



Port Kembla Gas Terminal

**Flora and Fauna Management Plan
Stage 2A and 2B Marine Berth Construction
and Dredging – Land and Marine Based**

Australian Industrial Energy

30 May 2022

→ **The Power of Commitment**



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Acronyms

Acronym	Definition
AIE	Australian Industrial Energy
AIS	automatic identification system
AMSA	Australian Maritime Safety Authority
ARPA	automatic radar plotting aid
BAM	Biodiversity Assessment Method
BC Act	<i>Biodiversity Conservation Act 2016</i>
BCD	Biodiversity and Conservation Division
BCT	Biodiversity Conservation Trust
Berth 101	MBD Site Compound
Biosecurity Act	<i>Biosecurity Act 2015</i>
BOS	Biodiversity Offsets Scheme
CSSI	Critical State Significant Infrastructure
CTMP	Construction Traffic Management Plan
DAWE	Department of Agriculture, Water and the Environment
DEMP	Dredge and Excavation Management Plan
DoEE	Department of the Environment and Energy
DPI	NSW Department of Primary Industries
DP&E	Department of Planning and Environment
DPTI	Department of Planning, Transport, and Infrastructure
ECR	Emplacement Cell Report
EIS	Environmental Impact Statement
EMS	Environmental Management Strategy
EPA	NSW Environment Protection Authority
EP&A Act	<i>Environmental Planning and Assessment Act 197</i>
EPBC Act	<i>Environment Protection Biodiversity Conservation Act 1999</i>
EPBC Regulations	<i>Environment Protection and Biodiversity Conservation Regulations 2000</i>
EPL	Environment Protection Licence
ESCP	Erosion and Soil Control Plan
FFMP	Flora and Fauna Management Plan
FM Act	<i>Fisheries Management Act 1994</i>
FSRU	Floating Storage and Re-gasification Unit
GHD	GHD Pty Ltd
GML	General mass limit
HM	Harbour Muds
HS	Harbour Silts
HSE	Health, Safety and Environment
IMP	introduced marine pest
LNG	liquefied natural gas

Acronym	Definition
KPI	Key Performance Indicators
m ³	Cubic metres
Marine Pollution Act	<i>Marine Pollution Act 2012</i>
MARPOL	The International Convention for the Prevention of Pollution from Ships
MBD	Marine Berth Construction and Dredging
MLA	Marine Loading Arms
MNES	Matters of National Environmental Significance
OHDSCA	Outer Harbour Dredged Spoil Containment Area
ORF	Onshore Receiving Facilities
PANSW	Port Authority of NSW
PASS	Potential Acid Sulfate Soils
PCT	Plant Community Types
PIRMP	Pollution Incident Response Management Plan
PKCT	Port Kembla Coal Terminal
PKGCT	Port Kembla Gas Terminal
PKGCT EIS	Port Kembla Gas Terminal Environmental Impact Statement
PKHD	Port Kembla Height Datum
Planning System SEPP	State Environmental Planning Policy (Planning Systems) 2021
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
POMP	Port Operations Management Plan
RL	Reduced level
SDS	Safety Data Sheet
SMEC	SMEC Australia Pty Ltd
SMP	Spoil Management Plan
SMPEP	Shipboard Marine Pollution Emergency Plan
SOLAS	International Convention for the Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plan
TEC	Threatened Ecological Communities
The Project	Port Kembla Gas Terminal Project

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1. Introduction

1.1 Overview

This Flora and Fauna Management Plan (FFMP) has been developed as a sub-plan to the Port Kembla Gas Terminal Project (the Project) Environmental Management Strategy (EMS). This FFMP has been prepared by GHD Pty Ltd (GHD) on behalf of Australian Industrial Energy (AIE) to apply to construction activities associated with Stage 2A and Stage 2B construction of the Project. This Stage 2A and Stage 2B FFMP supersedes the Stage 2A FFMP.

This FFMP interfaces with the other associated sub-plans, which together describe the proposed structure for environmental management and monitoring requirements for the Project. This FFMP addresses the requirements of the Port Kembla Gas Terminal Environmental Impact Statement (PKGT EIS) and associated Infrastructure Approval (SSI 9471) and Environment Protection Licence (EPL) No. 21529.

1.2 Background

AIE is developing the Project which involves the development of a liquefied natural gas (LNG) import terminal at Port Kembla, south of Wollongong, NSW. The Project will be the first of its kind in NSW and will provide a simple and flexible solution to the state's gas supply challenges.

NSW currently imports more than 95 percent of the natural gas it uses from other eastern states. In recent years, gas supplies to the Australian east coast market have tightened, resulting in increased natural gas prices for both industrial and domestic users.

The Project provides an immediate solution to address the predicted shortages and will result in significant economic benefits for both the Illawarra region and NSW. The Project will have a capacity to deliver more than 100 petajoules of natural gas, equivalent to more than 70 percent of NSW gas needs and will provide between 10 to 12 days of natural gas storage in case of interstate supply interruption. LNG will be sourced from worldwide suppliers and transported by LNG carriers to the gas terminal at Port Kembla where it will be re-gasified for input into the NSW gas transmission network.

The Project has been declared Critical State Significant Infrastructure (CSSI) in accordance with Section 5.13 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) (NSW) and Schedule 5 of the State Environmental Planning Policy (Planning Systems) 2021 (Planning Systems SEPP). The Project received Infrastructure Approval from the Minister for Planning and Public Spaces on 29 April 2019.

The construction of the Project is primarily associated with the establishment of a new berth facility at Port Kembla to enable an LNG carrier to berth alongside the Floating Storage and Re-gasification Unit (FSRU) and new infrastructure to connect the terminal to the existing gas network. Excavation and dredging would be required to establish the new berth facility, with spoil deposited in a cell (referred to as the 'Emplacement Cell') in the Outer Harbour.

The development has progressed to Stage 2A and Stage 2B works located at Berth 101 (referred to as the 'Marine Berth Construction and Dredging (MBD) Site Compound') and the Outer Harbour Dredged Spoil Containment Area (referred to as 'OHDSKA' or the Emplacement Cell). Collectively, these two locations are referred to as "the site". The Stage 2A works include:

- Completion of excavation works undertaken during Stage 1 (including transport of spoil materials to the Emplacement Cell Construction Site).
- Construction of the quay wall at the MBD Site Compound.
- Construction of Onshore Receiving Facilities (ORF) at the MBD Site Compound (including construction of Wharf Topside Area, Utility Area, and Common Area).
- Installation and commissioning of power, communications, and potable water.
- Installation of gas pipeline within the MBD Site Compound as part of ORF.

The Stage 2B works include:

- Continuation of Stage 2A works.

- Excavation and dredging of the MBD Site Compound in the Inner Harbour and the Emplacement Cell in the Outer Harbour.
- Construction of the Emplacement Cell in the Outer Harbour.
- Marine based construction activities including installation of navigational aids and revetments at the MBD Site Compound.

1.3 Purpose

This FFMP has been prepared in accordance with the PKGT EIS and associated Infrastructure Approval (SSI 9471) and EPL No. 21529. It describes how the management measures and commitments in the PKGT EIS, Infrastructure Approval (SSI 9471) and EPL No. 21529 relating to flora and fauna are to be implemented by the Principal Contractors during Stage 2A and Stage 2B construction of the Project. Specifically, this plan includes requirements to:

- Manage and minimise potential impacts to fauna.
- Reduce the potential risk of the introduction of weeds and pathogens.

AIE and its contractors acknowledge that minimising risks to flora and fauna in the vicinity of the Project site is paramount to the successful delivery of the construction phase of the Project. AIE is committed to ensuring this FFMP is reviewed and updated regularly to ensure its objectives are met and that the approval conditions outlined in the Infrastructure Approval (SSI 9471) and EPL No. 21529 are achieved.

This FFMP is applicable to all staff, employees, subcontractors, and any statutory service authorities undertaking the Stage 2A and Stage 2B works described in Section 2 of this FFMP. The FFMP implementation and on-going development will be managed by the Project Team (refer to Section 3).

2. Project overview

2.1 Site description

The site of the Project is situated at Port Kembla within the Illawarra region of NSW, about 80 kilometres south of Sydney. Port Kembla is mainly characterised by an existing import and export terminal and multiple other business, cargo, logistics, bulk goods, and heavy industrial facilities in the vicinity.

Port Kembla is situated about two kilometres south of the centre of Wollongong. Other localities surrounding Port Kembla and the Project site include Mangerton, Mount St. Thomas and Figtree to the north-west; Unanderra to the west; Berkeley to the south-west; and Cringila, Lake Heights, Warrawong and the residential region of Port Kembla to the south.

The zoned land use in the region includes special use and industrial use at Port Kembla and a mix of primarily residential and commercial uses at the surrounding localities. Major infrastructure in the region of Port Kembla includes the Princes Highway, which is a major state and regional highway connecting Sydney and Wollongong and regional areas further south. Princes Highway provides access to Port Kembla through turnoffs at Masters Road, Five Islands Road and Northcliffe Drive and is broadly utilised including by heavy vehicles from the port.

The South Coast railway line runs along the periphery of Port Kembla including the stations Port Kembla, Port Kembla North, Cringila and Lysaghts. The rail line services commuters and is also used to transport bulk solid goods like coal, grain, copper and steel from Port Kembla. The environmental features of Port Kembla and the surrounding region are limited given the extensive industrial, commercial and residential development. Waterways in the region include the Gurungaty Waterway, Allans Creek, American Creek and Byarong Creek. Green space includes JJ Kelly Park and Wollongong Golf Club to the north and a larger open area to the south-west.

The Project will be predominantly located within land zoned for dedicated port and industrial uses. Berth and wharf facilities, as well as the FSRU, would be situated at Berth 101 at the Inner Harbour, while the gas pipeline would extend around the periphery of port operations from Berth 101 to a tie-in point at Cringila. The Emplacement Cell will be located in the Outer Harbour. A site overview is provided as Figure 2.1.



Data source: Aerial imagery - nearmap 2022 (image date 16/04/2018, date extracted 18/02/2019); General topo - NSW LPI DTDB 2017 & 2015; Cadastre - NSW LPI DCDB 2017. Created by: elbertson

Figure 2.1 Site overview

2.2 Project construction scope of works

2.2.1 Overview

The Project construction scope of work has been divided into three main packages (with associated activities), as outlined in Table 2.1. Construction staging of the Project has been approved in accordance with Condition 3 of Schedule 4 of Infrastructure Approval (SSI 9471) as per correspondence from the Department of Planning and Environment (DP&E) dated 27 October 2021. This FFMP applies only to the works associated with Stage 2A and Stage 2B.

Table 2.1 Construction stages/work packages

Stage	Package	Proposed commencement	Activities
1	Early Enabling Works	May 2021	Demolition of Berth 101, removal of structures and land based excavation works, and Cone Penetration Testing in the Outer Harbour to inform Emplacement Cell design and relocation of Bunker Oil Pipeline.
2A	Marine Berth Construction – Land Based	January 2022	Completion of excavation works undertaken during Stage 1. Transport of spoil materials to Emplacement Cell Construction Site. Quay wall construction.
		February 2022	Installation of communications conduit, potable water line, 11kV power cable, and padmount substation within the MBD Site Compound.
		April 2022	Construction of the ORF, which comprises three areas: Wharf Topside Area; Utility Area; and Common Area.
		June 2022	Pipeline construction and associated ancillary infrastructure within MBD Site Compound
2B	Marine Berth Construction and Dredging – Land and Marine Based	March 2022	Continuation of Stage 2A with addition of the following activities:
			Excavation/dredging of the MBD Site Compound in the Inner Harbour and construction of the Emplacement Cell in the Outer Harbour
			Marine based construction activities including installation of navigational aids and revetment shore protection.
3	Pipeline Installation including tie-ins (NGP)	June 2022	Construction of an 18" onshore natural gas pipeline approximately 6.3km in length from the Berth 101 site boundary to tie-in facility at Cringila for connection to the Eastern Gas Pipeline Pipeline construction to occur concurrently with Jemena, subject to separate set of management plans.

*Proposed dates and may be subject to change.

The following will be undertaken as part of the Stage 2A works:

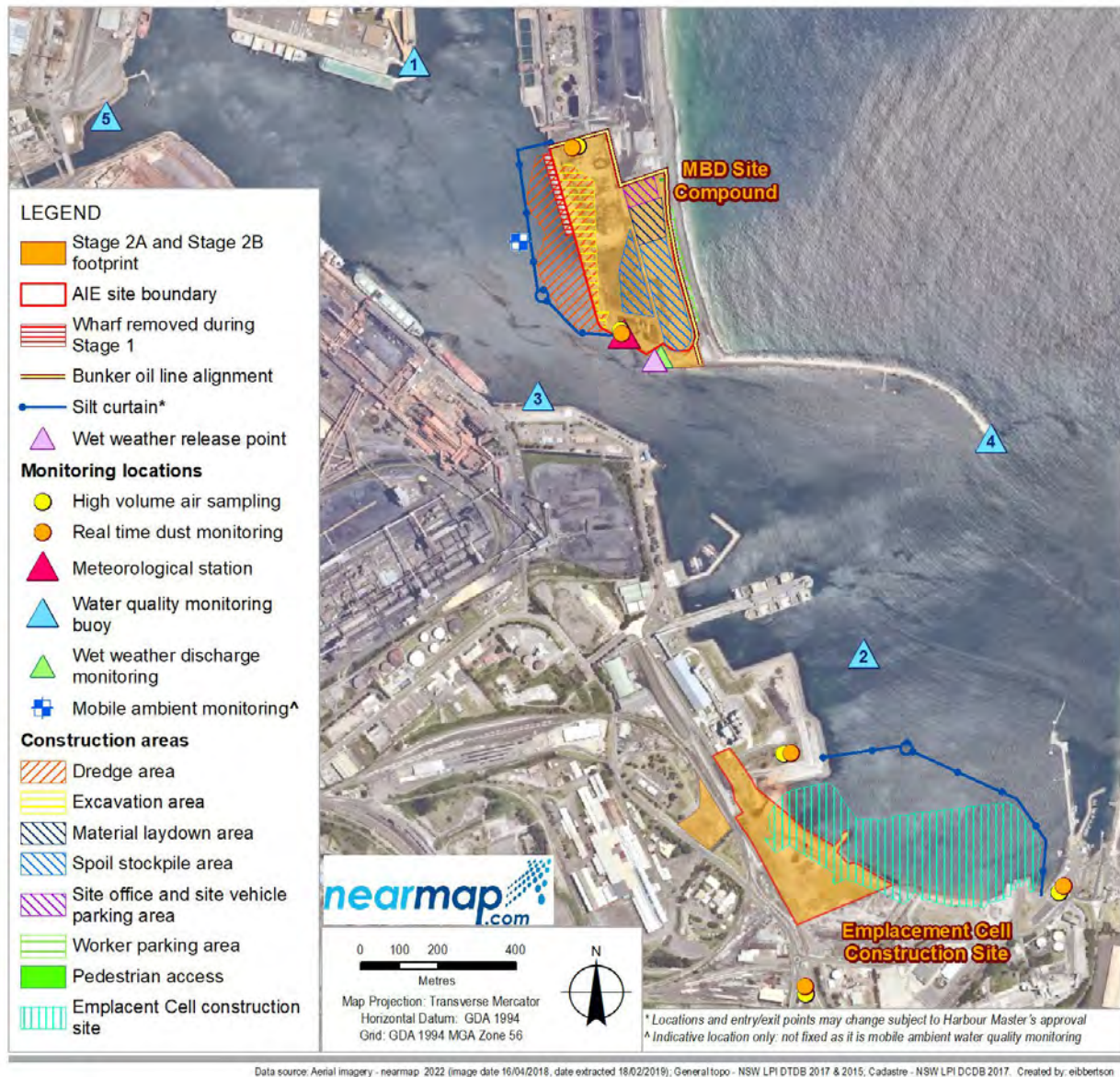
- Construction of the quay wall at MBD Site Compound incorporating finalisation of excavation works undertaken during Stage 1 (including transport of spoil materials to Emplacement Cell Construction Site).
- Installation of and commissioning of power, communications, and potable water line.
- Construction of ORF at MBD Site Compound (including construction of Wharf Topside Area, Utility Area, and Common Area).
- Installation of gas pipeline within MBD Compound site.

The following will be undertaken as part of the Stage 2B land and marine-based works:

- Continuation of Stage 2A works.
- Installation of site facilities and preparatory earthworks at Emplacement Cell Construction Site.
- Marine-based construction activities including installation of silt curtains, navigational aids, and revetment shore protection at the MBD Site Compound.

- Construction of the Emplacement Cell in the Outer Harbour.
- Excavation and dredging of the MBD Site Compound in the Inner Harbour.

An outline of the tasks associated with Stage 2A and Stage 2B is provided in Section 2.3 through Section 2.7. The site includes the MBD Site Compound, the Emplacement Cell Construction Site, and the Emplacement Cell located in the Outer Harbour. The location of the Stage 2A and Stage 2B works is shown in Figure 2.2.



Data source: Aerial imagery - nearmap 2022 (image date 16/04/2018, date extracted 18/02/2019); General topo - NSW LPI DTDB 2017 & 2015, Cadastre - NSW LPI DCDB 2017. Created by: elbertson

Figure 2.2 Stage 2A and Stage 2B works and location of MBD Site Compound, Emplacement Cell and Emplacement Cell Construction Site

2.2.2 Traffic

Road traffic generated by Stage 2A and Stage 2B will be controlled through the gate on Sea Wall Road. Heavy vehicle movements will be generated by the delivery of materials, equipment, and plant to the MBD Site Compound and transport of stockpiled material to the Emplacement Cell Construction Site.

In addition to the material that has already been transported to Emplacement Cell Construction Site (Outer Harbour Laydown Area) during Stage 2A, up to 30,000 cubic metres (m³) of material from the MBD Site Compound is anticipated to be transported via road to the Emplacement Cell Construction Site during Stage 2B. The activities associated with this task will involve loading, road transportation via truck and trailer (approximately 30-tonne capacity), unloading, stockpiling, and management of the stockpiles.

Light vehicle movements will be generated from construction workers accessing the MBD Site Compound and Emplacement Cell Construction Site. Parking will be provided for up to approximately 100 workers on the MBD Site Compound and approximately 37 workers at the Emplacement Cell Construction Site (refer to Figure 2.3 and Figure 2.4).

Road traffic movements will be undertaken in accordance with the Stage 2A and Stage 2B Construction Traffic Management Plan (CTMP).

The road traffic generated by Stage 2B will mainly be associated with the delivery of the quarry materials from quarries located in the surrounding area. It is anticipated that about 40-50 daily truck movements will be required, consisting of three - five axle semi-trailers or rigid truck and five axle dog-trailers of less than 40 tonnes (GML). The activities will take place during the standard daytime construction working hours, averaging approximately eight heavy truck movements per hour (four vehicles in and out of site). The total number of vehicles required for the operation will be 12-16.

The majority of traffic generated during Stage 2B activities will be marine traffic movements during dredging operations. Marine traffic navigation and management will be undertaken in accordance with a Port Navigation Plan, herein referred to as the Port Operations Management Plan (POMP). The POMP has been produced by the Stage 2B Principal Contractor in consultation with the Port Authority of NSW (PANSW) and is consistent with the principles in the CTMP for Stage 2A.

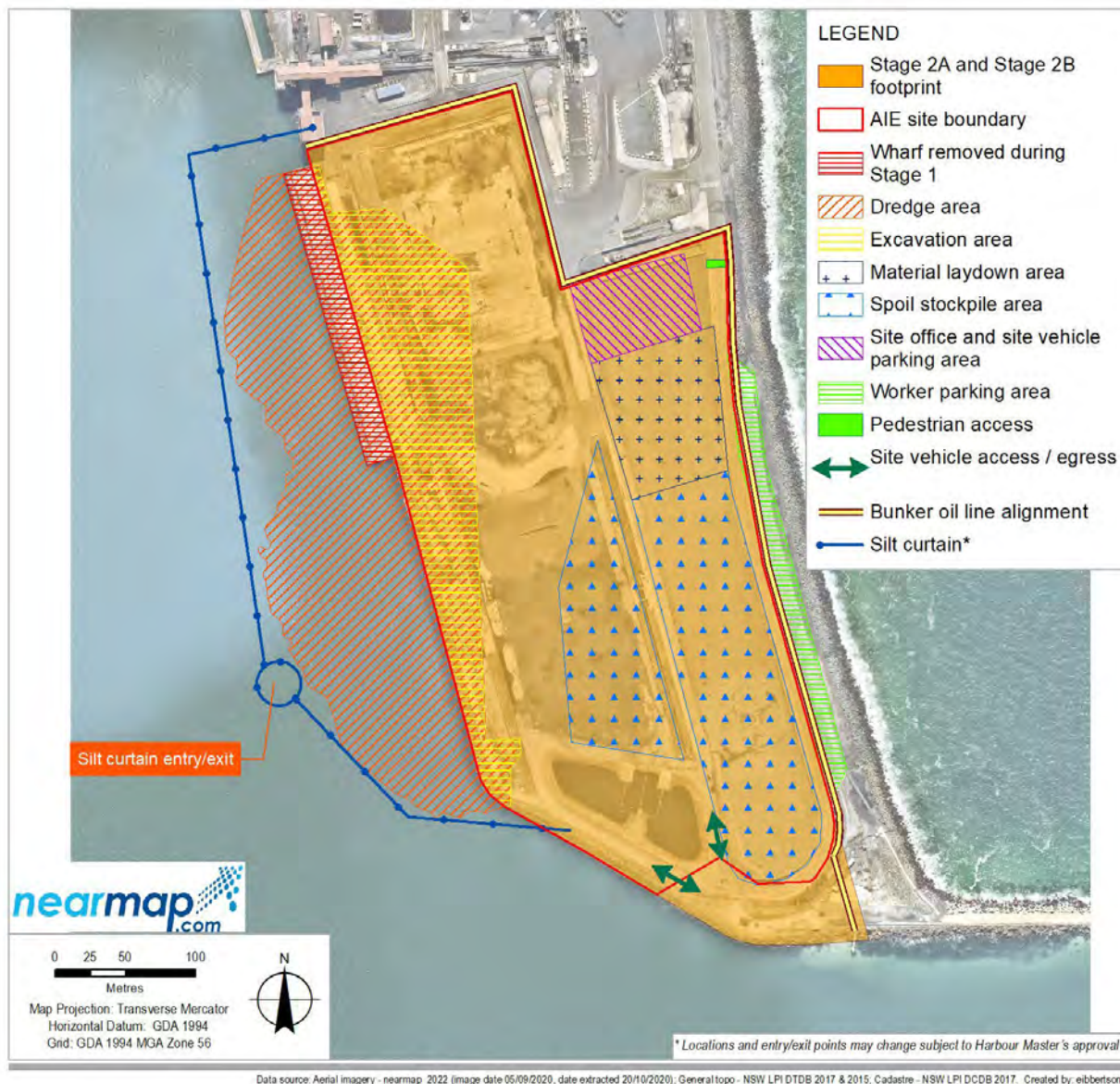


Figure 2.3 Layout of MBD Site Compound

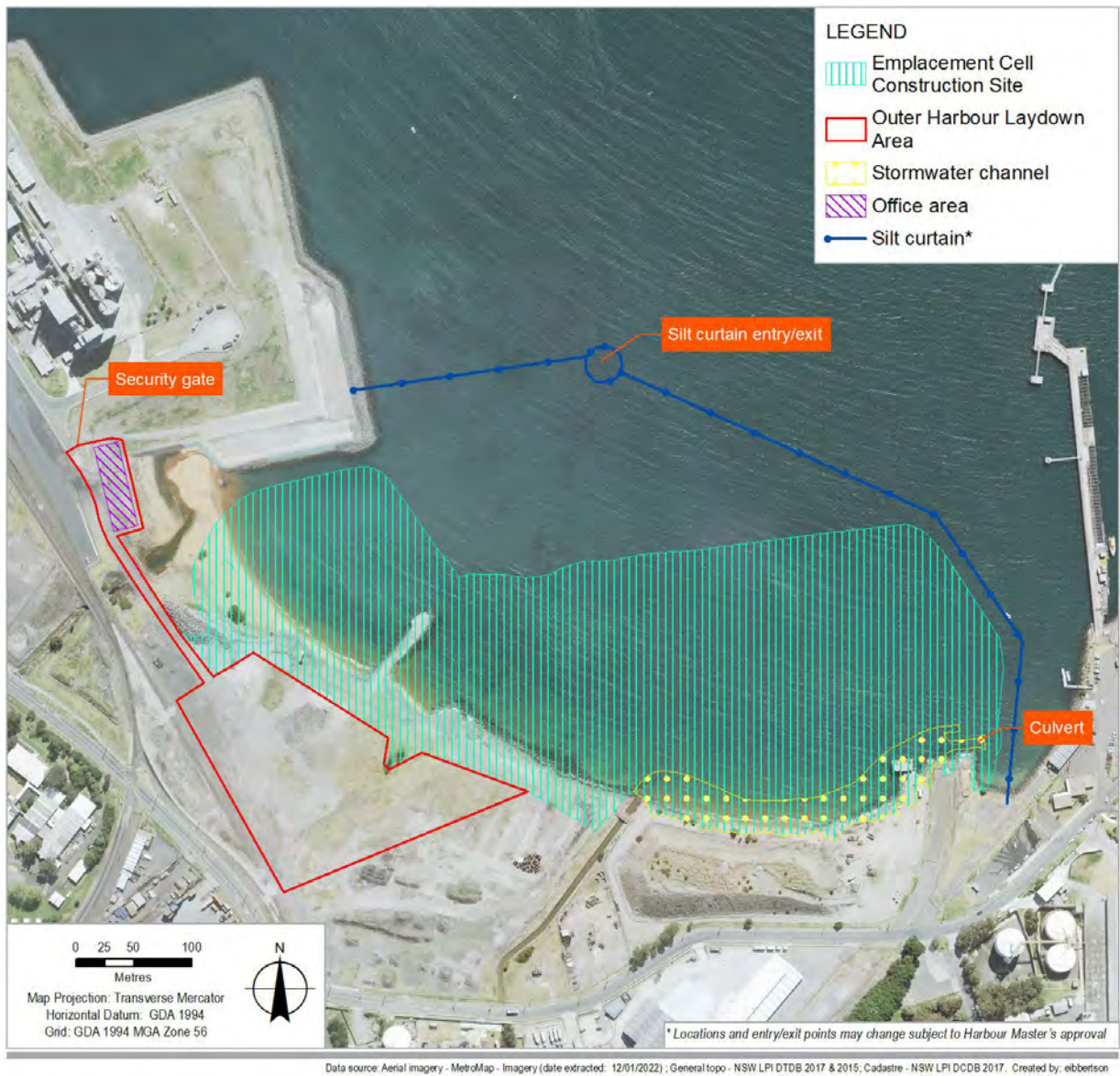


Figure 2.4 Layout of Emplacement Cell Construction Site

2.2.3 Program

The Stage 2A works commenced in January 2022. Stage 2B, which includes the continuation of land-based construction and marine-based works, are then anticipated to commence in March 2022 (refer to Table 2.1 for construction staging). As noted in Section 2.2, these dates are only proposed and may be subject to change.

2.3 Stage 2A: Construction of quay wall (MBD – Land Based)

A number of structures will be constructed within the MBD Site Compound to accommodate the FSRU and LNG carrier for the Project. Excavation and stockpiling activities from the Stage 1 Early Enabling Works will continue on-site during Stage 2A to lay the platform for ongoing construction activities at the MBD Site Compound.

The new structures that will commence construction during Stage 2A are summarised in Table 2.2. The location of the quay wall and layout of the marine berth and wharf facilities is shown in Figure 2.5.

Table 2.2 Marine berth and wharf structures to be constructed during Stage 2A

Component	Works required
Earthworks and stockpiles	<ul style="list-style-type: none"> – Completion of excavation and backfilling works from Stage 1 Early Enabling Works. – Excavated materials from the Early Enabling Works have been stockpiled within the Eastern and Western Stockyards of the MBD Site Compound and the Emplacement Cell Construction Site. – The excavated materials stockpiled at the MBD Site Compound include: <ul style="list-style-type: none"> • Approximately 9,700m³ of demolished concrete crushed to nominal 70mm minus. • Approximately 12,500m³ of heavily bound base course crushed to nominal -150mm minus. • Approximately 33,900m³ of mixed slag, general fill, and coal nominally < 150mm in size. • Approximately 10,700m³ of predominantly sand material. • Approximately 8,600 m³ of asbestos impacted soils. – The excavated materials stockpiled at the Emplacement Cell Construction Site include: <ul style="list-style-type: none"> • Approximately 44,000 m³ of sand material.* – The excavated materials will be used/reused for quay wall construction and to backfill the landside area of the quay wall or transported to the Emplacement Cell Construction Site for storage and use in construction of the Emplacement Cell.
Quay wall	<ul style="list-style-type: none"> – Construction of a new piled quay wall keyed into bedrock where necessary complete with sheet pile anchor wall, capping beam and tie rods to the south of the existing coal terminal. – Excavated and processed materials from the Stage 1 Early Enabling Works are stockpiled within the MBD Site Compound and will be used during construction of the quay wall and to backfill on landside area of the wall. – Installation of a marine fender system attached to the capping beam along the quay wall to protect the quay wall from berthing and mooring loads. – Installation of a cathodic protection system to the quay wall and associated elements, including assessment of the potential impacts the FSRU and pipeline cathodic protection will have on quay wall. – Backfilling and compaction on landside area of wall utilising the site stockpiled materials.
Mooring dolphins	<ul style="list-style-type: none"> – Installation of landside mooring dolphin structures on reinforced concrete platforms supported by steel piles. – Mooring equipment will be installed and comprise the following: <ul style="list-style-type: none"> • 20 load sensing quick release hooks. • Up to four land-based mooring winches on mooring dolphins may be required. • Up to four swivel fairleads may be required to enable each mooring line to land-based winches to be fed in a horizontal alignment.
Marine Loading Arm (MLA) foundations	Construction of a new reinforced concrete foundation supported on steel piles, located behind the new quay wall.
Gangway tower foundation	Construction of foundation for Gangway tower.
Fire monitor foundation	Fire monitor foundations, subject to risk studies.

*The volumes provided are approximate and may vary.

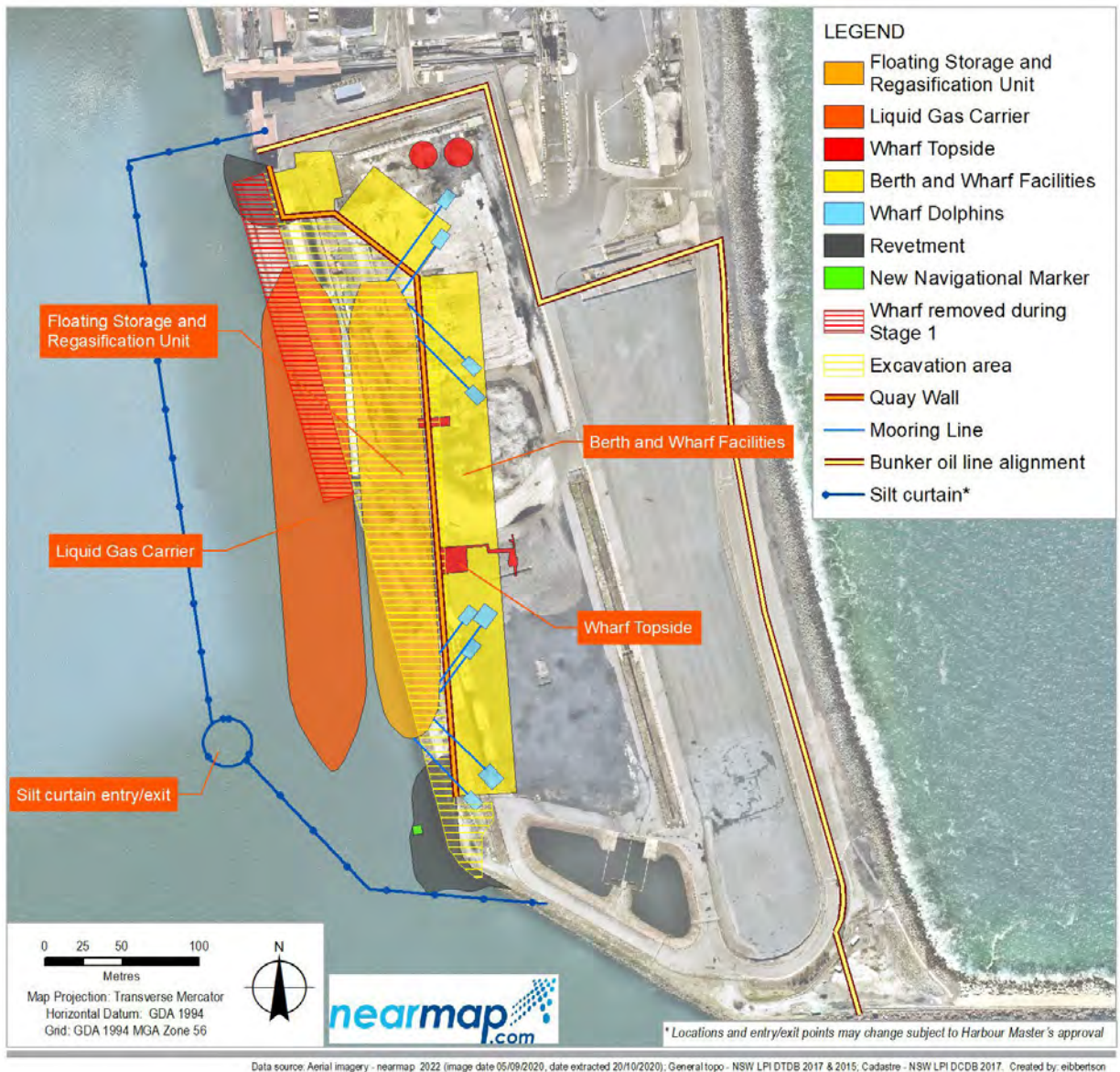


Figure 2.5 Location of quay wall and layout of MBD and ORF

2.4 Stage 2A: Power, communications, and water connections

Works required for power, communications, and water connections for Stage 2A are summarised in Table 2.3.

Table 2.3 Construction of utility connections for Stage 2A

Component	Works required
Power and communications	<ul style="list-style-type: none"> – Construction and installation of a new 11kV power cable in a buried conduit and Substation. – Energisation of the padmount substation and 415kV temporary building supply. – Installation of communication conduit and pits.
Potable water	<ul style="list-style-type: none"> – Extension of existing potable waterline within MBD Site Compound.

2.5 Stage 2A: Construction of ORF

The general layout of the ORF areas is shown in Figure 2.5. Works required for the three ORF areas during Stage 2A are summarised in Table 2.4.

Table 2.4 Structures to be constructed for ORF during Stage 2A

Component	Works required
Wharf Topside Area	
MLAs	Installation of MLAs, including: <ul style="list-style-type: none"> – Civils and structures. – Associated works such as piping, hydraulics, electrical, instrumentation, and auxiliary systems.
Piping and valving	<ul style="list-style-type: none"> – All necessary piping and valving. – Odorant injection facilities. – Pig launcher, downstream of the MLAs to tie-in to the natural gas pipeline.
Gangway	<ul style="list-style-type: none"> – Gangway access tower to provide connection between the wharf and FSRU.
Utility connections	FSRU utilities connections for: <ul style="list-style-type: none"> – Communications. – Marine Diesel Oil. – Freshwater. – Sewage, bilge, and grey water.
Utility Area	
Site utilities	Site utilities including: <ul style="list-style-type: none"> – Potable water and sewerage. – Instrument air and bottled nitrogen. – Diesel storage. – Electrical distribution (including UPS and emergency diesel generators). – Control and instrumentation. – Telecommunications.
Common Areas	
Firefighting systems and equipment	Firefighting equipment including: <ul style="list-style-type: none"> – Firewater storage. – Pumps. – Firewater monitors.
Security systems and equipment	<ul style="list-style-type: none"> – CCTV. – Fencing and gates.

Component	Works required
	<ul style="list-style-type: none"> – Security access and monitoring systems.
Equipment housing	Equipment shelters and buildings to house: <ul style="list-style-type: none"> – Electrical, control, and operating equipment, critical spares, emergency response and site monitoring facilities. – Buildings will include appropriate building services e.g., heating, ventilation and air conditioning , potable water, amenities, sewerage etc.
Site roadways, lighting and drainage	<ul style="list-style-type: none"> – Roads and car parking areas. – General lighting, earthing, lightning system. – Drainage system to tie into the existing Port Kembla drainage system.
Gas Pipeline	A section of gas pipeline will be installed within the MBD Site Compound as part of the Stage 2A works. Final safety studies will be prepared prior to the construction of the gas pipeline and prior to commencement of operation as per Schedule 3, Condition 21 of Infrastructure Approval (SSI 9471).

2.6 Stage 2B: Excavation and dredging

An Emplacement Cell Report (ECR) has been developed by SMEC Australia Pty Ltd (SMEC) titled 'Port Kembla Gas Terminal Development – Emplacement Cell Report' in accordance with Infrastructure Approval (SSI 9471) Schedule 3, Condition 8 and 9. The ECR outlines the design and construction methodology of the Emplacement Cell.

Approximately 450,000 m³ of materials will be excavated/dredged from the MBD Site Compound and placed within the boundaries of the Emplacement Cell. Further details, including detailed design drawings, can be found in the ECR (SMEC, 2022). A summary of the excavation and dredging works is provided in Section 2.6.2 and Section 2.6.3.

2.6.1 Silt curtains

Prior to the commencement of dredging activities, silt curtains will be installed within the Inner Harbour (MBD Site Compound) and Outer Harbour (Emplacement Cell). A fixed gate or bubble curtain gate will be installed to allow for the entrance and exit of barges whilst also controlling the dispersion of silt.

Silt curtains will be suitable for tidal and working harbour conditions.

Navigation and special markers will be installed to the satisfaction of the Harbour Master to alert marine vessels operating in the port harbours of the presence of silt curtains any other risks to navigation.

Further information regarding the use of silt curtains is provided in the Dredge and Excavation Management Plan (DEMP) for Stage 2A and Stage 2B.

2.6.2 Excavation and dredge staging

Construction activities undertaken during Stage 1 involved the excavation of fill materials at the MBD Site Compound. Excavation has continued through Stage 2A and will continue as part of Stage 2B. On completion of existing fill materials being excavated, dredging operations will commence at the MBD Site Compound as part of the Stage 2B works.

Dredging activities at the MBD Site Compound and Emplacement Cell will be staged to accommodate other construction works occurring at the MBD Site Compound.

Construction staging for excavation and dredging activities to be undertaken are summarised in the ECR (SMEC, 2022). Excavation and dredging at the MBD Site Compound is shown in Figure 2.6. An overview of the Emplacement Cell is shown in Figure 2.7.

2.6.3 Marine-based construction activities at MBD Site Compound

Marine based construction works required at the MBD Site Compound during Stage 2B are summarised in Table 2.5.

Table 2.5 Marine based construction works during Stage 2B

Component	Works required
Navigational aids	<ul style="list-style-type: none"> – Construction of new navigation aid pile through the new southern revetment. – Installation of navigation platform, tower, and lights, including all access requirements such as ladders, platforms, and handrails. – Lights will be battery powered and charged via solar panels. – Existing navigation aid to be removed after the commission of the new navigation aid.
Revetment shore protection	<ul style="list-style-type: none"> – Revetments will be constructed at the north and south embankments of the new MBD Site Compound wharf (refer to Figure 2.6) following completion of dredging works. – Works will comprise: <ul style="list-style-type: none"> • Laydown of Texcel 1200R geotextile. • Placement of thick quarry run to a depth of 190mm. • Placement of underlay rock to a depth of 400mm. • Placement of armour rock to a depth of 900 mm.
Revetted Trench	<ul style="list-style-type: none"> – Dredging of an approximate 10x10m trench to -14.5 reduced level (RL) Port Kembla Height Datum (PKHD) for accommodating the under-keel requirements of the FSRU strainers. An approach channel may also be required. – The trench should have sufficient scour protection.
Berthing box	<ul style="list-style-type: none"> – Dredging will be undertaken to facilitate berthing boxes to be constructed.

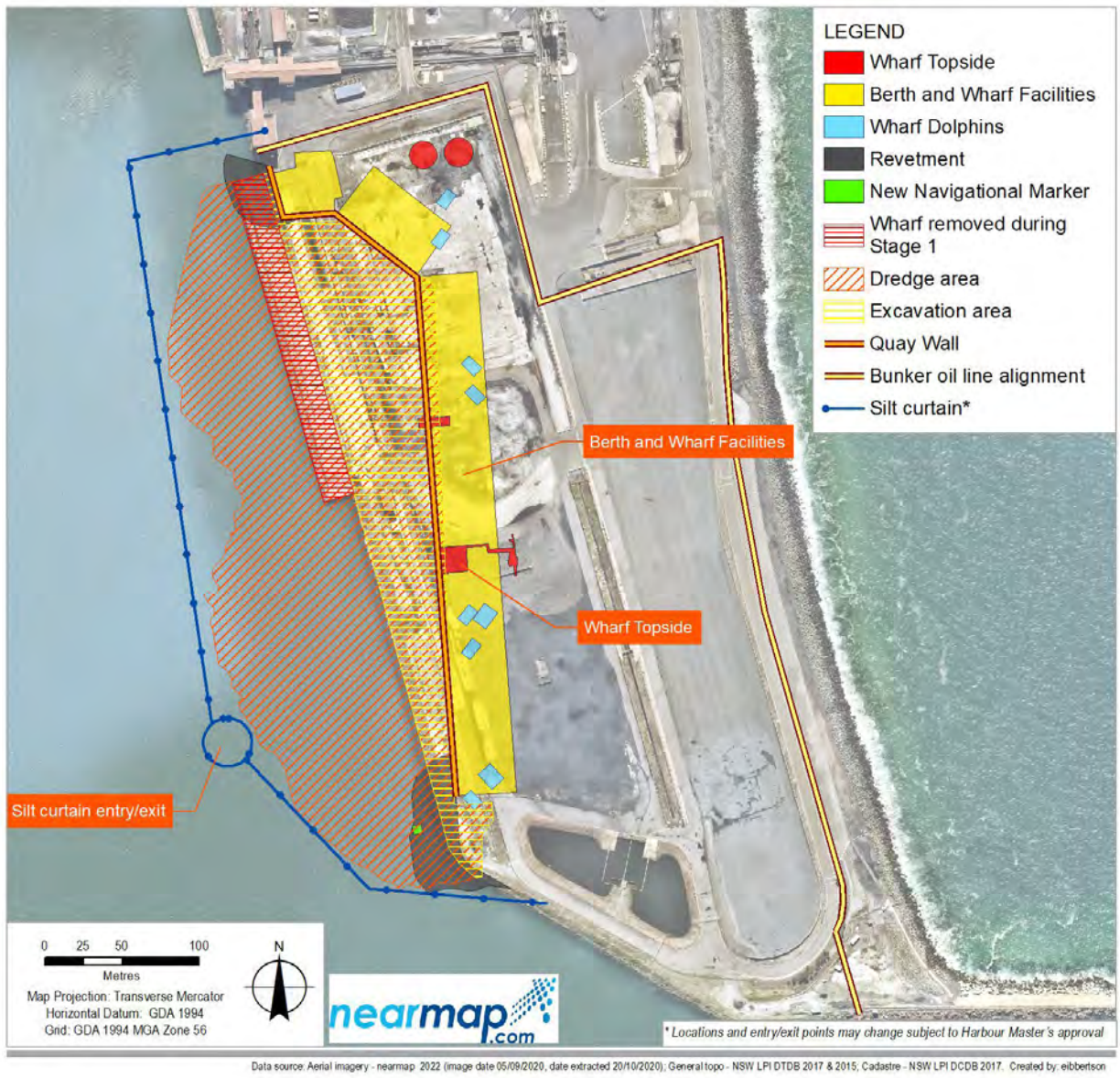


Figure 2.6 Dredging and excavation works for MBD Site Compound (Stage 2B)

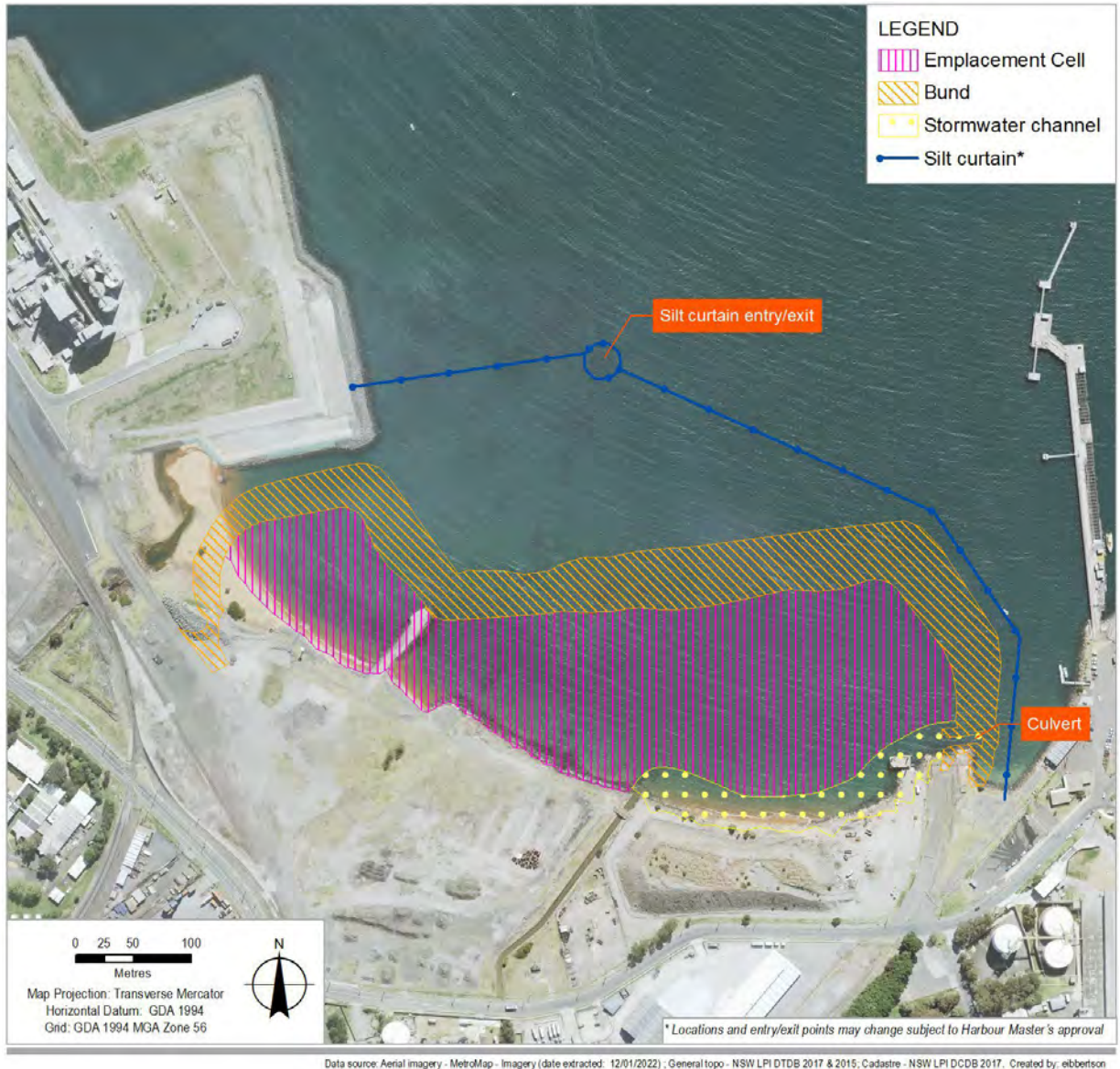


Figure 2.7 Emplacement Cell overview (Stage 2B)

2.7 Stage 2B: Construction of the Emplacement Cell

The Emplacement Cell will be located within the Outer Harbour, comprising of an approximate 800-metre perimeter bund. The Emplacement Cell has been designed and constructed to receive approximately 450,000 m³ of dredged materials from the MBD Site Compound. Harbour Muds (HM)/Harbour Silts (HS) is to be placed below -1 m PKHD and at a maximum below LAT (below ~-0.02 m PKHD), and Potential Acid Sulfate Soils (PASS) will be placed below +0.9m PKHD within the Emplacement Cell.

The construction work components and key features of the Emplacement Cell are summarised in Table 2.6. An overview of the Emplacement Cell is shown in Figure 2.7. Further details are provided in the ECR (SMEC, 2022).

Table 2.6 Emplacement Cell key features – Stage 2B

Component	Description
Emplacement Cell	<ul style="list-style-type: none"> – All contaminated soils, including HM/HS and PASS, will be placed within the Emplacement Cell generally below lower than -1.0m PKHD and in no instances above the LAT (~-0.02m PKHD). – The final Emplacement Cell levels will be graded towards the proposed stormwater channel. – Design life of 15 years.
Perimeter bund	<ul style="list-style-type: none"> – The design bund crest level was derived based on tide, storm surge, sea level rise and wave overtopping and assumed to be +3.55m PKHD. The adopted crest level also includes allowance for assessed post-construction settlement of up to 250mm. – Minimum crest width of 6m and 11m at passing bays. – Maximum permanent batter slopes of 1V:3H for seaward slopes and 1V:2H for landward/internal slopes. – The bund is to accommodate a 110t long reach excavator, fully loaded semi-trailer and temporary material stockpiles.
Rock revetment	<ul style="list-style-type: none"> – Rock revetment structure will extend to the toe of the main bund to provide protection to the bund structure against coastal processes.
Stormwater channel	<ul style="list-style-type: none"> – Stormwater channel to extend from the existing Darcy Road drain outlet to the eastern side of the Emplacement Cell. – Stormwater channel outlet is to comprise a box culvert structure on the eastern end of the Emplacement Cell, providing vehicular access onto the bund at the Jetty 3 abutment and within the NSW Ports property boundary.

3. Roles and responsibilities

The Project Team is responsible for all activities associated with Stage 2A and Stage 2B, including the implementation and maintenance of the various mitigation/management measures outlined in this FFMP. Relevant roles and responsibilities of the Project Team are outlined in Table 3.1.

Table 3.1 Roles and responsibilities of Project Team

Project Role	Responsibility
AIE Project Director	<ul style="list-style-type: none"> – Responsible for the overall funding and direction of works associated with Stage 2A and Stage 2B. – Ensuring provision of adequate resources to achieve the environmental objectives for the Project including ensuring sufficient resourcing for the Environmental Team, Engineering and Construction Teams.
AIE Construction Manager	<ul style="list-style-type: none"> – Proactively stewards the effective implementation of Stage 2A and Stage 2B in accordance with requirements of the Infrastructure Approval (SSI9471), this FFMP, Environmental Strategy, and all related Sub - plans. – Demonstrate proactive support for environmental requirements.
AIE HSE Manager	<ul style="list-style-type: none"> – Develop and update all Health, Safety and Environmental (HSE) Management Strategies and Sub - plans. – Ongoing liaison and engagement with government agencies and point of escalation for any environmental incidents. – Identifying environmental issues as they arise and proposing solutions. – Coordinate and facilitate periodic environmental inspections with the key contractors. – Environmental Reporting.
Emplacement Cell Auditor	<ul style="list-style-type: none"> – Audit the construction of the Emplacement Cell and verify that works have been completed in accordance with the design intent (Emplacement Cell), The auditor role is to satisfy Condition 10 Schedule 3 of the Infrastructure Approval and any other relevant conditions therein.
Stage 2A Principal Contractor Project Manager and Stage 2B Principal Contractor Project Manager	<ul style="list-style-type: none"> – On-site Project management and control. – Decision-making authority relating to environmental performance of the construction program. – Authority over Project construction and site activities in accordance with the EMS. – Ensure relevant training is provided to all Project staff prior to commencing individual activities. – Reports to AIE Construction Manager on environmental matters. – Ensures appropriate Contractor resources are allocated to implement the environmental requirements. – Responsible for planning and scheduling of construction, and to ensure operations are conducted in accordance with statutory requirements and the EMS. – Monitors performance against environmental Key Performance Indicators (KPI's). – Ensures that all environmental objectives associated with the Project are achieved. – Day-to-day decision-making authority relating to environmental performance of construction activities and direct site activities and construction. – To provide resources to ensure environmental compliance and continuous improvement. – Ensure all personnel are aware of any changes to EMS, this FFMP and improved procedures. – Ensure this FFMP is implemented for the duration of Stage 2A and Stage 2B.
Stage 2A Principal Contractor Construction Foreman and Stage 2B Principal Contractor Construction Foreman	<ul style="list-style-type: none"> – Implement requirements contained in the EMS and Sub - plans, work procedures and standard drawings. – Maintaining open and transparent communication with other Project discipline managers and other areas of the Project. – Reporting of hazards and incidents and implementing any rectification measures. – Ensures appropriate contractor resources are allocated.

Project Role	Responsibility
	<ul style="list-style-type: none"> – Orders STOP WORK for any environmental breaches and reports incidents to the Project Manager. – Ensure this FFMP is implemented for the duration of Stage 2A and Stage 2B.
Stage 2A Principal Contractor Environmental Representative and Stage 2B Principal Contractor Environmental Representative	<ul style="list-style-type: none"> – Delivers environmentally focussed toolbox talks and provides applicable site inductions. – Provides environmental advice, assistance, and direction to Project Manager to ensure construction activities are conducted in accordance with regulatory legislation and this FFMP. – Participate and cooperate with AIE HSE Manager with regards to undertaking of joint environmental site inspections. – Coordinate / undertake wet-weather inspections as per EPL No. 21529 and report accordingly to the AIE HSE Manager. – Develop strong working relationships with the AIE team and Consultants. – Ensure environmental risks are appropriately identified, communicated, and effectively managed. – Ensure communication of relevant environmental information to Project personnel. – Provide specialist advice and input as required. – Ensure construction manager, superintendents and field supervisors fully understand the environmental constraints and how construction practices must ensure any such constraints are considered and mitigated against during construction. – Orders STOP WORK for any environmental breaches and immediately reports incidents to Principal Contractor Project Manager and AIE HSE Manager.
Independent Discipline Engineering Consultants	<ul style="list-style-type: none"> – Certify the design and that the works have been completed in accordance with the design.
AIE Environmental Representative and AIE Environmental Contractor	<ul style="list-style-type: none"> – Develop strong working relationships with the Principal Contractor Team and Consultants. – Ensure environmental risks are appropriately identified, communicated, and effectively managed. – Instruct and advise management team on compliance issues. – Provide specialist advice and input as required. – Co-ordinate internal audits of this FFMP. – Conduct audit review as required. – Reports on the performance of this FFMP and recommends changes or improvements to Project Manager. – Orders STOP WORK for any environmental breaches and immediately reports incidents to the AIE Construction Manager and AIE HSE Manager. – Conducts investigation and response to environmental complaints and inquiries, where required. – Undertake all required environmental monitoring for this phase of the Project.
Subcontractors and construction personnel	<ul style="list-style-type: none"> – Undertake an environmental induction prior to accessing to site. – Comply with legislative requirements. – Participate in inspections and audits. – Follow environmental procedures. – Report all environmental incidents and hazards. – Introduce environmental topics to prestart meetings. – Ensure that all relevant permits and clearances are in place prior to commencing work.

4. Legislative requirements and applicable guidelines

4.1 Legislative requirements

The legislative requirements applicable to Stage 2A and Stage 2B are listed in Table 4.1.

Table 4.1 Legislation and relevant policy applicable to this FFMP

Legislation and Regulation	Description	Applicability
Commonwealth		
<i>Environment Protection Biodiversity Conservation Act 1999</i> (EPBC Act)	<p>The EPBC Act is the Australian Government’s central piece of environmental legislation that provides a legal framework to protect and manage environmental values considered to be of national environmental significance.</p> <p>The EPBC Act requires approval from the Commonwealth Minister for the Environment for actions that are likely to have a significant impact on listed matters of national environmental significance (MNES). It is the responsibility of the applicant proposing to undertake an action to initially consider whether the proposal is likely to have a significant impact on any MNES. If the applicant considers there is potential for significant impacts upon any matters protected under the EPBC Act, then a referral is required to be submitted to the Minister for the Environment. Developments considered likely to result in significant impacts are defined as “controlled actions” and require assessment and approval.</p>	<p>Consideration of potential impacts upon listed threatened species and communities and any other MNES potentially impacted by the Project has been undertaken as part of the EIS. No impacts have been identified that are considered likely to be significant and consequently a referral to the Commonwealth Minister for the Environment was not undertaken.</p>
<i>Environment Protection and Biodiversity Conservation Regulations 2000</i> (EPBC Regulations)	<p>The EPBC Regulations implement provisions of the EPBC Act, including the issuing of approvals and permits. The EPBC Regulations are divided into 24 parts which cover matters related to MNES, bilateral agreements and threatened species.</p>	<p>Part 8 of the EPBC Regulations provides for the protection and conservation of cetacean species, including the movement of marine vessels. Part 8, Division 8.05 outlines the operational requirements of vessels when interacting with adult cetaceans. Vessels within the caution zone (150 m for dolphins, 300 m for whales) of a cetacean species are required to operate the vessel at a constant speed of less than 6 knots and minimise noise and ensure the vessel does not drift or approach closer than 50 m of dolphins and 100 m of whales. Vessel operations will be managed in accordance with the Project POMP. Requirements under the EPBC Regulations and potential impacts of vessel movements to cetacean species is included in Section 7.2.</p>
<i>Biosecurity Act 2015</i>	<p>The Federal <i>Biosecurity Act 2015</i> provides for the management of biosecurity risks, risks related to ballast water, and gives effect to Australia’s international rights and obligations under the International Convention for the Control and Management of Ships’ Ballast Water and Sediments, the United Nations Convention</p>	<p>The Australian Ballast Water Management Requirements (DAWE, 2020) provides guidance to vessel operators on the management of ballast water when operating in Australian waters in order to comply with the legislative requirements of the Federal <i>Biosecurity Act 2015</i> measures. Under the Requirements, vessel masters must comply with the applicable provisions and obligations with regards to the management of ballast water.</p>

Legislation and Regulation	Description	Applicability
	on the Law of the Sea, and the Biodiversity Convention.	Additional information on ballast water requirements related to the Stage 2A and Stage 2B activities is provided in Section 7.2.3.
State		
<i>Biodiversity Conservation Act 2016</i> (BC Act)	<p>The BC Act aims to conserve biodiversity at the bioregional and state scale and lists a number of threatened species, populations, and ecological communities to be considered when deciding if a project is likely to have a significant impact on threatened biota, or their habitats.</p> <p>The BC Act provides the Biodiversity Offsets Scheme (BOS) to address biodiversity impacts from land clearing associated with development.</p>	<p>A detailed biodiversity assessment report was prepared as part of the EIS, and the Project would be unlikely to have a significant impact on any threatened species, populations or ecological communities listed under the BC Act. In accordance with the BOS and Infrastructure Approval (SSI 9471), biodiversity credits were required to be offset. These requirements have been complied with prior to the construction of the Project (refer to Appendix A).</p> <p>The MBD Site Compound where Stage 2A and Stage 2B construction works will occur has had previous sightings of the Green and Golden Bell Frog, a listed threatened species. Management measures related to Green and Golden Bell Frogs have been included in Section 8.</p> <p>Schedule 1 of the BC Act lists critically endangered, endangered, vulnerable species and populations occurring in NSW. Species listed under Schedule 1 that could potentially be present within the Project area were assessed under the Act's assessment criteria. The likelihood of occurrence and potential impacts to these species are outlined in Section 7.2.</p>
<i>Biosecurity Act 2015</i> (Biosecurity Act)	<p>The Biosecurity Act specifies the duties of public and private landholders as to the control of priority weeds and biosecurity matters including terrestrial, aquatic, and marine species. The Biosecurity Act defines priority weeds by local government area and assigns duties for their control. Part 3 of the Biosecurity Act provides that any person who deals with biosecurity matter and who knows, or ought reasonably to know, the biosecurity risk posed or likely to be posed by the biosecurity matter has a duty to ensure that, so far as is reasonably practicable, the biosecurity risk is prevented, eliminated, or minimised.</p>	<p>The terrestrial and marine biodiversity assessments prepared as part of the EIS identified weed and marine pest species in the Project area and vicinity. Weed species identified within the MBD Site Compound and Emplacement Cell Construction Site are listed in Appendix B. Marine pest species identified within Port Kembla are listed in Appendix C.</p> <p>Management measures have been developed to manage weed and marine pest species in accordance with the Biosecurity Act. These mitigation measures are outlined in Section 8.1.4 and Section 8.2.3.</p>
<i>Fisheries Management Act 1994</i> (FM Act)	<p>The objectives of the FM Act are to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations. Part 7 of the FM Act requires a permit for a number of activities, including those involving dredging and reclamation work and those involving harm to marine vegetation.</p>	<p>Permits under Section 201, 205 or 219 of the FM Act are not required for approved CSSI in accordance with Section 5.23 of the EP&A Act.</p> <p>Schedule 4, 4A and 5 of the FM Act provides lists of critically endangered, endangered, and vulnerable species, populations and ecological communities occurring in NSW. Those of relevance to the project have been identified and assessed under the FM Act assessment criteria for likelihood of occurrence within the Project area.</p> <p>The marine biodiversity assessment prepared for the PKGT EIS assessed potential impacts associated with dredging and disposal works on fisheries and marine vegetation. An overview of the assessment is provided in Section 6.2 and Section 7.2 and management measures are outlined in Section 8.2.</p>

Legislation and Regulation	Description	Applicability
<i>Marine Pollution Act 2012</i> (Marine Pollution Act)	<p>The Marine Pollution Act enhances the protection of the NSW marine environment by regulating marine pollution discharges from vessels. The Act incorporates relevant provisions from Annexes of The International Convention for the Prevention of Pollution from Ships (MARPOL), including:</p> <ul style="list-style-type: none"> – Annex I, which deals with prevention of pollution by oil. – Annex II, which deals with control of pollution by noxious liquid substances in bulk. – Annex III, which deals with prevention of pollution by harmful substances in packaged form. – Annex IV, which deals with prevention of pollution by sewage. – Annex V, which deals with prevention of pollution by garbage. <p>The Marine Pollution Act provides the framework for investigation and penalties arising from marine pollution incidents.</p>	<p>Accidental release of hydrocarbons, chemicals and other liquid waste from marine vessels has the potential to impact on the health of the Port Kembla marine environment. Management measures related to potential oil and chemical spills have been developed in accordance with the applicable MARPOL Annexes.</p> <p>An overview of potential impacts to marine fauna from ship pollution is provided in Section 7.2 and management measures are outlined in Section 8.2.</p> <p>Additional information related to contamination and spills is provided in the Stage 2A and Stage 2B Emergency Spill Plan and Spoil Management Plan (SMP).</p>

4.2 Guidelines

The framework for the terrestrial and marine biodiversity management measures were developed with reference to relevant guidelines relating to the assessment and management of potential impacts related to the Stage 2A and Stage 2B construction activities. These include:

4.2.1 Terrestrial

- DECC 2008, Hygiene protocols for the control of disease in frogs (Appendix D).
- DEWHA 2009, Significant impact guidelines for the vulnerable green and golden bell frog (*Litoria aurea*).
- DP&E 2020, Hygiene guidelines Protocols to protect priority biodiversity areas in NSW from *Phytophthora cinnamomi*, myrtle rust, amphibian chytrid fungus and invasive plants (Appendix E).
- South East Local Land Services 2017, South East Regional Strategic Weed Management Plan 2017 – 2022 (Appendix F).

