



CENTRE OF
DECOMMISSIONING
AUSTRALIA

Western Australia Decommissioning Hub Location Study

Public Report

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Executive — — summary

This abridged report has summarised the evaluation of potential sites on the Western Australian (WA) coast that would be suitable for the establishment of a decommissioning receival and dismantling yard for offshore oil and gas assets. The study has concluded that:

- 1** There is a significant decommissioning liability associated with the onshore disposal of offshore oil and gas assets (circa USD\$2.1b for assets in close proximity to WA ports). However, the value and intermittent demand profile does not justify the establishment of a complete greenfield site for this sole purpose.
- 2** There are multiple locations on the WA coast which have characteristics which would suit the establishment or configuration of an onshore decommissioning receival and dismantling yard.
- 3** The onshore decommissioning “solution” in WA will likely require multiple facilities to contribute to the disposal of the offshore assets and may service different parts of the market:
 - a. Over the last 5-years, offshore oil and gas assets (wellhead platforms, mooring systems, and flexible pipelines) have been received and dismantled in the ports of Dampier, Onslow Marine Support Base (OMSB) and Ashburton. Additionally, the Australian Marine Complex (AMC) has been used to dismantle Defence Vessels.
 - b. There is an immediate need for moderate capacity facilities that can load-in and process a variety of modules, jacket sections, and subsea infrastructure on a continual basis.
 - i. It is recommended that improvements to Pilbara port facilities are concentrated on Ashburton and OMSB as there is less short- and potential long-term congestion than Dampier. Utilising these ports in tandem offers flexibility which can reduce the vessel turnaround time benefiting the offshore decommissioning campaign and other port users.
 - ii. In order to better enable the ports of Ashburton and OMSB to accommodate the decommissioning market, supporting infrastructure and services in Onslow and the Shire of Ashburton need to be further established including regular flights, excess power capacity, and availability of housing.
 - c. There is a long-term requirement (early 2030’s) for a high capacity facility that can load-in large / heavy topsides or fixed jackets using a skidway; or load-in floating facilities using a float-on / roll-off approach.
 - i. Sites which have the potential to receive the largest / heaviest oil and gas assets are either undeveloped (in state Strategic Industrial Areas (SIAs)) or are remote from the offshore oil and gas infrastructure.
 - ii. A site in the state’s Southwest (AMC or Bunbury) may be suitable pending alignment with strategic planning for the Defence, Offshore Wind, and heavy fabrication industries.
 - iii. In the state’s Northwest, there are no existing deepwater ports with infrastructure to receive the largest/heaviest oil and gas assets. Expansion or development of these existing ports for sole decommissioning use are either cost-prohibitive or will adversely impact existing port operations.
 - iv. Overall, it is recommended that developments within AMC would provide the most optimal solution:
 - Provided Northern Harbour lots are available for development.
 - Unless there are proponents in the Northwest of the state which have similar requirements for quayside infrastructure – i.e., could co-develop a deep-water port.





4 The recovery of pipelines is likely to be the geographically closest port and serviced by smaller vessels compared to large, specialist vessels which are required for fixed assets (i.e., platforms). Quayside dismantling of pipelines is unlikely to be necessary as they should arrive on the wharf in road-transportable sections. The recovery and dismantling of pipelines should not govern the configuration or location of a dismantling hub.

5 There is considerable overlap in the specification for an onshore dismantling hub and an offshore wind staging and decommissioning site. Further development of concepts for each should be collaborative and consider interchangeable requirements for a dual use facility.

6 Existing oil and gas service providers, disposal companies, and local government bodies have made recent investments or have existing strategies to develop and support the local decommissioning market. Continued government (federal, state, shire) support – either financially or support with planning and permitting – will be a positive enabler for industry and the local economy.

The conclusions are supported by a number of specific, actionable recommendations for further work which are presented in Table 6.1.

Acronyms and abbreviations

| ACRONYM/ ABBREVIATION | DEFINITION |
|----------------------------------|---|
| AMC | Australian Marine Complex |
| ANSIA | Ashburton North Strategic Industrial Area |
| CODA | Centre of Decommissioning Australia |
| CSV | Construction Support Vessel |
| CUF | Common User Facility |
| DISR | Department of Industry, Science and Resources |
| DMIRS | Department of Mines, Industry Regulation and Safety (WA State Government) |
| DWER | Department of Water and Environmental Regulation |
| GBS | Gravity Base Structure |
| GIS | Geographic information system |
| HLV | Heavy Lift Vessel |
| IMO | International Maritime Organisation |
| JTSI | Department of Jobs, Tourism, Science and Innovation |
| LNG | Liquefied Natural Gas |
| LOA | Length Overall |
| MOF | Module Offloading Facility |
| NOPSEMA | National Offshore Petroleum Safety and Environmental Management Authority |
| NORM | Naturally Occurring Radioactive Material |
| OEUK | Offshore Energies UK |
| OMSB | Onslow Marine Support Base |
| OPGGSA | Offshore Petroleum and Greenhouse Gas Storage Act 2006 |
| OSV | Offshore Support Vessel |
| PLSA | Petroleum (Submerged Lands) Act 1982 |
| PPA | Pilbara Ports Authority |
| PRWMF | Pilbara Regional Waste Management Facility |
| SIA | Strategic Industrial Area |
| SPMT | Self-Propelled Modular Trailer |
| SSHTV | Semi-submersible heavy transport vessel |
| SURF | Subsea Umbilical, Risers, & Flowlines |
| USD | United States Dollar |
| WA | Western Australia |

1. Introduction

The objective of this scope of work, executed in Q2 2023, is to undertake a comprehensive evaluation of potential sites on the Western Australian coast that would be suitable for the establishment of a decommissioning receive and dismantling yard for offshore oil and gas assets.

The outcome of the present study will be a recommendation to CODA as to the most suitable location(s) – primary and, if necessary, secondary facilities.

Figure 1.1 presents the overall sequence of the study. Each of the steps in the study have been documented in the subsequent sections of this document.

- The review will include all current and proposed ports within the state of WA as defined by the Department of Transport [1] and private facilities in development by CODA partners.
- Consideration will be given to all offshore infrastructure in the Bonaparte, Browse, North Carnarvon, and Perth basins. Bass Strait and international infrastructure will not be considered explicitly in this study, however pursuant to the international Basel Convention and Australian Federal Hazardous Waste Act (Regulation of Exports and Imports) 1989 (for international infrastructure), WA dismantling hub(s) can service other markets.



Figure 1.1 | Study Sequence



2. Potential Facility Demand

CODA estimated that there is a USD\$40.5b decommissioning liability for the full removal of all equipment installed offshore [2, 3]. Of this liability, 59% is associated with the decommissioning of Fixed, Floating, Subsea and Pipelines Facilities; Well Plugging & Abandonment comprises the balance. Of this liability, 70% is associated with assets located in basins in close proximity to WA ports. Using norms from the UK [4], approximately 12% of the facility decommissioning liability can be contributed to the onshore disposal. Therefore, there is the potential for at least USD\$2.1b of spend to be located onshore in close proximity to port facilities within WA.

From the review of available demand information, the following observations were made for the anticipated throughput of WA dismantling facilities:

- It is anticipated that the demand on the dismantling facility may change with time. Life extensions of the oil & gas assets to accommodate increased production from existing reservoirs or tie-backs from new reservoirs may push out Cessation of Production dates. Additionally, the demand on dismantling facilities is expected to be self-moderating due to availability of vessels, labour, and the overall decommissioning supply chain (e.g., including drilling contractors for the P&A works).
- Peak demand from fixed, floating, and subsea assets is up to 130,000te per annum. However, cold stacking or redeploying floating facilities will drop the peak demand to 90,000te per annum.
- Overall, the maximum tonnage from a single facility (per year) is anticipated to be around 80,000te. Larger floating facilities (i.e., Prelude and Ichthys) represent greater tonnage than this; however, can be staged over multiple years as they do not immediately need to be landed on the quayside.
- The greatest tonnage is associated with the recovery of pipelines (up to 1,000,000te in a single campaign).
- The extent to which fixed facility substructures are removed (if aligned with the requirements of IMO A.672(16)) does not greatly impact the overall demand requirement.
- There are unique requirements for the dismantling of the Wandoo B concrete GBS which do not overlap with requirements for the dismantling of other structures. Therefore, it is not recommended for the functional requirements of the main WA dismantling hub to address dismantling of a concrete GBS.

The conclusions from the demand review were as follows:

1. There is an immediate requirement for the onshore dismantling of offshore oil and gas assets.
2. Peak demand does not need to be covered by a single dismantling facility.
3. The largest dismantling facility onshore in WA must be able to handle a peak demand of at least 80,000te / annum at minimum. The balance (10,000 – 50,000te) may be handled by alternative dismantling facilities.
4. Recovery of pipelines should not govern the sizing of a dismantling facility as the scrap spools will likely be deposited at the closest port using an OSV provided they do not have significant contamination. It is again noted that the precedent in the UK sector of the North Sea is to leave the majority of pipelines in-situ following the completion and acceptance of a comparative assessment.
5. From 2030 there will be a requirement for the skidded load-in of some offshore assets.

