Posidonia, 10% Amphibolis                    |                                                 | Posidonia dominated       |
| T4E | 1815 | -31.99665296 | 115.552304 | 16:02 | 3.2 | RM | 100% Posidonia                                   |                                                 | Posidonia dominated       |
| T4F | 1816 | -31.99743298 | 115.552387 | 16:03 | 3.4 | RM | 100% Posidonia                                   |                                                 | Posidonia dominated       |
| T4G | 1817 | -31.99839296 | 115.552139 | 16:05 | 3.2 | RM | 80% Amphibolis, 20% Posidonia                    |                                                 | Amphibolis dominated      |
| T4H | 1818 | -31.99915898 | 115.552314 | 16:06 | 4   | RM | 90% Posidonia, 10% Amphibolis                    |                                                 | Posidonia dominated       |
| T4I | 1819 | -32.00017302 | 115.552504 | 16:08 | 5   | RM | 90% sand, 10% Posidonia wrack                    |                                                 | Sand                      |
| T4J | 1820 | -32.00095103 | 115.5523   | 16:09 | 5.8 | RM | 100% Posidonia meadow                            | Minor Posidonia wrack on edge; photo shows edge | Posidonia dominated       |

## REPORT

|       |      |              |            |       |     |    |                                    |                               |                      |
|-------|------|--------------|------------|-------|-----|----|------------------------------------|-------------------------------|----------------------|
| T4K   | 1821 | -32.00177698 | 115.552292 | 16:11 | 3   | RM | 100% wrack (Posidonia & Ecklonia)  |                               | Sand with wrack      |
| Extra | 1822 | -32.00210698 | 115.552384 | 16:12 | 3   | RM | 80% Amphibolis, 20% Posidonia      | Surrounded by Posidonia wrack | Amphibolis dominated |
| Extra | 1823 | -32.00211201 | 115.552172 | 16:15 | 2   | RM | 100% Amphibolis meadow onto sand   | Patches of Posidonia          | Amphibolis dominated |
| Extra | 1824 | -32.00186298 | 115.550902 | 16:17 | 1.5 | RM | 100% wrack (Posidonia & Sargassum) |                               | Sand with wrack      |

Definitions: JB = James Brightmore, RM = Rosh McCallum, QAQC = Quality assurance and quality control

## REPORT

**Appendix Table 3: Field survey data 29th January 2024 (Main Jetty Survey Area with several sites also in the FSA)**

| Site ID | Wpt        | Lat          | Long         | Time  | Depth (m) | Observer | Benthic Habitat Description                                             | Notes                                                                                        | Classification         |
|---------|------------|--------------|--------------|-------|-----------|----------|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|------------------------|
| S01     | 1825       | -31.99263501 | 115.54257402 | 9:15  | 0.8       | JB/RM    | 100% Posidonia australis                                                | Snorkel QA/QC. Halophila ovalis & zostera present, Posidonia wrack accumulated in sandy gaps | Posidonia dominated    |
| S03     | 1826       | -31.99304002 | 115.54312999 | 9:30  | 1.2       | JB/RM    | 100% Posidonia (95% sinuosa, 5% australis)                              | QA/QC                                                                                        | Posidonia dominated    |
| S05     | 1827       | -31.99386296 | 115.54242197 | 9:35  | 0.8       | JB/RM    | 100% Posidonia sinuosa                                                  | QA/QC. Posidonia wrack accumulated in the patches                                            | Posidonia dominated    |
| S07     | 1828       | -31.99466896 | 115.54311901 | 9:37  | 1.3       | JB/RM    | 100% Posidonia sinuosa                                                  | QA/QC                                                                                        | Posidonia dominated    |
| S09     | 1829       | -31.99530104 | 115.54306897 | 9:39  | 1         | JB/RM    | 100% Posidonia (10% australis, 90% sinuosa)                             | QA/QC. High level of epiphytes                                                               | Posidonia dominated    |
| S08     | 1830       | -31.99527204 | 115.54238702 | 9:42  | 0.7       | JB/RM    | 100% sand                                                               | Wrack accumulation along edge of sand patch                                                  | Sand                   |
| S10     | 1831       | -31.99576297 | 115.54291299 | 9:47  | 4.9       | JB/RM    | Probable 100% sand (visibility low)                                     |                                                                                              | Sand                   |
| Extra01 | 1832       | -31.99623001 | 115.54287904 | 9:49  | 1.6       | JB/RM    | 100% Posidonia wrack with sand patches                                  |                                                                                              | Sand with wrack        |
| S12     | 1833       | -31.99637401 | 115.543376   | 9:52  | 2.3       | JB/RM    | 50% sand, 50% wrack                                                     |                                                                                              | Sand with wrack        |
| S14     | 1834       | -31.99690299 | 115.54310996 | 9:55  | 1.1       | JB/RM    | 100% Posidonia sinuosa                                                  | Small sand patches                                                                           | Posidonia dominated    |
| Extra02 | 1835       | -31.99682596 | 115.54302304 | 9:57  | 1.1       | JB/RM    | 80% Posidonia mix, 20% sand                                             | Sand patch, drifting along patchy bits                                                       | Posidonia dominated    |
| S16     | 1837       | -31.99792801 | 115.54307501 | 10:00 | 0.8       | JB/RM    | 90% Posidonia australis, 10% brown algae (brown algae may be epiphytes) | High level of epiphytes                                                                      | Posidonia dominated    |
| S17     | 1838       | -31.99797596 | 115.54331699 | 10:02 | 0.6       | JB/RM    | 100% Posidonia australis, with epiphytes                                | Boundary appears living seagrass from distance                                               | Posidonia dominated    |
| DA01    | 1839, 1840 | -32.00092999 | 115.54994004 | 10:09 | 2.8       | JB/RM    | 40% mixed algae, 40% wrack, 20% Posidonia                               | Development area site                                                                        | Mixed algae / seagrass |
| DA02    | 1841, 1842 | -32.00111004 | 115.54982001 | 10:14 | 2.6       | JB/RM    | 10% brown algae, 10% Posidonia, 80% wrack                               | Development area site                                                                        | Sand with wrack        |

