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Coastal and Marine

Nuclear-Powered Submarine Construction Yard Environmental Impact Statement

AUSTRALIAN NAVAL INFRASTRUCTURE

URPS

Coastal and Marine

15 November 2024

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Prepared for	ANI
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We acknowledge the Kaurna People as the Traditional Custodians of the land on which we work and pay respect to their Elders past, present and emerging.

Contents

1. Introduction

This report has been prepared to support the Environmental Impact Statement (EIS) for the nuclear-powered Submarine Construction Yard (SCY) at Osborne.

This report responds to the Coastal and Marine (PE1) assessment requirements. It considers:

- The existing coastal environment.
- Relevant coastal legislation.
- What coastal works are proposed for the SCY and how this may impact on the coastal system.
- What measures will be put in place to minimise impact to the coastal system.

Many of these aspects overlap with other parts of the EIS. In these instances, the relevant sections have been referred to avoid repetition of information.

The assessment is supplemented by the series of technical investigations provided within the appendices of the EIS. A further desktop analysis has been undertaken where necessary to support the findings of these investigations and to develop an understanding of the key implications of the proposed land use change.

2. Assessment Requirements

The assessment requirements prescribed by the State Planning Commission for coast and marine include the following:

Ref	Attribute	Objective	Method of investigations	Level
PE1	Coastal and marine	To ensure the natural features and processes of coastal systems are protected so that the environmental values of the coast are maintained. To ensure the quality and productivity of marine waters, sediment and biota are protected so that environmental values are maintained.	• Describe existing coastal environmental values including estuarine, littoral and marine environmental values (e.g. water quality, benthos, aquatic flora and fauna, mangrove areas, salt marsh, and amenity) that could be impacted by construction or operation of the development. • Describe current processes and recently historical estuarine, littoral and marine morphology with a description of the processes shaping the coastal system (e.g. tides, rivers, floods, coastal currents, sediment transport, major storms, rocky headlands, or islands) • Describe the legislative, regulatory and planning contexts for coastal systems that apply to the development. • Describe existing residential, commercial or recreational uses of the coastal system that could be impacted by construction or operation of the development. • Provide details of proposed works with potential to affect coastal processes including buildings and infrastructure to be built on the shore or on land close to the shore and excavations on or near the shore. • Provide detail of any required dredging (area and volume) within the Port River both immediate (capital) and likely ongoing (maintenance). Identify spoil de-watering and storage site/s and how the spoil storage sites will be protected from potential sea flood risk. • Identify the flooding and erosion risks to the site (including flooding and erosion exacerbated by sea	DETAILED

Ref	Attribute	Objective	Method of investigations	Level
			level rise and extreme weather events) and measures to reduce the risks. • Provide details of the pre- and post-development stormwater flow regime, including detail of runoff generated under a 1 EY, 50 year ARI and 100 year ARI events • Provide details of how natural processes and the protective function of landforms and vegetation will be maintained in sea erosion and storm tide inundation areas. • Identify any potential for Coastal Acid Sulfate Soils (CASS) to be encountered on the site and how this might be mitigated (refer to the Coast Protection Board policy on CASS). • Assess the potential impacts to the coastal system and existing uses from the development and propose mitigation measures to avoid or minimise those impacts during construction and operation. • Map existing vegetation communities and describe the effect of the proposed development on coastal features and associated vegetation communities and outline management and rehabilitation measures for these areas. • Identify the impact of coastal erosion due to expected sea level rise of 0.3 metre to 2050 and 1.0 metre to 2100. • Describe the effect on the conservation values of the nearby conservation areas (including conservation parks, national parks, land with heritage agreements, Adelaide Dolphin Sanctuary etc) • Describe historical marine uses and the potential for contamination of sediments or contaminated groundwater entering the marine environment and describe any known or suspected sediment or groundwater contamination within the study area	