4.2.2 Marine

- South Australian Department of Planning, Transport, and Infrastructure (DPTI) 2012, *Underwater Piling Noise Guidelines* (Appendix G).
- Department of the Environment and Energy (DoEE) 2017, *Australian Guidelines for Whale and Dolphin Watching* (Appendix H).
- Department of Agriculture, Water and the Environment (DAWE) 2020, *Australian Ballast Water Management Requirements Version 8* (Appendix I).
- MARPOL Regulations:
 - Annex I: Regulations for the prevention of pollution by oil.
 - Annex II: Regulations for the control of pollution by noxious liquid substances in bulk.
 - Annex III: Regulations for the prevention of pollution by harmful substances carried by sea in packaged form.
 - Annex IV: Regulations for the prevention of pollution by sewage from ships.
 - Annex V: Regulations for the prevention of pollution by garbage from ships.

5. Planning requirements

The planning requirements and the corresponding flora and fauna management measures applicable to Stage 2A and Stage 2B are listed in Table 5.1. Management measures are detailed in Section 8.

The planning requirements include the conditions set out in the Infrastructure Approval (SSI 9471) dated 13 October 2021 and the mitigation/management measures outlined in the PKGT EIS.

Table 5.1 Planning requirements

Requirement	Reference	Responsibility	Evidence	Applicability to this FFMP
Infrastructure Approval Requirements (SSI 9471)				
<p>Aquatic Habitat The Proponent must design and construct the water intake on the FSRU to minimise entrainment of aquatic organisms and plankton.</p>	Schedule 3, Condition 2			Not applicable
<p>Biodiversity Offsets Prior to the commencement of construction, unless otherwise agreed by the Planning Secretary, the Proponent must retire biodiversity credits of a number and class specified in Table 1 and Table 2 below in consultation with the Biodiversity and Conservation Division (BCD) and to the satisfaction of the Biodiversity Conservation Trust (BCT). The retirement of these credits must be carried out in accordance with the NSW Biodiversity Offsets Scheme and can be achieved by:</p> <ol style="list-style-type: none"> acquiring or retiring 'biodiversity credits' within the meaning of the BC Act making payments into an offset fund that has been developed by the NSW Government; or funding a biodiversity conservation action that benefits the threatened entity impacted by the development, consistent with the 'Ancillary Rules: Biodiversity conservation actions'. 	Schedule 3, Condition 20	AIE	Appendix A	Applicable – credits have been retired pre-construction (refer to Appendix A)
PKGT EIS Management Measures				
A site specific emergency spill plan will be developed, and will include spill management measures in accordance relevant NSW Environment Protection Authority (EPA) guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Transport for NSW and EPA officers).	EIS Measure W11 EIS Measure TB8	<ul style="list-style-type: none"> – AIE Construction Manager – AIE HSE Manager – Stage 2A Principal Contractor Environmental Representative and Stage 2B Principal Contractor Environmental Representative 	Refer to Emergency Spill Plan	Applicable
An emergency spill kit will be kept on site at all times. All staff will be made aware of the location of the spill kit and trained in its use.	EIS Measure W12 EIS Measure TB9	<ul style="list-style-type: none"> – AIE Construction Manager – AIE HSE Manager – Stage 2A Principal Contractor Environmental 	Refer to Emergency Spill Plan	Applicable

Requirement	Reference	Responsibility	Evidence	Applicability to this FFMP
		Representative and Stage 2B Principal Contractor Environmental Representative		
Machinery will be checked daily to ensure there is no oil, fuel or other liquids leaking from the machinery. All staff will be appropriately trained through toolbox talks for the minimisation and management of accidental spills.	EIS Measure W13 EIS Measure TB11	<ul style="list-style-type: none"> – AIE Construction Manager – Stage 2A Principal Contractor Construction Foreman and Stage 2B Principal Contractor Construction Foreman 	Refer to Emergency Spill Plan	Applicable
<p>Works to remove the current quay wall and piles will commence after a visual inspection for protected mobile fauna (e.g. Syngnathids). If present, these will be relocated to adjacent habitats, outside the zone of influence by the proposed works, where feasible.</p> <p>Dredging will be carried out using mechanical backhoe dredge, split barges and supporting tug vessels, as opposed to suction-style dredging, to minimise the potential mobilisation of sediments within the Inner Harbour.</p> <p>Disposal of the dredged material will be limited to the Outer Harbour disposal area within the perimeter bund.</p>	EIS Measure ME1	<ul style="list-style-type: none"> – AIE Construction Manager – AIE HSE Manager – Stage 2A Principal Contractor Environmental Representative and Stage 2B Principal Contractor Environmental Representative 	Section 8.2	Not Applicable – undertaken during Stage 1
<p>The following controls should be implemented prior to dredge activities:</p> <ul style="list-style-type: none"> – Physical controls such as installation of silt curtains prior to commencement of construction works would be adequate in minimising the spread of any sediments within the water column at the dredging and disposal locations. – Dredging techniques that minimise sediment resuspension during excavation and disposal (such as using mechanical methods over hydraulic methods) should be implemented throughout the project. Barge loads will also be controlled such that overflow of barge loads is avoided. – Screening technologies will be implemented to ensure that any contaminated sediments are disposed of responsibly. Contaminated dredge material will be placed such that it may be capped by uncontaminated material in accordance with a dredge management plan. – Implementation of a water quality monitoring program to ensure construction works do not exceed the project's agreed marine water quality criteria. 	EIS Measure ME2	<ul style="list-style-type: none"> – Stage 2A Principal Contractor Project Manager and Stage 2B Principal Contractor Project Manager – AIE Construction Manager – AIE HSE Manager – Stage 2A Principal Contractor Environmental Representative and Stage 2B Principal Contractor 	Section 8.2 Refer to DEMP	Applicable

Requirement	Reference	Responsibility	Evidence	Applicability to this FFMP
<ul style="list-style-type: none"> – Daily visual observations of any potential toxic dinoflagellate blooms within the Inner Harbour. 		Environmental Representative		
<p>During piling activities, the following standard operational procedures are to be implemented (DPTI, 2012):</p> <ul style="list-style-type: none"> – Pre-start procedure – The presence of marine mammals should be visually monitored by a suitably trained crew member for at least 30 minutes before the commencement of the soft start procedure. Particular focus should be put on the shut-down zone but the observation zone should be inspected as well, for the full extent where visibility allows. Observations should be made from the piling rig or a better vantage point if possible. – Soft start procedure – If marine mammals have not been sighted within or are likely to enter the shut down zone during the pre-start procedure, the soft start procedure may commence in which the piling impact energy is gradually increased over a 10-minute period. The soft start procedure should also be used after long breaks of more than 30 minutes in piling activity. Visual observations of marine mammals within the safety zones should be maintained by trained crew throughout soft starts. The soft start procedure may alert marine mammals to the presence of the piling rig and enable animals to move away to distances where injury is unlikely. – Normal operation procedure – If marine mammals have not been sighted within or are not likely to enter the shut down or observation zone during the soft start procedure, piling may start at full impact energy. Trained crew should continuously undertake visual observations during piling activities and shut-down periods. After long breaks in piling activity or when visual observations ceased or were hampered by poor visibility, the pre-start procedure should be used. Night-time or low visibility operations may proceed provided that no more than three shut-downs occurred during the preceding 24 hour period. – Stand-by operations procedure – If a marine mammal is sighted within the observation zone during the soft start or normal operation procedures, the operator of the piling rig should be placed on stand-by to shut-down the piling rig. An additional trained crew member should continuously monitor the marine mammal in sight. – Shut-down procedure – If a marine mammal is sighted within or about to enter the shutdown zone, the piling activity should be stopped immediately. If a shut-down procedure occurred and marine mammals have been observed to move outside the shut-down zone, or 30 minutes have lapsed since the last marine mammal sighting, then piling activities should recommence using the soft start procedure. If marine mammals are detected the shut-down zone during poor visibility, operations should stop until visibility improves. 	EIS Measure ME4	<ul style="list-style-type: none"> – Stage 2A Principal Contractor Project Manager and Stage 2B Principal Contractor Project Manager AIE Construction Manager – AIE HSE Manager – Stage 2A Principal Contractor Environmental Representative and Stage 2B Principal Contractor Environmental Representative 	Section 8.2.2 Appendix G	Applicable
Vessel and heavy machinery should be maintained in accordance with the manufacturer specifications to reduce noise emissions.	EIS Measure ME5	– Stage 2A Principal Contractor Project	Section 8.2.2	Applicable

Requirement	Reference	Responsibility	Evidence	Applicability to this FFMP
		Manager and Stage 2B Principal Contractor Project Manager – AIE Construction Manager – AIE HSE Manager	Appendix G	
<p>The interaction of all vessels with cetaceans and pinnipeds will be compliant with Part 8 of the EPBC Regulations. The Australian Guidelines for Whale and Dolphin Watching (DoEE, 2017) for sea-faring activities will be implemented across the entire project. This includes the implementation of the following guidelines:</p> <ul style="list-style-type: none"> – Caution zone (300 m either side of whales and 150 m either side of dolphins) – vessels must operate at no wake speed in this zone. – Caution zone must not be entered when calf (whale or dolphin) is present. – No approach zone (100 m either side of whales and 50 m either side of dolphins) – vessels should not enter this zone and should not wait in front of the direction of travel or an animal or pod, or follow directly behind. – If there is a need to stop, reduce speed gradually. – Do not encourage bow riding. – If animals are bow riding, do not change course or speed suddenly. 	EIS Measure ME6	<ul style="list-style-type: none"> – Stage 2A Principal Contractor Project Manager and Stage 2B Principal Contractor Project Manager – AIE Construction Manager – AIE HSE Manager – Stage 2A Principal Contractor Environmental Representative and Stage 2B Principal Contractor Environmental Representative 	Section 8.2.4 Appendix H	Applicable
<p>Locally sourced vessels (within NSW waters) to complete the construction works, where possible. International vessels to empty ballast water in accordance with the latest version of the Australian Ballast Water Management Requirements (DAWR, 2017). If an introduced marine pest (IMP) is identified or suspected, then the contractor is obliged to immediately (within 24 hours) notify the NSW Department of Primary Industries (DPI) Aquatic Biosecurity Unit hotline on (02) 4916 3877. Project activities to adhere to the National System for the Prevention and Management of Marine Pest Incursions (National System) and NSW requirements for IMP identification and management.</p>	EIS Measure ME9	<ul style="list-style-type: none"> – Stage 2A Principal Contractor Project Manager and Stage 2B Principal Contractor Project Manager – AIE Construction Manager – AIE HSE Manager – Stage 2A Principal Contractor Environmental Representative and Stage 2B Principal Contractor Environmental Representative 	Section 8.2.3 Appendix I Appendix K Appendix L	Applicable

Requirement	Reference	Responsibility	Evidence	Applicability to this FFMP
<p>In accordance with the offset rules established by the Biodiversity Conservation Regulation 2017 there are various means by which the offset obligations can be met. The following is recommended:</p> <ul style="list-style-type: none"> – Secure and retire appropriate credits from stewardship site/s that fit within the trading rules of the BOS in accordance with the 'like-for-like' report generated by the Biodiversity Assessment Method (BAM) calculator. If the required credits are unavailable, source credits in accordance with the 'variation report' generated by the BAM calculator. – Only consider a payment to the Biodiversity Conservation Fund if a suitable number and type of biodiversity credits cannot be secured from third parties. 	EIS Measure TB1	N/A	N/A	Not applicable – completed pre-construction
<p>Staff will be inducted and informed of the limits of clearing and the areas of vegetation to be retained.</p>	EIS Measure TB2	<ul style="list-style-type: none"> – AIE HSE Manager – Stage 2A Principal Contractor Environmental Representative and Stage 2B Principal Contractor Environmental Representative 	Section 8.1	Applicable
<p>A trained ecologist is to be present for construction activities that may impact frog habitat which includes dewatering / removal of detention basins and trenching immediately adjacent to Typha drainage line (west of Springhill Road).</p> <p>Temporary frog-proof fencing should be installed around drill sites, roadside drains and detention ponds near the project site to be retained to prevent frogs from being injured or killed by equipment.</p> <p>Any frogs identified will only be handled by an ecologist or wildlife rescue representative</p> <p>Any Green and Golden Bell Frogs or other resident frogs are to be handled in accordance with the Chytrid fungus hygiene protocols (DECC 2008c) and released into the most appropriate nearby habitat area.</p>	EIS Measure TB3	<ul style="list-style-type: none"> – AIE HSE Manager – Stage 2A Principal Contractor Environmental Representative and Stage 2B Principal Contractor Environmental Representative Project Ecologist 	Section 8.1.1 Section 8.1.2 Appendix D	Applicable for detention basins/ movement corridor within MBD Site Compound.
<p>The trench is to be covered at night to prevent fauna from falling in.</p> <p>An inspection is to be conducted each morning to check the trench for frogs.</p>	EIS Measure TB3	<ul style="list-style-type: none"> – AIE HSE Manager – Stage 2A Principal Contractor Environmental Representative and Stage 2B Principal Contractor Environmental Representative Project Ecologist 	Section 8.1.1 Section 8.1.2 Appendix D	Applicable –

Requirement	Reference	Responsibility	Evidence	Applicability to this FFMP
Priority weed control measures will be implemented as part of the EMS to prevent their spread in the study area.	EIS Measure TB4	<ul style="list-style-type: none"> – AIE HSE Manager – Stage 2A Principal Contractor Environmental Representative and Stage 2B Principal Contractor Environmental Representative 	Section 8.1.4 Appendix F	Applicable
<p>Declared priority weeds will be managed according to requirements of the NSW Biosecurity Act.</p> <p>Soil material and stripped groundcover vegetation with the potential to contain priority weeds will not be removed from the project site.</p> <p>Soil disturbance will be avoided as much as possible to minimise the potential for spreading weeds.</p>	EIS Measure TB5	<ul style="list-style-type: none"> – AIE HSE Manager – Stage 2A Principal Contractor Environmental Representative and Stage 2B Principal Contractor Environmental Representative 	Section 8.1.4 Appendix F Also refer to Erosion and Soil Control Plan (ESCP)	Applicable
<p>Areas disturbed during the works will be rehabilitated, including stabilising disturbed soils to resist erosion and weed invasion via establishment of with a suitable turf species such as a native Couch or repaving roads and sealed surfaces.</p> <p>Stabilisation activities will be carried out progressively to limit the time disturbed areas are exposed to erosion processes.</p> <p>Activities with a risk of soil erosion such as earthworks will not be undertaken immediately before or during high rainfall or wind events.</p>	EIS Measure TB7	<ul style="list-style-type: none"> – AIE HSE Manager – Stage 2A Principal Contractor Environmental Representative and Stage 2B Principal Contractor Environmental Representative 	Refer to ESCP	Applicable
Any herbicides used for weed control will be applied to the manufacturer's specifications and as outlined in the manufacturer's Material Safety Data Sheet (SDS).	EIS Measure TB10	<ul style="list-style-type: none"> – AIE HSE Manager – Stage 2A Principal Contractor Environmental Representative and Stage 2B Principal Contractor Environmental Representative 	Section 8.1.4	Applicable
Vehicle wash down facilities will be provided should evidence of pathogens or fungus such as Phytophthora or Chytrid be found.	EIS Measure TB12	<ul style="list-style-type: none"> – AIE HSE Manager – Stage 2A Principal Contractor 	Section 8.1.4 Appendix E	Applicable

Requirement	Reference	Responsibility	Evidence	Applicability to this FFMP
		Environmental Representative and Stage 2B Principal Contractor Environmental Representative Subcontractors and construction personnel		
<p>The Underwater Piling Noise Guidelines (2012) recommends the following standard management and mitigation procedures with respect to underwater piling operations:</p> <ul style="list-style-type: none"> – Avoid conducting piling activities during times when marine mammals are likely to be breeding, calving, feeding, migrating or resting in biologically important habitats located within the potential noise impact footprint. – Use low noise piling methods, instead of impact piling, where possible. – Presence of marine mammals should be visually monitored by a suitably trained crew member for at least 30 minutes before the commencement of the piling procedure. – If no marine mammals are nearby, a soft-start piling procedure should be used. This involves gradually increasing the piling impact energy over a 10-minute time period. – Visual observations of marine mammals within the safety zone should be maintained by trained crew throughout the start period. – If a marine mammal is sighted within the observation zone during the soft start of normal operation procedures, the operator of the piling rig should be placed on stand-by to shut down the piling rig. <p>A record of procedures employed during the operations should be maintained by the piling contractor.</p>	EIS Measure NV17	<ul style="list-style-type: none"> – Stage 2A Principal Contractor Project Manager and Stage 2B Principal Contractor Project Manager – AIE Construction Manager – AIE HSE Manager – Stage 2A Principal Contractor Environmental Representative and Stage 2B Principal Contractor Environmental Representative 	Section 8.2.2	Applicable

6. Existing environment

6.1 Terrestrial

The Project site is highly modified and disturbed from historical and current industrial and port activity. The surrounding environment comprises urban development. Stage 2A and Stage 2B works as described in Section 2 involve both land and water-based construction activities. Land based activities will be undertaken on the MBD Site Compound and Emplacement Cell Construction Site (refer to Figure 2.2). The MBD Site Compound is located within the Port Kembla Coal Terminal (PKCT) and as a result is highly modified. The MBD Site Compound is largely comprised of concrete or gravel surfaces with minimal biodiversity values present. The Emplacement Cell Construction Site is located at the Outer Harbour area along Foreshore Road and is located within industrial and port industry land uses. The Emplacement Cell Construction Site is highly modified and mostly cleared with limited non-native vegetation present.

6.1.1 Flora communities

Native vegetation has been entirely removed from the MBD Site Compound and Emplacement Cell Construction Site. No Threatened Ecological Communities (TEC), Plant Community Types (PCT) or threatened flora species have been identified within the Stage 2A and Stage 2B construction footprint and are unlikely to occur given the disturbed nature and absence of natural soil profile.

The MBD Site Compound is primarily hardstand with limited vegetation present. The vegetation that is present comprises non-native vegetation which provides limited habitat resource, does not form a functioning or self-sustaining ecosystem, and is significantly fragmented. Vegetation mapping classifies the vegetation present as 'Disturbed landscapes' – 'Weeds and Exotics', 'Cleared lands' or 'Modified lands' (NPWS, 2002). The Emplacement Cell Construction Site has been cleared and is currently used as a construction site, with stockpiles of materials present from the Stage 1 Early Enabling Works. Limited vegetation present comprises of exotic and non-native species.

6.1.2 Fauna species

The field survey identified 25 fauna species in the Project area, comprising 23 bird species, one mammal species and one frog species. No threatened or migratory species were recorded during site investigations (GHD, 2018a).

The MBD Site Compound provides limited habitat resources for fauna species. The hardstand areas and artificial sediment ponds located throughout the site provide limited and minimal habitat for potential threatened species. The Emplacement Cell Construction Site is an active construction site and provides little to no habitat resources for fauna species.

Green and Golden Bell Frogs are a threatened species that has been previously recorded in the area surrounding Port Kembla (refer to Figure 6.1). They are listed as endangered under the BC Act and vulnerable under the EPBC Act. Green and Golden Bell Frogs are known to occur in highly disturbed environments with moderate surface water contamination conditions, such as those described on the MBD Site Compound.

A potential movement corridor for the Green and Golden Bell Frog has been identified on the MBD Site Compound (refer to Figure 6.1). Within this area, up to four artificial detention ponds have been removed during the Stage 1 Early Enabling Works and Stage 2A construction works, which provides potential habitat and connectivity for the Green and Golden Bell Frog. An additional survey was undertaken in November 2021 to determine if any Green and Golden Bell Frogs were present in the Southern Pond detention basin. No Green and Golden Bell Frogs were identified; however, three native frog species were (Narla Environmental, 2021).

Potential impacts related to the scope of works for Stage 2A and Stage 2B are detailed in Section 7. Mitigation measures are provided in Section 8.1.



Figure 6.1 Green and Golden Bell Frog Habitat

6.1.3 Weed species

Several weed species, including Weeds of National Significance, occur within the MBD Site Compound and Emplacement Cell Construction Site. A list of weeds recorded within the entire Project area, priority weeds of concern that pose potential biosecurity risk, and the applicable Biosecurity Act requirements is included in Appendix B and Appendix F.

6.2 Marine

The Port Kembla marine environment has been historically impacted by urban and industrial development and port activities. Discharges from these activities have led to contamination of marine sediments, groundwater, and harbour waters. The harbour comprises of two areas, the Inner Harbour and Outer Harbour (refer to Figure 2.1). Higher species diversity has been historically recorded in the Outer Harbour. The Inner Harbour supports less species diversity due to its highly utilised and developed environment (GHD 2018c).

6.2.1 Marine habitat

Marine habitat is primarily restricted to hard substrates and soft sediments. Hard substrate habitat consists of infrastructure such as piles, quay walls, and breakwater around the perimeter of the port. Such hard substrate is ideal habitat for biofouling communities. Sparse assemblages are present around the Inner Harbour, reflective of the highly disturbed environment. Species noted within these communities are polychaete worms, bryozoans, barnacles, and ascidians (Worley Parsons, 2012). Comparatively, a higher diversity and abundance of sessile invertebrates has been reported in the Outer Harbour (Worley Parsons, 2012). Introduced species account for 50 per cent of hard substrate assemblages within Port Kembla (GHD 2018c).

The seabed within the Inner Harbour has been described in previous surveys as consisting of fine, unconsolidated silt expanses with large decapod burrows (Worley Parsons, 2012). Seagrass has historically been recorded within the Inner Harbour benthos but has not been recorded in recent surveys. There are no known mapped seagrass communities within or adjacent to the proposed footprint of the Stage 2A and Stage 2B works. No seagrass has been recorded within the vicinity of the Emplacement Cell (Worley Parsons, 2012; GHD, 2018c).

Macroalgae has been previously recorded in sparse distributions across soft sediment habitat throughout the port. Recent surveys undertaken in 2018 did not identify any macroalgae within or adjacent to the footprint of the Stage 2A and Stage 2B works, other than those observed on the piles at the MBD Site Compound.

The different habitats present within the Inner and Outer Harbour have been found to support varying diversities in fish assemblages and compositions. The Outer Harbour supports a higher diversity of species compared the Inner Harbour. The eastern breakwater environments in the Outer Harbour provide habitat for fish species including mado, yellowtail and moon-wrasse, and red morwong observed in deeper soft sediment habitat. The Inner Harbour supports less species and those recorded as typical of inshore habitats, such as the glass perchlet and Japanese striped goby. Fish assemblages are common across the region and do not include any threatened species. The area also does not support key fish habitat (GHD 2018c).

6.2.2 Marine fauna

Marine fauna listed under the FM Act, BC Act, and/or the EPBC Act identified as potentially occurring in the vicinity of the Stage 2A and Stage 2B works are listed in Table 6.1 (GHD 2018c).

6.2.3 Introduced marine species

Previous surveys of pest species in Port Kembla have identified 40 introduced species and 21 cryptogenic species. (Pollard & Pethebridge, 2002; Johnston, 2006). A list of these species is included in Appendix C. None of the pest species that have been recorded within Port Kembla are listed on the National Priority List of Exotic Environmental Pests, Weeds and Diseases (ABARES, 2020).

Table 6.1 Potential for species listed under the FM Act, BC Act and/or EPBC Act to occur in vicinity of Stage 2A/Stage 2B works

Species	Status			Distribution and habitat	Likelihood of occurrence
	FM Act	BC Act	EPBC Act		
Grey nurse shark (<i>Carcharias taurus</i>)	Critically Endangered	N/A	Critically Endangered	Found primarily in warm temperate inshore waters around rocky reefs and islands, in or near deep sandy-bottomed gutters or caves. In southern NSW, the species can be found at reefs around Sydney, Bateman's Bay and Narooma (DoEE, 2018). A critical habitat site for the species is located at Bass Point, 10 km south of Port Kembla (NSW DPI, 2016a).	May occur Species may transit the area during migrations.
Black rockcod (<i>Epinephelus daemeli</i>)	Vulnerable	N/A	Vulnerable	Usually found in caves, gutters and beneath bommies on rocky reefs, from near shore to depths of at least 50 m (NSW DPI, 2015).	May occur Species may use habitat within port as shelter.
Southern right whale (<i>Eubalaena australis</i>)	N/A	Endangered	Endangered, Migratory Listed marine species Whales and Cetaceans	Oceanic waters between 20° S and 55° S however, moves close inshore (5-10 m depth) during winter for calving and mating (NSW OEH, 2018b).	Likely to occur Records of sightings for the Outer Harbour.
Long-nosed fur seal, New Zealand fur seal (<i>Arctocephalus forsteri</i>)	N/A	Vulnerable	Listed marine species	Occurs in Australian coastal waters and offshore islands of South and Western Australia as well as southern Tasmania (IUCN, 2018). Small populations also present along the southern NSW coast, particularly on Montague Island but also other isolated areas to north of Sydney (NSW OEH, 2018b).	Likely to occur Known haul-out site near Port Kembla.
Australian fur seal, Australo-african fur seal (<i>Arctocephalus pusillus</i>)	N/A	Vulnerable	Listed marine species	Preference for rocky parts of islands and foraging occurs in oceanic waters of the continental shelf. There are 10 established breeding colonies, all restricted to the Bass Strait with six occurring in Victoria and four in Tasmania. In NSW the species can be found at Montague Island (DoEE, 2018). Seals are semi regular (every 1-2 years) visitors to the Outer Harbour.	Likely to occur Known haul-out site near Port Kembla.
Humpback whale (<i>Megaptera novaeangliae</i>)	N/A	Vulnerable	Vulnerable, Migratory Listed marine species Whales and Cetaceans	Oceanic waters. Regularly observed in NSW waters in June and July during northward migration, and October and November during Southern migration (NSW OEH, 2018b). Humpback whale sighted in the Inner Harbour in August 2006 and September 2012.	Likely to occur Records of sightings within Outer Harbour.
Indian Ocean Bottlenose Dolphin,	N/A	N/A	Listed marine species	Occurs continuously around Australian mainland in estuarine and coastal waters (DoEE, 2018).	Likely to occur

Spotted Bottlenose Dolphin (<i>Tursiops aduncus</i>)			Whales and Cetaceans		Species known throughout NSW and habitat occurs in Port area.
Bottlenose dolphin (<i>Tursiops truncatus s. str.</i>)	N/A	N/A	Listed marine species Whales and Cetaceans	Occurs throughout Australian waters, usually found offshore in waters deeper than 30 m but may be found in coastal waters (DoEE, 2018).	Likely to occur Species known throughout NSW and habitat occurs in Port area.
Syngnathids 21 species (i.e., seahorses, seadragons, pipefish and pipehorses)	N/A	N/A	Listed marine species	In NSW, found in a variety of habitats ranging from deep reefs to coastal algae, weed or seagrass habitats, or around man-made structures such as jetties or mesh nets (NSW DPI, 2018).	May occur Habitat may be suitable for species.

7. Potential impacts

7.1 Terrestrial

Potential impacts to terrestrial flora and fauna species during Stage 2A and Stage 2B construction works are summarised in Section 7.1.1 through Section 7.1.3:

7.1.1 Flora communities

No impacts to native vegetation or TECs are anticipated during Stage 2A and Stage 2B works due to the MBD Site Compound and Emplacement Cell Construction Site being devoid of any native vegetation or known threatened flora species.

7.1.2 Terrestrial fauna

Potential direct and indirect impacts on terrestrial fauna during Stage 2A and Stage 2B are as follows:

- Direct mortalities and injuries to native fauna during construction or traffic movements.
- Loss of potential habitat/movement corridor for the Green and Golden Bell Frog.
- Temporary increased noise levels from construction equipment, leading to disturbance of fauna, especially during breeding seasons.
- Sedimentation, pollution, contaminated run off or erosion within the construction corridor and adjoining native vegetation and aquatic habitats, through soil disturbance and construction activities.

7.1.3 Introduction of weed species and pathogens

7.1.3.1 Weeds

There is a potential to introduce new weeds to the site from the transportation and movement of personnel, materials, machinery, and equipment. Similarly, there is also the potential to impact native vegetation in the vicinity of the site through the dispersal of weed propagules carried on vehicles moving to/from the site.

7.1.3.2 Pathogens

Construction activities have the potential to introduce or spread pathogens throughout the Project site through disturbance and increased visitation numbers. Pathogens that could be potentially introduced or spread include:

- Phytophthora (*Phytophthora cinnamomi*).
- Myrtle Rust (*Uredo rangelii*).
- Chytrid fungus (*Batrachochytrium dendrobatidis*).

Phytophthora and Myrtle Rust may result in the dieback or modification of native vegetation and damage to fauna habitats. Chytrid fungus affects both tadpoles and adult frogs and can lead to the extinction of local populations once introduced into an area (GHD, 2018b).

The potential for impacts associated with these pathogens is low, given the existing modified nature of the MBD Site Compound, high visitation rates to the site, limited intact native vegetation and habitats within the Stage 2A and Stage 2B works footprint.

7.2 Marine

Potential impacts to marine flora and fauna species during Stage 2A and Stage 2B construction works are summarised in Section 7.2.1 through Section 7.2.7.

7.2.1 Biofouling and benthic community disturbance

Disturbance to biofouling and benthic habitats may occur during the following Stage 2A and Stage 2B activities:

- Removal of the existing berth infrastructure (including removal of the piles and quay wall).
- Pile driving.
- Dredging of the seabed.
- Development of the perimeter bund.
- Placement of the dredged material within the disposal area.
- Placement / anchoring of construction vessels.

Potential direct and indirect impacts to biofouling and benthic communities during Stage 2A and Stage 2B are as follows:

- Removal of existing biofouling communities associated with removal of berth infrastructure at MBD Site Compound.
- Temporary biodiversity loss and likely avoidance of/displacement of the area by mobile fauna.
- Potential mortality of slow moving or semi-sedimentary mobile fauna located on piles at time of removal.
- Generation of turbid plumes and suspension of sediments during piling and dredging activities.
- Direct removal of substrate during dredging activities.
- Development of the perimeter bund and disposal of dredged materials into Emplacement Cell will result in smothering and burial of epibenthic fauna and permanent removal of approximately 16.5 hectares of benthic habitat in the Outer Harbour.

7.2.2 Artificial noise and vibration emissions

Disturbance to marine fauna from underwater noise and vibration may occur in response to noise and vibrations generated by the following Stage 2A and Stage 2B works:

- Pile removal and pile driving.
- Dredging activities.
- Vessel and plant movements.
- Placement of rock armouring for protection of the perimeter bund.

Underwater piling activity and dredging have the potential to generate noise / vibrations that could displace fauna from the area and cause a temporary or permanent threshold shift in the hearing ability of sensitive fauna that use acoustic means of navigation or communication. Responses from cetacean (whale and dolphins) and pinniped (seals) species to artificially generated noise / vibration may include:

- Changes in swimming direction.
- Increases in swimming speed.
- ‘Shocked’ reactions.
- Changes to diving, surfacing, and breathing behaviours.
- Avoidance of the sound source and immediate area.

7.2.3 Pest introduction and proliferation

There is a potential for the introduction and proliferation of marine pest species during Stage 2A and Stage 2B construction of the Project. Vessels carrying invasive marine pests may unintentionally introduce new species to the region where the activity is occurring or carry pests from the region to other areas. Invasive marine pests may be carried within the external biological fouling on the vessel hull, within seawater pipes (e.g., cooling water) and associated infrastructure, or on submersible marine instruments and equipment. Ballast water exchange may also allow for the transportation and proliferation of invasive marine pests within the area of activity.

Introduced species in Port Kembla have been observed to be higher than in other NSW ports (Pollard & Pethebridge, 2002; Johnston, 2006). Due to the pervasiveness of introduced species in Port Kembla, there is the risk of translocation of invasive species from Port Kembla to other ports in NSW/Australia.

7.2.4 Marine fauna collision/interaction

There is the potential for collisions to occur between marine fauna (e.g., cetaceans, sharks, and fish) and vessels/construction materials which could result in impacts from changes in behavioural patterns, injury, or death during dredging and construction of the Emplacement Cell during Stage 2A and Stage 2B.

7.2.5 Accidental release of solid wastes

A variety of hazardous and non-hazardous solid waste may be released unintentionally into the environment from overfull and/or uncovered bins or if blown off the deck of a vessel. Accidental spillage during transfers of waste from vessel to shore, and incorrectly disposed items may also cause the unintentional release of solid waste into the surrounding environment.

The pollution of the immediate environment with the release of hazardous solid waste has the likely consequence of negatively affecting the health of marine flora and fauna within the area. Particularly fish and cetaceans are susceptible to chemical impacts, including disease or physical injury after ingesting or absorbing the waste.

The ingestion of solid non-hazardous waste such as plastic bags can result in internal tissue damage, prevention of normal feeding behaviours, and potentially death of the affected fauna.

7.2.6 Accidental release of hydrocarbons, chemicals and other liquid waste

Vessels require a wide variety of liquids, chemicals, and hydrocarbon compounds to operate and to be maintained. Examples of hazardous liquids include diesel fuel, corrosion inhibitors, biocide, and miscellaneous chemicals such as cleaning agents and lubricating oils. In addition, other liquid wastes such as sewage will be generated during construction.

There are various scenarios that may result in the accidental release of liquid waste to the marine environment during Stage 2A and Stage 2B construction of the Project. These include:

- Tank failure.
- Pipework failure.
- Inadequate bunding.
- Spills during refuelling (e.g., fuel hose breaks, coupling failure, or tank overfilling).

The accidental release of liquid waste to the marine environment has the potential to result in localised reductions in water quality and contamination of the nearby marine receiving environment (impacting marine flora and fauna).

7.2.7 Damaged fuel tank associated with vessel or plant collision

There is a possibility that vessels or plant could collide during Stage 2A and Stage 2B construction of the Project. This collision may result in the rupture of a vessel's fuel tank and subsequent release of fuel/oil into the marine environment. All vessels used during construction will be double skinned and fuel tanks will be located within the hull structure and not directly exposed to the exterior of the vessel, which would minimise the severity of impact during a collision.

Marine fauna located within the vicinity of a potential spill event would be impacted depending on their species characteristics. Potential impacts on fauna species include:

- **Cetaceans:** may be affected by oil via pathway mechanisms, such as
 - Ingestion and accumulation.
 - Skin contact.
 - Interference with feeding.
 - Vapour inhalation.
- **Pinnipeds:** contact with surface oil may lead to long-term impacts, such as:
 - Inhibiting ability to swim and thermoregulate.
 - Eye irritation, congestion of lungs and airways from inhalations.

- Gastrointestinal ulcerations, damages to kidneys, liver and brain.
- **Fish:** open sea fish have been observed to identify and avoid surface oil slicks and are unlikely to experience as much exposure to surface oil spills. Impacts are largely related to eggs, larvae and juvenile fish which inhabit planktonic sea surface waters. Surface oil could potentially impact on the future growth and development of exposed larvae, eggs or juvenile fish.
- **Seabirds:** preening and feeding/diving actions on surface of water could lead to ingestion of oil and cause intestinal irritation. Seabirds may also experience plumage fouling when in direct contact with surface oils, potentially causing loss of buoyancy, inability to fly and waterproofing loss which can result in hypothermia.
- **Krill and baitfish:** prey species for larger marine species being impacted from surface oil spills could cause impacts to the food chain through reduced availability and may be detrimental to the behaviour and survival of bird species which feed on surface water biota.

An oil spill within the port due to vessel / plant collision and rupturing of a fuel tank may result in confined impacts upon a wide variety of organisms inhabiting the port environment within the biofouling and benthic communities. However, if an oil spill occurred outside the port, impacts could extend to sensitive receptors such as rocky habitat (Red Point headland, Tom Thumb Islands and Five Islands Nature Reserve) and sandy beaches (Wollongong City Beach, Fisherman's Beach or North Beach) around Port Kembla.

8. Environmental management

This section provides a description of the steps and procedures required to protect native terrestrial and marine flora and fauna species during Stage 2A and Stage 2B construction of the Project. The Stage 2A and Stage 2B Principal Contractor Environmental Representatives are ultimately responsible for providing environmental advice, assistance, and direction to the Stage 2A and Stage 2B Project Manager's to ensure construction activities are conducted in accordance with regulatory legislation and this FFMP, specifically the procedures outlined in Section 8.1 and Section 8.2.

8.1 Terrestrial

8.1.1 Green and Golden Bell Frog

The following management actions are to be implemented to minimise the risk to the Green and Golden Bell Frog and other native frog species that may be present within the MBD Site Compound:

- A trained ecologist must be present for construction activities that may impact upon frog habitat which includes dewatering / removal of detention basins.
- Establish temporary frog-proof fencing around the MBD Site Compound northern boundary. The purpose of these fences is to prevent frogs from entering the MBD Site Compound.
- Undertake pre-clearance surveys immediately prior to construction works being undertaken within identified movement corridor of Green and Golden Bell Frog– (refer to Figure 6.1).
- Trenches are to be covered at night to prevent fauna from falling in.
- An inspection is to be conducted each morning to check the trenches for frogs.
- Should Green and Golden Bell Frogs be encountered, process as per the measures in Section 8.1.3. Ensure Green and Golden Bell Frogs are handled by an experienced handler and in accordance with the Hygiene protocols for the control of disease in frogs (DECC, 2008) (refer to Appendix D). Release into known, nearby habitat for Green and Golden Bell Frog.
- Ensure all staff inductions include a relevant section on the Green and Golden Bell Frog. The induction should include:
 - What to do in the event of unexpected finds of frogs within the construction zone.
 - Hygiene protocols for the handling of Green and Golden Bell Frogs.
- Implement a stop work or unanticipated find procedure for when Green and Golden Bell Frogs are observed within the construction zone.

8.1.2 Other fauna

The following management actions are to be implemented to minimise the risk to other fauna species that may be present within the MBD Site Compound and Emplacement Cell Construction Site:

- Undertake pre-clearance surveys immediately prior to construction works being undertaken.
- Cover excavations for cable trenching at the end of the day to prevent ground-dwelling fauna species falling in overnight.
- Check excavations for cable trenching each morning prior to the start of construction works for the presence of any fauna that may have fallen in overnight.
- Should fauna be encountered, process as per the measures in Section 8.1.3.
- Establish procedure for injured wildlife.
- Ensure handling of fauna is only undertaken by Project Ecologist.

8.1.3 Fauna encountered on-site

Should an animal be observed in the vicinity of the construction works and where an animal may be at risk of injury from works or becomes stuck within the live work area, the following procedure are to be followed:

- Stop work and contact the Principal Contractor Environment Representative's and Project Ecologist.
- The Project Ecologist shall determine if the animal is at risk of being harmed:
 - If yes, all works in the vicinity of the animal should be halted (works may continue in other areas of the site). Project Ecologist is to conduct a "catch and release" to safely remove the animal from harm.
 - If the animal is not at risk of being harmed and can move on of its own accord, then works should be halted in the vicinity of the animal until it moves on (works may continue in other areas of the site). If the animal is not capable of moving on of its own accord, the Project Ecologist will determine the appropriate action required.

A Fauna Register will be maintained that records all fauna interactions including:

- Date.
- Species.
- Condition.
- Status.
- Location (found and relocated).
- Habitat found in.
- Habitat relocated to.
- Treatment required.
- Details regarding any animal death or injury due to any construction activity.
- Outcome/treatment.

A copy of the Fauna Register is included in Appendix J.

8.1.4 Weed and pathogen management

Weed and hygiene management will be undertaken in accordance with the *Hygiene guidelines protocols to protect priority biodiversity areas in NSW from Phytophthora cinnamomi, myrtle rust, amphibian chytrid fungus and invasive plants* (DP&E, 2020) (refer to Appendix E). The following mitigation measures are to be implemented to manage the potential impacts related to weed and pathogens at the MBD Site Compound and Emplacement Cell Construction Site:

- Develop a Weed Hygiene register to record the following protocols for weed hygiene:
 - Inspection and verification of cleanliness for all site plant and equipment prior to MBD Compound Site entry, including date of clean down/inspection prior to mobilisation.
 - Develop and maintain a register of vehicles, machinery and equipment that have been inspected and/or cleaned.
- Undertake treatment and/or removal and disposal prior to commencement of ground clearing activities.
- Manage identified priority weeds according to the requirements of the Biosecurity Act (refer to Appendix F).
- Stockpile any weed-infested material separately to vegetation and topsoil that is free of weeds.
- Apply herbicides used for weed control to the manufacturer's specifications and as outlined in the manufacturer's SDS.
- Provide vehicle wash down facilities should evidence of pathogens or fungus such as Phytophthora or Chytrid fungus be detected.
- Implement erosion and sediment control measures outlined in the Stage 2A and Stage 2B ESCP, included in the Stage 2A and Stage 2B SMP.

8.2 Marine

8.2.1 Biofouling and benthic community disturbance

The following management actions are to be implemented to minimise biofouling and benthic community disturbance:

- Works to remove the remaining berth infrastructure (i.e., current quay wall and piles) will commence after a visual inspection for protected mobile fauna (e.g., Syngnathids). If present, these will be relocated to adjacent habitats, outside the zone of influence by the proposed works, where feasible.
- Dredging will be carried out using mechanical backhoe dredge, split barges, and supporting tug vessels, as opposed to suction-style dredging, to minimise the potential mobilisation of sediments within the Inner Harbour.
- Disposal of the dredged material will be limited to within the perimeter of the Emplacement Cell.

8.2.2 Artificial noise and vibration emissions

The following management actions are to be implemented to minimise noise / vibration emissions:

- During underwater piling activities the following standard operational procedures will be implemented (DPTI, 2012).
 - *Pre-start procedure* – The presence of marine mammals should be visually monitored by a suitably trained crew member for at least 30 minutes before the commencement of the soft start procedure. Particular focus will be put on the shut-down zone but the observation zone will be inspected as well, for the full extent where visibility allows. Observations will be made from the piling rig or a better vantage point if possible.
 - *Soft start procedure* – If marine mammals have not been sighted within or are likely to enter the shut down zone during the pre-start procedure, the soft start procedure may commence in which the piling impact energy is gradually increased over a 10-minute period. The soft start procedure will also be used after long breaks of more than 30 minutes in piling activity. Visual observations of marine mammals within the safety zones will be maintained by trained crew throughout soft starts. The soft start procedure may alert marine mammals to the presence of the piling rig and enable animals to move away to distances where injury is unlikely.
 - *Normal operation procedure* – If marine mammals have not been sighted within or are not likely to enter the shut down or observation zone during the soft start procedure, piling may start at full impact energy. Trained crew will continuously undertake visual observations during piling activities and shut-down periods. After long breaks in piling activity, or when visual observations ceased or were hampered by poor visibility, the pre-start procedure will be used. Night-time or low visibility operations may proceed provided that no more than three shut-downs occurred during the preceding 24 hour period.
 - *Stand-by operations procedure* – If a marine mammal is sighted within the observation zone during the soft start or normal operation procedures, the operator of the piling rig will be placed on stand-by to shut-down the piling rig. An additional trained crew member will continuously monitor the marine mammal in sight.
 - *Shut-down procedure* – If a marine mammal is sighted within or about to enter the shutdown zone, the piling activity will be stopped immediately. If a shut-down procedure occurred and marine mammals have been observed to move outside the shut-down zone, or 30 minutes have lapsed since the last marine mammal sighting, then piling activities will recommence using the soft start procedure. If marine mammals are detected the shut-down zone during poor visibility, operations will stop until visibility improves.
- Vessel and heavy machinery will be maintained in accordance with the manufacturer specifications to reduce noise emissions.
- The interaction of all vessels with cetaceans and pinnipeds will be compliant with Part 8 of the EPBC Regulations. The Australian Guidelines for Whale and Dolphin Watching (DoEE, 2017) for sea-faring activities will be implemented during Stage 2A and Stage 2B works (refer to Appendix H). This includes the implementation of the following guidelines:

- Caution zone (300 metres either side of whales and 150 metres either side of dolphins) –vessels must operate at no wake speed in this zone.
- Caution zone must not be entered when calf (whale or dolphin) is present.
- No approach zone (100 metres either side of whales and 50 metres either side of dolphins) – vessels should not enter this zone and should not wait in front of the direction of travel or an animal or pod, or follow directly behind.
- If there is a need to stop, reduce speed gradually.
- Do not encourage bow riding.
- If animals are bow riding, do not change course or speed suddenly.

8.2.3 Pest introduction and proliferation

The following management actions are to be implemented to minimise the potential for marine pest introduction/proliferation:

- Prior to arriving to site, vessels will be inspected/assessed by a marine biologist.
- Vessels will be sourced locally to complete the construction works, where possible (NSW and QLD).
- International vessels will empty ballast water in accordance with the latest version of the Australian Ballast Water Management Requirements (DAWR, 2017) (Appendix I).
- If an invasive marine pest is identified or suspected, then the contractor is obliged to immediately (within 24 hours) notify the NSW DPI Aquatic Pest & Disease Reporting hotline on 1300 550 474 and/or (02) 4916 3877. Contractors and personnel who suspect the presence of a marine pests will use the Marine Pest Advisory Booklet for Boaters and Fishers Brochure (NSW DPI, no date) (Appendix K) to identify marine pests that must be reported.
- New biosecurity requirements may come into force during the life of the Project. If this occurs, these management controls will be reviewed to confirm adequacy.
- Project activities will comply with Federal and NSW requirements for invasive marine pest identification and management, including the National Strategic Plan for Marine Pest Biosecurity 2018–2023 (DAWE, 2018) (Appendix L).

Updated DAWE requirements for the management of biofouling from international vessels arriving in Australia will commence 15 June 2022. Vessels arriving in the Port Kembla harbour from this date will comply with the new requirements, which includes:

- Providing information on how biofouling has been managed prior to arrival in Australia’s territorial seas via the Department’s Maritime Arrivals Reporting Scheme (MARS).
- Compliance with one of the following biofouling management practices:
 - Implementation of an effective biofouling management plan; or
 - Cleaned all biofouling within 30 days prior to arriving in Australian territory; or
 - Implementation of an alternative biofouling management method pre-approved by the department.

8.2.4 Marine fauna collision/interaction

The following management actions are to be implemented to prevent/avoid the potential for collisions/interactions with marine fauna:

- Operations of vessels will be commensurate with Part 8 of the EPBC Regulations (Interacting with Cetaceans and Whale Watching).
- The Australian Guidelines for Whale and Dolphin Watching (DoEE, 2017) for sea-faring activities will be implemented during Stage 2A and Stage 2B construction of the Project (refer to Appendix H). This includes the implementation of the following guidelines:
 - Caution zone (300 metres either side of whales and 150 metres either side of dolphins) –vessels must operate at no wake speed in this zone.
 - Caution zone must not be entered when calf (whale or dolphin) is present.

- No approach zone (100 metres either side of whales and 50 metres either side of dolphins) – vessels should not enter this zone and should not wait in front of the direction of travel or an animal or pod, or follow directly behind.
- If there is a need to stop, reduce speed gradually.
- Do not encourage bow riding.
- If animals are bow riding, do not change course or speed suddenly.

In the event of collision or interaction with marine fauna, the procedures regarding incident management and emergency response will be implemented, as outlined in Section 11.

Additional information and management measures related to port navigation is included in the Stage 2A and Stage 2B CTMP.

8.2.5 Accidental release of solid waste

The following management actions are to be implemented to prevent/avoid the potential for an accidental release of solid waste:

- Appropriate waste containment facilities will be included on site and managed to avoid overflow or accidental release to the environment.
- No waste materials will be disposed of overboard of vessels. All non-biodegradable and hazardous wastes will be collected, stored, processed and disposed of in accordance with the vessel's Garbage Management Plan as required under Regulation 9 of MARPOL Annex V.
- Hazardous wastes will be separated, labelled, and retained in storage onboard within secondary containment (e.g., bin located in a bund).
- All recyclable and general wastes will be collected in labelled, covered bins (and compacted, where possible) for appropriate disposal at a regulated waste facility.
- Solid non-biodegradable and hazardous wastes will be collected and disposed of onshore at a suitable waste facility.
- Sewage discharge ports on vessels will be blanked off to prevent accidental discharge.

Additional information and management measures related to spills and waste is included in the Stage 2A and Stage 2B SMP. In the event of an accidental release of solid waste, procedures will be followed as per the Stage 2A and Stage 2B Emergency Spill Plan.

8.2.6 Accidental release of hydrocarbons, chemicals and other liquid waste

The following management actions are to be implemented to prevent/avoid the potential for an accidental release of hydrocarbons, chemicals, and other liquid wastes:

- All liquid waste will be stored for discharge to an appropriate onshore facility.
- Chemicals and hydrocarbons will be packaged, marked, labelled, and stowed in accordance with MARPOL Annex I, II and III regulations.
- Materials SDS will be available for chemicals and hydrocarbons in locations nearby to where the chemicals / wastes are stored.
- Vessel operators will have an up-to-date Shipboard Oil Pollution Emergency Plan (SOPEP) and Shipboard Marine Pollution Emergency Plan (SMPEP). All shipboard chemical and hydrocarbon spills will be managed in accordance with these plans by trained and competent crew.
- Any contaminated material collected will be contained for appropriate onshore disposal.
- Any equipment or machinery with the potential to leak oil will be enclosed in continuous bunding or will have drip trays in place, where appropriate.
- Following rainfall events, banded areas on open decks of the vessels or within construction laydown areas will be cleared of rainwater.
- All hoses for pumping and transfers will be maintained and checked, as per the Planned Maintenance System.

Additional information and management measures related to spills and waste is included in the Stage 2A and Stage 2B SMP.

In the event of an accidental release of hydrocarbons, chemicals, or other liquid waste, procedures will be followed as per the Stage 2A and Stage 2B Emergency Spill Plan.

8.2.7 Damaged fuel tank associated with vessel or plant collision

The following management actions are to be implemented to prevent/avoid vessel or plant collision (and the potential for release of fuel/oil to the marine environment):

- Visual observations will be maintained by watch keepers on all vessels and plant/moving machinery.
- Regular notification will be made to the following Australian Government agencies before and during operations:
 - The Australian Hydrographic Office of proposed activity, location and commencement date to enable a 'Notice to Mariners' to be issued.
 - In the event of a spill resulting in notification to Australian Maritime Safety Authority (AMSA), other sea users (e.g., fishing industry) will be informed of the incident via Marine Notices to prevent vessels entering an area where hydrocarbons have been released.
- Vessels will operate in compliance with all marine navigation and vessel safety requirements in the International Convention for the Safety of Life at Sea (SOLAS) and the *Navigation Act 2012 (Commonwealth)*. This includes the requirement for all equipment and procedures to comply with the following AMSA Marine Orders:
 - Marine Orders - Part 30: Prevention of Collisions.
 - Marine Orders - Part 21: Safety of Navigation and Emergency Procedures.
 - Marine Orders - Part 27: Radio Equipment: sets out ship requirements regarding radio installations, equipment, watch keeping arrangements, sources of energy, performance standards, maintenance requirements, personnel, and recordkeeping.
 - Marine Orders Parts 3 and 6 – Seagoing Qualifications and Marine Radio Qualifications: Ensures seafarer competency standards meet the needs of the Australian Shipping Industry.
- Vessels will be equipped with appropriate navigational systems which may include an automatic identification system (AIS) and an automatic radar plotting aid (ARPA) system capable of identifying, tracking, and projecting the closest approach for any vessel (time and location) within the operational area and radar range (up to approximately 70 kilometres).
- Marine diesel oil compliant with MARPOL Annex VI Regulation 14.2 (i.e., sulphur content of less than 3.50 per cent m/m) will be the only diesel engine fuel to be used by the vessels.
- Oil spill responses will be executed in accordance with the vessel's SOPEP, as required under MARPOL.
- Emergency spill response procedures will be developed and implemented, when required.

Additional information and management measures related to spills and waste is included in the Stage 2A and Stage 2B SMP and Emergency Spill Plan.

In the event of collision, the procedures regarding incident management and emergency response will be implemented, as outlined in Section 11.

9. Communication and complaints

Effective communication between the Project Director, Project team, contractors and external stakeholders will be undertaken throughout the Project to ensure effective implementation of this FFMP.

Project communication can be categorised into internal and external communications, as well as communications specifically dealing with complaints. The specific communication methods for each category are discussed below.

9.1 Internal communications

Communication on environmental issues related to flora and fauna management within the Project team will be maintained, as a minimum, through the following forums (organiser as noted):

- Weekly project construction team meetings (AIE Construction Manager or delegate).
- Periodic Environmental management team meetings with relevant contractors (AIE HSE Manager or Delegate).
- Toolbox talks and daily pre-start briefings (Principal Contractor Project Managers or delegate).
- Minutes of formal meetings will be taken and distributed to record issues raised and actions required, with action status established at subsequent meetings.
- Monthly review of the internal AIE Environmental Compliance Tracking register (AIE HSE Manager or delegate).

All internal meetings include appropriate documentation in the form of agenda and formal distribution via the Project's document system.

In addition to the above, the AIE Environment Team will also undertake informal planning sessions and resource review meetings to plan and forecast for upcoming key construction dates, critical issues and other relevant matters associated with environmental planning and approvals.

9.2 External communications

AIE is committed to keeping the local community and relevant agencies informed about the development of the Project. The principal external communication objectives are, therefore, to:

- Continue to maintain open communication with relevant stakeholders.
- Minimise environmental impacts.
- Be proactive in addressing any concerns that the community / external stakeholder may express.

AIE will build upon the stakeholder and community engagement phase undertaken during project development including multiple group or one on one briefings. A Project website (www.ausindenergy.com) has been developed and provides comprehensive, clear, and accessible information that is updated on a regular basis.

As well as the local Port Kembla and broader community of the Wollongong region, extensive engagement was also undertaken with a range of other interested key stakeholders, such as local commerce organisations, the PANSW and local and state government.

Consultation with key stakeholders and the wider community on the Project will continue throughout Stage 2A and Stage 2B and subsequent construction phases. These measures will ensure the stakeholders, including the wider community, remain informed of the Project's progress.

Key methods of engagement are provided in the Stage 2A and Stage 2B EMS.

9.3 Complaints management

All complaints where a third party has identified a construction activity as being unsatisfactory or unacceptable will be dealt with promptly and efficiently in accordance with the complaint and dispute response outlined in the Project's Stage 2A and Stage 2B EMS.

AIE will operate a free 24-hour Community Information Line (1800 789 177) where members of the community can leave details about an inquiry, they may have regarding construction activities related to flora and fauna. This message will be passed on to site personnel and/or the Stakeholder Engagement Team, as appropriate. The phone number is listed on the AIE website (<https://ausindenergy.com/contact-us/>) and will be provided on all community newsletters. The AIE HSE Manager has notified the Port Kembla Harbour Environment Group of the Community Information Line.

Initial responses to complaints will be provided within 24 hours of the complaint being received. As part of the response, a review of the activity will be undertaken. If required and possible, immediate changes will be made to reduce any impact on the community. In some cases, the issues cannot be resolved immediately, and ongoing actions might be required to resolve the issue.

All complaints related to flora and fauna will be recorded in a Complaints and Disputes Register. The following information will be recorded for each complaint:

1. The date and time of the complaint.
2. The method by which the complaint was made.
3. Any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect.
4. The nature of the complaint.
5. The action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant.
6. If no action was taken by the licensee, the reasons why no action was taken.

The Complaints and Disputes Register will be maintained by the Project's HSE Manager or delegate, and will detail what the issue was, initial response provided, how and when the issue was resolved, and by whom. Records will be kept for at least four years after the complaint was made and will be produced on request by any authorised officer of the EPA.

Where resolving a complaint with a third party is protracted or develops into a dispute, the AIE HSE Manager shall escalate proactively to Senior Project Leadership (e.g., AIE Project Manager and/or Project Director) to assist with resolution. AIE will work proactively with the complainant to resolve the dispute including having face to face meetings, site familiarisation sessions and agreeing on actions to resolve the dispute. All communications and agreed actions shall be documented.

For the management and reporting of corrective actions (which may be required in response to a complaint), refer to the Project's Stage 2A and Stage 2B EMS.

10. Inspections, monitoring and audits

Monitoring and auditing will be undertaken to determine the impact on the environment and identify opportunities for improvement. Monitoring to be implemented for specific actions or environmental issues (e.g., water quality monitoring, air quality monitoring) will be detailed in their relevant Sub - plan and will specifically address the monitoring requirements for those issues.

10.1 Environmental inspections

10.1.1 AIE and Principal Contractors joint environmental inspection

As a minimum, the AIE HSE Manager (or nominated delegate) will undertake periodic inspection of the work sites with the relevant Principal Contractor's environmental personnel (Environmental Representative or similar) to evaluate the effectiveness of environmental controls (inclusive of erosion and sediment control measures) and general compliance with the implementation of the FFMP for site-based activities.

If any maintenance and/or deficiencies in environmental controls or in the standard of environmental performance are observed, they will be recorded on the checklist form. Records will also include details of any maintenance required, the nature of the deficiency, any actions required and an implementation priority.

Actions raised during inspections will be documented on the *Environmental Site Checklist* and will be issued formally through the Project's document management system to the relevant Contractor for action. If they represent an actual or potential significant environmental risk, these issues shall be reviewed at the Project Planning meetings and will have non - compliances raised if not closed out in the nominated timeframe (Non - compliance Report).

10.1.2 Contractor environmental inspections

In addition to the joint periodic environmental site inspection with AIE, the Principal Contractors will be required to undertake daily site environmental inspections, targeting key environmental risks commensurate with the activity being undertaken. The environmental site inspection will be documented on a checklist, or similar, to be prepared and completed by the Principal Contractors.

Copies of the environmental site inspection records are to be provide to AIE on request.

The HSE Manager is responsible for the initial reporting of significant non-compliances with the FFMP or relevant legislation to the AIE Project Director and government authorities (refer to Section 11).

10.1.3 EPL inspection requirements

In accordance with Condition O4.4 of the EPL No 21529, the Contractor will undertake wet-weather inspections daily during periods of rainfall and within 24 hours of cessation of a rainfall event causing runoff to occur on or from the premises (based on site observation, this equates to 10 millimetres of rainfall in a 24-hour period).

Daily inspections of water pollution controls will be undertaken in accordance with Condition M.10.1 of the EPL No 21529 and recorded. Records will include the date and time of inspection, location of dredging operations and conditions of silt curtains and other water pollution controls. Records will be produced to an EPA authorised officer on request.

The Principal Contractors must record all such inspections including observations and works undertaken to repair and/or maintain erosion and sediment controls.

10.2 Monitoring

Monitoring will be undertaken to validate the impacts predicted for the work, to measure the effectiveness of management plans, environmental controls, and implementation of this FFMP, and to address approval requirements.

As part of the daily monitoring, the AIE Environmental Representative will conduct visual inspections for any Green and Golden Bell Frogs or other native frog species and other ground dwelling fauna in the potential movement corridor in the MBD Site Compound and Southern Pond detention basin (refer to Figure 6.1).

Monitoring of flora and fauna management and mitigation measures will be undertaken as required by the Project Manager, Site Supervisor, HSE Representative/ Project Ecologist prior to, during and following construction.

If any threatened fauna species are observed during the Stage 2A and Stage 2B works, the environmental representative will record the location and immediately contact the Project Ecologist and report the presence, location, and condition of the threatened species in question. Record is then to be made in the Fauna Register (refer to Appendix J).

10.3 Auditing

AIE will conduct a program of internal audits for the purpose of verifying compliance with the following:

- The EMS and this FFMP.
- Compliance with the requirements of relevant components outlined within the EMS and FFMP, including but not limited to, site inspection compliance, document control / management, non-compliance, and incident management etc.
- Monitoring and reporting requirements as set out under EPL No. 21529.

Additional details regarding the auditing process are detailed in the Project's Stage 2A and Stage 2B EMS.

10.4 Environmental reporting

10.4.1 DP&E reporting

Regular reports on compliance and other matters will be provided during the construction phase of the Project. This will include reporting to DP&E in accordance with Schedule 4, Conditions 7 and 8 of the Infrastructure Approval (SSI 9471), with specific reference to the *Compliance Reporting Post Approval Requirements* (DPIE, 2020).

In addition, DP&E will be notified in writing of the date of commencement of each of the relevant phases of the Project in accordance with Schedule 2, Condition 8 of the Infrastructure Approval (SSI 9471).

Reporting applicable to this FFMP will consist of:

- Fauna species encountered during Stage 2A and Stage 2B.
- Construction works progress and appraisal of fauna and weed controls.
- Environmental Incident Report(s), as required.

10.4.2 Other reporting requirements

A monthly environmental monitoring report will be developed for each calendar month which will include details of the monitoring results and frequencies and inclusion of any exceedance of EPL No. 21529 limits / criteria. A copy of the monthly environmental monitoring report will be made available on the AIE Project website.

Further reporting requirements are provided in Section 10.6 and Section 11.

10.5 Compliance tracking register

A Compliance Tracking Register has been developed as a monitoring tool to assist with the compliance reporting requirement as set out under Condition 7, Schedule 4 of the Infrastructure Approval (SSI 9471)

The compliance tracking register includes a breakdown of the requirements from the following key approval and Project documents:

- Infrastructure Approval (SSI 9471).
- EPL No. 21529.

- Requirements of this FFMP.
- *Compliance Reporting Post Approval Requirements* (DPIE, 2020), or its most recent edition.

The Compliance Tracking Register includes tabulation of reference conditions, the requirements, responsibility, status (i.e., ongoing, close-out, not triggered, etc.) and supporting evidence where required.

A routine review of the Compliance Tracking Register is undertaken by the AIE HSE Manager (or delegate) with input sought from the relevant contractors as required. The Compliance Tracking is a live document which is kept up to date for each stage of the construction works.

10.6 Non-compliance, corrective, and preventative actions

Non - compliances or potential non - compliances are situations or events that do not comply with the safeguards and procedures stipulated in the EMS or this FFMP.