¹Within OEUK's Decommissioning Insight Report 2022 [4], Onshore Disposal (Element 8 of OEUK Cost Estimate WBS [25]) accounts for 12.4% of the total fixed facility decommissioning costs (Elements 4 – 8). The 12.4% excludes the costs associated with load-in and also includes an offset for the value of the rebate of recyclable material. Therefore, the USD\$2.1b of spend supporting the disposal of infrastructure is likely to be at the lower end of the potential. Finally, it has been assumed that the offshore-onshore cost split for floating, subsea, and pipeline facilities is the same as for fixed facilities.

3. Facility Specification



There is a wide range of infrastructure types that can come ashore as part of the offshore industry's decommissioning activities. The focus of the present study is on the requirements for a "hub" that can handle all types of offshore facilities. The requirements for such a facility are driven by the load-in and demolition of larger offshore facilities (i.e., integrated decks and jackets of fixed facilities) and components with significant quantities of hazardous wastes.

The requirements of the "hub" will not be driven by small components (i.e., wellhead platforms, subsea manifolds, etc), those brought onshore in containers or reels (i.e., piece small demolition, SURF, etc), or facilities with minimal hazardous components (i.e., minimal hydrocarbon sludge). Therefore, the overall specification and recommendations noted in the present study do not preclude other locations from being used for onshore dismantling. However, it is expected that as the decommissioning supply chain develops, most components will be landed at the hubs which meet some or all criteria even if other locations are closer to the offshore assets.

For the state of WA to dismantle all proximate offshore oil and gas assets, one or a collection of facilities will need to meet the requirements detailed in this section. Based on the review of established international facilities, the following specifications are recommended for potential WA facility:

1. Tidal range: Less than 5m preferred for operability reasons.
2. Vessel access:
 - Land-backed quayside to allow Heavy Lift Vessels and/or Semi-Submersible Heavy Transport Vessels to dock:
 - LOA > 210m
 - Draft >10m
 - Land-backed quayside to allow barges and Construction Support Vessels to dock:
 - LOA >110m
 - Draft >6m
3. Air draft: No restrictions
4. Quayside laydown area:
 - a. Total: 180,000m² of quayside laydown area available across all allocated dismantling facilities, based on total demand of 130,000te/year.
 - b. Largest Dismantling Facility: 110,000m² of quayside laydown area available within the single largest dismantling facility, based on maximum single facility demand of 80,000te.
 - c. Minimum for any Facility: 10,000m².
5. 10te/m² bearing capacity (min).
6. Impermeable (i.e., membrane) dismantling area with on-site water treatment.
7. Provision for the temporary installation of a skidway (i.e., a permanent skid track).
8. Located within established industrial areas.
9. Access to a labour market able to support 60 – 80 site-based jobs.
10. In close proximity to waste management facilities, including a Class III landfill, preferably Class IV.
11. Prescribed premise, in addition to holding licences for dangerous goods and NORMs.
12. No specific ownership criteria required: internationally dismantling yards are operated by fully privatised operations or on publicly owned facilities leased by contractors.

4. Screening Criteria

To enable a structured and consistent review of all potential locations, screening criteria was established. A two-phase approach was used for screening to prioritise effort. During each screening phase, if significant constraints were identified for one criterion no further review for the other criteria was carried out.

4.1. PHASE 1 SCREENING

The objective of the Phase 1 Screening was to use a small number of set (hard) criterion to rapidly eliminate unsuitable locations to allow effort to be focused on more likely candidates during the Phase 2 Screening. Specifically, the following criteria were used:

Marine Operability (Tides)

The tidal range at a port will reduce operability when performing load-in operations using SPMTs or a skidway.

Facilities with tides greater than the nominal 5m limit can still be part of the decommissioning supply chain (e.g., offshore support, loading-in components using quayside or vessel cranes) but are unlikely to be feasible options for the larger modules.

Quayside Infrastructure

The quayside infrastructure (access, berths, and quayside arrangements) will restrict the types of vessels, and thus the type of decommissioning “cargo”, that can service the facility / decommissioning hub. The limits have been prescribed to broadly capture the different types of vessels that could be used for the offshore decommissioning campaigns.

Availability of Laydown Areas or Undeveloped Land

The availability of laydown areas, or undeveloped land which could be used for dismantling activities and establishment of waste processing facilities, is the final Phase 1 screening criterion.

Port Operation

Common user facilities, or those which could be expanded to provide common user facilities, are required. Ports which have a single private operator (i.e., a resource exporter) are not suitable for receipt of offshore infrastructure for dismantling. Typically, the quayside infrastructure will be custom to the operation (trestle jetties for liquid or bulk transfers), but if there is a general cargo wharf it is also unlikely to be available. Resource exporter’s core business is not providing port services and any third-party cargo coming through their general cargo wharfs is likely to adversely impact their operational support activities.



4.2. PHASE 2 SCREENING

The Phase 2 Screening was a more thorough approach for locations that were not categorised as unsuitable in the Phase 1 Screening (i.e., no criteria coded red) and included more qualitative aspects.

Proximity to Industrial Work Force

A dismantling facility will need to access skilled labour, and secondary industries. Being in close proximity (<50km) to an established heavy industry labour market will reduce requirement for a FIFO work force and have flow on effects to the local economy. Additionally, existing heavy industry hubs will enable access to secondary industries for equipment hire and other technical services.

Proximity to Final Disposal Facilities

A major hub facility should be in close proximity to the final waste disposal locations. Scrap steel will be exported direct from the port, however waste materials will be handled at the closest waste management facility that can accept it. For the screening criteria, an ideal facility will be in close proximity (~50km) to:

- Class IV landfill (double-lined) to receive hazardous solid wastes are preferred, otherwise Class III (lined).
- Liquid Waste Management facilities.
- NORM Storage / Handling facilities.

Class III landfill means a lined landfill, which may include leachate collection, designed to accept putrescible and inert wastes for burial. Class IV landfill means a double-lined landfill with leachate collection, designed to accept contaminated soils and sludges (including encapsulated wastes) for burial [5].

Final disposal of NORMs will need to go to a Class V Intractable Waste Facility (i.e., Sandy Ridge [6]) and any hazardous waste that cannot be accepted at the closest landfill will also need to be transferred to a higher-class facility.

Proximity to Oil & Gas Infrastructure

Having a dismantling hub in close proximity to the offshore oil and gas infrastructure being decommissioned reduces transit time between the offshore and onshore phases of work. This is important to align and optimise offshore operability weather windows. For the purposes of the screening, a limit based on a 72hr tow time at 4kn (i.e., 3-day barge tow) and 24hr tow time at 12kn (i.e., 1-day transit for a heavy lift or construction vessel) was set as the standard. Onshore locations not proximate to the offshore infrastructure are not precluded on this basis (i.e., no red criteria), but are non-preferred.

This screening stage has been conducted based on available location data for offshore assets [7], with some supplementary information contained in Environmental Plans provided by NOPSEMA [8]. The screening has been done by count and is not weighted by the recovered mass as this information was not available.

Alignment with Planning / Zoning / Strategy for Area

Establishment of a dismantling yard must be aligned with the strategic plans for the facility and surrounding industry, community, traditional owners, and other stakeholders.



4.3. COLLATED SCREENING CRITERIA

| Criteria | Green Likely to be suitable to load-in and process the largest of facilities off the WA coast. | Yellow Likely to be able to load-in and process modules and subsea infrastructure | Orange May be suitable to support limited onshore dismantling activities. | Red Unsuitable for onshore dismantling activities. |
|---|---|---|---|--|
| Marine Operability (Tides) | Tidal range <5m | Graded between the green and orange limits. | Tidal range >10m | N/A |
| Channel / Quayside Infrastructure (Maximum vessel size) | Land-backed quayside will allow HLV and SSHTV to dock: | Land-backed quayside will allow barges and CSVs to dock: LOA >110m Draft >6m | Deep water quayside that is not land-backed. | Shallow water quayside that is not land-backed, or loop jetty. |
| Availability of Laydown Areas or Undeveloped Land | Available or undeveloped land immediately behind quayside in excess of 110,000m ² . | Available or undeveloped land in excess of 50,000m ² . | Available or undeveloped land in excess of 10,000m ² . | Use of the port for decommissioning activities will displace existing port users and industries. |
| Port Operation | Common User Port Facilities | N/A | Potential for development of Common User Port Facilities | Privately operated port (i.e., no opportunity to use for offshore decommissioning). |
| Proximity to Industrial Workforce | Within 50km of a local populace where heavy industry is a core component of its economy. | Within 50km of a local populace. | Remote with established FIFO workforce. | Remote. |
| Proximity to Final Disposal Facilities | Within 50km of final disposal facilities / companies including: <ul style="list-style-type: none"> Class IV landfill Liquid Waste Management NORM Storage / Handling | Within 50km of final disposal facilities / companies including: <ul style="list-style-type: none"> Class III landfill Liquid Waste Management | Remote from final disposal facilities and will require transshipment. | N/A |
| Proximity to Oil & Gas Infrastructure | 50% of offshore assets are within 72hrs @ 4kn or 24hrs @ 12kn. | 25% of offshore assets are within 72hrs @ 4kn or 24hrs @ 12kn. | Remote from offshore assets. | N/A |
| Alignment with Planning / Zoning / Strategy for Area. | Location is actively targeting decommissioning market. | Location does not have a strategy that includes decommissioning, but expansion to include decommissioning will not adversely impact other markets. | Location has been identified for alternative markets or developments. | Location is not targeting growth in the decommissioning or oil and gas markets. |

Table 4.1 | Collated Screening Criteria

5. WA Facility Summary & Screening

For the purposes of the study, all current and proposed port facilities within WA [1] have been identified and appraised against the established screening criteria.