Ref	Attribute	Objective	Method of investigations	Level
			that could be re-suspended released or otherwise disturbed as a result of the project. • Provide details of proposed works with potential to affect marine waters and current uses. The description should include the following matters (where relevant): – potential impact of vessel movements on the marine environment – any jetties, bunds, harbour walls, groynes, channel markers, or other infrastructure, to be built in the Port River – any proposals to undertake transhipping of material in state waters or the Commonwealth marine area – describe the underlying geology and the nature of the soils with special reference to coastal landforms – identify geological, seabed and substrate impacts that may occur as a result of any dredging activity that will be undertaken during the construction phase. Detail measures for managing these impacts. – identify the total 'in water' footprint of the proposed development (including all areas to be dredged and/or altered) • Model the sediment plume produced by any dredging including an assessment of likely risk to marine vegetation and fauna. Modelling should be developed using at least 12 continuous months of turbidity data collected from the site. • Describe the potential for pollution (e.g. sediment plumes, discharges or spills to land and water, discharge of stormwater and wastewater) of marine waters during construction and operation. Identify locations where discharge to marine waters or land	

Ref	Attribute	Objective	Method of investigations	Level
			may occur during construction, operation or decommissioning of the development. • Assess the potential impacts of the proposed project's activities in marine waters including, but not limited to, any potential impacts on the Adelaide Dolphin Sanctuary and Port River, commercial or recreational fisheries effects of the development on nursery habitat. Include spills of fuels and chemicals from water and land-based activities, run-off / discharge from land-based activities and propose mitigation or offset measures to avoid or minimise those impacts during construction and operation.	

3. Existing coastal environment

- *Describe existing coastal environmental values including estuarine, littoral and marine environmental values (e.g. water quality, benthos, aquatic flora and fauna, mangrove areas, salt marsh, and amenity) that could be impacted by construction or operation of the development.*
- *Describe current processes and recently historical estuarine, littoral and marine morphology with a description of the processes shaping the coastal system (e.g. tides, rivers, floods, coastal currents, sediment transport, major storms, rocky headlands, or islands)*
- *Describe the effect on the conservation values of the nearby conservation areas (including conservation parks, national parks, land with heritage agreements, Adelaide Dolphin Sanctuary etc)*
- *Map existing vegetation communities and describe the effect of the proposed development on coastal features and associated vegetation communities and outline management and rehabilitation measures for these areas.*
- *Identify any potential for Coastal Acid Sulfate Soils (CASS) to be encountered on the site and how this might be mitigated (refer to the Coast Protection Board policy on CASS).*
- *Describe existing residential, commercial or recreational uses of the coastal system that could be impacted by construction or operation of the development.*
- *Describe historical marine uses and the potential for contamination of sediments or contaminated groundwater entering the marine environment and describe any known or suspected sediment or groundwater contamination within the study area that could be re-suspended released or otherwise disturbed as a result of the project.*

3.1 Coastal vegetation

For information about coastal vegetation, refer to Chapter 12 Marine Flora and Fauna, Chapter 13 Terrestrial Flora and Fauna and Appendix 1.6 Terrestrial and Marine Flora and Fauna Ecological Report of the EIS.

3.2 Coastal fauna

For information about coastal fauna, refer to Chapter 12 Marine Flora and Fauna, Chapter 13 Terrestrial Flora and Fauna and Appendix 1.6 Terrestrial and Marine Flora and Fauna Ecological Report of the EIS.

3.3 Conservation areas

For information about conservation areas, refer to Chapter 12 Marine Flora and Fauna, Chapter 13 Terrestrial Flora and Fauna and Appendix 1.6 Succession Ecology's Terrestrial and Marine Flora and Fauna Ecological Report of the EIS.

3.4 Coastal acid sulphate soils

For information about coastal acid sulphate soils, refer to Chapter 19 Contamination, Appendix 1.14 Physical Environment.

3.5 Water quality

Historically, the Port River has suffered from poor water quality.

