SMITH BAY WHARF

DRAFT ENVIRONMENTAL IMPACT STATEMENT

MAIN REPORT

PREPARED FOR KANGAROO ISLAND PLANTATION TIMBERS BY ENVIRONMENTAL PROJECTS

JANUARY 2019

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SMITH BAY WHARF

DRAFT ENVIRONMENTAL IMPACT STATEMENT

KIPT

environmental projects

PREFACE

Kangaroo Island Plantation Timbers Ltd (KIPT) is seeking approval from the South Australian and Commonwealth governments to construct and operate a deep-water port at Smith Bay on Kangaroo Island. As a major development, the *Development Act 1993* requires that an environmental impact assessment be undertaken and an environmental impact statement (EIS) be prepared and publicly exhibited for at least 30 business days.

The publication of the Draft EIS provides the Kangaroo Island community and other stakeholders with the opportunity to make submissions directly to the State Government on this proposal.

We believe the proposal will unlock the potential for a sustainable plantation timber industry on Kangaroo Island, and we welcome comments.

John Sergeant
Managing Director
Kangaroo Island Plantation Timbers Ltd

THE EIS DOCUMENT

This document presents relevant and specific information to address the guidelines issued by South Australia's Development Assessment Commission (DAC) on 6 July 2017 for the purpose of assessing Kangaroo Island Plantation Timbers' proposal to develop a deep-water port at Smith Bay, Kangaroo Island.

The guidelines present a set of issues considered relevant for the assessment process, and rated as 'critical', 'medium' or 'standard' in terms of risk, as assessed and determined by DAC.

This document:

- provides background information as context to the development proposal and the proponent, and outlines the assessment process
- outlines the need for the project and why it is considered important for the proponent, Kangaroo Island, and South Australia
- clearly defines and describes the project for which the proponent is seeking approval and is therefore subject to assessment, in accordance with the guidelines
- describes the policies and legislative framework relevant to the planning, approval, design, construction, operation and potential future decommissioning and closure of the development
- sets out the methodology and approach to stakeholder and community engagement undertaken as part of the EIS process
- provides outcomes of risk assessments undertaken for the project and details the residual risks that have been identified and how they would be managed
- provides impact assessments and associated management measures for the natural and physical environment, including:
    - oceanographic and coastal processes
    - marine ecology
    - terrestrial ecology
    - MNES, that is, if an action is likely to have an impact on a species or community identified as 'listed 'or 'threatened' then additional approval is required from the Department of the Environment and Energy (DoEE)
    - the hydrogeological environment, including surface water, groundwater and soils
    - air quality
    - noise, vibration and light
    - biosecurity
    - heritage including Aboriginal and non-Aboriginal, and built and natural
    - climate change and sustainability
    - socio-economic environment
    - the economic environment
- provides a set of commitments made by the proponent to deliver net benefits to the environmental, social and economic values associated with the project – as an offset to the actual or potential impacts and risks that the project poses
- sets out an environmental management framework for the management and monitoring of the project to achieve the outcomes set for the various phases of the project to ensure its future sustainability
- provides specialist technical reports, references and other information to support and validate the various assessments and associated management measures and commitments for the project.

A checklist of required information (as stated in the guidelines), cross-referenced against its location within the EIS, is provided in Appendix W.

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ABBREVIATIONS

Abbreviation	Definition
AADT	Annual Average Daily Traffic
AAMI	Australian Associated Motor Insurers Limited
ABARES	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
ADGC	Australian Dangerous Goods Code
AEP	annual exceedance probability
AFS	Australian Forestry Standard AS4708
AH Act	*Aboriginal Heritage Act 1988*, Government of South Australia
Air Quality EPP	Environment Protection (Air Quality) Policy 2016
ALA	Atlas of Living Australia
ALARP	as low as reasonably practical
AMSA	Australian Maritime Safety Authority
ANZECC	Australian and New Zealand Environment and Conservation Council
ARI	average recurrence interval
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASC	Assessment of Site Contamination
ASD	Approach Sight Distance
ASRIS	Australian Soil Resource Information System
ATSB	Australian Transport Safety Bureau
AVG	abalone viral ganglioneuritis
BDSA	Biological Databases of South Australia
BOD	biological oxygen demand
BoM	Bureau of Meteorology
BWM Convention	International Convention for the Control and Management of Ships' Ballast Water and Sediments
CASS	coastal acid sulfate soils
CAZ	Contractor Activity Zone
CCZ	Coastal Conservation Zone
CD	chart datum
CEMP	Construction Environmental Management Plan
CFS	Country Fire Service
CFSR	Climate Forecast System Reanalysis

Abbreviation	Definition
CO_2	carbon dioxide
COAG	Council of Australian Governments
COD	chemical oxygen demand
COSEMA	Conservation Status of Endangered Marine Algae
CP	Conservation Park
CP Act	*Coast Protection Act 1972,* Government of South Australia
CPB	Coast Protection Board
CSD	Cutter Suction Dredge
CSI	Conservation Science Initiative
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTL	cut-to-length
DAC	Development Assessment Commission
DAWR	Department of Agriculture and Water Resources, Australian Government
dB	decibel
Development Act	*Development Act 1993*, Government of South Australia
Development Regulations	Development Regulations 2008, Government of South Australia
DEW	Department for Environment and Water (previously DEWNR), Government of South Australia
DEWNR	Department for Environment, Water and Natural Resources, Government of South Australia
DMP	Dredge Management Plan
DMPA	Dredge Material Placement Area
DoE	Department of the Environment, Australian Government
DoEE	Department of the Environment and Energy, Australian Government
DPC	Department of the Premier and Cabinet, Government of South Australia
DPTI	Department of Planning, Transport and Infrastructure, Government of South Australia
DSD	Department of State Development, Government of South Australia
DSD-AAR	Department of State Development Aboriginal Affairs and Reconciliation, Government of South Australia
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities (2010–2013), Australian Government
DWT	deadweight tonne
EDB	Economic Development Board (South Australia)
EIL/ESL	Ecological Investigation and Screening Level
EIS	Environmental Impact Statement
EMF	Environmental Management Framework
EMP	Environmental Management Plan
EP Act	*Environment Protection Act 1993*, Government of South Australia
EPA	Environment Protection Authority, Government of South Australia
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*, Australian Government
EPPs	Environment Protection Policies

Abbreviation	Definition
ESCOSA	Essential Services Commission of South Australia
ESD	ecologically sustainable development
ESE	east-south-east
FIT	Forestry Investment Trust
FOB	free-on-board
FSC	Forest Stewardship Council
FTE	full-time equivalent
GD	grab dredge
GDP	Gross Domestic Product
GIPs	grated inlet pits
GLC	ground-level concentration
GML	general mass limit
GPS	Global Positioning System
GRP	gross regional product
HA	Heritage Agreement
ha	hectare
HAFS Convention	International Convention on the Control of Harmful Anti-fouling Systems
HAT	highest astronomical tide
HIL/HSL	Health Investigation and Screening Level
HML	higher mass limit
Hs	wave height
HVNL	Heavy Vehicle National Law
IBRA	Interim Biogeographical Regionalisation of Australia
IFD	Intensity-Frequency-Duration
IGAB	Intergovernmental Agreement on Biosecurity
ILUA	Indigenous Land Use Agreement
IMO	International Maritime Organization
I-O	input-output
IPCC	Intergovernmental Panel on Climate Change
IWC	International Whaling Commission
KI	Kangaroo Island
KICE	Kangaroo Island Community Education
KIDP	Kangaroo Island Development Plan
KI Plan	Kangaroo Island Plan
KIPT	Kangaroo Island Plantation Timbers
km	kilometre
kph	kilometres per hour
kt	kilotonnes

Abbreviation	Definition
ktpa	kilotonnes per annum
kVA	kilo-volt-ampere
kW	kilowatt
LAT	lowest astronomical tide
LC	lethal concentration
LF	low frequency
LOEC	lowest observed effect concentration
LOR	limit of reporting
LOR	laboratory limit of reporting
m	metre
m AHD	metres Australian Height Datum
MAI	mean annual increment
MARPOL	International Convention for the Prevention of Pollution from Ships
MARS	Maritime Arrivals Reporting System
MAZ	Marine Activity Zone
m BGL	metres below ground level
MERCOM	Maritime Emergency Response Commander
mg/cm^2	milligram per square centimetre
mg/kg	milligram per kilogram
mg/L	milligram per litre
MHHW	mean high high water
MHLW	mean high low water
MIS	managed investment schemes
MLHW	mean low high water
MLLW	mean low low water
MMO	marine mammal observer
MNES	matters of national environmental significance
MoU	Memorandum of Understanding
MSIC	Maritime Security Identification Card
MSL	mean sea level
MWh	megawatt hour
MWO	Mitsui Bussan Woodchip Oceania
NEPMs	National Environmental Protection Measures
NFTP	New Forests Timber Products
NGER	National Greenhouse and Energy Reporting scheme
NHMRC	National Health and Medical Research Council
NITS	noise-induced threshold shift
NNTT	National Native Title Tribunal

Abbreviation	Definition
NRM	Natural Resource Management
NM	nautical miles
NOAA	National Oceanic Atmospheric Administration (USA)
Noise EPP	Environment Protection (Noise) Policy 2007
NPI	National Pollutant Inventory
NPW Act	*National Parks and Wildlife Act 1972*, Government of South Australia
NRKI	Natural Resources Kangaroo Island
NSCV	National Standard for Commercial Vessels
NTU	nephelometric turbidity units
NV Act	*Native Vegetation Act 1991*, Government of South Australia
NVC	Native Vegetation Council
NWW3	NOAA Wavewatcher III
NRM Act	*Natural Resources Management Act 2004*, Government of South Australia
OEMP	Operational Environmental Management Plan
PAR	photosynthetically active radiation
PAES	prescribed activities of environmental significance
PBS	Performance Based Standard
PCA	potentially contaminating activity
PDCA	Plan-Do-Check-Act
PEFC	Programme for the Endorsement of Forest Certification
PIRSA	Primary Industries and Resources/Regions South Australia
POMS	Pacific Oyster Mortality Syndrome
Project	Smith Bay Wharf Project
PSD	particle size distribution
PSI	preliminary site investigation
PTS	permanent threshold shift
PVC	polyvinyl chloride
RAI	Regional Australia Institute
RAM	Range-Dependent Acoustic Model
RDA	Regional Development Australia
RISE	Regional Industry Structure and Employment
RoW	right of way
RPA	remotely piloted aircraft
RPC	Representative Concentration Pathway
RSF	rapid sand filter
SARDI	South Australian Research and Development Institute
SARIG	South Australian Resources Information Geoserver
SEB	Significant Environmental Benefit

Abbreviation	Definition
SI	surface irradiance
SISD	Safe Intersection Sight Distance
SRG	Stakeholder Reference Group
SRTM	Shuttle Radar Topography Mission
SWAN	Simulating Waves Nearshore
t	tonne
TAFE	Technical and Further Education
TAPM	The Air Pollution Model
TDS	total dissolved solids
TEC	threatened ecological community
TIA	traffic impact assessment
TOC	total organic carbon
Tp	wave period
tpa	tonnes per annum
tph	tonnes per hour
TMP	Traffic Management Plan
TRH	total recoverable hydrocarbons
TSP	total suspended particulate
TSS	total suspended solids
TSSC	Threatened Species Scientific Committee
TTS	temporary threshold shift
TTV	toxicity trigger value
USGS	United States Geological Survey
VHF	very high frequency
VKT	vehicle kilometres travelled
VMS	variable message signs
vpd	vehicles per day
WBNM	Watershed Bound Network Model
WNW	west-north-west
Water Quality EPP	Environment Protection (Water Quality) Policy 2016
WoNS	Weeds of National Significance
WWF	World Wildlife Fund

01. INTRODUCTION

01. INTRODUCTION

1.1 BACKGROUND

Kangaroo Island Plantation Timbers Ltd (KIPT) is seeking approval to build a deep-water port and associated infrastructure at Smith Bay on Kangaroo Island. The proposed development, referred to as the Kangaroo Island Seaport (or KI Seaport), would export logs and woodchips to Asia. The facility would also be available to other approved users and for other cargoes.

Smith Bay is on the north coast of Kangaroo Island, approximately 20 km west of Kingscote and approximately 10 km west of Emu Bay (see Figure 1-1).

On 16 February 2017, the Minister for Planning (the Minister) declared KIPT's proposal would be assessed as a 'major development' pursuant to s.46(i) of the *Development Act 1993*.

Section 46 requires that matters affecting the environment, the community or the economy, to a significant extent, are fully examined and considered in the Minister's assessment of the proposal.

South Australia's Development Assessment Commission (DAC) is responsible for setting the level of assessment required (i.e. an environmental impact assessment, public environmental report or a development report) and formulating guidelines for the preparation of the assessment document.

Following the Minister's declaration, DAC determined that KIPT's proposal required that an environmental impact assessment be undertaken and that an environmental impact statement (EIS) be prepared, as set out in s.46B of the

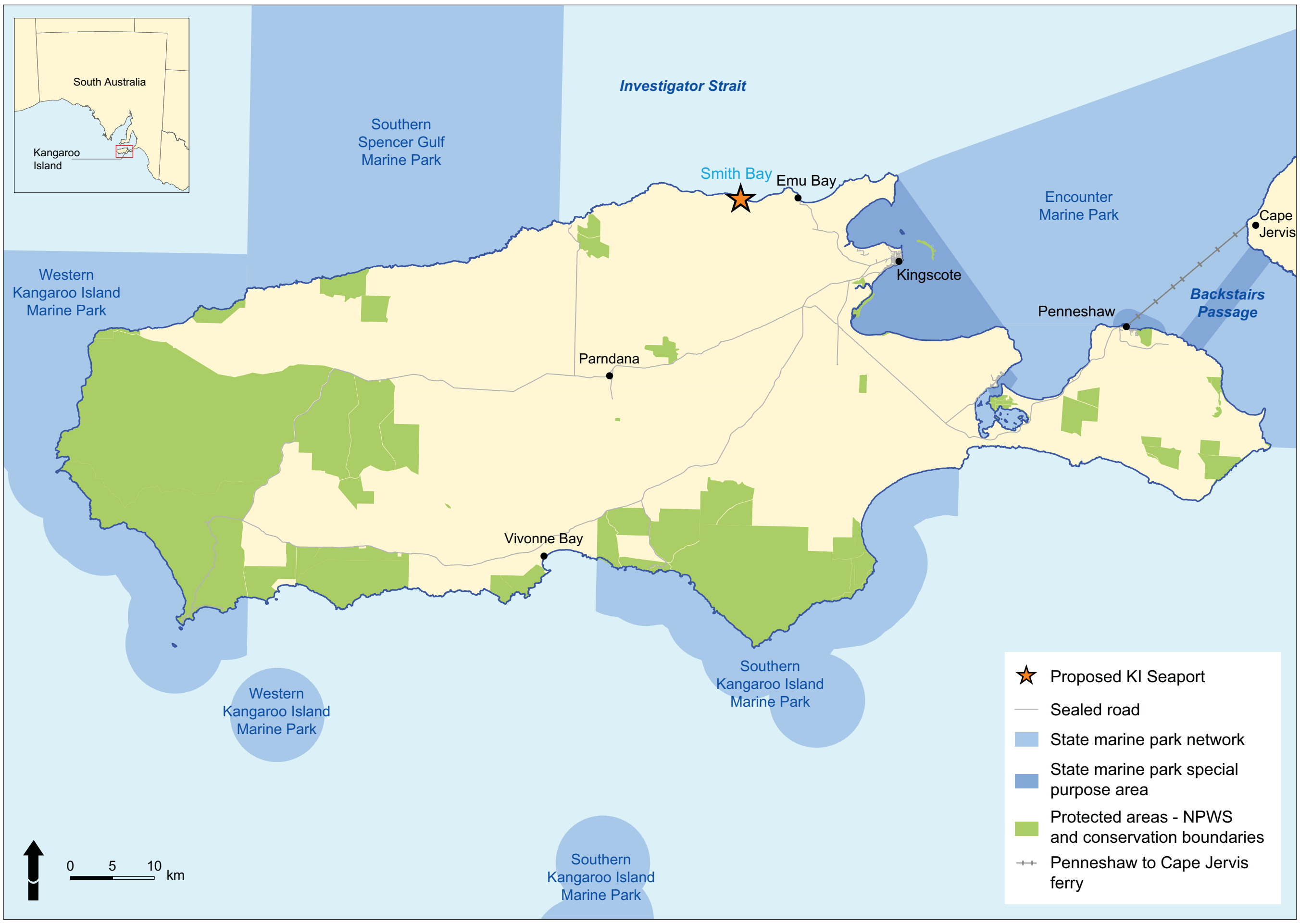


FIGURE 1-1 KANGAROO ISLAND SHOWING SMITH BAY LOCATION

Development Act. This decision was based on a number of issues including:

- the potential impact on the marine environment, including fisheries and biosecurity risks
- the level of non-conformity with existing zone policies within the Kangaroo Island Development Plan (KIDP)
- the establishment of a shipping port in a rural coastal location
- traffic generation and implications for the existing local road network
- potential economic benefits to the region
- potential impacts on other existing commercial operations in the area
- potential impacts on protected, threatened or vulnerable species, including migratory species
- visual and community impacts
- climate change and greenhouse gas emissions
- construction and operational impacts (including noise, dust and vibration)
- infrastructure requirements, in particular public roads.