## REPORT

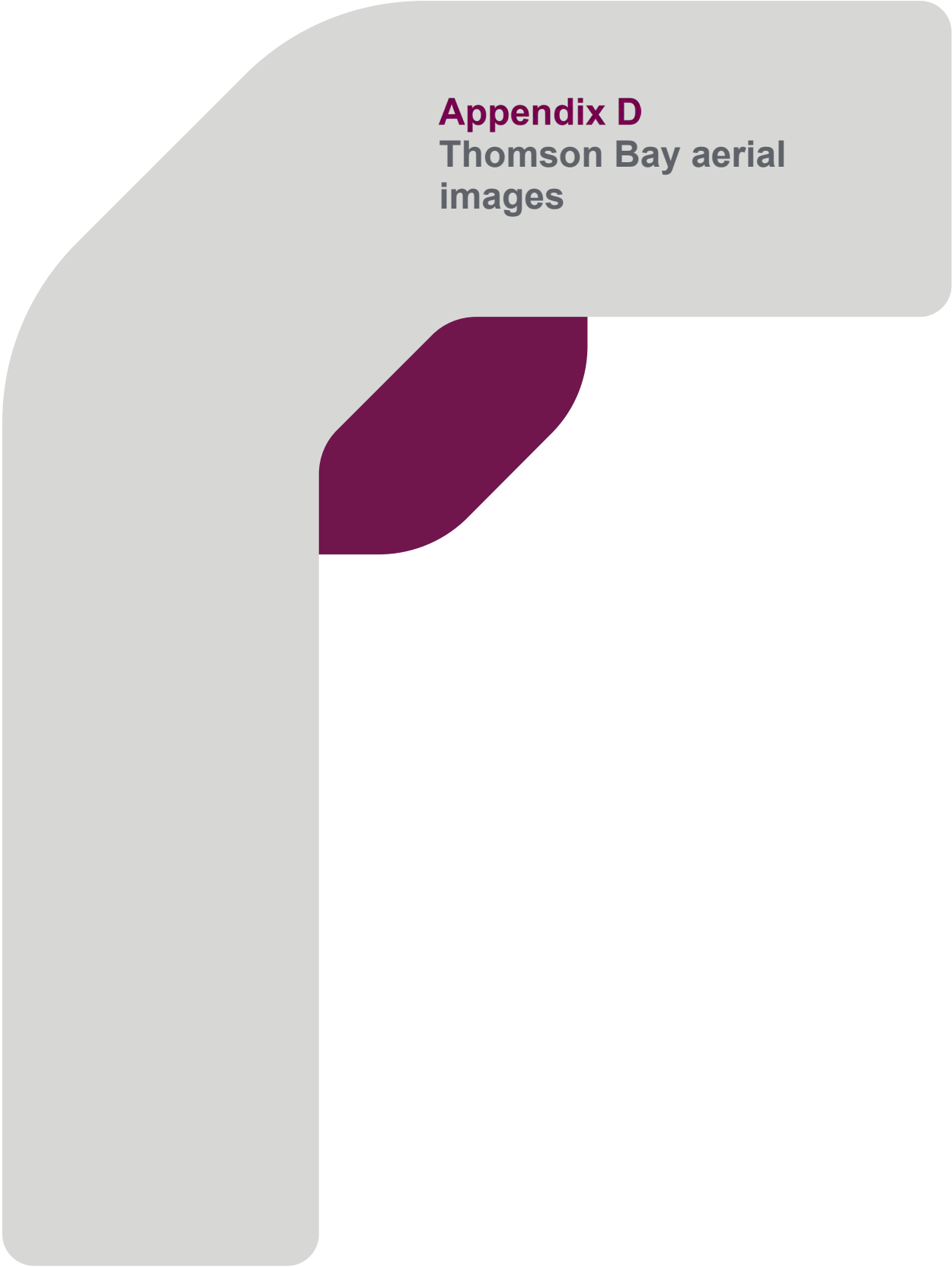
|         |      |              |              |       |         |       |                                                                                          |                                                                                                                                                              |                     |
|---------|------|--------------|--------------|-------|---------|-------|------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| DA03    | 1844 | -32.00143098 | 115.55014498 | 10:19 | 1.4     | JB/RM | 10% brown algae, 90% Posidonia (90% sinuosa, 10% australis)                              | Development area site. Lots of wrack on nearby beach                                                                                                         | Posidonia dominated |
| Extra03 | 1845 | -32.00124197 | 115.55022301 | 10:22 | 1.9     | JB/RM | 100% sand                                                                                | Wrack accumulated along edges                                                                                                                                | Sand                |
| Extra04 | 1846 | -31.99430301 | 115.54259196 | 10:32 | 0.8     | JB/RM | Sand patch with Posidonia wrack around edges. Meadow is Posidonia australis              |                                                                                                                                                              | Sand                |
| Extra05 | 1847 | -31.99391199 | 115.54279304 | 10:36 | 1.9     | JB/RM | Sand patch with Posidonia wrack on edges, 20% wrack in sand patches, 2% Halophila ovalis |                                                                                                                                                              | Sand                |
| Extra06 | 1848 | -31.99321504 | 115.54243002 | 10:41 | 1.3     | JB/RM | 100% sand, 5% wrack (95% sand with 5% wrack)                                             | Edges 50% wrack, 50% Posidonia australis                                                                                                                     | Sand                |
| Extra07 | 1849 | -31.99629002 | 115.54266103 | 10:46 | 1.4     | JB/RM | 100% sand                                                                                | Posidonia australis meadow with wrack accumulated at edge                                                                                                    | Sand                |
| S02     | 1850 | -31.99283802 | 115.54129503 |       | 1       | RM    | 100% wrack                                                                               | First wading/snorkelling site.<br><br>All wrack on way out. Wrack on top of sparse meadow. 26th Jan = very low tide that likely exposed shallow sites - RIA. | Sand with wrack     |
| Extra08 | 1851 | -31.99286501 | 115.54155403 |       | 0.2 - 1 | RM    | 100% Posidonia, small patches of Halophila                                               | Wpt 1851 = boundary of seagrass                                                                                                                              | Posidonia dominated |
| S04     | 1852 | -31.99367596 | 115.54132998 |       | 1       | RM    | 100% wrack                                                                               |                                                                                                                                                              | Sand with wrack     |
| Extra09 | 1853 | -31.99360496 | 115.541491   |       | 1       | RM    | 100% Posidonia, lots of epiphytes                                                        | Wpt 1852 = boundary of seagrass                                                                                                                              | Posidonia dominated |
| S06     | 1854 | -31.99452999 | 115.54166199 |       | 1-1.5   | RM    | 50% Posidonia australis, 50% sand                                                        |                                                                                                                                                              | Sand with seagrass  |
| Extra10 | 1855 | -31.99462504 | 115.54158202 |       | 1-1.5   | RM    | 100% Posidonia australis                                                                 |                                                                                                                                                              | Posidonia dominated |
| Extra11 | 1856 | -31.99491204 | 115.54153098 |       | 1       | RM    | 100% Posidonia australis                                                                 | Surrounded by 100% wrack all around                                                                                                                          | Posidonia dominated |
| Extra12 | 1857 | -31.99496099 | 115.54153299 |       | 1       | RM    | 100% wrack                                                                               |                                                                                                                                                              | Sand with wrack     |
| Extra13 | 1858 | -31.99486099 | 115.54152402 |       | 1       | RM    | 100% wrack                                                                               |                                                                                                                                                              | Sand with wrack     |
| S11     | 1859 | -31.99606497 | 115.54225802 |       | 1       | RM    | 100% Posidonia australis, mixed with wrack                                               | Green seagrass underneath wrack                                                                                                                              | Posidonia dominated |