This has been caused by a number of historic and current activities in and alongside the river including (Environment Protection Authority 2008, Environment Protection Authority 2003):

- Penrice Soda Products discharge directly into the Port River (discharges ceased in July 2013).
- Bolivar wastewater treatment plant discharge directly into the Port River (improvement of water quality treatment over recent decades).
- Torrens Island, Osborne and Pelican Point power stations use estuary water for cooling purposes, adding thermal pollution to the estuary.
- Regular dredging campaigns to maintain shipping channel depths.
- Stormwater carrying urban, agricultural and horticultural run-off.
- Building and maintenance of ships at slipways.
- Regular vessel movements.
- Historically, the river and adjacent marine environment have been used for the disposal of various types of waste, including industrial effluents and municipal waste.

These activities have led to high levels of the following water quality parameters which has reduced water quality (Environment Protection Authority 2003, Department for Environment, Water and Natural Resources 2007):

- Nutrients including particularly high levels of nitrogen and phosphorus.
- Water turbidity.
- Chlorophyll, an indicator of algae.
- Heavy metals, including copper and zinc as well as aluminium, cadmium, iron, lead and mercury.
- Bacteria.
- Chemical pollutants including hydrocarbons.

This poor water quality has had a number of significant negative consequences including (Environment Protection Authority 2008):

- Reduced habitat quality.
- Large-scale loss of intertidal and subtidal seagrasses.
- Mangrove decline.

- Occurrence of algal blooms including toxic species.
- Potential impact to the Port River dolphins and other marine fauna.
- Inability to safely use the Port River for recreational activities such as swimming.

Considerable effort and investment has been put into improving the water quality of the Port River since the early 1990s. As a result, water quality has improved in recent decades. However, given its status as a highly active port with regular dredging and significant stormwater loads from residential and industrial land uses, water quality issues remain.

3.6 River sediment and groundwater contamination

The historic and current uses of the Port River and surrounding land as described above has lead to contamination of sediments and groundwater in the region.

Refer to Chapter 19 Contamination, Appendix 1.14 Physical Environment for the contaminants identified in land-based soils and groundwater in the development site. The marine based portion of the development site is yet to be tested for contamination. This will be undertaken in advance of any marine works. Previous investigations have suggested that riverbed sediments may include contaminants including heavy metals (such as lead, mercury, and cadmium), hydrocarbons from oil spills and industrial discharge, and other hazardous substances. Dredging and excavation works in the Port River have the potential to disturb contaminated sediments, leading to their re-suspension and dispersion into the water column. This can result in elevated contaminant levels in the water, posing risks to marine life.

3.7 Coastal systems and morphology

3.7.1 Coastal morphology/geological features

The development site is located on the Port River, an estuary off the Gulf of St Vincent (Johnston & Hardison 2005). This diverse estuary includes deep channels, large areas of fringing mangroves, extensive tidal flats and seagrass beds.

The Barker Inlet-Port River estuary is u-shaped, divided into two by the Torrens and Garden Islands. On the eastern side is the Barker Inlet. This is a wide shallow tidal inlet which still retains a largely unmodified natural mangrove and tidal swamp habitat. The inlet is listed as a wetland of national importance. It receives periodic freshwater run-off from Dry Creek and the Little Para River after heavy rains.

On the western side is the Port River, a highly modified shipping channel fringed by industrial land uses. The river channel is dredged to a minimum depth of 9.3 metres.

Tidal waters enter estuaries from the ocean, while freshwater flows from the land. However, due to human development, stormwater and wastewater are now the only freshwater inputs to the Port River.

The eastern (Barker Inlet) and western (Port River) halves of the estuary are connected on the southern side of Garden Island by a narrow channel known as North Arm

3.7.2 Historic coastal system

Before European settlement of Adelaide's western suburbs and the construction of various flood mitigation channels and levees, the Port River formed one of the outlets of the River Torrens (Johnston & Hardison 2005). The Torrens used to flow north-west into the Port River, until sediment accumulated upstream built up, blocking the channels and forming a large area of marshland known as "the Reedbeds" across some of the present western suburbs. In 1937 a channel known as Breakout Creek was constructed to take the Torrens westwards to the sea.