The EIS is required to assess potential impacts and risks associated with both the construction and operational phases of the proposed development at Smith Bay. It will consist of the Draft EIS, which is prepared in accordance with the guidelines (for public and agency comment) and a Response Document that will outline how these comments have been considered and provide responses to submissions received during the public consultation period. Together, the Draft EIS and the Response Document comprise the EIS that is assessed as part of the South Australian and Commonwealth governments' approval process.

1.2 THE PROPONENT

KIPT is Australia's only ASX-listed (KPT) timberland company. It was established in January 2000 and adopted its current name in June 2013, by which time its operations were consolidated on Kangaroo Island. KIPT is committed to building a sustainable timber industry on Kangaroo Island. KIPT's key milestones are outlined in Table 1-1.

KIPT's organisational structure (see Figure 1-2) consists of a Board of Directors and an Executive Team, supported by specialists with operational expertise.

KIPT's assets include:

- approximately 25,400 ha of land on Kangaroo Island, comprising:
  - 14,200 ha of plantation timber, of which 12,780 ha (90 per cent) is hardwood species, Tasmanian blue gum (*Eucalyptus globulus*) and shining gum (*Eucalyptus nitens*), and 1420 ha (10 per cent) is softwood species, Monterey pine (*Pinus radiata*)
  - 7300 ha of land with remnant native vegetation
  - 3900 ha of cleared land with no remnant vegetation or forestry plantation
- a softwood sawmill, in care-and-maintenance
- 11.7 ha of land at the Smith Bay site and 173 ha of adjoining land to the west
- 20.8 ha of land at Ballast Head, formerly the site of a shiploading facility (for crude gypsum mined near Penneshaw, at Salt Lake and Pelican Lagoon) which operated from the late 1950s to the late 1980s
- building structures and dwellings located on some forestry and non-forestry allotments, at Smith Bay and at Ballast Head.

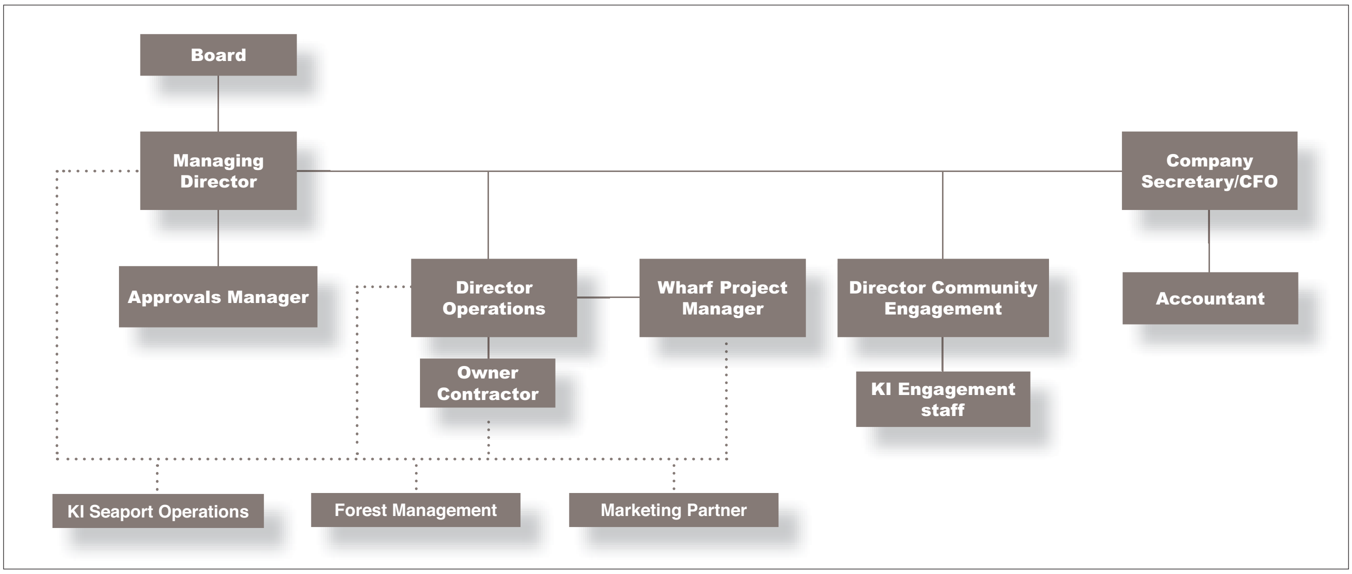


FIGURE 1-2 KIPT'S ORGANISATIONAL STRUCTURE

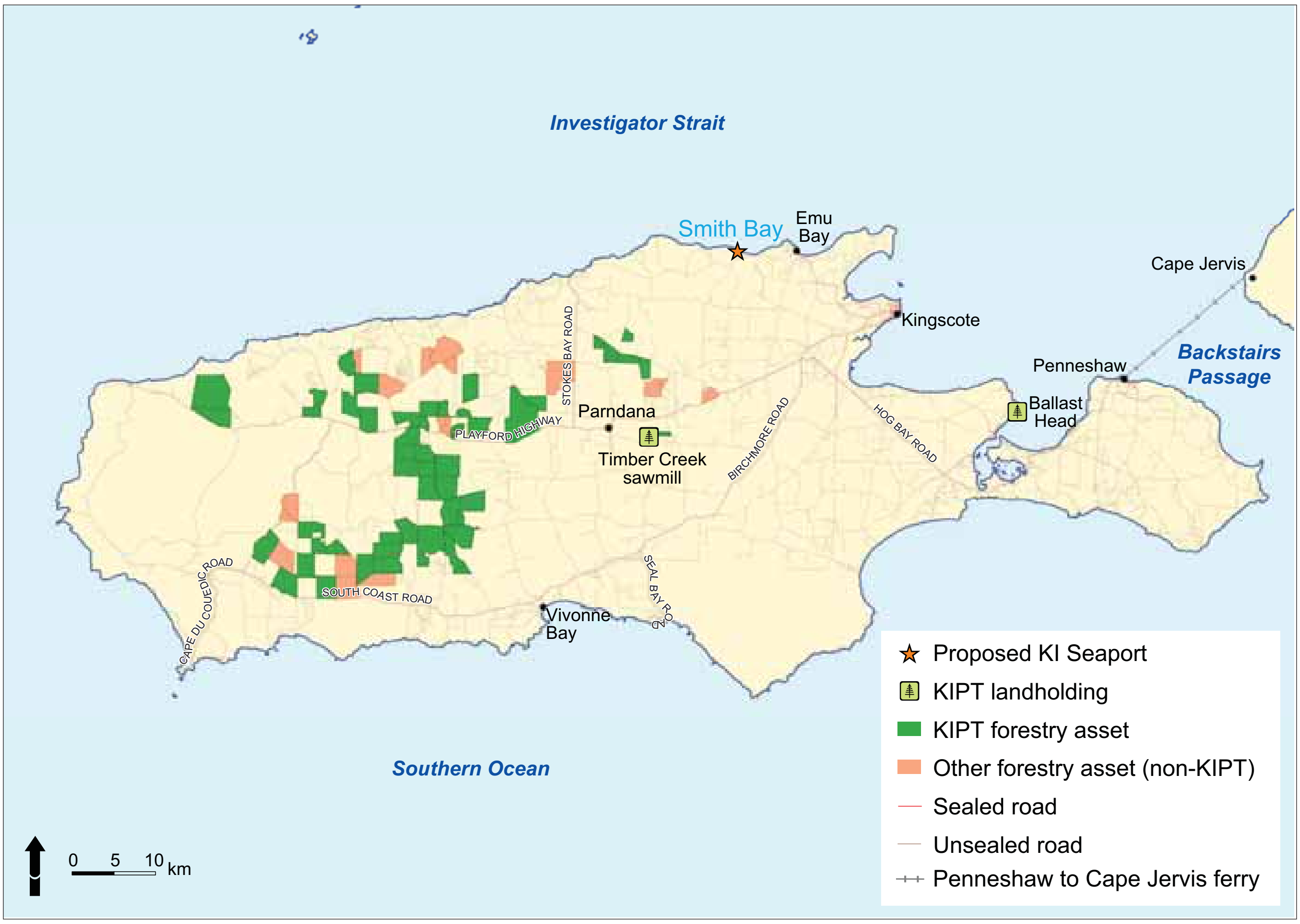


FIGURE 1-3 KIPT'S FORESTRY PLANTATION ASSETS

KIPT's plantation forests and its other assets are shown in Figure 1-3.

1.3 THE PROJECT

1.3.1 OBJECTIVE

KIPT owns 14,200 ha of plantation timber on Kangaroo Island. Much of this timber is ready to harvest. KIPT has sufficient timber to produce a sustainable annual average harvest of 600,000 tonnes per annum (tpa) for the first 13 years (i.e. the first rotation) and a further 500,000 tpa in the following 12 years (i.e. the second rotation). The market for this timber is in Asia, principally Japan and China.

KIPT's objective is to build and operate a deep-water port facility with associated on-land facilities suitable for exporting logs (softwood) and woodchip (hardwood). There is currently no facility on Kangaroo Island capable of handling the volume of available timber products economically.

There would be excess capacity at KI Seaport, which would be made available for other timber growers to export their products. The new facility could also be used, without modification, to export containerised or bulk agricultural produce and to import containerised freight. For further detail see Chapter 2 – Project Justification.

The proposed site for the onshore components of the deep-water port is within the freehold area of land owned by KIPT, at the western end of Smith Bay. It borders approximately 400 metres of the 5670 metres of Smith Bay coastline.

This area of land is identified as Allotment 51 and Allotment 52, Certificate of Title Volume 6127, Folio 273, Hundred of Menzies in the area of Wisanger (see Figure 1-4).

The proposed site is accessible from North Coast Road via Freeoak Road (formerly an unnamed road).

TABLE 1-1 KEY KIPT MILESTONES

Date	Milestone
December 2013	KIPT's site assessment and selection process is completed. Twelve separate sites evaluated, including three different options at two of the sites (Penneshaw and Kingscote); a total of 16 options evaluated. KIPT identifies an area at Smith Bay as the most suitable site on Kangaroo Island to develop a deep-water port.
February 2014	KIPT purchases 11.7 ha at Smith Bay.
2015	KIPT and New Forests Timber Products Pty Ltd (New Forests Timber Products), separately approach the SA Government with independent proposals to build a facility on Kangaroo Island to export their timber. Ongoing discussions occur throughout 2015.
19 December 2015	SA's Minister for Transport advises KIPT that the Government of South Australia will allow and assess only one port development proposal for Kangaroo Island.
October 2016	New Forests Timber Products agrees to sell its Forestry Investment Trust (FIT) estates and other assets (including all its plantation land, standing timber and the Ballast Head site proposed by New Forests Timber Products as an export facility) on Kangaroo Island to KIPT.
21 October 2016	KIPT submits an initial concept plan to develop an export facility at Smith Bay to SA's Minister for Planning, requesting the proposal be declared a major development under s.46(1) of the *Development Act 1993*.
8 November 2016	Referral of proposed action, Kangaroo Island Plantation Timbers Ltd Smith Bay Wharf Development, to DoEE to determine if a 'controlled action' under s.75 of the EPBC Act.
14 December 2016	DoEE notify KIPT of the referral decision of 'controlled action'.
31 January 2017	KIPT and Mitsui Bussan Woodchip Oceania Pty Ltd (MWO) enter into a Memorandum of Understanding to create an exclusive marketing arrangement for timber products from Kangaroo Island.
16 February 2017	The Minister for Planning declares the Smith Bay proposal a major development.
12 April 2017	KIPT concludes the purchase of New Forests Timber Products' Kangaroo Island assets.
6 July 2017	The Minister for Planning publishes guidelines for the EIS assessment, as defined by DAC.
19 September 2017	PF Olsen (Aus) Pty Ltd is engaged by KIPT to provide independent forestry management services to KIPT.
21 November 2017	KIPT and MWO enter into a binding five-year woodchip sale and purchase agreement, which provides that Mitsui will purchase up to 500,000 green tonnes per annum (tpa) of woodchip from KIPT on a free-on-board (FOB) basis or equivalent.

1.3.2 THE PROPOSED FACILITY

The facility would export up to 730,000 tonnes per annum of timber product and consist of:

- a log storage and laydown area
- a woodchip storage area
- materials handling infrastructure (e.g. woodchip materials management system)
- road transport access
- ancillary facilities including administration buildings, quality control equipment, car parks and associated infrastructure including security fencing.

The wharf structure would consist of:

- a (dredged) berthing pocket
- a causeway (constructed with material dredged for the berthing pocket)
- a link span bridge
- a floating pontoon
- tug mooring facilities
- retaining structures and mooring dolphins.

Ancillary services would include power, water, wastewater and stormwater management facilities, telecommunications and security.

All harvested timber products would be transported to the KI Seaport along public roads.

It is anticipated that timber-carrying ships (Panamax and Handymax vessels) would use the port for between 30–75 days per annum and would have priority over other vessels that might use KI Seaport in the future.

The facility would be available for third-party users, subject to relevant government approvals and commercial agreements with KIPT.

See Chapter 4 – Project Description for information regarding the KIPT project, of which the proposed KI Seaport is a major component.

FIGURE 1-4 SMITH BAY SITE COMPRISING ALLOTMENTS 51 AND 52

1.3.3 PROJECT PHASES AND TIMING

Following major development approval and subsequent permitting and licensing for the development, civil plant and equipment would be mobilised to site within the first month of the construction program to commence site preparatory works.

Site preparation would extend over a period of several weeks, followed by a dredging program inclusive of dredge spoil management, to establish the berth pocket. Dredging of the berth pocket is expected to be completed within a three-month period.

Causeway construction would commence once dredge spoil material of appropriate specification is available. Construction of the causeway (core and rock armouring) would extend over a seven-month period.

Marine piling works, the installation of the floating pontoon and wharf finishing works would be completed as part of the construction program. The facility would be built within a 15-month timeframe in readiness for the hand-over and commissioning phase. The installation of woodchip materials handling systems would follow once all civil works had been completed and would be subject to lead times of up to 12 months from the initial purchase order, which means this component of the construction program may not be completed until some months after the facility is ready for the export of logs.

1.4 THE PREFERRED OPTION

1.4.1 SITE LOCATION

KIPT purchased the Smith Bay site after evaluating 16 options across 12 sites. KIPT considers Smith Bay to have a number of distinct advantages that make it the preferred location for a deep-water port:

- it is the closest practicable sheltered north-coast site to the timber resource suitable for deep-draft ocean-going vessels
- deep-water (necessary to berth large ocean-going vessels) is relatively close to the shore
- the adjacent land is relatively flat, making it suitable to store logs, woodchips and other cargo safely, and for material from the stockpile to be transferred efficiently to the transport vessel
- the adjacent land is cleared and somewhat degraded
- the adjacent land was previously used for commercial aquaculture operations
- natural features, such as Smith Creek, and topography associated with the adjacent land have been altered for previous commercial aquaculture operations
- development of the site is unlikely to pose a threat to endangered marine or terrestrial species, or to endangered ecological communities, and critical habitat
- the site is not within a major tourism area or marine national park.

See Chapter 3 – Project Alternatives for more detail.

1.4.2 HISTORY OF THE SITE

Archaeological evidence suggests that Indigenous groups left Kangaroo Island about 2500 years ago.

It is well recorded and acknowledged that many Aboriginal people (predominantly women) were brought forcibly to the Island in the nineteenth century.

No Aboriginal heritage sites or listed heritage places have been recorded within the site area. No active Native Title Claims or Indigenous Land Use Agreements exist over, or adjacent to, the site.

The first European inhabitants of Smith Bay were sealers from Sydney who arrived in 1824 (Clarke 1996).

Agricultural settlements near Smith Bay followed in the 1850s (Bell and Austral Archaeology 2018).

Land at Smith Bay was alienated from the Crown in 1906 when Mr John Turner expanded his landholdings for cropping and grazing.

Historical photographs show that shipping and export activities once occurred at Smith Bay (Bell and Austral Archaeology 2018). (For further information see Chapter 24 – Heritage.)