## REPORT

|         |      |              |              |                |     |                                              |                                 |                                       |
|---------|------|--------------|--------------|----------------|-----|----------------------------------------------|---------------------------------|---------------------------------------|
| Extra14 | 1860 | -31.99632296 | 115.54223296 | 1              | RM  | 50% Posidonia australis, 50% sand            | Edge of meadow                  | Sand with seagrass                    |
| S15     | 1861 | -31.997193   | 115.54246296 | 1              | RM  | 100% sand                                    |                                 | Sand                                  |
| Extra15 | 1862 | -31.99713903 | 115.54260101 | 1              | RM  | 100% Posidonia australis                     | Edge of meadow                  | Posidonia dominated                   |
| S13     | 1863 | -31.99684599 | 115.54251602 | 1.5            | RM  | 10% Posidonia australis, 10% sand, 80% wrack |                                 | Sand with wrack                       |
| Extra16 | 1864 | -31.99677902 | 115.542354   | 12:15<br>(end) | 0.8 | RM                                           | 70% Posidonia (mixed), 30% sand | Edge of meadow<br>Posidonia dominated |

Definitions: JB = James Brightmore, RM = Rosh McCallum, QAQC = Quality assurance and quality control

A large, light grey L-shaped graphic that occupies the left and top portions of the page. It has rounded corners. A smaller, maroon-colored shape is nested within the corner of the L-shape, also with rounded corners.