Many existing facilities are unsuitable due to existing operations and infrastructure (either undeveloped or at capacity), remote proximity to offshore infrastructure, or operability reasons. The results from the Phase 1 Screening are graphically presented in Figure 5.1 and Figure 5.2.

The Phase 2 screening was only completed for locations that were not categorised as unsuitable in the Phase 1 Screening (i.e., no criteria coded red). The facilities, and screening outcomes, are graphically presented in Figure 5.3 and Figure 5.4.

Table 5.1 provides a tabular summary of the screening outcomes and includes key open items and actions recommended for the second phase of the study. A full discussion for each facility, including detailed assessments of the shortlisted facilities is included in the full report.

| Region | Port | Screening Outcome |
|-----------|-------------------------------|---|
| Kimberley | Wyndham | Unsuitable (Phase 1) |
| | Yampi Sound (Cockatoo Island) | Unsuitable (Phase 1) |
| | Yampi Sound (Koolan Island) | Unsuitable (Phase 1) |
| | Derby | Unsuitable (Phase 1) |
| | Broome | Suitable to support some decommissioning activities, but not as a major hub. |
| Pilbara | Port Hedland | Suitable to support some decommissioning activities, but not as a major hub. |
| | Balla Balla (proposed) | Unsuitable (Phase 1) |
| | Port Walcott | Unsuitable (Phase 1) |
| | Anketell (proposed) | Detailed assessment completed for its potential to be a high capacity / intermittent volume facility that can load-in large/heavy topsides or fixed jackets using a skidway; or load-in floating facilities using a float-on / roll-off approach. Without certainty of the development timeframe, it is not recommended that any further decommissioning-specific concept work is undertaken at Anketell. The high CAPEX of developing a greenfield site precludes Anketell unless there are other foundation proponents with which the development costs can be shared. |

| Region | Port | Screening Outcome |
|------------------|-----------------------------------|---|
| Pilbara | Dampier | <p>Detailed assessment completed for its potential to be a moderate capacity / continuous volume facility that can load-in and process a variety of modules, jacket sections, and subsea infrastructure.</p> <p>The use of the Birdon-operated Toll slipway is a viable option as is using the common-user port facilities for smaller Offshore Support Vessel delivered cargos. However, due to the port congestion, it is not deemed to be a suitable long-term port in which to bring regular moderate-sized decommissioning cargos through.</p> |
| | Cape Preston East (proposed) | Unsuitable (Phase 1) |
| | Cape Preston | <p>Unsuitable (Phase 2)</p> <p>Oil & gas decommissioning is not aligned with usage at the port, despite its MOF wharf having suitable characteristics to receive small volumes.</p> |
| | Cape Preston West (proposed) | Unsuitable (Phase 1) |
| | Varanus Island | Unsuitable (Phase 1) |
| | Barrow Island | Unsuitable (Phase 1) |
| | Onslow (Airlie Island) | Unsuitable (Phase 1) |
| | Onslow (Thevenard Island) | Unsuitable (Phase 1) |
| | Onslow Marine Support Base (OMSB) | <p>OMSB and Ashburton were reviewed together due to the common services offered out of Onslow and the potential for the facilities to be used in tandem during a removal campaign.</p> <p>Detailed assessment completed for OMSB and Ashburton to be moderate capacity / continuous volume facilities (individually or in tandem) that can load-in and process a variety of modules, jacket sections, and subsea infrastructure.</p> |
| | Ashburton | <p>Overall, it is expected that a successful Onslow hub will utilise both port facilities in tandem. Improvements to OMSB, the Port of Ashburton, and the wider Onslow industrial service sector are, however, necessary to best enable the establishment of a decommissioning hub.</p> |
| Urala (proposed) | Unsuitable (Phase 1) | |

| Region | Port | Screening Outcome |
|--------------|--|---|
| Mid West | Gascoyne Gateway (private development, proposed) | Support some decommissioning activities, but not as a major hub. |
| | Carnarvon (Cape Cuvier) | Unsuitable (Phase 1) |
| | Carnarvon (Useless Loop) | Unsuitable (Phase 1) |
| | Oakajee (proposed) | Unsuitable (Phase 2) No advantages over AMC and planned developments are not aligned with decommissioning. |
| | Geraldton | Unsuitable (Phase 1) |
| Metropolitan | Fremantle Inner Harbour | Unsuitable (Phase 1) |
| | AMC | Detailed assessment completed for its potential as a high capacity / intermittent volume facility that can load-in large / heavy topsides or fixed jackets using a skidway; or load-in floating facilities using a float-on / roll off approach. Other than proximity to the oil & gas infrastructure, AMC has the most favourable aspects associated with development of undeveloped lots into a high capacity / intermittent volume facility. A concept has been proposed for Lots 15, 16, & 17 in the Northern Harbour as part of the Integrated Infrastructure Program initiative led by JTSI and the Commonwealth Department of Defence. |
| | Kwinana Outer Harbour | Unsuitable (Phase 1) |
| Southern | Bunbury | Detailed assessment completed for its potential as a high capacity / intermittent volume facility that can load-in large/heavy topsides or fixed jackets using a skidway; or load-in floating facilities using a float-on / roll off approach. No advantages over AMC, planned developments are not aligned with oil & gas decommissioning, and in close proximity to residential zones. If the overall strategic review of the AMC precinct and future usage result in that facility being unavailable for onshore dismantling works then Bunbury may be a suitable alternative due to the availability of land (not withstanding issues associated with residential zoned land in close proximity). |
| | Albany | Unsuitable (Phase 1) |
| | Esperance | Unsuitable (Phase 1) |
| | | |