Non - compliances or potential non-compliances may be identified in any of the following situations:

- As part of site inspections, supervision or monitoring of construction activities.
- During internal audits.
- Following justified / supported verbal or written third party complaints.

All non - compliances related to flora and fauna will be managed and reported using the non - compliance function of the Project's document management system. Each non - compliance event and follow-up action will be documented and traceable, including identification of key dates and responsible personnel.

Additional details regarding corrective and preventative actions are outlined in the Project's Stage 2A and Stage 2B EMS.

The Department must be notified in writing via the Department's Major Projects Website within seven days after the identification of any non - compliance issue. The notification must identify the development, including the application number, set out the condition of approval that the development is non - compliant with, the way in which it does not comply, the reasons for the non - compliance (if known) and what actions have been taken, or will be taken, to address the non - compliance.

11. Incident management and emergency response

11.1 Incident management

11.1.1 Overview

Incidents are defined as an occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance. The consequences of such incidents may result in material environmental harm, damage, or asset loss. 'Near misses' are extraordinary events that could have reasonably resulted in an incident.

All incidents related to flora and fauna, including those of the Principal Contractors, its subcontractors, and visitors that occur during the undertaking of the construction works for the Project will be managed to satisfy the requirements of AIE's Incident Reporting and Investigation System Requirements. Whilst it is noted that key Contractors will be implementing their own environmental management system procedures and processes, AIE will be responsible for ensuring that these systems and processes satisfy the requirements of the AIE EMS, including the incident management components. The Principal Contractors will be responsible for providing all necessary documentation with regards to the incident investigation and close-out actions where required. The timing of the provision of this documentation is to align with the AIE requirements.

The AIE HSE Manager must be notified immediately of any environmental incident or near miss related to flora and fauna. These may include, but are not limited to the following:

- Marine fauna collision/interaction.
- Vessel collision.
- Exceedance of monitoring criteria as required under the Project EPL (EPL No. 21529).
- Spill of any dangerous goods or hazardous substance to ground or water.
- Substantiated complaints received from members of the community or regulatory authorities.
- Regulatory breaches such as fines, prosecutions, improvement notices, breaches of licence conditions.
- All incidents of third-party property damage or loss.
- Incidents involving impact or potential damage to items or places of cultural heritage significance.
- Land-based off-site sediment loss to the environment, including sediment tracking onto the roadway.

The AIE HSE Manager will be responsible for regulatory notification of all notifiable environmental incidents (refer to Section 11.1.2 for notifiable incidents). All environmental incidents will be reported immediately to DP&E in writing via the Department's Major Projects Website after AIE becomes aware of the incident, as per Schedule 4 Condition 5 of the Infrastructure Approval (SSI 9471). The notification must identify the development, including the application number, and set out the location and nature of the incident.

In the event of a notifiable non-compliance incident arising, the Principal Contractors will notify the AIE HSE Manager immediately to allow the AIE HSE Manager to notify DP&E in writing via the Department's Major Projects Website within seven days of AIE becoming aware of the non-compliance, as per Schedule 4 Condition 6 of the Infrastructure Approval (SSI 9471). The notification must identify the development, including the application number, set out the condition of approval that the development is non-compliant with, the way in which it does not comply, the reasons for the non-compliance (if known) and what actions have been taken, or will be taken, to address the non-compliance.

11.1.2 Notifiable incident under the POEO Act

In the event of a Notifiable Incident as defined under the *Protection of the Environment Operations Act 1997* (POEO Act), AIE is responsible for immediately notifying the EPA, and any other relevant authority, of pollution

incidents on or around the site via the EPA Environment Line (telephone 131 555) in accordance with Part 5.7 of the POEO Act. The circumstances where this will take place include:

- *If the actual or potential harm to the health or safety of human beings or ecosystems is not trivial.*
- *If actual or potential loss or property damage (including clean-up costs) associated with an environmental incident exceeds \$10,000.*

Follow-up written notification to the EPA and any other relevant authorities will be required in accordance with the POEO Act and requirements of the EPA. This includes the provision of written details of the notification to the EPA within seven days of the date on which the incident occurred.

All notifiable incidents will also be managed, documented, and reported in accordance with the AIE *Incident Reporting and Investigation System Requirement*.

In addition, an authorised officer of the EPA has the right to request a written report (in accordance with Condition R3 of the EPL No. 21529) if they suspect on reasonable grounds that an event has occurred at the licensed premises which has caused, is causing or is likely to cause material harm to the environment (whether the harm occurs on or off premises to which the licence applies). The written report is to address all the requirements under Condition R3 of the EPL.

11.1.3 Notifiable incident under the Infrastructure Approval (SSI-9471)

In accordance with Condition 5 of Schedule 4, DP&E must be notified in writing to via the Department’s Major Projects Website immediately after AIE becomes aware of an incident on site.

Additional details regarding notifiable incidents and procedures are outlined in the Project’s Stage 2A and Stage 2B EMS.

11.2 Emergency response

Actual or potential emergency situations will vary in type and severity. The required level of response and notification will be at the discretion of the AIE Construction Manager in consultation with the AIE HSE Manager.

Any emergency situation may require only isolated containment and control or may require the complete evacuation of the site and notification of relevant emergency services. Consideration should be made of the response requirements for different situations. If at any time there is uncertainty on how to proceed, response should be for the worst possible scenario. Ultimately, the AIE Construction Manager or representative has authority and responsibility to instigate an evacuation if he/she feels it is warranted.

In the event of an emergency, the following plans listed in Table 11.1 shall be consulted and implemented, as relevant.

Table 11.1 Emergency plans

Plan	Reference	Application
Principal Contractor Local Emergency Response Plan	-	Principal Contractor’s emergency response plan implemented in the event of any incident occurring during a Project activity as per the Contractor’s policies and management framework.
AIE Port Kembla Gas Terminal Emergency Spill Plan	PKGT-AIE-PRO-039	Developed as a Sub - plan to the EMS to be implemented detailing: <ul style="list-style-type: none"> – Response plans in the event of land or water-based spill events. – Inspections, notification, and incident management requirements in accordance with the Infrastructure Approval (SSI 9471) and EPL No 21529 in relation to spills.
Pollution Incident Response Management Plan (PIRMP)	PKGT-AIE-PRO-007	Implemented immediately in the event of a pollution incident occurring during a Project activity. The PIRMP: <ul style="list-style-type: none"> – Outlines the actions to be taken during or immediately after a pollution incident.

Plan	Reference	Application
		<ul style="list-style-type: none"> – Lists details of relevant authorities to be notified, as required. – Outlines community and neighbour notification details, as required.
AIE Emergency Management Procedures	PKGT-AIE-PRO-014	<p>Implemented immediately in the event of any emergency incident occurring during the Project. Procedures include:</p> <ul style="list-style-type: none"> – Types of emergencies and the detailed steps to be taken in response. – Notification details to relevant authorities and AIE Project team. – Incident response to follow up from incident and preventative actions to be implemented, if applicable.

12. Document management and review

12.1 Record management

Records and registers specified in this FFMP for Stage 2A and Stage 2B shall be maintained. Records to be kept may include but will not be limited to the following:

- Environmental Inspection Checklist.
- Environment Reporting.
- Environmental Monitoring Reports / Records.
- Fauna and Weed Register.
- Internal Audit Reports.
- Incident Reports and Register.
- Toolbox Talk Records.
- Induction Presentation and Register.
- Environmental Activities Safe Work Method Statement (SWMS).
- Corrective Actions Register.
- Waste and Resource Register.
- Material Tracking Register.
- Training Register / Matrix.
- Complaints Register.

12.2 Review and revision of the FFMP

This FFMP will be reviewed and updated, as required under Condition 3 of Schedule 4 of Infrastructure Approval (SSI 9471) to ensure the objectives of the applicable approval conditions contained within are being met throughout Stage 2A and Stage 2B.

In addition, as required under Condition 4 of Schedule 4 of Infrastructure Approval (SSI 9471), the FFMP must be reviewed, and if necessary, revised within three months (unless otherwise agreed with DP&E) for any of the following:

- Following the submission of an incident report as per Condition 5, Schedule 4 4 of Infrastructure Approval (SSI 9471) (refer to Section 11).
- Following approval of any modification to the conditions of approval outlined in Infrastructure Approval (SSI 9471).
- At the direction of the Planning Secretary as per Condition 4, Schedule 2 4 of Infrastructure Approval (SSI 9471).

Where a review leads to revisions, then within 4 weeks of the review the revised document must be submitted to the Planning Secretary for approval, unless otherwise agreed with the Planning Secretary

12.3 Access to information

AIE will make the following information publicly available on the PKGT website, as per Schedule 4, Condition 12 of the Infrastructure Approval (SSI 9471) and the requirements as set-out under the Project EPL (No. 21529):

- The PKGT EIS.
- Current statutory approvals for the Project.
- Approved strategies, plans or programs required under the conditions of Infrastructure Approval (SSI 9471).

- A comprehensive summary of the monitoring results of the development, reported in accordance with the specification of any conditions, or any approved plans and programs relating to Infrastructure Approval (SSI 9471).
- A summary of complaints (updated monthly).
- Any independent environmental audit, and responses to the recommendations in any audit.
- The approved premises map (EPL No. 21259, Condition A2.4).
- PIRMP (EPL No. 21529, Condition E2).
- Any other matter required by the Planning Secretary.

This information will be kept up to date by AIE when required.

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References

DPIE 2020, *Compliance Reporting Post Approval Requirements*.

Environment Protection Licence No. 21529, dated 3 December 2021.

GHD 2018a, Port Kembla Gas Terminal Environmental Impact Statement.

GHD 2018b, Port Kembla Gas Terminal EIS Terrestrial Ecology Assessment.

GHD 2018c, Port Kembla Gas Terminal EIS Marine Ecology Impact Assessment.

Infrastructure Approval SSI 9471 dated 13 October 2021. Narla Environmental 2021, Green and Golden Bell Frog Targeted Survey Report – Port Kembla Gas Terminal.

NSW National Parks and Wildlife Service 2002, *Native Vegetation of the Illawarra Escarpment and Coastal Plain*. (Mapping updated by Wollongong City Council in 2014.)

SMEC March 2022, Port Kembla Gas Terminal Development – Emplacement Cell Report.

South East Local Land Services 2017, *South East Regional Strategic Weed Management Plan 2017 – 2022*.

Appendices

Appendix A

Biodiversity credits retirement certificate



Statement confirming payment into the Biodiversity Conservation Fund for an offset obligation

Pursuant to section 6.33 of the *Biodiversity Conservation Act 2016*, the NSW Biodiversity Conservation Trust confirms that the following payments have been made into the Biodiversity Conservation Fund under section 6.30(1) of the Act to satisfy an obligation to retire biodiversity credits.

Payment made by:	Australian Industrial Energy Pty Ltd				
Date received:	12 April 2021				
NSW statutory obligation reference ¹	SSI 9471				
Commonwealth EPBC Act controlled action reference (if applicable) ²	NA				
BCT Reference	BCF186				
Biodiversity credit retirement obligations satisfied by payment to the Biodiversity Conservation Fund:					
Biodiversity credit type (Credit ID and name)	Offset trading group	EPBC Act Controlled Action offset obligation (Y / N)	Number of credits	Cost per credit (Exc. GST)	Total payment per credit type (Exc. GST)
1326 - Woollybutt - White Stringybark - Forest Red Gum grassy woodland on coastal lowlands, southern Sydney Basin Bioregion and South East Corner Bioregion	Coastal Valley Grassy Woodlands greater than or equal to 90% cleared	N	3	\$17,568.69	\$52,706.08
10483 – Litoria aurea (Green and Golden Bell Frog)	Litoria aurea (Green and Golden Bell Frog)	N	1	\$7,449.44	\$ 7,449.44
10549 - Myotis macropus (Southern Myotis)	Myotis macropus (Southern Myotis)	N	2	\$974.69	\$ 1,949.37
Total (Exc. GST)					\$62,104.89
GST					\$ 6,210.49
Total (Inc. GST)					\$68,315.38

Emily McCosker

Director Strategy & Finance

¹This refers to either; a development application number for a development consent under Part 4 of the *Environmental Planning and Assessment Act 1979 (EP&A Act)*, a State significant infrastructure approval under the previous Part 5.1 (now Part 5, Division 5.2) of the EP&A Act, a decision of a determining authority to carry out or approve the carrying out of an activity under Part 5 of the EP&A Act, or a biobank statement number or biodiversity certification number.

² This refers to a controlled action under the Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* for which a biodiversity offset obligation has been met through payment into the BCF.

Appendix B

**Weed species recorded in vicinity of
Project**

Table B.1 Weeds recorded within vicinity of Project\ (GHD 2018b)

Common name	Scientific name	Status
Khaki Weed	<i>Alternanthera pungens</i>	
Bitou Bush	<i>Chrysanthemoides monilifera subsp. Rotundata</i>	State priority weed
Fountain grass	<i>Cenchrus setaceus</i>	
Moth vine	<i>Araujia sericifera</i>	Regional significance
Oleander	<i>Nerium oleander</i>	
Crofton weed	<i>Ageratina Adenophora</i>	Regional significance
Mistflower	<i>Ageratina riparia</i>	
Groundsel bush	<i>Baccharis halimifolia</i>	Regional priority weed
Spear thistle (also known as black thistle)	<i>Cirsium vulgare</i>	
Japanese honeysuckle	<i>Lonicera japonica</i>	
Morning glory - coastal (also known as mile-a-minute)	<i>Ipomoea cairica.</i>	Regional significance
Cockspur coral tree	<i>Erythrina crista-galli</i>	
African olive	<i>Olea europaea subsp. cuspidate</i>	
Tussock paspalum	<i>Paspalum quadrifarium</i>	
Fountain grass	<i>Cenchrus setaceus</i>	
Giant Parramatta grass	<i>Sporobolus fertilis</i>	Regional priority weed
Coolatai grass	<i>Hyparrhenia hirta</i>	Regional priority weed
Broad-leaf pepper tree (also known as Brazilian pepper tree)	<i>Schinus terebinthifolius.</i>	
Trad (also known as Wandering Jew) (<i>Tradescantia fluminensis</i>	
Castor oil plant (<i>Ricinus communis</i>).	<i>Ricinus communis</i>	
Chinese tallow tree (also known as Chinese Tallow, Chinese tallowood)	<i>Triadica sebifera</i>	
Honey locust (<i>Gleditsia triacanthos</i>).	<i>Gleditsia triacanthos</i>	Regional significance
Cassia (also known as senna, Easter cassia)	<i>Senna pendula var. glabrata</i>	
Camphor laurel	<i>Cinnamomum camphora</i>	
Cotoneaster (also known as large-leaf cotoneaster)	<i>Cotoneaster glaucophyllus</i>	
Ochna (also known as Mickey mouse plant)	<i>Ochna serrulate</i>	
Turkey rhubarb (also known as rambling dock)	<i>Rumex sagittatus</i>	Regional significance
Green cestrum (also known as green poison berry, Chilean cestrum)	<i>Cestrum parqui</i>	Regional significance
Madeira vine (also known as lamb's tails)	<i>Anredera cordifolia</i>	WoNS
Blackberry	<i>Rubus fruticosus species aggregate</i>	WoNS
Lantana	<i>Lantana camara</i>	WoNS

Common name	Scientific name	Status
Bridal creeper (also known as common bridal creeper)	<i>Asparagus asparagoides</i>	WoNS
Ground asparagus (also known as asparagus fern, basket fern, Sprenger's fern, bush asparagus, emerald asparagus, Sprenger's cultivar, Variegata cultivar)	<i>Asparagus aethiopicus</i>	WoNS
Fireweed	<i>Senecio madagascariensis</i>	WoNS

Appendix C

**Marine pest species recorded in vicinity of
Project**

Table C.1 Marine pest species recorded within vicinity of Project (GHD 2018c)

Scientific name	Category
<i>Alexandrium</i> sp. (catenella type)	Dinoflagellate
<i>Alexandrium ostenfeldii</i> / <i>peruvianum</i>	Dinoflagellate
<i>Halecium delicatulum</i>	Hydrozoan
<i>Boccardia chilensis</i>	Polychaete
<i>Boccardia proboscidea</i>	Polychaete
<i>Hydroides dirampha</i>	Polychaete
<i>Hydroidesezoensis</i>	Polychaete
<i>Megabalanus rosa</i>	Crustacean
<i>Cirolana harfordi</i>	Crustacean
<i>Paracerceis sculpta</i>	Crustacean
<i>Sphaeroma walkeri</i> ,	Crustacean
<i>Corophium acutum</i>	Crustacean
<i>Paradexamine pacifica</i>	Crustacean
<i>Liljeborgia c.f. dellavallei</i>	Crustacean
<i>Elasmopus rapax</i>	Crustacean
<i>Amathia</i> sp.	Bryozoa
<i>Bowerbankia</i> sp.	Bryozoa
<i>Bugula dentata</i>	Bryozoa
<i>Bugula flabellata</i>	Bryozoa
<i>Bugula neritina</i>	Bryozoa
<i>Bugula stolonifera</i>	Bryozoa
<i>Cryptosula pallasiana</i>	Bryozoa
<i>Schizoporella errata</i>	Bryozoa
<i>Schizoporella</i> sp. A	Bryozoa
<i>Schizoporella</i> sp. B	Bryozoa
<i>Schizoporella</i> sp. C	Bryozoa
<i>Schizoporella unicornis</i>	Bryozoa
<i>Tricellaria occidentalis</i>	Bryozoa
<i>Watersipora arcuata</i>	Bryozoa
<i>Watersipora subtorquata</i>	Bryozoa
<i>Botryllus schlosseri</i>	Ascidian
<i>Ciona intestinalis</i>	Ascidian
<i>Styela plicata</i>	Ascidian
<i>Acanthogobius flavimanus</i>	Fish
<i>Tridentiger trigonocephalus</i>	Fish
<i>Theora lubrica</i>	Bivalve
<i>Botrylloides leachii</i>	Colonial ascidian
<i>Perophora japonica</i>	Colonial ascidian
Seven additional unidentified cryptogenic species.	

Appendix D

Frog hygiene protocol

Threatened Species Management Information Circular No. 6



hygiene protocol for the
control of disease in

frogs

April 2008

Department of **Environment & Climate Change** NSW



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This hygiene protocol is an adaptation of the Declining Amphibian Population Task Force (DAPTF) Fieldwork Code of Practice and the recommendations of Speare et al. (1999) and has drawn on recommendations from earlier guidelines prepared by Environment ACT.

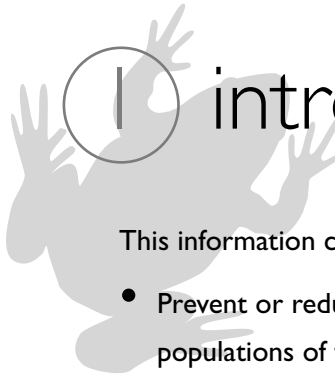
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hygiene protocol for the control of disease in

frogs

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I introduction

This information circular outlines measures to:

- Prevent or reduce disease causing pathogens being transferred within and between wild populations of frogs.
- Ensure captive frogs are not infected prior to release.
- Deal safely with unintentionally transported frogs.
- Assist with the proper identification and management of sick and dead frogs in the wild.

1.1 Who should read this document?

This protocol is intended for use by all researchers, wildlife consultants, fauna surveyors and students undertaking frog field-work. In addition, the protocol should be read by Department of Environment and Climate Change (DECC) personnel, frog keepers, wildlife rescue and carer organisations, herpetological/frog interest groups/societies, fauna park/zoo operators/workers and other individuals who regularly deal with or are likely to encounter frogs.

This protocol outlines the expectations of the DECC regarding precautionary procedures to be employed when working with frog populations. The intention is to promote implementation of hygiene procedures by all individuals working with frogs. New licences and licence renewals will be conditional upon incorporation of the protocol. The DECC recognises that some variation from the protocol may be appropriate for particular research and frog handling activities. Such variation proposals should accompany any licence application or renewal to the DECC.

1.2 Background

1.2.1 Amphibian Chytrid Fungus

The apparent decline of frogs, including extinctions of species and local populations, has attracted increased international and national concern. Many

potential causes for frog declines have been proposed (eg see Pechmann et al., 1991; Ferrero and Bergin, 1993; Pechmann and Wilbur, 1994; Pounds and Crump, 1994; Pounds et al., 1997). However, the patterns of decline at many locations suggest that epidemic disease maybe the cause (Richards et al., 1993; Laurance et al., 1996; Alford and Richards, 1997). Recent research has implicated a water-borne fungal pathogen *Batrachochytrium dendrobatidis* as the likely specific causative agent in many of these declines both in Australia and elsewhere (Berger et al., 1998; 1999). This agent is commonly known as the amphibian or frog chytrid fungus and is responsible for the disease Chytridiomycosis (Berger et al., 1999).

B. dendrobatidis is a form of fungus belonging to the phylum Chytridiomycota. Most species within this phylum occur as free-living saprophytic fungi in water and soil and have been found in almost every type of environment including deserts, arctic tundra and rainforest and are considered important primary biodegraders (Powell 1993). *B. dendrobatidis* is a unique parasitic form of Chytridiomycete fungi, in that it invades the skin of amphibians, including tadpoles, often causing sporadic deaths with up to 100% mortality in some populations. Chytridiomycosis has been detected in over 40 species of native amphibian in Australia (Mahony and Workman 2000). However, it is not currently known whether the fungus is endemic or exotic to Australia.

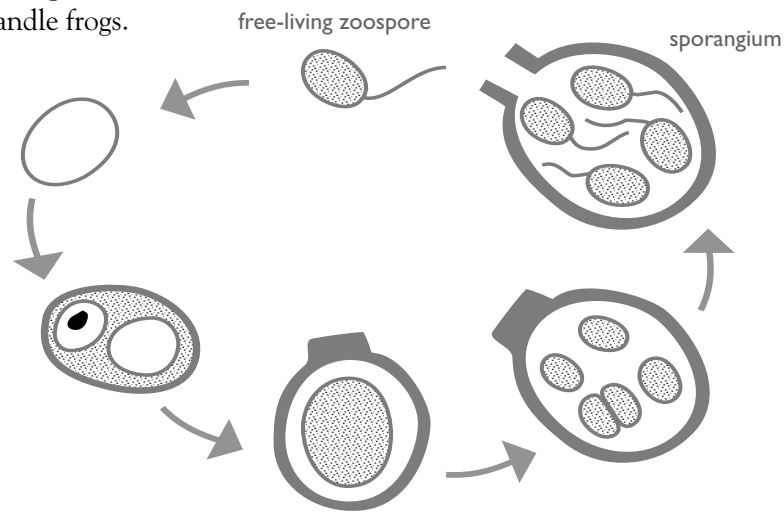
The infective stage of *B. dendrobatidis* is the zoospore and transmission requires water (Berger et al., 1999). Zoospores released from an infected amphibian can potentially infect other amphibians in the same water. More research is needed on the dynamics of infection in the wild. *B. dendrobatidis* is known to be susceptible to seasonal temperature changes, dehydration, salinity, water pH, light, nutrition and dissolved oxygen (Berger et al., 1999).

1.3 Objectives

The objectives of the hygiene protocol are to:

- Recommend best-practice procedures for DECC personnel, researchers, consultants and other frog enthusiasts or individuals who handle frogs.

- Suggest workable strategies for those regularly working in the field with frogs or conducting fieldwork activities in wetlands and other aquatic environments where there is the potential for spreading pathogens such as the frog chytrid fungus.
- Provide background information and guidance to people who provide advice or supervise frog related activities.
- Provide standard licence conditions for workers engaged in frog related activities.
- Inform Animal Care and Ethics Committees (ACEC) for their consideration when granting research approvals.



Life cycle of frog chytrid fungus from infective free-living zoospore stage to sporangium (adapted from L. Berger).



2 site hygiene management

A checklist of risk management procedures and recommended standard hygiene kit is provided in Appendix I. Please note Footnote I on page 4.

Individuals studying frogs often travel and collect samples of frogs from multiple sites. Some frog populations can be particularly sensitive to the introduction of infectious pathogens such as the frog chytrid fungus. Also, the arrangement of populations in the landscape may make frogs particularly vulnerable to transmission of infectious pathogens. Therefore, it is important that frog workers recognise the boundaries between sites and undertake measures which reduce the likelihood of spreading infection.

Where critically endangered species or populations of particular risk are known to occur, this protocol should be applied over very short distances ie a single site may need to be subdivided and treated as separate sites.

When planning to survey multiple sites, always start at a site where frog chytrid fungus is not known to be present before entering other infected areas.

2.1 Defining a site

Defining the boundary of a site maybe problematic. In some places, the boundary between sites will be obvious but in others, less so. Undertaking work at a number of sites or conducting routine monitoring at a series of sites within walking distance creates obvious difficulties with boundary definitions. It is likely that defining the boundary between sites will differ among localities. It may be that a natural or constructed feature forms a logical indicator of a site boundary eg a road/ track, a large body of water such as a river or the sea, a marked habitat change or a catchment boundary.

As a guiding principle, each individual waterbody should be considered a separate site.

When working along a river or stream or around a wetland or a series of interconnecting ponds it is reasonable, in most instances, to treat such examples as a single site for the purposes of this protocol. Such a case would occur in areas where frogs are known to have free interchange between ponds.

Where a stream consists of a series of distinctive tributaries or sub-catchments or where there is an obvious break or division then they should be treated as separate sites, particularly if there is no known interchange of frogs between sites.

2.2 On-site hygiene

When travelling from site to site it is recommended that the following hygiene precautions be undertaken to minimise the transfer of disease from footwear, equipment and/or vehicles.

Footwear

Footwear must be thoroughly cleaned and disinfected at the commencement of fieldwork and between each sampling site.

This can be achieved by initially scraping boots clear of mud and standing the soles in a disinfecting solution. The remainder of the boot should be rinsed or sprayed with a disinfecting solution that contains *benzalkonium chloride* as the active ingredient. Disinfecting solutions should be prevented from entering any water bodies.

Rubber boots such as 'gum boots' or 'Wellingtons' are recommended because of the ease with which they can be cleaned and disinfected.

Several changes of footwear bagged between sites might be a practical alternative to cleaning.

Equipment

Equipment such as nets, balances, callipers, bags, scalpels, headlamps, torches, wetsuits and waders etc that are used at one site must be cleaned and disinfected before re-use at another site.

Disposable items should be used where possible. Non-disposable equipment should be used only once during a particular field exercise and disinfected later or disinfected at the site between uses using procedures outlined in 2.4 below.

Vehicles

Where necessary, vehicle tyres should be sprayed/flushed with a disinfecting solution in high-risk areas.

Transmission of disease from vehicles is unlikely to be a problem. However, if a vehicle is used to traverse a known frog site, which could result in mud and water being transferred to other bodies of water or frog sites, then wheels and tyres should undergo cleaning and disinfection. This should be carried out at a safe distance from water bodies, so that the disinfecting solution can infiltrate soil rather than run-off into a nearby water body.

Spraying with 'toilet duck' (active ingredient *benzalkonium chloride*) is recommended to disinfect car wheels and tyres.

Cleaning of footwear before getting back into the car will prevent the transfer of pathogens from/to vehicle floor and control pedals.

2.3 Handling of frogs in the field

The spread of pathogenic organisms, such as the frog chytrid fungus, may occur as a result of handling frogs.

Frogs should only be handled when necessary.

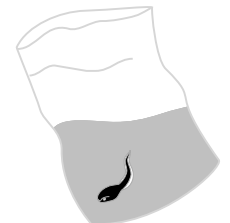
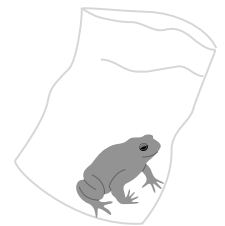
Where handling of frogs is necessary the risk of pathogen transfer should be minimised as follows:

- Hands should be either cleaned and disinfected between samples or a new pair of disposable gloves used for each sample¹. This may be achieved by commencing with a work area that has a dish containing a disinfecting solution and paper towels.
- A 'one bag – one frog' approach to frog handling should be used especially where several people are working together with one person processing frogs and others doing the collecting. Bags should not be reused.
- A 'one bag – one sample' approach to tadpole sampling should be used. Bags should not be reused.

Researchers who use toe clipping or Passive Integrated Transponder (PIT) tagging are likely to increase the risk of transmitting disease between frogs due to the possibility of directly introducing pathogens into the frogs' system. This can be minimised by using:

- Disposable sterile instruments
- Instruments disinfected previously and used once
- Instruments disinfected in between each frog

Disinfecting solutions containing *benzalkonium chloride* are readily available from local supermarkets. Some brands include Toilet Duck, Sanpic, New Clenz and Pine Clean.



¹ As a principle, this protocol assumes that not all frogs in an infected pond will be contaminated by the frog chytrid fungus. The infective load of a body of water may not be high enough to cause cross contamination of individual frogs in the same pond. Therefore care should be taken to use separate gloves and bags and clean hands for each sample, to avoid transmission of high infective loads between individuals.

Open wounds from toe clipping and PIT tagging should be sealed with a cyanoacrylate compound such as *Vetbond*® to reduce the likelihood of entry of pathogens. The DECC ACEC further recommends the application of topical anaesthetic *Xylocaine*® cream and *Betadine*® disinfectant (1% solution) before and after any surgical procedure. This should then be followed by the wound sealant.

All used disinfecting solutions, gloves and other disposable items should be stored in a sharps or other waste container and disposed or sterilised appropriately at the completion of fieldwork. Disinfecting solutions must not come into contact with frogs or be permitted to contaminate any water bodies

2.4 Disinfection Methods

Disinfecting agents for hands and equipment must be effective against bacteria and both the vegetative and spore stages of fungi. The following agents are recommended:

- Chloramine and Chlorhexidine based products such as *Halamid*®, *Halasept*® or *Hexifoam*® are effective against both bacteria and fungi. These products are suitable for use on hands, footwear, instruments and other equipment. The manufacturers instructions should be followed when preparing these solutions.
- Bleach and alcohol (ethanol or methanol), diluted to appropriate concentrations can be effective against bacteria and fungi. However, these substances may be less practical because of their corrosive and hazardous nature.

When using methanol either:

- immerse in 70% methanol for 30 minutes or
- dip in 100% methanol then flame for 10 seconds or boil in water for 10 minutes

Fresh bleach (5% concentration) may be also effective against other frog pathogens such as Rana Virus.

Some equipment not easily disinfected in these ways can be effectively cleaned using medical standard 70% isopropyl alcohol wipes – *Isowipes*®.



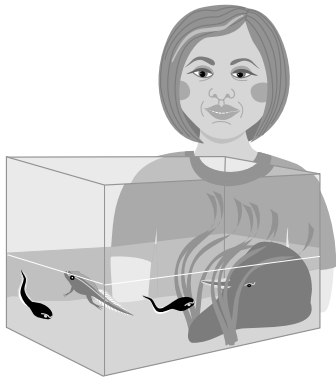
3 captive frog hygiene management

3.1 Housing frogs and tadpoles

Frogs and tadpoles should only be removed from a site when absolutely necessary.

When it is necessary for frogs or tadpoles to be collected and held for a period of time, the following measures should be undertaken:

- Animals obtained at different sites should be kept isolated from each other and from other captive animals.
- Aquaria set up to hold frogs should not share water, equipment or any filtration system. Splashes of water from adjacent enclosures or drops of water on nets may transfer pathogens between enclosures.
- Prior to housing frogs or tadpoles, ensure that tanks, aquaria and any associated equipment are disinfected.
- Tanks and equipment should be cleaned, disinfected and dried immediately after frogs/tadpoles are removed.

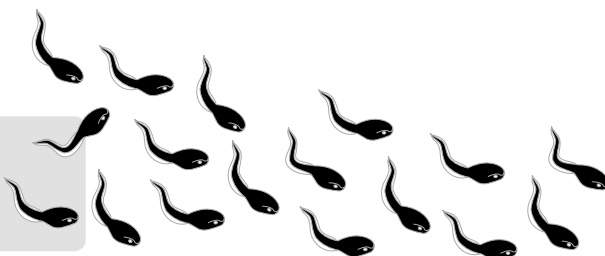


Careful maintenance of your enclosures will ensure a safe and hygienic environment for captive frogs and tadpoles.

3.2 Tadpole treatment

In most instances:

Release to the wild of tadpoles held or bred in captivity should be avoided.



When contemplating a release of captive bred tadpoles for conservation purposes a Translocation Proposal should be submitted to the DECC and pathological screening for disease should be undertaken (see also DECC Translocation Policy). Tadpoles can be tested by randomly removing 10 individuals at 6 weeks and again at 2 weeks before anticipated release. Testing could be undertaken by the pathology section at Taronga Zoo, Newcastle University, CSIRO Australian Animal Health Laboratories at Geelong and James Cook University at Townsville. Such an arrangement would need to be negotiated by contacting one of these institutions well before the anticipated release date. (see Appendix 2 for contact details)

DECC have licenced NSW Schools to allow students and/or teachers to remove tadpoles for classroom life cycle studies. They are authorised to remove individuals from only one location, each school also requires endorsement from Department of Education and Training Animal Care and Ethics Committee and comply with this protocol.

Tadpoles collected for these purposes are to be obtained from the local area of the school and are not to be obtained from DECC Reserves. As soon as tadpoles have transformed, froglets must be returned to the exact point of capture. Tadpoles from different locations are not to be mixed.

Antifungal cleansing treatments to clear tadpoles of the frog chytrid fungus are currently being trialed. In the future, such a treatment may be an added procedure required prior to froglet releases.

Detailed information on safely maintaining frogs in captivity is provided in Voigt (2001).

3.3 Frog treatment

The rigour with which frogs must be treated to ensure pathogens are not introduced to native populations means that any proposal for the removal of adult frogs (particularly threatened species) from wild populations should be given careful consideration.

When it is essential for frogs to be removed from the wild, the following should apply.

Individuals to be released should be quarantined for a period of 2 months and monitored for any signs of illness or disease.

Frogs must not be released if any evidence of illness or infection is detected. If illness is suspected, further advice must be sought from a designated frog recipient (Appendix 2) as soon as possible to determine the nature of the problem. Chytridiomycosis can be diagnosed in live frogs by microscopical examination of preserved toe clips or from shedding skin samples. Research is still in progress on the development of a simple technique for the detection of Chytridiomycosis and a treatment for infected frogs.

Current methods which may be used include:

- A technique for the treatment of potentially infected frogs is to place the frogs individually in a 1mg/L benzalkonium chloride solution for 1 hour on days 1, 3, 5, 9, 11 and 13 of the treatment period. Frogs are then isolated/quarantined for two months. This and other possible treatments are documented in Berger and Speare (1998)
- *Betadine*© and *Bactone*© treatments have also been used on adult frogs with some success (M. Mahony, Newcastle University pers. comm.)
- *Itraconazole*© is an expensive drug

which has been used successfully (Lee Berger CSIRO Australian Animal Health Laboratory pers. comm.). Information on this method is available on the Website <http://www.jcu.edu.au/school/PHTM/frogs/adms/attach6.pdf>.

Frogs undergoing treatment should be housed individually and kept separate from non-infected individuals.

3.4 Displaced frogs

Displaced frogs are those native frog species and introduced Cane Toads (*Bufo marinus*) which have been unintentionally transported around the country with fresh produce, transported produce and landscaping supplies. Procedures to be undertaken when encountering introduced/displaced native frog species (as well as Cane Toads) are as follows.

3.4.1 Banana box frogs

'Banana Box' frog is the term used to describe several native frog species (usually *Litoria gracilentata*, *L. infrafrenata*, *L. bicolor* and *L. caerulea*) commonly transported in fruit and vegetable shipments and landscaping supplies. In the past, well meaning individuals have attempted to return these frogs to their place of origin but this is usually impossible to do accurately. There is risk of spread of disease if these frogs are transferred from place to place.

It is strongly recommended that:

Displaced Banana Box frogs should be treated as if they are infected and should not be freighted anywhere for release to the wild unless specifically approved by DECC.

When encountering a displaced frog:

- Contact a licensed wildlife carer organisation to collect the animal. The frog should then undergo a quarantine period of 2 months along with an approved disinfection treatment.
- Post-quarantine, the frog (if one of the species identified above) may be transferred to a licensed frog keeper. All other species require the permission from DECC Wildlife Licensing and Management Unit (WLMU) prior to transfer. Licensed carer groups are to record and receipt frogs obtained and disposed of in this way.
- Licensed Frog Keepers are to list these frogs in their annual licence returns to DECC.

Frogs held by licensed frog keepers are not to be released to the wild except with specific DECC approval.

Displaced frogs may be made available to recognised institutions for research projects, display purposes or perhaps offered to the Australian Museum as scientific specimens once approval has been provided by the DECC WLMU.



Frogs are often unintentionally transported with fresh produce and landscaping supplies. They are collectively known as 'banana box' or displaced frogs.

3.4.2 Cane toads

Cane toads are known carriers of the Frog chytrid fungus and should not be knowingly transported or released to the wild.

If a cane toad is discovered outside of its normal range, it should be humanely euthanased in accordance with the recommended NSW Animal Welfare Advisory Council procedure (see Appendix 3). Care should be taken to avoid euthanasia of native species due to mistaken identity.

3.4.3 Local frog species

Frogs encountered on roads, around dwellings and gardens or in swimming pools should not be considered as displaced frogs.

Frogs encountered in these situations should be assisted off roads, away from dwellings, or out of swimming pools preferably to the nearest area of vegetation or suitable habitat.

Incidences of frogs spawning or tadpoles appearing in swimming pools should be referred to a wildlife carer/rescue organisation for assistance (see Appendix 4).

Contact the Frogwatch Helpline if you are unsure whether a frog is a local species or displaced.

An NPWS information brochure titled 'Cane Toads in NSW' provides further information on cane toads and assistance with identification of some of the commonly misidentified native species. This information is also available on the DECC website.

4 sick or dead frogs

Unless an obvious cause of illness or death is evident (eg predation or road mortality): Sick or dead frogs encountered in the wild should be collected and disposed of in accordance with the procedures described in section 4.2 below.

4.1 Symptoms of sick and dying frogs

Sick and dying frogs exhibit a range of symptoms characteristic of chytrid infection. Symptoms may be expressed in the external appearance or behaviour of the animal. A summary of these symptoms are described below. More detailed information can be found in Berger et al., (1999) or at the James Cook University Amphibian Disease website at: <http://www/jcu.edu.au/school/phtm/PHTM/frogs/ampdis.htm>.



Appearance (one or more symptoms)

- darker or blotchy upper (dorsal) surface
- reddish/pink-tinged lower (ventral) surface and/or legs and/or webbing or toes
- swollen hind limbs
- very thin or emaciated
- skin lesions (sores, lumps)
- infected eyes
- obvious asymmetric appearance

Behaviour (one or more symptoms)

- lethargic limb movements, especially hind limbs
- abnormal behaviour (eg a nocturnal, burrowing or arboreal frog sitting in the open during the day and making no vigorous attempt to escape when approached)
- little or no movement when touched

Great barred frog (*Mixophyes fasciolatus*) with severe Chytrid infection — note lethargic attitude and sloughing skin. Photo: L. Berger

Diagnostic behaviour tests

Sick frogs will fail one or more of the following tests:

test	healthy	sick
Gently touch with finger	Frog will blink	Frog will not blink above the eye
Turn frog on its back	Frog will flip back over	Frog will remain on its back
Hold frog gently by its mouth	Frog will use its forelimbs to try to remove grip	No response from frog

4.2 What to do with sick or dead frogs

A procedure for the preparation and transport of a sick or dead frog is given below². Adherence to this procedure will ensure the animal is maintained in a suitable condition for pathological examination and assist the DECC and researchers to determine the extent of the disease and the number of species affected.


- Disposable gloves should be worn when handling sick or dead frogs. Avoid handling food and touching your mouth or eyes as this could transfer pathogens and toxic skin secretions from some frog species.
- New gloves and a clean plastic bag should be used for each frog specimen to prevent cross-contamination. When gloves are unavailable, use an implement to transfer the frog to a container rather than using bare hands.
- If the frog is dead, keep the specimen cool and preserve as soon as possible (as frogs decompose quickly after death making examination difficult). Specimens can be fixed/preserved in 70% ethanol or 10% buffered formalin.

Cut open the belly and place the frog in about 10 times its own volume of preservative. Alternatively, specimens can be frozen (although this makes tissues unsuitable for some tests). If numerous frogs are collected, some should be preserved and some should be frozen. Portions of a dead frog can be sent for analysis eg a preserved foot, leg or a portion of abdominal skin.

- The container should be labelled showing at least the species, date and location. A standardised collection form is provided in Appendix 5.
- If the frog is alive but unlikely to survive transportation (death appears imminent), euthanase the frog (see Appendix 3) and place the specimen in a freezer. Once frozen, the specimen is ready for shipment to the address provided below.
- If the frog is alive and likely to survive transportation, place the frog into either a moistened cloth bag with some damp leaf litter or into a plastic bag with damp leaf litter and partially inflated before sealing. Remember to keep all frogs separated during transportation.
- Preserved samples can be sent in jars or wrapped in wet cloth, sealed in bags and placed inside a padded box.
- Send frozen samples in an esky with dry ice (available from BOC/CIG Gas outlets).
- Place live or frozen specimens into a small styrafoam esky (available from K-Mart/Big W for approximately \$2.50).
- Seal esky with packaging tape and address to one of the laboratories listed in Appendix 4.
- Send the package by courier.

Further information on sick and dying frogs is available on the Amphibian Disease Home Page at <http://www.jcu.edu.au/dept/PHTM/frogs/ampidis.htm> — in particular refer to 'What to do with dead or ill frogs'.

²The measures described below are standard procedures and may vary slightly depending on the distance and time required to reach the intended recipient. Contact the intended recipient of the sick or dead frog prior to sending to confirm the appropriate procedure.



5 references

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appendix I

hygiene protocol checklist and field kit

The following checklist and field kit are designed to assist with minimising the risk of transferring pathogens between frogs.

Have you considered the following questions before handling frogs in the field:

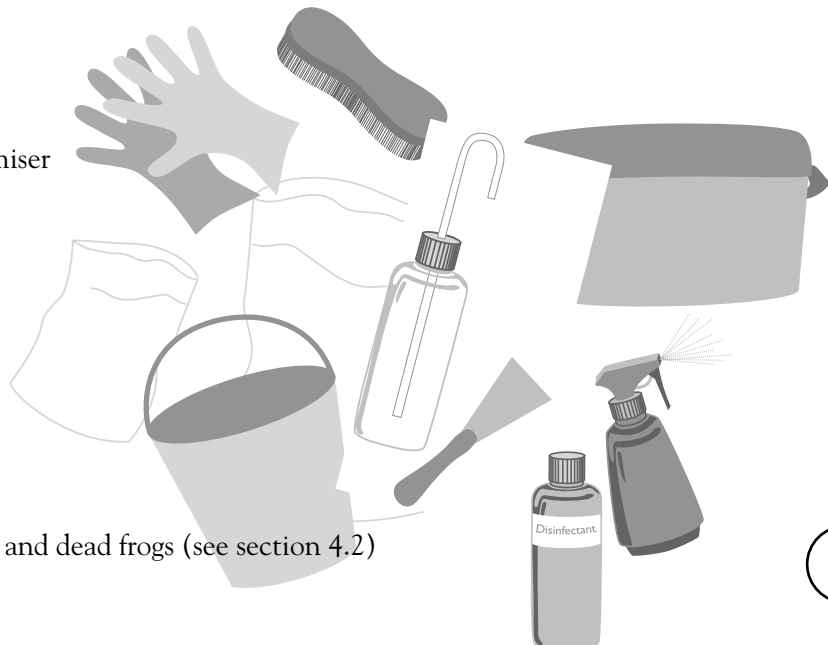
- Has your proposed field trip been sufficiently well planned to consider hygiene issues?
- Have you taken into account boundaries between sites (particularly where endangered species or populations at risk are known to occur)?
- Have footwear disinfection procedures been considered and a strategy adopted?
- Have you planned the equipment you will be using and developed a disinfection strategy?
- Are you are planning to visit sites where vehicle disinfection will be needed (consider both vehicle wheels/tyres and control pedals) and if so, do you have a plan to deal with vehicle disinfection?
- Have handling procedures been planned to minimise the risk of frog to frog pathogen transmission?
- Do you have a planned disinfection procedure to deal with equipment, apparel and direct contact with frogs?

If you answered NO to any of these questions please re-read the relevant section of the DECC Hygiene Protocol for the Control of Disease in Frogs and apply a suitable strategy.

Field hygiene kit

When planning to survey frogs in the field a portable field hygiene kit should be assembled to assist with implementing this protocol. Recommended contents of a field hygiene kit would include:

- Small styrofoam eski
- Disposable gloves
- Disinfectant spray bottle (atomiser spray) and/or wash bottle
- Disinfecting solutions
- Wash bottle
- Scraper or scrubbing brush
- Small bucket
- Plastic bags large and small
- Container for waste disposal
- Materials for dealing with sick and dead frogs (see section 4.2)



appendix 2

Always contact the relevant specialist prior to sending a sick or dead frog. In some cases, only wild frogs will be assessed for disease. Analysis may also attract a small fee per sample.

designated sick and dead frog recipients

Contact one of the following specialists to arrange receipt and analyse sick and dead frogs. Make contact prior to dispatching package:

Karrie Rose
Australian Registry of Wildlife Health
Taronga Conservation Society, Australia
PO Box 20
MOSMAN NSW 2088
Phone: 02 9978 4749
Fax: 02 9978 4516
Krose@zoo.nsw.gov.au

Diana Mendez or
Rick Speare
School of Public Health,
Tropical Medicine and
Rehabilitation Sciences
James Cook University
Douglas Campus
TOWNSVILLE QLD 4811

Phone: 07 4796 1735
Fax: 07 4796 1767
Diana.Mendez@jcu.edu.au
Richard.Speare@jcu.edu.au

Michael Mahony
School of Biological Sciences
University of Newcastle
CALLAGHAN NSW 2308

Phone: 02 4921 6014
Fax: 02 4921 6923
bimjm@cc.newcastle.edu.au

For information on frog keeping licences and approvals to move some species of displaced frog contact:

Co-ordinator, Wildlife Licensing
Wildlife Licensing and Management Unit
DECC
PO Box 1967
Hurstville NSW 1481
Ph 02 9585 6481
Fax 02 9585 6401
wildlife.licensing@environment.nsw.gov.au

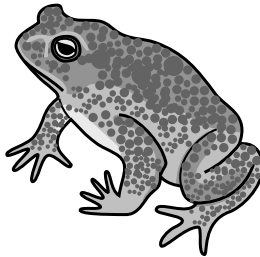
For information on the possible identity of displaced frogs contact:

Frog and Tadpole Society (FATS)
Frogwatch Helpline
Ph: 0419 249 728

appendix 3

NSW Animal Welfare Advisory Council methodology

The NSW Animal Welfare Advisory Council procedure for humanely euthanasing cane toads or terminally ill frogs is stated as follows:



- Using gloves, or some other implement, place cane toad or terminally ill frog into a plastic bag.
- Cool in the refrigerator to 4°C.
- Crush cranium with a swift blow using a blunt instrument.

Note: Before killing any frog presumed to be a cane toad, ensure that it has been correctly identified and if outside the normal range for cane toads in NSW (north coast) that local DECC regional office is informed.

appendix 4

licensed wildlife carer and rescue organisations

Following is a list of wildlife rehabilitation groups licensed by
Department of Environment and Climate Change (NSW):

Northern NSW

Australian Seabird Rescue
For Australian Wildlife Needing Aid
(FAWNA)
Friends of the Koala
Friends of Waterways (Gunnedah)
Great Lakes Wildlife Rescue
Koala Preservation Society of NSW
Northern Rivers Wildlife Carers
Northern Tablelands Wildlife Carers
Tweed Valley Wildlife Carers
Seaworld Australia
WIRES branches in Northern NSW

Southern NSW

Looking After Our Kosciuszko Orphans
(LAOKO)
Native Animal Network Association
Native Animal Rescue Group
Wildcare Queanbeyan
WIRES branches in Southern NSW

Sydney, Hunter and Illawarra

Hunter Koala Preservation Society

Ku-ring-gai Bat Colony Committee
Kangaroo Protection Co-operative
Native Animal Trust Fund
Organisation for the Rescue and Research of
Cetaceans (ORRCA)
Sydney Metropolitan Wildlife Services
Wildlife Aid
Wildlife Animal Rescue and Care (Wildlife
ARC)
Waterfall Springs Wildlife Park
Oceanworld
Wildlife Care Centre, John Moroney
Correctional Centre
Koalas in Care
WIRES branches around Sydney, Hunter and
Illawarra

Western NSW

Rescue and Rehabilitation of Australian
Native Animals (RRANA)
RSPCA Australian Capital Territory Inc.
Wildlife Carers Network (Central West)
WIRES branches in Western NSW
Cudgegong Wildlife Carers

appendix 5 — sick or dead frog collection form

Sender details:

name: _____ address: _____ postcode: _____
 phone: (w) _____ (h) _____ fax: _____ email: _____

Collector details: (where different to sender)

name: _____ address: _____ postcode: _____
 phone: (w) _____ (h) _____ fax: _____ email: _____

Specimen details:

record no: _____ no. of specimens: _____ species name: _____ date collected: _____
day/month/year

time collected: _____ sex: _____ status at time of collection: _____ date sent: _____
male/female healthy(H)/ sick(S)/ dead(D) day/month/year

location: _____ map grid reference: _____
(easting) (northing)

reason for collection: _____

Batch details for multiple species collection:

species	no.	locality	(AMG)	date	sex	status (H/S/D)

habitat type: _____ vegetation type: _____ micro habitat: _____
eg creek, swamp, forest eg rainforest, sedgeland eg creek bank, under log, amongst emergent vegetation, on ground in the open

unusual behaviour of sick frogs: _____
eg lethargic, convulsions, sitting in the open during the day, showing little or no movement when touched.

dead frogs appearance: _____
eg thin, reddening of skin on belly and/or toes, red spots, sore, lumps or discolouration on skin

deformed frogs: _____ dead/sick tadpoles: _____
eg limb(s) missing, abnormal shape or length eg numbers/behaviour

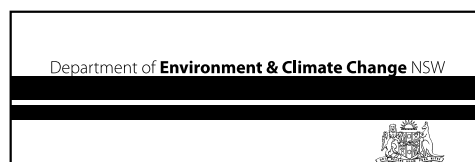
unusual appearance of egg masses: _____ recent use of agricultural chemicals in area: _____
eg grey or white eggs eg pesticides, herbicides, fertilisers

other potential causes of sickness/mortality/comments/additional information: _____



**NSW
NATIONAL
PARKS AND
WILDLIFE
SERVICE**

General inquiries: PO Box A290 South Sydney 1232
Phone: 9995 5000 or 1300 361967
Fax: 02 9995 5999 **Web site:** www.environment.nsw.gov.au



Appendix E

Pathogen hygiene protocol



SAVING OUR SPECIES

Hygiene guidelines

Protocols to protect priority biodiversity areas in NSW from *Phytophthora cinnamomi*, myrtle rust, amphibian chytrid fungus and invasive plants



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Foreword

This document sets out guidelines to reduce the risks of introducing pathogens (*Phytophthora cinnamomi*, myrtle rust and chytrid fungus) and invasive plants into new areas of New South Wales, especially those with susceptible threatened species, threatened ecological communities and areas of outstanding biodiversity value. The procedures in this document can also be applied to protect non-threatened species.

These guidelines promote the adoption of basic hygiene procedures into daily routines when working in the field. They are simple procedures to ensure potentially-contaminated material is not transferred to a new, susceptible area.

Under select circumstances, more strict hygiene procedures are recommended. These circumstances include when a general biosecurity eradication or containment effort is underway or when undertaking activities that could expose susceptible threatened species, threatened ecological communities or areas of outstanding biodiversity value to a new threat. Strict hygiene procedures are similar to the basic measures but include more thorough cleaning or disinfection.

These protocols and their application should be reviewed five years from the date of publication or if significant new information becomes available.

This document was developed as part of the NSW Government's *Saving our Species* program.

Who should use this guide?

This guide should be used by NSW Department of Planning, Industry and Environment (DPIE) employees, and contractors and volunteers undertaking works on behalf of DPIE, on public or private land.

This guide may also be used by private individuals or businesses working in conservation and revegetation, agriculture, construction, forestry, other primary industries or fields involving work in the agricultural or natural environments.

How to use this guide

Follow the steps below to determine which hygiene measures you should incorporate into your work plan. Clicking on an underlined word or phrase will take you to the relevant section of this document.

1. Read the section on planning considerations. This section provides information on what is likely to influence the risks a certain activity poses, but will not affect the level of hygiene recommended.
2. Read the section on determining your hygiene requirements, and review Appendix B and Appendix C to identify whether any species you are working with or near are susceptible to *Phytophthora cinnamomi* or myrtle rust infection. For *Phytophthora cinnamomi* and myrtle rust, use Decision tree 1 for Phytophthora and myrtle rust to determine which protocols are suitable for your work. If you are working on an island, use Decision tree 2 for visiting or working on islands. For invasive plants and amphibian chytrid fungus (*Batrachochytrium dendrobatidis*), there are set protocols that should be applied in all circumstances.
3. Incorporate the relevant procedure(s) into your work activities.

Useful tools in this document

A list of species known to be susceptible to *Phytophthora cinnamomi* infection can be found at [Appendix B](#).

A list of species known to be susceptible to myrtle rust infection can be found at [Appendix C](#).

Lists of significant invasive non-native plants can be found at [Appendix A](#) and [Appendix D](#).

Additional advice for working with and handling amphibians can be found at [Appendix E](#).

A template for a hygiene management plan can be found at [Appendix F](#).

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Introduction

Purpose

This document provides guidance for people undertaking activities that have the potential to spread or introduce specific pathogens or invasive plant propagules in the natural environment of New South Wales. The protocols outlined in this document are recommended to ensure the risks of spreading pathogens and invasive plants are effectively managed to protect biodiversity in New South Wales.

Objective

The objective of these guidelines is to outline hygiene practices that can help avoid or minimise introduction of pathogens or invasive plants to areas in New South Wales with threatened species and threatened ecological communities. The guidelines were developed to address the following key threatening processes (KTPs) listed under the *Biodiversity Conservation Act 2016* (BC Act):

- infection of native plants by *Phytophthora cinnamomi*
- introduction and establishment of exotic rust fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae (myrtle rust)
- infection of frogs by amphibian chytrid causing the disease chytridiomycosis (chytrid fungus).

These guidelines can also be applied to invasive plant-related KTPs (see [Invasive plants](#)) and invasive plants identified in National Parks and Wildlife Service [branch pest management strategies](#). They may also have relevance to other disease and pest (including invertebrate and microbial pest) organisms, particularly those borne in soil or water, although these may require additional case-specific protocols (see Biosecurity Hotline contacts below).

The protocols in this document are also relevant to a number of KTPs listed under the Commonwealth [Environment Protection and Biodiversity Conservation Act 1999](#). Use of these guidelines may also reduce the risk from a number of pathogens and diseases yet to arrive in Australia, but assessed as being likely to do so and of high environmental risk (see [Priority list of exotic environmental pests and diseases](#), last reviewed 4 February 2020).

For more general information on managing disease risks in wildlife, including hygiene recommendations, see the [National Wildlife Biosecurity Guidelines \(PDF 2.3MB\)](#) (Wildlife Health Australia 2018).

Scope and application

In New South Wales, the most practical, outcomes-based approach to hygiene is to focus on protecting areas that are: (1) not infested, (2) habitat for threatened species and threatened ecological communities, and (3) not subject to high visitation by people. The protocols in this document can help to achieve this for *Phytophthora cinnamomi*, myrtle rust, chytrid fungus and invasive plants. They may also be useful in reducing risks associated with other pathogens. In the latter case, further information about the risks of transmission will help determine when and where the protocols should be applied.

Some sites or projects may require a specific hygiene management plan. If a hygiene management plan has been developed for your site or project, that plan should take precedence. This document is a guide and should not replace the development of specific hygiene management plans for areas, sites and projects. A template for a hygiene management plan can be found at [Appendix F](#). The template can be used to record the specific hygiene actions for your work.

Hygiene measures should be applied by people working in areas of high biodiversity importance across New South Wales, where appropriate (see [Determining your hygiene requirements](#)). People working with Bellinger River snapping turtles (*Myuchelys georgesii*) in the Bellinger River may need to take extra hygiene precautions due to the presence of Bellinger River virus. Those people should first contact the NSW Department of Primary Industries Aquatic Biosecurity Hotline on 02 4916 3877 or 131 555 or by [email](#) to confirm what hygiene precautions they should take.

This document does not:

- address biosecurity risks associated with handling animal biological samples, carcasses and waste (see the National Wildlife Biosecurity Guidelines (Wildlife Health Australia 2018) for general information on managing those risks)
- address the risks that native and pest animals play in transferring pathogens and invasive plants between locations, but acknowledges that control of pest animals may be important in reducing the spread of pathogens and invasive plants in some landscapes
- provide species-specific guidance for invasive plants
- replace the benefit or need for developing tailored landscape-, project- or site-specific hygiene management strategies for pathogens and invasive plants.

Pathogens

Pathogens are organisms that can cause disease, and they have the potential to cause significant declines in species and disrupt ecological communities. Preventing entry of pathogens is always the most cost-effective management strategy; however, when pathogens are detected, eradication should be the next option considered, followed by containment (when eradication is not feasible). When containment is not feasible, protecting susceptible threatened species, threatened ecological communities and areas of outstanding biodiversity value is of paramount importance.

Phytophthora cinnamomi

Phytophthora cinnamomi (Phytophthora) is a soil-borne water mould that attacks the roots of susceptible plants, destroying the root system and reducing the ability of the plant to conduct water and nutrients, which can sometimes kill the infected plant (Makinson 2018b).

Any activity that moves soil or plant matter can spread Phytophthora. Clothing, equipment, footwear and vehicles that can carry soil are potential vectors for transmission (NSW TSSC 2011). In most situations, Phytophthora is impossible to eradicate from infested areas, so the current approach to management aims to prevent its introduction to unaffected areas to protect threatened species and ecological communities that are most at risk.

The development of phytosanitary protocols to reduce risks of spreading Phytophthora is a strategic objective of the draft *Saving our Species* (SoS) Phytophthora KTP strategy. This document directly addresses that objective.

Other *Phytophthora* species (e.g. *P. aggregate*, *P. multivora*) are emerging as threats to biodiversity in New South Wales. They have similar dispersal characteristics to *P. cinnamomi* and so the application of hygiene measures outlined in this document will be effective in also containing their spread.

Myrtle rust

Myrtle rust is a disease caused by the fungus *Austropuccinia psidii* (Beenken 2017; Makinson 2018b). It affects trees and shrubs in the Myrtaceae family by attacking young, soft, actively-growing leaves, shoot tips, young stems, fruits and flower parts.

The primary vector of myrtle rust at local and intermediate scales is wind (Makinson 2018b; Pegg et al. 2014); however, myrtle rust spores can quickly spread via people on contaminated clothing, footwear, tools, vehicles and machinery, as well as on animals. While good hygiene practices cannot control the spread of myrtle rust by wind, they can help slow the spread by people to areas that are not yet infested.

The hygiene management approach outlined in this document is consistent with Action 2 of the [Management plan for myrtle rust on the national parks estate \(PDF 1.4MB\)](#) to limit the spread of myrtle rust from infested sites and limit the introduction of myrtle rust to non-infested sites (OEH 2015). No hygiene actions have been identified in the draft SoS myrtle rust KTP strategy; nevertheless, it is important to enact due diligence and ensure it is not spread to areas with susceptible species through poor hygiene. The protocols set out in this document are also consistent with the draft action plan for myrtle rust in Australia (Makinson 2018a).

Amphibian chytrid fungus

Amphibian chytrid fungus (*Batrachochytrium dendrobatidis*) is a fungal pathogen that causes the disease chytridiomycosis, which has led to the decline and extinction of frog populations globally and in Australia (OEH 2018). Chytridiomycosis has been detected in over 40 species of native Australian frogs (DECC 2008).

The fungus is transferred by direct contact between frogs and tadpoles or via zoospores in infected water (OEH 2018). Humans can spread the disease by contaminated footwear and equipment and by (illegally) moving frogs from one area to another.

Batrachochytrium dendrobatidis is listed as prohibited matter under the [Biosecurity Act 2015](#). Consequently, it is an offence to knowingly spread chytrid in New South Wales. Implementing the protocols detailed in this document will help people to carry out their [general biosecurity duty to prevent, eliminate or minimise risk](#) posed by chytrid fungus.

The protocols outlined in this document replace the *Hygiene protocol for the control of disease in frogs* (DECC 2008).

Invasive plants

Invasive plants are (generally) non-native to Australia and have an adverse effect on, or are suspected of having an adverse effect on, the environment, the economy or the community (Biosecurity Act). The financial impact of invasive plants in New South Wales on agriculture alone is approximately \$4.3 million every year (DPI 2017). Impacts on the environment have not been quantified but are likely equal to or greater than those on agriculture. Many invasive plants can occupy natural areas and disturb ecosystems by altering plant and animal community composition, nutrient cycles and fire regimes (DoE 2015).

Invasive plants can be spread by dispersal of seed and vegetative material on wind, animals, waterways and people (via contaminated clothing, hats, footwear, tools, equipment, machinery and vehicles; DoE 2015). Although non-human vectors are difficult to control, the dispersal capacity of humans can be reduced by modifying behaviour. Implementing hygiene protocols will assist with controlling the spread of invasive plants by preventing the transportation of plant material that is capable of proliferating in new sites. The primary approach to preventing spread of invasive species is through effective project planning and cleaning of clothing, equipment and vehicles.

The following KTPs under the BC Act involve one or more invasive plant species:

- invasion and establishment of exotic vines and scramblers
- invasion and establishment of Scotch broom (*Cytisus scoparius*)
- invasion, establishment and spread of lantana (*Lantana camara* L. *sens. lat.*)

- invasion of native plant communities by African olive *Olea europaea* subsp. *cuspidata* (Wall. ex G. Don) Cif.
- invasion of native plant communities by *Chrysanthemoides monilifera*
- invasion of native plant communities by exotic perennial grasses
- loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.

Some invasive plants may be subject to targeted eradication or containment programs and may have increased hygiene requirements. Outside of those programs, the procedures in these guidelines can be used to reduce the likelihood of spreading invasive plants to new areas.

Invasive plants in New South Wales are regulated under the *Biosecurity Act 2015*. The Biosecurity Act establishes the concept of a 'general biosecurity duty', which requires that any person who deals with (e.g. possesses, breeds, propagates, moves, displays, acquires) a plant and knows (or ought to know) of any biosecurity risks associated with the plant, has a duty to ensure the risk is prevented, eliminated or minimised, as far as is reasonably practical.