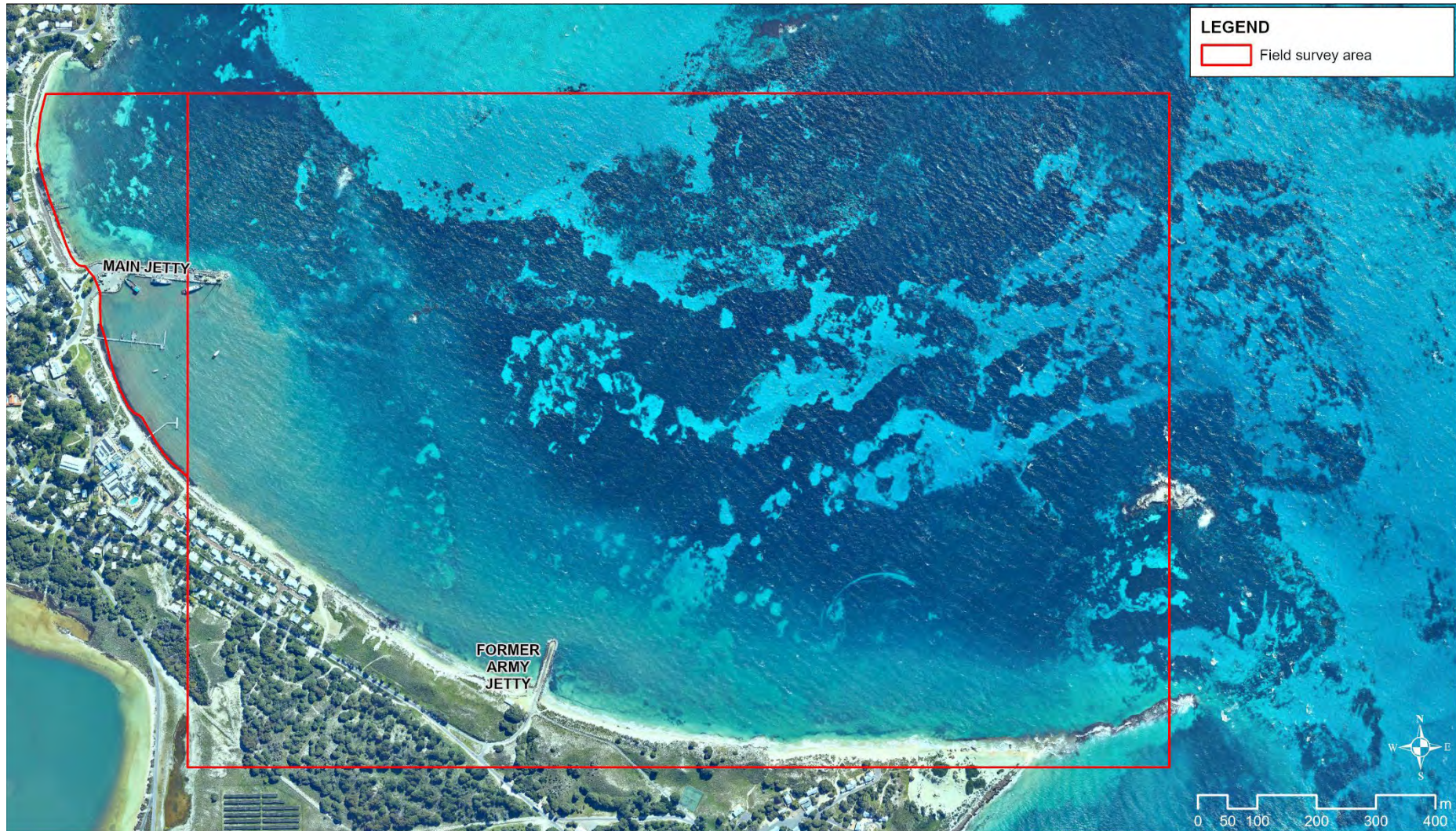
## **Appendix D**

### **Thomson Bay aerial images**



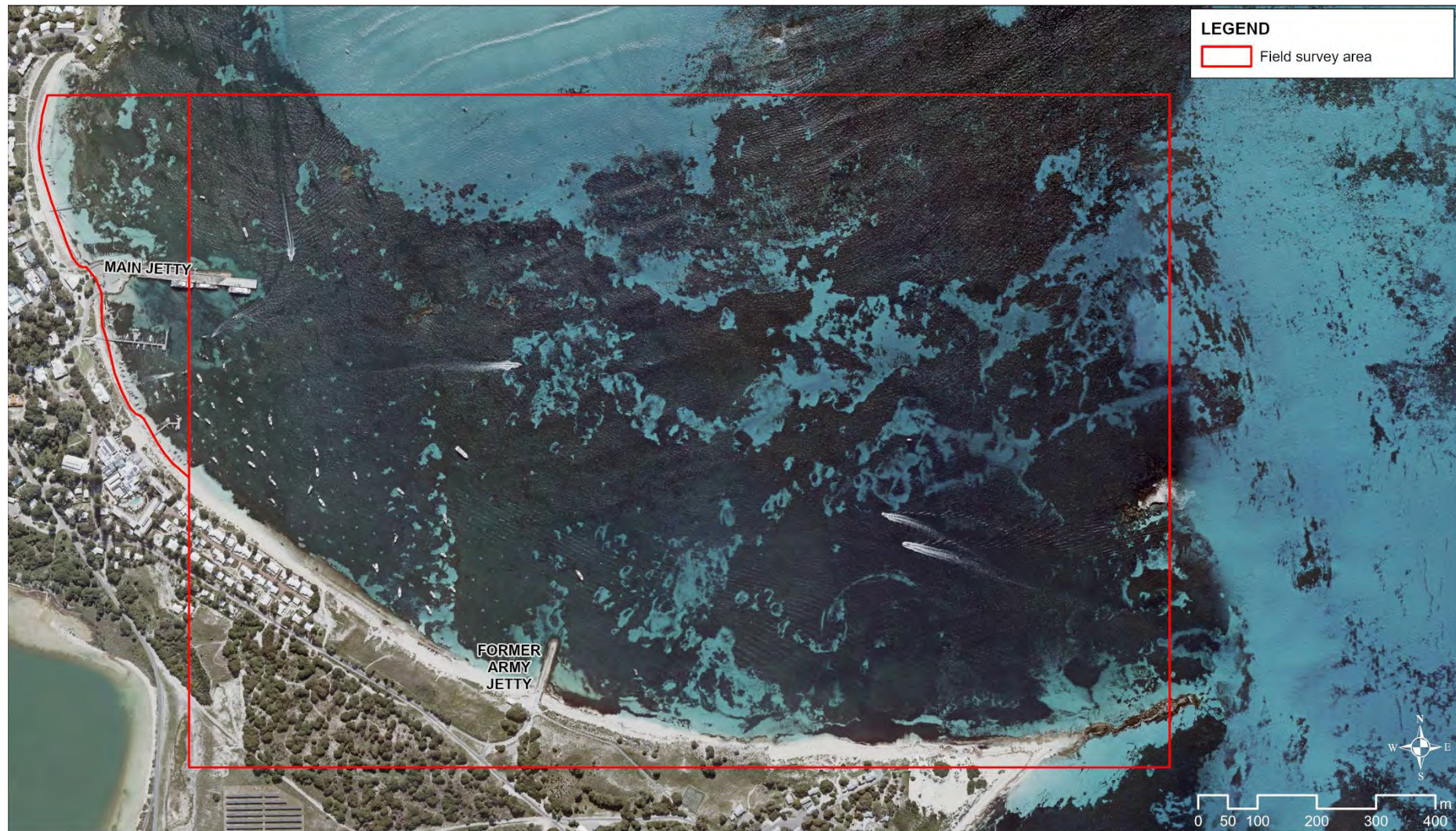
Appendix Figure 3: Thomson Bay aerial image, February 2023 (source: Landgate)