3.7.3 Shaping processes

Tides

The Port River experiences two tides each day (Johnston & Hardison 2005). Because the estuary is sheltered from the wave action of the ocean, tides are the major influence of sediment movement and erosion.

River inflows

The Port River historically received freshwater inputs from the River Torrens (Johnston & Hardison 2005). The direct influence of the Torrens has since been reduced due to flood mitigation infrastructure. Now, stormwater is the main freshwater flow into the river. The topographical features of the Port Adelaide estuary have a significant influence on these inflows to the river as the Port area is the lowest lying area of the northern Adelaide plains (Department for Environment, Water and Natural Resources 2007). Consequently, natural runoff gravitates to this area, bringing with it pollutants from natural, industrial, and domestic sources. Freshwater inflows also contribute to salinity gradients within the estuary and influence sediment transport dynamics.

Wind

The estuary is sheltered from prevailing southwest winds by the Lefevre Peninsula, and from the south, east and north by its shoreline. It is only exposed to Gulf St Vincent from the north-west. The effects of such shelter are (Department for Environment, Water and Natural Resources 2007):

- Reduced wave action, with more sediment deposition than erosion. In Barker Inlet, wide areas of intertidal sediments have accumulated.
- The sediments are fine-grained, have a high content of organic detritus, and are anaerobic beneath the surface.
- Sulfate reduction in anaerobic sediments can deplete oxygen in overlying water.
- Sediments with these characteristics are also a natural sink for trace metals, radionuclides, nutrients and other pollutants transported by water.

Coastal Currents

Coastal currents, influenced by tidal flows and wind patterns, play a significant role in the movement of sediments along the coast (Johnston & Hardison 2005). In the Port River, these currents contribute to the

formation and reconfiguration of littoral features such as sandbars and spits. The interaction between tidal currents and coastal winds also affects sediment transport within the estuarine system.

Sediment Transport

Sediment transport within the Port Adelaide River is driven primarily by tidal currents (Johnston & Hardison 2005). Fine-grained sediments, including silt and clay, are transported and deposited in the estuarine and littoral zones. This sediment transport is crucial for maintaining the estuarine and coastal landforms, including intertidal flats and mudflats.

Major Storms

Major storms, including cyclones and intense weather systems, impact the coastal morphology by generating high-energy waves and storm surges (Johnston & Hardison 2005). These events can cause significant erosion, sediment redistribution, and damage to coastal infrastructure. The Port River and its estuarine environment are subject to storm impacts that can alter sediment distribution and coastal features.

4. Coastal legislation

- *Describe the legislative, regulatory and planning contexts for coastal systems that apply to the development.*

Refer to Chapter 3 Legislation and Regulatory Approvals and Chapter 12 Coastal and Marine of the EIS for a description of legislation, regulatory and planning context including for the coastal system.

5. Proposed coastal works

- *Provide details of proposed works with potential to affect coastal processes including buildings and infrastructure to be built on the shore or on land close to the shore and excavations on or near the shore.*
- *Provide detail of any required dredging (area and volume) within the Port River both immediate (capital) and likely ongoing (maintenance). Identify spoil de-watering and storage site/s and how the spoil storage sites will be protected from potential sea flood risk.*
- *Provide details of how natural processes and the protective function of landforms and vegetation will be maintained in sea erosion and storm tide inundation areas.*
- *Assess the potential impacts to the coastal system and existing uses from the development and propose mitigation measures to avoid or minimise those impacts during construction and operation.*
- *Map existing vegetation communities and describe the effect of the proposed development on coastal features and associated vegetation communities and outline management and rehabilitation measures for these areas.*
- *Provide details of proposed works with potential to affect marine waters and current uses. The description should include the following matters (where relevant):*
  - *potential impact of vessel movements on the marine environment*
  - *any jetties, bunds, harbour walls, groynes, channel markers, or other infrastructure, to be built in the Port River*
  - *any proposals to undertake transhipping of material in state waters or the Commonwealth marine area*
  - *describe the underlying geology and the nature of the soils with special reference to coastal landforms*
  - *identify geological, seabed and substrate impacts that may occur as a result of any dredging activity that will be undertaken during the construction phase. Detail measures for managing these impacts.*
  - *identify the total 'in water' footprint of the proposed development (including all areas to be dredged and/or altered)*
- *Model the sediment plume produced by any dredging including an assessment of likely risk to marine vegetation and fauna. Modelling should be developed using at least 12 continuous months of turbidity data collected from the site.*
- *Describe the potential for pollution (e.g. sediment plumes, discharges or spills to land and water, discharge of stormwater and wastewater) of marine waters during construction and operation. Identify locations where discharge to marine waters or land may occur during construction, operation or decommissioning of the development.*