Some invasive plants are listed as 'prohibited matter' under the Biosecurity Act. Invasive plants that are prohibited matter are more heavily-regulated than other invasive plants. Any dealing with prohibited matter (including movement) in New South Wales is an offence. Any person who becomes aware of or suspects the presence of prohibited matter must notify the Department of Primary Industries immediately on 1800 680 244 or by email at weeds@dpi.nsw.gov.au. Visit [NSW WeedWise](#) for details of the biosecurity duties for each invasive plant species.

See [Appendix D](#) for a list of invasive non-native plants that are listed as prohibited matter. You can contact the Botanical Information Service (Royal Botanic Gardens and Domain Trust) at botanical.is@rbgsyd.nsw.gov.au to confirm plant identification and lodge voucher specimens in the National Herbarium of New South Wales.

Hygiene management

Hygiene refers to specific measures to prevent the spread of pathogens and invasive plant propagules by removing seeds, spores, contaminated soil, water, and organic materials from machinery, vehicles, equipment, footwear and clothing.

The appropriate level of hygiene (basic or strict) is dependent on whether the location is already infested and whether you are working near any susceptible threatened species, threatened ecological communities or declared areas of outstanding biodiversity value, as well as any non-listed species known to be highly susceptible to a pathogen or threat process (susceptible high-risk entities). A list of known susceptible high-risk entities can be found at [Appendix B](#) (for *Phytophthora cinnamomi*) and [Appendix C](#) (for myrtle rust).

Where a pathogen is not present at a site but there are susceptible animals or plants present, hygiene measures should be more stringent.

Maintaining good hygiene is consistent with the management principles for national parks, historic sites, state conservation areas, regional parks, karst conservation areas, nature reserves and Aboriginal land set out in the *National Parks and Wildlife Act 1974*. Those management principles include conserving natural values and conserving biodiversity, maintaining ecosystem function and maintaining natural landscapes.

Good hygiene standards are also consistent with the national standards for implementing ecological restoration activities (Standards Reference Group SERA 2017).

Planning considerations

Below is a list of factors that can decrease the likelihood of transmitting pathogens and invasive plants. It is not intended as a list of activities prescribed by this document for all circumstances (because they may be impractical in many cases) but can help readers recognise risk factors when planning and undertaking their work.

Factors that can reduce the risk of introducing or spreading pathogens or invasive plants include:

- scheduling work during dry weather (and not immediately following wet weather) to reduce adhesion of soil to footwear, clothing, equipment and vehicles
- (when working across multiple field sites) visiting known non-infested sites first, followed by sites with unknown infestation status and lastly sites known to be infested
- scheduling activities so they do not immediately follow warm, moist conditions (which are favourable for spore production) or during times of peak seed production by invasive plants
- restricting movement of soil and plant material to and from a site
- keeping vehicles, machinery and people to dry surfaces, formed roads and walking trails
- maintaining drainage to prevent flooding or pooling
- planning to use methods that minimise soil disturbance.

Additional planning considerations for fire management work

The primary focus of emergency bushfire operations is the protection of life and property. It is rarely practical to implement strict hygiene procedures under those circumstances; however, it is advisable to maintain a basic level of hygiene wherever practical to reduce the spread of plant pathogens.

For non-emergency fire management practices (e.g. prescribed burning, firebreak construction and maintenance), appropriate hygiene measures should be incorporated. We recommend using [Decision tree 1](#) and/or [Decision tree 2](#) (when relevant) to identify suitable hygiene measures before undertaking fire management activities.

There are additional fire management planning actions that can be considered to reduce risks of spreading plant pathogens and invasive plants. These include:

- avoiding construction of firebreaks near susceptible threatened species and threatened ecological communities, where practical and where it does not increase risk to life and property
- constructing firebreaks in areas with good drainage
- preferentially burning areas bound by well-formed hard surfaces.

Determining your hygiene requirements

During the project planning phase, it is important to determine whether [basic](#) or [strict](#) hygiene protocols are appropriate. For example, when working in areas unsuitable for establishment of a pathogen or invasive plants, it may not be necessary to implement strict hygiene measures. [Basic hygiene protocols](#) should always be applied at a minimum.

You can use the hygiene management plan at [Appendix F](#) to summarise the relevant risks and record the recommended hygiene measures for your project.

Phytophthora cinnamomi

Phytophthora cinnamomi (Phytophthora) establishment typically occurs in areas with warm conditions (optimal spore production occurs at 24–25°C under laboratory conditions; Nesbitt et al. 1979) and average annual rainfall of >500 millimetres (*Phytophthora* Technical Group 2006). In New South Wales, Phytophthora has established in the following Local Land Services regions:

- Greater Sydney (including the Greater Blue Mountains World Heritage Area; Newby 2014)
- Hunter
- North Coast
- Northern Tablelands
- Central Tablelands
- South East.

Phytophthora is also present in parts of the Central West, Riverina and Murray regions.

Strict hygiene measures are recommended at sites in these regions where:

- susceptible high-risk entities exist
- Phytophthora is not present
- there is no public access OR there is public access with hygiene measures already in place (e.g. boot-cleaning stations)
- environmental conditions are conducive to the establishment of Phytophthora.

The aim of this approach is to reduce the introduction of Phytophthora to non-infested areas.

[Decision tree 1](#) can help you determine your hygiene requirements with respect to Phytophthora; however, if working on an island, see [Visiting or working on islands](#).

Myrtle rust (Austropuccinia psidii)

There are varied reports of climatic preferences for myrtle rust spore germination (Makinson 2018b). For example, Kriticos et al. (2013) found that laboratory germination occurred between 8.8 and 29.7°C, but was optimal between 12 and 20°C. Ruiz et al. (1989) reported a thermal tolerance range of 5–25°C on a eucalypt host. Myrtle rust prefers moist environments and incidence tends to decrease during dry periods (Carnegie et al. 2016).

Myrtle rust has established throughout coastal New South Wales (including some areas of the lower Blue Mountains) and spores are likely to have spread throughout almost all moist terrestrial habitats in the region due to high dispersal capacity by wind (DPI 2015). Consequently, it is not always practical or cost-effective to implement strict hygiene procedures for myrtle rust in this region.

Hygiene measures can go some way to reducing the spread of myrtle rust to some non-infested areas such as potential habitat on or west of the Great Dividing Range in New South Wales and jurisdictions not yet affected by myrtle rust (e.g. South Australia and Western Australia). Before travelling to other states and territories not affected by myrtle rust, you should launder all of your fieldwork clothes if you have been working in an area infested with myrtle rust.

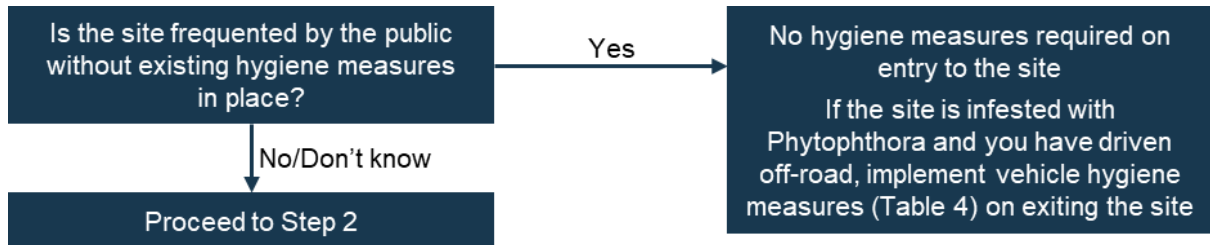
The far south-west of Western Australia contains approximately 40% of Australia's myrtaceous species (Makinson 2018b). Consequently, if introduced, myrtle rust has the potential to cause significant damage to the region. The continued exclusion of the pathogen from south-west Western Australia is a national biosecurity priority.

[Decision tree 1](#) can help you determine your hygiene requirements with respect to myrtle rust; however, if working on an island, see [Visiting or working on islands](#).

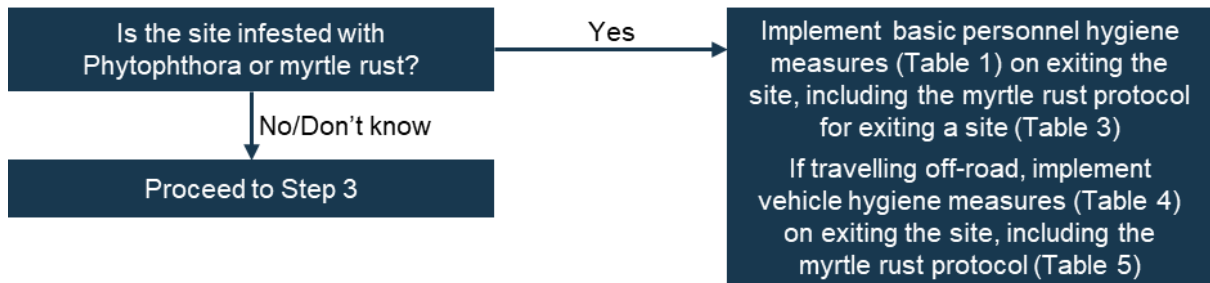
Decision tree 1: Phytophthora and myrtle rust

This decision tree should only be used when there is no site-specific hygiene protocol for the area you are visiting or working in.

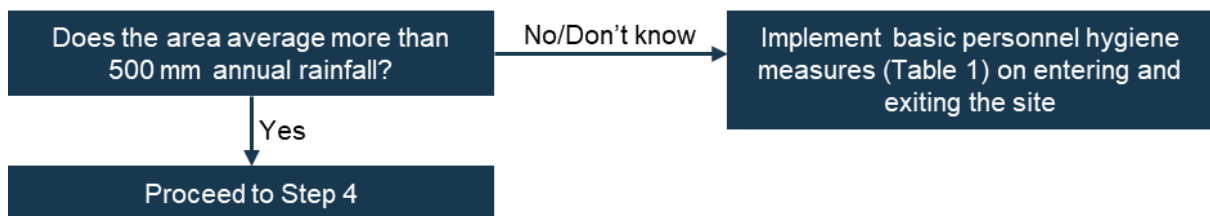
Step 1: Determine nature of public access



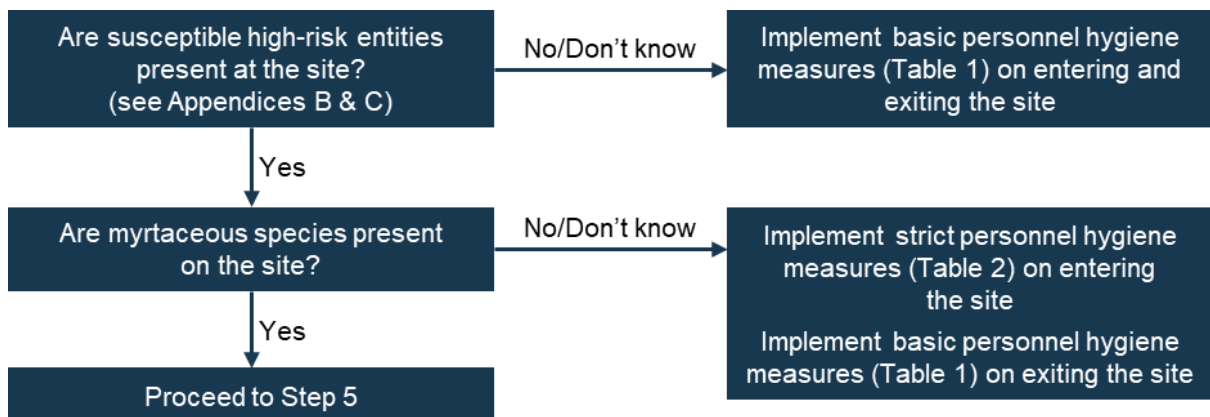
Step 2: Determine presence of Phytophthora or myrtle rust

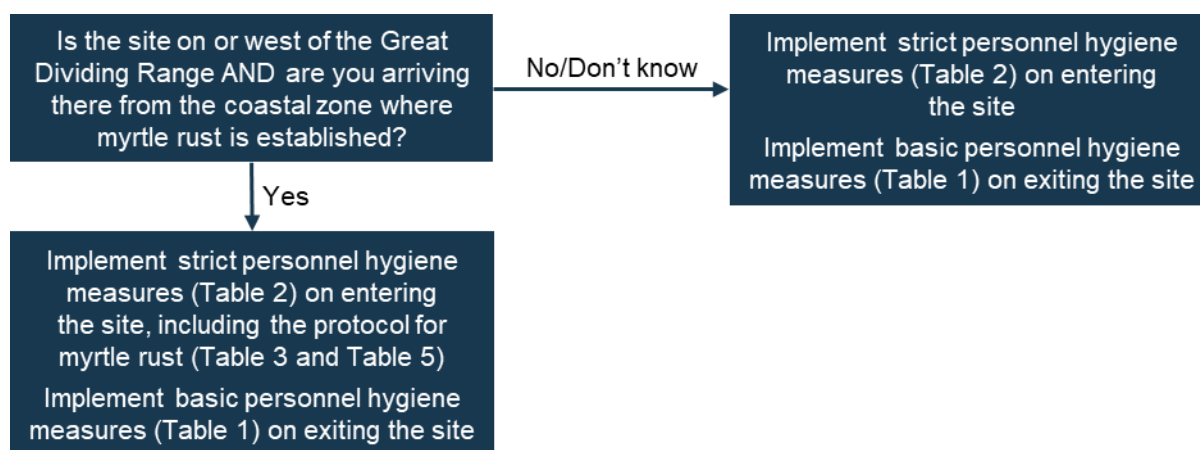


Step 3: Determine average annual rainfall



Step 4: Determine presence of susceptible entities and/or myrtaceous species



Step 5: Determine risk of spread of myrtle rust to or beyond the Great Dividing Range**Invasive plants**

[Appendix A](#) and [Appendix D](#) list invasive plants listed as KTPs or prohibited matter under the BC Act and Biosecurity Act, respectively. It is recommended that hygiene measures are implemented whenever working with these species or in areas where these species occur.

The basic hygiene procedure ([Table 1](#)) and the vehicle hygiene procedure ([Table 4](#)) recommend checking and removing seed and plant debris from clothing, footwear, equipment and vehicles. These measures are sufficient to remove invasive plant propagules under most circumstances, but people should be particularly vigilant when checking and cleaning after work on sites with KTP-listed plants, weeds of national significance or regional priority invasive plants (see the [NSW WeedWise website](#)).

During peak seed production, consideration should be given to additional measures, such as designating site-specific shoes, clothing or equipment that are used only at a single site and are bagged prior to leaving that site. When operating heavy machinery that captures a lot of soil in an infested site, implement strict vehicle hygiene measures ([Table 4](#)).

Amphibian chytrid fungus (*Batrachochytrium dendrobatidis*)

Reducing the spread of amphibian chytrid fungus between sites and between frogs should be a central objective when working with or near amphibians or in habitats where amphibian chytrid fungus is pervasive. Consequently, strict hygiene should be practised under all circumstances for personnel, clothing, footwear, tools and equipment. See [Table 6](#) for details; however, if working on an island, see [Visiting or working on islands](#).

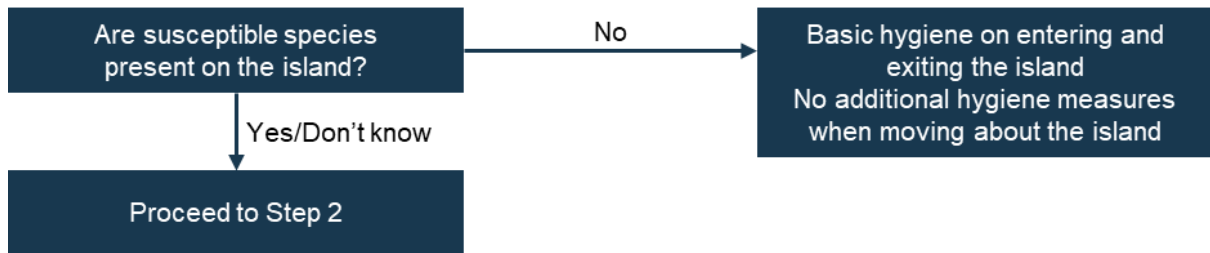
Visiting or working on islands

When visiting or working on islands, the recommended level of hygiene depends on whether or not the island is affected by pathogens and if so, to what extent. In some cases, this may be difficult to determine, so a cautious approach may be sensible. [Decision tree 2](#) is a general guide to the 'when' and 'what' of hygiene on islands. It can be applied to Phytophthora, myrtle rust and amphibian chytrid fungus. For invasive plants, follow the advice above under [Invasive plants](#).

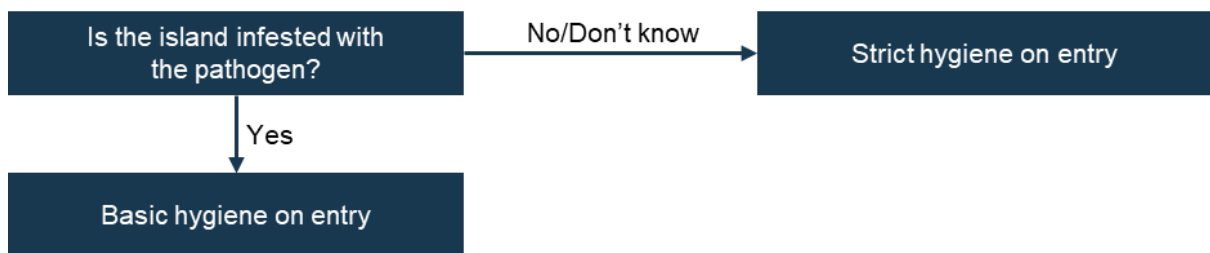
Where hygiene measures are recommended for moving about an island (see Step 3 below), it will be important to establish hygiene points at the boundary of the infested area(s).

Decision tree 2: visiting or working on islands

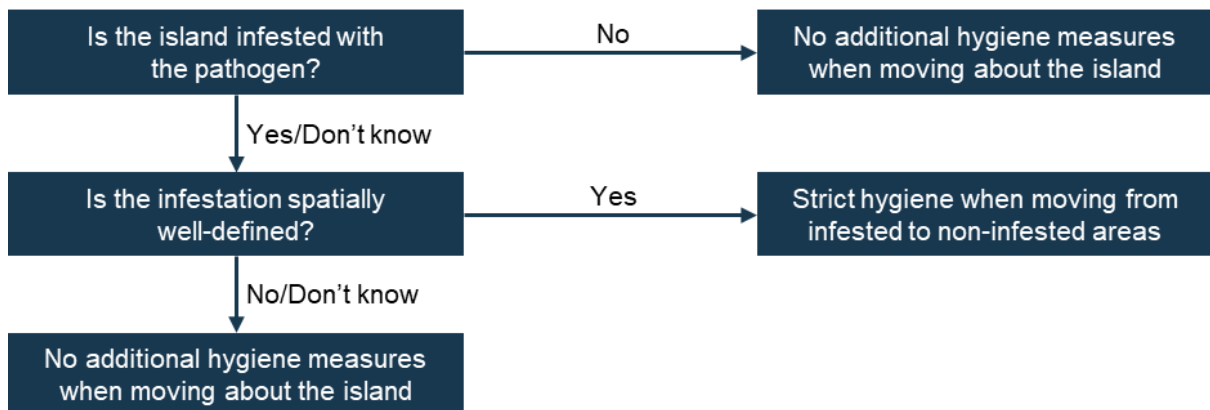
Step 1: Determine presence of susceptible species



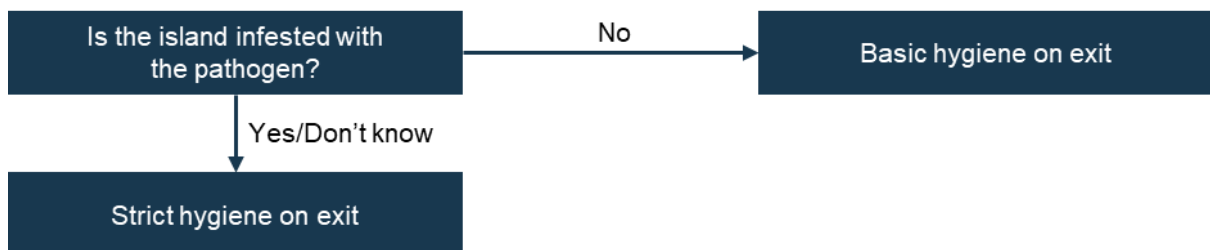
Step 2: Determine hygiene measures before entry to the island



Step 3: Determine hygiene measures for moving about the island



Step 4: Determine hygiene measures for exit from the island



Recommended hygiene protocols

Personnel, clothing, footwear, tools and equipment

Basic hygiene measures

Table 1 Basic hygiene protocol for personnel, clothing, footwear, tools and equipment

Step	Description
1. Check	<ul style="list-style-type: none"> Check personnel, clothing, footwear, backpacks and equipment for soil, plant material/propagules and other debris.
2. Clean	<ul style="list-style-type: none"> Remove all soil, plant material and other debris using a hard brush and (if required) clean water. If dirty, wash hands with soap and water¹. Remove seeds from clothing, footwear, tools and equipment by hand. Seeds that are difficult to remove can sometimes be scraped off clothing with a sharp implement (e.g. a knife), but use caution. Where possible, have a co-worker double-check that you have removed all seeds.
3. Dry	<ul style="list-style-type: none"> Where practical, ensure hands, clothing, footwear, and equipment are dry before proceeding.

Strict hygiene measures

Where possible, strict hygiene procedures should be implemented at a set hygiene point at the site boundary. The site boundary should be defined by the project or site manager. It could be the boundary of a national park. If not on-park, the boundary could be identified based on the distribution of the threatened entities at risk. Where a site boundary is unclear, it should be determined at the project or site manager's discretion.

Where possible, disinfectant should be applied and disposed of in a dry area that is at least 30 metres from a waterway or drainage channel, and where there is limited possibility of it running into a waterway or sensitive environmental area. The complete elimination of all spores on contaminated materials (e.g. boots, vehicles) is an unreasonable expectation, so the goal of disinfection is to *reduce* the spore load present.

Table 2 Strict hygiene protocol for personnel, clothing, footwear, tools and equipment

Project planning

Step	Description
1. Check	<ul style="list-style-type: none"> Ensure you have a fully stocked hygiene kit, or easy access to one.
2. Select	<ul style="list-style-type: none"> Where practical, select clothing, footwear, tools and equipment that are easy to clean (e.g. non-absorbent).
3. Clean	<ul style="list-style-type: none"> Make sure all equipment is clean before use (routinely following this protocol will achieve this).

¹ For general information on hand hygiene, refer to the *National Wildlife Biosecurity Guidelines* (Wildlife Health Australia 2018).

Table 2, continued...*Protocols*

Step	Description
1. Check	<ul style="list-style-type: none"> Thoroughly check all clothing, footwear, backpacks tools and equipment for soil, water, organic material or other debris. Where possible, have a co-worker double-check for you.
2. Clean	<ul style="list-style-type: none"> Remove all soil, water, organic material and debris using a hard brush and clean water. Remove any residual seeds from clothing, footwear, tools and equipment by hand. Where possible, have a co-worker double-check that you have removed all seeds. If dirty, wash hands with soap and water.
3. Disinfect	<ul style="list-style-type: none"> Spray or soak potentially contaminated materials (e.g. footwear, equipment) with disinfectant (Table 7). Leave for 30 seconds before proceeding. Where practical, rinse with clean water.
4. Dry	<ul style="list-style-type: none"> Where practical, ensure all personnel, clothing, footwear, tools and equipment are dry before proceeding.

Myrtle rust

[Decision tree 1](#) identifies when hygiene measures specifically for myrtle rust should be considered. Generally, this will only be after visiting a site that is infested with myrtle rust or when travelling from an infested area to a non-infested site.

Table 3 Myrtle rust hygiene protocol for personnel, clothing, footwear, tools and equipment

Step	Description
1. Disinfect	<ul style="list-style-type: none"> Spray equipment and clothing with disinfectant.
2. Clean	<ul style="list-style-type: none"> At the end of the day, launder all hats and clothing using detergent and warm or hot machine wash to kill residual spores. At the end of the day, shower thoroughly to remove residual spores from skin and hair.

Vehicles and heavy machinery

Generally, protocols for vehicles and heavy machinery (Table 4) only need to be implemented when you have driven off-road. The myrtle rust protocol (Table 5) is an exception and should be implemented whenever you have driven in a site infested with myrtle rust, because spores can adhere to clothing and be transferred to the vehicle's interior.

Table 4 Hygiene protocol for vehicles and heavy machinery

Step	Description
1. Check	<ul style="list-style-type: none"> Check the exterior and interior of vehicles and machinery for soil, plant material and other debris. Use Figure 2 as a guide for where to focus your attention.
2. Clean	<ul style="list-style-type: none"> Remove large clods of dirt and soil using a stiff brush or crowbar. Remove all soil, plant material and other debris from the interior using a vacuum or dustpan and brush. Focus on the cabin floor, floor mats and pedals. Place debris in a bag and dispose of in a commercial waste bin. <i>If returning from a potentially-contaminated area, wash vehicle and/or machinery as soon as possible (e.g. at a commercial carwash) before heading back to base. If a carwash facility is not available, spray tyres thoroughly with a disinfectant (Table 7).</i> <i>If leaving a potentially-contaminated area and travelling to a new site, reassess your hygiene requirements using Decision tree 1 for Phytophthora and myrtle rust.</i>
3. Dry	<ul style="list-style-type: none"> Where practical, allow vehicle or machinery to dry before proceeding.

Myrtle rust

Table 5 Myrtle rust hygiene protocol for vehicles and heavy machinery

Step	Description
1. Disinfect	<ul style="list-style-type: none"> Use 70% alcohol wipes or a spray bottle to apply disinfectant (Table 7) to the interior of vehicle (focus on seats, steering wheel, gear stick, pedals and floor). Spray the exterior with disinfectant or hand pressure sprayer. Allow the disinfectant to remain in contact with the surface for at least 30 seconds before rinsing with clean water.

Amphibian fieldwork

Table 6 Strict hygiene protocols for undertaking amphibian fieldwork

Project planning

Step	Description
1. Select	<ul style="list-style-type: none"> Where practical, select clothing, footwear, tools and equipment that are easy to clean (e.g. non-absorbent). Where practical, when visiting multiple sites, pack separate sets of equipment (including shoes) for use at each site.

Before arriving at a site and on leaving a site

Step	Description
1. Check	<ul style="list-style-type: none"> Thoroughly check all personnel, clothing, footwear and equipment for soil, water, organic material or other debris. Where possible, have a co-worker double-check for you.
2. Clean	<ul style="list-style-type: none"> Remove all soil, water, organic material or other debris using a hard brush and clean water.
3. Disinfect	<ul style="list-style-type: none"> Spray or soak potentially-contaminated materials with disinfectant (Table 7). Leave for 30 seconds before proceeding. Where practical, rinse with clean water.
4. Dry	<ul style="list-style-type: none"> Where practical, ensure all clothing, footwear, tools and equipment are dry before proceeding.

When in the field

- Wear disposable, non-powdered gloves when handling amphibians.
- Use new gloves or a new bag for handling each individual amphibian.
- Wear well-rinsed (with water) vinyl gloves when handling tadpoles.
- If gloves are not available, wash hands with 70% alcohol between handling each animal. Make sure hands are dry before handling amphibians as alcohol exposure may be toxic to them. Rinse hands with potable water (if available) after disinfecting.
- Keep individual amphibians in separate containers. Dispose of containers after use.
- Where possible, keep tadpoles in separate containers. If necessary, tadpoles from the same pond or stream section can be grouped in one container but avoid overcrowding.
- Never mix amphibians from different sites.
- Amphibians should be released where they were captured.
- If using toe clipping or Passive Integrated Transponder (PIT) tagging, use disinfected instruments (preferably unused disposable instruments). Open wounds should be sealed using an appropriate tissue adhesive, followed by application of a topical anaesthetic disinfectant.

Hygiene tools

Hygiene kits

A simple hygiene kit should be kept in each field vehicle to allow staff to implement hygiene measures as required. At a minimum, hygiene kits should contain a stiff brush (for removing soil from boots, bags, etc.), a spray bottle and a container of disinfectant solution (with enough volume for several refills of the spray bottle).

A more comprehensive hygiene kit should include:

- stiff brush
- nail brush
- dustpan (for removing soil from vehicle interior)
- spray bottle
- container of disinfectant solution (enough for several refills of spray bottle)
- container of clean water (for disinfectant dilution and hand washing)
- disposable garbage bags for waste
- plastic tubs that can be used to carry items and for soaking equipment
- alcohol wipes or gel
- soap
- towel
- disposable gloves for handling disinfectant (long-arm waterproof gloves can further reduce risk of skin exposure when diluting disinfectant)
- non-powdered gloves (if working with amphibians).

Disinfectants

Disinfectants should be used for personnel, field equipment and tools, clothing, footwear, vehicles, machinery and personal items to reduce the number of residual spores and other pathogens. For disinfectants to be effective, all surfaces must first be cleaned of soil and organic matter.

All people must take reasonable care for their health and safety, and the health and safety of others, by following product safety instructions and wearing appropriate personal protection equipment when preparing and using disinfectants. Commercially-available fungicides should generally not be mixed with other chemicals (unless the manufacturer explicitly states it is safe to do so). This is especially important for chlorine-based compounds as these may produce toxic vapours when mixed with fungicides (Allan & Gartenstein 2010).

Table 7 Disinfectants

Disinfectant	Application	Notes
70% methylated spirits in water	Spraying absorbent and non-absorbent materials, including vehicle interiors. Can also be used to disinfect hands.	Store in a closed container to reduce evaporation. Solutions at lower or higher concentrations may be less effective or even completely ineffective. Can be used on clothing.
1% sodium hypochlorite in water	Soaking non-absorbent materials	Dilution of household bleach is sufficient. Use only in a well-ventilated area. Do not use on clothing. Bleach has a limited shelf life. Degradation increases with exposure to UV light and at higher temperatures. See manufacturer's details for further information.
Benzalkonium chloride (various concentrations)	Spraying or soaking materials (e.g. equipment, vehicles, boot-cleaning stations)	Some commercial fungicidal products are available (e.g. Phytoclean®). Use as per manufacturer's instructions. Avoid contact with skin or items likely to come into contact with skin (e.g. clothing).
Industrial strength detergent	Cleaning and disinfecting vehicle exteriors, shoes and equipment	There are several commercial products available. Use as per manufacturer's instructions.
Chloramine and chlorhexadine-based products	Disinfecting hands, footwear and equipment	Examples include <i>Halamid</i> ®, <i>Halasept</i> ® and <i>Hexifoam</i> ®. Use as per manufacturer's instructions.
Alcohol wipes	Wiping down vehicle interiors	For multi-use packets, ensure the packaging is properly sealed between uses.
Alcohol gel	Disinfecting hands	

Boot-cleaning stations

Installation of boot-cleaning stations along popular walking trails can help to mitigate the risk of bushwalkers spreading *Phytophthora* and other soil-borne pathogens, as well as some invasive plant propagules. Where present, they are a suitable alternative to a stiff brush for cleaning boots. Boot-cleaning stations can vary in complexity from simple systems with fixed brushes that people can use to scrub their shoes (see Figure 1), or a bench with a hand brush attached by chain, to mechanisms that deliver disinfectant to footwear (O’Gara et al. 2005). Boot-cleaning stations accompanied by instructional material and signage about *Phytophthora* increase awareness and provide context for users, and may increase compliance (Massenbauer 2018).

It is recommended that disinfectant solutions in boot-washing stations are regularly monitored and replaced as necessary. Solutions may need to be replaced more frequently in high traffic areas.



Figure 1 Boot-cleaning station in Barrington Tops National Park

Photo: Peter Beard/DPIE

Vehicle and machinery cleaning checklist

When you are likely to drive off-road or use heavy machinery, it is useful to develop a cleaning checklist during the planning phase of the project. The checklist should include components of the vehicle or machinery that are likely to come into contact with soil or plant material, whether through direct contact (e.g. tyres) or by transfer (e.g. cabin floor, gear stick). An example illustrated cleaning checklist can be found at Figure 2.

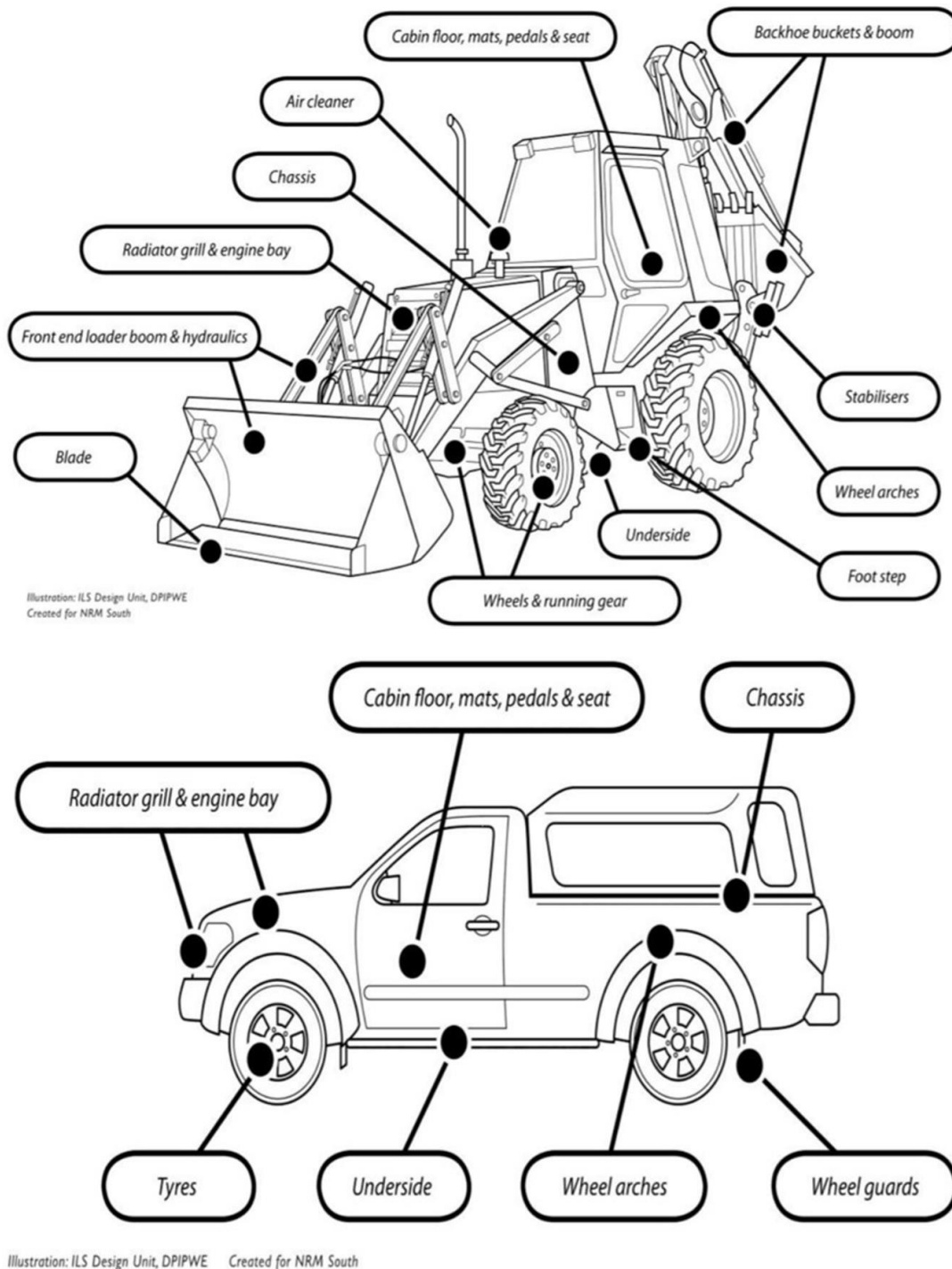


Figure 2 Example illustrated machinery and vehicle cleaning checklists

These are the parts of the vehicle that should be checked and cleaned. Reproduced from DPIPWE (2015) with permission. Original image credit: Allan and Gartenstein (2010).

Appendix A: Legislation

Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) is the primary piece of legislation that protects biodiversity in New South Wales. One of the purposes of the BC Act is to assess the extinction risk of species and ecological communities, and identify key threatening processes (KTPs), through an independent and rigorous scientific process (BC Act s.1.3(f)).

A threat may be listed as a KTP if, in the opinion of the Threatened Species Scientific Committee (NSW TSSC), it:

- adversely affects threatened species, populations of a species or ecological communities
- could cause species, populations of a species or ecological communities to become threatened.

There are several pathogen and weed-related threats that are listed KTPs under the BC Act, including:

- infection of frogs by amphibian chytrid causing the disease chytridiomycosis
- infection of native plants by *Phytophthora cinnamomi*
- introduction and establishment of exotic rust fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae
- invasion and establishment of exotic vines and scramblers
- invasion and establishment of Scotch broom (*Cytisus scoparius*)
- invasion, establishment and spread of lantana (*Lantana camara* L. *sens. lat*)
- invasion of native plant communities by African olive (*Olea europaea* subsp. *cuspidata* (Wall. ex G. Don) Cif.)
- invasion of native plant communities by *Chrysanthemoides monilifera*
- invasion of native plant communities by exotic perennial grasses
- loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.

Division 6 of Part 4 of the BC Act establishes the Biodiversity Conservation Program, known as *Saving our Species* (SoS). The objectives of SoS are:

1. to maximise the long-term security of threatened species and ecological communities in nature and
2. to minimise the impacts of KTPs on biodiversity and ecological integrity.

This document helps to achieve the second objective of SoS by outlining means of reducing the introduction and spread of pathogens and invasive plants throughout New South Wales.

National Parks and Wildlife Act 1974

The main act governing the management of national parks and reserves in New South Wales is the *National Parks and Wildlife Act 1974* (NPW Act). The NPW Act contains provisions for the reservation of land as:

- a national park
- a historic site
- a state conservation area
- a regional park
- a karst conservation reserve
- a nature reserve
- an Aboriginal area.

The National Parks and Wildlife Service administers the NPW Act and is responsible for managing reserved land. Implementation of hygiene measures in national parks helps to meet the obligation to manage national parks in accordance with the management principles set out in Division 2 of Part 4 of the NPW Act, which include conserving biodiversity, maintaining ecosystem function and maintaining natural landscapes.

Biosecurity Act 2015

The *Biosecurity Act 2015* provides a framework for managing biosecurity risks in New South Wales while promoting that biosecurity is a shared responsibility between government, industry and the public. The Biosecurity Act establishes the general biosecurity duty (s.22), which requires any person who knows or ought to know about a biosecurity risk to (so far as is reasonably practical) ensure that risk is prevented, eliminated or minimised.

The Biosecurity Act also establishes prohibited matter, which includes certain plant and animal pests and diseases listed in Schedule 2 of the Act. Any dealing with prohibited matter throughout New South Wales is an offence. An additional biosecurity duty applies to some people who become aware of prohibited matter, including those in charge of premises on which the prohibited matter occurs, as well as consultants who become aware of prohibited matter during the provision of professional services. Those people also have a duty to notify the Department of Primary Industries of any biosecurity event. Additional details of affected people can be found in Divisions 3 and 4 of Part 2 of the Act.

Adopting hygiene into fieldwork routines is a way that people can manage their biosecurity risks and meet their general biosecurity duty under the Biosecurity Act.

Appendix B: NSW species that are susceptible to *Phytophthora cinnamomi*

Phytophthora cinnamomi (Phytophthora) is as a threat to several threatened species and ecological communities. Further surveys and species-susceptibility testing is required to identify additional species and ecological communities that are susceptible to Phytophthora in New South Wales. The research is ongoing and, therefore, the list below is likely to be incomplete. Staff should check the best available and most recent information on any species or ecological community of interest.

Table 8 NSW plant species that are susceptible (or suspected to be susceptible) to *Phytophthora cinnamomi*

NSW conservation status in parentheses: Protected (P), Vulnerable (V), Endangered (E), Critically endangered (CE), Extinct (Ex).

Species	Reference(s)	Species	Reference(s)
<i>Acacia buxifolia</i> subsp. <i>buxifolia</i>	NSW TSSC (2011)	<i>Angophora costata</i>	NSW TSSC (2011)
<i>Acacia genistifolia</i>	NSW TSSC (2011)	<i>Aotus ericoides</i>	Podger et al. (1990); Schahinger et al. (2003); Weste (2001)
<i>Acacia siculiformis</i>	NSW TSSC (2011)	<i>Astroloma humifusum</i>	NSW TSSC (2011)
<i>Actinotus helianthin</i> (P)	Fraser (1956)	<i>Banksia cunninghamii</i>	Weste (2001); McDougall and Summerell (2003b)
<i>Acrotriche serrulata</i>	NSW TSSC (2011)	<i>Banksia ericifolia</i>	NSW TSSC (2011)
<i>Allocasuarina rigida</i>	NSW TSSC (2011)	<i>Banksia marginata</i>	Pratt and Heather (1973); Podger et al. (1990); Lee and Wicks (1977); Vickery (1997); Schahinger et al. (2003); Weste (2001)
<i>Allocasuarina verticillata</i>	NSW TSSC (2011)	<i>Banksia serrata</i>	Pratt and Heather (1973); Podger et al. (1990); Schahinger et al. (2003); Weste (2001)
<i>Amperea xiphoclada</i> (Ex)	NSW TSSC (2011)	<i>Banksia spinulosa</i> var. <i>cunninghamii</i> (P)	NSW TSSC (2011)

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Species	Reference(s)	Species	Reference(s)
<i>Bauera rubioides</i>	Podger and Brown (1989); Podger et al. (1990); Schahinger et al. (2003); Weste (2001)	<i>Daviesia mimosoides</i>	NSW TSSC (2011)
<i>Boronia anemonifolia</i> (P)	NSW TSSC (2011)	<i>Daviesia wyattiana</i>	McDougall and Summerell (2003b)
<i>Boronia deanei</i> (V)	NSW TSSC (2011)	<i>Dianella longifolia sens. lat.</i>	NSW TSSC (2011)
<i>Bossiaea cinerea</i>	Podger et al. (1990); Schahinger et al. (2003); Weste (2001)	<i>Dillwynia cinerascens</i>	Weste (2001)
<i>Bossiaea obcordata</i>	NSW TSSC (2011)	<i>Dillwynia glaberrima</i>	Podger et al. (1990); Weste (2001); Schahinger et al. (2003)
<i>Bossiaea prostrata</i>	Weste (2001)	<i>Dillwynia phyllicoides</i>	NSW TSSC (2011)
<i>Brachyloma daphnoides</i>	Weste (2001)	<i>Dillwynia sericea</i>	NSW TSSC (2011)
<i>Callitris preissii</i>	NSW TSSC (2011)	<i>Dillwynia tenuifolia</i> (V)	NSW TSSC (2011)
<i>Calytrix tetragona</i>	Podger et al. (1990); Weste (2001); Schahinger et al. (2003)	<i>Diplarrena moraea</i>	NSW TSSC (2011)
<i>Cassinia aculeata</i>	NSW TSSC (2011)	<i>Dodonaea boroniifolia</i>	NSW TSSC (2011)
<i>Conospermum taxifolium</i>	NSW TSSC (2011)	<i>Dodonaea viscosa</i>	NSW TSSC (2011)
<i>Correa reflexa</i>	Podger et al. (1990); Weste (2001)	<i>Epacris hamiltonii</i> (E)	NSW TSSC (2011)
<i>Crowea exalata</i> (P)	NSW TSSC (2011)	<i>Epacris impressa</i>	Weste (2001)
<i>Crowea saligna</i> (P)	NSW TSSC (2011)	<i>Epacris paludosa</i>	NSW TSSC (2011)
<i>Darwinia biflora</i> (V)	NSW TSSC (2011)	<i>Epacris purpurascens</i> (V)	Fraser (1956)
<i>Darwinia peduncularis</i> (V)	NSW TSSC (2011)	<i>Epacris sparsa</i> (V)	NSW TSSC (2011)
<i>Daviesia leptophylla</i>	Weste (2001)	<i>Eriostemon myoporoides</i> (P)	NSW TSSC (2011)

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Species	Reference(s)	Species	Reference(s)
<i>Eucalyptus baxteri</i>	NSW TSSC (2011)	<i>Grevillea irrasa</i> subsp. <i>irrasa</i>	McDougall and Summerell (2003b) (NSW TSSC (2011))
<i>Eucalyptus camfieldii</i> (V)	NSW TSSC (2011)	<i>Grevillea juniperina</i> sens. <i>lat.</i>	NSW TSSC (2011)
<i>Eucalyptus imlayensis</i> (CE)	NSW TSSC (2011)	<i>Grevillea lanigera</i>	NSW TSSC (2011)
<i>Eucalyptus macrorhyncha</i>	NSW TSSC (2011)	<i>Grevillea linsmithii</i>	NSW TSSC (2011)
<i>Eucalyptus niphophila</i>	NSW TSSC (2011)	<i>Grevillea molyneuxii</i> (V)	NSW TSSC (2011)
<i>Eucalyptus obliqua</i>	NSW TSSC (2011)	<i>Grevillea mucronulata</i>	NSW TSSC (2011)
<i>Eucalyptus polyanthemos</i>	NSW TSSC (2011)	<i>Grevillea oleoides</i>	McDougall and Summerell (2003b)
<i>Eucryphia moorei</i>	NSW TSSC (2011)	<i>Grevillea parviflora</i> subsp. <i>parviflora</i> (V)	NSW TSSC (2011)
<i>Exocarpus cupressiformis</i>	NSW TSSC (2011)	<i>Grevillea parviflora</i> subsp. <i>supplicans</i> (E)	NSW TSSC (2011)
<i>Genoplesium rhyoliticum</i> (E)	NSW TSSC (2011)	<i>Grevillea polybractea</i>	NSW TSSC (2011)
<i>Goodenia hederacea</i> subsp. <i>hederacea</i>	Weste (2001)	<i>Grevillea rivularis</i> (CE)	NSW TSSC (2011)
<i>Goodenia humilis</i>	Weste (2001)	<i>Grevillea rosmarinifolia</i>	NSW TSSC (2011)
<i>Grevillea acanthifolia</i> subsp. <i>paludosa</i> (E)	NSW TSSC (2011)	<i>Grevillea victoriae</i> sens. <i>lat.</i>	NSW TSSC (2011)
<i>Grevillea acanthifolia</i> subsp. <i>stenomera</i>	NSW TSSC (2011)	<i>Grevillea wilkinsonii</i> (E)	NSW TSSC (2011)
<i>Grevillea alpina</i>	NSW TSSC (2011)	<i>Hakea bakeriana</i>	NSW TSSC (2011)
<i>Grevillea caleyi</i> (CE)	NSW TSSC (2011)	<i>Hakea ulicina</i>	NSW TSSC (2011)
<i>Grevillea granulifera</i>	NSW TSSC (2011)	<i>Hakea dohertyi</i> (E)	NSW TSSC (2011)

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Species	Reference(s)	Species	Reference(s)
<i>Haloragodendron monospermum</i>	NSW TSSC (2011)	<i>Leionema lachnaeoides</i> (E)	NSW TSSC (2011)
<i>Helichrysum collinum</i>	NSW TSSC (2011)	<i>Leionema ralstonii</i> (V)	NSW TSSC (2011)
<i>Hibbertia calycina</i>	NSW TSSC (2011)	<i>Leptospermum coriaceum</i>	NSW TSSC (2011)
<i>Hibbertia circinate</i> (CE)	Wan et al. (in prep.)	<i>Leptospermum juniperinum</i>	Lee and Wicks (1977); Vickery (1997); McDougall and Summerell (2003b)
<i>Hibbertia cistiflora</i>	Weste (2001)	<i>Leptospermum lanigerum</i> (P)	NSW TSSC (2011)
<i>Hibbertia fasciculata</i>	Weste et al. (2002)	<i>Leucopogon collinus</i>	NSW TSSC (2011)
<i>Hibbertia marginata</i> (V)	NSW TSSC (2011)	<i>Leucopogon confertus</i>	NSW TSSC (2011)
<i>Hibbertia obtusifolia</i>	NSW TSSC (2011)	<i>Leucopogon ericoides</i>	Podger et al. (1990); Weste (2001); Schahinger et al. (2003)
<i>Hibbertia procumbens</i> (E)	NSW TSSC (2011)	<i>Leucopogon esquamatus</i>	NSW TSSC (2011)
<i>Hibbertia villosa</i>	NSW TSSC (2011)	<i>Leucopogon exolasius</i>	NSW TSSC (2011)
<i>Hibbertia virgata</i>	NSW TSSC (2011)	<i>Leucopogon fletcheri</i> subsp. <i>fletcheri</i> (E)	NSW TSSC (2011)
<i>Hovea linearis</i>	Weste (2001)	<i>Leucopogon lanceolatus</i>	NSW TSSC (2011)
<i>Isopogon fletcheri</i> (V)	NSW TSSC (2011)	<i>Leucopogon maccraei</i>	NSW TSSC (2011)
<i>Isopogon petiolaris</i> (P)	NSW TSSC (2011)	<i>Leucopogon microphyllus</i> var. <i>pilibundus</i>	NSW TSSC (2011)
<i>Kennedia prostrata</i>	NSW TSSC (2011)	<i>Leucopogon virgatus</i>	Taylor (1974); Lee and Wicks (1977); Podger et al. (1990); Weste (2001)
<i>Kunzea ambigua</i>	NSW TSSC (2011)	<i>Lissanthe strigose</i>	Weste (2001)
<i>Lasiopetalum joyceae</i> (V)	NSW TSSC (2011)	<i>Lomatia fraseri</i>	NSW TSSC (2011)

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Species	Reference(s)	Species	Reference(s)
<i>Macrozamia communis</i>	Pratt and Heather (1973); McDougall and Summerell (2003b)	<i>Persoonia glaucescens</i> (E)	NSW TSSC (2011)
<i>Macrozamia johnsonii</i> (E)	NSW TSSC (2011)	<i>Persoonia hindii</i> (E)	NSW TSSC (2011)
<i>Melaleuca biconvexa</i> (V)	NSW TSSC (2011)	<i>Persoonia hirsuta</i> (E)	NSW TSSC (2011)
<i>Melaleuca squamea</i>	NSW TSSC (2011)	<i>Persoonia juniperina</i> (P)	Weste (2001)
<i>Melaleuca uncinata</i>	NSW TSSC (2011)	<i>Persoonia marginata</i> (V)	NSW TSSC (2011)
<i>Melichrus urceolatus</i>	NSW TSSC (2011)	<i>Persoonia mollis</i> subsp. <i>maxima</i> (E)	NSW TSSC (2011)
<i>Monotoca elliptica</i>	Podger et al. (1990); McDougall and Summerell (2003b); Schahinger et al. (2003)	<i>Persoonia nutans</i> (E)	NSW TSSC (2011)
<i>Monotoca scoparia</i>	Taylor (1974); Weste (2001)	<i>Persoonia pauciflora</i> (CE)	NSW TSSC (2011)
<i>Nematolepis rhytidophylla</i> (V)	Wan et al. (accepted)	<i>Persoonia sylvatica</i> (P)	McDougall and Summerell (2003b)
<i>Oxylobium ellipticum</i>	Podger et al. (1990); McDougall and Summerell (2003a)	<i>Petrophile pulchella</i> (P)	NSW TSSC (2011)
<i>Ozothamnus obcordatus</i> subsp. <i>major</i>	NSW TSSC (2011)	<i>Phebalium phyllicifolium</i>	NSW TSSC (2011)
<i>Patersonia sericea</i>	NSW TSSC (2011)	<i>Phebalium squamulosum</i> spp. <i>alpinum</i> (P)	Rigg et al. (2018)
<i>Persoonia acerosa</i> (V)	NSW TSSC (2011)	<i>Philotheca myoporoides</i> (P)	Taylor (1974)
<i>Persoonia bargoensis</i> (E)	NSW TSSC (2011)	<i>Phyllanthus hirtellus</i>	NSW TSSC (2011)
<i>Persoonia cornifolia</i> (P)	McDougall and Summerell (2003b)	<i>Phyllota humifusa</i> (V)	NSW TSSC (2011)

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Species	Reference(s)	Species	Reference(s)
<i>Pimelea linifolia</i> subsp. <i>linifolia</i>	Weste (2001); Weste et al. (2002)	<i>Prostanthera ringens</i>	NSW TSSC (2011)
<i>Podocarpus lawrencei</i>	NSW TSSC (2011)	<i>Prostanthera saxicola</i> var. <i>montana</i>	NSW TSSC (2011)
<i>Pomaderris delicata</i> (CE)	Wan et al. (in prep.)	<i>Pultenaea altissima</i>	NSW TSSC (2011)
<i>Pomaderris intermedia</i>	NSW TSSC (2011)	<i>Pultenaea aristata</i> (V)	NSW TSSC (2011)
<i>Prostanthera askania</i> (E)	NSW TSSC (2011)	<i>Pultenaea baeuerlenii</i> (V)	NSW TSSC (2011)
<i>Prostanthera cineolifera</i> (V)	NSW TSSC (2011)	<i>Pultenaea benthamii</i>	McDougall and Summerell (2003b)
<i>Prostanthera cryptandroides</i> (V)	NSW TSSC (2011)	<i>Pultenaea daphnoides</i>	Pratt and Heather (1973); Podger et al. (1990); McDougall and Summerell (2003b); Schahinger et al. (2003)
<i>Prostanthera cuneata</i>	NSW TSSC (2011)	<i>Pultenaea flexilis</i>	NSW TSSC (2011)
<i>Prostanthera decussata</i>	Weste (2001)	<i>Pultenaea glabra</i> (V)	NSW TSSC (2011)
<i>Prostanthera densa</i> (V)	NSW TSSC (2011)	<i>Pultenaea humilis</i> (V)	NSW TSSC (2011)
<i>Prostanthera discolour</i> (V)	NSW TSSC (2011)	<i>Pultenaea mollis</i>	Barker and Wardlaw (1995); Weste (2001)
<i>Prostanthera junonis</i>	NSW TSSC (2011)	<i>Pultenaea parrisiae</i>	Wan et al. (in prep.)
<i>Prostanthera lasianthos</i>	NSW TSSC (2011)	<i>Pultenaea parrisiae</i> subsp. <i>elusa</i> (V)	NSW TSSC (2011)
<i>Prostanthera marifolia</i> (CE)	Wan et al. (accepted); NSW TSSC (2011)	<i>Pultenaea parrisiae</i> subsp. <i>parrisiae</i> (V)	NSW TSSC (2011)
<i>Prostanthera ovalifolia</i>	NSW TSSC (2011)	<i>Pultenaea parviflora</i> (E)	NSW TSSC (2011)
<i>Prostanthera palustris</i> (V)	NSW TSSC (2011)	<i>Pultenaea pedunculata</i> (E)	NSW TSSC (2011)

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Species	Reference(s)	Species	Reference(s)
<i>Pultenaea procumbens</i>	NSW TSSC (2011)	<i>Tetradthea glandulosa</i> (V)	NSW TSSC (2011)
<i>Pultenaea pycnocephala</i>	NSW TSSC (2011)	<i>Tetradthea juncea</i> (V)	NSW TSSC (2011)
<i>Pultenaea</i> sp. Genowlan Point (CE)	Wan et al. (accepted)	<i>Tetradthea pilosa</i> (Ex)	Podger et al. (1990); Weste (2001)
<i>Pultenaea subcapitata</i>	NSW TSSC (2011)	<i>Tetradthea subaphylla</i>	McDougall and Summerell (2003b)
<i>Pultenaea villifera</i> var. <i>villifera</i>	NSW TSSC (2011)	<i>Triplarina nowraensis</i> (E)	NSW TSSC (2011)
<i>Rulingia prostrata</i>	NSW TSSC (2011)	<i>Westringia davidii</i> (V)	NSW TSSC (2011)
<i>Sprengelia incarnata</i> (P)	Podger and Brown (1989); McDougall and Summerell (2003b); McDougall et al. (2018)	<i>Westringia kydrensis</i> (E)	NSW TSSC (2011)
<i>Stylidium graminifolium</i>	NSW TSSC (2011)	<i>Wollemia nobilis</i> (CE)	Bullock et al. (2000)
<i>Styphelia adscendens</i>	Weste (2001); Schahinger et al. (2003)	<i>Woolisia pungens</i>	Fraser (1956)
<i>Styphelia perileuca</i> (V)	NSW TSSC (2011)	<i>Xanthorrhoea australis</i> (P)	Weste (2001); McDougall and Summerell (2003b)
<i>Tasmannia glaucifolia</i> (V)	NSW TSSC (2011)	<i>Xanthorrhoea glauca</i> subsp. <i>glauca</i> (P)	McDougall and Summerell (2003b)
<i>Tasmannia lanceolata</i>	NSW TSSC (2011)	<i>Xanthorrhoea resinifera</i> (P)	Weste (2001); McDougall and Summerell (2003b)
<i>Tasmannia purpurascens</i> (V)	McDougall and Summerell (2003a)	<i>Xanthosia dissecta</i>	Weste (2001); Weste et al. (2002)
<i>Telopea mongaensis</i> (P)	NSW TSSC (2011)	<i>Xanthosia tridentata</i>	Fraser (1956)
<i>Telopea speciosissima</i> (P)	Taylor (1974)	<i>Zieria adenophora</i> (CE)	NSW TSSC (2011)
<i>Tetradthea ciliata</i>	Weste (2001); Schahinger et al. (2003)	<i>Zieria baeuerlenii</i> (E)	NSW TSSC (2011)

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Species	Reference(s)	Species	Reference(s)
<i>Zieria buxijugum</i> (CE)	NSW TSSC (2011)	<i>Zieria murphyi</i> (V)	NSW TSSC (2011)
<i>Zieria coventyi</i> (E)	NSW TSSC (2011)	<i>Zieria parrisiae</i> (CE)	NSW TSSC (2011)
<i>Zieria formosa</i> (CE)	NSW TSSC (2011)	<i>Zieria prostrata</i> (E)	NSW TSSC (2011)
<i>Zieria laevigata</i>	NSW TSSC (2011)	<i>Zieria tuberculata</i> (V)	NSW TSSC (2011)
<i>Zieria lasiocaulis</i> (E)	NSW TSSC (2011)		

Appendix C: NSW species that are susceptible to myrtle rust (*Austropuccinia psidii*)

Myrtle rust affects plants in the Myrtaceae family. There are over 300 native species known to be susceptible to myrtle rust (Makinson 2018b). The Myrtaceae family is ecologically important in Australia, accounting for about 10% of Australia's native flora, with many Australian plant communities primarily comprised of myrtaceous species. Consequently, there are also many species of native fauna, which depend on the Myrtaceae family, that are also indirectly threatened by the impacts of myrtle rust.

Table 9 NSW endemic species susceptible to myrtle rust (Makinson 2018b; Soewarto et al. 2019)
NSW conservation status in parentheses: Protected (P), Vulnerable (V), Endangered (E), Critically endangered (CE), Extinct (Ex).