Table 5.1 I Tabular Summary of Screening Results

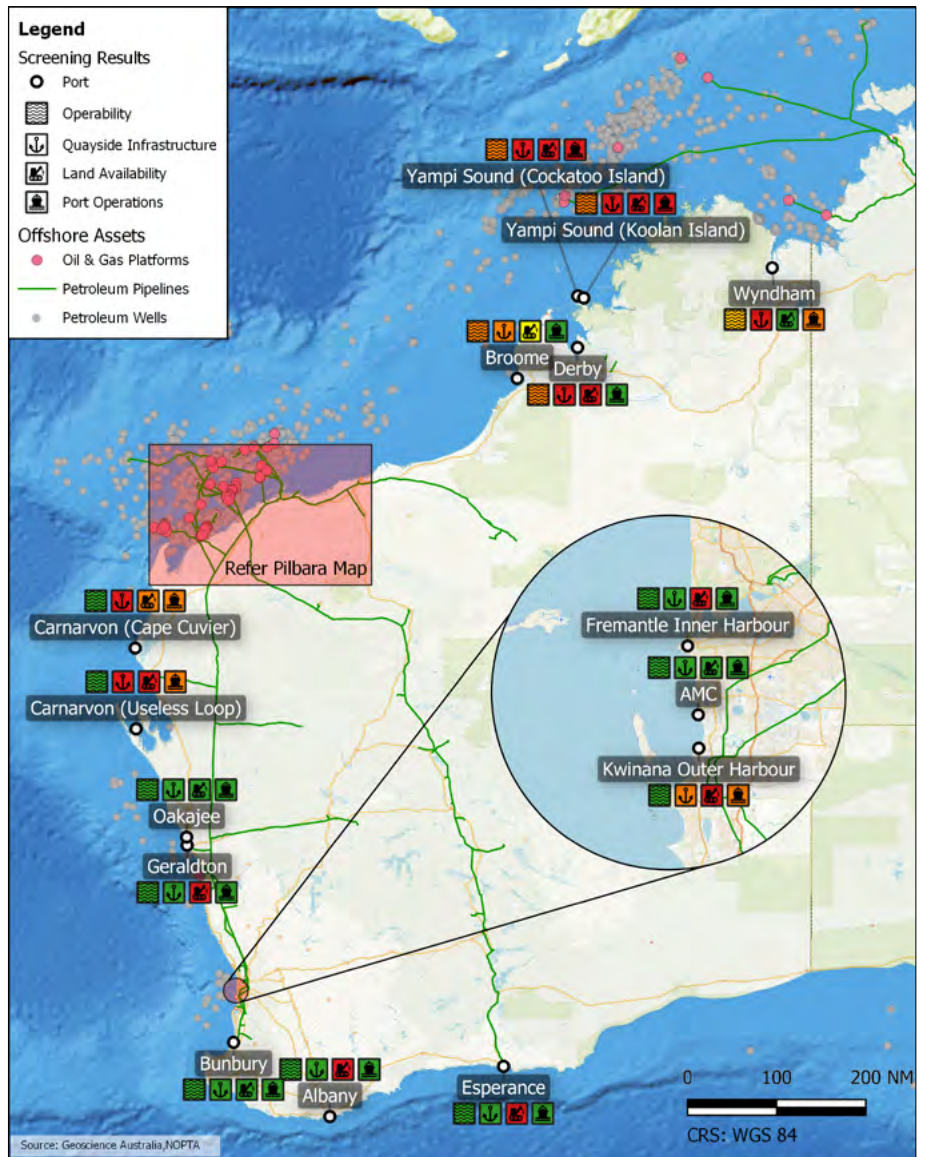


Figure 5.1
WA Ports – Screening
Results – Phase 1

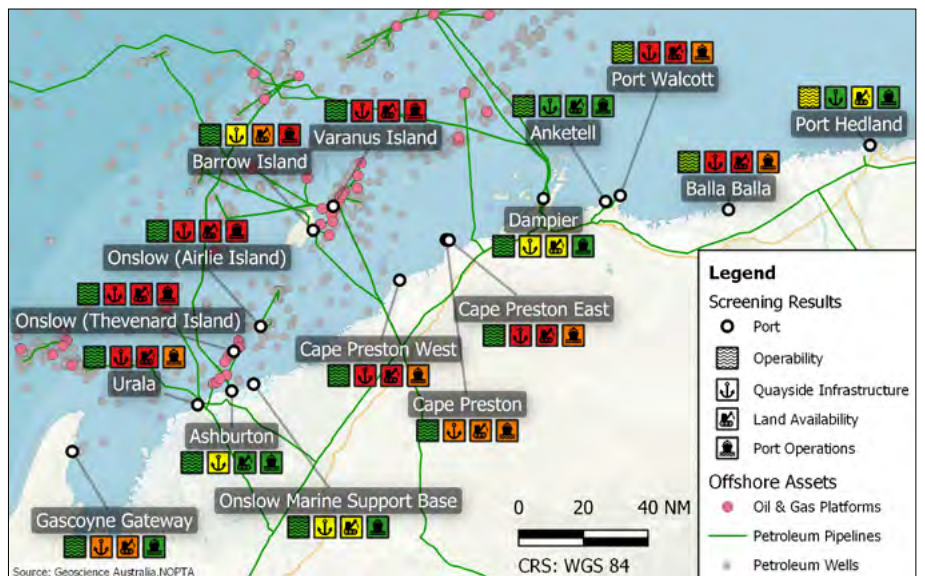


Figure 5.2
Pilbara Ports – Screening
Results – Phase 1

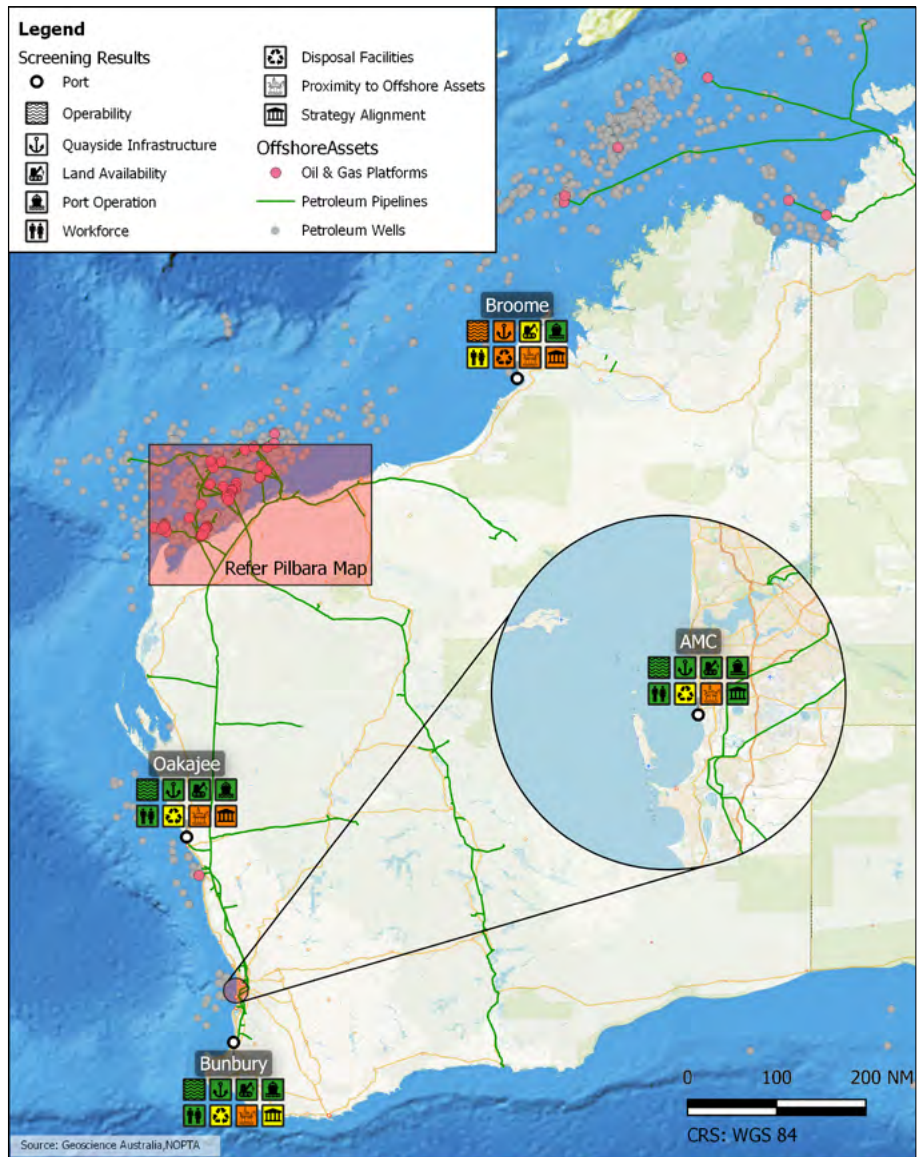


Figure 5.3
WA Ports – Screening Results – Phase 2

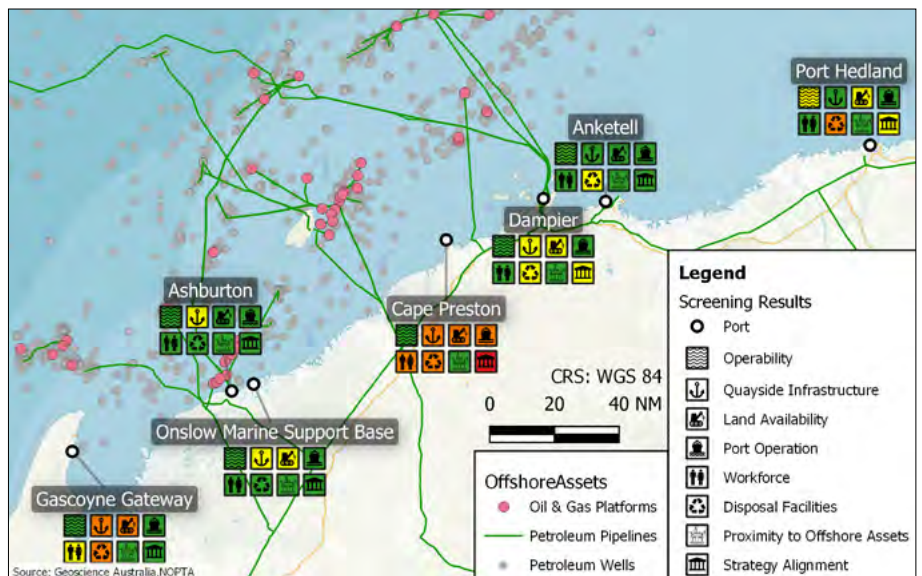


Figure 5.4
Pilbara Ports – Screening Results – Phase 2

6. Recommendations

Table 6.1 presents a list of recommendations for further work as an outcome of the present study. Most are recommendations focussed on actionable items for the federal government, state government, or CODA which are grouped as follows:

- Potential Workload (refined volumes/tonnages and timing).
- Decommissioning Facility Specification.
- Regulatory.
- Infrastructure and Planning.

In addition to these general study, strategy, and regulatory related recommendations there are many specific recommendations for each of the short-listed facilities which should be considered in the overall strategy for each site to develop or improve the execution of decommissioning works at the site.

The urgency and impact of recommendation has been considered and is presented in Figure 6.1. The overall importance (impact + urgency) of each item has also been highlighted in Table 6.1.