Appendix Figure 4: Thomson Bay aerial image, August 2022 (source: Landgate)





Appendix Figure 5: Thomson Bay aerial image, August 2023 (source: Landgate)



## **Appendix C**

### **Benthic habitat assessment: Plume extension survey area, South Thomson Barge Landing Development (RPS 2024b)**



# SOUTH THOMSON BARGE LANDING DEVELOPMENT

## Benthic habitat assessment: Plume Extension Survey Area

The Plume Extension Survey Area (PESA) represents the 2.54 hectare (ha) area southeast of the Thomson Bay Field Survey Area (FSA) and within the eastern extent of the dredge plume modelling Zone of Influence (maximum predicted extent of visible plumes; ZoI) (Figure 1, Figure 2). A benthic habitat map of the PESA was developed for assessing the estimated impacts of planned dredging activities in the development area of the FSA.

### Methods

Habitat mapping was undertaken using methods described in the South Thomson Barge Landing Development: Marine Fauna and Benthic Habitat Assessment (RPS, 2024). Esri's ArcGIS Pro was used to create a digitised image in vector shapefile format, using select Landgate Web Map Service aerial photographs. The February 2023 image (summer; Figure 3) was used as the base-map to maintain consistency with the habitat map developed for the FSA. The August 2023 image (winter; Figure 4) was used as the reference image, which provided a clear comparison against the base-map for identifying areas of wrack that are not present year-round (i.e., areas of dark seabed not shared between the two images), so that these could be removed from the habitat map. Note that isolated areas of habitat less than a few metres in diameter were generally too small for effective digitisation and mapping; however, this is not expected to have a meaningful effect on the results.

The RIA visually surveyed the benthic habitat at six sites within the 2.54 ha PESA on 22 March 2024 (Figure 1, Figure 2). Five sites were assessed over the darker areas of habitat observed in the aerial images, and one site over the lighter area of habitat. For the purposes of developing the habitat map, benthic habitat data obtained from the RIA survey are assumed to be commensurate with the species identifications and dominance-based method used by RPS in the FSA (RPS, 2024).

Benthic habitat was then classified into categories based on the dominant habitat type observed in the aerial images and confirmed via ground truth survey data (Table 1). Habitat classifications may be limited by aerial image clarity and habitat complexity (e.g., mixing of wrack with living seagrass). Darker areas of habitat shared between the aerial images that have confirmed seagrass dominated habitat at RIA survey sites are classified as "mixed seagrass". Based on similar habitat in the FSA, habitats in this category are likely comprised of *Posidonia*, *Amphibolis*, and *Halophila* seagrass species, but may also include macroalgae and sand. As such, the area of seagrass may be overestimated. This classification of the non-sand habitat as "mixed seagrass" provides a conservative estimate of the dredge plume impact on seagrass habitat in the PESA.

**Table 1: Classification scheme used in the analysis of benthic habitat in the PESA**

| Benthic habitat class                  | Description                                                        |
|----------------------------------------|--------------------------------------------------------------------|
| Sand / Sand with wrack <sup>1</sup>    | Sand dominated (majority bare sand) and/or wrack                   |
| Mixed seagrass <sup>1</sup>            | Seagrass dominated (majority seagrass species)                     |
| Limestone reef / pavement <sup>2</sup> | Limestone reef or platform with minor attached seagrass/macroalgae |

<sup>1</sup>Identified by aerial image classification and RIA ground-truth data

<sup>2</sup>Identified by aerial image classification only

### Results

Six sites were surveyed by the RIA on 22 March 2024 for the development of the benthic habitat map. Five sites were identified as *Posidonia sinuosa* dominated, and one site as sand (Figure 1, Figure 2).

"Sand/Sand with wrack" dominated 50 % of the PESA (1.27 ha), while "mixed seagrass" and "limestone reef/pavement" covered 36.22 % (0.92 ha) and 13.78 % (0.35 ha) of the PESA, respectively (Table 2, Figure 1, Figure 2). Mixed seagrass dominated the central area of the PESA,

surrounded by sand and wrack. RIA survey data confirmed the presence of living seagrass at sites along the edge of the mixed seagrass habitat. A significant amount of wrack was present to the east of the mixed seagrass, as shown by the markedly different shaded areas between the February and August aerial images (Figure 3, Figure 4). Closer to the FSA, limestone reef/pavement habitat extended from the shoreline to the north of the PESA. Patches of mixed seagrass covered the southern and eastern edges of the limestone reef/pavement habitat, with sand and wrack between the reef/pavement and the FSA.