Species	Species	Species
<i>Angophora costata</i> subsp. uncertain	<i>Backhousia subargentea</i> (Synonym: <i>Choricarpia subargentea</i>)	<i>Callistemon salignus</i> (Synonym: <i>Melaleuca salicina</i>)
<i>Angophora floribunda</i>	<i>Baeckea gunniana</i>	<i>Callistemon sieberi</i> (Synonym: <i>Melaleuca paludicola</i>)
<i>Angophora subvelutina</i>	<i>Baeckea linifolia</i> (P)	<i>Callistemon</i> sp. 'Rock of Gibraltar' (LM Copeland 3618)
<i>Archirhodomyrtus beckleri</i> [southern chemotype]	<i>Callistemon citrinus</i> (Synonym: <i>Melaleuca citrina</i>)	<i>Callistemon viminalis</i> (Synonym: <i>Melaleuca viminalis</i>)
<i>Austromyrtus dulcis</i>	<i>Callistemon linearifolius</i> (Synonym: <i>Melaleuca linearifolia</i>) (V)	<i>Calytrix tetragona</i>
<i>Austromyrtus tenuifolia</i>	<i>Callistemon linearis</i> (Synonym: <i>Callistemon rigidus</i>)	<i>Corymbia citriodora</i> subsp. <i>citriodora</i> and subsp. uncertain
<i>Backhousia leptopetala</i> (Synonym: <i>Choricarpia leptopetala</i>)	<i>Callistemon pachyphyllus</i> (Synonym: <i>Melaleuca pachyphylla</i>)	<i>Corymbia citriodora</i> subsp. <i>variegata</i>
<i>Backhousia myrtifolia</i>	<i>Callistemon pallidus</i> (Synonym: <i>Melaleuca pallida</i>)	<i>Corymbia gummifera</i>
<i>Backhousia sciadophora</i>	<i>Callistemon pinifolius</i> (Synonym: <i>Melaleuca linearis</i> var. <i>pinifolia</i>)	<i>Corymbia henryi</i>

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Species	Species	Species
<i>Corymbia intermedia</i>	<i>Eucalyptus cinerea</i>	<i>Eucalyptus microcorys</i>
<i>Corymbia maculata</i>	<i>Eucalyptus crebra</i>	<i>Eucalyptus moluccana</i>
<i>Corymbia tessellaris</i>	<i>Eucalyptus dalrympleana</i> subsp. <i>dalrympleana</i>	<i>Eucalyptus nitens</i>
<i>Corymbia variegata</i> [= <i>citriodora</i>] x <i>C. torelliana</i>	<i>Eucalyptus deanei</i> (Synonym: <i>Eucalyptus brunnea</i>)	<i>Eucalyptus obliqua</i>
<i>Darwinia glaucophylla</i> (V)	<i>Eucalyptus delegatensis</i>	<i>Eucalyptus olida</i>
<i>Darwinia procera</i>	<i>Eucalyptus dunnii</i>	<i>Eucalyptus ovata</i> var. <i>ovata</i>
<i>Decaspermum humile</i> [Southern metapopulation]	<i>Eucalyptus elata</i>	<i>Eucalyptus pauciflora</i> subsp. <i>pauciflora</i>
<i>Eucalyptus agglomerata</i>	<i>Eucalyptus fastigata</i>	<i>Eucalyptus perriniana</i>
<i>Eucalyptus baileyana</i>	<i>Eucalyptus gillii</i>	<i>Eucalyptus pilularis</i>
<i>Eucalyptus baueriana</i> subsp. <i>baueriana</i>	<i>Eucalyptus globoidea</i>	<i>Eucalyptus planchoniana</i>
<i>Eucalyptus burgessiana</i>	<i>Eucalyptus globulus</i> subsp. <i>bicostata</i> (Synonym: <i>Eucalyptus bicostata</i>)	<i>Eucalyptus populnea</i> subsp. uncertain
<i>Eucalyptus camaldulensis</i> subsp. uncertain	<i>Eucalyptus globulus</i> subsp. <i>Globulus</i> (Synonym: <i>Eucalyptus globulus</i> [sens. strict.])	<i>Eucalyptus punctata</i> (Synonym: <i>Eucalyptus biturbinata</i>)
<i>Eucalyptus camfieldii</i> (V)	<i>Eucalyptus globulus</i> subsp. uncertain	<i>Eucalyptus radiata</i> subsp. <i>radiata</i>
<i>Eucalyptus campanulata</i> (Synonym: <i>E. andrewsii</i> subsp. <i>campanulata</i>)	<i>Eucalyptus goniocalyx</i> subsp. uncertain	<i>Eucalyptus resinifera</i> [subsp. uncertain]
<i>Eucalyptus camphora</i> subsp. uncertain	<i>Eucalyptus grandis</i>	<i>Eucalyptus resinifera</i> subsp. <i>hemilampra</i>
<i>Eucalyptus carnea</i>	<i>Eucalyptus haemastoma</i>	<i>Eucalyptus robusta</i>
<i>Eucalyptus cephalocarpa</i>	<i>Eucalyptus laevopinea</i>	<i>Eucalyptus rubida</i> subsp. <i>rubida</i>

Hygiene guidelines

Species	Species	Species
<i>Eucalyptus saligna</i>	<i>Lenwebbia prominens</i>	<i>Leptospermum trinervium</i>
<i>Eucalyptus siderophloia</i>	<i>Lenwebbia</i> sp. Main Range (P.R.Sharpe+4877) (CE)	<i>Leptospermum whitei</i>
<i>Eucalyptus sieberi</i>	<i>Leptospermum brachyandrum</i>	<i>Lophostemon suaveolens</i>
<i>Eucalyptus smithii</i>	<i>Leptospermum continentale</i> 'cv. Horizontalis'	<i>Melaleuca alternifolia</i>
<i>Eucalyptus tereticornis</i> subsp. uncertain	<i>Leptospermum deuense</i>	<i>Melaleuca armillaris</i> [subsp. uncertain]
<i>Eucalyptus tindaliae</i>	<i>Leptospermum juniperinum</i>	<i>Melaleuca biconvexa</i> (V)
<i>Eucalyptus viminalis</i> [sens. str.; = subsp. <i>viminalis</i>]	<i>Leptospermum laevigatum</i>	<i>Melaleuca comboynensis</i>
<i>Gossia acmenoides</i>	<i>Leptospermum lanigerum</i> (P)	<i>Melaleuca decora</i>
<i>Gossia bidwillii</i>	<i>Leptospermum liversidgei</i>	<i>Melaleuca howeana</i>
<i>Gossia floribunda</i>	<i>Leptospermum luehmannii</i>	<i>Melaleuca linariifolia</i>
<i>Gossia fragrantissima</i> (E)	<i>Leptospermum morrisonii</i> 'cv. Burgundy'	<i>Melaleuca nodosa</i>
<i>Gossia hillii</i>	<i>Leptospermum myrsinoides</i>	<i>Melaleuca quinquenervia</i>
<i>Gossia punctata</i>	<i>Leptospermum petersonii</i>	<i>Melaleuca sieberi</i>
<i>Homoranthus flavescens</i>	<i>Leptospermum polygalifolium</i> [subsp. uncertain]	<i>Melaleuca squamea</i>
<i>Homoranthus melanostictus</i>	<i>Leptospermum polygalifolium</i> x <i>L. scoparium</i>	<i>Melaleuca squarrosa</i>
<i>Homoranthus prolixus</i> (V)	<i>Leptospermum rotundifolium</i> (P)	<i>Melaleuca styphelioides</i>
<i>Homoranthus virgatus</i>	<i>Leptospermum scoparium</i>	<i>Metrosideros nervulosa</i>
<i>Homorathus croftianus</i> (E)	<i>Leptospermum scoparium</i> x <i>L. macrocarpum</i>	<i>Metrosideros sclerocarpa</i>
<i>Kunzea baxteri</i>	<i>Leptospermum semibaccatum</i>	<i>Pilidiostigma glabrum</i>
<i>Kunzea ericoides</i>	<i>Leptospermum spectabile</i> (P)	<i>Rhodamnia argentea</i>

Hygiene guidelines

Species	Species	Species
<i>Rhodamnia maideniana</i>	<i>Syzygium francisii</i>	<i>Syzygium oleosum</i>
<i>Rhodamnia rubescens</i> (CE)	<i>Syzygium fullagarii</i>	<i>Syzygium smithii</i> (Synonym: <i>Acmena smithii</i>)
<i>Rhodomyrtus psidioides</i> (CE)	<i>Syzygium hemilamprum</i> [subsp. uncertain] (Synonym: <i>Acmena hemilampra</i>)	<i>Syzygium wilsonii</i> x <i>luehmannii</i> (Synonym: <i>S. luehmannii</i> x <i>wilsonii</i>)
<i>Syncarpia glomulifera</i> subsp. uncertain	<i>Syzygium hodgkinsoniae</i> (V)	<i>Tristania neriifolia</i>
<i>Syzygium anisatum</i> (Synonym: <i>Backhousia anisata</i> , <i>Anetholea anisata</i>)	<i>Syzygium ingens</i> (Synonym: <i>Acmena ingens</i>)	<i>Tristaniopsis collina</i>
<i>Syzygium australe</i>	<i>Syzygium luehmannii</i>	<i>Tristaniopsis laurina</i>
<i>Syzygium corynanthum</i>	<i>Syzygium moorei</i> (V)	<i>Uromyrtus lamingtonensis</i>
<i>Syzygium floribundum</i> (Synonym: <i>Waterhousea floribunda</i>)		

Appendix D: Invasive non-native terrestrial plants that are prohibited matter under the *Biosecurity Act 2015*

The *Biosecurity Act 2015* identifies prohibited matter in Schedule 2. Any person who deals with prohibited matter is guilty of an offence under that Act.

The definition of dealing includes moving, releasing, propagating, experimenting with, disposing, acquiring and possessing plants or animals that are listed prohibited matter.

Table 10 Invasive non-native terrestrial plants that are prohibited matter

Scientific name	Common name	Related BC Act KTP
<i>Andropogon gayanus</i>	Gamba grass	Invasion of native plant communities by exotic perennial grasses
<i>Annona glabra</i>	Pond apple	Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants
<i>Asparagus declinatus</i>	Bridal veil creeper	Invasion and establishment of exotic vines and scramblers
<i>Bassia scoparia</i> (excluding subsp. <i>trichophylla</i>)	Kochia	
<i>Centaurea stoebe</i> subsp. <i>micranthos</i>	Spotted knapweed	
<i>Centaurea x moncktonii</i>	Black knapweed	
<i>Chromolaena odorata</i>	Siam weed	
<i>Clidemia hirta</i>	Koster's curse	Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants
<i>Cryptostegia grandiflora</i>	Rubber vine	Invasion and establishment of exotic vines and scramblers
<i>Hieracium</i> (all species except <i>H. murorum</i>) and <i>Pilosella</i> spp. (all species)	Hawkweed	Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants
<i>Miconia</i> spp. (all species)	Miconia	Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants
<i>Mikania micrantha</i>	Mikania vine	Invasion and establishment of exotic vines and scramblers
<i>Mimosa pigra</i>	Mimosa	Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants
<i>Nassella tenuissima</i> (syn. <i>Stipa tenuissima</i>)	Mexican feather grass	Invasion of native plant communities by exotic perennial grasses

Hygiene guidelines

Scientific name	Common name	Related BC Act KTP
<i>Orobanche</i> spp. (all species except the native <i>O. cernua</i> var. <i>australiana</i> and <i>O. minor</i>)	Broomrape	
<i>Parthenium hysterophorus</i>	Parthenium weed	
<i>Striga</i> spp. (except the native <i>S. parviflora</i>)	Witchweed	
<i>Vachellia karroo</i> (syn. <i>Acacia karroo</i>)	Karoo acacia	Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants
<i>Vachellia nilotica</i> (syn. <i>Acacia nilotica</i>)	Prickly acacia	Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants

Appendix E: Additional considerations for amphibian chytrid fungus

Captive frog hygiene management

Frogs and tadpoles should only be removed from a site when absolutely necessary. When holding frogs in captivity, it is important to maintain a high level of hygiene because turnover of frogs in a facility can lead to potentially high risk of amphibian chytrid transmission.

The risks of transmitting amphibian chytrid among captive frogs can be reduced by:

- keeping frogs collected from different sites separate from each other
- reducing the amount of water, equipment or filtration systems shared between tanks or aquaria that are housing frogs
- cleaning, disinfecting and drying tanks and aquaria immediately after removing frogs.

When removal of a frog from the wild is essential (e.g. for research purposes), you should keep frogs from different sites separate (as above) while you monitor for signs of illness or disease. If signs of illness or disease are detected, seek advice from a veterinarian to determine the nature of the problem.

If a frog (or frogs) is infected with chytrid, seek advice from a licensed veterinarian. Common treatments including anti-fungal agents such as *Itraconazole*® can be used to treat chytrid infection. Carefully controlled, ramping heat treatment can be an effective chytrid treatment or prevention strategy in some frog species, but this method can be lethal to native species that cannot withstand high temperatures. This approach should only be considered by experienced laboratories and only with authorisation from a relevant animal ethics committee.

If tadpoles have been bred or held in captivity, they should not be released into the wild. If considering a release of captive tadpoles, you should contact the National Parks and Wildlife Service wildlife team at wildlife.licensing@environment.nsw.gov.au (or 02 9585 6406) to determine your licensing requirements. Pathological testing should be undertaken prior to any release, to reduce the likelihood of releasing individuals infected with amphibian chytrid fungus.

Displaced frogs

Frogs may be inadvertently transported long distances in fruit and vegetable shipments and landscape supplies (this commonly occurs to *Litoria gracilentata*, *L. bicolor* and *L. caerulea*). These frogs pose a risk for the spread of disease and it is rarely feasible to return them to their place of origin with any accuracy.

If you encounter a displaced frog, you should contact a local wildlife carer organisation to collect the animal. The frog should be monitored for signs of infection.

Frogs found on or around roads, dwellings, gardens or swimming pools should not be considered displaced.

Sick and dead frogs

Symptoms

Frogs infected with amphibian chytrid fungus may exhibit a range of physical and/or behavioural symptoms, including:

- discoloured skin
- swollen hind limbs
- emaciation

- skin lesions, increased sloughing (shedding of skin)
- showing little or no response to physical stimuli
- being lethargic or having no appetite.

What to do with sick or dead frogs

Unless part of a licensed research project, sick or dead frogs encountered in the wild should not be touched, collected or moved due to risks of spreading disease.

If collection of a sick or dead frog is part of a licensed research project, you should first (i.e. before you encounter a sick or dead frog) establish what you intend to do with it. This may include preserving it at your own research institute for testing or sending it to a research institute for testing.

When handling sick or dead frogs, wear a new pair of disposable gloves for handling each frog, use a clean plastic bag for transporting each frog (for live frogs, ensure the bag is not airtight) and keep the frog cool during transport.

If the frog is dead, you should preserve it as soon as possible. A frog can be preserved in 10 times its own volume of preservative (70% ethanol or 10% buffered formalin). The frog's belly should be cut open prior to preservation to maximise preservation of internal organs. Alternatively, frogs can be frozen, although freezing can make tissues unsuitable for some laboratory tests.

Euthanasia

If the frog is sick and unlikely to survive, it should be euthanased using an acceptable method. The American Veterinary Medical Association's [Guidelines for the Euthanasia of Animals \(PDF 11.8MB\)](#) (AVMA 2020) prescribes a number of acceptable euthanasia methods, including using injectable and topical agents. These methods should only be undertaken by a licensed veterinarian.

Where other methods are not available, the generally-accepted method of euthanasia is blunt force trauma to the head, followed by decapitation or pithing to ensure quick death. This should only be applied by trained and skilled people (AMVA 2020). Gradually cooling the animal in the refrigerator prior to applying blunt force trauma may reduce the risk of causing suffering.

Euthanasia of frogs associated with animal research must only be done in accordance with an animal research authority.

Appendix F: Template for a hygiene management plan

Team/region/area/park/project	Identify the team, region, area or park to which the hygiene management plan applies. If the plan applies to a specific project (e.g. construction works, conservation project, etc.) specify it here.
Background and infestation status	<p>Provide relevant background information. Consider including:</p> <ul style="list-style-type: none"> • infestation status (known, suspected, unknown) for pathogens of interest, or past occurrences • presence of susceptible species or ecological communities • the type of work generally being undertaken (earthworks, general maintenance, conservation projects, etc.). <p>If the plan is for a specific project and/or species, specify why hygiene management is an important component.</p>
Objective(s)	<p>What are your specific objectives as they relate to your team, region or area?</p> <p>This could include:</p> <ul style="list-style-type: none"> • restricting the entry of pathogens to certain locations • restricting exit of pathogens from infested locations in the area • prioritising specific sites or locations for protection • determining the extent of pathogen distribution.
Mapping and risk assessment	<p>Do you propose to undertake any mapping exercises to determine the extent of pathogen distribution? Mapping can help to refine the objectives.</p> <p>What are the risks related to movement of the pathogen(s) throughout, into or out of the area?</p> <p>What are the potential consequences?</p>
Hygiene measures	<p>How will you apply the hygiene measures outlined in the hygiene guidelines? This should relate directly to your objectives and risks identified above and refer to both vehicle and personnel hygiene. For example, if the objective is to restrict pathogen entry to a specific site, strict hygiene measures could be applied at the border of the site prior to entry.</p> <p>Are there any circumstances or sites where additional hygiene measures might be required?</p> <p>Consider developing a tailored decision tree or simply identifying the sites or areas that are prioritised for strict hygiene.</p> <p>How (if at all) will you address hygiene risks posed by the general public? For example, through installation of boot-cleaning stations. Consider boot-cleaning station design and location.</p>
Protecting vegetation	<p>Will you consider any proactive treatments to protect susceptible plants from infection? If so, consider undertaking a risk assessment to help you prioritise areas (or species) for treatment.</p>

Hygiene guidelines

Prescriptions for external parties undertaking work on-park	Will you place any prescriptions on external parties undertaking work on-park? Work may include (but should not be limited to) contractors undertaking maintenance or earthworks, research or bush regeneration. If the prescriptions are different from the 'Hygiene measures' above, explain why. These should be included in contracts or agreements when engaging third parties to undertake work on your behalf.
Education and communication	How will you inform people about this hygiene management plan (or appropriate hygiene practices generally)? Consider relevant audiences, including internal staff, contractors and the general public. Examples include signage, pamphlets, information on a website, etc.

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Appendix F

Regional strategic weed management plan

Appendix 1: Priority weeds for South East Local Land Services Region

This appendix covers State level determined priority weed species (A1.1) as set by NSW DPI and regionally determined priorities (A1.2) as determined by the rigorous weed prioritisation and expert review process outlined in Section 4.3.

Appendix 1.1 details the specific legal requirements for state level priority weeds and high risk activities. For each state level priority weed, the management objective, and specific requirements for its management (as stated in the *Biosecurity Act 2015* and regulations) is included. These specific requirements include Prohibited Matter, Biosecurity Zones, Control Orders and Mandatory Measures.

Appendix 1.2 identifies regionally prioritised weeds and outcomes to demonstrate compliance with the General Biosecurity Duty. Recommended measures to achieve these outcomes are provided in the NSW DPI web and mobile based application, WeedWise.

A1.1 State priority weeds

State Priority Weed Objective – PREVENTION (Whole of State): *The following weeds are currently not found in some parts of the state, pose significant biosecurity risk and prevention of the biosecurity risk posed by these weeds is a reasonably practical objective.*

Species	Biosecurity Act requirements & Strategic Response in the region
Gamba grass <i>Andropogon gayanus</i>	<p>Prohibited Matter (Part 4, Division 1, Clause 28, Biosecurity Act 2015): A person who deals with any biosecurity matter that is Prohibited Matter throughout the State is guilty of an offence.</p> <p>Regional Strategic Response: Trigger rapid response protocol</p>
Pond apple <i>Annona glabra</i>	
Bridal veil creeper <i>Asparagus declinatus</i>	
Kochia <i>Bassia scoparia</i> (excluding subsp. <i>trichophylla</i>)	
Spotted knapweed <i>Centaurea stoebe</i> subsp. <i>micranthos</i>	
Black knapweed <i>Centaurea x moncktonii</i>	
Siam weed <i>Chromolaena odorata</i>	
Koster's curse <i>Clidemia hirta</i>	
Rubber vine <i>Cryptostegia grandiflora</i>	
Anchored water hyacinth <i>Eichhornia azurea</i>	
Hawkweed <i>Hieracium</i> spp. (all species)	
Hydrocotyl/Water pennywort <i>Hydrocotyle ranunculoides</i>	
Lagarosiphon <i>Lagarosiphon major</i>	
Frogbit/Spongeplant <i>Limnobium</i> spp. (all species)	
Yellow burrhead <i>Limnocharis flava</i>	
Miconia <i>Miconia</i> spp. (all species)	
Mikania vine <i>Mikania micrantha</i>	
Mimosa <i>Mimosa pigra</i>	
Eurasian water milfoil <i>Myriophyllum spicatum</i>	
Mexican feather grass <i>Nassella tenuissima</i> (syn. <i>Stipa tenuissima</i>)	
Broomrape <i>Orobanche</i> spp. (all species except the native <i>O. cernua</i> var. <i>australiana</i> and <i>O. minor</i>)	
Water soldier <i>Stratiotes aloides</i>	
Witchweed <i>Striga</i> spp. (except the native <i>S. parviflora</i>)	
Water caltrop <i>Trapa</i> spp. (all species)	
Karoo acacia <i>Vachellia karroo</i> (syn. <i>Acacia karroo</i>)	
Prickly acacia <i>Vachellia nilotica</i> (syn. <i>Acacia nilotica</i>)	

State Priority Weed Objective – PREVENTION (Whole of State): <i>The following weeds are currently not found in some parts of the state, pose significant biosecurity risk and prevention of the biosecurity risk posed by these weeds is a reasonably practical objective.</i>	
Species	Biosecurity Act requirements & Strategic Response in the region
All species of vascular plant (Tracheophyta)	<p>Mandatory Measure (Part 2, Division 8, Clause 34, draft Biosecurity Regulation 2016) Duty to notify on importation of plants into the State:</p> <p>(1) A person must not import into the state a species of vascular plant (Tracheophyta) if the species is not currently present in the State unless the person has, at least 20 working days before the plant is imported into the State, notified the species of plant and its proposed location within the State.</p> <p>(2) The notification is to be given to the secretary and is to be given in accordance with Part 6.</p> <p>(3) A species of plant is taken not to be present in the State if the National Herbarium of New South Wales does not show it as being present in the State. See http://plantnet.rbg Syd.nsw.gov.au/.</p> <p>Regional Strategic Response: Trigger rapid response protocol</p>
Parthenium weed <i>Parthenium hysterophorus</i>	<p>Prohibited Matter (Part 4, Biosecurity Act 2015): A person who deals with any biosecurity matter that is Prohibited Matter throughout the State is guilty of an offence.</p> <p>Mandatory Measure (Part 2, Division 8, Clause 35, draft Biosecurity Regulation 2016) - Parthenium weed carriers, machinery and equipment</p> <p>(1) This clause applies to the following equipment:</p> <ul style="list-style-type: none"> (a) grain harvesters (including the comb or front) (b) comb trailers (including the comb or front) (c) bins used for holding grain during harvest operations (d) augers or similar equipment used for moving grain (e) vehicles used for transporting grain harvesters (f) vehicles used as support vehicles with grain harvesters and that have been driven in paddocks during harvest operations (g) mineral exploration drilling rigs and vehicles used for transporting those rigs <p>(2) A person must not import into the State from Queensland any equipment to which this clause applies.</p> <p>Regional Strategic Response: Trigger rapid response protocol</p>

State Priority Weed Objective – ERADICATION (Whole of State):

The following weeds are present in limited distribution and abundance in some parts of the state. Elimination of the biosecurity risk posed by these weeds is a reasonably practical objective.

Species	Biosecurity Act requirements & Strategic Response in the region
Tropical soda apple <i>Solanum viarum</i>	<p><i>Biosecurity (Tropical Soda Apple) Control Order 2017.</i></p> <p><u>6. Control measures for owners and occupiers of land</u></p> <p>Pursuant to section 62(1)(b) of the Act, an owner or occupier of land in the Tropical Soda Apple Control Zone on which there is Tropical Soda Apple must:</p> <p>(a) notify the local control authority for the area if the Tropical Soda Apple is part of a new infestation of Tropical Soda Apple on the land:</p> <ul style="list-style-type: none"> i) as soon as practicable after becoming aware of the new infestation; ii) verbally or in writing; iii) giving the following: <ul style="list-style-type: none"> (1) the person’s full name and contact number; (2) the location of the Tropical Soda Apple, including the property identification code for the land (if this is known); and (3) any other information reasonably requested by the local control authority; and <p>(b) destroy all Tropical Soda Apple on the land, including fruit; and</p> <p>(c) ensure that subsequent generations of Tropical Soda Apple are destroyed; and</p> <p>(d) that the land is kept free of Tropical Soda Apple.</p> <p>(e) The owner or occupier does not need to comply with (a) above if they know that notification of the infestation on the land has already been given to the local control authority for the area.</p> <p><u>7. Control measures for persons dealing with carriers</u></p> <p>Pursuant to section 62(1)(b) of the Act, a person who deals with a carrier of Tropical Soda Apple in the Tropical Soda Apple Control Zone, in circumstances where the person knows or ought reasonably to know of the presence of Tropical Soda Apple on the land or in or on the carrier, must:</p> <p>(a) ensure that Tropical Soda Apple (including any seed and propagules) is not moved from the land; and</p> <p>(b) immediately notify the local control authority for the area:</p> <ul style="list-style-type: none"> i) as soon as practicable after becoming aware of the presence of Tropical Soda Apple; ii) verbally or in writing; iii) giving the following: <ul style="list-style-type: none"> (1) the person’s full name and contact number; (2) the location of the Tropical Soda Apple, including the property identification code for the land (if this is known); and iv) any other information reasonably requested by the local control authority. <p>(c) The person who deals with a carrier of Tropical Soda Apple does not need to comply with (b) above if they know that notification of the infestation on the land has already been given to the local control authority for the area.</p> <p>Regional Strategic Response: Trigger rapid response protocol</p>

State Priority Weed Objective – ERADICATION (Whole of State):

The following weeds are present in limited distribution and abundance in some parts of the state. Elimination of the biosecurity risk posed by these weeds is a reasonably practical objective.

Species	Biosecurity Act requirements & Strategic Response in the region
Boneseed <i>Chrysanthemoides monilifera</i> subspecies <i>monilifera</i>	<p><i>Biosecurity (Boneseed) Control Order 2017.</i></p> <p><u>1. Control measures for owners and occupiers of land</u></p> <p>Pursuant to section 62(1)(b) of the Act, an owner or occupier of land in the Boneseed Control Zone on which there is Boneseed must:</p> <p>(a) notify the local control authority for the area if the Boneseed is part of a new infestation on the land:</p> <ul style="list-style-type: none"> i) as soon as practicable after becoming aware of the new infestation; ii) verbally or in writing; iii) giving the following: <ul style="list-style-type: none"> (1) the person’s full name and contact number; (2) the location of the Boneseed, including the property identification code for the land (if this is known); and (3) any other information reasonably requested by the local control authority; and <p>(b) immediately destroy all Boneseed on the land;</p> <p>(c) ensure that subsequent generations of Boneseed are destroyed; and</p> <p>(d) the land is kept free of Boneseed.</p> <p>(e) The owner or occupier does not need to comply with (a) above if they know that notification of the infestation on the land has already been given to the local control authority for the area.</p> <p><u>2. Control measures for persons dealing with carriers</u></p> <p>Pursuant to section 62(1)(b) of the Act, a person who deals with a carrier of Boneseed in the Boneseed Control Zone, in circumstances where the person knows or ought reasonably to know of the presence of Boneseed on the land or in or on the carrier, must:</p> <p>(a) ensure that Boneseed (including any seed and propagules) is not moved from the land; and</p> <p>(b) immediately notify the local control authority for the area:</p> <ul style="list-style-type: none"> i) as soon as practicable after becoming aware of the presence of Boneseed; ii) verbally or in writing; iii) giving the following: <ul style="list-style-type: none"> (1) the person’s full name and contact number; (2) the location of the Boneseed, including the property identification code for the land (if this is known); and iv) any other information reasonably requested by the local control authority. <p>(c) The person who deals with a carrier of Boneseed does not need to comply with (b) above if they know that notification of the infestation on the land has already been given to the local control authority for the area.</p> <p><i>Mandatory Measure (Part 2, Division 8, Clause 33, draft Biosecurity Regulation 2016):</i> A person must not import into the State or sell.</p> <p>Regional Strategic Response: Trigger rapid response protocol</p>

State Priority Weed Objective – ERADICATION (Whole of State):

The following weeds are present in limited distribution and abundance in some parts of the state. Elimination of the biosecurity risk posed by these weeds is a reasonably practical objective.

Species	Biosecurity Act requirements & Strategic Response in the region
Parkinsonia <i>Parkinsonia aculeata</i>	<p><i>Biosecurity (Parkinsonia) Control Order 2017.</i></p> <p><u>3. Control measures for owners and occupiers of land</u></p> <p>Pursuant to section 62(1)(b) of the Act, an owner or occupier of land in the Parkinsonia Control Zone on which there is Parkinsonia must:</p> <p>(f) notify the local control authority for the area if the Parkinsonia is part of a new infestation of Parkinsonia on the land:</p> <ul style="list-style-type: none"> i) as soon as practicable after becoming aware of the new infestation; ii) verbally or in writing; iii) giving the following: <ul style="list-style-type: none"> (1) the person's full name and contact number; (2) the location of the Parkinsonia, including the property identification code for the land (if this is known); and (3) any other information reasonably requested by the local control authority; and <p>(g) immediately destroy all Parkinsonia on the land; and</p> <p>(h) ensure that subsequent generations of Parkinsonia are destroyed; and</p> <p>(i) the land is kept free of Parkinsonia.</p> <p>(j) The owner or occupier does not need to comply with (a) above if they know that notification of the infestation on the land has already been given to the local control authority for the area.</p> <p><u>4. Control measures for persons dealing with carriers</u></p> <p>Pursuant to section 62(1)(b) of the Act, a person who deals with a carrier of Parkinsonia in the Parkinsonia Control Zone, in circumstances where the person knows or ought reasonably to know of the presence of Parkinsonia on the land or in or on the carrier, must:</p> <p>(d) ensure that Parkinsonia (including any seed and propagules) is not moved from the land; and</p> <p>(e) immediately notify the local control authority:</p> <ul style="list-style-type: none"> i) as soon as practicable after becoming aware of the presence of Parkinsonia; ii) verbally or in writing; iii) giving the following: <ul style="list-style-type: none"> (1) the person's full name and contact number; (2) the location of the Parkinsonia, including the property identification code for the land (if this is known); and iv) any other information reasonably requested by the local control authority. <p>(f) The person who deals with a carrier of Parkinsonia does not need to comply with (b) above if they know that notification of the infestation on the land has already been given to the local control authority for the area.</p> <p><i>Mandatory Measure (Part 2, Division 8, Clause 33, draft Biosecurity Regulation 2016):</i> A person must not import into the State or sell.</p> <p>Regional Strategic Response: Trigger rapid response protocol</p>

State Priority Weed Objective – CONTAINMENT:

These weeds are widely distributed in some parts of the state. While broad scale elimination is not practicable, minimisation of the biosecurity risk posed these weeds is reasonably practicable.

Species	Land area where requirements apply	Biosecurity Act requirements & Strategic Response in the region
Alligator weed <i>Alternanthera philoxeroides</i>	<p>A Biosecurity Zone, to be known as the alligator weed biosecurity zone, is established for all land within the state except land in the following regions:</p> <p>(a) Greater Sydney,</p> <p>(b) Hunter (but only in respect of land in the local government area of City of Lake Macquarie, City of Maitland, City of Newcastle or Port Stephens).</p>	<p>Biosecurity Regulation 2017 - Part 5, Division 2 (Alligator weed biosecurity zone)</p> <p>An owner or occupier of land in the alligator weed biosecurity zone on which there is the weed <i>Alternanthera philoxeroides</i> (Alligator weed) must:</p> <p>(a) if the weed is part of a new infestation of the weed on the land, notify the local control authority for the land as soon as practicable in accordance with Part 6, and</p> <p>(b) eradicate the weed or, if that is not practicable, destroy as much of the weed as is practicable and suppress the spread of any remaining weed.</p> <p>Mandatory Measure (Part 2, Division 8, Clause 33, draft Biosecurity Regulation 2017): A person must not import into the State or sell.</p> <p>Regional Strategic Response: Trigger rapid response protocol</p>
Bitou bush <i>Chrysanthemoides monilifera</i> subsp. <i>rotundata</i>	<p>A Biosecurity Zone, to be known as the bitou bush biosecurity zone, is established for all land within the State except land within 10 kilometres of the mean high water mark of the Pacific Ocean between Cape Byron in the north and Point Perpendicular in the South.</p>	<p>Biosecurity Regulation 2017 - Part 5, Division 3 (Bitou bush biosecurity zone)</p> <p>An owner or occupier of land in the bitou bush biosecurity zone on which there is the weed <i>Chrysanthemoides monilifera</i> subsp. <i>rotundata</i> (Bitou bush) must:</p> <p>(a) if the weed is part of a new infestation of the weed on the land, notify the local control authority for the land as soon as practicable in accordance with Part 6, and</p> <p>(b) eradicate the weed or if that is not practicable destroy as much of the weed as is practicable and suppress the spread of any remaining weed.</p> <p>Mandatory Measure (Part 2, Division 8, Clause 33, draft Biosecurity Regulation 2017): A person must not import into the State or sell.</p> <p>Regional Strategic Response within the Biosecurity Zone: Trigger rapid response protocol</p> <p>Regional Strategic Response outside the Biosecurity Zone: Species managed in accordance with published weed management plans</p>

State Priority Weed Objective – CONTAINMENT:

These weeds are widely distributed in some parts of the state. While broad scale elimination is not practicable, minimisation of the biosecurity risk posed these weeds is reasonably practicable.

Species	Land area where requirements apply	Biosecurity Act requirements & Strategic Response in the region
Water hyacinth <i>Eichhornia crassipes</i>	<p>A Biosecurity Zone, to be known as the Water Hyacinth Biosecurity Zone, is established for all land within the State except land in the following regions:</p> <p>(a) Greater Sydney or North Coast,</p> <p>(b) North West (but only land in those regions that is in the local government area of Moree Plains),</p> <p>(c) Hunter (but only land in that region that is in the local government area of City of Cessnock, City of Lake Macquarie, Mid-Coast City of Maitland or Port Stephens),</p> <p>(d) South East (but only land in that region that is in the local government area of Eurobodalla, Kiama, City of Shellharbour, City of Shoalhaven or City of Wollongong).</p>	<p>Biosecurity Regulation 2017 - Part 5, Division 4 (Water hyacinth biosecurity zone)</p> <p>An owner or occupier of land in the water hyacinth biosecurity zone on which there is the weed <i>Eichhornia crassipes</i> (Water Hyacinth) must:</p> <p>(a) if the weed is part of a new infestation of the weed on the land, notify the local control authority for the land as soon as practicable in accordance with Part 6, and</p> <p>(b) eradicate the weed or if that is not practicable destroy as much of the weed as is practicable and suppress the spread of any remaining weed.</p> <p>Mandatory Measure (Part 2, Division 8, Clause 33, draft Biosecurity Regulation 2017): A person must not import into the State or sell.</p> <p>Regional Strategic Response within the Biosecurity Zone: Trigger rapid response protocol</p> <p>Regional Strategic Response outside the Biosecurity Zone: Species managed in accordance with published weed management plans</p>

State Priority Weed Objective – ASSET PROTECTION (Whole of State):

These weeds are widely distributed in some areas of the State. As Weeds of National Significance, their spread should be minimised to protect priority assets.

Species	Biosecurity Act requirements & Strategic Response in the region
Madeira vine <i>Anredera cordifolia</i>	<p>Mandatory Measure (Part 2, Division 8, Clause 33, draft Biosecurity Regulation 2017): A person must not import into the State or sell.</p> <p>Regional Strategic Response: Species managed in accordance with published weed management plans.</p> <p># These species have additional outcomes and regional strategic responses in Appendix 1.2</p>
Asparagus weeds <i>Asparagus aethiopicus</i> #, <i>A. africanus</i> #, <i>A. asparagoides</i> # including the Western Cape form, <i>A. plumosus</i> #, <i>A. scandens</i> #	
Cabomba <i>Cabomba caroliniana</i> #	
Scotch/English broom <i>Cytisus scoparius</i> subsp. <i>scoparius</i> #	
Cat's claw creeper <i>Dolichandra unguis-cati</i> #	
Cape/Montpellier broom <i>Genista monspessulana</i> #	
Olive Hymenachne <i>Hymenachne amplexicaulis</i>	
Bellyache bush <i>Jatropha gossypifolia</i>	
Lantana <i>Lantana camara</i> #	
African boxthorn <i>Lycium ferocissimum</i>	
Chilean needlegrass <i>Nassella neesiana</i>	
Serrated tussock <i>Nassella trichotoma</i> #	
Opuntoid cacti: <i>Opuntia</i> spp., <i>Cylindropuntia</i> spp., <i>Austrocylindropuntia</i> spp. (Excludes <i>O. ficus-indica</i>)	
Mesquite <i>Prosopis</i> spp.	
Blackberry <i>Rubus fruticosus</i> agg. (Blackberry except the varieties Chester Thornless, Dirksen Thornless, Loch Ness, Silvan, Black Satin, Murrindindi, Smooth Stem, Thornfree and Chehalem)	
Sagittaria <i>Sagittaria platyphylla</i>	
Willows <i>Salix</i> spp. (excludes <i>S. babylonica</i> , <i>S. x calodendron</i> & <i>S. x reichardtii</i>)	
Salvinia <i>Salvinia molesta</i> #	
Fireweed <i>Senecio madagascariensis</i> #	
Silver-leaf nightshade <i>Solanum elaeagnifolium</i>	
Athel pine <i>Tamarix aphylla</i>	
Gorse <i>Ulex europaeus</i> #	

A1.2 Regional priority weeds

Regional Priority Weed Objective – PREVENTION (Whole of Region):

The following weeds are currently not found in the region, pose significant biosecurity risk and prevention of the biosecurity risk posed by these weeds is a reasonably practical objective.

Species	Outcomes to demonstrate compliance with the GBD	Strategic Response in the region
Sicklethorn <i>Asparagus falcatus</i>	<ul style="list-style-type: none"> The plant is eradicated from the land and the land is kept free of the plant 	<ul style="list-style-type: none"> Implement quarantine and/or hygiene protocols
Kidney leaf mud plantain <i>Heteranthera reniformis</i>		
Glush weed <i>Hygrophila costata</i>	<ul style="list-style-type: none"> Land managers mitigate the risk of new weeds being introduced to their land 	<ul style="list-style-type: none"> Undertake high risk sites & pathways analysis to identify potential introduction areas and preventative options
Water lettuce <i>Pistia stratiotes</i>		
Holly leaved senecio <i>Senecio glastifolius</i>	<ul style="list-style-type: none"> The Local Control Authority is aware the plant is found on the land 	<ul style="list-style-type: none"> Have a collaborative rapid response protocol in place
Giant rat's tail grass <i>Sporobolus pyramidalis</i>		
	<ul style="list-style-type: none"> The plant or parts of the plant are not traded, carried, grown or released into the environment 	

Regional Priority Weed Objective – ERADICATION (Whole of Region):

The following weeds are present in limited distribution and abundance in the region. Elimination of the biosecurity risk posed by these weeds is a reasonably practical objective.

Species	Outcomes to demonstrate compliance with the GBD	Strategic Response in the region
Ming asparagus <i>Asparagus macowanii</i> var. <i>zuluensis</i>	<ul style="list-style-type: none"> The plant is eradicated from the land, or if that is not practicable then as much of the plant as is practicable is destroyed and the spread of any remaining plant is suppressed Land managers mitigate the risk of new weeds being introduced to their land The plant or parts of the plant are not traded, carried, grown or released into the environment Local Control Authority is notified if the plant is found on the land <p>* For these species, the following legislative requirement also applies: Mandatory measure (Part 2, Division 8, Clause 29, draft Biosecurity Regulation 2016): A person must not move, import into the State or sell any plant.</p> <p>** For these species, the following legislative requirements also apply: Duty to notify presence of prohibited matter (Part 4, Division 3, Clause 30, Biosecurity Act 2015): A person who becomes aware of, or suspects, that a prohibited matter event has occurred, is occurring or is about to occur has a biosecurity duty to immediately notify the prohibited matter event in accordance with the requirements specified in the regulations.</p>	<ul style="list-style-type: none"> Establish agreed quarantine and/or hygiene protocols Surveillance and mapping to locate all infested properties Monitor progress towards eradication. High level analysis of pathways to identify potential introduction areas and preventative options
Groundsel bush <i>Baccharis halimifolia</i>		
Pink pampas grass <i>Cortaderia jubata</i>		
Blue hound's tongue <i>Cynoglossum creticum</i>		
Cats claw creeper <i>Dolichandra unguis-cati</i> (<i>Macfadyena unguis-cati</i>)*		
Senegal tea plant, Temple plant <i>Gymnocoronis spilanthoides</i>		
Horsetail <i>Equisetum</i> spp.		
Spanish heath <i>Erica lusitanica</i>		
Long-leafed water primrose <i>Ludwigia longifolia</i>		
Ludwigia <i>Ludwigia peruviana</i>		
Cane needle grass <i>Nassella hyalina</i>		
Salvinia <i>Salvinia molesta</i> *		
Giant Devil's fig <i>Solanum chrysotrichum</i>		
Spanish broom <i>Spartium junceum</i>		

Regional Priority Weeds objective – CONTAINMENT:

These weeds are widely distributed in parts of the region. While broad scale elimination is not practicable, minimisation of the biosecurity risk posed by these weeds is reasonably practicable.

Species	Land area where requirements apply	Outcomes to demonstrate compliance with the GBD	Strategic Response in the region
Mysore thorn <i>Caesalpinia decapetala</i>	Exclusion zone: Whole of region except core infestation area Core infestation area: Wollongong Local Government Area	<p>Whole region:</p> <ul style="list-style-type: none"> Land managers mitigate the risk of new weeds being introduced to their land The plant or parts of the plant are not traded, carried, grown or released into the environment <p>* The following legislative requirement also applies to these species: Mandatory measure (Part 2, Division 8, Clause 33, draft Biosecurity Regulation 2017): A person must not import into the State or sell any plant.</p> <p>Within Exclusion zone:</p> <ul style="list-style-type: none"> The plant is eradicated from the land, or if that is not practicable then as much of the plant as is practicable is destroyed and the spread of any remaining plant is suppressed <p>Within Core infestation area:</p> <ul style="list-style-type: none"> Land managers reduce impacts from the plant on priority assets 	<p>Within Exclusion zone:</p> <ul style="list-style-type: none"> Establish agreed quarantine and/or hygiene protocols. Surveillance and mapping to locate all infested properties and maintain currency of exclusion zone and objectives. Monitor change in current distribution to ensure containment of spread. High level analysis of pathways to identify potential introduction areas and preventative options <p>Within Core infestation area:</p> <ul style="list-style-type: none"> Identification of key sites/assets in the geographic area Identification of regional containment zones where required Develop region-wide coordinated campaigns for collaborative management Species managed in accordance with published weed management plan
Cabomba <i>Cabomba caroliniana</i> *	Exclusion zone: Whole of region except core infestation area Core infestation area: Wollongong, Shellharbour and Kiama Local Government Areas		
Scotch broom / English broom <i>Cytisus scoparius subsp. scoparius</i> *	Exclusion zone: Bega Valley Local Government area Core infestation area: Whole of region except exclusion zone		
Sea spurge <i>Euphorbia paralias</i>	Exclusion zone: Whole of region except core infestation Core infestation area: Eurobodalla and Bega Valley Local Government Areas		
Flax-leaf broom, Mediterranean broom <i>Genista linifolia</i> *	Exclusion zone: Whole of region except core infestation area Core infestation area: Wollongong, Shellharbour, Kiama, Shoalhaven and Eurobodalla Local Government Areas		
Montpellier broom <i>Genista monspessulana</i> *	Exclusion zone: Wingecarribee and Bega Local Government Areas Core infestation area: Whole of region except exclusion zone		
Coolatai grass <i>Hyparrhenia hirta</i>	Exclusion zone: Whole of region except core infestation area Core infestation area: Wollongong Local Government Area and localities of Bigga, Crooked Corner and Narrawa in the Upper Lachlan Local Government Area		
Lantana <i>Lantana camara</i> *	Exclusion zone: Whole of region except core infestation area Core infestation area: Wollongong, Shellharbour and Kiama Local Government Areas, and the part of Shoalhaven LGA north of 35 11'42"S (known as the Lantana National Containment Line, running east-west through the Princess Hwy / Bandalong Rd intersection)		
Fireweed <i>Senecio madagascariensis</i> *	Exclusion zone: Whole of region except core infestation area Core infestation area: Wingecarribee, Wollongong, Shellharbour, Kiama, Shoalhaven, Eurobodalla and Bega Valley Local Government Areas		
Giant Parramatta grass <i>Sporobolus fertilis</i>	Exclusion zone: Whole of region except core infestation area Core infestation area: Wollongong, Shellharbour, Kiama, Shoalhaven and Eurobodalla Local Government Areas		
Gorse <i>Ulex europaeus</i> *	Exclusion zone: Whole of region except core infestation area Core infestation area: Upper Lachlan, Wollongong, Shellharbour, Kiama, Shoalhaven, Eurobodalla, Yass Valley and Bega Valley Local Government Areas		

Regional Priority Weeds objective – CONTAINMENT:

These weeds are widely distributed in parts of the region. While broad scale elimination is not practicable, minimisation of the biosecurity risk posed by these weeds is reasonably practicable.

Species	Land area where requirements apply	Outcomes to demonstrate compliance with the GBD	Strategic Response in the region
Serrated tussock <i>Nassella trichotoma</i> *	<p>Exclusion zone: Wollongong, Shellharbour, Kiama, Shoalhaven, Eurobodalla and Bega Valley Local Government Areas</p> <p>Core infestation area: Whole of region except exclusion zone</p>	<p>Whole region:</p> <ul style="list-style-type: none"> • Land managers mitigate the risk of new weeds being introduced to their land • The plant or parts of the plant are not traded, carried, grown or released into the environment <p>* The following legislative requirement also applies to these species: Mandatory measure (Part 2, Division 8, Clause 33, draft Biosecurity Regulation 2017): A person must not import into the State or sell any plant.</p> <p>Within Exclusion zone:</p> <ul style="list-style-type: none"> • Land managers prevent spread from their land <p>Within Core infestation area:</p> <ul style="list-style-type: none"> • Land managers reduce impacts from the plant on priority assets 	<p>Within Exclusion zone:</p> <ul style="list-style-type: none"> • Establish agreed quarantine and/or hygiene protocols. • Surveillance and mapping to locate all infested properties and maintain currency of exclusion zone and objectives. • Monitor change in current distribution to ensure containment of spread. • High level analysis of pathways to identify potential introduction areas and preventative options <p>Within Core infestation area:</p> <ul style="list-style-type: none"> • Identification of key sites/assets in the geographic area • Identification of regional containment zones where required • Develop region-wide coordinated campaigns for collaborative management • Species managed in accordance with published weed management plan

Regional Priority Weeds objective – ASSET PROTECTION:

These weeds are widely distributed in the region. While broad scale elimination or containment is not practicable, preventing the spread to priority assets or reducing the impact on priority assets by weeds already present is reasonably practicable. Priority assets for protection typically have high environmental, economic and/or social value.

Species	Land area where requirements apply	Outcomes to demonstrate compliance with the GBD	Strategic Response in the region
African lovegrass <i>Eragrostis curvula</i>	Whole of region	Land managers reduce impacts from the plant on priority assets	<ul style="list-style-type: none"> • Identification of key sites/assets • Species managed in accordance with published weed management plan

Appendix 2: Other weeds of concern in the South East Local Land Services region

Appendix 2.1: Potential regional priority weeds

These species pose a potential biosecurity risk within the region however there is insufficient information on their distribution, pathways, impacts and/or feasibility of control to complete a regional risk assessment and inform an appropriate regional response.

Regional Strategic Response:

- Complete local surveys to determine the current distribution across the region
- Develop regional level weed risk assessments
- Determine the regional priority objective and whether the weed should be included in Appendix A1.2, A2.2 or simply managed under the GBD

Common name	Scientific name
Blue stars/Blue corn-lily	<i>Aristea ecklonii</i>
Chinese knotweed	<i>Persicaria chinensis</i>
Chinese violet	<i>Asystasia gangetica</i> subsp. <i>micrantha</i>
Glory lily	<i>Gloriosa superba</i>
Hymenachne	<i>Hymenachne amplexicaulis</i> and hybrids
Kudzu	<i>Pueraria lobata</i>
Ragwort	<i>Senecio jacobea</i>
Reed canary grass	<i>Phalaris arundinacea</i>
Sea wheatgrass	<i>Thinopyrum junceiforme</i>
Sicilian sea lavender	<i>Limonium hyblaicum</i>
Skunk vine	<i>Paederia foetida</i>
Water poppy	<i>Hydrocleys nymphoides</i>
White blackberry / Mysore raspberry	<i>Rubus niveus</i>
Yellow bells / Golden bells	<i>Tecoma stans</i>

Appendix 2.2: Species subject to local management programs

These species are high risk, high priority for a number of local programs and have significant environmental and/or animal health impacts. It is not possible to eradicate or contain these weeds across the region.

Regional Strategic Response:

- Work within existing widespread weed programs for strategic asset protection
- Prioritise actions under the GBD to assist with management
- Work with industry and the community to develop voluntary restrictions on sale and trade.

Common name	Scientific name
Arum lily	<i>Zantedeschia aethiopica</i>
Asparagus species*	<i>Asparagus</i> spp. (except <i>A. officianalis</i> , <i>A. racemosus</i> , <i>A. declinatus</i> , <i>A. falcatus</i> & <i>A. macowanii</i> var. <i>zuluensis</i>)*
Balloon vine	<i>Cardiospermum grandiflorum</i>
Blackberry*	<i>Rubus fruticosus</i> aggregate (except cultivars)*
Cape ivy	<i>Delairea odorata</i>
Chilean needle grass*	<i>Nassella neesiana</i> *
Chinese celtis	<i>Celtis sinensis</i>
Creeping lantana	<i>Lantana montevidensis</i>
Crofton weed	<i>Ageratina adenophora</i>
Dolichos pea	<i>Dipogon lignosus</i>
Giant reed	<i>Arundo donax</i>
Green cestrum	<i>Cestrum parqui</i>
Honey locust	<i>Gleditsia triacanthos</i>
Madeira vine	<i>Anredera cordifolia</i>
Morning glory	<i>Ipomoea</i> spp
Moth vine	<i>Araujia sericifera</i>
Ox-eye daisy	<i>Leucanthemum vulgare</i>
Pampas grass (Common)	<i>Cortaderia selloana</i>
Rhus tree	<i>Toxicodendron succedaneum</i>
St. John's wort	<i>Hypericum perforatum</i>
Tree of heaven	<i>Ailanthus altissima</i>
Turkey rhubarb	<i>Acetosa sagittata</i>
Willows*	<i>Salix</i> spp.*

* The following legislative requirement also applies to these species: **Mandatory measure (Part 2, Division 8, Clause 29, draft Biosecurity Regulation 2016)**: A person must not move, import into the State or sell any plant.

Appendix G

Underwater piling noise guidelines

Underwater Piling Noise Guidelines



Underwater Piling Noise Guidelines



Government of South Australia

Department of Planning,
Transport and Infrastructure

Department of Planning, Transport and Infrastructure

Underwater Piling Noise Guidelines

First published: November 2012

Version 1.

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The guidelines were developed by the Environmental Group, Projects Directorate, Transport Services Division with the assistance of AECOM.

It has been approved and authorised for use by Departmental staff and its authorised agents by:

A handwritten signature in blue ink, appearing to read 'Lou George'.

Lou George
Director Projects

21 November 2012

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Glossary

Ambient sound	Environmental background noise not of direct interest during a measurement or observation.
Decibel (dB)	Unit used in the logarithmic measure of sound strength.
Frequency	Rate at which water particles move backwards and forwards measured in cycles per seconds or Hertz (Hz).
Impulse sound	Transient sound produced by a rapid release of energy, e.g. from a piling impact or explosive. Impulse sound has extremely short duration and high peak sound pressure level.
TTS	Temporary threshold shift (TTS) is a temporary reduction in hearing sensitivity as a result of exposure to sound. Exposure to high levels of sound over relatively short time periods can cause the same amount of TTS as exposure to lower levels of sound over longer time periods. The duration of TTS varies depending on the nature of the stimulus.
PTS	Permanent threshold shift (PTS) is a permanent reduction in hearing sensitivity caused by irreversible damage to the sensory hair cells of the ear.
Transmission loss	Reduction of the sound pressure level with distance from the noise source, which occurs through geometric spreading, absorption and scattering of sound energy.
Peak level	Peak level is the highest sound pressure level of an impulsive sound signal.
SEL	Sound exposure level (SEL) is most often used to compare the total energy in impulsive signals with different time durations, average pressure levels and temporal characteristics. Impulsive underwater noise sources for which the SEL noise descriptor is useful include piling, blasting and geophysical surveys.
SPL	Sound pressure level (SPL) is the sound pressure expressed in the decibel (dB) scale and with the standard reference pressures of 1 μ Pa for water.
SL	Source level (SL) is the noise level that would be measured at a standard reference distance of 1 m away from an ideal point source radiating the same amount of sound energy as the actual source.
Spectrum	Distribution of sound energy versus frequency.
Spherical spreading	Received level diminishes by 6 dB per doubling of distance from the source.
Hearing threshold	The hearing threshold represents the lowest signal level an animal can detect at a particular frequency, usually referred (and measured) as the threshold at which an animal will indicate detection 50% of the time.

1.0 Introduction

1.1 Background

Given the growing pressure on marine environments, it is important to minimise the impacts on marine biodiversity from infrastructure works. In addition to commonly recognised ecological marine impacts, such as disturbance to sensitive habitats and seagrasses, the impacts of underwater noise on marine fauna should also be considered. Underwater noise impacts on marine fauna are not as well understood as the impact in air, and are an area of continuing global research.

Marine animals live in an environment in which vision is not the primary sense because light does not penetrate far beneath the surface of the ocean. As such, marine mammals are reliant upon sound, instead of light, as their primary sense for communication and being aware of their surrounding environment. Marine mammal communication has a variety of functions such as mother/calf cohesion, group cohesion, individual recognition and danger avoidance.

The ocean is filled with many sounds, both naturally occurring and man-made, that may interfere with marine mammal communication, alter their behaviour, or even cause injury or death. Man-made sources of noise include shipping, geophysical surveys, and various construction activities such as drilling and piling.

Offshore piling produces noise levels that are amongst the highest recorded for construction activities, especially for impact piling. Minimising the impacts of underwater noise from piling activities is now considered an important environmental issue, with assessments undertaken for various marine infrastructure projects.

1.2 Application and objectives of the guidelines

The Department of Planning, Transport and Infrastructure (DPTI) Underwater Piling Noise Guidelines (Guidelines) apply to any proposed piling activity to be undertaken in South Australian (SA) state waters by DTEI staff and contractors that has the potential to impact significantly on marine mammals.

The aims of the Guidelines are as follows:

- Provide advice to DPTI staff and contractors on their legal responsibilities under the *Environment Protection and Biodiversity Conservation Act 1999*.
- Provide practical management and mitigation measures to minimise the risk of injury to occur in marine mammals within the vicinity of piling activities.
- Provide a framework that minimises the risk of significant impacts to occur on marine mammals in biologically important habitats or during critical behaviours (e.g. breeding and calving).

1.3 Limitations of the guidelines

The Guidelines do not intend to prevent all behavioural changes in marine mammals that might occur in response to audible but non-traumatic noise events. To some extent, avoidance behaviour is expected to provide a form of mitigation as it prevents the marine mammal from approaching the piling rig closely enough for noise-induced hearing injury to occur from intense or prolonged noise exposure.

Research into the effects of underwater noise on marine mammals is a rapidly evolving field and gaps in knowledge still exist. The Guidelines may be amended as further information becomes available.

2.0 Legislation and policy

This section presents the Commonwealth and State legislation that applies to offshore piling activities undertaken in SA state waters by DPTI staff and contractors. Links to useful websites and documents with more detailed information are included at the end of this section.

2.1 Commonwealth legislation

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) is the central piece of environmental legislation relevant to assessments of impacts on marine fauna. It provides the legal framework to protect and manage nationally and internationally important biota, ecological communities and heritage places, which are defined in the EPBC Act as matters of National Environmental Significance (NES).

There are seven matters of NES protected by the EPBC Act:

- World Heritage properties
- National Heritage places
- Wetlands of international importance (listed under the Ramsar Convention)
- Migratory species (listed under international agreements)
- Nationally threatened species and ecological communities (listed under the EPBC Act)
- The Commonwealth marine area
- Nuclear matters.

Nationally threatened species and ecological communities are listed under the EPBC Act as extinct in the wild, critically endangered, endangered or vulnerable.

Under the EPBC Act, a person must not take an action that has, will have or is likely to have a significant impact on any matters of NES without approval under the Act.

2.1.2 When are significant impacts on matters of NES likely to occur?

Significant impact criteria that assist in determining if the impacts of an action on any matter of NES are likely to be significant are provided in the *Significant impact guidelines 1.1 – Matters of National Environmental Significance* document (Significant impact guidelines 1.1).

Based on the significant impact criteria, significant impacts on matters of NES are more likely to occur if any of the following occur in the marine area:

- Habitat critical to the survival of a listed species or ecological community.
- Population of species listed as endangered or critically endangered
- Important population of species listed as vulnerable
- Important habitat for a migratory species
- Ecologically significant proportion of the population of a migratory species

Definitions for the terms included in the above, e.g. an important population or habitat, are given in the Significant impact guidelines 1.1 document.

2.1.3 Australian Whale Sanctuary

Section 225 of the EPBC Act establishes the Australian Whale Sanctuary in order to give formal recognition of the high level of protection and management afforded to cetaceans in Commonwealth marine areas and prescribed waters.

The Australian Whale Sanctuary includes all Commonwealth waters from the three nautical mile state waters limit out to the boundary of the Exclusive Economic Zone (EEZ), i.e. out to 200 nautical miles and further in some places and under certain circumstances (see Figure 1).



Figure 1 – Australian Whale Sanctuary (dark blue)

Under the EPBC Act (Part 13, Division 3, Subdivision C), it is an offence to kill, injure, take, trade, keep, move, harass, chase, herd, tag, mark or brand a cetacean within the Australian Whale Sanctuary.

Section 228 of the EPBC Act states that if the Minister is satisfied that a law of a State or the Northern Territory adequately protects cetaceans in the coastal waters, or a part of the coastal waters, of the State or Territory, the Minister may make a declaration accordingly, whether or not those coastal waters or that part are prescribed waters.

Section 229 of the EPBC Act states that a person is guilty of an offence if the person takes an action that results in the death or injury of a cetacean, and the cetacean is in the Australian Whale Sanctuary (but not the coastal waters, or part of the coastal waters, of a State or the Northern Territory for which a declaration under Section 228 is in force), or waters beyond the outer limits of the Australian Whale Sanctuary.

2.1.4 How does the EPBC Act apply to piling activities in SA state waters?

Actions undertaken outside the Commonwealth marine area that have, will have, or are likely to have a significant impact on the environment in a Commonwealth marine area require approval by the Minister. This includes impacts on marine species in state waters that use Commonwealth marine areas.

If piling activities and the associated underwater noise have a significant impact on listed migratory species, threatened species, or commonwealth species, a referral under the EPBC Act and approval of the Minister is required.

2.1.5 EPBC Act Policy Statement 2.1

The *EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales* (Policy Statement 2.1) provides a framework and standards for minimising the risk of acoustic injury to whales from seismic surveys, and acoustic disturbance to whales in biologically important habitats or during critical behaviours.

Seismic surveys use air-guns that generate short and intense pulses of sound directed at the sea floor. The resulting noise is similar in character and frequency content to impact piling noise but usually of a higher level, especially in comparison to piling activities typically conducted by DPTI staff and contractors. The management and mitigation framework and standard procedures outlined in Policy Statement 2.1 have been used to form the basis of the Guidelines.

The background paper to Policy Statement 2.1 recognises the uncertainties related to understanding the sound levels that cause hearing injury as well as the cumulative effect of multiple exposures in whales. The policy therefore adopts a sound energy level (SEL) threshold of 160 dB re 1 $\mu\text{Pa}^2\cdot\text{s}$ for a single seismic shot at 1 km which should not be exceeded for 95% of the time.

The SEL threshold value is used in the policy to determine the extent of the *low power zone*. When a whale enters this zone, seismic surveys must lower their acoustic power output in order to prevent significant exposure to sound levels that could induce hearing injury. If SELs from air-gun shots fall below this threshold, they can operate with a reduced 1 km low power zone while if they are above this threshold, the surveys are required to operate with the default 2 km low power zone.

When a whale is sighted within or appears to enter the *shut-down* zone, which extends to 500 m, the acoustic source must immediately be shut down completely. The *observation zone* extends to 3+ km and whales and their movements should be monitored to determine whether they are approaching or entering the low power zone.

2.2 State legislation

2.2.1 Adelaide Dolphin Sanctuary Act 2005

The *Adelaide Dolphin Sanctuary Act 2005* establishes the Adelaide Dolphin Sanctuary within the Port Adelaide River and Barker Inlet marine area, and aims to protect dolphins and their habitat within the sanctuary. Section 32 of this Act states that there is a general duty of care for a person to take all reasonable measures to prevent or minimise any harm to the sanctuary through his or her actions or activities.



2.2.2 National Parks and Wildlife Act 1972

Section 68 of the *National Parks and Wildlife Act 1972* states that a person must not interfere with, harass or molest a protected animal, or undertake or continue an act or activity that is, or is likely to be, detrimental to the welfare of a protected animal unless authorised by a permit granted by the South Australian Minister for the Department of Environment and Natural Resources. The marine mammal species listed as 'protected animals' under the Act are also listed under the EPBC Act.

2.2.3 Fisheries Management Act 2007

Section 77 of the *Fisheries Management Act 2007* states that a person must not engage in an operation involving or resulting in interference with aquatic animals of any waters forming part of an aquatic reserve, except as authorised by the regulations or a permit issued by the Minister.

2.2.4 Marine Parks Act 2007

Section 37 of the *Marine Parks Act 2007* states that there is a general duty of care for a person to take all reasonable measures to prevent or minimise harm to a marine park through his or her actions or activities.



Useful websites

EPBC Act

<http://www.environment.gov.au/epbc/index.html>

EPBC protected matters search tool

<http://www.environment.gov.au/erin/ert/epbc/index.html>

Listed threatened species and ecological communities under EPBC Act

<http://www.environment.gov.au/epbc/protect/species-communities.html>

Listed migratory species under EPBC Act

<http://www.environment.gov.au/epbc/protect/migratory.html>

Whales, dolphins and porpoises

<http://www.environment.gov.au/coasts/species/cetaceans/index.html>

Australian Whale Sanctuary

<http://www.environment.gov.au/coasts/species/cetaceans/conservation/sanctuary.html>

<http://www.environment.gov.au/coasts/species/cetaceans/conservation/pubs/sanctuary-map.pdf>

Adelaide Dolphin Sanctuary

<http://www.environment.sa.gov.au/coasts/ads/index.html>

http://www.environment.sa.gov.au/coasts/ads/pdfs/ads_map.pdf

Aquatic reserves and marine parks

http://www.pir.sa.gov.au/fisheries/recreational_fishing/closures/aquatic_reserves_and_marine_parks

http://www.environment.sa.gov.au/marineparks/pdfs/Boundaries_SA_A4200709.pdf

Useful documents

Significant impact guidelines 1.1 – Matters of National Environmental Significance

<http://www.environment.gov.au/epbc/publications/pubs/nes-guidelines.pdf>

Significant impact guidelines 1.2 – Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies

<http://www.environment.gov.au/epbc/publications/pubs/commonwealth-guidelines.pdf>

EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales

<http://www.environment.gov.au/epbc/publications/pubs/seismic-whales.pdf>

Background paper to EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales

3.0 The nature of underwater noise

3.1 What is underwater noise?

Sound is a vibration or acoustic wave that travels through some medium, in this case water, and occurs as a backward and forward motion of the medium's particles driven by a vibrating source.

The magnitude of the water particle motion determines the intensity of the sound. The rate at which the water particles oscillate backward and forward determines its frequency given in Hertz (Hz) or cycles per second.

Sound travels about four-and-a-half times faster in water than in air. Absorption of sound energy is much smaller in water at lower frequencies, where man-made noise generally has most energy. As a result, man-made noise generally travels much further underwater than in air.

A tone is a sound of a constant frequency. Most underwater noise sources are not tonal but include a broad range of frequencies. Screeching or whistling noises are composed mainly of high frequency sound while rumbles or booms are composed mainly of low frequency sound.

Underwater sounds are classified according to whether they are continuous or impulsive in character.

- Continuous sounds occur without pauses and are typically produced by the ambient environment, ships, or rotating machinery such as pumps.
- Impulsive sounds are of short duration and occur singly, irregularly, or as part of a repeating pattern. An explosion represents a single impulsive event whereas the periodic impacts from a piling rig or a geophysical survey result in a patterned impulsive sequence. Pulses typically sound like clicks or bangs and may include a broad range of frequencies.

3.2 Sound pressure and decibels (dB)

In water, the sound pressure is typically measured with a hydrophone – the underwater equivalent of a microphone. The international standard unit of sound pressure is the Pascal (Pa).

Typical sound pressures encountered in underwater acoustics range from levels just detectable by the marine animal ear (hundreds of μPa) to much greater levels causing hearing damage (billions of μPa). Because this range is so enormous, it would be impractical to express sound pressures in units of Pascal. Sound pressure is therefore described in terms of a sound pressure level (SPL) in units of decibel (dB), with reference to a standard pressure of 1 μPa for underwater sound. In decibel notation, the range of sound pressures typically encountered ranges from 50 to 250 dB re 1 μPa .