More recently (since the 1990s) the site has been used for a land-based aquaculture enterprise and there is evidence of vegetation clearing, modified natural topography and land disturbance, as well as some abandoned infrastructure remaining on the site from previous commercial aquaculture ventures.

In 2014, the site (Allotment 51 and Allotment 52) was created by subdivision.

There are no World Heritage Sites, Commonwealth Heritage Sites or National Heritage Sites in the study area.

There are reports of four shipwrecks (three of which are protected under Commonwealth legislation) that may be located in or around Smith Bay (which extends 5670 metres along Kangaroo Island's northern coast), but their precise locations are unknown.

1.4.3 CURRENT LAND USE

There is a three-bedroom dwelling onsite, known as Smith Bay House, which KIPT makes available for short-term accommodation.

As a consequence of previous agriculture and land-based aquaculture use, the natural environment has been significantly disturbed and little or no native vegetation remains.

Land use surrounding the site includes:

- an active land-based aquaculture operation (to the east)
- sheep grazing and vacant land (to the west)
- the Smith Bay foreshore (to the north)
- cropping and vacant land (to the south).

1.5 LEGISLATIVE REQUIREMENTS

In addition to the legislation directly associated with approval processes (see Section 1.6.3), several state and Commonwealth legislative requirements must be met. These requirements include permits or licences for specific activities and whole-of-project approvals.

Relevant Commonwealth legislation includes:

- *Biosecurity Act 2015*
- *Environment Protection and Biodiversity Conservation Act 1999*
- *Environment Protection (Sea Dumping) Act 1981*
- *Historic Shipwrecks Act 1976*
- *National Environment Protection Council Act 1994*
- *National Greenhouse and Energy Reporting Act 2007*
- *Native Title Act 1993.*

Relevant South Australian legislation includes:

- *Aboriginal Heritage Act 1988*
- *Aquaculture Act 2001*
- *Coast Protection Act 1972*
- *Dangerous Substances Act 1979*
- *Development Act 1993*
- *Environment Protection Act 1993*
- *Fisheries Management Act 2007*
- *Harbors and Navigation Act 1993*
- *Heritage Places Act 1993*
- *Historic Shipwrecks Act 1981*
- *Marine Parks Act 2007*
- *Native Title (South Australia) Act 1994*
- *Native Vegetation Act 1991*
- *National Parks and Wildlife Act 1972*
- *Natural Resources Management Act 2004.*

See Chapter 5 – Legislative Framework and Chapter 6 – Land Use and Planning for further details.

1.6 THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

1.6.1 PURPOSE

The development will be assessed under the process and procedures required by the *Development Act 1993* for the preparation of an EIS.

It is anticipated that the comparable ‘impact assessed development’ provisions of the new *Planning, Development and Infrastructure Act 2016* will come into effect some time in 2019. Should these provisions become operational before the assessment process for the KI Seaport is complete, the provisions of the Development Act will continue to apply to the process, other than the final decision which will be the responsibility of the Minister for Planning rather than the Governor, which is the case under the Development Act at present.

An EIS describes and analyses issues relevant to the development process and the means by which those issues can be addressed. It provides:

- information regarding the proponent’s proposal, its justification for the proposal, and the alternatives and options assessed
- an evaluation of the potential environmental, social and economic effects of the construction and operation of the development and proposed mitigation, management and monitoring measures to address any potential adverse effects
- a document for public consultation and informed comment on the proposal
- a framework for decision-makers to consider the environmental, social and economic aspects of the proposal.

More specifically, the purpose of the EIS is to describe the proposed development and address the issues outlined in the DAC Guidelines (see Appendix A1). The Draft EIS considers the extent to which the expected impacts of the development are consistent with the provisions of any development plan, the South Australian Planning Strategy and any matter prescribed by regulations under the Development Act (see Chapter 5 – Legislative Framework).

An EIS, as required by the Development Act, is an accredited assessment mechanism under a bilateral agreement between the Commonwealth and South Australian governments (Bilateral Agreement made under s.45 of the *Environment Protection and Biodiversity Act 1999* (Clth) (EPBC Act)), which relates to environmental assessment. As such, it will be used by the Commonwealth Minister for the Environment to determine the acceptability of the proposed development under this Act.

The Adelaide-based firm, Environmental Projects, has prepared the Draft EIS. Environmental Projects manages legislative approvals and regulatory documentation and has extensive experience in environmental legislation, planning, regulatory requirements, risk management and due diligence.

KIPT is committed to meeting approval conditions so that any potential adverse impacts of the development on the environment (natural, social and economic) are avoided, mitigated or satisfactorily controlled and managed.

1.6.2 SCOPE

The Draft EIS is required to assess KIPT's proposal in accordance with guidelines set by South Australia's DAC.

It is therefore limited to assessing the:

- proposed construction and operation of offshore infrastructure at Smith Bay
- proposed construction and operation of onshore facilities to support offshore facilities including site access from North Coast Road
- traffic impacts on Kangaroo Island's road network for construction and operation of the proposed development.

All other aspects of KIPT's operations, including forest management, harvesting, developments on any other land owned by the Company, and any other associated licences and/or approvals are outside the scope of the EIS. To the extent that information on these activities is provided, it is to provide context for the development at Smith Bay.

In discussions with South Australia's Department of Planning, Transport and Infrastructure (DPTI) the scope of the guideline requirements relating to 'public roads' has been limited to those specified in the Draft EIS. Subsequent evaluation of a specific timber haulage route will be conducted if the proposed development is approved. The Draft EIS identifies the specific haulage route (see Chapter 21 – Traffic and Transport).

The maintenance/building of a new public boat ramp at Smith Bay and use of the KI Seaport by cruise ships (both of which were described in the initial proposal put forward) is no longer within the scope of the development.

1.6.3 PROCESS

The Draft EIS must be reviewed by officers from DPTI before the document can be released for public and agency consultation.

During the consultation process submissions will be invited and Environmental Projects will prepare a Response Document addressing these submissions. The Draft EIS and the Response Document will then be assessed together by the State Government. Its assessment will be presented in an Assessment Report, which will be publicly released for information.

The proposal is a major development; hence the South Australian Governor will make a decision on the proposed development on the advice of Cabinet, which in turn, will have been advised by the Minister for Planning.

Before approving any major development, the Governor must also have regard to other documentation specified in the Development Act. The Governor's decision may be an approval, refusal or an approval with conditions. Some matters of detail may also be reserved for a later decision. (Refer to Section 1.6.1 for minor amendments to the approval process as a result of provisions in the new Planning, Development and Infrastructure Act coming into effect in 2019.)

In accordance with the Bilateral Agreement discussed in Section 1.6.1, a single set of impact assessment documents are prepared, and the South Australian Government will provide its Assessment Report to the Commonwealth Minister for the Environment, who will make a separate decision under Part 9 of the EPBC Act.

Figure 1-5 presents an overview of the EIS approvals process, with further detail provided in the following sections.

Declaration as a major development and referral to the Development Assessment Commission

The Minister for Planning declared the project a major development pursuant to s.46(1) of the *Development Act 1993* on 16 February 2017, and the announcement was published in the Government Gazette on 23 February 2017 (see Appendix A2). The application was referred to DAC for determination of the assessment level and guidelines.

DAC subsequently determined that the proposed development would be subject to an EIS process and published its the guidelines for this process on 6 July 2017.

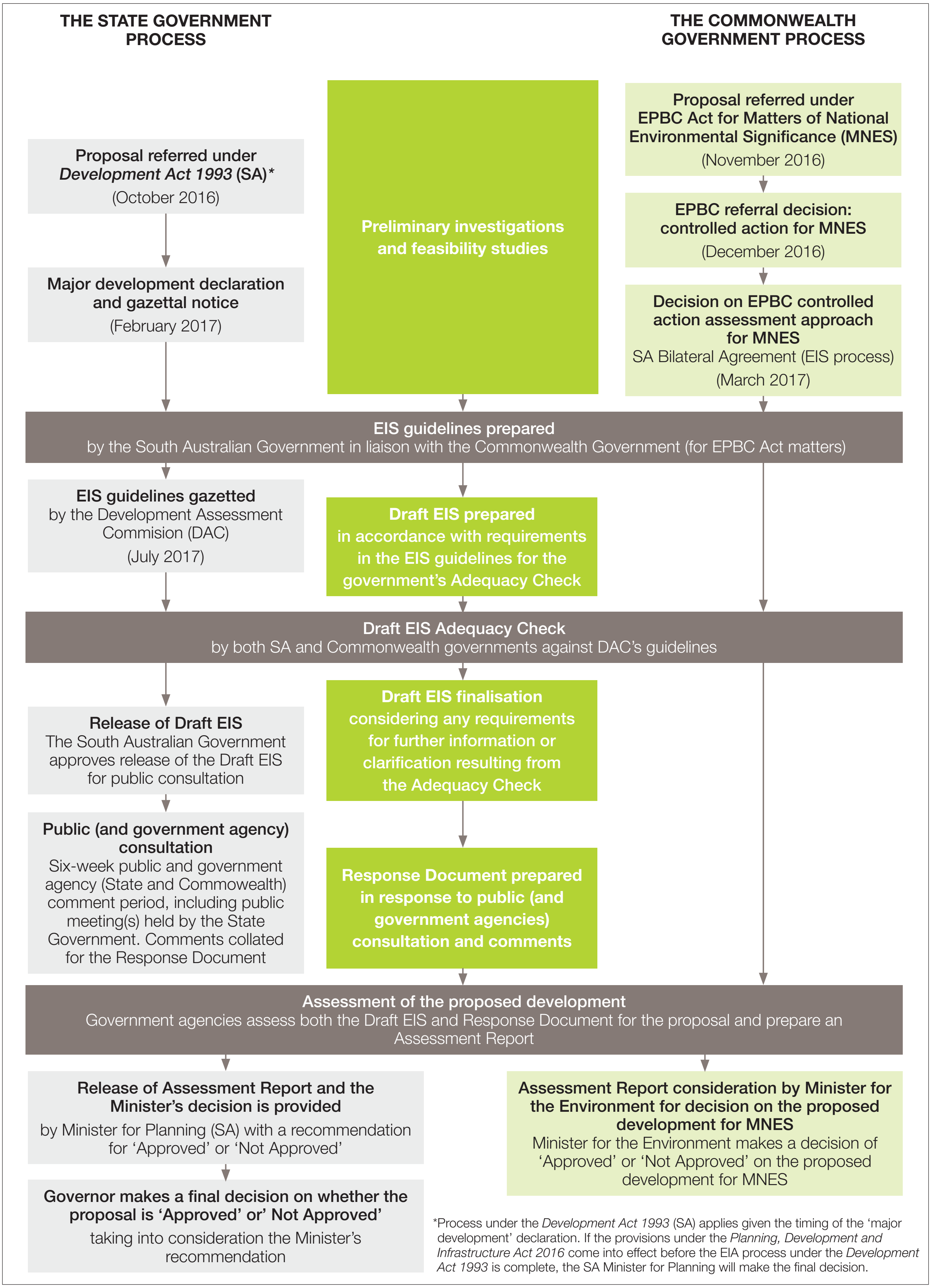


FIGURE 1-5 OVERVIEW OF THE ASSESSMENT PROCESS

Declaration as a controlled action under the EPBC Act

On 14 December 2016 the Australian Government Minister for the Environment and Energy declared the project a controlled action under s.75 of the EPBC Act, because the development may have a significant impact on matters of national environmental significance (MNES). See Chapter 14 – Matters of National Environmental Significance.

Under the bilateral agreement referred to above, the guidelines issued by the South Australian DAC for the purposes of this EIS refer to the MNES identified by the Commonwealth Minister for the Environment in determining the proposal to be a controlled action. These MNES are addressed in the EIS and will be assessed by the South Australian Government. The Commonwealth Minister will use that assessment in the approval process.

Public release of the Environmental Impact Statement

Section 46B(5)(b) of the *Development Act 1993* requires the Minister to ensure that copies of the EIS are made available to the public (and government agencies) for at least 30 business days. The Minister will invite interested persons to make written submissions on the EIS during that time. Early in the public exhibition period, South Australia's DPTI will facilitate a public meeting at Kangaroo Island to consult with the community about the EIS and the proposed development.

The Response Document

The Response Document will address public (and government agency) submissions regarding the proposal as presented in the EIS and provide additional information if required. It may include amendments to the EIS, or changes to the original proposal in response to concerns raised. The Response Document will also be released for public information.

Assessment Report and decision – State level

The Minister for Planning (with input from DPTI and other relevant government agencies) will assess the proposal, the Draft EIS and the Response Document. The outcome of this assessment will be detailed in an Assessment Report that will be publicly released. The proposal may be refined further in response to the Assessment Report.

The Governor of South Australia will make a decision on the proposed development (on the advice of the Cabinet) taking into account the Assessment Report and other documentation. This decision will be published in the South Australian Government Gazette, on the DPTI website and in appropriate local media. The Governor's decision cannot be appealed.

Assessment Report and decision – Commonwealth level

The Commonwealth Government Minister for the Environment (with the assistance of the Department of the Environment and Energy (DoEE)) will comment on the Assessment Report and (independent of the State Government's decision) decide whether to approve the development. The Minister, in making a decision, is constrained to consider only MNES.

02. PROJECT JUSTIFICATION

Guideline		Comment
1.1	Describe the background of the proposal including the title of the action, the full name and postal address of the designated proponent and a clear outline of the objective of the action.	See Chapter 1, Sections 2.3 and 2.4
Page 8	Include a statement of the objectives and justification for the proposal, including the specific objectives that the proposal is intended to meet, including market requirements.	See Section 2.3 Project Objectives and 2.4 Market Demand and Supply
Page 8	Include a statement regarding arrangements for other users to gain access to port facilities and/or to establish additional facilities onsite.	See Section 2.3.4
1.14	Provide information on feasible alternatives including: • taking no action • a comparative description of the impacts of each alternative on the above listed MNES • sufficient detail to make clear why any alternative is preferred to another (short, medium and long-term advantages and dis-advantages of each alternative are to be discussed)	See Sections 2.6 and 3.6
1.15	Provide details on the current status of the proposal and the consequences of not proceeding with the proposal.	Chapter 2 (current status) and Section 2.6
4.14	Outline the expected consequences of not proceeding with the development (ie ‘do nothing’ option).	See Section 2.6
14.14	Outline the associated risks should the proposal not go ahead, or if the proposal is not completed, and identify measures to mitigate these risks.	See Sections 2.6 and 4.9.5

02. PROJECT JUSTIFICATION

2.1 INTRODUCTION

This chapter outlines the objectives and justification for the proposed Smith Bay deep-water port, referred to as KI Seaport. It addresses three of the requirements specified in the Development Assessment Commission's (DAC) guidelines for the EIS (see page 8 of the guidelines, Appendix A1).

The guidelines also require the EIS to address the expected local, regional and state benefits and costs, and provide a summary of the environmental, economic and social arguments to support the proposal. These matters are discussed in full elsewhere in the EIS and are summarised in the Executive Summary. They will not be restated in this chapter.

Note that the expected consequences of not proceeding are also separately specified in Guideline 1.14, 1.15 and 4.14 (referred to as the 'Do Nothing' option). This issue is addressed in Section 2.6.

2.2 BACKGROUND – THE DEVELOPMENT OF PLANTATION FORESTRY ON KANGAROO ISLAND

2.2.1 GOVERNMENT POLICY – THE COUNCIL OF AUSTRALIAN GOVERNMENTS

In 1992, the Australian Commonwealth, states and territories (i.e. the Council of Australian Governments, or COAG) through the Australian Forestry Council and the Australian and New Zealand Environment and Conservation Council, published the National Forest Policy Statement, A New Focus for Australia's Forests (Commonwealth of Australia 1992). This policy statement was developed in consultation with other relevant government agencies, the Australian Local Government Association, unions, industry representatives, conservation organisations and the general community. A second edition of the statement was published in 1995.

The statement, which was endorsed by all Australian governments and remains the basis for government policy in relation to forestry throughout Australia, expresses the agreed objectives and policies for the future of Australia's public and private forests. It defines 11 specific national goals, which include the need to:

- develop an internationally competitive and ecologically sustainable Australian wood production industry
- expand Australia's commercial plantations of softwoods and hardwoods to provide an additional, economically viable, reliable and high-quality wood resource for industry
- expand employment opportunities and the skills base of people working in forest management and forest-based industries.

The statement acknowledges that private forests will play a role in nature conservation and maintaining forest biological diversity and will contribute to regional economic development and employment opportunities. The COAG-agreed approach expressly recognised that efforts to support wood production from economically viable and internationally competitive plantation forests would also be part of the armoury of measures required to conserve and manage Australia's remaining old growth forests.