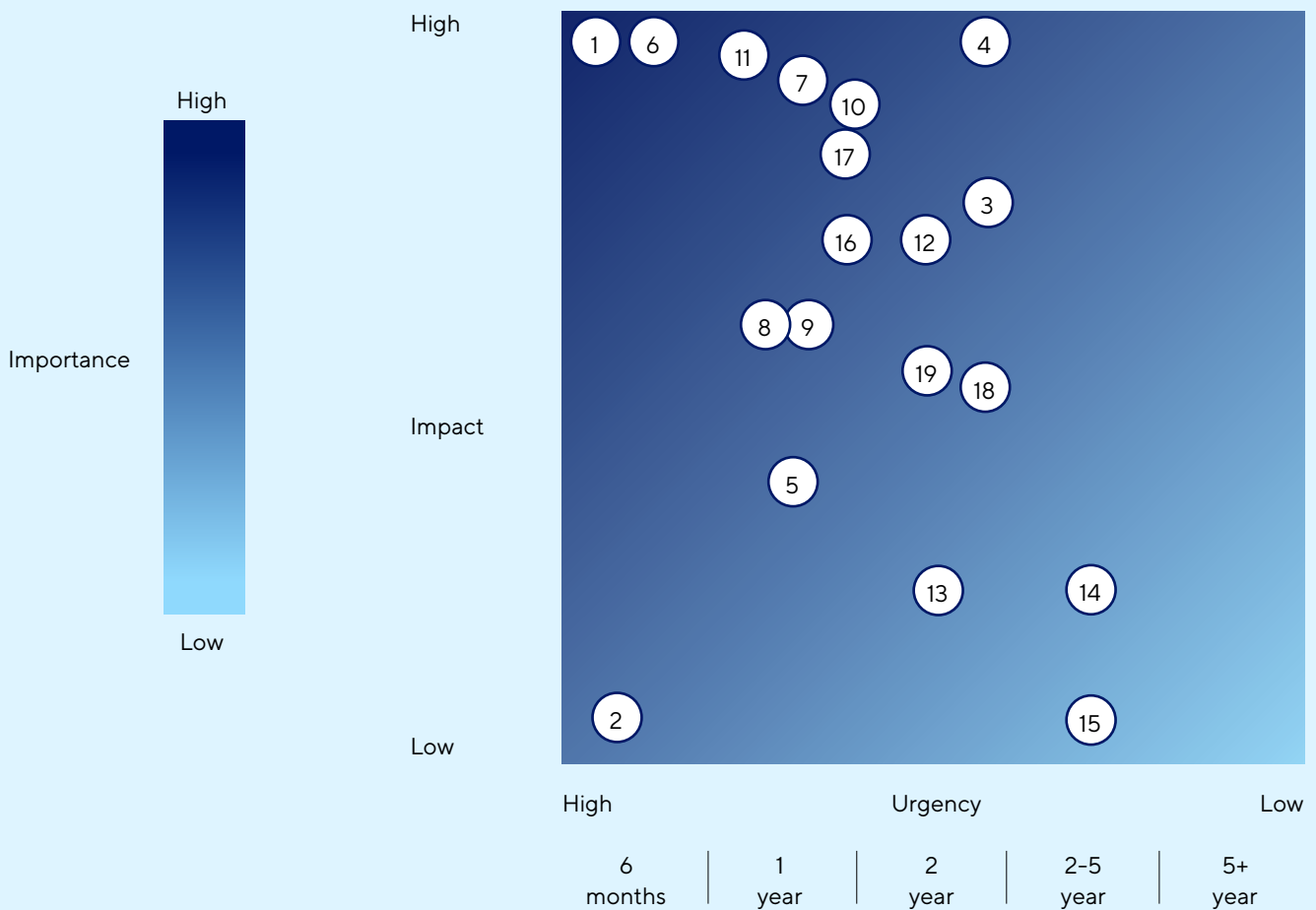


Figure 6.1 | Recommendations – Urgency / Impact Mapping

| # | Recommendation | Impact | Urgency | Comment |
|---------------------------|---|--------|--------------------|--|
| Potential Workload | | | | |
| 1 | <p>Decommissioning Database – Offshore Oil & Gas Infrastructure</p> <p>An enhanced database of infrastructure to be decommissioned would support planning activities for regulators, port operators and disposal supply chain companies.</p> <p>Many of the more recent Environmental Plans submitted to NOPSEMA hold information regarding:</p> <ul style="list-style-type: none"> • Type and number of infrastructure within the title. • Size (dimensions and weight). • Materials & hazardous wastes. <p>In addition, there are timelines for the decommissioning activities (or for operational assets the expected field life).</p> <p>It is recommended that this information is standardised, collated, and kept live in a single repository available to industry – either via a subscription or publicly available. Subject to Australian competition law, this may enable greater collaboration across operators and industry.</p> <p>As an example, the OSPAR Commission (North Sea) publish a GIS Inventory of Offshore Installations every 2-years [9].</p> | High | High ~6 months | |
| 2 | <p>Updated Demand Profile – “Creaming Curve” for Load-In</p> <p>As a secondary scope from the development of a decommissioning database, the information could be collated into a “creaming curve” as indicated in Figure 6.2.</p> <p>The purpose of this analysis will be to project the throughput that is technically feasible for each port to support demand modelling.</p> <p>Each port will have a limit to the size of infrastructure that could be loaded in due to hardstand capacity or ability for vessels to come into the quayside. Understanding the total tonnage that could be loaded in for each port may assist with planning, especially for the disposal pathways (e.g., landfill). The data can be filtered by decommissioning date, proximity to the port, or asset type and limits could be imposed by weight (quayside capacity) or footprint (if this constrains the vessels available for removal and hence access into the port).</p> | Low | High ~6 months | This work is a natural extension of Recommendation #1 |
| 3 | <p>Development of Skidway Requirements (Anketell, AMC & Bunbury)</p> <p>It is recommended that, in conjunction with relevant operators, a detailed review of oil & gas facilities that are unable to be loaded in via SPMTs is undertaken. These facilities may require a skidway to be loaded-in (pending operator’s intended decommissioning methodology). Understanding the weights and arrangement used to load-out the structures during construction (i.e., the required skidway-width) can feed into an overall specification for a skid track to be developed at the high capacity / intermittent volume facility. The timing of each structure’s decommissioning will also enable there to be more confidence in the required delivery date for this infrastructure.</p> | High | Medium ~2 years | It is expected that a skidway will need to be commissioned in the early 2030’s based on the forecasted decommissioning dates of certain assets. The ~2 year timeframe for this specific recommendation is to ensure that the inputs for the facility specification will be received in sufficient time within the overall project timeframe. |

| # | Recommendation | Impact | Urgency | Comment |
|-------------------------------|--|--------|---------------------|---------|
| Potential Workload | | | | |
| 4 | <p>Decommissioning Database – Expansion to Include Onshore & Defence Infrastructure</p> <p>Further to the creation of an enhanced, live offshore oil & gas infrastructure decommissioning database, it is recommended to expand the scope of the decommissioning database to include onshore infrastructure (oil & gas, petrochemical, and mining) and defence infrastructure.</p> <p>An integrated decommissioning database may assist with planning, especially for the disposal pathways (e.g., landfill) and skills gaps.</p> | High | Medium ~2 years | |
| Facility Specification | | | | |
| 5 | <p>International Networking</p> <p>Further networking between the Australian industry and international dismantling facilities is recommended (especially European which have similar regulations and are nominally 10-15 years ahead of Australia in the decommissioning space). Most facilities have unique constraints, requirements, and execution methods so a broad industry view helps inform planning for the decommissioning hub(s). Such facilities may include:</p> <ul style="list-style-type: none"> • Able Seaton, UK. • Lerwick Port Authority, UK – improvements to existing Dales Voe facility in planning (Ultra-deep-water quay). • M.A.R.S., USA. • Bintan Offshore Marine Centre, Indonesia (Qube-operated) – decommissioning yard expansion underway. • Brunei Darussalam Maritime Cluster, Anson International, Brunei (CessCon Decom-lead development underway). | Medium | Medium (ongoing) | |
| Regulatory | | | | |
| 6 | <p>Multi-Agency Working Group for Decommissioning Regulations</p> <p>It is recommended that a multi-agency working group is established to expedite improvements to regulations, policies, and guidelines associated with the onshore aspects of oil & gas decommissioning. This may include federal and state government agencies with potential input from affected local cities and/or shires.</p> | High | High ~6 months | |

| # | Recommendation | Impact | Urgency | Comment |
|---|---|--------|-------------------|--|
| Regulatory | | | | |
| 7 | <p>Regulatory Guidelines for Onshore Disposal Activities</p> <p>The federal government (DISR) has published a decommissioning guideline [10] and the WA state government (DMIRS) has published a draft position paper [11] and intends to submit a corresponding policy following completion of the consultations.</p> <p>Both of these guidelines acknowledge onshore disposal, however as this activity is outside of the remit of the legislation (OPGGSA and PLSA, respectively) it is not the focus of the document.</p> <p>An equivalent guideline addressing the waste management and disposal regulations and, importantly, waste hierarchy expectations would provide clarification to operators and industry. Additionally, this guideline should address the cross-regulatory nature of these activities (Commonwealth – State and interstate). This may also include the expectation for the public reporting of the total recovered material and disposal route (e.g., landfill, recycling, waste-to-energy, re-use) which is the expectation within Close Out reports provided to the UK Regulator (Offshore Petroleum Regulator for Environment and Decommissioning).</p> | High | High ~1 year | This may be an outcome of the work addressed by the Multi-Agency Working Group (see Recommendation #6). |
| 8 | <p>Decommissioning Environmental Plans to be expected to include onshore impacts</p> <p>Environmental Plans submitted to date typically address environmental impacts on the marine environment but have not necessarily addressed the terrestrial impacts at the dismantling location or impact of the final disposal route. It is recommended that clear expectations are established for including these aspects in Environmental Plan submissions.</p> | Medium | Medium ~1 year | It is noted that operators are already considering these aspects under their “social licence” obligations, however to date this has not explicitly considered by the regulator in a similar manner to impacts on the marine environment. |
| Infrastructure Strategy & Planning | | | | |
| 9 | <p>Consideration of community and other stakeholder requirements</p> <p>Feedback from multiple stakeholders that were consulted with recommended that the oil and gas industry continue to consider social and community impacts and benefits when planning and executing decommissioning activities.</p> | Medium | Medium ~1 year | It is noted that operators and demolition contractors are already considering these aspects under their “social licence” obligations. |
| 10 | <p>Availability of Infrastructure Funding or Loans</p> <p>It is recommended that Federal or State funding and loans are made available for infrastructure improvements to port facilities (and adjacent or service infrastructure) to better enable the establishment of the industry. Specific allocation to be made on a per-facility basis as further development work is undertaken.</p> | High | Medium ~1 year | This may be an outcome of the work addressed by the Multi-Agency Working Group (see Recommendation #6). |