**Table 2: Area of benthic habitats within the PESA**

| Benthic habitat class                  | Area (hectares) | Percentage of PESA (%) |
|----------------------------------------|-----------------|------------------------|
| Sand / Sand with wrack <sup>1</sup>    | 1.27            | 50                     |
| Mixed seagrass <sup>1</sup>            | 0.92            | 36.22                  |
| Limestone reef / pavement <sup>2</sup> | 0.35            | 13.78                  |
| <b>Sum</b>                             | <b>2.54</b>     | <b>100</b>             |

<sup>1</sup>Identified by aerial image classification and RIA ground-truth data

<sup>2</sup>Identified by aerial image classification only



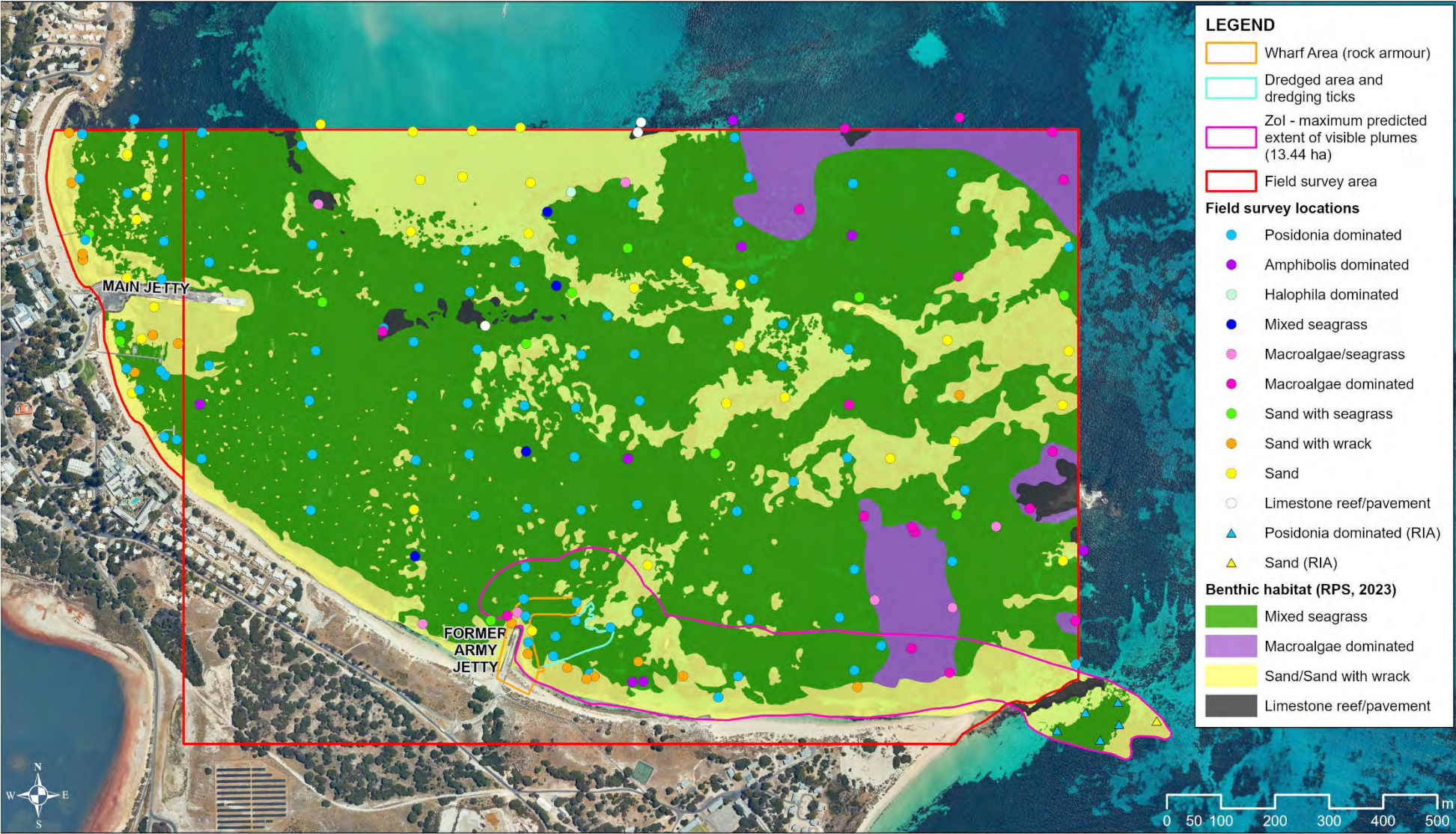


Figure 1: Benthic habitat map of the Field Survey Area, Main Jetty Survey Area, and Plume Extension Survey Area at Thomson Bay, Rottneest Island