The COAG defined three specific objectives in relation to Australia's plantation forest resource:

- to increase commercial plantation development on cleared agricultural land and, where possible, to integrate plantation enterprises with other agricultural land uses
- to improve the productivity of existing plantation areas by means of improved technology, breeding of genetically improved stock, and selection of species
- to continue to encourage industrial growers, and where appropriate public forestry agencies, to expand their plantation base to satisfy specific requirements.

The statement acknowledges that viable plantation forests would provide stability and growth for Australia's forest industries. The COAG recognised that world competitive processing plants need a reliable supply of wood from plantations as feedstock, and that large areas of plantation, such as those normally planted by private industrial and investment companies or public forestry agencies, would be required. Accordingly, state and local governments committed to providing a planning framework that facilitated the development of large-scale industrial plantations.

2.2.2 STATE GOVERNMENT POLICY

Kangaroo Island has a long history of pine plantations. Some trees were planted in 1980 so are approaching 40 years old, and today, about 20 per cent of the Island's plantation forest is softwood, Monterey pine (*Pinus radiata*).

The development of large-scale plantation eucalypt forests on Kangaroo Island began in the early 2000s, driven by supportive state government policies which actively encouraged farm forestry, and also encouraged private-sector investment in so-called managed investment schemes. These state government policies were intended to give effect to the commitments embodied in the National Forest Policy Statement.

At this time, South Australia's Strategic Plan developed by the government included an explicit goal to increase the area under softwood and hardwood forest plantation in appropriate locations, and a number of Private Forestry Development Committees were established to support sustainable, commercial private forestry enterprises, particularly in the Green Triangle region (largely in the South East), the Mount Lofty Ranges and on Kangaroo Island. The government's ambitions recognised that private forestry development could provide long-term economic, environmental and social benefits to these regions.

In his report to State Parliament on the achievements of The Planning Strategy for South Australia in September 2004, Premier Mike Rann (see Plate 2-1) expressly referred to the success of Private Forestry KI in attracting Natural Heritage Trust and Envirofund finance for approximately 100 ha of new, multipurpose, hardwood plantations on farms since 2002.

The South Australian Government supported the development of large-scale plantation forestry on Kangaroo Island because the western end of the Island has a number of natural advantages that make it one of the best regions in Australia for growing plantation timber. These advantages include:

- high rainfall – an average of more than 600 mm a year
- low rainfall variability
- mild summers with low evaporation
- no salinity issues
- high growth rates for timber (mean average increment).

Moreover, because of the characteristics of the soils on Kangaroo Island, plantation forestry is currently a more productive and profitable use of the land than many alternative agricultural and pastoral options. Most of the areas suitable for forestry typically have high-rainfall, low pH (acidic) soils. In a 2016 soil research review, the Adelaide and Mount Lofty Ranges Natural Resource Management Board found that such acidic soils present a number of challenges for pastoral use:

PLATE 2-1 PREMIER MIKE RANN PLANTING A BLUEGUM ON KANGAROO ISLAND IN 2007

they adversely affect the health of soil biota, reduce the viability of many perennial grasses, cause deficiencies in grazing animals in minerals such as copper, selenium, manganese, zinc, molybdenum and cobalt, and leach phosphates extremely quickly.

These deficiencies can be managed through substantial additions of gypsum (soil liming), supplements and injections for stock, as well as applications of organic material such as chicken manure, and applications of high-nitrogen fertilisers. Managing these soils can be very expensive, however, and in some cases unfeasible, particularly on Kangaroo Island where the availability and cost of transporting suitable materials becomes prohibitive. In contrast, plantation forestry thrives in these conditions because species such as Tasmanian blue gum (*Eucalyptus globulus*) are highly adapted to them and require very little maintenance once the root zone is established.

For these reasons, Kangaroo Island is one of the best regions in Australia for plantation forestry and, as envisaged by government policy, this industry represents a significant, long-term sustainable economic opportunity for the Island.

2.3 PROJECT OBJECTIVES

2.3.1 ORIGINAL CONCEPT

The vast majority of the Island's timber resource is suitable only for international export. South Australia currently lacks suitable processing facilities to add value to raw material harvested, hence there is currently no opportunity for domestic sales. There are essentially only three options for exporting timber products from Kangaroo Island in commercial quantities:

- transhipment to a mainland deep-water port (such as Port Adelaide, Port Giles on Yorke Peninsula or Portland in western Victoria), accessed via barge or by road via the SeaLink ferry
- transhipment by barge to a vessel anchored in deep water off Kangaroo Island
- direct loading of timber onto ships moored at a deep-water wharf on the Island.

The transhipment options (option 1 and 2) have four principal disadvantages:

- There would be a significant additional cost of approximately $15 per tonne for materials handling, which would have a significant impact on the viability of any plantation forestry operation on the Island.
- Barging necessarily involves moving all the timber as logs, with the result that there would be less processing and value-adding on the Island.
- Loading logs is inherently more hazardous than loading woodchips, so a logs-only operation would raise significant work health and safety concerns. Barging requires double or multiple handling: first in loading the barge and again in transhipment, or, worse still, unloading and then reloading at a mainland port.
- Any barging solution would still require an onshore storage site capable of storing 15,000 to 30,000 tonnes of unprocessed logs, and a facility to load the logs onto barges. No such specific facility exists on Kangaroo Island. Facilities that could be adapted for this purpose are located in population and tourist centres, such as Kingscote.

For these reasons, KIPT proposes to export timber products using the direct loading to ship method (option 3). The advantages and disadvantages of this option are explained in more detail in this section.

The Smith Bay site was acquired after an extensive evaluation of alternative locations; this process is discussed in Chapter 3 – Project Alternatives. When KIPT acquired the site in February 2014, the Company owned 5000 ha of plantable land, of which approximately two-thirds was planted with softwood (*Pinus radiata*), and the remaining third with a mixture of two hardwood species, Tasmanian blue gum (*Eucalyptus globulus*) and shining gum (*Eucalyptus nitens*).

The original concept was to develop a facility at Smith Bay to export the softwood as logs and the hardwood, most likely, as woodchips. A new facility was required because the Island had no facilities capable of economically handling the volume of material available.

It was always envisaged by KIPT that there would be excess capacity at the KI Seaport, which would be available for other growers to export their timber products, and for other possible users.

2.3.2 PROJECT EVOLUTION

When KIPT acquired the Smith Bay site, New Forests owned the Forestry Investment Trust (FIT) estate on Kangaroo Island, which included 19,000 ha of land, of which more than 10,700 ha was planted with Tasmanian blue gum.

New Forests also owned a site at Ballast Head, which had been used to ship gypsum to the mainland on small coastal vessels. Those operations ceased in 1986 and the shiploading facility was demolished. New Forests had developed concept plans to build a new woodchip export facility at Ballast Head and had also approached the South Australian Government, seeking major project status for its proposed development.

Throughout 2015, KIPT and New Forests engaged in discussions to agree on a single development proposal which could accommodate the requirements of both businesses (woodchips only for New Forests, and woodchips and logs for KIPT), and those of the remaining 12 independent plantation owners on Kangaroo Island, some of whom also require a facility that can handle logs.

On 19 December 2015 the then South Australian Minister for Transport and Infrastructure, Stephen Mullighan, separately advised KIPT and New Forests that he was:

> *… not of a mind to support more than one new port on Kangaroo Island … I am committed to ensuring that essential services continue to be delivered to Kangaroo Island to ensure its strong economic future. I am mindful, however, that Kangaroo Island does not necessitate two ports for similar purpose. I am mindful that to progress both projects through what would most likely be a comprehensive environmental impact assessment process, would be an inappropriate use of the State's resources.*

In subsequent discussions, State Government officials indicated that the government had no view about the relative merits of Smith Bay and Ballast Head as suitable locations for a new export facility, but they reiterated the Minister's position that there would be only one new port on Kangaroo Island and that, if and when a single proposal/application was lodged, the government would assess this, provided the port was available for a range of timber and non-timber users.

As a consequence, KIPT and New Forests renewed their discussions, and in October 2016, KIPT agreed to purchase the entire FIT estate managed by New Forests. This sale was completed in May 2017 at a cost of more than A$55 million. Part of the reason for KIPT buying New Forests' Kangaroo Island assets, rather than New Forests' buying KIPT's, was that it had become clear to both parties that a seaport at the KIPT-controlled site at Smith Bay offered greater benefits to the community at lower cost than could be achieved at Ballast Head and would therefore be more likely to be approved.

2.3.3 PROJECT RATIONALE – EXPORT OF LOGS AND WOODCHIPS

The acquisition of the FIT estate, which effectively quadrupled the size of KIPT's plantation area and tripled its standing timber resource, resolved the impasse between the two companies and allowed for a single development proposal to be lodged for assessment in accordance with the Minister's stated wishes.

As a consequence of the transaction, KIPT owns 86 per cent of the plantation forestry on Kangaroo Island. KIPT's portfolio is now approximately 80 per cent hardwood and 20 per cent softwood.

There is enough plantation timber on Kangaroo Island to sustain a long-term harvesting regime which produces 600,000 tonnes of timber products annually for the first rotation (the first 13 years of harvesting operations), and at least 500,000 tonnes a year for the second rotation (the following 12 years). This is an internationally significant resource and would add around 6–7 per cent to Australia's total timber exports.

KIPT's original objective of building and operating a deep-water port and associated on-land facilities suitable for exporting both logs and woodchips remains unchanged, although the volumes of hardwood chips to be exported from the Smith Bay site increased significantly with the New Forests acquisition.

The Smith Bay site remains the preferred location because:

- KIPT requires (and independent growers also need) a facility that can handle both logs and woodchips, and the topography and water depth at Ballast Head preclude this as a commercially feasible option
- the additional transport costs incurred in moving timber products from the western end of Kangaroo Island to Ballast Head are significant; note that these include costs incurred by KIPT (such as greater capital outlays to acquire a larger vehicle fleet because of longer journey times, fuel, labour costs, and vehicle maintenance), by government (road upgrades and maintenance) and by the community, due to increased interaction with residents and tourists (see Chapter 3 – Project Alternatives)
- the social and environmental impacts would be greater at Ballast Head, given the proximity of oyster farms in the in-water footprint, the nearby townships of American River and Island Beach, the environmentally sensitive Pelican Lagoon, and the extensive native vegetation on the site itself.

2.3.4 OTHER USERS AND OTHER CARGOES

The Smith Bay facility could also be used, without significant modification, for other uses such as exporting containerised agricultural commodities and importing containerised farm inputs.

The high cost of exporting produce from Kangaroo Island has long been identified as a constraint affecting economic development opportunities. For example, in a report to the South Australian Government in 2011, the SA Economic Development Board said the Island was languishing economically and socially, in part because:

> *The cost of inputs to production and the cost of delivering goods to market are higher for Kangaroo Island than for mainland producers.*

In 2016, the South Australian Government, through the Office of the Commissioner for Kangaroo Island, also acknowledged that the development of a port to export timber products could help to address this concern:

> *With forestry harvesting about to commence there is an opportunity for the development of a port and associated facilities to accommodate bulk and break-bulk shipping services to enable direct import/export from the Island.*

The opportunity for other users and other cargoes to take advantage of the KI Seaport arises because of attributes inherent in the proposed development at Smith Bay:

- **Excess capacity** – Timber ships would be moored at the facility to load KIPT's timber products for 30–75 days a year, or approximately 20 per cent of the time available. This means there would be significant spare capacity at the facility for:
  - the independent plantation timber owners to use the facility to export their timber products without exporting through KIPT if they wished
  - other users and other products.
- **Engineering design** – The facility is designed to handle large-capacity vessels, such as Handymax and Panamax, to ship timber products to overseas markets. Without significant modification, it could accommodate a wide range of vessels and other uses:
  - the facility has been designed with a roadway to the floating berth
  - the floating pontoon that would form the actual berth is 40 metres wide, which is sufficient for an articulated truck or a large vehicle to safely traverse and turn
  - there is enough room on land to stockpile containerised freight – the absence of such a stockpile area would effectively preclude most other users who require stockpiling facilities and other cargoes from using the facility.
- **Pricing** – KIPT has publicly stated that all non-timber users would be charged a fee based on the marginal costs associated with their use; however, they would not be expected to contribute to the initial capital cost (the cost of constructing the facility).

KIPT has had informal discussions with a number of parties to clarify whether there are currently other users who may have an interest in using the Smith Bay facility. The existing volumes of freight on the Island, however, are not significant in comparison to the projected volumes of timber products. For example, the average annual grain harvest (the largest commodity produced on the Island) for the 10 years to 2017 was 39,600 tonnes (PIRSA 2017).

Ultimately, whether other users see opportunities to use the Smith Bay facility is beyond KIPT's control; the private commercial considerations of third parties would determine these outcomes. To the extent that such other uses eventuated, these would be the subject of separate assessment and approvals processes that would be the responsibility of the individual proponents.

2.4 MARKET DEMAND AND SUPPLY

2.4.1 DEMAND

Global demand for timber is growing, supported by a rising world population and increasing per capita consumption of timber products, especially in Asia. In the developed world, per capita consumption of timber products is approximately 200 kg per annum, whereas the equivalent figures in China and India are still only 70 kg and 9 kg respectively. The World Wildlife Fund (WWF), for example, projects that annual global demand for wood products from all sources (natural forests and timber plantations) may triple by 2050 (WWF 2012). This is driven both by rising consumption and by the need for increased carbon sequestration.

New technologies are also contributing to the growing demand for wood and wood fibre, and to the emergence of a bio-economy that offers new and expanded markets for timber as a renewable input into many innovative and value-added products, including biofuels, pharmaceuticals, plastics, textiles and building products. For example, according to the Timberland Investment Outlook, 2015–2019, prepared by New Forests, an international company specialising in sustainable real assets investment management, innovations in architecture and building engineering are enabling the use of manufactured wood products as substitutes for concrete and steel.

> *The recent history of the forest industry has seen a continuous substitution of reconstituted and engineered wood products from smaller and lower grade timber for larger timbers from older, larger trees. This trend will continue as we see a range of panel, laminate and composite products form the basis of future building systems.*

At the same time, according to the WWF, there is a growing awareness of, and concern about, the impacts of deforestation in natural forests, and an increasing demand for certified 'deforestation-free' supply chains where retailers, manufacturers and investors pledge to eliminate deforestation from their portfolios.

> *Forest certification provides assurance that the wood in a product comes from a well-managed forest, with an audited chain of custody running from the forest floor to the customer. Perhaps 30 per cent of the world's production forest is certified, with around 13 per cent of this under the Forest Stewardship Council (FSC) – which WWF considers the only credible forest certification system in use today.*

2.4.2 SUPPLY

While the global demand for timber is growing, especially in Asia, the supply of timber from native or natural forests is declining as a result of deforestation and the growing efforts to prevent further deforestation. This means all incremental supply will need to come from plantations.

Plantation forests yield more wood per hectare than natural forests, and there is scope for further improvements underpinned by improved silviculture (growing and cultivating trees), plant nutrition, forest management, and plant genetics.

The outlook for the supply of, and demand for, hardwood chips (KIPT's principal product) in Asian markets suggests a long-term shortage, as shown in Figure 2-1.

The supply of plantation timber in Australia, however, is diminishing because the distortion caused by managed investment schemes (MIS) is coming to an end and there are long lead-times to producing the end product. Approximately half of Australia's hardwood plantation estate is expected to return to conventional agriculture after harvest rather than remain in timber production, according to New Forests' David Evans in an ABC interview in 2016. Despite rising timber prices, there is a steady decline in the area of Australia's plantation forests, as land planted for MIS-driven forestry returns to grazing, a trend exacerbated by high red meat prices.

2.4.3 KIPT'S PLANTATION ESTATES

This combination of growing global demand for plantation timber products and the declining global supply of timber from native forests and plantations underpins the long-term opportunity to supply timber products from fast-growing, capital-efficient and sustainably managed plantation estates, such as the estates owned and managed by KIPT and independent growers on Kangaroo Island.

KIPT's plantation estates are shown in Figure 2-2.

KIPT has entered into a five-year Woodchip Sale and Purchase Agreement with Mitsui, which establishes the key terms under which the hardwood timber resource would be monetised. To provide the required level of certainty for both parties and for pulp mill customers, an automatic term extension is built into the agreement. In July 2018, KIPT achieved accreditation under the Forest Stewardship Council (FSC) which enables KIPT to attach FSC Mix Credits to woodchip sales.

Under the terms of the agreement, Mitsui would purchase up to 500,000 green tonnes of woodchips from KIPT annually on a free-on-board (FOB) basis. The blue gum growing on Kangaroo Island is expected to produce woodchips equal to the best-quality chips currently exported from Australia and would add around 6–7 per cent to Australia's total chip exports.