| # | Recommendation | Impact | Urgency | Comment |
|---|---|--------|---------------------|---------|
| Infrastructure Strategy & Planning | | | | |
| 11 | <p>South-West Quayside Integrated Planning Review (AMC & Bunbury)</p> <p>In the South-West there is future demand for Common User facilities (i.e., the Southern Harbour CUF at AMC) or undeveloped land within existing port precincts. From the present study, demand for these spaces may come from:</p> <ul style="list-style-type: none"> Defence. It is anticipated that Defence demand for the existing Common User Facility in the Southern Harbour of the AMC will increase as a result of the AUKUS program and other Defence shipbuilding and sustainment programs. Project and Construction works. Currently being undertaken in the AMC South CUF. Offshore Wind staging. Within WA, the Indian Ocean region off Perth/Bunbury has been identified as priority areas for assessment for suitable area declaration. Offshore Oil & Gas Decommissioning. <p>An integrated planning review of port usage requirements within the South-West is recommended to ensure each industry can strategically plan developments and execution activities.</p> | High | High ~1 year | |
| 12 | <p>Multi-User Facility Licencing</p> <p>Within WA, the operators of facilities (prescribed premises) where dismantling works are undertaken hold the licence for the works. However, the facility operator is unlikely to be the one executing the works which may be one of several demolition or waste management contractors.</p> <p>This may be managed by excising a portion of the site that will be used for decommissioning works and create or adjust licences. However, as decommissioning works become more prevalent in multi-user facilities this may be administratively inefficient for the facility operator, the prime contractors, and the regulator (DWER). Alternatively contractual methods may be used to share the compliance risk.</p> <p>A review of suitable mechanisms for managing licences or risk from a regulatory and commercial (for port-authority operated or state-leased sites like AMC) standpoint is recommended to enable an efficient and standardised approach to be applied across the state.</p> | High | Medium ~2 years | |
| 13 | <p>General Collaboration – Offshore Wind (AMC & Bunbury)</p> <p>There is considerable overlap in the requirements for an offshore wind staging area as for offshore oil & gas decommissioning. Further state-led initiatives for either should consider collaboration or at least communication of the scope and outcomes.</p> | Low | Low ~2 years | |
| 14 | <p>General Collaboration – Other Decommissioning Activities</p> <p>Further to Recommendation 2 above, the decommissioning of other infrastructure – particularly onshore oil & gas, petrochemical, mining, and defence – have similar regulatory requirements and functional demands as the onshore dismantling and disposal activities for offshore oil and gas infrastructure. Further state-led initiatives for either should consider collaboration or at least communication of the scope and outcomes.</p> | Low | Low ~2 – 5 years | |

| # | Recommendation | Impact | Urgency | Comment |
|--------------------------|---|--------|---------------------|--|
| Facility Specific | | | | |
| 15 | <p>Anketell</p> <p>Monitor development proposals for the site to determine if future foundation proponent's specification may align with the offshore decommissioning requirements. It is not recommended that this site is actively pursued due to the high CAPEX requirements for developing a greenfield site for the sole offshore oil & gas decommissioning use.</p> | Low | Low ~2 – 5 years | |
| 16 | <p>Australian Marine Complex (AMC)</p> <p>Proceed with further concept works associated with the development of a facility on Lots 15, 16, & 17. Specifically, this should include:</p> <ul style="list-style-type: none"> • Dismantling Facility. • Dredging and breakwater upgrades. • Extension of Clarence Beach Road. <p>Further work to enable a Class 4 estimate to be developed is recommended as the next step.</p> | High | High ~1 year | |
| 17 | <p>Onslow – Service Sector</p> <p>Use of the Port of Ashburton and OMSB will increase demand for industrial services within Onslow. State or Shire-led increases in capacity for the following services may enable service providers to execute work more efficiently:</p> <ul style="list-style-type: none"> • Flights are currently charter-only into Onslow. Establishing a regular schedule of flights would reduce costs for getting staff into Onslow. • There is no excess power available from the grid in Onslow. Service providers need to provide their own power solutions (i.e., diesel generators). Spare power capacity in the grid would reduce barriers for setting up project-specific decommissioning sites. <p>Residential sub-division lots are available within Onslow via Development WA. Funding to build excess housing would reduce pressure on existing supply.</p> | High | High ~1 year | |
| 18 | <p>Ashburton</p> <p>Service providers are establishing project-specific zones within the PRWMF, ~30km from the Ashburton North SIA. To reduce travel distance between quaysides (OMSB or Port of Ashburton), it is recommended that land within the ANSIA is identified and allocated for future dismantling project works. This will be suitable for projects like what has been committed to be executed out of PRWMF, however will also be well suited to processing of pipeline sections (if recovered) in the future. Reducing the on-road transport of material to be dismantled will increase the efficiency of dismantling works given most of the recyclable materials will be transhipped from the same port that loaded the structures in.</p> | Medium | Medium ~2 years | The immediate term dismantling activities where project-specific land is required are utilising the PRWMF. Therefore, the timeframe of this action is more aligned with the medium-term demand which may have not yet committed to a dismantling location. |

| # | Recommendation | Impact | Urgency | Comment |
|--------------------------|--|--------|--------------------|---|
| Facility Specific | | | | |
| 19 | <p>OMSB</p> <p>OMSB have undertaken a number of expansions and improvements of their facility since it was constructed in 2016. They are proposing further improvements in the short and mid-term including:</p> <ul style="list-style-type: none"> • Dredging the channel to allow larger vessels to access the port. • Gaining access to further land to the west and south of the existing facility. <p>Support from the Commonwealth, state, and shire to enable these developments would increase the potential throughput of the facility and be an enabler for industry (dismantling companies and other service providers) to set up permanent facilities in close proximity to a port.</p> | Medium | Medium ~2 years | These proposed improvements have been identified by OMSB and are part of their 2 – 5 year plan. |
| 20 | <p>Bunbury</p> <p>No specific recommendations prior to the completion of Recommendation #8 regarding a South-West Quayside Integrated Planning Review.</p> | | | |
| 21 | <p>Dampier</p> <p>No specific recommendations.</p> | | | |

Table 6.1 | Study Recommendations



Creaming Curve Example - Infrastructure Weight

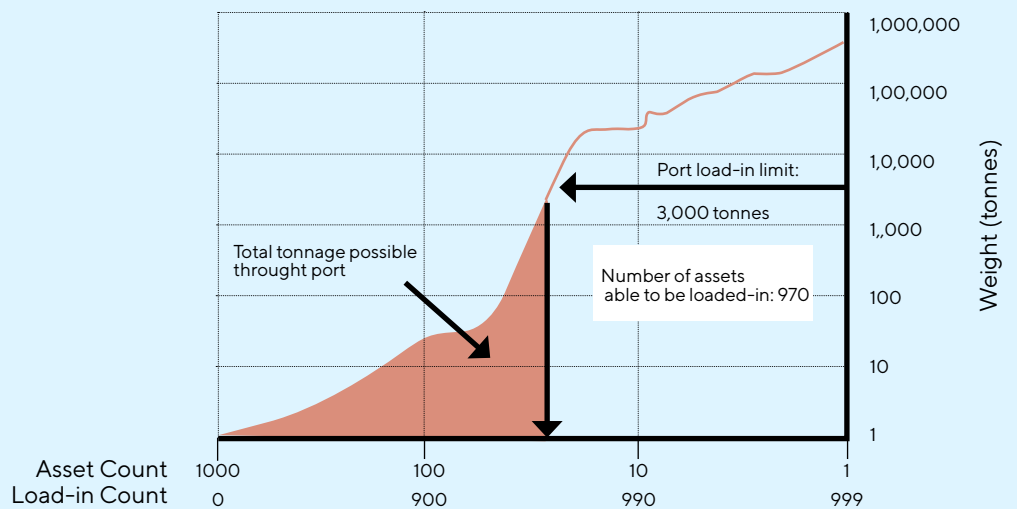
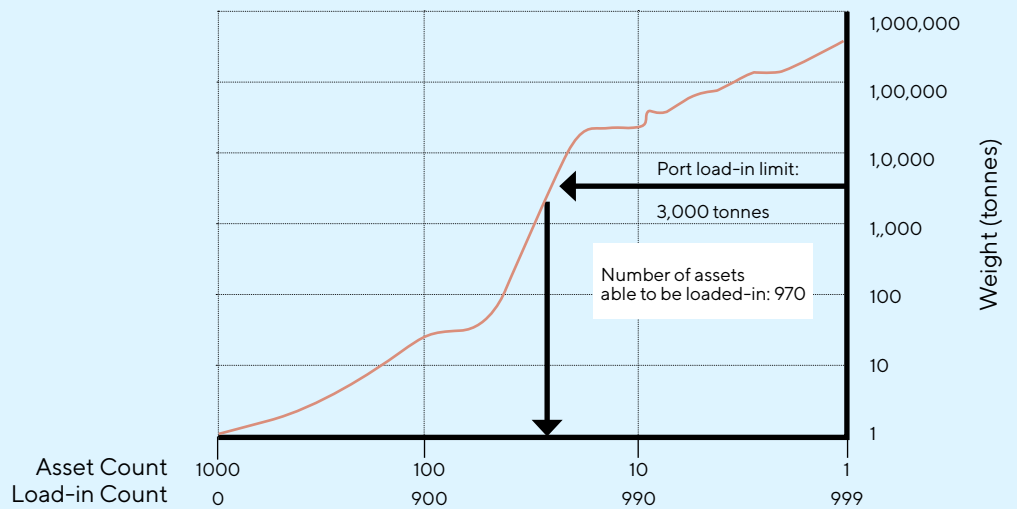
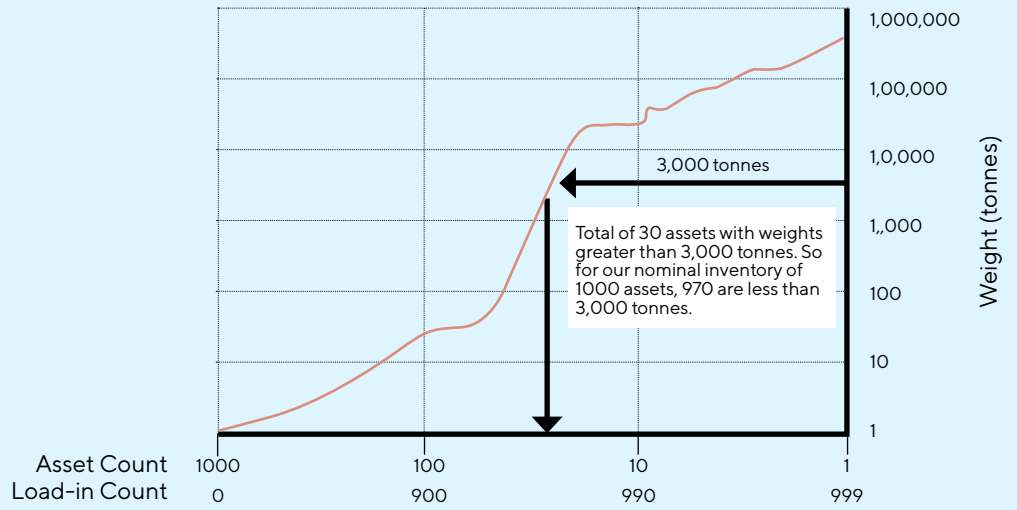