Underwater sound pressure levels are usually expressed on a linear decibel scale in dB rather than on an A-weighted decibel scale in dB(A) as normally used for environmental noise assessments of traffic and industrial sources. The A-weighting accounts for the fact that the human ear is most sensitive to mid-range and high frequencies (1–8 kHz) and is less sensitive to the lower frequencies. Underwater noise assessments generally consider the impacts on marine animals rather than humans, such that the A-weighting is not applicable.

3.3 Underwater noise descriptors

3.3.1 Measured or received levels

Noise descriptors that are commonly used in underwater acoustics to present measured or received levels include the following:

- *Sound pressure level (SPL)* – Average noise level over the measurement period expressed in dB re 1 μPa . For impulsive sources, such as impact piling and blasts, the measurement period is the time period that contains 90% of the sound energy (Southall et al. 2007). Continuous sources, such as vibro-piling and shipping, are commonly described in terms of an SPL.
- *Sound exposure level (SEL)* – Total noise energy over the measurement period expressed in dB re 1 $\mu\text{Pa}^2\cdot\text{s}$. The SEL is commonly used for impulsive sources because it allows a comparison of the energy contained in impulsive signals of different duration and peak levels.
- *Peak level* – Maximum noise level recorded during the measurement period expressed in dB re 1 μPa . The peak level is commonly used as a descriptor for impulsive sources.
- *Peak-to-peak level* – Difference between the maximum and minimum noise level recorded during the measurement period, expressed in dB re 1 μPa . The peak-to-peak level is used as a descriptor for impulsive sources.

SPLs and SELs can be presented either as overall levels or as frequency dependent levels showing the frequency content of a source.

Overall SPLs and SELs present the total average noise and energy level of a source within a given frequency bandwidth, which usually is the band that contains most of the signal's energy.

Frequency dependent representations include spectral density levels, one-third octave band levels, or octave band levels. Spectral density levels give a greater frequency resolution, which is sometimes desirable for identifying narrowband sources such as rotating machinery, and are expressed in unit of dB re 1 $\mu\text{Pa}^2/\text{Hz}$. One-third octave and octave band levels are expressed in units of dB re 1 μPa .

It is important to note that an underwater noise level of 150 dB re 1 μPa is not equivalent to an in-air noise level of 150 dB re 20 μPa . To obtain an approximate comparison between underwater and in-air noise levels, 61.5 dB should be subtracted from the underwater noise level. This is to account for the differences in density and speed of sound between water and air, and the different reference pressures that are used to calculate the decibel levels, i.e. 1 μPa for water and 20 μPa for air. For example, ambient noise levels in South Australian coastal water are typically in the order of 100 to 120 dB re 1 μPa . This corresponds to in-air levels of 39 to 59 dB re 20 μPa .

3.3.2 Source levels

The strength of underwater noise sources can be compared by their source level (SL). The source level is defined as the sound pressure or energy level that would be measured at 1 m from an ideal point source radiating the same amount of sound as the actual source being measured.

The source level is often back-calculated from a measured level at a distance R from the source, assuming a transmission loss (dB) of $N \cdot \log_{10}R$. The value of N determines the noise decay rate with distance from the source, with $N = 20$ for spherical spreading. Typical values for N range from 15 to 25, depending on the source characteristics and sound propagation within the marine environment.

Example calculation of noise descriptors

An example calculation of the noise descriptors is presented based on the impulsive signal shown in Figure 1.

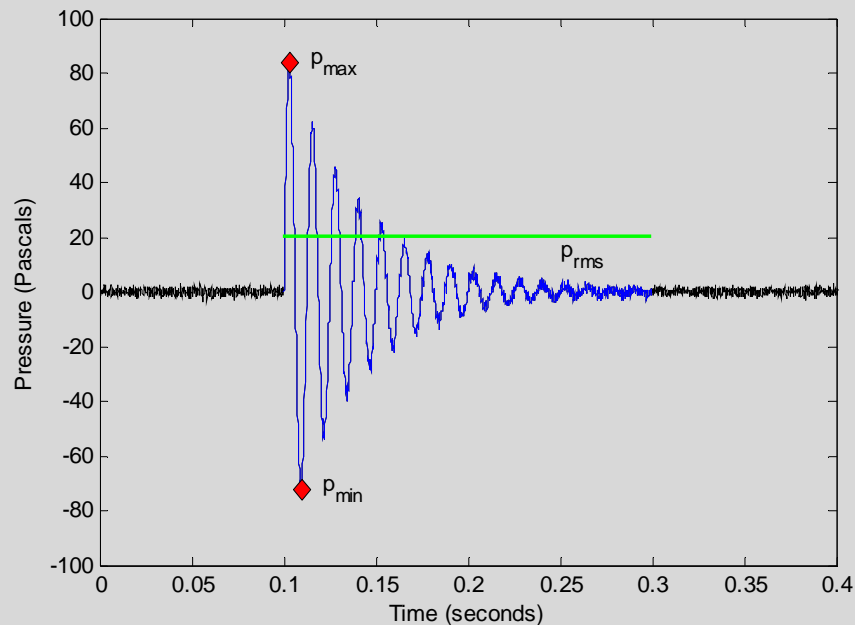


Figure 2 – Example of an impulsive signal

The pulse (blue line) starts at 0.1 seconds and has decayed back to ambient noise levels (black line) at 0.3 seconds, such that the pulse duration is $T = 0.2$ seconds.

The noise descriptors are now calculated as follows:

$$SPL = 20 \cdot \log_{10} \frac{P_{rms}}{P_{ref}}$$

$$SEL = 10 \cdot \log_{10} \frac{P_{rms}^2 \cdot T}{P_{ref}^2}$$

$$Peak = 20 \cdot \log_{10} \frac{P_{max}}{P_{ref}}$$

$$Peak\text{-to-peak} = 20 \cdot \log_{10} \frac{P_{max} - P_{min}}{P_{ref}}$$

The reference pressure p_{ref} is $1 \mu\text{Pa}$, the root-mean-square (rms) sound pressure p_{rms} presents the average level over the duration of the pulse, p_{max} is the maximum sound pressure, and p_{min} is the minimum sound pressure, all in Pascals.

The resulting levels are SPL 146 dB re $1 \mu\text{Pa}$, SEL 139 dB re $1 \mu\text{Pa}^2\text{-s}$, peak 159 dB re $1 \mu\text{Pa}$, and peak-to-peak 164 dB re $1 \mu\text{Pa}$.

3.4 Underwater piling noise characteristics

Piling noise varies with the size of the pile being installed and the pile driving method used. The most common pile driving methods include impact pile driving, where a pile is hammered into the ground by a hydraulic ram, and vibro-driving, where rotating eccentric weights create an alternating force on the pile, vibrating it into the ground.

- *Impact piling* – 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 SEL 170–225 dB re 1 $\mu\text{Pa}^2\cdot\text{s}$ for a single pulse, and peak level 190–245 dB re 1 μPa . 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-driving* – Continuous in character and usually of a much lower level than impact piling. Typical source levels range from SPL 160–200 dB re 1 μPa , 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.

Table 1 summarises the characteristics of impact piling and vibro-driving noise. By comparison, a typical seismic survey produces source levels in the order of SPL 200–250 dB re 1 μPa (see Policy Statement 2.1).

Table 1 – Piling noise characteristics

Piling method	Character	Noise descriptor	Source levels	Most energy
Impact	Impulsive	SEL	170–225 dB re 1 $\mu\text{Pa}^2\cdot\text{s}$	100 Hz and 1 kHz
		SPL	180–235 dB re 1 μPa	
		Peak level	190–245 dB re 1 μPa	
Vibro-driving	Continuous	SPL	160–200 dB re 1 μPa	100 Hz and 2 kHz

3.5 Ambient underwater noise environments

The level and frequency characteristics of the ambient noise environment are two factors that control how far away a given noise source can be detected (Richardson et al. 1995).

In general, noise is only detectable if it is of a higher level than the ambient noise environment at similar frequencies. A lower ambient noise environment results in noise propagating out to greater ranges before diminishing below the background noise level. The potential zone in which noise emissions from a piling rig are detectable thus depends on the levels and types of ambient noise in the ocean waters surrounding the site.

The main sources of ambient noise in the ocean are man-made sources including shipping and sonar activity, and environmental sources including wind-dependent noise and biological noise from a variety of sources such as snapping shrimp (Richardson et al. 1995). Other environmental sources include surf noise typically localised near the coast, precipitation noise from rain and hail, seismic noise from volcanic and tectonic activity, and thermal noise.

Typical levels and spectral contents of the identified ambient noise sources were compiled into generalised ambient noise spectra by Wenz (1962). These generalised spectra are often used to make predictions about the ambient noise environment for a specific site when measurements are not available.

3.6 Underwater noise propagation modelling

Underwater noise propagation models predict the spreading of sound from a noise source throughout the marine environment. The *source-path-receiver* model illustrated in Figure 3 presents the basic principles of underwater sound propagation modelling.

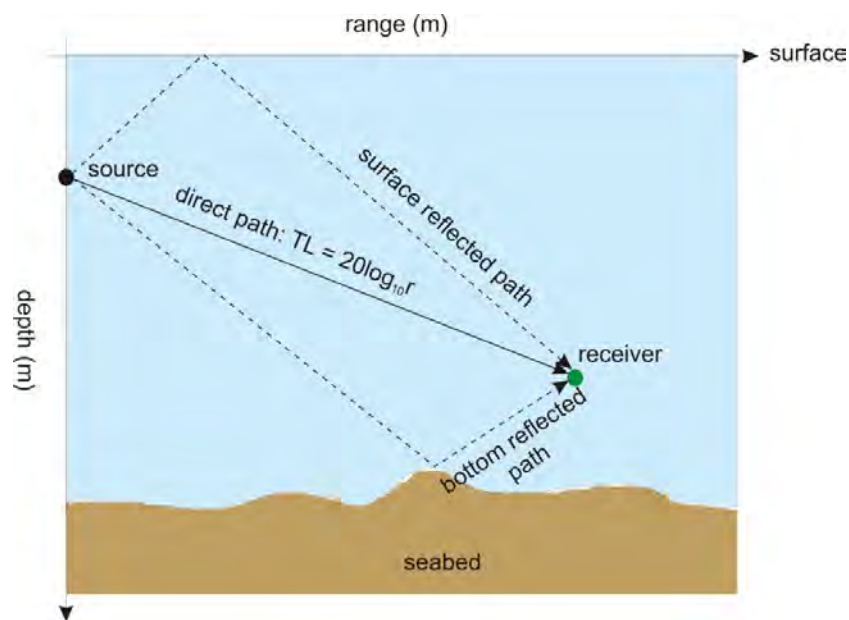


Figure 3 – Source-path-receiver model used for predicting sound transmission from source to receiver

An underwater noise model can predict the sound transmission loss (TL) between the source and a receiver. Given the source level (SL) of the considered noise source, the predicted TL across the transmission path is used to predict the sound pressure level (SPL) at the receiver location as $SPL = SL - TL$. Factors that determine the transmission loss are discussed below.

- *Spherical spreading* – Along the direct path between the source and the receiver, spherical spreading of the sound energy causes the noise level to drop off at $20\log_{10}R$ with R the distance from the source.
- *Reflection, absorption, scattering and refraction* – The transmission path is often not only the direct path between the source and receiver. Multiple transmission paths can occur due to reflections from the surface and seafloor. A rough surface or seafloor causes scattering of the source noise, and some of the noise impacting on the seafloor is absorbed. Temperature variations in the water column cause refraction of sound. These transmission loss mechanisms are generally frequency dependent, and depend on the seafloor geo-acoustic properties and the surface and seafloor roughness.



- *Total transmission loss* – The combination of the various transmission loss mechanisms give a total transmission loss that may be smaller than due to spherical spreading alone, especially in shallow water environments. For example, this occurs when surface and seafloor reflected sound waves interfere at the receiver location such that the noise level is increased, i.e. the transmission loss is reduced.

Both computational and semi-empirical models have been developed for shallow water environments (Richardson et al. 1995). Semi-empirical models are least complex to implement, and generally give reasonable transmission loss predictions if the bottom is either flat or slopes uniformly and the speed of sound is not varying much with water depth. If the speed of sound varies greatly within the water column or there is significant bathymetry, such as a shipping channel, more complex computational models are required to obtain reasonable predictions.

A suitable modelling method can be determined based on the properties of the marine environment, including the bathymetry of the site, the acoustic properties of the sea bottom, the speed of sound profile within the water column, and the frequency characteristics of the noise source.

4.0 Marine mammals and sound

4.1 Marine mammal sounds

Marine animals live in an environment in which vision is not the primary sense because light does not penetrate far beneath the surface of the ocean. As such, marine mammals have become reliant upon sound, instead of light, as their primary sense for communication and being aware of their surrounding environment. Marine mammal communication has a variety of functions such as intra-sexual selection, mother/calf cohesion, group cohesion, individual recognition and danger avoidance.

- Baleen whales form one of the two suborders of cetaceans, and include all of the great whales such as the Southern Right and Humpback Whales. These species produce sounds that are primarily at frequencies below 1 kHz, and have durations from approximately 0.5 to over 1 second and sometimes much longer (Richardson et al. 1995). Humpback whales and some other species produce sounds with frequencies above 1 kHz. Many baleen whale sounds are uncomplicated tonal moans or sounds described as knocks, pulses, ratchets, thumps, and trumpet-like. Blue whales for example produce low frequency moans in the frequency range of 10–15 Hz.
- Toothed whales form the other of the two suborders of cetaceans, and include all dolphins, porpoises, beaked whales, sperm whales, and killer whales. These species communicate underwater with whistles at frequencies below 20 kHz with most energy typically occurring around 10 kHz (Richardson et al. 1995). The killer whale produces whistles with energy between 1–6 kHz and most of its sounds are pulsed. Sperm whales and some porpoises (phocoenid) produce clicks that are sometimes used for communication. Toothed whales also use echolocation sounds to determine the physical features of their surroundings. The echolocation sounds are pulses with most energy generally occurring at high frequencies between 30–130 kHz or higher (Richardson et al. 1995). Killer whale echolocation clicks, however, have most energy at 12–25 kHz.
- Pinnipeds include all seals and sea lions, and produce underwater vocalisations sounding like bark and clicks with frequencies ranging from below 1–4 kHz. Pinnipeds are especially vocal during the breeding season.

In summary, baleen whales produce sounds that are dominant at frequencies that overlap with man-made industrial noise, such as piling. In contrast, the social sounds produced by toothed whales occur above the low-frequency range where most man-made sounds have their dominant energy.

It is noted that the source levels, directionality, maximum detection distances, and functions of most marine animal sounds are unknown or poorly documented (Richardson et al. 1995). It is therefore generally not possible to evaluate with accuracy the severity of animal sound masking by man-made noise.

4.2 Marine mammal hearing sensitivity

4.2.1 Hearing thresholds and audiograms

The hearing sensitivity of marine mammals varies with frequency. Audiograms are used to represent an animal's sensitivity to sounds of different frequencies. An audiogram of a species relates the absolute threshold of hearing (in dB re 1 μ Pa) of that species to frequency. An animal is most sensitive to sounds at frequencies where its absolute threshold of hearing is lowest. As an example, humans are most sensitive to sounds between 2–4 kHz where the absolute threshold is lowest.

- *Toothed whales* – Hearing is most sensitive at frequencies ranging from 8–90 kHz. The upper limits of auditory sensitivity are believed to range from 100 kHz in the killer whale to over 150 kHz and sensitivity is typically poor below 1 kHz (Richardson et al. 1995). The hearing of the beluga whale and bottlenose dolphin extends at least as low as 75 Hz but their sensitivity at these low frequencies seems quite poor.
- *Baleen whales* – There are no underwater audiograms available for baleen whales, and there is a little data available on their hearing sensitivity. Baleen whale vocalisations are low in frequency content for a number of species, and the frequency range of acute hearing presumably includes the frequency range of vocalisations. From behavioural observations, it is apparent that baleen whales are quite sensitive to frequencies below 1 kHz, but can hear sounds up to a considerably higher but unknown frequency (Richardson et al. 1995).
- *Pinnipeds* – In comparison to toothed whales, pinnipeds tend to have lower frequencies of maximum hearing sensitivity, poorer sensitivity at frequencies of maximum hearing sensitivity, and lower high-frequency hearing cut-offs. However, some species may have better sensitivity at frequencies below 1 kHz than toothed whales.

4.2.2 Marine mammal functional hearing groups

Species of cetaceans and pinnipeds were assigned to functional hearing groups based on their hearing characteristics by Southall et al. (2007). Table 2 presents the four functional hearing groups, the estimated auditory bandwidth for each group, the listed species that may occur in SA state waters for each functional hearing group, and the group-specific frequency weightings.

Table 2 – Marine mammal functional hearing groups, estimated auditory bandwidth, listed species under the EPBC Act that may occur in SA state waters, and group-specific frequency weightings (Southall et al. 2007)

Functional hearing group	Estimated auditory bandwidth	Listed species that are known to, likely to, or may occur in SA state waters	Frequency-weighting
Low-frequency cetaceans (All baleen whales)	7 Hz to 22 kHz	Southern Right Whale (<i>Eubalaena australis</i>) – Migratory, endangered Minke Whale (<i>Balaenoptera acutorostrata</i>) – Migratory Bryde's Whale (<i>Balaenoptera edeni</i>) – Migratory Blue Whale (<i>Balaenoptera musculus</i>) – Migratory, endangered Pygmy Right Whale (<i>Caperea marginate</i>) – Migratory Humpback Whale (<i>Megaptera novaeangliae</i>) – Migratory, vulnerable	M _{lf}
Mid-frequency cetaceans (Majority of toothed whales)	150 Hz to 160 kHz	Bottlenose Dolphin (<i>Tursiops truncatus</i>) Common Dolphin (<i>Delphinus delphis</i>) Dusky Dolphin (<i>Lagenorhynchus obscurus</i>) – Migratory Killer Whale (<i>Orcinus orca</i>) – Migratory Spotted Bottlenose Dolphin (<i>Tursiops aduncus</i>)	M _{mf}
High-frequency cetaceans (Other toothed whales)	200 Hz to 180 kHz	None that may occur	M _{hf}
Pinnipeds (Seals and sea lions)	75 Hz to 30 kHz	Australian Sea Lion (<i>Neophoca cinerea</i>) – Vulnerable Australian Fur Seal (<i>Arctocephalus pusillus</i>) New Zealand Fur Seal (<i>Arctocephalus forsteri</i>)	M _{pw}



The low-frequency cetaceans group includes all baleen whales. Most toothed whales are represented in the mid-frequency cetaceans group. The high-frequency cetaceans group contains the pygmy and dwarf sperm whales.

The group-specific frequency weightings account for the fact that marine mammals do not hear equally well at all frequencies within their functional hearing range. Noise levels are M-weighted to de-emphasize frequencies that are near the lower and upper frequency end of the estimated hearing range, where noise levels have to be higher to result in the same auditory effect. The M-weighting functions are similar in intent to the C-weighting function that is commonly used when assessing the impact of high-amplitude sounds on humans.

4.3 Behavioural and physiological impacts of noise

Underwater noise impacts on marine mammals are often divided into behavioural and physiological impacts (Southall et al. 2007).

4.3.1 Behavioural impacts

Behavioural responses to noise include changes in vocalisation, resting, diving and breathing patterns, changes in mother-infant spatial relationships, and avoidance of the noise source (NRC 2005). Masking of biologically important sounds may interfere with communication and social interaction, and cause changes in behaviour as well.

Table 3 summarises noise exposure criteria for behavioural impacts. The noise exposure criteria are based on current interim criteria adopted by the US National Oceanic and Atmospheric Administration (NOAA 2011). The noise exposure criteria for impact piling and vibro-driving are different due to their different noise character (i.e. impulsive versus continuous).

Table 3 – Underwater noise exposure criteria for behavioural impacts (NOAA 2011)

Species	Behavioural noise exposure criteria	
	Impact piling	Vibro-driving
Cetaceans	SPL 160 dB re 1 μ Pa	SPL 120 dB re 1 μ Pa
Pinnipeds	SPL 160 dB re 1 μ Pa	SPL 120 dB re 1 μ Pa

M-weighting functions

The M-weighting (dB) is calculated as a function of frequency (f) as follows (Southall et al. 2007):

$$M(f) = 20 \cdot \log_{10} \frac{R(f)}{\max[R(f)]} \quad \text{with} \quad R(f) = \frac{f_{\text{high}}^2 f^2}{(f_{\text{high}}^2 + f^2)(f_{\text{low}}^2 + f^2)}$$

Table 2 presents the estimated lower (f_{low}) and upper (f_{high}) functional hearing limits for each of the four marine mammal functional hearing groups.

As an example, consider an underwater piling noise impact assessment for the Southern Right Whale. This species is represented in the low-frequency cetacean functional hearing group. The estimated lower and upper functional hearing limits are $f_{\text{low}} = 7$ Hz and $f_{\text{high}} = 22$ kHz, respectively for this group. The resulting M-weighting function for the Southern Right Whale is illustrated in Figure 4.

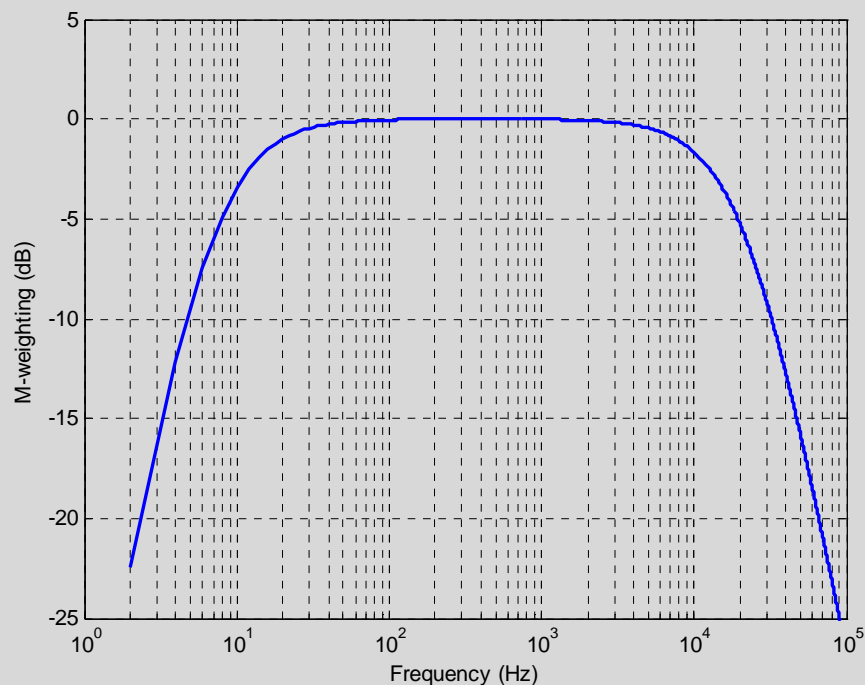


Figure 4 – M-weighting function for Southern Right Whale. This species is represented in the low-frequency cetaceans functional hearing group.

The M-weighting function in Figure 4 de-emphasises noise energy below 7 Hz and above 22 kHz, where the hearing sensitivity of the Southern Right Whale is thought to be poor. If the received noise has significant energy in these frequency ranges, the M-weighted level in dB(M) will be significantly lower than the linear level in dB.

4.3.2 Physiological impacts (TTS and PTS)

Most discussions of physiological effects of underwater noise have centred on the auditory system, as this system is likely to be most sensitive to noise.

When the auditory system is exposed to a high level of sound for a specific duration, the sensory hair cells begin to fatigue and do not immediately return to their normal shape. This causes a reduction in the animal's hearing sensitivity, or an increase in hearing threshold. If the noise exposure is below some critical sound energy level, the hair cells will eventually return to their normal shape. This effect is called a temporary threshold shift (TTS) as the hearing loss is temporary. If the noise exposure exceeds the critical sound energy level, the hair cells become permanently damaged and the effect is called permanent threshold shift (PTS).

Table 4 summarises noise exposure criteria for physiological impacts, which are based on the study presented by Southall et al. (2007), and noise exposure criteria adopted by the NOAA (2011). Note that the SEL noise exposure criteria are M-weighted levels expressed in dB(M) re 1 $\mu\text{Pa}^2\cdot\text{s}$.

Table 4 – Underwater noise exposure criteria for physiological impacts

Functional hearing group	Impact	Physiological noise exposure criteria	
		Impact piling	Vibro-driving
Low-frequency cetaceans	TTS	Peak 224 dB re 1 μPa SEL 183 dB(M _{lf}) re 1 $\mu\text{Pa}^2\cdot\text{s}$	SPL 180 dB re 1 μPa
	PTS	Peak 230 dB re 1 μPa SEL 198 dB(M _{lf}) re 1 $\mu\text{Pa}^2\cdot\text{s}$	Peak 230 dB re 1 μPa SEL 215 dB(M _{lf}) re 1 $\mu\text{Pa}^2\cdot\text{s}$
Mid-frequency cetaceans	TTS	Peak 224 dB re 1 μPa SEL 183 dB(M _{mf}) re 1 $\mu\text{Pa}^2\cdot\text{s}$	SPL 180 dB re 1 μPa
	PTS	Peak 230 dB re 1 μPa SEL 198 dB(M _{mf}) re 1 $\mu\text{Pa}^2\cdot\text{s}$	Peak 230 dB re 1 μPa SEL 215 dB(M _{mf}) re 1 $\mu\text{Pa}^2\cdot\text{s}$
High-frequency cetaceans	TTS	Peak 224 dB re 1 μPa SEL 183 dB(M _{hf}) re 1 $\mu\text{Pa}^2\cdot\text{s}$	SPL 180 dB re 1 μPa
	PTS	Peak 230 dB re 1 μPa SEL 198 dB(M _{hf}) re 1 $\mu\text{Pa}^2\cdot\text{s}$	Peak 230 dB re 1 μPa SEL 215 dB(M _{hf}) re 1 $\mu\text{Pa}^2\cdot\text{s}$
Pinnipeds	TTS	Peak 212 dB re 1 μPa SEL 171 dB(M _{pw}) re 1 $\mu\text{Pa}^2\cdot\text{s}$	SPL 190 dB re 1 μPa
	PTS	Peak 218 dB re 1 μPa SEL 186 dB(M _{pw}) re 1 $\mu\text{Pa}^2\cdot\text{s}$	Peak 218 dB re 1 μPa SEL 203 dB(M _{pw}) re 1 $\mu\text{Pa}^2\cdot\text{s}$

Note: TTS = Temporary threshold shift, PTS = Permanent threshold shift

4.3.3 Zones of impact

Given the source noise characteristics, a model that predicts the propagation of sound away from the source, and the noise exposure criteria, the radii within which impacts are expected to occur can be predicted. The resulting radii define zones of impact which are illustrated in Figure 5.

The following zones of impact can be defined (Richardson et al. 1995):

- *Zone of audibility* – Area within which marine mammal might hear the source noise but not show any significant behavioural response. The size of the zone of audibility is highly dependent on the ambient noise environment.
- *Zone of responsiveness* – Area within which the considered marine mammal might react behaviourally to the noise source. This zone can be smaller than the zone of audibility as marine mammals usually do not show significant behavioural responses to noises that are faint but audible.
- *Zone of hearing injury* – Area closest to the noise source where the noise levels may be high enough to cause a physiological impact such as TTS or PTS.

The zones of impact define the likely environmental footprint of a noise source and indicate how far away a noise source is expected to have an impact on a marine mammal species, either behaviourally or physiologically. This information, together with information on the biological importance of the marine site as a habitat for the considered species, e.g. breeding, calving or resting areas, or confined migratory routes or feeding areas, is used to assess the likely impact of a noise source.

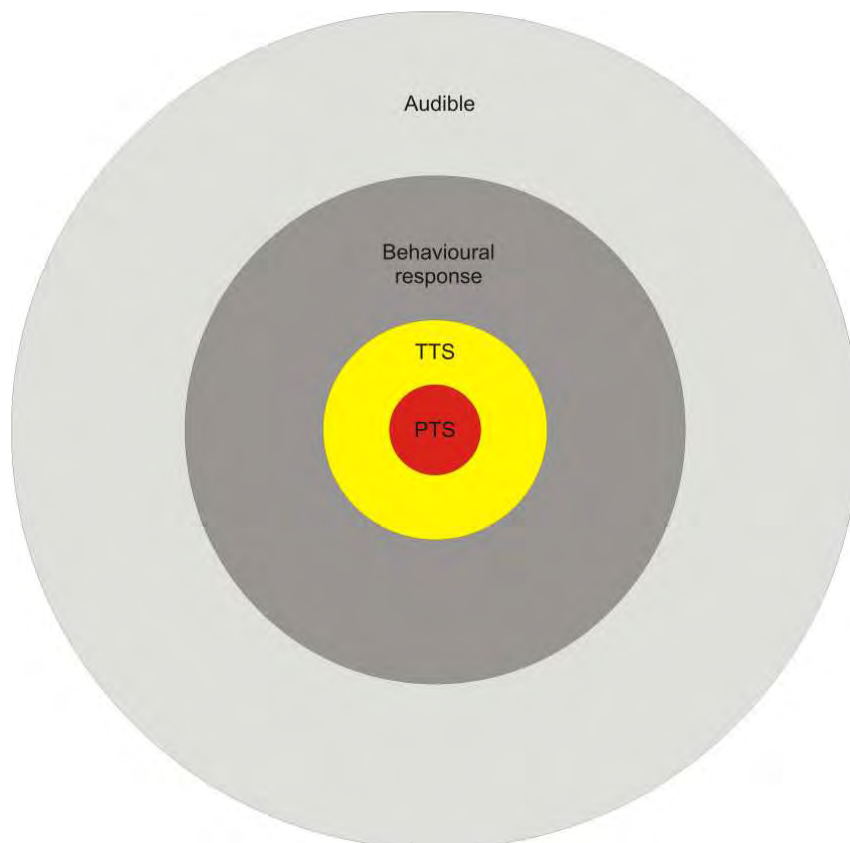


Figure 5 – Impact zones for underwater noise sources, including zone of audibility, responsiveness, and hearing injury. The zone of hearing injury is further divided into temporary and permanent threshold shift (TTS and PTS) zones.

5.0 Management and mitigation procedures

5.1 Framework

The framework for management and mitigation of underwater noise impact from piling activities has been adapted from Policy Statement 2.1, and includes safety zones, standard management and mitigation procedures, and additional management and mitigation measures. These are to be implemented as follows.

- *Safety zones* – The safety zones include observation and shut-down zones that are sized based on the likely noise levels produced by the piling activity. The safety zones should be used in the operational procedures that are part of the standard management and mitigation procedures. A diagram showing safety zones around a jetty is included in Figure 6.
- *Standard management and mitigation procedures* – These procedures are to be used for all piling activities irrespective of location and time of year, unless no marine mammal species listed under the EPBC Act are identified within the potential noise footprint of the piling activity.
- *Additional management and mitigation measures* – Additional management and/or mitigation measures to the standard management and mitigation procedures are to be used when the impacts of the piling activity on listed marine mammal species are likely to be significant (refer to Section 2.1.2).
- *Underwater noise impact assessment* – An underwater noise impact assessment should be conducted when the impacts of the piling activity on listed marine mammal species are likely to be significant (refer to Section 2.1.2). The noise impact assessment should be in general accordance with the methodology outlined in Sections 3.0 and 4.0.

Details on the safety zones, standard procedures, and additional measures are presented below.

5.2 Safety zones

The safety zones to be used in the standard management and mitigation procedures for piling activities include *observation* and *shut-down* zones. In the observation zone, the movement of marine mammals should be monitored to determine whether they are approaching or entering the shut-down zone. When a marine mammal is sighted within or appears to enter the shut-down zone, piling activities must be stopped as soon as reasonably practical.

The safety zones aim to minimise the likelihood of hearing injury to occur to marine mammals, and do not intend to prevent behavioural responses to audible but non-traumatic noise events. It is likely that marine mammals in the vicinity of a piling activity will show an avoidance reaction to the noise, which reduces the chance of marine mammals approaching the source close enough to enter the zone of hearing injury. The impacts of such a temporary displacement are unlikely to be significant unless it occurs during critical behaviours, such as breeding, feeding and resting, or in important areas such as migratory corridors.

The shut-down zones allow for the cumulative effect of multiple impacts, i.e. in the order of 30 minutes of exposure to pile driving noise for cetaceans and 2 minutes for pinniped. This allows some time to move away from the noise source thereby reducing the likelihood of hearing injury to occur.

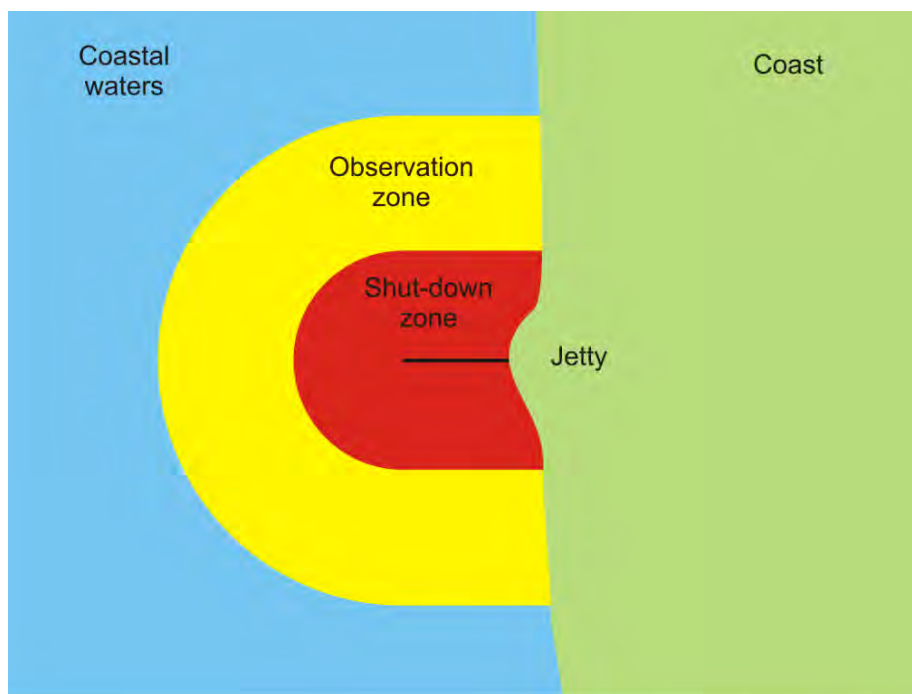


Figure 6 – Diagram showing safety zones around a jetty.

Safety zones for impact piling and vibro-driving activities are presented in Table 5, together with the estimated zone of behavioural response. The safety zones are sized by comparing expected received noise levels with the following noise exposure thresholds.

- *Impact piling* – Noise exposure threshold is SEL 150 dB(M) re 1 $\mu\text{Pa}^2\text{s}$ for a single impact at either 100 m or 300 m.
- *Vibro-driving* – Noise exposure threshold is SPL 180 dB re 1 μPa at 10 m for cetaceans and SPL 190 dB re 1 μPa at 10 m for pinniped.

Compliance with the noise exposure thresholds may be demonstrated through noise modelling or empirical measurements of a similar piling activity, i.e. similar piling rig and marine environment.

Table 5 – Summary of safety zones for impact piling and vibro-driving

Species	Noise exposure threshold	Observation zone	Shut-down zone	Zone of behavioural response
Impact piling	SEL in dB(M) re 1 $\mu\text{Pa}^2\text{s}$ for single impact			
Low-frequency cetaceans	≤ 150 dB(M _{ir}) at 100 m	1 km	100 m	≤ 150 m
	≤ 150 dB(M _{ir}) at 300 m	1.5 km	300 m	≤ 500 m
	> 150 dB(M _{ir}) at 300 m	2 km	1 km	≤ 3 km
Mid-frequency cetaceans	≤ 150 dB(M _{mf}) at 100 m	1 km	100 m	≤ 150 m
	≤ 150 dB(M _{mf}) at 300 m	1.5 km	300 m	≤ 500 m
	> 150 dB(M _{mf}) at 300 m	2 km	1 km	≤ 3 km

Species	Noise exposure threshold	Observation zone	Shut-down zone	Zone of behavioural response
High-frequency cetaceans	≤ 150 dB(M_{HF}) at 100 m	1 km	100 m	≤ 150 m
	≤ 150 dB(M_{HF}) at 300 m	1.5 km	300 m	≤ 500 m
	> 150 dB(M_{HF}) at 300 m	2 km	1 km	≤ 3 km
Pinnipeds	≤ 150 dB(M_{PW}) at 100 m	1 km	100 m	≤ 150 m
	≤ 150 dB(M_{PW}) at 300 m	1.5 km	300 m	≤ 500 m
	> 150 dB(M_{PW}) at 300 m	2 km	1 km	≤ 3 km
Vibro-driving	SPL in dB re 1 μPa for single impact			
Cetaceans	≤ 180 dB at 10 m	500 m	10 m when no avoidance	≤ 5 km
	> 180 dB at 10 m	1 km	100 m when no avoidance	≤ 10 km
Pinnipeds	≤ 190 dB at 10 m	500 m	10 m when no avoidance	≤ 5 km
	> 190 dB at 10 m	1 km	100 m when no avoidance	≤ 10 km

5.3 Standard management and mitigation procedures

5.3.1 Planning of piling activities

The planning stage of piling activities should consider the following:

- Timing and duration** – Avoid conducting piling activities during times when marine mammals are likely to be breeding, calving, feeding, or resting in biologically important habitats located within the potential noise impact footprint. Where possible, also avoid conducting piling activities in areas adjacent migratory corridors or important feeding areas during migration season. If work is proposed in these areas, the piling activities and associated mitigation measures may require further assessment under the EPBC Act.
- Piling method** – Use low noise piling methods, such as vibro-driving, instead of impact piling methods where possible. Vibro-driving methods produce lower noise levels and are not impulsive in character. This reduces the likelihood of hearing injury to occur within marine mammals. The piling method should be optimised taking into account time on-site and likely noise levels.
- Contract documentation** – Include the standard management and mitigation procedures, and any additional measures to be put in place, in the contract documentation.
- Trained crew** – Ensure that a suitably qualified person is available during piling activities to conduct the standard operational procedures outlined below. A suitably qualified person must have qualifications in ecology, zoology or environmental sciences and demonstrated experience with the identification and management of dolphins or whales. A briefing on environmental matters, including information on these guidelines, marine mammal identification, and the environmental legal obligations for companies operating in SA state waters, should be provided to all staff involved in the piling activities. Likely marine mammal concentration areas, peak migration paths and times, key feeding sites, and other aggregation areas should be identified during the planning stage and this information should be provided to trained crew members and the marine mammal observer to improve the identification and observation of marine mammals.

5.3.2 Standard operational procedures

Standard operation procedures that must be undertaken by contractors during piling activities include pre-start, soft start, normal operation, stand-by operation, and shut-down procedures.

- *Pre-start procedure* – The presence of marine mammals should be visually monitored by a suitably trained crew member for at least 30 minutes before the commencement of the soft start procedure. Particular focus should be put on the shut-down zone but the observation zone should be inspected as well, for the full extent where visibility allows. Observations should be made from the piling rig or a better vantage point if possible.
- *Soft start procedure* – If marine mammals have not been sighted within or are likely to enter the shut down zone during the pre-start procedure, the soft start procedure may commence in which the piling impact energy is gradually increased over a 10 minute time period. The soft start procedure should also be used after long breaks of more than 30 minutes in piling activity. Visual observations of marine mammals within the safety zones should be maintained by trained crew throughout soft starts. The soft start procedure may alert marine mammals to the presence of the piling rig and enable animals to move away to distances where injury is unlikely.
- *Normal operation procedure* – If marine mammals have not been sighted within or are not likely to enter the shut down or observation zone during the soft start procedure, piling may start at full impact energy. Trained crew should continuously undertake visual observations during piling activities and shut-down periods. After long breaks in piling activity or when visual observations ceased or were hampered by poor visibility, the pre-start procedure should be used. Night-time or low visibility operations may proceed provided that no more than 3 shut-downs occurred during the preceding 24 hour period.
- *Stand-by operations procedure* – If a marine mammal is sighted within the observation zone during the soft start or normal operation procedures, the operator of the piling rig should be placed on stand-by to shut-down the piling rig. An additional trained crew member should continuously monitor the marine mammal in sight.
- *Shut-down procedure* – If a marine mammal is sighted within or about to enter the shut-down zone, the piling activity should be stopped immediately. If a shut-down procedure occurred and marine mammals have been observed to move outside the shut-down zone, or 30 minutes have lapsed since the last marine mammal sighting, then piling activities should recommence using the soft start procedure. If marine mammals are detected in the shut-down zone during poor visibility, operations should stop until visibility improves.

A flow chart illustrating the standard operation procedures is included in Appendix A.

5.3.3 Compliance and sighting report

The contractor conducting the piling activities should maintain a record of procedures employed during operations. Information on any marine mammals sighted during the piling activity, and their reaction to the piling activity, may be used in the planning and assessment of future projects.

A report on the piling activity should at a minimum contain the location, date, start and completion time of the piling activity, information on the piling rig (hammer weight and drop height, pile size, number of piles, number of impacts per pile, etc.), details on the trained crew members conducting the visual observations, times when observations were hampered by poor visibility or high winds, times when start-up delays or shut-down procedures occurred, and the time and distance of any marine mammal sightings.

5.4 Additional management and mitigation measures

If the piling work will have, or is likely to have, a significant impact on any matters of NES under the EPBC Act, additional mitigation measures need to be considered to further minimise the likelihood for impacts to occur.

It may not be necessary, practical or possible to apply the additional management and mitigation measures outlined below. In planning a piling activity, the contractor conducting the piling should consider which of the measures best apply to their circumstances. Details of the measures to be applied should be provided to DPTI by the contractor.

In considering additional measures, there may be a trade-off between the noise reduction that can be achieved and the additional construction time that results from the mitigation measures. This needs to be taken into account when assessing the overall benefit of any additional measures.

5.4.1 Management measures

Additional management measures that need to be considered include some or all of the following.

- *Increased safety zones* – For biologically important habitats, such as breeding, resting or feeding areas, the shut-down zone should be increased to ensure that behavioural disturbance of marine mammals does not occur. Such a measure may not be needed for all marine mammal species or the entire construction period. As an example, it should be used for piling activities undertaken adjacent known whale breeding and calving sites during whale migration season. The size of increased safety zones should be established on a precautionary basis. Noise propagation modelling and relevant scientific evidence should be used to determine and justify an appropriate size of the safety zones.
- *Marine mammal observers* – The contractor conducting the piling should engage a suitably qualified marine mammal observer(s) (MMO) when migratory, vulnerable or endangered marine mammals are likely to be present within the area surrounding the piling activity. A suitably qualified MMO must have qualifications in ecology, zoology or environmental sciences and demonstrated experience with the identification and management of dolphins or whales. They should be experienced in marine mammal identification and behaviour and distance estimation, assist other trained crew members, and provide advice should marine mammals enter the observation zone.
- *Operations during night time or poor visibility* – The soft start procedure should not be initiated until conditions allow visual inspection of the safety zones. Daylight spotter vessels or aircraft should search the area to determine the presence of marine mammals. If marine mammals are spotted within or likely to enter the safety zones during night time operations, piling activities should be postponed.
- *Spotter vessel or aircraft* – If clear observations cannot be made from land or the piling rig, visual observations for the presence of marine mammals within the safety zones may be improved by employing a spotter vessel and/or aircraft. The spotter vessel and aircraft should maintain continuous contact with the piling operator. An MMO should be on board of both the vessel and aircraft.
- *Emerging technologies* – Passive acoustic monitoring (PAM) is an emerging technology that, once reliable commercial PAM systems are available, may be used to complement visual observations for the presence of marine mammals. PAM consists of listening to marine mammal's underwater vocalisations using hydrophones, and aims to identify and locate a variety of vocal marine mammals.

PAM presently has some limitations, and commercially available systems used to date are generally of poor quality, have left-right ambiguity (i.e. cannot determine which side the signal is coming from), and have no range-finding ability. However, extensive research into PAM is set to improve the performance of passive acoustic monitoring for marine mammals.

5.4.2 Mitigation measures

Additional mitigation measures that need to be considered include some or all of the following.

- *Press-in piling* – Press-in piling machines use static forces to install piles such that impacts are not required. Underwater noise levels have not been reported but are expected to be significantly less than those produced by conventional piling methods as all impulsive type of noise associated with the impact are removed. The technology has been used on land and in shallow waters when low noise construction methods were required. The current technology allows for installation of piles with diameters of up to 1.5 metres, with larger piles being replaced by multiple smaller piles.
- *Suction piling* – Suction piling uses tubular piles that are driven into the seabed, or dropped a few metres into a soft seabed, after which air and water are sucked out the top of the tubular pile thereby sinking the pile into the ground. Suction piles are often used to secure offshore floating platforms, in both shallow and deep waters. Although noise levels have not been reported, they are expected to be low as the only source of noise is the pump.
- *Pile type selection* – There is some evidence that steel H-piles produce significantly lower peak levels, potentially in the order of 10 to 20 dB, than circular concrete and steel piles. Use of alternative piles that produce less noise should be considered but may be somewhat limited as H-piles may not be suitable for all situations.
- *Bubble curtain* – A bubble curtain is a sheet of air bubbles that are produced around the location where the piling activity occurs. The bubbles are created by forcing air through small holes drilled in metal or PVC rings using air compressors, with either one ring deployed on the sea bottom or several vertically stacked rings forming a bubble ‘tree’. The bubbles in the bubble curtain create an acoustic impedance mismatch between the water and air trapped in the bubble, which results in sound attenuation across the bubble curtain. Reported noise reductions range from 3 to 20 dB. The use of bubble curtains may be limited by the water depth and practical or cost reasons, but may be considered when piling activities are expected to produce high noise levels and marine mammals are likely to be present within the area.
- *Cofferdam* – A cofferdam is created by placing a solid casing around a pile and removing the water from the casing. This approach has the potential to result in significant noise reductions as noise from the pile is radiated into the cofferdam rather than the water. The solid casing can be constructed from a single hollow pile or by interlocking sheet piles. The down-side is that construction of cofferdams often requires piling of the solid casing to achieve a water tight seal at the sea bottom, which should be of a significantly lower noise level and duration than the piling activity the cofferdam is put in place for. The use of cofferdams may be limited by the water depth and practical or cost reasons, but may be considered where significant impacts are likely to occur.

6.0 Underwater piling noise assessment

This section describes the typical steps that need to be taken as part of an underwater piling noise assessment. A flow chart for a typical assessment is presented in Figure 7.

Step 1 – What works are planned when, how, and where?

- Establish what works are planned at what location, and whether piling will be undertaken in SA state waters as part of the proposed works. These guidelines only apply if piling will occur in marine waters.
- Identify what piling method is likely to be used for the proposed works (e.g. impact piling or vibro-driving), and get information on the size, shape, length and material of the pile, the weight and drop height of the hammer, and the type and depth of the seabed, if available.
- Determine the duration, time of the day, and time of the year (e.g. during whale season) of the piling activity.

Step 2 – What marine mammal species are potentially affected?

- Determine the potential noise footprint of the piling activity, which is the marine area where piling noise could potentially impact on marine mammals. This footprint extends up to 10 km for impact piling activities and 5 km for vibro-driving activities.
- Use the EPBC protected matters search tool to identify listed marine mammal species that are likely to be present within the potential noise footprint of the piling activity. A link to this search tool is included on page 7. The status of the identified species may be listed as migratory, threatened, commonwealth marine species, or a combination of the aforementioned. Note that threatened species are listed as vulnerable, endangered, or critically endangered species.
- If no listed marine mammal species are found within the potential noise footprint, the piling activity may proceed without implementation of management and mitigation measures for underwater noise.

Step 3 – Are potential impacts on listed marine mammals likely to be significant?

- Where listed species are present, determine if the work will occur in a biologically important habitat for the species, such as a breeding, calving or resting area, or a migratory route or feeding area during season (refer to Section 2.1.2 for more details).
- If the piling work will not have, or is not likely to have, a significant impact on any matters of NES under the EPBC Act, implement the standard management and mitigation procedures from Section 5.3. The safety zones to be used in these procedures should be determined as follows:
 - Engage an acoustic consultant to determine the safety zones that apply from Table 5. The acoustic consultant needs information on the piling method to be used, the size, shape, length and material of the pile, the weight and drop height of the hammer, and the type and depth of the seabed, if available. Refer to Section 5.2 for more details on the safety zones.
 - The acoustic consultant may document noise levels and identify the relevant project noise exposure thresholds in Table 5 through noise modelling or empirical measurements of a similar piling activity, i.e. similar piling rig and marine environment.



- If the piling work will have, or is likely to have, a significant impact on any matters of NES under the EPBC Act:
 - Engage an acoustic consultant to undertake a site specific acoustic assessment. The underwater noise impact assessment should address the following as a minimum:
 - Determine the existing ambient noise environment based on measurements or predictions from available empirical models (Wenz 1962).
 - For the considered marine mammal species, establish the likely hearing sensitivity and bandwidth, and determine noise exposure criteria for behavioural and physiological impacts based on Tables 4 and 5.
 - Determine the expected source levels for the piling activity, and predict received levels versus distance from the piling activity using a suitable noise propagation modelling method.
 - Estimate the size of the zone of audibility, responsiveness, and hearing injury based on the above information, and determine suitable sizes for the safety zones.
 - Consider additional management and mitigation measures (Section 5.4).
 - Prepare a referral under the Commonwealth legislation (EPBC Act). The EPBC referral should detail the management and mitigation procedures that will be put in place to minimise the impacts of underwater piling noise.
 - Obtain approval under State legislation if required.
 - If the potential noise footprint of the piling activity overlaps with the Adelaide Dolphin Sanctuary, advise the Adelaide Dolphin Sanctuary Advisory Board on the proposed works. Refer to Section 2.2.1.
 - If the potential noise footprint of the piling activity overlaps with an aquatic reserve or marine park, establish whether legislative approvals are required under the *Fisheries Management Act 2007* or *Marine Parks Act 2007*. Refer to Sections 2.2.3 and 2.2.4.

Step 4 – Contract management

- Include management and mitigation procedures, and additional management and mitigation measures if applicable, into contract documentation.
- Ensure contractor provides a compliance and sighting report. Refer to Section 5.3.3.
- Undertake auditing of the piling activity.

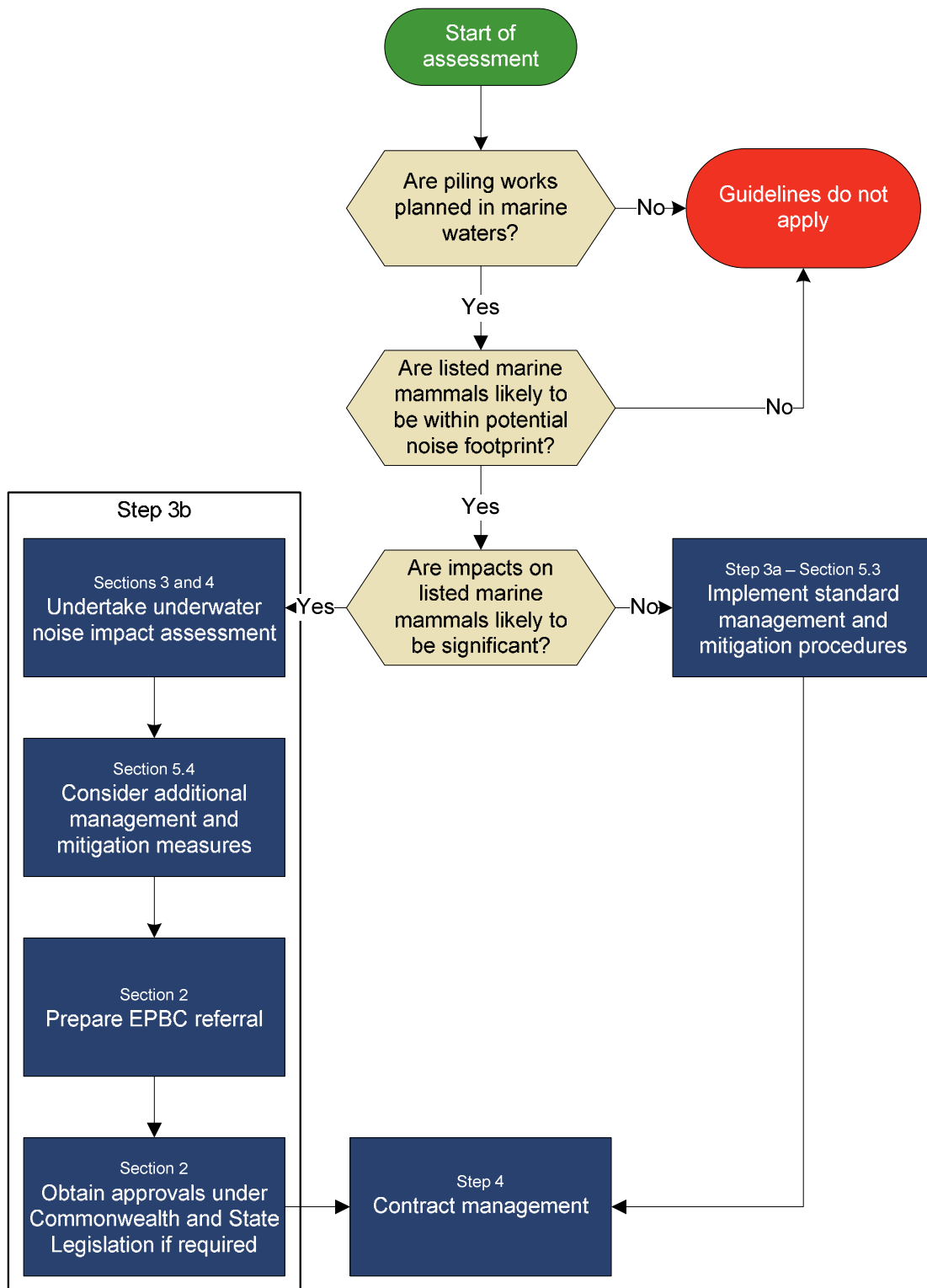


Figure 7 – Noise impact assessment



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Appendix A – Procedures flow chart

Underwater Piling Noise Guidelines

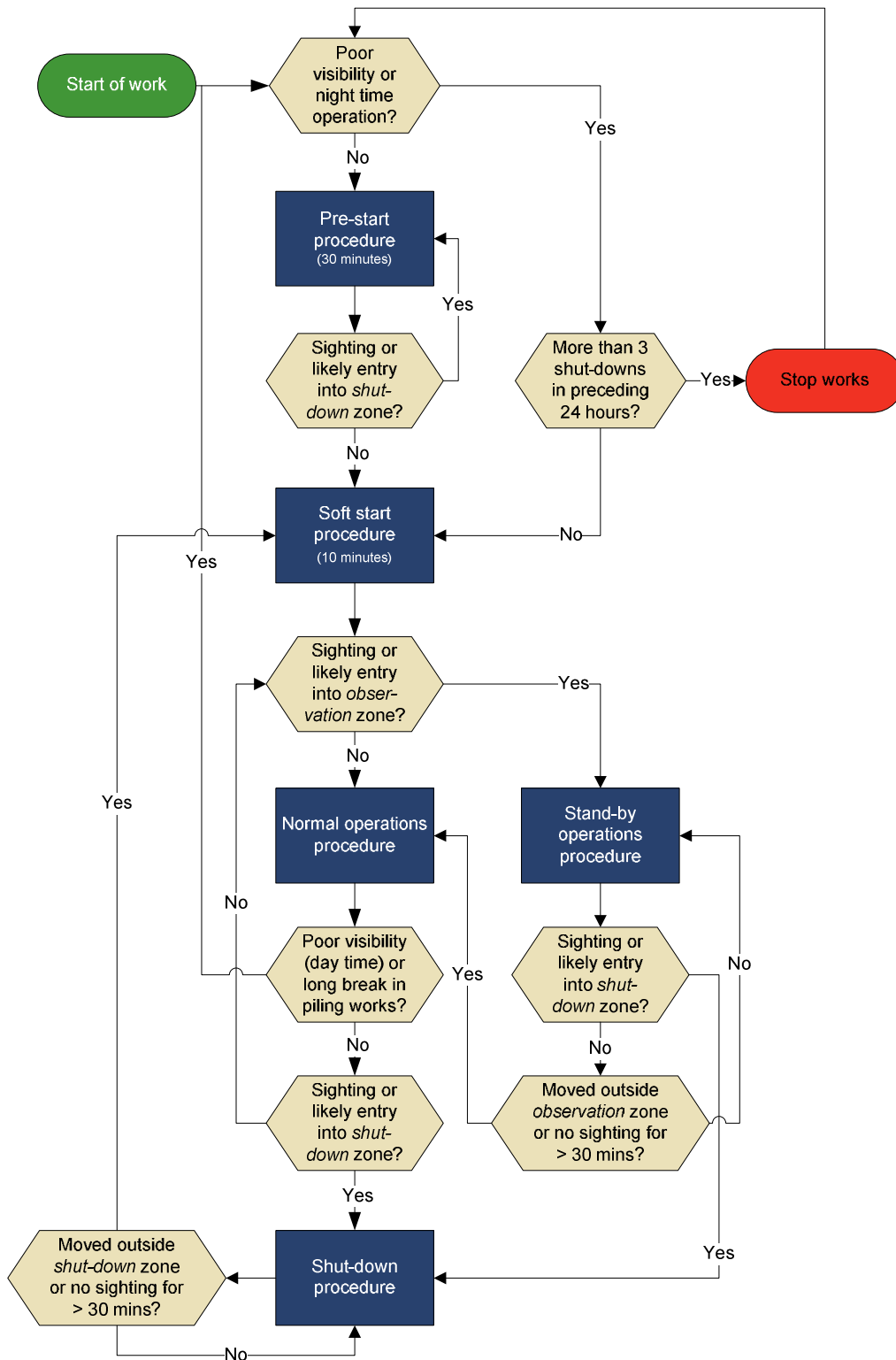


Figure 8 – Flow chart for procedures to be undertaken by contractor during piling activities



Appendix B – Listed species information

Cetaceans & Pinnipeds found in South Australian Neritic Zone Waters that appear on Protected Matters Search Tool searches of South Australian Marine Facilities

Key: Species or species habitat - ✓ known to occur; # Likely to occur; + May occur; * Foraging, feeding or related behaviour known to occur; ^ Breeding known to occur

Cetaceans – Whale Species	Pelagic/ Oceanic/ Neritic	EPBC Listing	Regions**							Comments	
			Eyre & Upper Eyre	Far West	Fleurieu	Kangaroo Island	Metro	Mid North	South East		
Antarctic Minke Whale <i>(Balaenoptera bonaerensis)</i>		Migratory; Marine	+	+	+	+			+	Pelagic species; Likely occurrence in state waters during winter months; Species fact sheet available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=67812	
Blue Whale <i>(Balaenoptera musculus)</i>	Oceanic	Threatened (Endangered); Migratory; Marine		+	+	+			+	#*	Species fact sheet available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=36 Distribution Map available at: http://www.environment.gov.au/coasts/species/cetaceans/pubs/blue-map.pdf Listed as Endangered under the National Parks & Wildlife Act, 1972;
Bryde's Whale <i>(Balaenoptera edeni)</i>	Oceanic and inshore	Migratory; Marine	+	+	+	+	+	+	+	+	Species fact sheet available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=35 ; Listed as Rare under the National Parks & Wildlife Act, 1972; Likely to be found along either east or west coast, less so along the south coast.
Humpback Whale <i>(Megaptera novaeangliae)</i>	Antarctic pelagic, (summer); temperate– subtropical/tropic al coastal (winter)	Threatened (Vulnerable); Migratory; Marine	#	#	#	#	#	#	#	#	Species fact sheet available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=38 Distribution map available at: http://www.environment.gov.au/coasts/species/cetaceans/pubs/humpback-map.pdf Listed as Vulnerable under the National Parks & Wildlife Act, 1972;
Killer Whale <i>(Orcinus orca)</i>	Oceanic, pelagic and neritic	Migratory; Marine		+	+	+				+	Species fact sheet available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=46 May be more common in cold, deep waters. Off Australia, often seen along continental slope and on shelf. Often seen near seal colonies.
(Dwarf) Minke Whale Ssp. <i>(Balaenoptera acutorostrata)</i>	Generally oceanic	Marine		+	+	+				+	Species fact sheet available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=82013 ; Listed as Rare under the National Parks & Wildlife Act, 1972; Sub-species of the Antarctic Minke Whale.
Pygmy Right Whale <i>(Caperea marginata)</i>	oceanic, pelagic and inshore	Migratory; Marine	+	+	+	+	+	+	+	+	Species fact sheet available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=39 Concentrations of stranded animals have occurred at the entrance of the gulfs in South Australia and around Tasmania, but live sightings have predominated in the former region (Kemper 2002a).
Southern Right Whale (Eubalaena australis)	Pelagic (summer), Onshore (winter),	Threatened (Endangered); Migratory; Marine	✓ ^	✓ ^	✓ ^	✓	✓	✓	✓	✓	Species fact sheet available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=40 ; Listed as Vulnerable under the National Parks & Wildlife Act, 1972; Distribution map available at: http://www.environment.gov.au/coasts/species/cetaceans/pubs/southern-right-map.pdf

Cetaceans & Pinnipeds found in South Australian Neritic Zone Waters that appear on Protected Matters Search Tool searches of South Australian Marine Facilities

Cetaceans – Dolphin Species	Pelagic/ Oceanic/ Neritic	Listing	Eyre & Upper Eyre	Far West	Fleurieu	Kangaroo Island	Metro	Mid North	South East	Comments
Bottlenose Dolphin (<i>Tursiops truncatus s.str.</i>)	Coastal, Estuarine, Pelagic & Oceanic	Marine	+	+	+	+	+	+	+	Species fact sheet available at : http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=68417 From the sighting and stranding records the Bottlenose Dolphin appears to occur in at least two main locations in Australia: south Pacific Ocean and southern Indian Ocean. All seasons
Common Dolphin, Short-beaked Common Dolphin (<i>Delphinus delphis</i>)	Neritic, pelagic and oceanic	Marine	+	+	+	+	+	+	+	Species fact sheet available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=60 Common Dolphins appear to occur in two main locations around Australia, with one cluster in the southern south-eastern Indian Ocean and another in the Tasman Sea. All seasons
Dusky Dolphin (<i>Lagenorhynchus obscurus</i>)	Primarily neritic but also pelagic at times when water temp >18°C	Migratory; Marine	+	+	+	+	+	+	+	Species fact sheet available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=43 Only 13 reports since 1828, however confirmed sightings near Kangaroo Island
Indian Ocean Bottlenose Dolphin, spotted Bottlenose Dolphin (<i>Tursiops aduncus</i>)		Marine	#	#	#	#	#	#	#	Species fact sheet available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=68418 All seasons
Risso's Dolphin, Grampus (<i>Grampus griseus</i>)	Generally considered pelagic and oceanic.	Marine		+	+	+			+	Species fact sheet available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64 ; Listed as Rare under the National Parks & Wildlife Act, 1972; Fraser Island has the only known 'resident' population in Australia. (Kemper, 1996)
Mammals – Pinniped Species		Listing	Eyre & Upper Eyre	Far West	Fleurieu	Kangaroo Island	Metro	Mid North	South East	Comments
Australian Fur Seal, Australo-African Fur-seal (<i>Arctocephalus pusillus</i>)		Marine	+		+	+	+	+	+	Species fact sheet available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=21
Australian Sea-lion (<i>Neophoca cinerea</i>)		Threatened (Vulnerable); Marine	+	#	+	# +	+	+	+	Species fact sheet available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=22 Listed as Vulnerable under the National Parks & Wildlife Act 1972.
New Zealand Fur-seal (<i>Arctocephalus forsteri</i>)		Marine	+	+	+	+	+	+	+	Species fact sheet available at: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=20

****Regions:** *Eyre & Upper Eyre* – Cowell (Franklin Harbour), Port Lincoln; *Far West* – Fowlers Bay, Port Kenney, Streaky Bay, Venus Bay; *Fleurieu* – Bluff (Rosetta Head), Cape Jervis, Causeway (Granite Island), Rapid Bay, Screwpile; *Kangaroo Island* – American River, Kingscote, Penneshaw, Vivonne; *Metropolitan* – Grange, Henley, Largs, North Arm, Outer Harbour, Semaphore; *Mid North* – Moonta Bay, Port Broughton, Port Wakefield, Wallaroo Spur; *South East* – Beachport, Blackfellows Caves, Cape Jaffa, Port MacDonnell, Southend

NB – Each region has sites which may or may not contain any given species within a Protected Matters Search Tool search. It is recommended that an individual search be undertaken for each site where an activity is proposed to be undertaken to determine the likelihood (known, likely, may) of the presence of any given species.