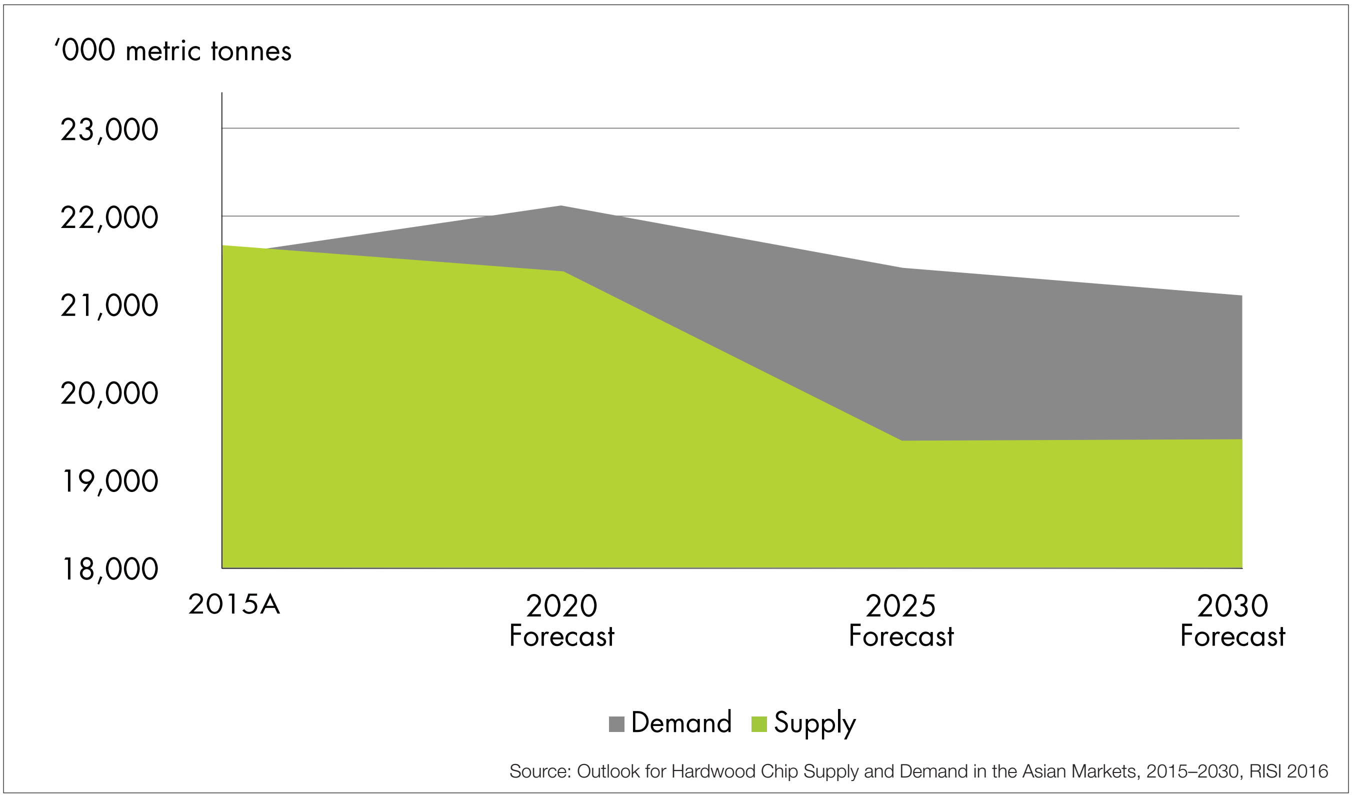


FIGURE 2-1 OUTLOOK FOR HARDWOOD CHIPS IN ASIAN MARKETS

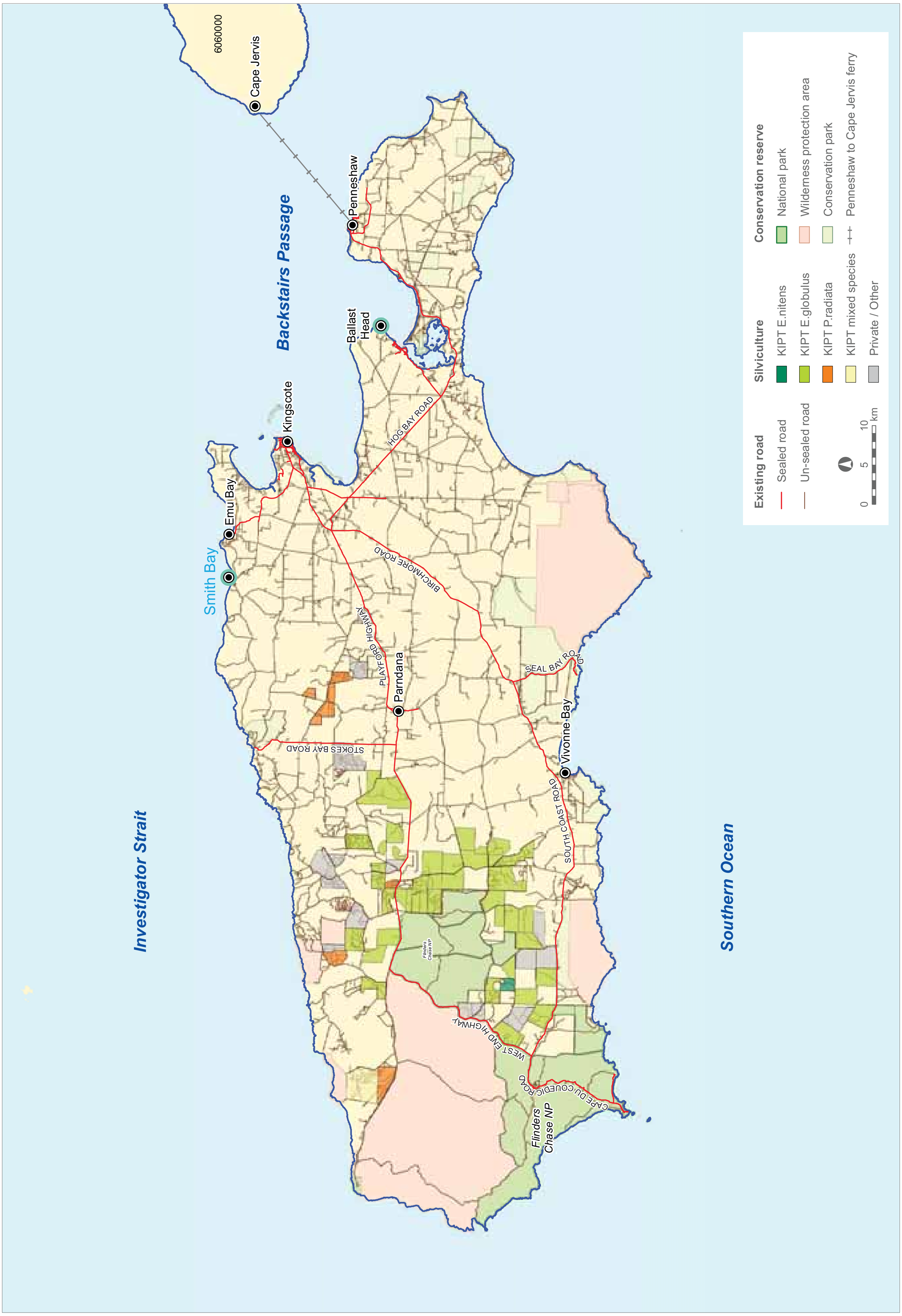


FIGURE 2-2 LOCALITY MAP OF KANGAROO ISLAND'S PLANTATION PROPERTIES

2.5 ALTERNATIVE USES FOR KANGAROO ISLAND PLANTATION TIMBER

The two hardwood plantation timber species grown on Kangaroo Island, blue gum and shining gum, are suitable for woodchips. The pine species is suited to logs, but there is also a market for softwood chips; the logs generally attract a higher price than chips.

KIPT considered a number of alternative uses of this resource before selecting the export option.

2.5.1 SAWMILLING

KIPT owns a sawmill at Timber Creek near Parndana, which had been used by previous owners to produce sawn pine that was packed into sea containers and sent to wholesalers in Adelaide and Melbourne on the SeaLink ferry from Penneshaw.

At its peak the mill processed approximately 45,000 cubic metres of milled timber annually, at a conversion rate of 51 per cent, producing 23,000 cubic metres of sawn pine. The mill could not process hardwood, which comprises 80 per cent of the timber on the Island. It never operated profitably and led to the insolvency of at least two previous owners.

The mill was severely damaged by fire in 2013, and significant reinvestment would be required to resume production. KIPT has no plans to reopen the mill, which is carried in the Company's accounts at its scrap value: it is a sub-scale, out-of-date facility that would not be able to compete with large, modern mills on the mainland and internationally.

For these reasons, milling timber on Kangaroo Island is not a commercially feasible operation because:

- the cost of repairing and refurbishing the mill is prohibitive
- the high operating costs (including for power) cannot be justified, given the small volume of timber that milling would produce and the likelihood of further large operating losses
- the volume of timber suited to milling is small relative to the volume of timber which KIPT and independent growers own
- the cost of shipping any commercial quantities of milled timber to markets on the SeaLink ferry is also a significant disincentive.

2.5.2 MANUFACTURED TIMBER PRODUCTS

Although there is a growing demand for manufactured timber products using veneers, the opportunity to produce such products on Kangaroo Island is severely constrained because:

- the three species planted, and the subsequent silvicultural regime, have been designed to produce trees that, in the main, are not suitable feedstock for the production of veneers
- the cost of importing commercial quantities of non-timber inputs such as glues is prohibitive
- facilities of this type are typically energy-intensive and polluting
- the cost of exporting commercial quantities of the finished product from the Island on the SeaLink ferry is similarly prohibitive.

It is not considered commercially or environmentally feasible to establish a new pulp mill to process woodchips on Kangaroo Island.

2.5.3 BIOMASS POWER GENERATION

The Kangaroo Island Council is currently investigating the opportunity to establish a biomass power plant. KIPT has offered to make available up to 70,000 tonnes per annum (tpa) of low-cost forestry waste material, which is the by-product of harvesting operations, and a further 30,000 tpa of higher-cost 'prime material', provided it is purchased at a price equivalent to the export price.

KIPT's ability to provide any material to a biomass energy plant is contingent on establishing a commercially viable harvesting operation, which in turn depends on establishing a commercially viable process to export logs and woodchips to markets in Asia.

The demand for 30,000 tonnes of 'prime material' is, by itself, far too small to justify establishing a timber harvest and haulage operation on Kangaroo Island, and without a large-scale, commercially viable harvest, there cannot be any waste material for a biomass energy plant.

2.5.4 BIOMASS PELLET PRODUCTION

In this option the whole tree and the harvest residue could be considered for feedstock to produce a biomass pellet for use in industrial heating and power plants around the world; the current demand is mainly from Europe and Japan.

The commercial viability of producing pellets has yet to be established, and in any event a facility would be required to export pellets in bulk form, using a deep-water wharf. Such a facility does not exist on Kangaroo Island.

Biomass pellets may become a value-added option once a woodchip export facility had been built because they could use the same facility to access export markets and produce a valuable product from what otherwise might be a waste stream.

2.6 EXPECTED CONSEQUENCES OF NOT PROCEEDING – THE 'DO NOTHING' OPTION

At present, there is no feasible method of exporting plantation timber from Kangaroo Island. The trees are mature and the customers are ready to receive the product. The proposed KI Seaport at Smith Bay is the essential piece of infrastructure required to unlock the significant potential that plantation forestry offers Kangaroo Island.

Many companies operating or seeking to operate in South Australia have sought subsidies or financial assistance from the State Government, especially when a key piece of public infrastructure is not available. In this instance, KIPT would finance the delivery of a piece of critical infrastructure using private capital. The only viable alternative to KIPT's proposal is a government-funded facility that might take years to be delivered, at considerable cost to taxpayers.

KIPT has investigated a series of alternative sites, as discussed in Chapter 3 – Project Alternatives. None of the alternatives are suited to exporting both logs and woodchips. A chips-only operation could be established at three of the alternative sites, however:

- the inability to export logs would represent a material loss of value and income for KIPT and leave those independent growers who have 100 per cent pine facing financial hardship
- the capital and operating costs at these other sites would be greater than at Smith Bay, with a material impact on the profitability of plantation forestry on Kangaroo Island
- there would be no scope for other cargoes and other users (apart from other hardwood forest owners) to use the facility, because these require the same infrastructure that would be used to export logs.

The 'Do Nothing' option means forgoing the opportunity to realise the inherent value in approximately 20,000 ha of plantation timber, most of which is now ready to harvest. The next best option would entail a significant loss of value for KIPT, and a significant lost economic opportunity for both Kangaroo Island and South Australia. This option would also present challenges with ongoing maintenance of the forests –controlling weeds and feral animals and managing bushfire risks – if they were not producing a financial return.

It would also mean there would continue to be no alternative available for exporting bulk products from Kangaroo Island other than on the SeaLink ferry, and no realistic prospect of such a facility ever being built on the Island by the private sector. Inevitably, the burden would fall on government to provide a route to market for the forestry products whose production it actively encouraged in the first decade of this century.

2.7 CONCLUSION

The global demand for timber products is growing and there is a projected long-term supply shortfall, especially in hardwood chips.

Kangaroo Island has a natural and sustainable advantage as one of the best locations in Australia for growing plantation timber. Kangaroo Island has a substantial supply of plantation timber that is ready for harvest to meet some of this projected shortfall.

Smith Bay is the best location for a seaport on Kangaroo Island. There is no commercially feasible alternative site for realising this opportunity.

The proposed KI Seaport would be a critical piece of infrastructure that would immediately unlock the opportunity to establish a sustainable plantation forestry industry on the Island. The facility would also create opportunities for other users, other industries and other cargoes, and this would also boost the Island's economy.

The only feasible alternative to this proposal is a government-funded facility that may lack some of the key functionality which is designed into the KIPT proposal at the Smith Bay site.

03. PROJECT ALTERNATIVES

Guideline		Comment
6	To enable a thorough assessment, and a comparative basis of the suitability of the location of the proposal, information should be included on alternative locations that have been considered for the development. This information should include investigations that have been undertaken and reasoning behind why the proponent has deemed them less suitable than the proposed location.	
6.1	Provide information on alternative locations for the proposal that have been considered, with specific regard for: • sites nominated for ports • sites where the proponent owns the adjacent land.	See Sections 3.2 to 3.5
6.2	Identify the operational benefits and constraints for each alternative location.	See Sections 3.3 to 3.5
6.3	Provide evidence and/or justification (social, economic, environmental) as to the potential suitability or unsuitability of each alternative location. Include information on the ability of these sites to accommodate multi-users.	See Sections 3.3 to 3.5
1.14	Provide information on feasible alternatives to the proposal including: • taking no action • a comparative description of the impacts of each alternative on the above listed MNES • sufficient detail to make clear why any alternative is preferred to another (short, medium and long-term advantages and disadvantages of each alternative are to be discussed).	Taking no action is addressed in Chapter 2 Section 2.6 The expected consequences of not proceeding – the 'Do Nothing' option See Section 3.6 for MNES
7	The proposal includes the construction of a solid causeway that will extend approximately 200 metre into the ocean for the purpose of loading the timber products onto the ships at the attached floating berth. A solid causeway, as proposed, is likely to inhibit the natural water flow within Smith Bay, and potentially lead to pooling of water upstream. The nature and level of impacts of the proposed causeway on the marine environment (including water temperature), and the ecosystems, recreational and commercial operations reliant upon the waters of Smith Bay, have not been detailed. Merits of alternative in water structures (including a jetty) should be investigated to determine the most appropriate structure for the area and operation.	
7.1	Identify alternative structures that could be used for the intended purpose. Include a description of the coastal engineering requirements for each structure.	See Section 3.7
7.2	Evaluate the merits and the impacts (environmental, economic and social) of each alternative structure. Include information on the long-term operational benefits and costs of each alternative structure.	See Section 3.7
7.3	Outline the measures that could be undertaken to mitigate the impacts/costs identified for each structure.	See Section 3.7

03. PROJECT ALTERNATIVES

3.1 INTRODUCTION

This chapter addresses Guideline 6, which stipulates that the EIS should provide information on alternative locations for the development, and Guideline 7, which requires the EIS to address the merits of alternative in-water structures. Some parts of Guideline 1, which is concerned with matters of national environmental significance (MNES), also asks for information on feasible alternatives, which is addressed in this chapter.

3.2 SELECTION PROCESS – CONSIDERATION OF ALTERNATIVE SITES

KIPT purchased the Smith Bay site in February 2014 after evaluating several options in a two-stage process during the second-half of 2013.