Figure 6.21 "Creaming Curve" Demand Example

7. Conclusion

This report has documented the evaluation of potential sites on the Western Australian coast that would be suitable for the establishment of a decommissioning receive and dismantling yard for offshore oil and gas assets.

The study has concluded that:

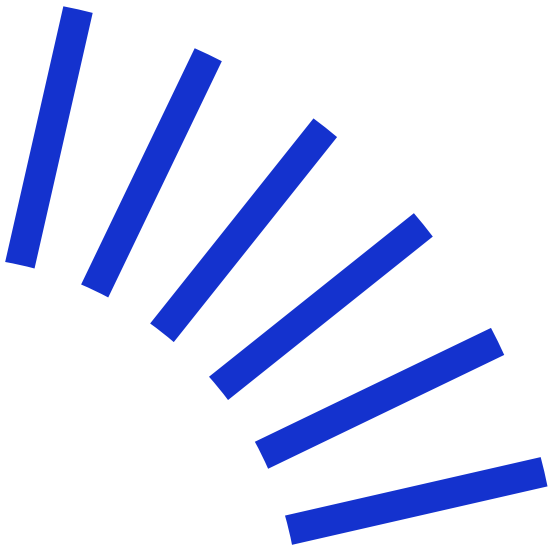
1. There is a significant decommissioning liability associated with the onshore disposal of assets (circa USD\$2.1b for assets in close proximity to WA ports). However, the value and intermittent demand profile does not justify the establishment of a complete greenfield site for this sole purpose.
2. There are multiple locations on the WA coast which have characteristics which would suit the establishment or configuration of an onshore decommissioning receive and dismantling yard.
3. The onshore decommissioning “solution” in WA will likely require multiple facilities to contribute to the disposal of the offshore assets and may service different parts of the market:
 - a. Moderate capacity / continuous volume facilities that can load-in and process a variety of modules, jacket sections, and subsea infrastructure.
 - There is an immediate need for one or more moderate capacity / continuous volume facilities.
 - Existing locations in close proximity to the offshore oil and gas infrastructure have limitations which prevent future developments from meeting the minimum requirements to receive the largest/heaviest oil and gas assets. However, these facilities either have, or will have, the capacity and capability to receive a large proportion of the present assets:
 - The Port of Ashburton has suitable quayside facilities for loading structures in via SPMTs, however is constrained in the available space on quayside due to the Wheatstone LNG Plant and the in-development Onslow Iron development. Undeveloped land in the nearby Ashburton North SIA (ANSIA) or further inland at the Pilbara Regional Waste Management Facility (PRWMF) may be used for dismantling activities. Some infrastructure has already been loaded in via Ashburton for decommissioning.
 - The Port of Dampier (Dampier Cargo Wharf operated by Pilbara Ports Authority (PPA) and the Toll Dampier Supply Base) also has suitable quayside facilities for loading structures in via SPMTs. However, the port is currently highly congested and once the Perdaman Urea Project is online in 2027 there will be 10,000m² and 30,000m² of laydown within the PPA and Toll operated areas, respectively, which will need to be shared with other port users. Infrastructure has already been loaded in via both the PPA and Toll operated areas for decommissioning.
 - Onslow Marine Support Base (OMSB) is actively pursuing the decommissioning market and has undeveloped land in close proximity to the quayside. Similar to Ashburton, undeveloped land is also available at the ANSIA or the PRWMF, however the transport route to these sites from the quayside is less optimal. Despite limitations with channel access (compared with Ashburton), there are longer term plans (2-5 years) for larger vessels to be able to service the port. Some infrastructure has already been loaded in via OMSB for decommissioning.
 - Overall, it is recommended that improvements for Pilbara port facilities are concentrated on Ashburton and OMSB as the dual approach offers flexibility and there is less short- and potential long-term congestion than Dampier.
 - b. High capacity / intermittent volume facility that can load-in large/heavy topsides or fixed jackets using a skidway; or load-in floating facilities using a float-on / roll off approach.
 - Such a facility will be required around 2030 as this is the earliest current projected decommissioning date for fixed structures to be loaded in with weights beyond the typical SPMT operating range.
 - Sites which have the potential to receive the largest/heaviest oil and gas assets are either undeveloped (state Strategic Industrial Areas) or are remote from the offshore oil and gas infrastructure.

- A site in the state's Southwest may be suitable pending alignment with strategic planning for the Defence, Offshore Wind, and heavy fabrication industries.
 - The Australian Marine Complex (AMC) in Henderson currently has suitable characteristics to decommission some facilities at the South Common User Facility (CUF) if loaded in via SPMTs (defence decommissioning has been undertaken for several years). Longer term, this site may be unavailable for decommissioning works due to demand from other users (Defence in particular). Additionally, the existing CUF would require improvements to the drainage systems if used to decommission larger topsides structures as they have a greater risk of loss of containment of residual liquids. However, concept-level engineering has been undertaken to develop a 14ha combined defence and offshore infrastructure decommissioning site in the Northern Harbour [12].
 - The Port of Bunbury has significant undeveloped land and potential availability of the Wandoo B casting basin. However, AMC is more advantageous in that it has better access to industrial services and, unlike the Port of Bunbury, has no residential properties nearby. However, Bunbury may be a suitable alternative if lots are not made available at AMC due to other industrial demand on the space.
 - Within the state's Northwest, there are no existing deepwater ports with capacity to receive the largest/heaviest oil and gas assets, however there are several greenfield projects or developments that may be suitable for offshore oil & gas decommissioning to co-exist with if infrastructure can be shared.
 - The Anketell SIA (currently undeveloped) is located to the east of Karratha and may include a deep-water port (or has access to deep water close to the coastline). Currently there are no foundation proponents for the development and therefore the establishment timeframe is uncertain.
 - Overall, it is recommended that developments within AMC would provide the most optimal solution if Northern Harbour lots are available for development for the purpose of a decommissioning hub unless there are proponents in the Northwest of the state which have similar requirements for quayside infrastructure – i.e., could co-develop a deep-water port.
- c.** Lower capacity facilities may be able to receive materials or provide support to decommissioning operations.
- These facilities have insufficient quayside infrastructure to load-in moderate sized infrastructure and are some distance from final disposal locations, or established support industries, but may offer benefits to some decommissioning activities:
 - Broome.
 - Port Hedland.
 - Gascoyne Gateway (proposed).
- 4.** The recovery of pipelines is likely to be the geographically closest port and serviced by Offshore Support Vessels and barges, rather than larger Construction Support Vessels, or Heavy Lift Vessels. Quayside dismantling of pipelines is unlikely to be necessary as they should arrive on the wharf in road-transportable sections. The recovery and dismantling of pipelines should not govern the configuration or location of a dismantling hub.
 - 5.** There is considerable overlap in the specification for an onshore dismantling hub and an offshore wind staging and decommissioning site. Further development of concepts for each should be collaborative and consider interchangeable requirements for a dual use facility if located in the Southwest of WA.
 - 6.** Existing oil and gas service providers, disposal companies, and local government bodies have made recent investments or have existing strategies to develop and support the local decommissioning market. Continued state government support – either financially or support with planning and permitting – will be a positive enabler for industry and the state economy.