Cetaceans & Pinnipeds found in South Australian Neritic Zone Waters that appear on Protected Matters Search Tool searches of South Australian Marine Facilities

Although the species listed in the above table are those listed as occurring on EPBC PMST reports for the regions as stated above, consultation with Catherine Kemper, Senior Curator of Mammalogy at the South Australian Museum has revealed that some of those species listed do not occur in South Australian waters either frequently if at all (Kemper pers. Comm.) as some are pelagic (oceanic) as opposed to Neritic (inshore). Of those species listed above found on the PMST reports for the marine regions as defined by DPTI, Catherine Kemper indicated that the species listed below are most likely to present in South Australian waters:

- Southern Right Whale Seasonal – April through October
- Pygmy Right Whale Possibly seasonal – may occur any time but mainly spring and summer
- Humpback Whale Any season but mainly June, July and August
- Short-beaked Common dolphin All seasons
- Killer Whale Unknown
- Indo-Pacific Bottlenose Dolphin All seasons
- Common Bottlenose Dolphin All seasons

Those species unlikely or not known to be present in South Australian waters (Kemper Pers. Comm.):

- Dwarf Minke Whale
- Bryde's Whale

For the purposes of risk assessment that the likelihood of any given species to be present at any location is:

Known = High; Likely = Medium; May = Low

Appendix H

**Guidelines for whale and dolphin
watching**



Australian Government

Department of the Environment and Energy

Australian National Guidelines for Whale and Dolphin Watching 2017



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Cover image: Whale watching in Hervey Bay, Queensland. © Robert Thorn

Back cover: A whale tail. © L. Parsons

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Introduction

Australia's vast coastline provides many opportunities for people to watch whales and dolphins by boat, aircraft or from land.



Common bottlenose dolphins. © Ian Anderson (CALM)

While dolphin watching tends to occur all year round, the highest intensity whale watching activities are focussed on humpback whales and southern right whales that migrate through our coastal waters from May until November.

In recent times, whale and dolphin watching has increased in popularity and it now presents an important economic opportunity for many coastal communities. To ensure this activity remains sustainable and minimises impacts on whales and dolphins, the Australian Government has established a legal regime under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and *Environment Protection and Biodiversity Conservation Regulations 2000* (EPBC Regulations) that addresses the management of whale and dolphin watching in Commonwealth waters. The Australian Government works closely with state and territory governments and

the Great Barrier Reef Marine Park Authority to help develop complementary management regimes in all Australian waters.

The *Australian National Guidelines for Whale and Dolphin Watching 2017* (the national guidelines) replace the *Australian National Guidelines for Whale and Dolphin Watching 2005*. They have been developed in consultation with the state and territory governments and relevant stakeholders, such as the whale and dolphin watching industry, to ensure they are applicable across all Australian waters.

The purpose of the national guidelines is to:

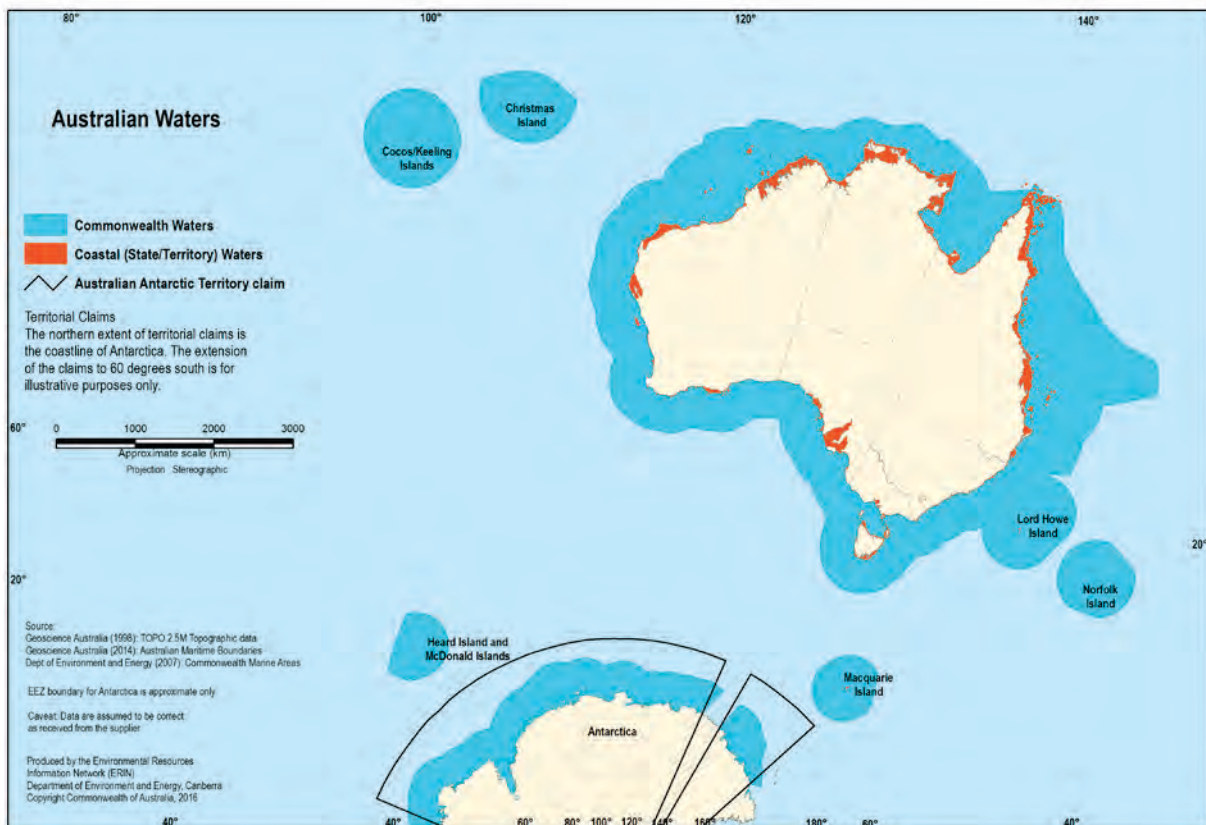
1. provide information to commercial operators and the general public on how they can watch whales and dolphins safely and consistently with the EPBC Act and EPBC Regulations which apply in Commonwealth waters
2. encourage a consistent approach to whale and dolphin watching across all jurisdictions
3. make recommendations to state and territory governments in relation to additional management measures to be applied in situations where there is a need to better protect either whales and dolphins or people. Typically this would occur in situations where there is a high level of whale and dolphin watching activity, where animals may be particularly sensitive to disturbance, or where new techniques are being proposed.

It is important to note that the state and territory governments must implement their own laws and guidelines to best suit their jurisdictions. In some cases, these will differ from the national guidelines and so it is the responsibility of the public and whale watching industry to be aware of the laws that apply in their specific location.

The EPBC Act and EPBC Regulations apply to whale watching undertaken in Commonwealth waters. Typically, the boundary for Commonwealth waters starts three nautical miles from the shore and extends to the edge of our exclusive economic zone at 200 nautical miles.

Figure 1 shows the extent of Commonwealth waters around Australia's mainland and territories. State and territory regulations apply in the coastal waters adjacent to each state and territory.

Figure 1—A map showing the extent of Commonwealth waters and state and territory waters.



Disturbed or Injured Whales and Dolphins

It is not always possible or desirable to get close to a whale or dolphin. Some animals may become disturbed by the presence of vessels, aircraft or people or may be injured, including through entanglement with fishing gear or marine debris. Disturbed and injured whales behave unpredictably and even aggressively and so it is important that they are not approached, except by authorised personnel.

The following may indicate that a whale or dolphin is disturbed or injured:

- moves away erratically and at speed
- stops feeding
- evidence of ropes, nets or buoys being attached to the animal
- the presence of lacerations
- changes in direction or speed of swimming
- hasty dives

- changes in breathing patterns
- increased time spent below the surface
- changes in body posture
- changes in acoustic behaviour
- aggressive behaviours, such as tail slaps and trumpet blows.

Whales and dolphins that are disturbed or injured may stop feeding or nursing their young. They may also alter their migration paths and become displaced from important habitats used for resting, breeding, calving or feeding.

For your safety, it is important that you do not approach a disturbed or injured animal and that you stay outside the caution zones outlined in the national guidelines if in a vessel or as a swimmer. Injured, stranded or entangled animals should be reported to the relevant authority. Contact details for reporting injured, stranded or entangled animals in the states and Northern Territory are provided below.

Table 1—State and territory contact details for reporting injured, stranded or entangled whales and dolphins.

STATE/TERRITORY	CONTACT DETAILS
NEW SOUTH WALES	NSW National Parks & Wildlife Service State Duty officer: (02) 9895 6444 ORRCA whale and dolphin rescue: (02) 9415 3333 (24 hours hotline)
SOUTH AUSTRALIA	24 hour FISHWATCH hotline: 1800 065 522
TASMANIA	Department of Primary Industries, Parks, Water and Environment Marine Conservation Program Whale Hotline: 0427 942 537
VICTORIA	Department of Environment Land Water and Planning Whale and Dolphin Emergency Hotline: 1300 136 017
WESTERN AUSTRALIA	Wildcare Helpline: (08) 9474 9055
QUEENSLAND	RSPCA Qld: 1300 ANIMAL (1300 264 625)
NORTHERN TERRITORY	Marine Wild Watch hotline: 1800 453 941

How to use the National Guidelines

The national guidelines address the various ways people watch whales and dolphins, including from a vessel, an aircraft, while swimming and from shore.

It also provides information on other issues associated with whale and dolphin watching, such as feeding, and touching animals, as well as managing noise.

Most of the sections in this document contain two parts. The first part of these sections provides a plain English version of the EPBC Regulations that apply to whale and dolphin watching in Commonwealth waters, while the second part outlines recommended management that may be applied in certain situations where a greater level of protection or an alternative management approach is needed.

1—Requirements in Commonwealth waters

When interacting with whales and dolphins, people must comply with the requirements of the EPBC Regulations that apply to whale and dolphin watching activities in Commonwealth waters.

These requirements are described in the standards outlined under Part 1 of the sections on watching whales and dolphins from vessels, from aircraft and while swimming and the section on feeding.

These standards have also largely been reflected in state guidelines and regulations. However, if you are whale and dolphin watching in state or territory waters you will need to be familiar with the relevant legislation that applies there since, in some cases, the requirements are different.

2—Additional management

Many species of whales and dolphins are resident in or dependent upon specific areas for their survival. In these areas, there is a greater potential for whale and dolphin watching to have a detrimental impact, which may include disruption of important behaviour or displacement from favoured habitat areas.

The Conservation Values Atlas (www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf) identifies Biologically Important Areas (BIAs) for some whale and dolphin species. BIAs are spatially defined areas where aggregations of individuals of a species are known to display biologically important behaviour such as breeding, foraging, resting or migration. For more information on BIAs visit the Department of the Environment and Energy's website at: www.environment.gov.au/marine/marine-species/bias.

In areas such as BIAs, or where there is a substantial whale and dolphin watching industry, or when new techniques for watching whales and dolphins are being introduced, there may be a need to implement additional management measures. These measures may be applied through various administrative means including regulations, permits, licenses, management plans and codes of practice.

Additional management requirements may lead to different measures to those currently required under the EPBC Regulations, including the potential to allow closer interactions that are coupled with more stringent restrictions on other elements of an operation (e.g. limits on the time spent with animals, number of trips per day, area closures etc).

Additional management requirements will apply primarily to the commercial whale and dolphin watching industry. Under the EPBC Act and EPBC Regulations they may be implemented through the declaration of an Important Cetacean Habitat Area (an area of important habitat for one or more species of whale or dolphin that requires enhanced protection), which then requires commercial operators to obtain a permit to undertake whale watching in that area. They may also be reflected in laws, guidelines and management plans adopted by the states or territories.

Special Interest Animals

In some circumstances particular animals may require additional protection. Examples include predominately white whales and entangled animals, which often attract the attention of the media and members of the public. In order to prevent this attention from causing additional disturbance or distress to an animal, state and territory governments may impose different restrictions on vessels, aircraft and swimmers when approaching a special interest animal. It is recommended that vessels maintain a distance of at least 500m from ‘Special Interest Animals’, as required under Queensland legislation.



Migaloo the albino humpback whale © Craig Parry

Watching whales and dolphins

To protect whales and dolphins and achieve 'best practice' in whale and dolphin watching, interactions must allow animals to move freely without being chased or harassed if they choose not to interact.

The national guidelines stipulate approach distances and practices for watching whales and dolphins under different circumstances. If the whale or dolphin chooses to approach more closely the EPBC Regulations will not be breached. If, while approaching a whale or dolphin the animal shows signs of disturbance then the approach must be abandoned immediately.

Vessels

One of the most common ways of watching a whale or dolphin is from a vessel. If vessels are appropriately designed and operated the impacts of whale and dolphin watching can be minimised. Vessels should be manoeuvred with care around whales and dolphins, and erratic vessel behaviour around animals should not occur. Responsible vessel operation, that allows the animals the choice to interact, will not only minimise impacts but may also provide people with a safer and more enjoyable experience.

Part 1—Requirements for operating a vessel in Commonwealth waters

Certain vessel types, due to the noise they generate or the speed at which they travel, may lead to greater negative impacts. Due to this some vessels are prohibited from engaging in whale and dolphin watching. These are referred to as prohibited vessels.

Prohibited vessels

Vessels prohibited for use in whale and dolphin watching include all personal motorised watercraft (e.g. jet skis and underwater scooters), parasails, remotely operated craft, wing-in-ground effect craft, and hovercraft.

Prohibited vessels must not approach closer than 300m to any whale or dolphin. If a prohibited vessel unintentionally moves to within this distance it should slow down and avoid the whale or dolphin, moving away from the animal at a speed of less than 6 knots, to at least 300m.

Allowable Vessels

Vessels which may engage in whale and dolphin watching include all other motorised, paddle and/or sail craft (e.g. motorboats, yachts, kayaks, canoes, surf skis and inflatable craft).

Approach Distances

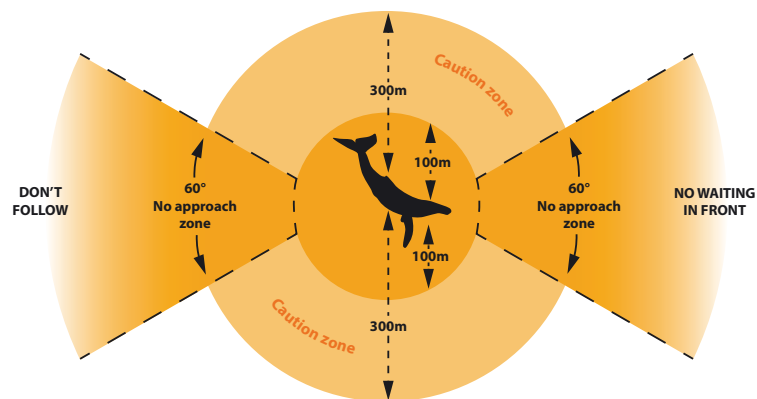
To operate allowable vessels consistent with the EPBC Regulations and minimise potential impacts on whales and dolphins, vessels must comply with the approach distances and operating procedures described in this section and summarised in Table 2.

Note, if a whale or dolphin surfaces in the vicinity of your vessel when you are travelling for a purpose other than whale and dolphin watching, take all care necessary to avoid collisions. This may include stopping, slowing down and/or slowly steering away from the animal.

Whales

Figure 2 illustrates the approach distances for vessels near adult whales. The **no approach zone** is within 100m to an adult whale; this is a zone of total vessel exclusion and also includes the area directly in front of or behind a whale out to 300m. Vessels must not enter the **no approach zone** and must not wait in front of the direction of travel of an animal or pod of animals.

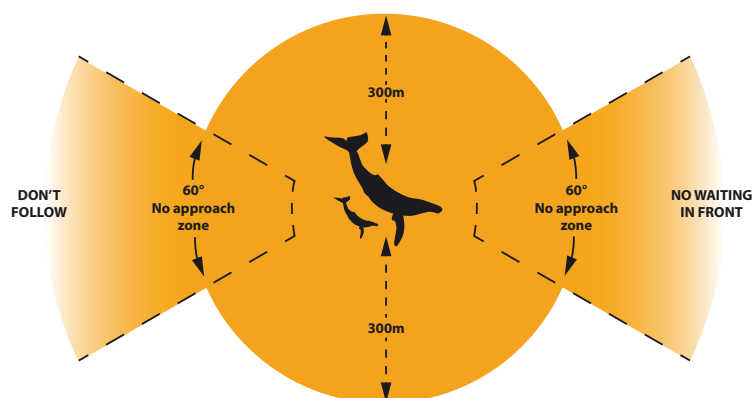
Figure 2—Vessel approach distances for adult whales.



The caution zone is the area within 300m either side of a whale. No more than three vessels are allowed within the caution zone at any one time and vessels must operate at speeds of less than 6 knots within this zone.

Figure 3 illustrates the approach distances for vessels near whale calves. **Vessels must not enter the caution zone when a calf is present.** Vessels must not enter or remain in the caution zone of a whale if it shows signs of disturbance.

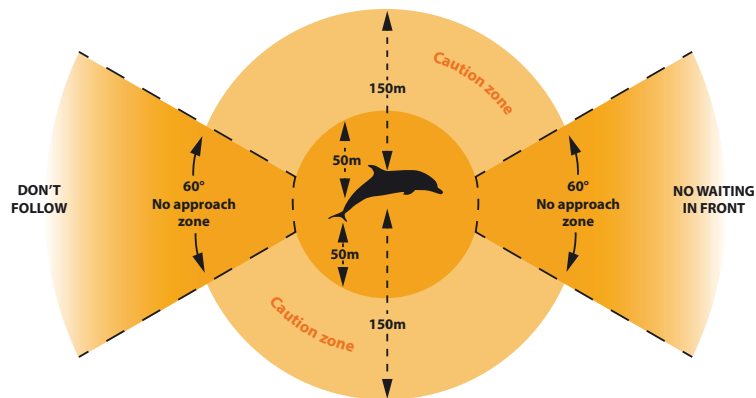
Figure 3—Vessel approach distances for whale calves



Dolphins

Figure 4 illustrates the approach distances for vessels near adult dolphins. The **no approach zone** is within 50m of an adult dolphin; this is a zone of total vessel exclusion and also includes the area directly in front of or behind a dolphin out to 150m. Vessels must not enter the **no approach zone** and must not wait in front of the direction of travel of an animal or pod of animals.

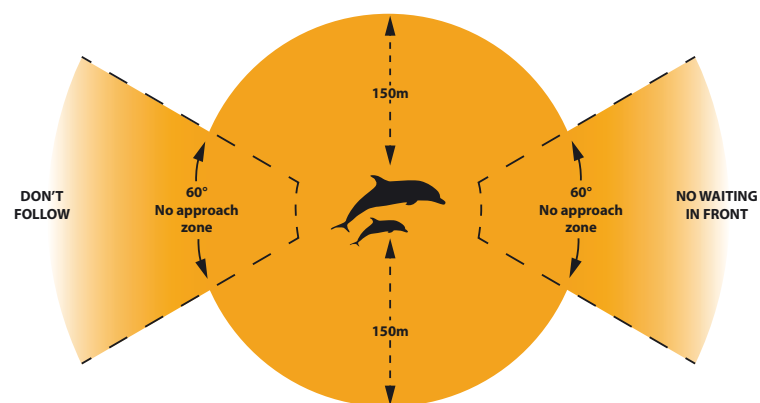
Figure 4—Vessel approach distances for adult dolphins



The caution zone is the area within 150m either side of a dolphin. No more than three vessels are allowed within the caution zone at any one time and vessels must operate at speeds of less than 6 knots within this zone.

Figure 5 illustrates the approach distances for vessels near dolphin calves. **Vessels must not enter the caution zone when a calf is present.** Vessels must not enter or remain in the caution zone of a dolphin if it shows signs of disturbance.

Figure 5—Vessel approach distances for dolphin calves



For the purposes of the national guidelines, a calf is defined as **an animal which is less than half the length of the mother to which it usually remains in close proximity.**

Table 2—summary of vessel approach distances and operation.

Requirements	Distance to an adult whale	Distance to an adult dolphin
<i>No approach zone</i>	Within	Within
<ul style="list-style-type: none"> a zone of total vessel exclusion no waiting in front of direction of travel no following directly behind 	100 metres to the side 300m in front and to the rear	50 metres to the side 150m in front and to the rear
<i>Caution zone</i>	Between	Between
<ul style="list-style-type: none"> speed must be no more than 6 knots maximum of 3 vessels do not enter caution zone if animals are injured, stranded, entangled or distressed do not enter the caution zone if a calf is present do not enter if operating a prohibited vessel 	300 and 100 metres	150 and 50 metres
<i>Bow riding</i>		
<ul style="list-style-type: none"> do not deliberately encourage bow riding when animals are bow riding - do not change course or speed suddenly if there is a need to stop – reduce speed gradually 		

Part 2—Additional management considerations for vessels

Recent research and experience shows that whale and dolphin watching from vessels has a relatively low impact on target animals when appropriate management measures, such as those described in these guidelines, are adhered to. There are, however, some situations where this is not the case and special management considerations may apply.

Whales

In some situations whale watching can have a greater impact on whales or pose an increased risk to human safety. Whales that are calving, accompanied by young, resting or feeding can be more sensitive to disturbance and so should not be approached.

Southern right whales use sheltered near-shore areas along the southern Australian coast. Their preference for remaining in these areas for relatively long periods of time and using shallow water makes them an obvious focus for whale watchers. Being so close to the coast also makes southern right whales more prone to disturbance, particularly when they are about to give birth or while nursing a calf. Being

disturbed by a vessel may lead to the whales moving away into less suitable habitat or behaving aggressively. For this reason both commercial and recreational whale watching vessels should be extra vigilant when operating near southern right whales and other whale species that are remaining in an area to rest or nurse calves.

A number of whale species are known to feed in Australian waters and these include blue, brydes, humpback and killer whales. It is important that whale watching vessels do not interrupt feeding whales. If a vessel encounters a whale feeding it is recommended that it moves outside the caution zone to reduce the risk of disturbance.

If a particular location attracts a large number of whale watching vessels or is regularly frequented by resting, feeding or calving whales then additional management measures may need to be implemented.

These can include:

- requiring boat skippers and owners to participate regularly in a certified training course
- limiting the number of boats that can offer commercial whale watching experiences
- limiting the time for interactions by commercial whale watching boats
- increasing no-approach distances.

Dolphins

When dolphin watching is undertaken in enclosed bays and estuaries, where dolphins are restricted to relatively small areas or where there are a large number of both recreational and commercial vessels operating, additional management may be required to provide enhanced protection for dolphin populations. It is recommended that state and territory governments consider introducing a mechanism that involves authorising commercial activities through the use of permits or licenses, or the use of an industry code of conduct to enhance the protection of inshore dolphin populations. The following measures should be considered when establishing a management regime:

- requiring boat skippers and owners to participate regularly in a certified training course

- limiting the number of boats that can offer commercial dolphin watching experiences in a given area
- limiting the time for interactions by commercial dolphin watching boats
- increasing the no-approach distance to dolphins for all vessels to at least 100m, except where a permit, license or code of conduct allows for a closer approach
- closing important areas of habitat to all dolphin watching
- requiring a propeller guard on commercial dolphin watching boats
- implementing an independent monitoring program to determine the effectiveness of management measures
- raising awareness amongst the boating community and general public of the applicable regulations and threats (not just vessel disturbance) facing dolphin populations in heavily utilised waterways
- ongoing compliance activities.

Confined waterways and close to the shore

In confined or crowded waterways such as bays, estuaries, channels and rivers it may not be possible for vessels to maintain the specified approach distances or the appropriate number of boats within the caution zone. Whale and dolphin watching should not be undertaken when approach distances cannot be maintained. If a vessel is inadvertently within the specified approach distance it should take all necessary caution to avoid whales and dolphins, including reducing vessel speed and posting extra lookouts. Do not trap, drive or corral animals.

Where possible and practical vessels should position themselves on the landward side of the whale or dolphin to prevent interactions with sandbars and shark nets.

Whale and dolphin watching while fishing

When fishing is undertaken in conjunction with whale or dolphin watching all fishing lines should be reeled in and equipment stowed prior to engaging in whale and dolphin watching activities. This will reduce the risk of an entanglement should a whale or dolphin approach the boat.

Swimming

Swimming (which includes snorkelling and diving) with a whale or dolphin may place both people and animals at risk. Risks to people include injury and possible death from forceful interactions with a whale or dolphin. The greatest risk to whales and dolphins is disturbance caused by the misuse of vessels and the inappropriate placement of people in the water, forcing animals to actively avoid interaction.

These impacts and risks may be minimised by ensuring that swim programs are only conducted by operators who are authorised by the relevant state, territory or Commonwealth agency. In addition permits may be issued that allow people to swim or dive with whales and dolphins for scientific or educational purposes.

Part 1—Requirements for swimming in Commonwealth waters

Deliberately swimming (including snorkelling or diving) with whales and dolphins is not recommended unless under the authorisation of the relevant state, territory or Commonwealth agency. If a person is in the vicinity of a whale or dolphin:

- they must not enter the water closer than 100m to a whale or 50m to a dolphin, and must not approach closer than 30m to any whale or dolphin
- they are not in contravention of the EPBC Regulations if whales or dolphins approach or pass close to that person. If approached by a whale or dolphin a swimmer must move slowly to avoid startling the animal and must not attempt to touch it or swim towards it.

Vessels carrying swimmers must always abide by the requirements outlined under Part 1 for vessels, which includes the requirement to remain outside the caution zone of a pod when a calf is present.

Definition of a swimmer

A swimmer is a person who is **entering** or **in** the water.

Part 2—Additional management considerations for swimming and diving

Authorised swimming programs

In order to ensure the long-term sustainability and safety of swimming operations, commercial swim programs that involve close approaches to whales and dolphins by vessels and swimmers should include:

- authorisation from a relevant authority
- a comprehensive risk assessment and risk management plan
- an appropriately trained captain and guides
- an ongoing research program to monitor whale and dolphin responses to swimmers
- adaptive management to ensure compliance occurs and negative impacts are avoided.

Consideration should also be given to undertaking research prior to the development or expansion of operations. Research should focus on the biology and behaviour, seasonal requirements, and habitat requirements of the target population of whales or dolphins and be able to detect behavioural changes in response to swim-with activities.

Authorised swim programs may apply a different management regime than that specified in the EPBC Regulations because of more stringent restrictions on swimmer behaviour and increased management and oversight from the relevant authority. This may include allowing swimmers to enter the water closer than 100m from a whale or 50m from a dolphin.

Specific issues to be considered when developing or reviewing swimming operations include:

- the sensitivity of the target animals to disturbance. Species such as the southern right whale are not suitable due to their sensitivity to disturbance
- the management of swimmers if the behaviour of animals becomes boisterous
- limits on the number of vessels and swimmers
- the risk of vessel strike with a swimmer or whale
- maximum cumulative time with a pod, individual or population per day
- maximum time for each interaction

- time required between successive swim attempts
- establishment of no approach times (e.g. when the animals are likely to be feeding, resting etc)
- the need for temporal or spatial exclusion zones
- the locations swimmers can be placed in the water relative to the position of the target whales or dolphins
- the distance of swimmers to animals
- the risks associated with different techniques to manage swimmers such as mermaid lines or boom nets (for example long mermaid lines may pose an entanglement risk to whales or dolphins).

Vessels should be operated in accordance with the national guidelines or any other relevant regulations, codes of practice or restrictions. Vessels should not actively tow swimmers and no other vessel should be closer than 100m to a vessel conducting swims.

Swimming should not occur with whale or dolphin calves, or pods containing calves, animals that are feeding or with disturbed, injured or entangled whales or dolphins.

Attempts at swimming with whales or dolphins should stop if the animals show signs of disturbance or agitation.

Aircraft

Aircraft, including drones (unmanned aerial vehicles or remotely piloted aircraft) may disturb whales and dolphins due to their speed, noise, shadow, or downdraft in the case of helicopters. Aircraft should be operated in accordance with the provisions outlined below.

Drones

Drones are considered to be aircraft and this means that people operating drones near whales and dolphins must abide by the requirements of the EPBC Regulations that apply to aircraft or the relevant marine park, state or territory legislation. The requirements under the EPBC Regulations are inconsistent with requirements for operating drones under the *Civil Aviation Act 1988* and so a person who wishes to operate a drone in close proximity to a whale or dolphin will need to apply for a permit from the Department of the Environment and Energy (in Commonwealth waters), the relevant state or territory government or the Great Barrier Reef Marine Park Authority and, depending on the height the drone will be operated at, may also need approval from the Civil Aviation Safety Authority (CASA).

Details regarding the lawful operation of drones can be found on CASAs website at: www.casa.gov.au/aircraft/landing-page/remotely-piloted-aircraft-system

Information regarding cetacean permits can be found on the Department of the Environment and Energy's website at: www.environment.gov.au/marine/marine-species/cetaceans/research-permits



Swimmers in the water with a humpback whale on Ningaloo Reef, Western Australia. © K. Waples



Dwarf minke whale. © Commonwealth of Australia (GBRMPA)

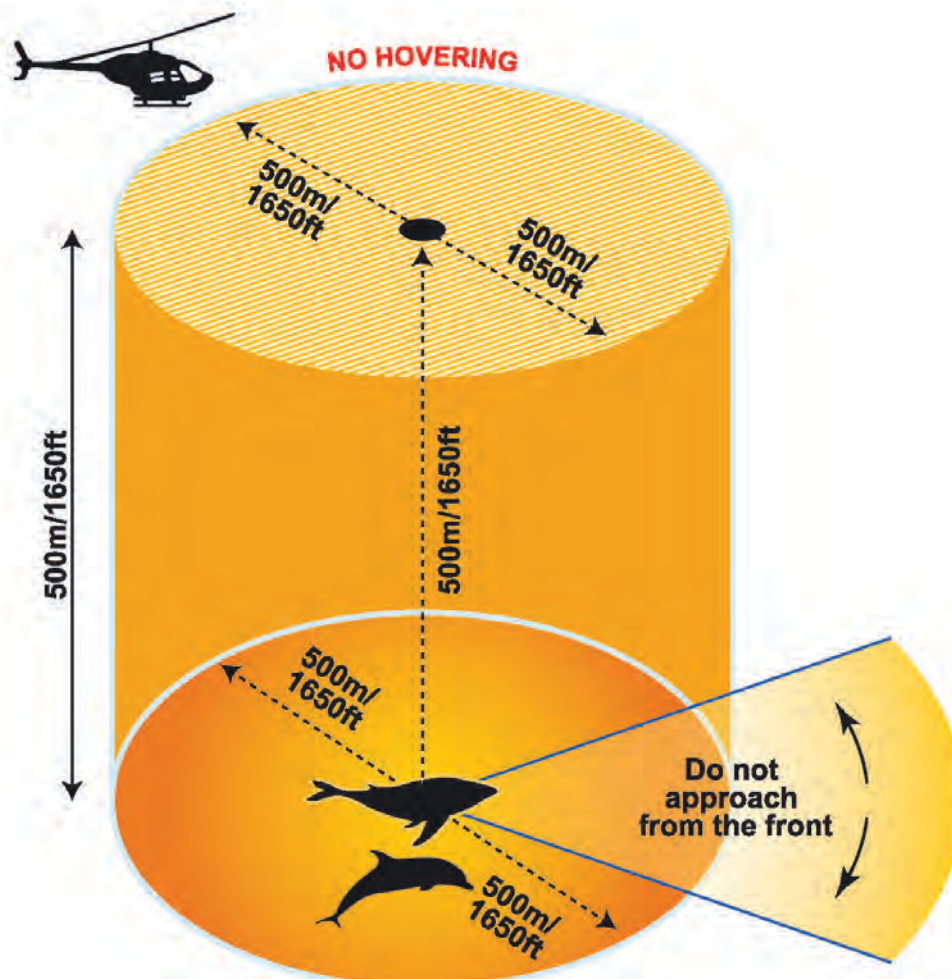
Part 1—Requirements for operating aircraft in Commonwealth waters

Helicopters (including gyrocopters)

As illustrated in Figure 6, a person operating a helicopter or gyrocopter in the vicinity of whales and dolphins must not:

- fly lower than 500m within a 500m radius of a whale or dolphin; and
- approach a whale or dolphin from head on.

Figure 6—Helicopter approach distances for whales and dolphins.

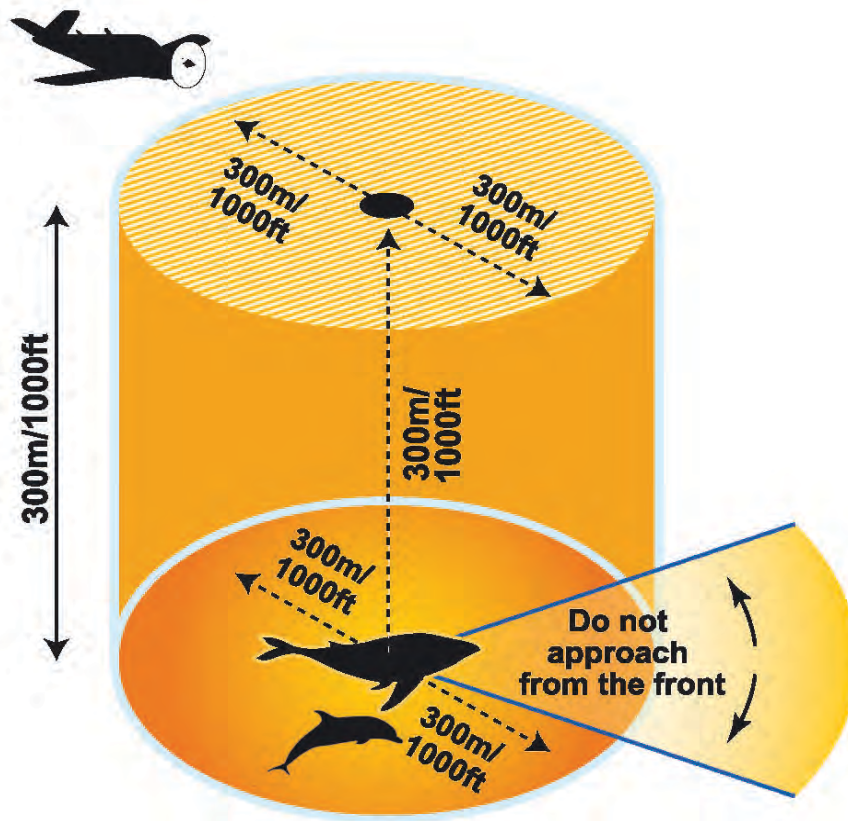


Other aircraft

As illustrated in Figure 7, a person operating any other airborne craft including drones, fixed wing aircraft, gliders, hang-gliders, hot air balloons and airships in the vicinity of whales and dolphins must not:

- fly lower than 300m within a 300m radius of a whale or dolphin
- approach a whale or dolphin from head on
- land on the water within 300m of a whale or dolphin.

Figure 7—Aircraft approach distances for whales and dolphins.



Part 2—Additional management considerations for aircraft

In some instances such as for scientific or educational purposes, or commercial filming it may be necessary for aircraft to approach closer to a whale or dolphin than outlined in the EPBC Regulations or state and territory regulations. This may only occur under the authorisation of the relevant state, territory or Commonwealth authority. In these cases all aircraft must operate within the conditions of the authorisation.



Feeding dolphins at Monkey Mia in the Shark Bay World Heritage Area. © Dragi Markovic

Land-based Whale and Dolphin Watching

Watching from land causes the least disturbance to whales and dolphins. Cliffs and headlands can provide excellent vantage points for viewing many different species of whales and dolphins. It is important to be aware of the impact you may have on the environment and remember coastal dunes and headlands can be sensitive areas. At all times consider the safety of yourself and others and move cautiously around cliffs and rocky shores.

Feeding

There are environmental, health and safety concerns associated with deliberate feeding of whales and dolphins. In most cases feeding by humans has been shown to have adverse effects, sometimes severe, on the whales and dolphins concerned. Feeding wildlife is illegal in most states and territories.

Part 1—Feeding whales and dolphins in Commonwealth waters

A person must not deliberately feed or attempt to feed wild whales or dolphins. This includes throwing food or rubbish in the water in the vicinity of whales and dolphins, and feeding from vessels.

Part 2—Additional management considerations for feeding

Feeding programs

Feeding is only permitted under existing programs authorised by the relevant Commonwealth, state or territory agency. In these cases, feeding programs must operate within the conditions of authorisation and permit compliance must be monitored regularly. There should be no further establishment or expansion of feeding programs. In the event an approved program needs to replace an animal then a risk assessment should be undertaken by the relevant state or territory government agency before approval is given to recruit a new animal.

The management of permitted feeding programs should include consultation with appropriately qualified stakeholders.

All existing feeding programs should be accompanied by ongoing research to monitor whale and dolphin responses to help track any changes in animal behaviour.

Touching cetaceans in Commonwealth waters

Touching whales and dolphins is illegal unless allowed under a relevant permit issued by the Minister for the Environment and Energy or another relevant authority. If you are approached by a whale or dolphin, avoid touching or sudden movements that might startle it and move away to a safe distance. Do not encourage interactions with a whale or dolphin.

Stranded animals

For the safety of both people and animals, people must avoid interacting with stranded animals unless under the guidance and approval of the relevant Commonwealth, state or territory management authority.

All jurisdictions have laws that prohibit people, without approval, from interfering with whales or dolphins.

If you come across a stranded animal please contact the relevant state or territory based authority using the contact details provided in Table 1.

Habituated solitary dolphins

Sometimes solitary dolphins become habituated to people and their activities. This can lead to people feeding, touching or swimming with the animal, as they believe this is not in breach of regulations because the animal approached them. These interactions are not beneficial to the dolphin and puts the animal at greater risk of injury or death due to boat strike or entanglement. In addition these interactions are often in breach of state regulations.

Noise

Whales and dolphins have sensitive hearing and sound plays an important role in their communication, navigation and prey location. Noise that humans introduce into the environment can cause disorientation, mask important sounds or damage an animal's hearing. It is very difficult to determine how whales and dolphins may react to a particular sound or how severe the effects may be, so production of noise, while whale and dolphin watching, should be minimised.

Operation of vessels

An important feature of noise generated by vessels is the rate at which noise changes, especially as it increases. Rapid increases in noise have a greater impact than slower changes. Vessels engaged in whale and dolphin watching should, where possible, be constructed to be as quiet as possible and follow the guidelines below:

- vessels should be left to drift out of gear but with engines running
- re-positioning and constant re-starting of engines should be minimised
- the starting and running of engines should avoid rapid changes in revolutions
- the departure of vessels should be controlled so that engine revolutions build up slowly
- vessels should avoid using the reverse gear
- vessel operators and passengers should not intentionally make any noise to attract whales or dolphins. This includes underwater playback of recorded whale or dolphin sounds or song and hitting the side of the boat.



A southern right whale and her calf. © J. Bannister



Dolphin. © L. Parsons

Design of whale and dolphin watching vessels

Some vessels are better designed to minimise noise and so are more appropriate for whale and dolphin watching. Since commercial whale and dolphin operators spend a lot of time in close proximity to whales and dolphins, it is recommended that they use vessels that are as quiet as possible. Vessels whose primary use is whale and dolphin watching should, where possible, apply the [*International Maritime Organization Guidelines for the Reduction of Underwater Noise from Commercial Shipping to Address Adverse Impacts on Marine Life*](#).

Regular hull and propeller maintenance and removal of fouling is encouraged along with sound reduction features such as machinery isolation and low-cavitation propellers. Other aspects of boat design and operation that should also be considered are:

- the station keeping ability of the vessel. Poor station keeping and steerage require vessels to move often and use reverse gear
- poor viewing access for passengers requires skippers to frequently move a vessel to give all passengers good viewing access
- high windage in relation to draft requires frequent manoeuvring to account for the vessel drifting off station.

Skilled captains, who are familiar with whale and dolphin behaviour, can minimise noise and compensate for design limitations in a vessel.



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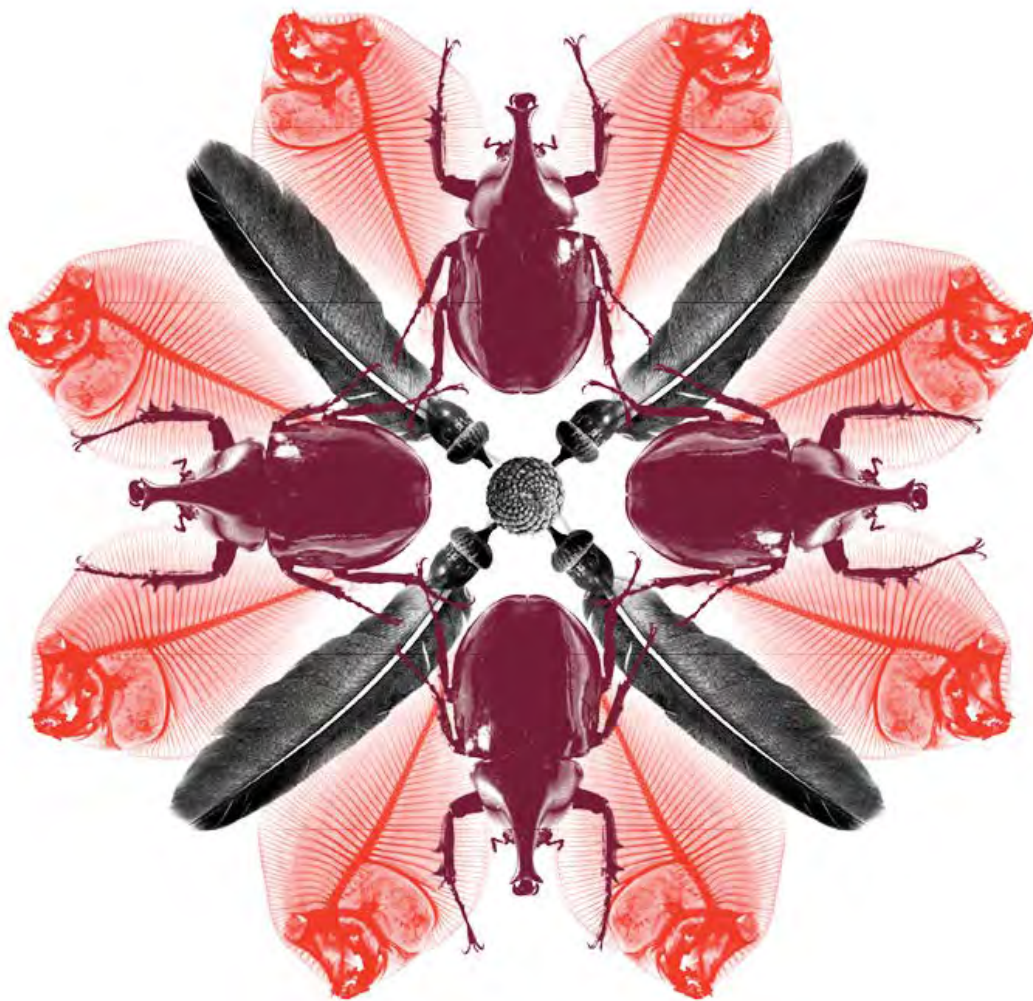
Appendix I

Ballast water management requirements



Australian Ballast Water Management Requirements

Version 8





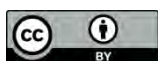
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Version history

The Australian Ballast Water Management Requirements are updated periodically. You can check that this version is still current at awe.gov.au/abwmmr

The following table describes recent changes to the requirements.

Version	Date	Reason for issue
5.3	1 August 2011	Review and update of document to reflect new ballast water management requirements.
6	6 June 2016	Review and update of document to reflect new ballast water management requirements under the <i>Biosecurity Act 2015</i> .
7	07 July 2017	Review and update of document to reflect the <i>Biosecurity (Ballast Water and Other Measures) Amendment Act 2017</i> and the <i>Biosecurity (Ballast Water & Sediment) Determination 2017</i> .



8	13 October 2019	Review and update of document to reflect the <i>Biosecurity (Ballast Water and Sediment) Amendment (Ballast Water Management Methods) Determination 2019</i> ; and the <i>Biosecurity (Ballast Water Same Risk Area) Amendment (Great Barrier Reef and Northern Territory) Instrument 2019</i> .
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1 Introduction

The Australian Ballast Water Management Requirements set out the obligations on vessel operators with regards to the management of ballast water and ballast tank sediment when operating within Australian seas. These requirements include legislative obligations under the:

- [Biosecurity Act 2015 \(Biosecurity Act\)](#), and
- International Convention for the Control and Management of Ships' Ballast Water and Sediments (Ballast Water Convention).

The requirements provide guidance for vessel operators on best practice policies and apply to all vessels operating internationally and domestically in Australia.

The legislative obligations on vessels to manage ballast water are contained in the Commonwealth Biosecurity Act 2015 and associated legislation. Vessels following these requirements will be complying with these obligations.

Ballast water can contain a range of invasive marine species, which, if unmanaged, can lead to an unacceptable economic and environmental impact on Australia's unique maritime environment.

This version of the requirements reflects the implementation of the Ballast Water Convention and other changes associated with the introduction of new national domestic ballast water requirements to reduce the risk of spreading marine pests that have already established in Australian seas.

Contact details for more information on these requirements is included in [Section 10](#).

Checklist for Masters

This checklist is to assist masters in complying with these requirements and includes page references for more information.

- Ensure the vessel has a valid Ballast Water Management Plan (BWMP, management plan) and a valid Ballast Water Management Certificate (BWMC, management certificate) as set out in [Section 2](#).
- Ensure all operations are recorded in the Ballast Water Record System, as described in [Section 2](#).
- Ensure the vessel has met the reporting obligations set out in [Section 3](#).
- Ensure all ballast water is managed in accordance with [Section 4](#).



2 Documents Required

Key points

- All vessels must carry a valid ballast water management plan
- All vessels must carry a valid International Ballast Water management certificate
- Vessels with a ballast water management system (BWMS) must carry a Type Approval Certificate specific to the type of Ballast Water Management System (BWMS) installed
- All vessels must maintain a complete and accurate record of all ballast water movements

For clarification of requirements for different vessel types please refer to [Attachment A](#)

Ballast Water Management Plans

All vessels designed to carry ballast water are required to carry a valid Ballast Water Management Plan (BWMP). A valid BWMP must be approved by either a survey authority, classification society, or the Administration of the vessel. For Australian flagged vessels, a management plan must be approved by the Director of Biosecurity, or an approved survey authority.

BWMPs should be consistent with the Ballast Water Convention's *Guidelines for Ballast Water Management and Development of Ballast Water Management Plans* (G4 Guidelines).

The department strongly recommends Responsible Officers include a copy of the Australian Ballast Water Management Requirements with the vessels Ballast Water Management Plan. All crew responsible for ballast water management must familiarise themselves with the requirements within the document.

The BWMP must

- be vessel specific (vessel name and International Maritime Organization (IMO) number),
- be approved by a survey authority, recognised organisation, or the vessel's flag administration,
- nominate the rank(s) of the responsible officer and crew, and
- contain the ballast water management method and pumping rates.

Non-commercial vessels that are less than 400 gross tonnes are exempt from carrying Ballast Water Management Plans and International Ballast Water certificates.

Refer to [Section 7](#) for details on seeking an exemption.



Ballast Water Management Certificates

A Ballast Water Management Certificate (BWMC) is required for all vessels to which the Ballast Water Convention applies. The majority of Australian domestic vessels designed to carry ballast water will also need to obtain a ballast water management certificate. [Attachment A](#) lists the certification requirements for different classes of vessel.

A BWMC verifies the vessel has been surveyed to a standard compliant with the Ballast Water Convention, and must be consistent with the format described in Appendix I of the Ballast Water Convention. A statement of fact, or a certificate of compliance, is also accepted for vessels flagged to an administration that is not party to the Ballast Water Convention.

A valid BWMC must be issued by either a survey authority, classification society, or the administration of the vessel, and be in accordance with Regulation E-1 of the Ballast Water Convention. For Australian flagged vessels, a management certificate must be issued by the Director of Biosecurity, or an approved survey authority.

The certificate should

- be vessel specific (vessel name and IMO number),
- be approved by survey authority, administration or recognised organisation,
- state the principal ballast water method(s) used (Regulation D-1 (Exchange Standard) or Regulation D-2 (Treatment Discharge Standard or Potable water) or Regulation D-4 (Prototype System)),
- certify Regulation E-1 in fine print (survey schedule), and
- have an end date up to five years from time of issue.
- need only state the principal method of ballast water management (D-2) if the keel lay date is on or after 8th September 2017. Contingency methods must be included with the vessels BWMP and need not be included on the vessels certificate.

Regulation D-1 on a BWMC is for vessels that utilise ballast water exchange as their primary method of ballast water management. Regulation D-2 on the certificate is for vessels that utilise an IMO Type Approved Ballast Water Management System (BWMS); or meet the D-2 standard of the Convention through use of another method. If Regulation D-2 has been selected, the management certificate should clearly state the name of the system installed on the vessel.

Floating platforms, Floating Storage Units (FSUs) and Floating Production, Storage and Offloading Units (FPSOs) are required to obtain a BWMP and BWMC. The survey schedule required for these vessels is not required to follow the schedule specified in Regulation E.1.1. Certification for floating platforms, FSUs and FPSOs may remain valid for a maximum of five years in-between surveys.

An example of valid certificates is provided in [Attachment B](#).



Type Approval Certificate

For vessels with a BWMS, also known as a ballast water treatment system, a Type Approval Certificate must be retained on board. A Type Approval Certificate relates specifically to the ballast water management system, and is not vessel specific.

Ballast Water Record System

All vessels that utilise ballast water management, must maintain a complete and accurate Ballast Water Record System (Record System). The system may be electronic or in hard copy and should comply with Regulation B-2 of the Annex to the Ballast Water Convention.

The Record System should contain a complete and current record of all ballast water movements. Records that should be kept in the vessel's ballast water recording system when conducting a ballast water exchange are:

- start and finish coordinates of uptake and discharge of ballast water
- start and finish times for pumping water during an exchange
- actual pumping times (these should not be affected by the crossing of time zones)
- residual volume remaining in the tank at the end the empty cycle prior to refill (empty refill method only)
- signature of the officer in charge of the operation.

A manual ballast water handling log is recommended for vessels that use an electronic record keeping system as a backup for verification purposes. A vessel must maintain a minimum of two years of records on board from 8 September 2017.

If you require further advice and information, please contact us using the details available in [Section 10](#).



3 Ballast Water Reporting

Key points

- It is highly recommended that all vessels submit a Ballast Water Report. Vessels arriving from an international location and intending to discharge ballast are obligated to submit a report.
- International vessels can submit a Ballast Water Report through the [Maritime Arrivals Reporting System \(MARS\)](#)
- Domestic trading vessels can request a low risk exemption through a Domestic Risk Assessment. All applications must be submitted through MARS.

Reporting obligations differ depending on whether a vessel is trading domestically in Australia, or making international voyages. This is distinct from the flag of the vessel and is based on whether the vessel has been released from biosecurity control by the department.

If there are exceptional circumstances that prevent the vessel from managing the ballast, the department should be notified as soon as practicable. In the event of a BWMS failure the operator must notify the [Maritime National Coordination Centre \(MNCC\)](#) as soon as they are aware of the failure, to seek the department's advice on possible contingency measures.

Reporting obligations for international vessels

Vessels that are intending to discharge internationally sourced ballast water must submit a Ballast Water Report through MARS at least 12 hours prior to arrival.

However to prevent the discharge of high risk ballast, even vessels not intending to discharge ballast water are strongly encouraged to manage their ballast water, and submit a Ballast Water Report. This action may assist in avoiding delays should the vessel have an itinerary change.

The Ballast Water Report will be assessed by the department through MARS and a response will be issued through the Biosecurity Status Document. The Ballast Water Report should be updated if the ballast water situation changes on board. This should be completed as soon as practicable.

Following the first point of arrival, international vessels may uptake Australian sourced ballast water for discharge later in Australia or overseas. The movement of Australian sourced ballast water between Australian ports is prohibited unless it has been managed, or a low risk exemption has been provided by the department.

Vessels can report the status of Australian sourced ballast water by resubmitting their Ballast Water Report with an updated status about their ballast water tanks. This is not compulsory however may be used to check the vessels compliance prior to arrival at the subsequent Australian port.

More information about Ballast Water Reports and Biosecurity Status Documents is available on our website at a.gov.au/biosecurity/avm/vessels



Reporting obligations for domestic vessels

Vessels that have been released from biosecurity control are still required to manage the movement of Australian sourced ballast water. All ballast water must be managed or receive a low risk exemption from the department prior to discharge.

Vessels can seek a low risk exemption through a Domestic Risk Assessment submitted through [MARS](#). Exemptions will be granted for ballast water which is determined to be low risk based on the date and port of uptake and the date and port of discharge. Once submitted, a Domestic Risk Assessment Outcome document will be issued advising the vessel of the status of the exemption.

Vessel operators should be aware that seasonal changes will affect the outcome of risk based exemptions within Australian ports. Risk based exemptions for Australian sourced ballast water are only issued for a single voyage on the specified dates.

Vessel operators must retain evidence of the exemption notice on board, and may be required to present this on request during an inspection. If a risk based exemption is issued, the vessel is not required to manage the relevant ballast water prior to discharge at the port specified in the exemption.

Ballast Water Verification Inspections

The department may conduct on-board ballast water verification inspections to assess the ballast water information on board, including plans, certificates, and ballast water records.

In addition to the above records, a responsible officer that is listed in the BWMP must be available to assist with the inspection.

Fees apply to verification inspections, as per the Department's charging guidelines.



4 Ballast Water Management Options

Key points

- Australia is phasing out ballast water exchange in line with the agreed schedule set out under the Ballast Water Convention.
- All ballast water should be managed using one of the approved ballast water management options.
- Carrying high risk ballast water is strongly discouraged, as a vessel's itinerary may change or discharge may be necessary to ensure the safety of the vessel or prevent pollution

Phase out of ballast water exchange

Australia is implementing the agreed implementation schedule for the Ballast Water Convention that requires vessels to phase out ballast water exchange in favour of a method that is compliant with the D-2 discharge standard. In order to achieve this, vessels will be required to install an IMO approved BWMS, or use one of the other approved methods of management.

Vessels constructed on or after 8 September 2017

New vessels constructed on or after 8 September 2017, will be required to meet the Regulation D-2 discharge standard from the date they are put into service.

Vessels constructed before 8 September 2017

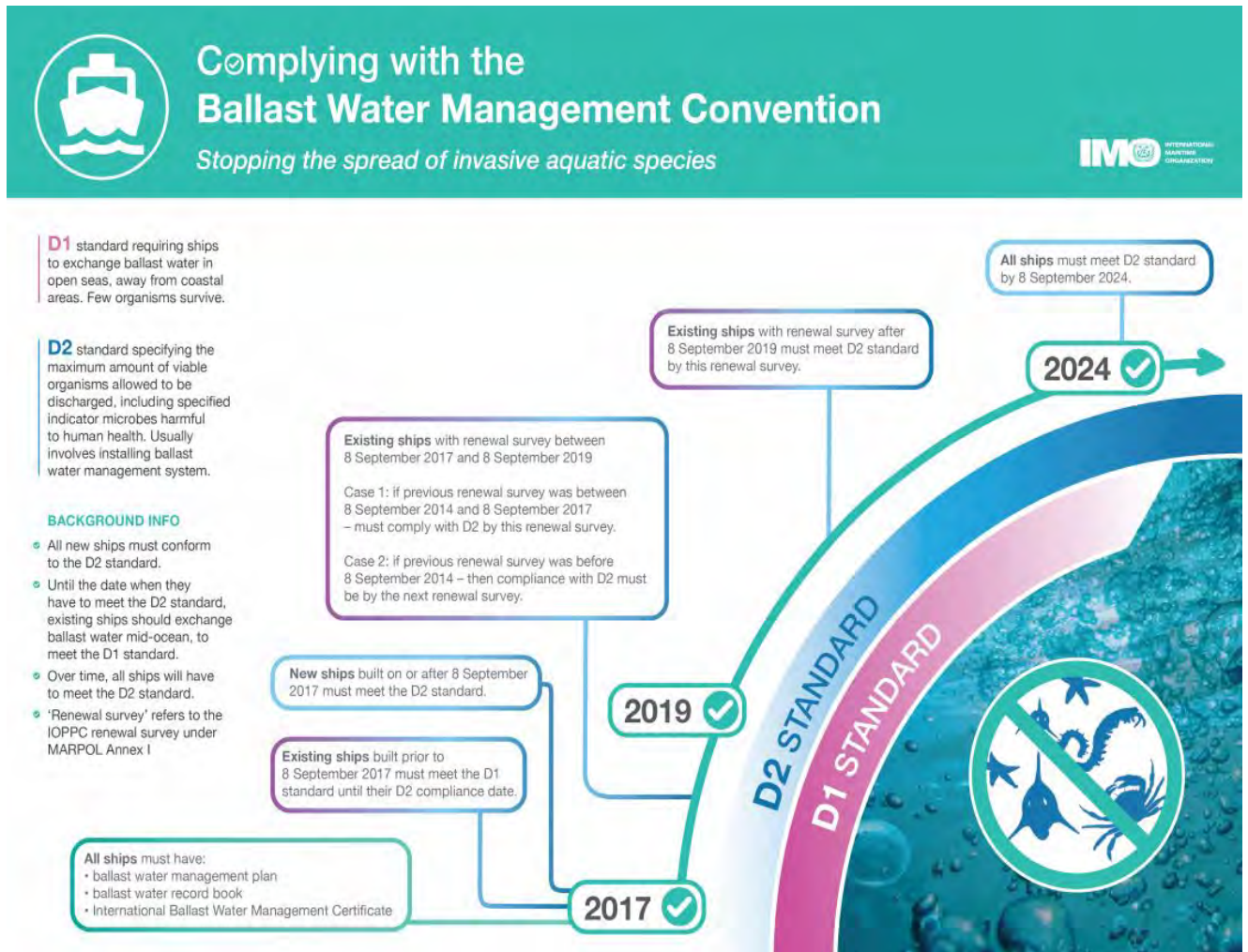
Vessels constructed before 8 September 2017 will need to comply with the Regulation D-2 standard by either the first or second five-year renewal survey of the vessel associated with the International Oil Pollution Prevention Certificate (IOPP) under the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex I.

Vessels must comply with the Regulation D-2 standard by their first renewal survey date, when the first renewal survey takes place on or after 8 September 2019



Vessels that are not subject to IOPP renewal surveys

An existing vessel to which the IOPP renewal survey under MARPOL Annex I does not apply must meet the Regulation D-2 standard from 8 September 2024.



Source: [International Maritime Organization \(IMO\)](https://www.imo.org)

Approved methods of ballast water management

The approved methods of ballast water management are:

- use of a BWMS
- ballast water exchange conducted in an acceptable area
- use of low risk ballast water (such as fresh potable water, high seas water or fresh water from an on-board fresh water production facility)
- retention of high-risk ballast water on board the vessel
- discharge to an approved ballast water reception facility.



Use of a Ballast Water Management System

The department accepts any IMO Type Approved BWMS, and prototype systems being tested for approval. The list of Type Approved and Prototype Approved systems is available at imo.org.

All Type Approved systems have been included in the department's reporting documents. If your vessel's particular system does not appear on this form, contact the [MNCC](#).

BWMS must be used in accordance with the manufacturer's instructions as described in the BWMP.

Ballast Water Management System Commissioning

The Australian Government expects Australian flagged ships to which the Ballast Water Management Convention applies to adhere to **BWM.2/Circ.70 on "Guidance for the commissioning testing of ballast water management systems"**. A circular to inform the industry on the application of this guidance was released on 18 October 2019 and is available at [Attachment E](#).

The purpose of the commissioning test is to verify that the mechanical, physical, chemical and biological processes of the installed BWMS are working properly on installation.

Contingency Measures for BWMS

A contingency measure means a process undertaken on a case-by-case basis after a determination that ballast water to be discharged from a ship is not compliant.

Vessels installed with BWMS and wishing to utilise a contingency measure should incorporate ship-specific contingency measures into the BWMP. The contingency measures and BWMP should subsequently be approved by a Registered Organisation (RO).

The ship-specific contingency measures incorporated in the BWMP does not permit a vessel to discharge unmanaged ballast water in Australian Waters. The department must be informed of the defective BWMS as soon as practical.

Ballast Water Exchange

Ballast water exchange is an approved method only for those vessels that are not yet required to meet the Convention's Regulation D-2 discharge standard as described in the phase out schedule above.