Because the vast majority of the timber resource on Kangaroo Island was established in a plantation regime that produced trees suitable only for wood chipping and pulp production, it is necessary to create a route to the appropriate market for this product. The only feasible markets for hardwood woodchips are the large-scale pulp-mills in Japan, China and, to a lesser extent South Korea and Taiwan. Efficient movement of woodchips, which are a bulky commodity, requires the use of large ocean-going vessels, typically of Panamax size or greater. This does not necessarily create a requirement for a deep-water port, but it does require a means of getting timber off the Island and onto an ocean-going bulk carrier.

Moreover, because there is also a significant pine estate on the Island, and because this was established to produce sawlogs, any export facility needs also to be able to handle timber in this form. Again, the best value recovery is obtained by exporting these logs to processors in North Asia. Ocean-going log carriers are typically of Handymax size.

The volume of timber products and the cost of long-distance road haulage is such that transport to an existing mainland port via the use of timber haul trucks on the existing Kangaroo Island vehicle ferry service is considered unfeasible. Therefore, KIPT looked at sites where it was possible to get timber products (woodchips and logs) off Kangaroo Island and into large ships, either directly, or using barge transhipment, or via an existing mainland port.

KIPT's selection of a suitable location on Kangaroo Island for a port was a staged approach. Stage 1 focused on four sets of evaluation criteria to determine which sites potentially could be used as an export facility: physical setting, environmental impacts, social and community impacts, and economic and financial impacts. KIPT initially considered 12 sites (see Figure 3-1) and evaluated three types of port options at two of these (Penneshaw and Kingscote); that is, 16 different options were evaluated in Stage 1.

Stage 1 led to the conclusion that, while indirect export methods were theoretically feasible, a direct deep-water port was the only economically viable option. It identified four potential sites for such a facility. These four sites were then subjected to a more detailed evaluation in Stage 2 to determine the relative merits of each site on logistical, economic, environmental and social criteria. Stage 2 involved more detailed analysis and a greater range of criteria than Stage 1, including the condition of the seabed and the ability to establish a multi-user, multi-cargo operation (physical); the impact on sensitive receptors (environmental); potential impacts on neighbours (social and community); and the estimated capital and operating costs (economic).

3.3 STAGE 1 EVALUATION

3.3.1 SITE SELECTION CRITERIA

The criteria used to evaluate the original set of sites and options is summarised in Table 3-1.

TABLE 3-1 SITE SELECTION CRITERIA

Criterion	Factor	Rationale
Physical setting	Proximity of deep water close to shore	The proximity of deep water (at least 10 metres draft) close to shore is a key consideration because large cargo vessels cannot berth in shallow water. Shallow bays require more dredging to establish a safe berth pocket, or more extensive in-water structures to reach deep water. Both options increase costs and would potentially cause environmental impacts.
	Exposure to wave and storm energy	The southern and western coastlines of Kangaroo Island are subject to significant average and peak wave energy. The north coast is comparatively protected as prevailing southern swells are deflected around the Island. The north coast is, however, still subject to substantial wave energy and storm swells, especially towards the north-western end of the Island.
	Onshore land gradient	The onshore component of the KI Seaport requires an area of relatively flat land to stockpile timber products. Ideally, a gentle approach to the water is preferred because this facilitates shiploading. Steep slopes limit the storage capacity of the facility and make loading and unloading difficult. The ideal setting has relatively flat land, adjacent to shore.
	Distance from plantations	Transporting logs and woodchips by truck to the seaport raises concerns about safety and cost. Both are minimised by selecting a site as close to the plantations as is reasonably possible. Increased travel distances imply greater risks to safety and to the environment, greater costs, and increased wear and tear on roads and vehicles.
	Capability of existing infrastructure	Some sites on Kangaroo Island have existing infrastructure that has been or is currently used for transporting goods. These include Penneshaw (existing ferry service), Kingscote (a well-developed wharf facility not currently in use), Vivonne Bay (a substantial timber jetty used seasonally by fishing craft), American River (a rudimentary berth face in shallow water) and Ballast Head (once used to offload gypsum, since dismantled).
Environmental constraints	Marine parks	Large expanses of the waters around Kangaroo Island are protected within marine parks, including the entire western coastline, three quarters of the northern coastline and more than a third of the southern coastline. While wharves and ports are not specifically prohibited, marine parks would add another layer of complexity to the assessment and approvals process. The habitat protection zone at Cape Dutton, for example, would likely be a significant issue; mooring of vessels longer than 80 metres is prohibited, and dredging would be especially problematic.
	Conservation areas	Large portions of Kangaroo Island are protected within the parks and reserves system (such as national parks and wilderness protection areas), including the entire western coastline and a substantial part of the southern coastline. Development of a port or wharf within a conservation area would be at odds with government policy and community expectations and may have significant environmental impacts.
	Native vegetation	Clearing native vegetation would result in significant environmental impacts and is a key driver of decline for both flora and fauna species on the Island. Although detailed flora and fauna surveys were not conducted at each site, the presence and extent of native vegetation was used as a proxy to assess potential environmental impact to terrestrial environments, both at the sites in question and in relation to the native vegetation around the transport route to each site.
	Environment Protection and Conservation Biodiversity Act 1999 (EPBC Act)	The EPBC Act is Commonwealth legislation designed to protect the environment and conserve biodiversity, where these are deemed to be of national or international significance. The risk that approval may be refused because of EPBC Act issues at a given site would increase the project risk.

TABLE 3-1 SITE SELECTION CRITERIA (CONT'D)

Criterion	Factor	Rationale
Social and community constraints	Nearby townships and settlements	The construction and operation of the KI Seaport may affect nearby residents, through increased traffic or disturbance from noise, light and dust. Areas with lower population densities will have reduced risk of negative impacts to nearby residences.
	Existence of 'sensitive receptors' – the impact on neighbours, especially nearby residences	The construction and operation of the KI Seaport may affect neighbours (although this will depend on the nature of their occupation and use, and their distance from the site). Areas with fewer 'sensitive receptors' reduces the overall risk of negative impacts, especially on nearby residences.
Economic constraints	Site availability	A land parcel of a suitable size to accommodate the shore-based infrastructure must be available for a port to be built at a particular site.
	Site condition and previous use	The nature of current and previous use (e.g. agriculture, industry), and the condition of the site, is relevant to assessing the likely impacts of developing a port. Sites which are currently used, or have been used, for similar purposes, or are degraded by previous use were preferred to prime agricultural land and uncleared native vegetation.
	Impact on tourism	Tourism is a major industry on the Island and there was a strong preference for avoiding or minimising direct impacts on tourism businesses and secondary impacts through interaction with tourist vehicles.
	Nearby businesses	The construction and operation of the KI Seaport may affect nearby businesses (although this would depend on the nature of the business and its distance from the site). The risk of negative impacts is reduced if there are few businesses nearby and if the nature of their operations is such that any negative impacts can be managed.
	Economic viability of facility	Likely cost of construction and likely operating costs, including transport, materials handling and demurrage (in the case of low berth availability due to weather), do not exceed the capacity of the exported product to pay for the facility.

The assessment process included:

- a review of relevant government policy documents, including the Kangaroo Island Plan, which is part of the South Australian planning strategy, and the Kangaroo Island Development Plan (September 2015)
- a review of relevant data and reports available on the public record, including data on road distances and conditions, details of marine and terrestrial protected zones and published naval charts for Kangaroo Island waters
- discussions with some stakeholders, including the then Kangaroo Island Futures Authority, Kangaroo Island Council, officers of DPTI, other Kangaroo Island timber growers, and external timber, port and shipping experts
- a review of various documents and photographs provided by former owners of the Ballast Head site, and in relation to historical usage of both Smith Bay and Kingscote
- a series of tours of Kangaroo Island, including a physical inspection of all potential sites, followed by a review of aerial photography, topography and hydrology
- searches of protected matters using the Commonwealth Department of the Environment and Energy (DoEE) spatial database
- Biological Databases of South Australia (BDSA) searches to identify flora and fauna species previously recorded at the potential locations
- Department for Environment and Water database records of vegetation associations.

The Stage 1 evaluation was conducted with reference to the criteria outlined in Table 3-1 above.

3.3.2 STAGE 1 EVALUATION OF SITE OPTIONS

The evaluated locations are shown in Figure 3-1, and the results from the Stage 1 evaluation are summarised in Table 3-2.

At Penneshaw and Kingscote, where some marine infrastructure exists, three types of port options were evaluated:

- barge/transhipment – use of barge to transfer timber product from land to a ship moored offshore
- barge to Port Adelaide – use of barge to transfer timber product to Port Adelaide for storage before loading onto ship
- extended wharf – where an existing structure would be upgraded or a new wharf built.

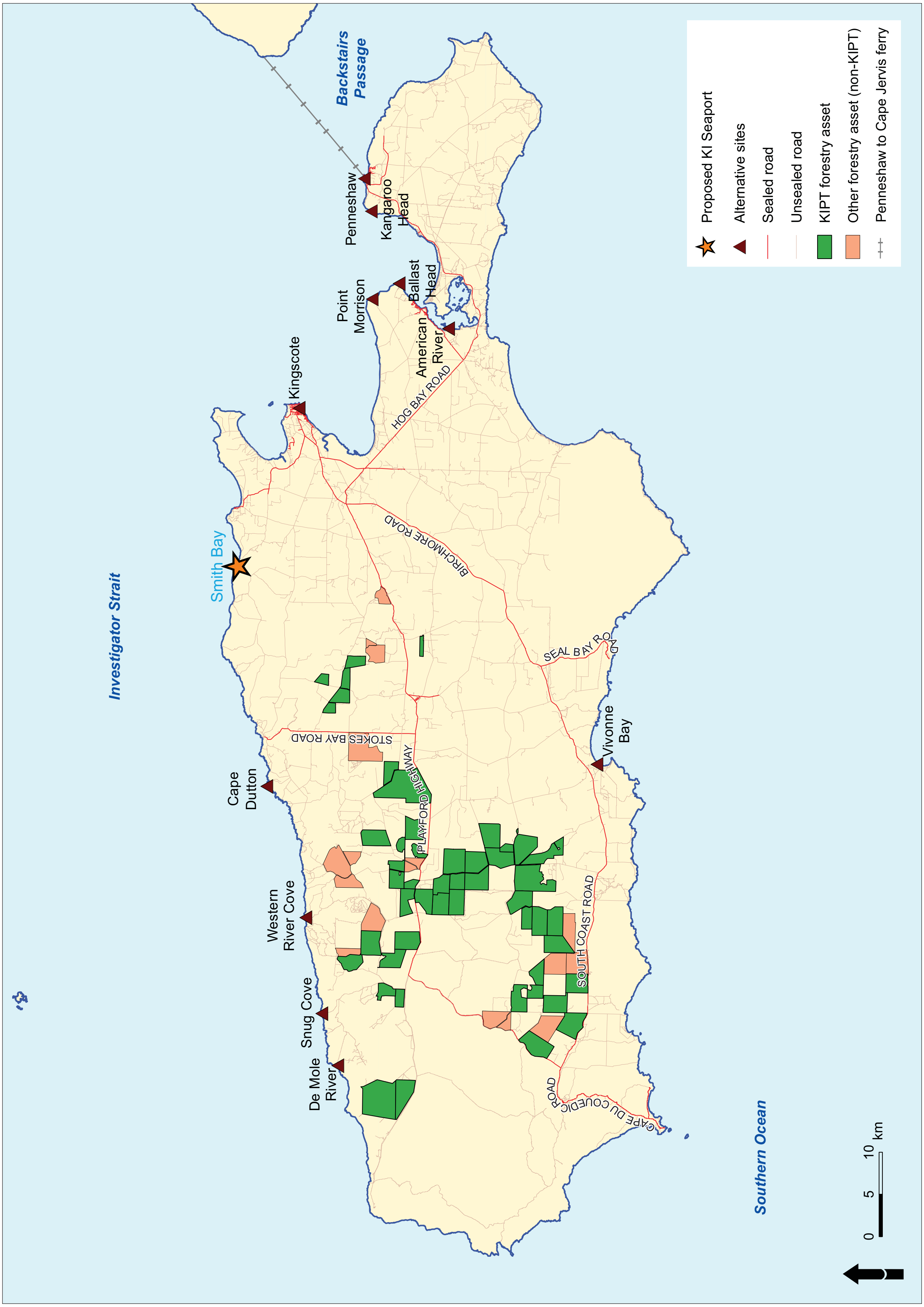


FIGURE 3-1 EVALUATED LOCATION ALTERNATIVES FOR A KI SEAPORT

TABLE 3-2 STAGE 2 SITE OPTIONS AND INITIAL EVALUATION

Site option	Conclusion	Key reasons
De Mole River	Not viable	Inadequate physical setting: harbor too small and shallow, and too exposed to wave energy. Environmental constraints: EPBC Act issues, marine park, substantial native vegetation. Social and community constraints: housing estate nearby. Economic constraint: lack of suitable available land for onshore facilities, likely demurrage due to low berth availability. Not viable and no realistic prospect of approval, likely community and environmental opposition.
Snug Cove	Not viable	Inadequate physical setting: harbor too small and shallow, and too exposed to wave energy. Environmental constraints: EPBC Act issues, marine park, substantial native vegetation. Economic constraint: lack of suitable available land, likely demurrage due to low berth availability. Not viable and no realistic prospect of approval, likely environmental opposition.
Western River Cove	Not viable	Inadequate physical setting: harbor too small and shallow, and too exposed to wave energy. Environmental constraints: EPBC Act issues, marine park, substantial native vegetation. Social and community constraints: a holiday and tourism area. Economic constraint: lack of suitable available land, likely demurrage due to low berth availability. Not viable and no realistic prospect of approval, likely environmental opposition.
Cape Dutton (east)	Further evaluation warranted	See Section 3.4 Stage 2 Evaluation.
Smith Bay	Further evaluation warranted	See Section 3.4 Stage 2 Evaluation.
Kingscote		Several options considered.
a. Barge/tranship	Not viable	Physical setting: location would lead to traffic conflict with tourists and residents. Environmental constraint: within marine park. Social and community constraints: nearby township, including school and hospital. Economic constraint: limited landside area, conflict with tourism, very high operating costs due to double handling. Not viable to secure approval due to likely community opposition.
b. Barge to Port Adelaide	Not viable	Physical setting: location would lead to traffic conflict with tourists and residents. Environmental constraint: within marine park. Social and community constraints: nearby township, including school and hospital. Economic constraint: limited landside area, conflict with tourism, very high operating costs due to double handling and additional port charges. Not viable to secure approval due to likely community opposition.

TABLE 3-2 STAGE 2 SITE OPTIONS AND INITIAL EVALUATION (CONT'D)

Site option	Conclusion	Key reasons
c. Extended wharf	Not viable	Physical setting: location would lead to traffic conflict with tourists and residents. Environmental constraint: within marine park. Social and community constraints: nearby township, including school and hospital. Economic constraint: limited landside area, conflict with tourism, significant capital costs, inefficiencies due to limited draft in Nepean Bay. Not viable to secure approval due to likely community opposition.
Point Morrison (Norma Cove)	Further evaluation warranted	See Section 3.4 Stage 2 Evaluation.
Ballast Head	Further evaluation warranted	See Section 3.4 Stage 2 Evaluation.
American River (barge)	Not viable	Physical setting: location would lead to traffic conflict with tourists and residents. Environmental constraints: located close to important wetland habitat and likely to trigger significant EPBC Act issues. Social and community constraints: nearby township, including existing and proposed tourist accommodation, oyster leases. Economic constraint: limited landside area, conflict with tourism, very high operating costs due to haulage distance and double handling. Not viable to secure approval due to likely community opposition.
Kangaroo Head	Not viable	Physical setting: steep land, exposure to wave energy, distance from plantations, traffic conflict with tourists, residents and other freight. Environmental constraint: within marine park. Economic constraint: site not necessarily available, high operating costs due to haulage distance, likely demurrage and difficult materials handling on steep site. Not commercially viable.
Penneshaw		Several options considered.
a. Domestic sales (no export)	Not viable	Physical setting: location would lead to traffic conflict with tourists, residents and other freight. Social and community constraints: nearby township, including school and tourist accommodation. Economic constraint: limited landside area, conflict with tourism, very high operating costs due to haulage distance, limited domestic market for smaller pine logs and no accessible market for hardwood logs or chip, which comprises 80 per cent of the resource. Not commercially viable to secure approval due to likely community opposition.
b. Access mainland port by road	Not viable	Physical setting: location would lead to traffic conflict with tourists, residents and other freight. Social and community constraints: nearby township, including school and tourist accommodation. Economic constraint: limited landside area, conflict with tourism, very high operating costs due to extreme haulage distance to Port Adelaide (closest log port) or Port of Portland (closest woodchip port). Not commercially viable to secure approval due to likely community opposition.