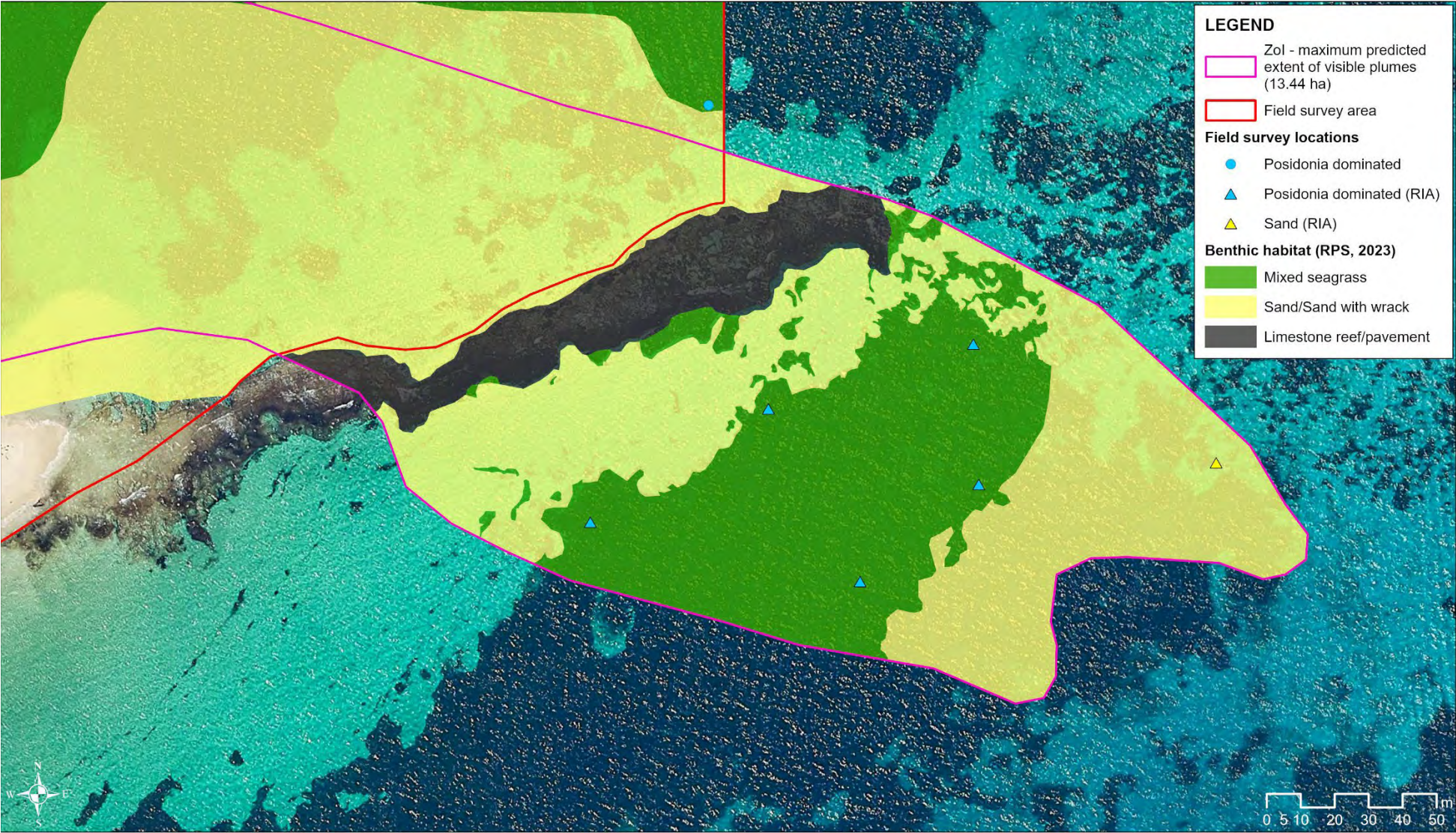


Figure 2: Benthic habitat map of the Plume Extension Survey Area at Thomson Bay, Rottne Island