Ballast water exchange must be conducted to the equivalent of a 95 per cent (or greater) volumetric exchange, using one of the acceptable methods of ballast water exchange provided below. Ballast water exchanges must be conducted as far from the nearest land as possible, and in all cases within an acceptable area (see acceptable areas for ballast water exchange).

The safety of the vessel and crew are paramount, all safety considerations must be taken into account when conducting ballasting operations. The Master of the vessel must ensure that the ballast water exchange is conducted in accordance with the vessel's BWMP to ensure the method is appropriate to manage the risk of transferring pests whilst also ensuring the safety of the vessel and crew.



Acceptable methods for ballast water exchange

Australia's acceptable ballast water exchange methods are consistent with the Ballast Water Convention. A vessel should only use ballast water exchange methods that are described in the vessel's BWMP. Under the requirements of the Ballast Water Convention, three management methods are considered suitable to meet a 95 per cent (or greater) volumetric exchange:

- sequential exchange (empty/refill)
- flow-through
- dilution.

Sequential exchange (empty/refill)

Sequential exchange is emptying of at least 95 per cent of the total tank volume prior to refilling it with water sourced from an area considered acceptable for ballast water exchange. Vessels conducting a sequential exchange must ensure that the residual volume is less than 5 per cent of the total tank volume prior to refilling the tank. This residual volume quantity must be recorded in the vessel's ballast water records.

When verifying an empty/refill operation, a biosecurity officer will compare the residual volume of the tank recorded at the end of the empty cycle to the final volume on arrival, to ensure that at least 95 per cent of high-risk water was exchanged.

Flow-through method

A total of three times the total ballast capacity of the tank (300 per cent) must be pumped through, as a minimum, when conducting exchange using the flow-through method.

This is calculated from the time when the tank is full and/or water begins to overflow from the tank, not from when the pumps start. This is the case regardless of whether the tank was partially or completely full at the beginning of the flow-through process.

Tanks must be flushed one at a time or in similar port and starboard pairs. If co-joined ballast tanks are flushed, a biosecurity officer may request documentary evidence of the ballast tank layouts to ensure compliance with these requirements (e.g. the vessel's ballast water management plan). Flushing dissimilar tanks together does not meet Australian requirements and may result in the ballast water not being managed for discharge in accordance with the Biosecurity Act.

A biosecurity officer can verify if a sufficient volume of water has been exchanged by using the current verified pumping capacity and pump time to determine if at least 300 per cent of the total tank capacity has passed through the tank. Pumping times must be calculated from the time each tank starts to overflow, not from when the pumping operation has begun.

For further advice on conducting flow-through exchanges, please refer to [Section 9](#).

Dilution method

At least three times the tank's maximum capacity must be pumped through when conducting an exchange using the dilution method.



Tanks must be flushed one at a time or in similar port and starboard pairs. If co-joined ballast tanks are flushed, a biosecurity officer may request documentary evidence of the ballast tank layouts (which could be included in the BWMP) to ensure compliance with these requirements. Flushing tanks inconsistent with the vessels BWMP will result in the ballast water not being managed for discharge in accordance with the Biosecurity Act.

For further advice on conducting flow-through exchanges, please refer to [Section 9](#).

Low-risk ballast water

A tank is considered to contain low-risk ballast water if at least 95 per cent of the ballast water in that tank is from a low-risk source. Tanks containing less than 95 per cent low-risk water will be considered high risk, and will need to be managed consistent with the methods outlined in this document.

Fresh potable water

Fresh potable water can be sourced from a municipal water supply or from an on-board desalination system. Documentation will be required to confirm the source of any potable water.

Documentation may include:

- a bill of sale or receipt, or
- a signed letter on company letterhead verifying the origin of the water, or
- a surveyor's report, or
- records of operating a desalination system detailing the volume of fresh water generated, or
- a test report verifying compliance of the fresh water with the D-2 discharge standard

If these conditions cannot be met, the ballast water will be considered high-risk, and must be managed by an acceptable method outlined in this document prior to discharge in Australian seas.

Water taken up on the high seas

Water that has been taken up on the high seas, or international waters, is considered to be low risk. This includes water that is greater than 200 nautical miles from any land mass and in water that is greater than 200 metres deep. See section 5 for alternate areas.

Water taken up and discharged within the same place

Ballast water taken up and discharged in the same place is considered low risk, provided that the water comprises 95 per cent or greater of the volume of water in the tank. The same place is considered to be within the port limits of the same port, or within one nautical mile of the point of uptake.



Retention of high-risk ballast water

Operators may choose to retain high-risk water within a ballast water tank if there is no intention to discharge the water in Australian seas. However, carrying high-risk ballast water into Australian seas is strongly discouraged, as a vessel's itinerary may change, or discharge may be necessary in the case of safety or pollution considerations.

Tank-to-tank transfers

Ballast water may be transferred between ballast tanks to control the trim and draft of the vessel. Tank-to-tank transfers of high-risk ballast water complicate ballast water management and may result in accidental discharge. Operators must be vigilant to ensure the risk of high-risk ballast discharging during the transfer operations is minimised.

Mixing low-risk water with high-risk water through tank-to-tank transfers may result in ballast water being considered high risk and unsuitable for discharge. Vessel operators must update their ballast water records for each transfer operation.

Empty tanks

Tanks are considered to be empty when the pumps lose suction, and the remaining volume cannot be removed.

It is recommended that soundings of empty tanks be conducted, and recorded separately in the vessels ballast water recording system at the end of the pump out cycle of ballast operations. These soundings must demonstrate that the volume remaining is less than 5 per cent of the total volume of the ballast water tank.

If the residual volumes exceed 5 per cent of the final volume, the tank is considered to be unmanaged and any water introduced to that tank would result in a mixed tank. A biosecurity officer may ask vessel operators to conduct soundings on a selection of empty tanks to ensure the residual volumes are recorded accurately. If tanks cannot achieve 5 percent or less as a minimum, [contact the MNCC for advice](#)

Mixed tanks

Where water from more than one source is added to a ballast water tank, it is considered to be a mixed tank. The mixing of ballast water from multiple sources in one tank is not recommended by the department as it increases the complexity in managing the tank and increases the likelihood of discharge of high risk water.

Mixed tanks may be eligible for discharge if all water is from low risk sources.

If you are concerned about your vessel's eligibility for a mixed tank for discharge, [contact the MNCC for advice](#).



Discharge to a ballast water reception facility

Ballast water may be discharged to a ballast water reception facility that has been approved by the Director of Biosecurity in accordance with the G5 Guidelines of the Ballast Water Convention. The ballast water must be treated or disposed of at the facility in accordance with the approval requirements.

If there is an intention to discharge to a ballast water reception facility, [contact the MNCC](#) to ensure the facility intended for discharge is an approved facility.

Discharge relating to safety, accident or pollution

A vessel is able to discharge high risk ballast water when:

- it is necessary for ensuring the safety of a vessel in emergency situations or saving a life at sea
- the discharge is accidental and results from damage to the vessel or its equipment, or
- it is necessary for the purposes of minimising or avoiding pollution.

All reasonable precautions must be taken to prevent or minimise the discharge. Vessel masters must report the discharge to the department as soon as possible after the incident. Under no circumstances should this information be sent to the department any later than the submission of the pre-arrival report.

For enquiries, or to report discharges relating to safety, accident or pollution, [contact the MNCC](#).

Alternative methods

Vessels wishing to use alternative methods for ballast water management that are not specified in this document must receive approval from the department prior to discharge. Vessels that cannot comply with the requirements, [contact the MNCC](#) as soon as practicable to avoid possible delays in operations.



5 Acceptable Areas for Ballast Water Exchange

Key points

- Vessels must not exchange ballast water within the Great Barrier Reef or Ningaloo Reef, as described in this section and in [Attachment D](#).
- Vessels taking up and discharging ballast water within the [Same Risk Areas](#) described in this section are not required to exchange ballast water. However if the vessel is fitted with a type approved ballast water management system this system will be required to be used.

Ballast water exchange should be conducted in at least 200nm from nearest land and in waters 200m deep. For voyages that cannot practically meet these requirements ballast water exchange must occur at least 12 nautical miles from the nearest land and in water at least 50 metres deep.

Ballast water must not be exchanged within 12 nautical miles of the Great Barrier Reef ([Map 1](#)), or within the Ningaloo Reef ballast water exchange exclusion area ([Map 2](#).)

Same Risk Areas

The waters within the following areas are considered [Same Risk Areas \(SRA\)](#) and water may be taken up and discharged within these areas without undertaking ballast water exchange. For vessels that have been required to phase out the use of ballast water exchange, ballast water must be managed utilising an alternative method within these areas:

- Queensland - The Great Barrier Reef Marine Park SRA
- South Australia- Gulf St Vincent and the Spencer Gulf SRA
- Victoria - Port Phillip Bay SRA
- Northern Territory – Northern Territory SRA - excluding international ports of Darwin, Gove and Milner Bay.

The operation of the same risk area only applies only to vessels utilising ballast water exchange as their primary method of ballast water management. When a vessel is required to meet the discharge standard under Regulation D-2 of the BWM Convention and Australia's ballast water requirements (see [Section 4](#)) the vessels' ballast water must be managed in accordance with the BWMP.

Discharging ballast water sourced inside the SRA

Vessel operators are not required to exchange ballast water sourced within the SRA if:

- their vessel uses ballast water exchange as their primary method of ballast water management, and
- the ballast water was taken up in the SRA, and
- ballast water exchange is the only practicable ballast water management method available.

Discharging ballast water sourced outside the SRA

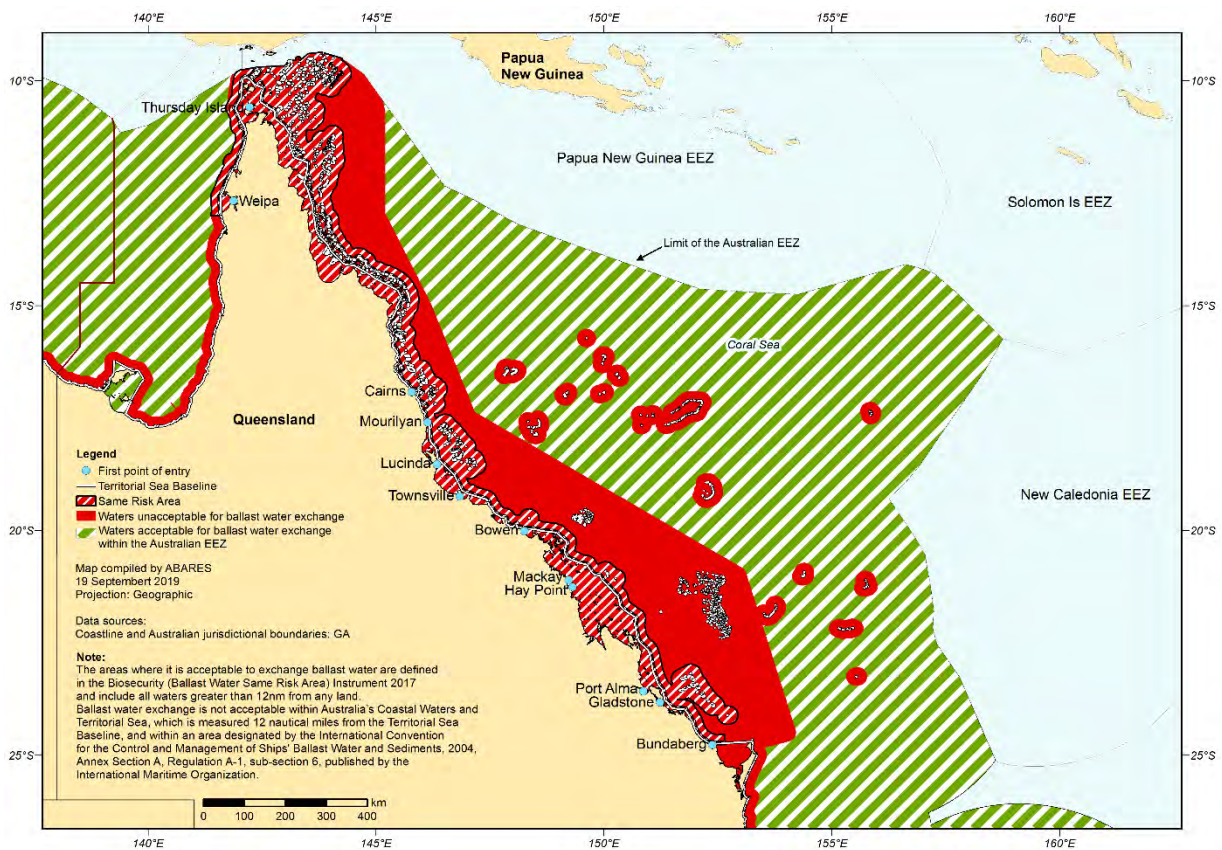
Ballast water management operations must occur prior to entering an SRA, if you plan to discharge ballast water sourced from a port outside an SRA.



Great Barrier Reef Marine Park SRA

The ports within the Great Barrier Reef Marine Park, and part of the Torres Strait and Gulf of Carpentaria, are known as the Great Barrier Reef Marine Park Same Risk Area. This area includes:

- all ports located within the boundaries of the Great Barrier Reef World Heritage Area
- the ports of Weipa and Amrun
- all ports located within the boundaries of the Torres Strait Islands; and
- Bundaberg.



The area bounded by the line starting at the point described in item 1 of the following table and running sequentially as described in the table is specified.



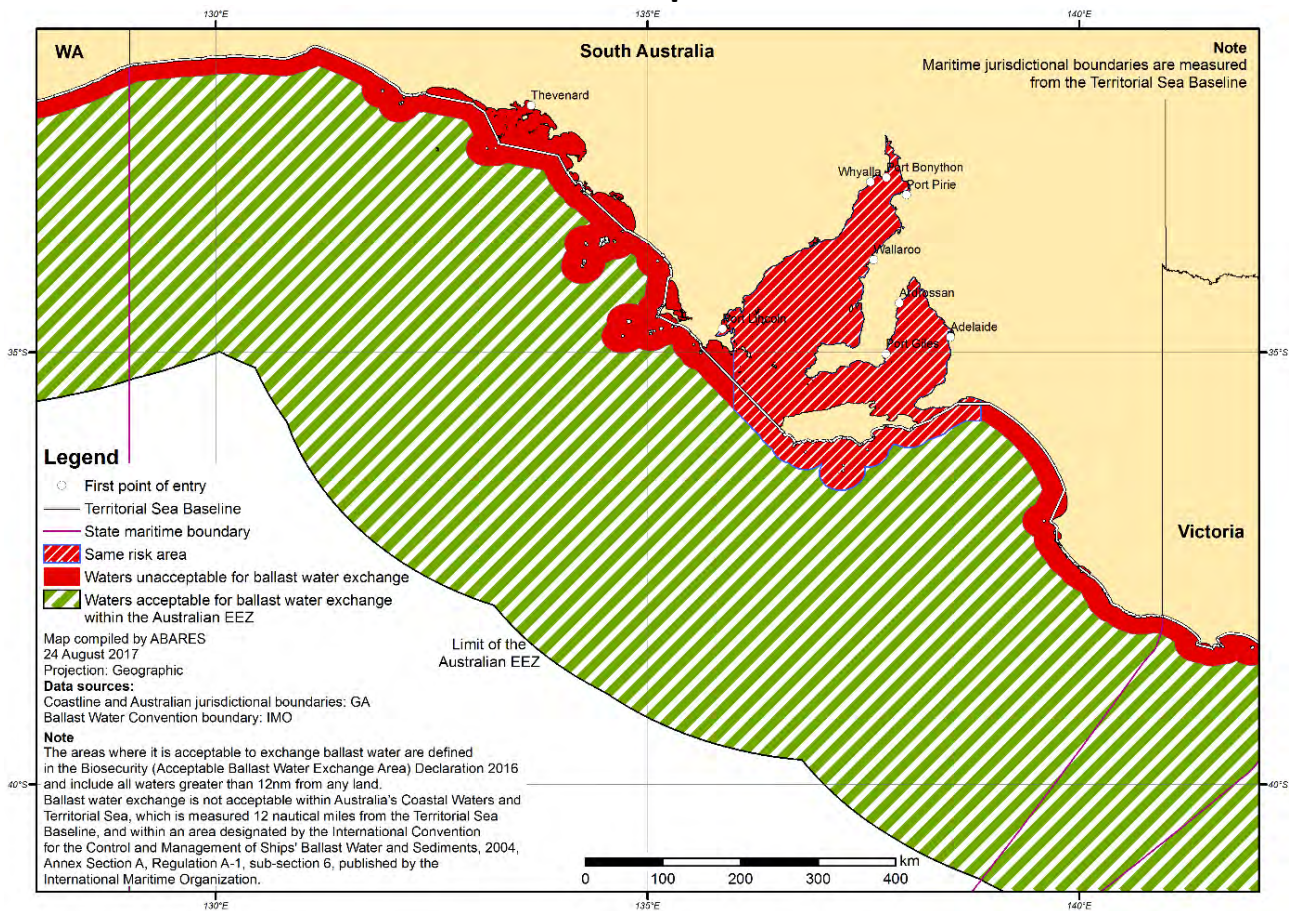
Queensland—Great Barrier Reef

Item	Description
1	The westernmost intersection of the mean low water line of the mainland of Australia around Thud Point, Queensland, by the parallel of latitude 13°00'00"S
2	West along that parallel to its intersection by the outer limit of the territorial sea of Australia
3	Generally northerly along that outer limit to its intersection by the parallel of latitude 10°00'00"S
4	East along that parallel to its intersection by the outer limit of the territorial sea of Australia
5	Generally southerly and south-easterly along that outer limit to its intersection 12 nautical miles north of the territorial sea baseline across Hervey Bay by the meridian of longitude 152°39'00"E
6	South along that meridian to its intersection by the parallel of latitude 24°46'00"S
7	West along that parallel to its intersection by the mean low water line of the mainland of Australia around South Head, Bundaberg, Queensland
8	Generally north-westerly, northerly, north-westerly and southerly along that mean low water line to the starting point

Note: Geographic coordinates in this instrument are expressed in terms of the Geocentric Datum of Australia 1994 (commonly known as GDA94).



South Australia- Gulf St Vincent and Spencer Gulf



Eastern boundary

River Murray mouth (west bank): 138° 52' 28.325"E. 35° 33' 26.697"S

Intersection with edge of waters acceptable for BW exchange: 138° 52' 30.469"E. 35° 47' 44.164"S

Southern boundary (east to west)

Intersection with edge of waters acceptable for BW exchange (east): 138° 33' 51.748"E. 35° 50' 32.605"S

Eastern end of Kangaroo Island: 138° 8' 6.428"E. 35° 50' 29.078"S

Western end of Kangaroo Island: 136° 32' 1.042"E. 35° 52' 29.632"S

Intersection with edge of waters acceptable for BW exchange (west): 136° 12' 29.499"E. 35° 52' 31.625"S

Western boundary

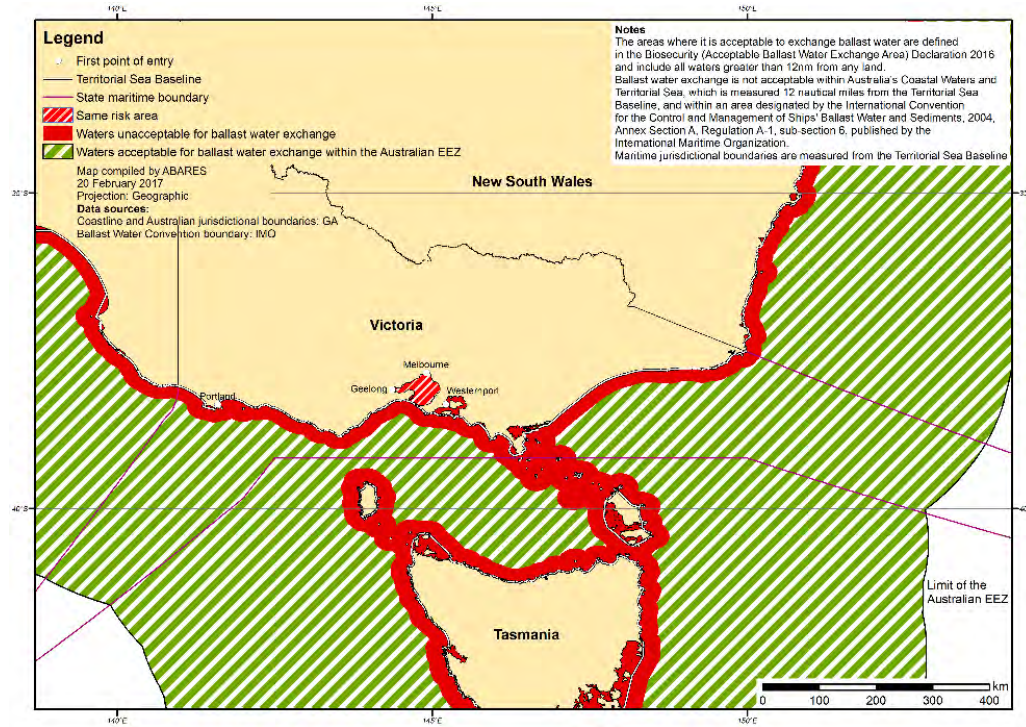
Cape Catastrophe: 136° 0' 8.018"E. 34° 59' 8.712"S

Intersection with edge of waters acceptable for BW exchange: 136° 0' 2.63"E. 35° 39' 47.805"S



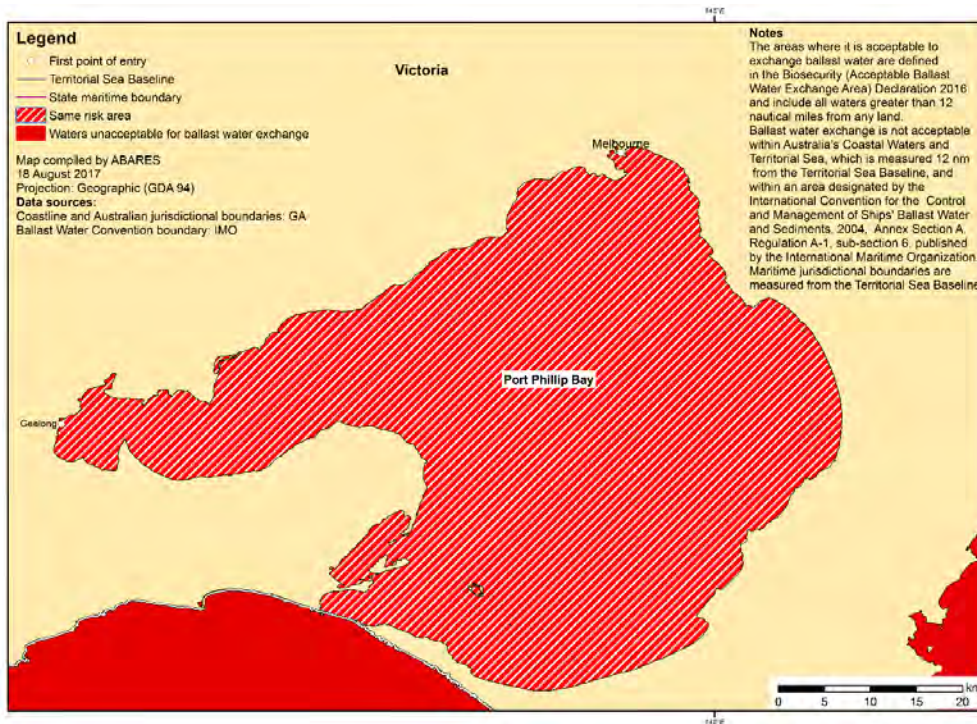
Victoria- Port Philip Bay

This area is inclusive of all waters north of the heads (coordinates below) of Port Philip Bay.



Western boundary 144° 36' 54.272" E 38° 17' 29.988" S

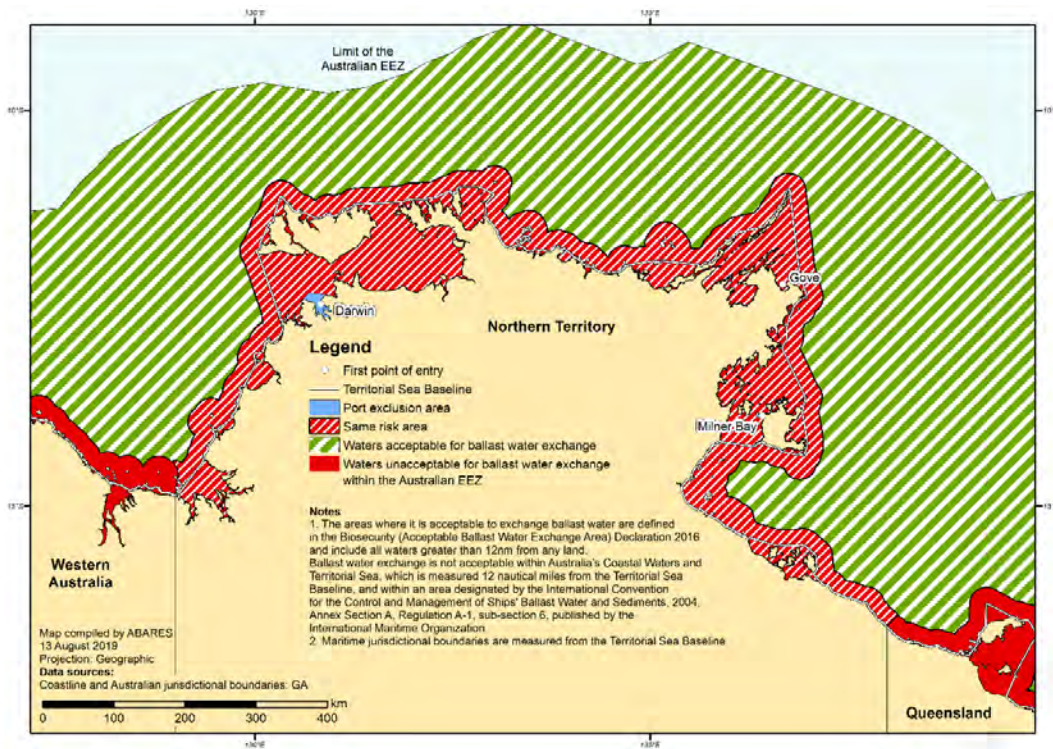
Eastern boundary 144° 39' 2.7" E 38° 18' 6.737" S





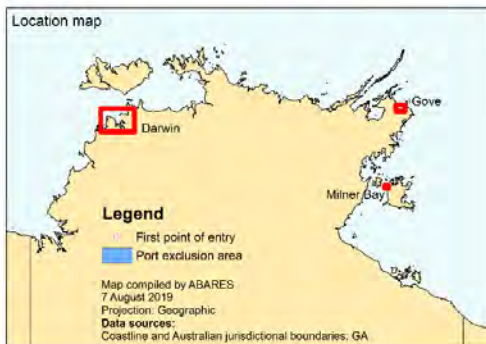
Northern Territory Excluding Ports of Darwin, Gove & Milner Bay

This area excludes the uptake of ballast water in the ports of Darwin, Gove and Milner Bay



Western boundary: Longitude 129°00'01.659560"E

Eastern Boundary: Longitude 138°07'33.574000"E





6 Ballast Water Management For Vessels servicing offshore installations

Vessels arriving at an offshore oil and gas installation within Australia's Exclusive Economic Zone (EEZ) must manage their ballast water in accordance with one of the acceptable methods of ballast water management, prior to arrival.

Vessels using ballast water exchange that are arriving in Australia's EEZ from a port outside of Australia, the ballast water exchange must be conducted consistent with the requirements of [Section 4](#) of this document.

Vessels that operate between offshore oil and gas installations and Australian ports are also required to manage their ballast water before arrival at the installation and Australian port. The acceptable area for a ballast water exchange between an installation and an Australian port is in sea areas that are no closer than 500 metres from the offshore installation, and no closer than 12 nautical miles from the nearest land.

If any vessels are unable to achieve these ballast water requirements, they must [contact the MNCC](#) for further advice.



7 Exemptions

Key points

- Exemptions apply to some vessels when meeting the D-2 discharge standard of the Ballast Water Management Convention. If your vessel fits the eligibility criteria, the exemption applies automatically.
- Other exemptions are available on application, including risk based exemptions and time limited extension for the use of ballast water exchange.
- Application and/or assessment fees may apply to exemptions.
- The department does not regulate ballast water management for military vessels and those that fall under Article 3.2(e) of the ballast water convention and the *Biosecurity Act 2015* - Sect 263(a)

Exemptions from the Ballast Water Convention's Regulation D-2 discharge standard

A number of vessel types and operations are exempt from meeting the Regulation D-2 discharge standard of the Ballast Water Convention. Vessels meeting these conditions **do not** need to seek an exemption from the obligations specified in brackets:

- vessels that do not use ballast water to control trim, stability or list (exempt from all requirements)
- vessels with sealed tanks, and only discharge for the purpose of scheduled maintenance, dry-docking or emergency (exempt from ballast water management requirements except keeping ballast water records)
- vessels using only potable water, and operating solely in Australian waters (are not required to meet the Regulation D-2 discharge standard, and therefore are not required to install an (IMO) approved BWMS)
- vessels that only uptake and discharge ballast water in the same place (within the port limits of the same port, or within 1 nautical mile of the point of uptake) are not required to meet the Regulation D-2 discharge standard, and therefore are not required to install an (IMO) approved BWMS)
- dumb barges with no power source, that do not uptake and discharge ballast water (are not required to meet the Regulation D-2 discharge standard, and therefore are not required to install an (IMO) approved BWMS)
- recreational, or search and rescue vessels, less than 50 metres in length, with less than 8 cubic metres of ballast (do not need a BWMC, and because they are not required to meet the Regulation D-2 discharge standard, do not need to install an (IMO) approved BWMS).

Case by case exemptions are available upon application for vessels operating only in Australian waters. Applications will considered for:

- floating platforms, FSUs and FPSOs operating exclusively in Australian waters
- fishing vessels that only source ballast water outside 12 nautical miles from the nearest land.



Exemption from the requirement to obtain a Ballast Water Management Certificate and Ballast Water Management Plan

While all vessels must keep records of ballast operations, case by case exemptions from having a BWMP and BWMC are available upon application for vessels operating only in Australian waters. [Attachment A](#) explains the requirements for different vessel types in detail.

Vessels may apply for an exemption where equivalent measures to address biosecurity and safety concerns can be demonstrated. Applications will be considered for vessels that:

- are less than 400 gross tonnes
- use potable water as ballast, and only discharge for the purpose of scheduled maintenance, dry-docking or emergency
- are dumb barges with no power source, and that do not uptake and discharge ballast water on a regular basis

Risk based exemptions

A risk based exemption from ballast water management may be granted upon application to the Director of Biosecurity. Applications must include a risk assessment based on the Convention guidelines for risk assessments (G7), which demonstrates the level of biosecurity risk associated with the ballast water is acceptable.

How to apply for an exemption

To apply for an exemption email awepestsmarine@awe.gov.au. The application will be assessed within 28 days of receipt of a valid application. Assessment fees may apply.

An application for an exemption must include:

- a completed and signed application form
- proof of legal entity showing the business or organization name that is the owner of the vessel
- vessel particulars or an attachment showing vessel particulars and ballast capacity
- operational profile of the vessel, demonstrating operation solely in Australian waters or the high seas
- an approved BWMP detailing ballast operations and methods
- an approved BWMC.

Further information may be required in order to assess the application.

It is strongly encouraged you contact the department at pestsmarine@awe.gov.au prior to submitting an application to ensure an exemption is required for your vessel. If you have questions about applying for an exemption, please email pestsmarine@awe.gov.au.



Military Vessels

The Department has an expectation of all visiting international and domestic military vessels, or vessels that fall under Article 3.2(e) of the ballast water convention and the *Biosecurity Act 2015* - Sect 263(a) to undertake measures to manage any biosecurity risk that may be related to the vessel's ballast water management.

The department will provide further information, including guidelines on sovereign immunity if required. [Contact the MNCC for further advice.](#)



8 Disposal of Ballast Tank Sediment

Key points

- Disposal of tank sediment is prohibited in Australia's EEZ
- A vessel may discharge ballast tank sediment outside 200 nautical miles from the nearest land, and in at least a depth of 200 metres or at an approved land-based reception facility

Sediment must be disposed of in an area outside 200 nautical miles from the nearest land, and in at least a depth of 200 metres, or at an approved land-based reception facility. Australian state and territory legislation may apply to land-based sediment reception facilities.

Stripping of ballast tank sediment in Australian seas is not permitted, unless a vessel seeks permission to discharge sediment to a reception facility.

The discharge of sediment is permitted if:

- it is necessary for ensuring the safety of the vessel in an emergency or saving life at sea
- if the discharge is accidental and results from damage to the vessel or its equipment
- where all reasonable precautions have been taken to prevent or minimise the discharge
- for the purposes of minimising pollution.

The department must be contacted with details of the disposal as soon as is practicable of the vessels crew becoming aware of the disposal.

For more information, [contact the MNCC](#).



9 Practical Considerations

Masters must apply the requirements in this section if applicable to their vessel type.

Ballasting under pilotage

A vessel that is under pilotage may manage ballast water to adjust trim for safety considerations and/or to allow for draft restrictions. This may occur after the responsible ballast water officer has submitted the ballast water report to the department demonstrating the ballast water on-board has been acceptably managed for discharge. The vessel's responsible ballast water officer is required to record all ballast water management in the vessel's ballast water records. These records must be presented to a biosecurity officer on request.

Estimating pump rates

The definition of a single pressure source includes using two or more pumps simultaneously into common lines.

Estimating the quantity of water flushed through each tank involves estimating the delivery rate of ballast pumps, and timing the hours of running of those pumps.

The actual pump rates will differ from their rated capacity due to:

- wear on pumps, pipes etc.
- depth underwater of sea inlet (vessel's draft)
- horizontal and vertical distance of each tank from the pump (friction/gravity)
- vessel trim (trim by the stern will pump the water uphill and force the pump to overcome gravity)
- variations in ballast main diameter.

To ensure that sufficient water has been flushed through a tank to satisfy Australian requirements, we strongly recommend that ballast water management equipment such as pumps be regularly surveyed, and tested to verify actual delivery rates.

Pumping rates should be recorded in the BWMP or the ballast water record book and verified through annual surveys.

Test to estimate pumping rates:

Pump tests should be conducted against the fore peak tank or similarly situated tanks forward of the vessel and should be the furthest tank/s from the ballast pumps. Most vessels have a portion above the waterline, and most ballast mains (pipes) will incorporate a series of reductions in diameter and changes in direction between the pump and the tank. The combination of all of these factors leads to the fore peak tank receiving less water per hour than any other on the vessel.

The pump test should therefore comprise filling the fore peak from empty or waterline (as proven by a manual sounding) until the tank is full or overflows and timing the operation. A template for documenting ballast pump tests is available in [Attachment C](#).

If more than one ballast pump is fitted, each pump should be tested separately. If two pumps are intended to be used together in flow-through operations, a separate test using both pumps



together should be conducted. The quantity being delivered by two pumps operating together into a common line would usually be less than the sum of each pump’s individual delivery rate.

As it would be unusual to use two pumps to fill the fore peak tank, a test of the combined delivery rate of two pumps should be conducted against forward upper wing tanks, ideally above the waterline. For example, Top Side Tanks 1 Port and Starboard.

The department recommends pump tests only be conducted when it is safe to do so and in accordance with the vessels ballast water management plan.

Exchange calculation examples

Sequential exchange

Calculation example 1

A vessel has a fore peak ballast tank with full capacity 2,000 m³. The vessel’s master wishes to arrive in an Australian port with the fore peak tank only half full (1,000 m³). Regardless of how much high-risk water is in the tank before the exchange, the water in the tank must be exchanged so that, after refilling, not more than 5 per cent of the resulting mixture in the tank is high-risk water. After pumping out (when suction on the pump is lost), a sounding of the tank is taken and this shows that only 5 m³ remains.

In this situation, provided at least 95 m³ of deep ocean water is added to the fore peak tank, the resultant mixture will be acceptable for discharge in Australian seas. The master may fill the tank only to his desired volume of 1,000 m³ and the ballast water in the tank requires no further management.

Calculation example 2

A vessel has a centre line, double bottom tank beneath No. 1 Cargo Hold (DB1C) with full capacity 6,000 m³. The vessel’s master wishes to arrive in an Australian port with DB1C only filled to one-third of its capacity (2,000 m³).

After pumping out (when suction on the pump is lost), a sounding of the tank is taken and this shows that 250 m³ remains in the tank.

To achieve a 95 per cent volumetric exchange in this tank, the master has two options:

- 1) Fill the tank up to 5,000 m³ and then pump out water until his desired level of 2,000 m³ is reached
- 2) Strip the tank until only 100 m³ remains before refilling the tank to 2,000 m³.

Flow-through/dilution

A cape-sized vessel (100,000 DWT) with nine cargo holds, has the following dedicated ballast tanks:

Tank/hold	Capacity	Contents
WBT 1P	3 000 m ³	Full
WBT 1S	3 000 m ³	Full



Tank/hold	Capacity	Contents
WBT 2P	4 200 m ³	Full
WBT 2S	4 200 m ³	Full
WBT 3P	3 000 m ³	1200 m ³
WBT 3S	3 000 m ³	Full
WBT 4P	4 200 m ³	Full
WBT 4S	4 200 m ³	Full
After peak	1 200 m ³	800 m ³

The 10-year-old vessel is fitted with two main ballast pumps each with a rated capacity of 2,500 m³/hr when the vessel was new. From pump tests, the chief officer is aware that each of these pumps now delivers about 2,000 m³/hr when used by itself, or a total of 3 700 m³/hr when the pumps are used together.

Calculation example 1

Fore peak tank (capacity 2,000 m³) initially contains 1,000 m³ of high-risk ballast water. The Master wants to exchange the tank's contents in mid-ocean using the flow-through method.

300 per cent of the tank's full capacity (i.e. 3 x 2,000 m³) = 6,000 m³.

Using only one pump, the master must pump clean seawater into the tank for three hours. Using two pumps together, the required pumping time would be 6,000 ÷ 3,700 = 1.62 hours (1 hour 37 minutes).

One pump delivers 2,000 m³/hr = 6,000 m³ in 3 hours = 300% of tank's FULL capacity.

Two pumps deliver 3,700 m³/hr = 6,000 m³ in 1.62 hours = 300% of tank's FULL capacity.

Calculation example 2

The Master wants to use flow-through method on WBT 1P, WBT 1S, WBT 2P and WBT 2S.

Acceptable

Using both ballast pumps together, the master simultaneously flushes WBT 1P and 1S for at least 4.86 hours (combined capacity of 1P&S = 6,000 m³, 4.86 hours pumping @ 3,700 m³/hr = 18,000 m³ = 300% of each tank's full capacity).

After the ballast exchange in WBT 1P and S, those tanks are closed off and a new exchange begins on WBT 2P and S simultaneously. No. 2s, with combined capacity of 8,400 m³, require a further 6.81 hours of flushing with both pumps simultaneously.

Unacceptable



Master uses both pumps to flush WBT 1P&S and WBT 2P&S (combined capacity = 14,400) simultaneously for 11.68 hours. The pumps deliver the same quantity of water in total but it is impossible to say how much water each tank received if this procedure is used. It is clear though that No. 1s, being further from the pumps, will receive less than No. 2s.



10 Further Advice and Information

General advice and support

Further information can be obtained by contacting the department or visiting the department's [website](#). For further information on the process to manage ballast water in Australian waters, please contact the Maritime National Coordination Centre or the department's nearest [regional office](#).

Maritime National Coordination Centre

Email: maritimeNCC@awe.gov.au

Phone: 1300 004 605

Fax: 1300 005 882

Exemptions

For further information on exemptions please contact the department's Marine Biosecurity Unit.

Marine Biosecurity Unit

Email: pestsmarine@awe.gov.au

Website: awe.gov.au/ballast



Attachment A: Ballast Water Management Plan and Certificate Requirements

This table shows the requirements for ship types/classes designed to carry ballast water, to obtain a ballast water management plan and ballast water management certificate.

Ballast Water Management Plan and Certificate requirements

Scenario number	Ship type/class	Sub-category	Ballast Water Management Plan & Certificate required?	Exemption Policy
1	Ships which use an IMO Type Approved BWMS	Any size	Yes—approved by a survey authority or a Flag State Administration	Not eligible for an exemption
2	Commercial and non-commercial ships (that don't meet table items 1, 3, 4 or 7)	Greater than 400 gross tonnes	Yes—approved by a survey authority or a Flag State Administration	Exemption may be available on a case-by-case basis. Vessel must manage ballast water
3	Ships using potable water, Vessels with no power source	Any size	Yes—approved by a survey authority, registered surveyor or Flag State Administration.	Exemption may be available on a case-by-case basis. Vessel must manage ballast water.
4	Ships that are covered by Equivalent Compliance	(Regulation A-5) of the Ballast Water Convention ¹	Yes—approved by a survey authority, registered surveyor or Flag State Administration.	Exemption may be available on a case-by-case basis. Vessel must manage ballast water
5	Commercial ships	Less than 400 gross tonnes	Yes—approved by a survey authority, registered surveyor or Flag State Administration.	Exemption may be available on a case-by-case basis. Vessel must manage ballast water.
6	Non-commercial ships	Less than 400 gross tonnes	No (application for exemption <u>not</u> required)	Exempt from this requirement. Vessel must manage ballast water.

¹ The *Guidelines for Ballast Water Management Equivalent Compliance (G3)* apply to pleasure craft used solely for recreation or competition or craft used primarily for search and rescue less than 50 metres in overall length and with a maximum ballast water capacity of eight cubic metres. Overall length means the length of the hull excluding bowsprits, booms, bumpkins, pulpits.



Scenario number	Ship type/class	Sub-category	Ballast Water Management Plan & Certificate required?	Exemption Policy
7	Ships considered to have sealed tanks ²	Any size	No (application for exemption <u>not</u> required)	Exempt from this requirement. Must still manage ballast water.
8	Government and defence vessels	Used only for non-commercial purposes	No (application for exemption <u>not</u> required)	Exempt from this requirement

² Sealed Tanks - Ballast tanks that are permanently sealed and unable to receive or discharge ballast water from the environment. Vessels that have been fitted with spectacle blinds or similar, and do not intend to discharge or uptake ballast water during normal operations, are considered to have sealed tanks.



Attachment B: Example Ballast Water Management Certificate

Certificate no:
Page 1 of 2



Ballast Water Management Certificate/Document/Statement of Compliance

This Certificate/Document/Statement of Compliance is issued for the information of interested parties to indicate compliance with the provisions of the International Convention for the Control and Management of Ships' Ballast Water and Sediments (hereinafter referred to as "the Convention") **under the authority of the Government of** by Lloyd's Register EMEA.

	Particulars of ship
Name of ship	
Distinctive numbers or letters	
Port of registry	
Gross tonnage	
IMO number	
Date of construction	
Ballast water capacity (in cubic metres)	
Method of Ballast water management used	Details of Ballast water management method(s) used
Date installed (if applicable)	
Name of manufacturer (if applicable)	

The principal ballast water management method(s) employed on this ship is/are:

in accordance with regulation D-1

in accordance with regulation D-2 (describe)

the ship is subject to regulation D-4

This is to certify:

- that the ship has been surveyed in accordance with regulation E-1 of the Annex to the Convention; and
- that the survey shows that Ballast Water Management on the ship complies with the Annex to the Convention

This certificate is valid until _____ subject to surveys in accordance with regulation E-1 of the Annex to the Convention

Completion date of the survey on which this certificate is based:

issued at _____ on _____

Surveyor to Lloyd's Register EMEA

a member of the Lloyd's Register group.

Lloyd's Register Group Limited, its affiliates and subsidiaries and their respective officers, employees or agents are, individually and collectively, referred to in this clause as 'Lloyd's Register'. Lloyd's Register assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.

Form 6608 (2015, 08)



Attachment C: Ballast water pump test

Vessel name:.....

IMO number:

Port of registry:

Date launched:

ID of ballast pump(s) tested:.....

Original rated capacity of pump(s) tested:

Details of tank(s) used in test:

(Fore peak tank preferred for single pump tests, forward upper wing tanks preferred for testing combined pumps)

a) Maximum tank capacity (m³):

b) Initial contents (m³):

c) Time start pumping:

d) Time tank overflowed: e) Hours Pumping (d – c): f) Volume pumped (a – b):

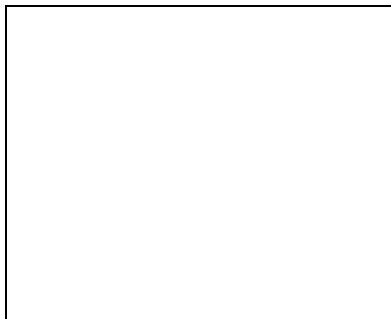
e) Pump’s delivery rate: (f ÷ e) per hour

f) Date of Pump Test/...../.....

Master’s signature:

Chief officer’s signature:

Vessel’s stamp:



The safety of the vessel and crew are paramount. We strongly recommend pump tests are only to be conducted if safe to do so, and that pumps are tested at least every 12 months.



Attachment D: Maps of Ballast Water Exchange Exclusion Areas

Great Barrier Reef ballast water exchange exclusion area

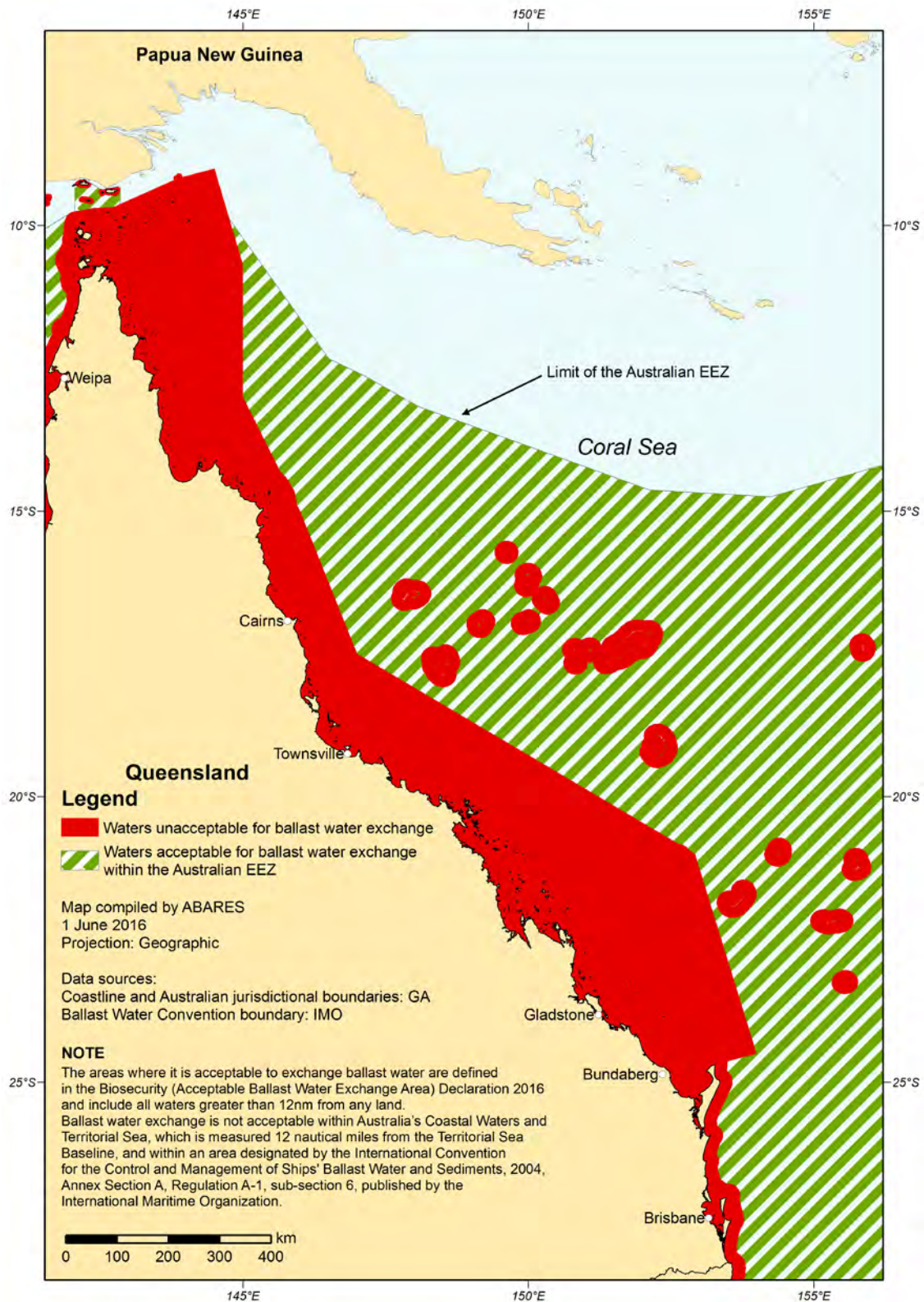
From the nearest land off the north-eastern coast of Australia means from a line drawn from a point on the coast of Australia in:

latitude	11°00′	S,	longitude	142°08′	E
to a point	in	latitude	10°35′ S,	longitude	141°55′ E
thence to a point	latitude	10°00′ S,	longitude	142°00′ E	
thence to a point	latitude	9°10′ S,	longitude	143°52′ E	
thence to a point	latitude	9°00′ S,	longitude	144°30′ E	
thence to a point	latitude	10°41′ S,	longitude	145°00′ E	
thence to a point	latitude	13°00′ S,	longitude	145°00′ E	
thence to a point	latitude	15°00′ S,	longitude	146°00′ E	
thence to a point	latitude	17°30′ S,	longitude	147°00′ E	
thence to a point	latitude	21°00′ S,	longitude	152°55′ E	
thence to a point	latitude	24°30′ S,	longitude	154°00′ E	
thence to a point	on the coast of Australia in latitude 24°42′ S, longitude 153°15′ E				

If the requirements to conduct a ballast water exchange outside 12 nautical miles of the Great Barrier Reef Marine Park (see Map 1) are unachievable, the master should contact the MNCC for advice as soon as possible.



Map 1 - North-eastern Australian areas that are acceptable for ballast water exchange within the Australian EEZ





Ningaloo ballast water exchange exclusion area

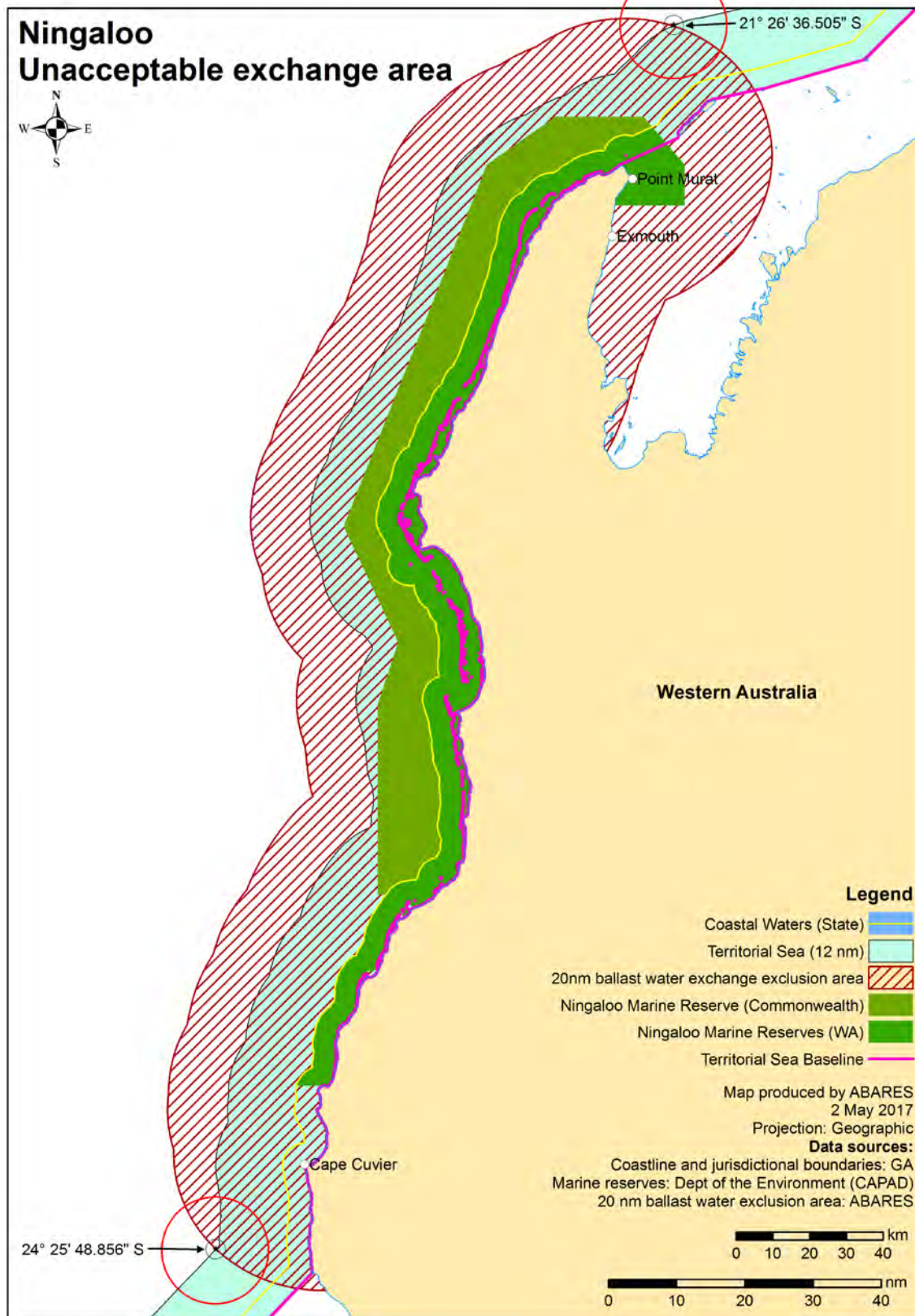
Ballast water exchange is not permitted in the Ningaloo ballast water exchange exclusion area.

The Ningaloo ballast water exchange exclusion area is the area bounded by the line starting at the point described in Item 1 of the following table and running sequentially as described in the table below.

Item	Description
1	The point of intersection of the outer limit of the territorial sea, north of North West Cape Western Australia, by the meridian of longitude 114°14'21" East
2	North along that meridian to its intersection by the outer limit of the line every point of which is 20 nautical miles from the territorial sea baseline
3	Generally south-westerly along that outer limit to its intersection by the parallel of latitude 24°01'53" South
4	East along that parallel to its intersection by the outer limit of the territorial sea
5	Generally north-easterly along that outer limit to the starting point



Map 2: Ningaloo Reef Marine Park Exclusion Zone





Attachment E: Ballast Water Management System Commissioning Circular



Australian Government
Department of Agriculture

10/18/2019

Marine Biosecurity Unit
Department of Agriculture
18 Marcus Clarke St
Canberra 2601
pestsmarine@agriculture.gov.au

DEPARTMENT OF AGRICULTURE SHIPPING CIRCULAR

NO. 01 OF 2019

Who does this notice affect?

Shipowners, ship managers, operators, Masters of Australian flagged ships, Recognised Organisations (ROs), ballast water management equipment manufacturers, testing laboratories and shipyards

COMMISSIONING TESTING OF BALLAST WATER MANAGEMENT SYSTEMS

1. This circular is to inform the industry on the application of BWM.2/Circ.70 on "**Guidance for the commissioning testing of ballast water management systems**" for Australian flagged ships to which the Ballast Water Management Convention applies.
2. The Marine Environment Protection Committee (MEPC) of the International Maritime Organization (IMO) approved the proposed amendments to regulation E-1.1.1 and E-1.1.5 of the Ballast Water Management Convention (BWM Convention) which are expected to enter into force at a later date¹. The amendments require an installed ballast water management system (BWMS) to undergo a commissioning test during the initial, or additional, survey.
3. The purpose of the commissioning test is to verify that the mechanical, physical, chemical and biological processes of the installed BWMS are working properly, taking into account guidelines developed by the IMO (i.e. the BWM.2/Circ.70, as may be amended). The commissioning test is not intended to validate the type approval of the BWMS.
4. The commissioning test shall be carried out for BWMS that are installed on board applicable Australian Flagged Ships² of 400GT and above after **8 September 2019**. Applicable ships of less than 400GT may undergo the commissioning test voluntarily.
5. The commissioning test shall be carried out to the satisfaction of the attending RO surveyor after a complete installation of the BWMS, and after all ballasting equipment (e.g. pumps and piping) has been fully tested as appropriate. The commissioning testing should be carried out in accordance with the Annex of BWM.2/Circ.70 - Guidance for the commissioning testing of ballast water management systems.
6. The ballast water samples collected for the commissioning test should be a representative sample, analysed using at least an appropriate indicative analysis method³. The commissioning test is considered to be successful if the analysis indicates that the sample does not exceed the D-2 standard and the self-monitoring equipment of the BWMS indicates correct operation of all sensors and related equipment.

¹Amendments to the Biosecurity (Ballast Water and Sediment) Determination 2017 shall be made accordingly.

²Ships that are required to meet the D2 performance standards as per Ballast Water Management Convention Regulation B3, as amended.

³List of indicative analysis methods are listed in table 3 of BWM.2/Circ.42/Rev.1, as may be amended



7. A written report including methods and detailed results of the commissioning testing should be provided to the attending RO surveyor for verification before an International Ballast Water Management Certificate (IBWMC) can be issued. The report should be provided to the Australian Department of Agriculture (Agriculture) for information.

8. The arrangement for conducting the test and any commercial dealings pertaining to the commissioning test shall be between the shipowners/manager/shipyard/contractor and the manufacturer. Agriculture does not carry out approval of any specific testing facility. The testing facility engaged to conduct the commissioning test shall be independent of the manufacturer of the BWMS and accepted by the RO which issues the IBWMC.

9. If the commissioning test cannot be successfully carried out due to the equipment's system design limitation, a short term IBWMC may be issued for a period of not more than three (3) months. This is to allow time for the commissioning test to be carried out to the satisfaction of the attending RO surveyor. No authorisation from Agriculture is required for such cases provided that the attending RO surveyor ensures the following:

- reasons for the commissioning test not being completed successfully are recorded in the ballast water record book;
- the attending RO surveyor is provided with arrangements for the commission test (e.g. date, time, location);
- the ship's ballast water management plan (BWMP) has incorporated appropriate contingency measures in line with the "Amendments to the Guidelines for ballast water management and development of ballast water management plans (G4)" (*Resolution MEPC.306(73)*);
- the ship's Master and the designated ballast water management officer are aware of the "Guidance on contingency measures under the BWM Convention", BWM.2/Circ.62, as may be amended, in particular on the communication between the ship and the port State; and
- the ship's Master and the designated ballast water management officer are aware of the reporting requirements to the competent port Authority as per regulation E-1.7 of the BWM Convention when the vessel is calling a foreign port and shall comply with any additional requirements that the port State may impose.
- The RO surveyor must collect the following information and provide it to the Marine Biosecurity Unit at pestsmarine@agriculture.gov.au as soon as reasonably practical:
 - vessel details, including name and IMO number
 - circumstances which led to incomplete testing, and
 - date for proposed next test.

10. If the commissioning test is not completed within the three (3) months of the short term IBWMC, Agriculture's approval for an extension is to be sought.

11. Any queries to this circular should be directed the Marine Biosecurity Unit at pestsmarine@agriculture.gov.au

Further information

- a) [BWM.2/Circ.70](#) - Guidance for the commissioning testing of ballast water management systems
- b) [Resolution MEPC.306\(73\)](#) - Amendments to the Guidelines for ballast water management and development of ballast water management plans (G4)
- c) [BWM.2/Circ.62](#) - Guidance on contingency measures under the BWM Convention
- d) [Proposed amendments](#) to regulation E-1.1.1 and E-1.1.5 of the BWM Convention



11 Glossary

Australian ballast water

Water that has been sourced within the Australian exclusive economic zone (within 200Nm of Australia). Also referred to as domestic ballast water.

Ballast Water Convention

The International Convention for the Control and Management of Ship' Ballast Water and Sediments which came into force on 8 September 2017 and has been ratified by Australia.

BWMP

A Ballast Water Management Plan (also referred to as a management plan) is specific to the vessel and provides the appropriate procedures for the safe management of ballast water on that vessel.

BWMC

A Ballast Water Management Certificate verifies the vessel has been surveyed to a standard compliant with the Convention and states the principle management methods used.

BWMS

A Ballast Water Management System, also known as a treatment system, is a system designed to remove and destroy/inactivate biological organisms (zooplankton, algae, and bacteria) from ballast water. These systems must be approved by the International Maritime Organization.

Department

Australian Department of Agriculture, Water and the Environment

Domestic ballast water

Water that has been sourced within the Australian exclusive economic zone (within 200Nm of Australia). Also referred to as Australian ballast water.

Empty tank

Ballast tanks that contain less than, or equal to, 5 per cent high risk water based on the total tank capacity.

High-risk ballast water

Ballast water that is considered to represent an unacceptable biosecurity risk to Australia. This includes, but not limited to, any ballast water that has not been managed in accordance with these requirements and has been taken up:

- within 12 nautical miles of any land mass or in water less than 50 metres deep
- within 500 metres of an offshore installation, or
- in an Australian port and intended for discharge in the Australian territorial seas.

Vessels without records to demonstrate the management or source of the ballast water will be considered to have high risk ballast water.

Low-risk ballast water

Water that has:

- been managed using one of the approved methods listed in [Section 4](#), or
- an approved low risk exemption and is sourced in Australia.



MARS

The Maritime Arrivals and Reporting System, used to submit the Ballast Water Report and Domestic Risk Assessment.

Record System

A Ballast Water Record System which is a complete and accurate record of all ballast water operations.

Responsible officer

The officer or crew member identified in the ballast water management plan to conduct the ballasting operations.

Sealed Tanks

Ballast tanks that are permanently sealed and unable to receive or discharge ballast water from the environment. Vessels that have been fitted with spectacle blinds or similar, and do not intend to discharge or uptake ballast water during normal operations, are considered to have sealed tanks.

Sloshing

The official term for the movement of water in a slack tank. Such movement can be so violent that it causes damage to structural steelwork inside a vessel's tank.

Appendix J

Fauna register

Appendix K

Marine pest identification brochure



Keeping your boat & gear clean will

SAVE MONEY ON FUEL

INCREASE BOAT PERFORMANCE

STOP THE SPREAD OF MARINE PESTS



Australian Government



Natural Resources Advisory Council
NEW SOUTH WALES



NSW DEPARTMENT OF
PRIMARY INDUSTRIES