TABLE 3-2 STAGE 2 SITE OPTIONS AND INITIAL EVALUATION (CONT'D)

Site option	Conclusion	Key reasons
c. Extended wharf	Not viable	Physical setting: location would lead to traffic conflict with tourists, residents and other freight. Social and community constraints: nearby township, including school and tourist accommodation. Economic constraint: limited landside area, conflict with tourism, high capital cost, very high operating costs due to haulage distance and likely demurrage. Not commercially viable to secure approval due to likely community opposition.
Vivonne Bay	Not viable	Inadequate physical setting: harbor too small and shallow, too exposed to wave energy, location would lead to traffic conflict with tourists and residents. Social and community constraints: nearby settlement, including tourist accommodation. Environmental constraints: EPBC Act issues, marine park, substantial native vegetation. Economic constraint: site availability, conflict with tourism and fishing, high operating costs due to likely demurrage and need for frequent dredging. Not commercially viable to secure approval due to likely community and environmental opposition.

An assessment of locations and sites, using imagery, is provided in Appendix B1.

3.4 STAGE 2 EVALUATION OF SITE OPTIONS

3.4.1 STAGE 2 CRITERIA AND EVALUATION

Approach

The four options that were not excluded in Stage 1 (Cape Dutton, Smith Bay, Point Morrison and Ballast Head) were subject to a second-stage, more in-depth examination. Although many issues and factors were considered, three issues emerged as being of particular importance in this stage of the evaluation process:

- KIPT's material handling requirements and those of independent timber growers
- the ability to accommodate other users and other cargoes
- the economic feasibility of constructing a facility without any government subsidy.

KIPT's materials handling requirements

The plantation timber on Kangaroo Island would be sold and exported in one of two forms to meet market requirements: softwood (mainly pine) logs and hardwood (mainly eucalypt) chips. The materials handling requirements for the two products differ. Note that a small proportion of very superior eucalypts may be exported in the form of logs and, likewise, a small proportion of very inferior pine may be exported in the form of woodchips. Such decisions would be driven by market pricing at the time. Notwithstanding this, the freight task is a dual one, with the need to export chips and logs.

Woodchips would be loaded onto ships via a conveyor, and logs would be loaded from trucks positioned on the berth within reach of the ship's cranes. This means an export facility designed to handle logs requires vehicular access to the berth face.

As 80 per cent of the plantation estate is eucalypt and most or all of this will be exported as chip, the export facility must be designed to handle woodchips. It is preferable that the facility can also handle logs because pine logs generally attract a price premium; the economic value of the plantation estates would be maximised if the export facility could handle both products. Moreover, several independent growers on the Island only grow pine trees and they too would require a wharf configuration that could handle their product.

If it is not feasible to build a facility that can handle both logs and woodchips (the preferred option), the best alternative is to build a facility that can handle just chips. This would mean all plantation timber would be exported as woodchips, which would lead to a loss in value for the pine.

Conversely, an export facility built just for logs would not be commercially feasible; 80 per cent of the resource would have to be processed into woodchips elsewhere, which would result in a significant loss of value for KIPT and jeopardise the feasibility of the entire venture. This would also represent a missed opportunity to add value (by chipping) in South Australia. Moreover, loading logs is less efficient than loading chips, so a log-only port would require a significantly more expensive production system and shiploading operation. This in turn would potentially result in shut-down periods when timber prices were low, due to high embedded materials handling costs, a destabilising eventuality for the Kangaroo Island community and economy. For these reasons, a port capable of efficiently and safely handling both timber formats is essential.

Accordingly, the imperative to build a facility that can accommodate both woodchips and logs was a critical factor influencing the Stage 2 site selection process.

The ability to accommodate other users and other cargoes

The South Australian government has indicated to KIPT that any new deep-water port on Kangaroo Island must be able to accommodate a range of users and cargoes. The ability of the KI Seaport to accommodate multiple users and other cargoes depends on whether the facility has the capability to handle logs. This is because:

- containerised freight would be loaded onto ships from trucks positioned on the berth in the same way that logs would be loaded
- containerised import or export freight would require a level hardstand laydown area near the wharf, in the same way that logs need to be stockpiled awaiting shipment
- some bulk export freight (e.g. grain) can be loaded using a conveyor belt but most is containerised or break bulk (e.g. hay) and is loaded from the berth by ship's cranes. In practice, even grain produced on Kangaroo Island is containerised for export.

A woodchip-only operation would not have these features and would therefore effectively preclude most of the potential multi-user, multi-cargo opportunities on Kangaroo Island. It would also be of no value to potential importers.

The economic feasibility of constructing a facility without government subsidy

All money, whether public or private, needs to be expended in the most efficient manner, taking into account all costs and benefits. KIPT plans to construct and operate the export facility without any government subsidy. A critical issue affecting site selection is, therefore, whether it will be cost-effective for KIPT alone to establish the necessary vehicular access to the berth face at the selected site. The more expensive this vehicle access becomes, the more difficult it is to justify the investment; eventually these costs outweigh the benefits, and a chip-only operation becomes the only commercially viable option. Sites or wharf configurations that are most costly militate in favour of a facility with reduced functionality. Likewise, sites and configurations that are more affordable enable a facility to be built that delivers a range of functional benefits.

Site topography (whether the site is relatively flat, gently sloping, or a cliff face that abuts the sea) and the length of the causeway and road system (which is determined by the depth of water close to shore and the cost of constructing the in-water infrastructure) become critical factors which determine whether it is commercially feasible to build a wharf capable of handling logs. In summary, the most versatile sites are those with relatively flat land adjacent to relatively deep water, enabling a multi-user facility to be constructed affordably and without a government subsidy.

3.4.2 SUMMARY OF THE STAGE 2 EVALUATION

The additional criteria used, and the results of the Stage 2 evaluation are summarised in Table 3-3.

Three particular points are worth noting from the Stage 2 evaluation:

- the site topography explains, in large part, why the build cost estimates for Cape Dutton, Point Morrison and Ballast Head were significantly greater than for Smith Bay (refer to Table 3-3), and why the estimated capital contribution from government is commensurately greater. The government's objective of establishing a multi-user, multi-cargo facility can be met at Smith Bay at no extra cost to KIPT, and no cost to the government. It would not, however, be a commercially viable option for KIPT to provide this capability at other sites and, as a consequence, significant public subsidies would be required to cover the markedly greater cost of construction at these sites
- Smith Bay has the lowest estimated operating cost, as a result of its proximity to the source plantations, high berth availability and the simplified logistics associated with getting material from a stockpile into a vessel
- the risk that the construction and operation of the facility may have an impact on the neighbouring land based abalone facility at Smith Bay can be understood, and the measures to mitigate impacts (if required) are considered economical to implement. These particular matters are discussed in a number of chapters in the EIS and are summarised in Chapter 11 – Land-Based Aquaculture.

In summary, Smith Bay has a number of distinct advantages that make it the best site on Kangaroo Island for a deep-water port and, in practice, the only viable option:

- it is the only site which can accommodate both wood products relatively easily (i.e. without significant extra costs associated with on-site roadworks and constructing the in-sea components of the facility)

TABLE 3-3 IN-DEPTH SITE EVALUATION

Evaluation criterion	Alternative locations				Weight[++]	Range of scores	Relative rating				
	Cape Dutton	Smith Bay	Point Morrison	Ballast Head			Cape Dutton	Smith Bay	Point Morrison	Ballast Head	
Minimum estimated build cost: civil and marine	$60 m	$35 m	$50 m	$55 m	10	3–10	3	10	6	4	
Estimated build duration	24 months	12 months	12 months	18 months	4	2–4	2	4	4	3	
Capital contribution from government required[+]	$25 m	$0	$15 m	$20 m	5	0–5	0	5	2	1	
Estimated minimum cost of road upgrades	$5 m	$5 m	$7.5 m	$7.5 m	2.5	1.5–2.5	2.5	2.5	1.5	1.5	
Total cost to government	$25 m	$5 m	$22.5 m	$27.5 m	7.5	1.5–7.5					
Total cost (all sources)	$75 m	$35 m	$72.5 m	$77.5 m	17.5	5.5–17.5					
On-site roadworks	Extensive roadworks required on steep site some distance from public road	Straightforward	Extensive roadworks required to access foreshore	Extensive and challenging roadworks required due to steep site and high elevation	2	0–2	1	2	1	0	
Ability to accommodate multiple users (loading and unloading with vehicles)	Difficult, due to difference in elevation between laydown area and sea level	Easily accommodated, short distances and no significant change in elevation	Difficult, difference in elevation betweenlaydown area and sea level	Difficult and challenging due to distance to deep water and difference in elevation between laydown area and sea level	2	1–2	1.5	2	1.5	1	
Operating costs	Moderate: short haul route and straightforward load-out offset by reduced berth availability and resulting high rates of demurrage	Low, simple load-out and high berth availability, accommodating large vessels. Acceptable haul distance.	High, due to road distance, long and difficult load-out and lack of draft, restricting vessel size and loading	High, due to road distance, long and difficult load-out and lack of draft, restricting vessel size and loading	10	5–10	8	10	5	5	

TABLE 3-3 IN-DEPTH SITE EVALUATION (CONT'D)

Evaluation criterion	Alternative locations				Weight++	Range of scores	Relative rating				
	Cape Dutton	Smith Bay	Point Morrison	Ballast Head			Cape Dutton	Smith Bay	Point Morrison	Ballast Head	
Seabed condition	Undisturbed	Evidence consistent with limited prior dredging	Undisturbed	Prior use for conveyor footings and mooring structure	2	1–2	2	1	2	1	
Inferred seabed composition	Rock	Sand and cobbles	Sand and clay	Clay and sand	2	0.5–2	0.5	2	1.5	1	
Current/most recent land use	Grazing	Former on-land abalone farm	Grazing	Former gypsum terminal	2	1–2	1	1.5	1	2	
Sensitive receptors	Southern Spencer Gulf Marine Park habitat protection zone	On-land abalone farm, nearest intake 450 metres from causeway	In-water oyster lease within 3 km	Oyster lease within footprint	5	2.5–5	4	3.5	5	2.5	
Native vegetation	Substantial	None significant	None significant	Extensive *Allocasuarina verticillata* forest	5	2–5	3	5	5	2	
Historical maritime use	No	Inter-war barging	No	Shallow draft port	5	0–5	0	2.5	0	5	
Extant shipwrecks	No	No	No	No	2	2–2	2	2	2	2	
Raw Score*							30.5	53	37.5	31	Total
Evaluation score (%)**							**52%**	**91%**	**64%**	**53%**	**vs Max**

* Raw score is the assigned relative rating.

** Evaluation score is the percentage of the perfect score (i.e. the perfect score being the maximum value indicated in the range of scores) that the raw score represents.

+ Capital contribution is required from government (for additional costs) to make this a viable option for KIPT.

++ Derivation of the 'weight' value is inherently subjective and developed by KIPT based on professional advice.

- it is the closest practicable sheltered north coast site to the timber resource that is suitable for deep-draft ocean-going vessels to transport timber products directly to Asian markets
- deep water (necessary to berth large ocean-going vessels) is relatively close to the shore
- the adjacent land is relatively flat, making it suitable for storing logs, woodchips and other cargo safely and securely, and for transferring material from the stockpile to ships efficiently
- the site topography is conducive to constructing an export facility that can handle both logs and woodchips (and other potential uses)
- the adjacent land is cleared and somewhat degraded, and the seabed shows signs of having been disturbed, possibly by past dredging
- development of the site is unlikely to pose a threat to endangered marine or terrestrial species, or to endangered ecological communities, and critical habitat
- the site is not within a major tourism area or marine park.

3.5 BALLAST HEAD REVISITED

At the time of the original evaluation, the Ballast Head site was owned by New Forests. Following KIPT's acquisition of all of New Forests' Kangaroo Island assets, including Ballast Head, in May 2017, this site was re-evaluated as a matter of sound prudential management. KIPT had access to some of New Forests' confidential working papers at this time.

A review of New Forests' internal documentation (not previously accessible by KIPT) confirmed the outcome of the initial evaluation. No new material information was discovered in favour of the Ballast Head site, and the high capital and operating costs were confirmed. Critically, the economics of building a log and woodchip export facility at Ballast Head without significant government subsidies (capital subsidy, operating subsidy, significant road upgrades and ongoing maintenance) remain a major impediment to this option. It might also have been necessary to compensate the oyster leaseholder currently occupying the development footprint. Significant likely opposition from the large number of residences whose views would be affected by a development at Ballast Head also militated in favour of Smith Bay, where the number of objectors was judged to be lower. On this basis, New Forests was actually investigating Smith Bay as a site for a jointly-owned facility at the time that negotiations for the asset sale reached their conclusion.

3.6 MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Subsequent to KIPT's evaluation of suitable locations, the Commonwealth Minister for the Environment and Energy determined (EPBC/2016/7814) the proposed development at Smith Bay would be likely to, or may have, a significant impact on the following matters of national environmental significance (MNES).

- listed threatened species and communities (sections 18 and 18A) including but not limited to:
  - southern right whale (*Eubalaena australis*)
  - Kangaroo Island echidna (*Tachyglossus aculeatus multiaculeatus*)
  - hooded plover (eastern) (*Thinornis rubricollis rubricollis*)
  - southern brown bandicoot (eastern) (*Isoodon obesulus obesulus*)
- listed migratory species (sections 20 and 20A) including but not limited to:
  - southern right whale (*Eubalaena australis*).

As a consequence, existing spatial datasets, relevant literature, aerial imagery and any relevant previous survey information have been reviewed for the MNES assessment of the four principal site options post-Stage 2 evaluation in order to satisfy guidelines set by the Commonwealth for preparation of the Draft EIS. The principal sources used for the MNES review were:

- protected matters reports for Ballast Head, Cape Dutton and Point Morrison, generated on 9 May 2018 using a 10 km buffer zone to identify MNES as listed under the EPBC Act (DoEE 2018)
- Biological Databases of South Australia (BDSA) searches obtained from DEW on 14 May 2018 to identify flora and fauna species previously recorded within and around the four sites (DEW 2018)
- the results of a field survey of the study area (Smith Bay) conducted during August 2016 and February 2018 (EBS Ecology 2018).

Data from the search of Protected Matters Reports include all species or communities that have a modelled distribution within the search area (in this case, within a 10 km radius of the central point of the four site options). As a result, species or communities on the list include those actually recorded within the search area, as well as species thought to possibly occur based on broad-scale habitat and climatic mapping.

Whether or not a species is likely to occur within the alternate sites was then determined based on the individual, specific habitat requirements of each species or community compared to the actual conditions of the site (determined using aerial photographs) and informed by historical records. The reports generated from the Protected Matters Search, identified the potential for all four MNES species listed in the guidelines to occur at each of the locations.

The results from these database searches are summarised in Table 3-4. Chapter 14 – MNES discusses the MNES and associated assessment for the Smith Bay site and proposed development in more detail.

TABLE 3-4 RESULTS OF DATABASE SEARCHES FOR THE FOUR SITE OPTIONS

Criterion	Evaluation			
	Cape Dutton	Smith Bay	Point Morrison	Ballast Head
Dominant vegetation associations (BDSA records)	*Allocasuarina verticillata* woodland	Project site is mostly cleared of native vegetation (EBS Ecology 2018)	Mostly cleared of native vegetation	*Allocasuarina verticillata* (mixed) forest
	Eucalyptus diversifolia ssp. *diversifolia, Melaleuca lanceolata* mallee woodland	Small patch of *Eucalyptus cneorifolia* mallee forest	Small patch of *Eucalyptus cneorifolia* mallee forest	*Eucalyptus cneorifolia* mallee forest
	Eucalyptus diversifolia ssp. *diversifolia* mallee woodland			
Threatened ecological community (TEC) (Protected Matters Search results)	None likely to be found in the area	Adjacent to Kangaroo Island narrow-leaved mallee woodland (*Eucalyptus cneorifolia* mallee forest) TEC	Patches of Kangaroo Island narrow-leaved mallee woodland (*Eucalyptus cneorifolia* mallee forest) TEC in the area	Adjacent to Kangaroo Island narrow-leaved mallee woodland (*Eucalyptus cneorifolia* mallee forest) TEC
			Subtropical and temperate coastal saltmarsh likely to be found in the area	Subtropical and temperate coastal saltmarsh likely to be found in the area
Listed species (and habitat) under the EPBC Act Protected Matters Search and observations	Feeding habitat (*Allocasuarina verticillata*) for the glossy black-cockatoo (Kangaroo Island) (*Calyptorhynchus lathami halmaturinus*)	White-bellied sea-eagle (*Haliaeetus leucogaster*) observed flying overhead during the site assessment (EBS Ecology 2018)		Feeding habitat (*Allocasuarina verticillata*) for the glossy black-cockatoo (Kangaroo Island) (*Calyptorhynchus lathami halmaturinus*) White-bellied sea-eagle nest (*Haliaeetus leucogaster*) observed at the location in 2016
	Southern right whale (*Eubalaena australis*) Kangaroo Island echidna (*Tachyglossus aculeatus multiaculeatus*) Hooded plover (eastern) (*Thinornis rubricollis rubricollis*) Glossy black-cockatoo (Kangaroo Island) (*Calyptorhynchus lathami halmaturinus*)	Southern right whale (*Eubalaena australis*) Southern brown bandicoot (eastern) (*Isoodon obesulus obesulus*) Hooded plover (eastern) (*Thinornis rubricollis rubricollis*)	Southern right whale (*Eubalaena australis*) Kangaroo Island echidna (*Tacyhyglossus aculeatus multiaculeatus*) Southern brown bandicoot (eastern) (*Isoodon obesulus obesulus*) Glossy black-cockatoo (Kangaroo Island) (*Calyptorhynchus lathami halmaturinus*)	Southern right whale (*Eubalaena australis*) Kangaroo Island echidna (*Tachyglossus aculeatus multiaculeatus*) Southern brown bandicoot (eastern) (*Isoodon obesulus obesulus*) Glossy black-cockatoo (Kangaroo Island) (*Calyptorhynchus lathami halmaturinus*)

3.6.1 MNES ASSESSMENT

After completing the database searches, each site was assessed, applying the criteria specified in the guidelines. This assessment is summarised in Table 3-5. Details of the assessment of potential impacts on the four listed threatened species are also presented in this section. Further detail on the impact assessment for Smith Bay is provided in Chapter 14 – MNES.