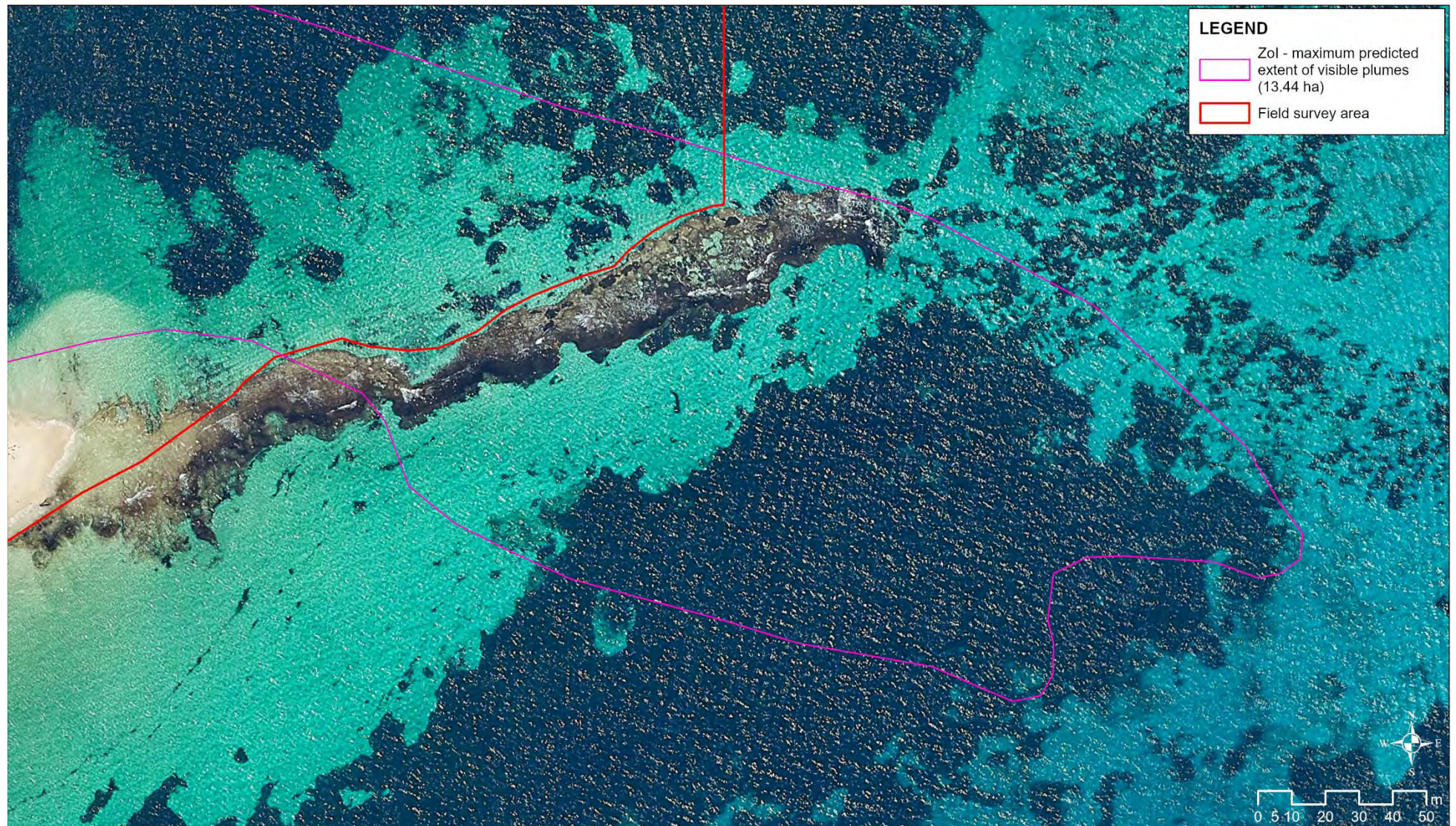


Figure 3: Aerial image of the Plume Extension Survey Area, Thomson Bay, February 2023 (source: Landgate)



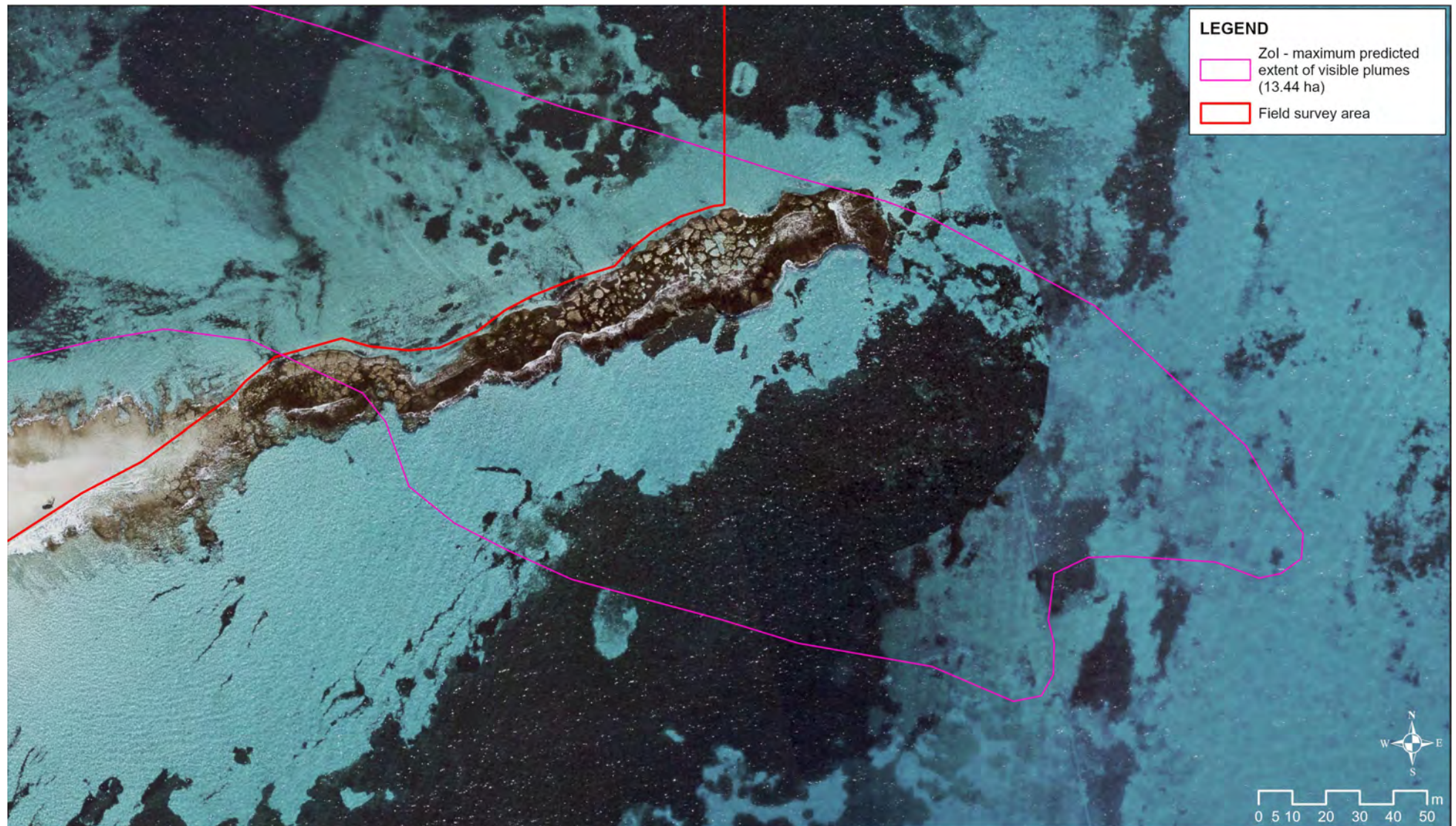


Figure 4: Aerial image of the Plume Extension Survey Area, Thomson Bay, August 2023 (source: Landgate)



### References

RPS, 2024. South Thomson Barge Landing Development: Marine Fauna and Benthic Habitat Assessment.  
RPS AAP Consulting Pty Ltd.