- *Assess the potential impacts of the proposed project's activities in marine waters including, but not limited to, any potential impacts on the Adelaide Dolphin Sanctuary and Port River, commercial or recreational fisheries effects of the development on nursery habitat. Include spills of fuels and chemicals from water and land-based activities, run-off / discharge from land-based activities and propose mitigation or offset measures to avoid or minimise those impacts during construction and operation.*

5.1 Coastal development

Marine works for the development will include dredging, piling along the waterfront and construction of maritime infrastructure within the Port River.

5.1.1 Stage 1 Dredging

Capital dredging is defined to be 'the removal of solid matter from the bed of any marine waters or inland waters by any digging or suction apparatus' (EPA 2024c). Essentially it is the removal and relocation of solid material from below a body of water usually for the purposes of safe access and movement of vessels.

Capital dredging within Port River would be undertaken as part of the maritime infrastructure works for the wet dock, main wharf berth pocket and the shiplift. Capital dredging will occur between the existing riverbank and existing shipping channel. A license is required for dredging activities.

The EIS excludes dredging of the Port River navigational channel and basin (to support the launching and movement of vessels to and from the new shipyard) and other maintenance dredging as part of the operation of the development. The EIS only includes an assessment of the dredging that is required to construct the development.

Preliminary dredging areas and sizes for the construction of the development are shown in Figure 5.1 and Table 5.1 below. These details may change as the development progresses through detailed design.

Figure 5.1 - Preliminary dredging areas for the construction of the development

Table 5.1 Preliminary dredging quantities for the construction of the development

Area	Footprint m2	Depth	Approx. m^3 of materials to be removed
Launch Facility/ Shiplift	5,000m2	-18.5m CD (-20AHD)	190,000 – 266,000
Main Wharf Berth	10,000m2	-10.5m CD (-12m AHD) at central pocket	139,000 – 195,000

Area	Footprint m2	Depth	Approx. m^3 of materials to be removed
Wet Basin	15,500m2	-20.5m CD (-22m AHD)	307,000 – 430,000
Total			636,000 – 891,000

Dredging methodology is yet to be determined.

The disposal location for dredged materials has not been confirmed. Dredge ponds used for comparatively smaller previous ANI dredging campaigns that have had smaller volumes of dredged material are within the development site and will be developed as part of the development, meaning they are no longer able to be used for this purpose.

For the purposes of the EIS, due to the likely quantity of material, and the absence of a suitable land-based site currently identified, it has been assumed that all dredged material for the construction phase of the development would be disposed of within the Gulf St Vincent. The Gulf St Vincent site would be the same deposition site as was used for the previous dredging programmes of the Port River undertaken by Flinders Ports Holdings in 2005 and 2018 (EPA 2024).

Previous testing of material dredged from the Port River, as reported within the Flinders Ports 2017 Development Application[Error! Bookmark not defined.], has indicated it is not suitable for beach regeneration or engineered fill. Land based disposal would also require large areas of land and lengthy drying periods, as investigated by Flinders Ports Holdings for the 2005 Outer Harbor Channel Deepening (EPA 2024), and was discounted as an alternative.