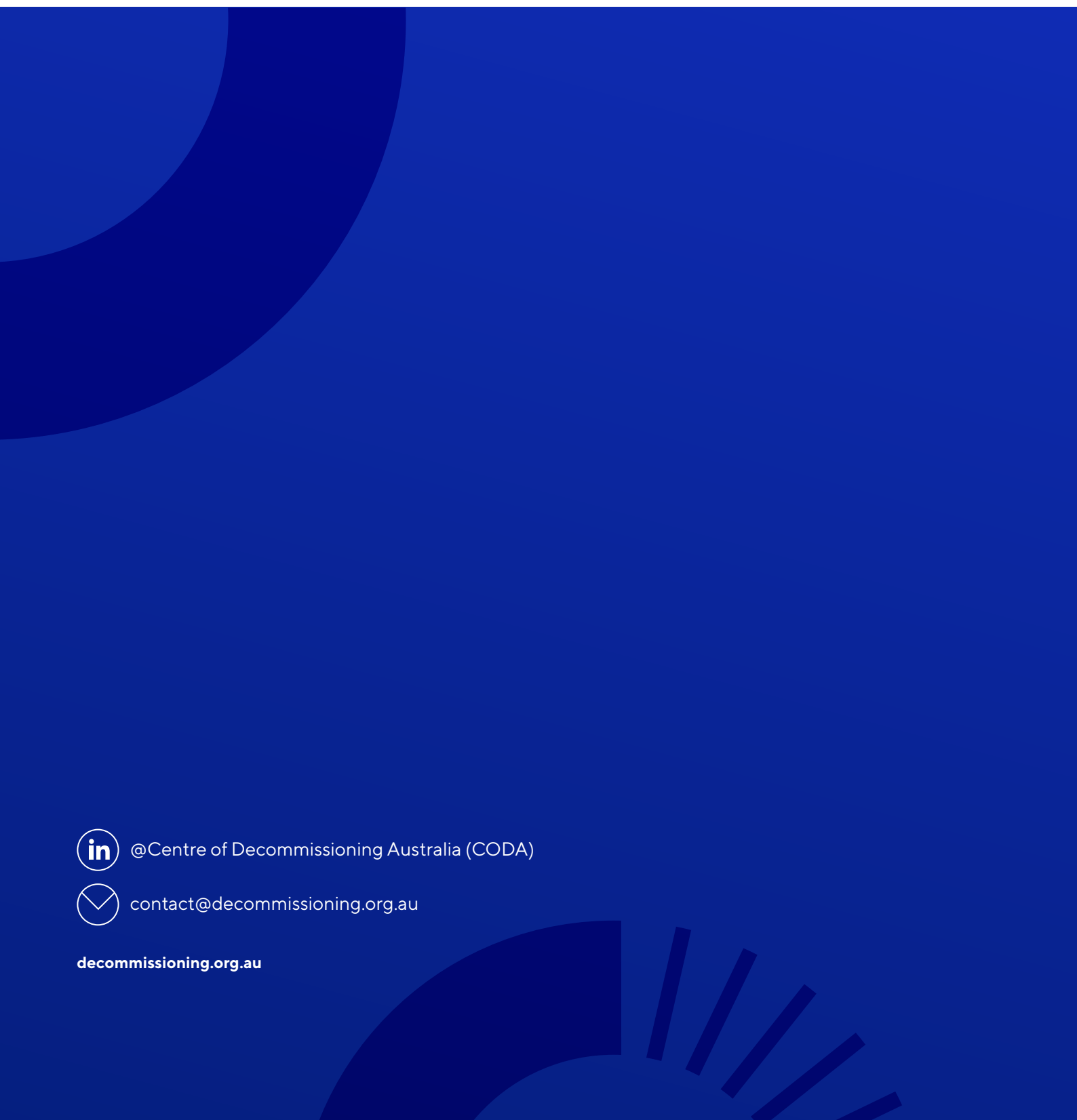
8. References

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| [1] | Department of Transport (The Government of Western Australia), "Western Australian Ports - Ports and Maritime Map," https://www.transport.wa.gov.au/mediaFiles/Freight-Ports/FRE_P_WAPortsPortAuthoritiesMap.pdf , 1/07/2021. |
| [2] | Centre of Decommissioning Australia, "A Baseline Assessment of Australia's Offshore Oil and Gas Decommissioning Liability," 2021. |
| [3] | Centre of Decommissioning Australia, "Understanding the Opportunity for Local Disposal and Recycling Pathways," 2022. |
| [4] | OEUK, "Decommissioning Insight 2022," 2022. |
| [5] | Government of Western Australia, "Landfill Waste Classification and Waste Definitions 1996 (as amended 2019)," 1/12/2019. |
| [6] | Tellus Holdings, "Tellus Sandy Ridge Permanent Isolation Fact Sheet," [Online]. Available: https://tellusholdings.com/wp-content/uploads/2021/10/Tellus_Permanent-Isolation-Fact-Sheet_2021-10-01.pdf . [Accessed 26 April 2023]. |
| [7] | Commonwealth of Australia (Geoscience Australia), "Offshore Oil and Gas Platforms (2014)," [Online]. Available: https://ecat.ga.gov.au/geonetwork/srv/eng/catalog.search#/metadata/82609 . [Accessed 06 March 2023]. |
| [8] | NOPSEMA, "Environment plan submissions for offshore energy activities," [Online]. Available: https://info.nopsema.gov.au/ . [Accessed 22 April 2023]. |
| [9] | OSPAR Commission, "OSPAR Inventory of Offshore Installations," [Online]. Available: https://odims.ospar.org/en/search/?dataset=offshore_installations . [Accessed 07 June 2023]. |
| [10] | Australian Government, "Guideline: Offshore petroleum decommissioning," 2/03/2022. |
| [11] | Government of Western Australia (Department of Mines, Industry Regulation and Safety), "Draft Decommissioning Discussion Paper for WA onshore and State waters petroleum, geothermal and pipeline property, equipment and infrastructure," 19/09/2022. |
| [12] | Aurecon, "AMC Integrated Infrastructure Program - Northern Harbour Concept Report," 511998-0000-REP-JJ-0009, Rev 0, 6/12/2022. |
| [13] | Commonwealth of Australia (Geoscience Australia), "SSLA 1973 Territorial Sea Limits (2021)," [Online]. Available: https://services.ga.gov.au/gis/rest/services/SSLA_1973/MapServer/3 . [Accessed 06 March 2023]. |
| [14] | Commonwealth of Australia (Geoscience Australia), "OPGGSA 2006 Offshore Areas Limits (2021)," [Online]. Available: https://services.ga.gov.au/gis/rest/services/OPGGSA_2006_Areas/MapServer/3 . [Accessed 06 March 2023]. |
| [15] | NOPTA, "Titles and Permits," [Online]. Available: https://arcgis.nopta.gov.au/arcgis/rest/services/Public/TitlesCompany_NOPTA/MapServer/0 . [Accessed 06 March 2023]. |
| [16] | NOPTA, "Petroleum Wells," [Online]. Available: https://arcgis.nopta.gov.au/arcgis/rest/services/Public/PetroleumWells_NOPIMS/MapServer/0 . [Accessed 06 March 2023]. |
| [17] | NOPTA, "Petroleum Pipelines," [Online]. Available: https://arcgis.nopta.gov.au/arcgis/rest/services/Public/PetroleumPipelines_NOPTA/MapServer/0 . [Accessed 06 March 2023]. |
| [18] | Commonwealth of Australia (Geoscience Australia), "Waste Management Facilities (2022)," [Online]. Available: https://services.ga.gov.au/gis/rest/services/Waste_Management_Facilities/MapServer . [Accessed 06 March 2023]. |
| [19] | Commonwealth of Australia (Geoscience Australia), "Oil and Gas Pipelines (2017)," [Online]. Available: https://ecat.ga.gov.au/geonetwork/srv/eng/catalog.search#/metadata/104762 . [Accessed 06 March 2023]. |

| | |
|-------------|--|
| [20] | Commonwealth of Australia (Geoscience Australia), "Resources Export Ports (2020)," [Online]. Available: https://ecat.ga.gov.au/geonetwork/srv/eng/catalog.search#/metadata/144326 . [Accessed 06 March 2023]. |
| [21] | Commonwealth of Australia (Geoscience Australia), "Australian Topographic Base Map (2016)," [Online]. Available: https://services.ga.gov.au/gis/rest/services/Topographic_Base_Map/MapServer . [Accessed 06 March 2023]. |
| [22] | Commonwealth of Australia (Geoscience Australia), "Australian National Base Map (2020)," [Online]. Available: https://services.ga.gov.au/gis/rest/services/NationalBaseMap/MapServer . [Accessed 06 March 2023]. |
| [23] | OpenStreetMap, "OpenStreetMap tiles," [Online]. Available: https://tile.openstreetmap.org/{z}/{x}/{y}.png . [Accessed 06 March 2023]. |
| [24] | Commonwealth of Australia (Geoscience Australia), "Australian Bathymetry and Topography Grid, June 2009," [Online]. Available: https://data.gov.au/data/dataset/australian-bathymetry-and-topography-grid-june-2009 . [Accessed 21 April 2023]. |
| [25] | OEUK, "Decommissioning Work Breakdown Structure - Guidelines," October 2019. |



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