5.1.2 Stage 2 Piling

The development of the coastal edge of Area 3 into the submarine launch facility, wet basin and wharf will require piling along the coastal edge to establish foundations and stabilise the area for development.

5.1.3 Stage 3 Maritime infrastructure

The entire coastal edge of Area 3 is anticipated to be hardened as part of the development (refer Figure 5.2 below). Coastal armouring or similar will protect infrastructure and stabilise the riverbank.

Coastal infrastructure including a wet dock, wharf and launch facility/shiplift will be constructed along the river edge.

Figure 5.2 - Render showing coastal infrastructure within Area 3

The wet dock will be a dock or maritime structure that would be able to maintain non-tidal conditions and ancillary infrastructure such as cranes, services, such as water, power and backup facilities.

All marine infrastructure (and infrastructure within Area 3 - the assembly and testing area generally) will be designed and constructed to meet nuclear licensing requirements. These include requirements to withstand all current and future natural disasters and human induced hazards. The infrastructure will have redundant systems in place which provide alternative systems to provide reliability and minimise or avoid risks.

Figure 5.3 - Maritime facilities at Barrow in the United Kingdom (HMS Audacious prior to launch) (Source: BAE Systems 2023a)

Figure 5.4 - 9 Dock at Devonport in the United Kingdom (Source: Navy Lookout 2020)

5.2 Impacts to the coast

The construction and operation of marine infrastructure will have a number of impacts to the coast including:

- Loss of intertidal habitat which will be hardened, dredged or excavated, impacting on marine fauna and flora.
- Loss of benthic habitat in the dredge footprint, impacting on marine fauna and flora.
- Sedimentation from dredging and discharge of dredge spoil, impacting on the water quality of the wider area with potential impacts on marine flora and fauna and visual amenity.
- Noise and vibration impacts to marine fauna.
- Potential for spills to the marine environment, impacting on the water quality of the wider area with potential impacts on marine flora and fauna.
- Stormwater runoff, impacting on the water quality of the wider area.

- Altered coastal morphology.

These impacts are considered throughout the technical chapters of the EIS (i.e., Chapters 7 to 24).

Sediment testing and plume modelling have not yet been undertaken. These assessments will be undertaken as the development progresses through detailed design.

5.3 Mitigation measures

A wide range of mitigation measures will be put in place to minimise coastal impacts.

These mitigation measures will be captured in a range of technical reports including a:

- Dredge Management Plan
- Marine and Coastal Environmental Management Plan
- Stormwater Management Plan
- Construction Noise and Vibration Management Plan
- Soil, Erosion and Contamination Management Plan
- Biosecurity Management Plan
- Dewatering Management Plan
- Water Quality Strategy

The development will comply with all relevant legislation. All relevant licenses, permits and approvals will be acquired before the relevant phase of works commences.

Direct loss of habitat and altered coastal morphology is not able to be mitigated, due to the constraints of the design of the SCY.

6. Coastal flooding risk

- *Identify the flooding and erosion risks to the site (including flooding and erosion exacerbated by sea level rise and extreme weather events) and measures to reduce the risks.*
- *Provide details of the pre- and post-development stormwater flow regime, including detail of runoff generated under a 1 EY, 50 year ARI and 100 year ARI events*
- *Identify the impact of coastal erosion due to expected sea level rise of 0.3 metre to 2050 and 1.0 metre to 2100.*

Refer to Chapter 18 Flooding and Appendix 1.13 Stormwater Management Plan for more detail about stormwater management for the project.

Refer to Chapter 14 Climate Change Adaptation and Appendix 1.8 Climate Review Report for more detail about flooding and erosion risk including consideration of sea level rise and storm events.

7. References

Environment Protection Authority 2024, Outer harbour dredging (Flinders Ports). Available at: https://www.epa.sa.gov.au/community/stay-informed/flinders-ports

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