TABLE 3-5 ASSESSMENT OF ADVANTAGES AND DISADVANTAGES OF THE FOUR SITE OPTIONS FOR MNES

Criterion	Evaluation			
	Cape Dutton	Smith Bay	Point Morrison	Ballast Head
Short-term advantages		Minor vegetation clearance required Minimal habitat for native fauna	Minor vegetation clearance required Minimal habitat for native fauna	
Short-term disadvantages	Feeding habitat (*Allocasuarina verticillata*) for glossy black-cockatoo (Kangaroo Island)			Feeding habitat (*Allocasuarina verticillata*) for glossy black-cockatoo (Kangaroo Island) Likely impact on breeding activity of existing white-bellied sea-eagle population (*Haliaeetus leucogaster*)
Medium-term advantages		No significant impacts on native vegetation or native species	No significant impacts on native vegetation or native species	
Medium-term disadvantages				Likely impact on breeding activity of existing white-bellied sea-eagle population (*Haliaeetus leucogaster*)
Long-term advantages		Potential for expansion of the operations without the requirement to clear additional native vegetation	Potential for expansion of the operations without the requirement to clear additional native vegetation	
Long-term disadvantages	Vegetation clearance would be required for the Cape Dutton location which would potentially impact population size, habitat availability of future generations of MNES as well as other listed species			Vegetation clearance would be required for the Ballast Head location which would potentially impact population size, habitat availability of future generations of MNES as well as other listed species Likely impact on breeding activity of existing white-bellied sea-eagle population (*Haliaeetus leucogaster*)

Southern right whale (*Eubalaena australis*)

It is unlikely the proposed development would have significant impacts on the southern right whale at any of the four alternative locations, for the reasons summarised in Table 3-6.

TABLE 3-6 ASSESSMENT OF IMPACTS ON SOUTHERN RIGHT WHALE

Location	Assessment
Cape Dutton	Cape Dutton is not in a biologically important area for southern right whales (DSEWPaC 2012). Shipping activity (approximately 10–20 vessels per annum) to and from Cape Dutton is unlikely to result in an increase in whale strikes. The site is not near an aggregation area or historic high use areas, therefore this option is considered to have a negligible noise impact on southern right whales (15 records of southern right whales at Cape Dutton, DEW 2018). The relative increase in shipping-based debris from equipment associated with construction and decommissioning, to which migrating whales would be exposed, is negligible.
Smith Bay	Smith Bay is not in a biologically important area for southern right whales (DSEWPaC 2012). Shipping activity (approximately 10–20 vessels per annum) to and from Smith Bay is unlikely to result in an increase in whale strikes. The site is not near an aggregation area or historic high use areas, therefore this option is considered to have a negligible noise impact on southern right whales. The relative increase in shipping-based debris from equipment associated with construction and decommissioning, to which migrating whales would be exposed, is negligible.
Point Morrison	Point Morrison is not in a biologically important area for southern right whales (DSEWPaC 2012). Shipping activity (approximately 10–20 per annum) to and from Point Morrison is unlikely to result in an increase in whale strikes. The site is not near an aggregation area or historic high use areas, therefore this option is considered to have a negligible noise impact on southern right whales. The relative increase in shipping-based debris from equipment associated with construction and decommissioning, to which migrating whales would be exposed, is negligible.
Ballast Head	Ballast Head is not in a biologically important area for southern right whales (DSEWPaC 2012). Shipping activity (approximately 10–20 per annum) to and from Ballast Head is unlikely to result in an increase in whale strikes. The site is not near an aggregation area or historic high use areas, therefore this option is considered to have a negligible noise impact on southern right whales. The relative increase in shipping-based debris from equipment associated with construction and decommissioning, to which migrating whales would be exposed, is negligible.

Kangaroo Island echidna (*Tachyglossus aculeatus multiaculeatus*)

There is potential for an impact on the Kangaroo Island echidna if the development was located at Ballast Head or Cape Dutton. It is unlikely there would be a significant impact if the development occurred at Point Morrison or Smith Bay. The reasons for this assessment are summarised in Table 3-7. (Note that impacts are considered in the context of clearing existing vegetation only and do not extend to activities that might occur following clearance activities, including the transport of timber to the location.)

Southern brown bandicoot (eastern) (*Isoodon obesulus obesulus*)

There is potential for an impact on the southern brown bandicoot (eastern) if the proposal was to proceed at Ballast Head or Cape Dutton. It is unlikely the proposal would have a significant impact on the southern brown bandicoot (eastern) if development occurred at Point Morison or Smith Bay. The reasons for this assessment are summarised in Table 3-8.

TABLE 3-7 ASSESSMENT OF IMPACTS ON THE KANGAROO ISLAND ECHIDNA

Location	Assessment
Cape Dutton	Would require clearing of native vegetation that is potentially habitat for the echidna. The fragmentation of habitat in the Cape Dutton area could negatively impact the species' distribution and occurrence. The introduction of predators (such as cats that are attracted by human activity) to the local area could reduce population numbers. There would be an increased likelihood of vehicle strikes (BDSA results show 10 records within a 10 km radius).
Smith Bay	Vegetation in the Smith Bay location is not considered habitat critical to the survival of the species and would not result in fragmentation of an existing population.
Point Morrison	Vegetation in the Point Morrison location is not considered habitat critical to the survival of the species and would not result in fragmentation of an existing population.
Ballast Head	The introduction of predators (such as cats that are attracted by human activity) to the local area could reduce population numbers. There would be an increased likelihood of vehicle strikes (based on historic records).

TABLE 3-8 ASSESSMENT OF IMPACTS ON THE SOUTHERN BROWN BANDICOOT (EASTERN)

Location	Assessment
Cape Dutton	Would require clearing native vegetation that is potentially habitat for southern brown bandicoot (eastern). The fragmentation of local native habitat would reduce connectivity between patches of vegetation and negatively impact the species distribution and occurrence. There would be an increased likelihood of vehicle strikes (BDSA search results show eight individual records within a 10 km radius).
Smith Bay	There is an absence of native vegetation which would potentially be habitat for southern brown bandicoot (eastern). There are virtually no records of the bandicoot in the vicinity (BDSA search results shows one individual record within a 10 km radius).
Point Morrison	There is an absence of native vegetation which would potentially be habitat for southern brown bandicoot (eastern). There would be an increased likelihood of vehicle strikes (BDSA search results show 15 individual records within a 10 km radius).
Ballast Head	Would require clearing native vegetation which would potentially be habitat for southern brown bandicoot (eastern). An increased fragmentation of local native habitat would reduce connectivity between patches of vegetation and negatively impact the species' distribution and occurrence. There would be an increased likelihood of vehicle strikes (BDSA search results show 30 individual records within a 10 km radius).

Hooded plover (eastern) (*Thinornis rubricollis rubricollis*)

The hooded plover (eastern) is widely dispersed in south-eastern Australia on or near sandy beaches with strong (high-energy) waves, and their adjacent dunes (DoEE 2017).

If the proposal was to proceed at Ballast Head, Cape Dutton or Point Morrison it is unlikely it would have a significant impact on the hooded plover (eastern) based on:

- the lack of suitable habitat (sandy beaches and sand dunes) in the area
- the proposal would not be on a large-enough scale to fragment existing populations
- a lack of records in the vicinity (BDSA search results show one record within a 10 km radius of these sites).

If the proposal was to proceed at the Smith Bay location, it is unlikely to have a significant impact on the hooded plover (eastern) based on:

- the lack of critical habitat for the species
- the location is not a known breeding site
- it is unlikely that the proposal would reduce the availability of critical habitat for the hooded plover (eastern).

Glossy black-cockatoo (Kangaroo Island) (*Calyptorhynchus lathami halmaturinus*)

The glossy black-cockatoo (Kangaroo Island) (*Calyptorhynchus lathami halmaturinus*) is listed as Endangered under the EPBC Act and the *National Parks and Wildlife Act 1972*. Ballast Head and Cape Dutton locations have BDSA records (six and 60 respectively) of glossy black-cockatoo (Kangaroo Island) individuals as well as feeding habitat for the species.

Choosing Ballast Head or Cape Dutton would require approval and offsets for clearance of native vegetation. This activity would likely impact on the glossy black-cockatoo (Kangaroo Island) and is unlikely to receive State and/or Commonwealth approval.

There are no records of glossy black-cockatoo at Point Morrison or Smith Bay. It is therefore unlikely that development at either of these locations would have an impact on this species.

White-bellied sea-eagle (*Haliaeetus leucogaster*)

The white-bellied sea-eagle is listed as Marine under the EPBC Act and Endangered under the *National Parks and Wildlife Act 1972*. Ballast Head is a known breeding site. If the proposal was to proceed at this location approval would be required under the EPBC Act as the proposal would likely impact critical habitat for this species. Approval for this location is unlikely to be obtained.

There are no records of breeding activity of white-bellied sea-eagle at Cape Dutton, Point Morrison or Smith Bay. It is therefore unlikely that development at any of these locations would have an impact on this species.

3.7 ALTERNATIVE STRUCTURES (IN-WATER)

Having identified Smith Bay as the preferred site and having identified that there were no matters of national environmental significance that would prevent or constrain a development at that site, a design brief was issued to KIPT's engineering consultant to determine the best in-water structure to enable the efficient loading of woodchips and logs and to enable other possible future uses.

The design requirement was for a berth face in water of 14 metre depth at lowest astronomical tide (LAT), to enable sufficient under keel clearance for a fully-loaded vessel in most wave conditions. It might be possible to operate the facility with a depth of 13.5 metre or even 13.0 metre at LAT. However, these would result in significant reductions in berth availability (to 93 per cent and 80 per cent respectively for Panamax vessels). The commercial viability of any port can be threatened by low levels of certainty about whether it is possible to dock in the first place, and with the constant threat of having to move off the berth part-loaded at high tide in the event of poor weather being predicted. Given the very high demurrage cost incurred by keeping a Panamax vessel waiting for suitable berthing conditions, 13.5 metre depth was identified as the required configuration, once it was determined that the facility would need to accommodate Panamax vessels.

3.7.1 IN-WATER DESIGNS CONSIDERED

Studies to optimise the conceptual design focused on investigating alternative structures for the offshore infrastructure. Several alternatives were evaluated, for:

- the built form of the approach structure leading to the berth face. There were three main alternatives, although the approach in all options must allow for vehicular traffic and support a conveyor system:
  - a solid causeway which would minimise seabed disturbance but would be more expensive than a causeway in less than eight metre depth or if the seabed was not receptive to piling
  - a fully-piled suspended deck which would have a large seabed footprint as depth increases, and would be cheaper than a suspended deck in less than eight metre depth but more expensive in deeper water

  - a combination of a solid causeway and suspended deck which would be the most cost-effective option for the causeway to approximately eight metre depth, after which a suspended deck in deeper water would be more cost-effective
- the built form of the berth face itself. There were four main alternatives:
  - a sheet-piled solid fill structure, which would be the most expensive and technically difficult due to poor seabed receptivity at 14 metre depth, and it would require significant backfill
  - a solid fill structure with a projecting suspended deck, which would avoid the need for sheet piling but require large volumes of fill, and constructing the deck would be expensive
  - a totally suspended deck structure, which would entail very high construction costs given large numbers of piles to be secured into an unreceptive seabed
  - a floating berth face, which would require limited piling for restraints, would be the lowest cost and have the lowest environmental impact, but would require linkspan due to tidal movement. It would also provide consistent air draft for shiploading
- whatever the built form, the berth face needs to be sufficiently wide to accommodate a turning articulated vehicle, and sufficiently long to enable large vessels to berth securely
- the length of the approach and, consequently, the extent and location of the dredged area. The longer the approach, the less dredging would be required to achieve the required safe water depth; however, the less material would be liberated for causeway construction if that is part of the approach structure.

Having identified a preferred design, further trade-offs would be required to optimise the parameters of that design. These are discussed later in Section 3.7.2.

There are twelve possible combinations of approach structure (three alternatives) and berth face (four alternatives), and a wide range of approach lengths, giving rise to considerable variation in the resulting dredge volume. The main considerations in the evaluation were the anticipated environmental impact and the expected construction cost. To simplify the task of comparing alternatives, the first two factors listed above (approach structure and the built form of the berth face) were considered in combination initially, before a separate optimisation exercise in relation to the length of the approach and the consequent position and extent of dredging.

Table 3-9 shows each combination of approach structure and berth face structure, ranked according to the environmental impact and the construction cost on a scale from one to 12. Low ranks indicate lower impact and lower cost respectively. While many ways of combining the environmental and economic information could be supported, the ranks have simply been given equal weighting and have been added.

TABLE 3-9 ASSESSMENT OF IMPACTS EACH COMBINATION OF APPROACH STRUCTURE AND BERTH FACE

	Approach	Piled suspended deck	Rock and fill causeway	Causeway leading to suspended deck
Berth face				
Sheet piled and filled	Environmental impact	8	12	10
	Construction cost	12	11	9
	Total impact	**20**	**23**	**19**
Rock and fill with projecting deck	Environmental impact	7	11	9
	Construction impact	10	8	6
	Total impact	**17**	**19**	**15**
Suspended deck	Environmental impact	2	6	4
	Construction cost	7	5	3
	Total impact	**9**	**11**	**7**
Floating pontoon	Environmental impact	1	5	3
	Construction cost	4	2	1
	Total impact	**5**	**7**	**4**

The estimated environmental impact and estimated construction cost were ranked based on a notional 350 metre approach length and berth deck dimensions of 40 x 150 metres. Other factors, such as design life, maintenance cost and construction duration were excluded for the sake of simplicity. The most favoured structure (a combined approach with a causeway leading to a suspended deck jetty and floating pontoon) would also be the least expensive to construct and would have relatively low environmental impact. A significant and unjustified increase in construction cost would be required to reduce the environmental impact any further.

Accordingly, a combination of a rock and fill causeway extending to approximately eight metres LAT leading to a suspended deck jetty in deeper water and connected to a floating pontoon by a linkspan bridge was identified as the only viable approach. The question of the total length of the approach was considered as a secondary matter and remains subject to detailed design. It is directly related to the dredge quantity in that a longer approach results in a reduced dredge requirement to achieve 14 metre under keel clearance. As the project stands, certain parameters have been established and discussed below.

Building the approach to the 14 metre LAT depth contour (and thereby avoiding dredging altogether) is not practicable: to do so requires a total approach length of 620 metres, only 250 metres of which could be cost-effectively achieved with a rock and fill causeway, leaving approximately 370 metres to be covered by a suspended deck jetty, much of which would require screw piling, as opposed to driven piles. The cost of this option would be such that the Project would be economically unviable. Maintenance costs and operating costs would also be high for such a long structure in open water. Moreover, the cost of the nearshore rock and fill causeway would also rise substantially, due to the lack of coarse dredge spoil from which to form the causeway fill. Approximately 75,000 cubic metres of coarse fill would need to be brought to the site, at considerable cost. Dredge spoil, on the other hand, is available on site and (based on offshore geotechnical investigation) is known to contain a high proportion of coarse material (sand and cobbles) due to the winnowing action of waves that make it suitable for use as causeway core fill material.

Following from this, and assuming that fine materials compose no more than 25 per cent of dredge spoil as indicated by the geotechnical investigations conducted for the EIS, the length of the approach is optimised by extending to the point where the required dredge volume is approximately 100,000 cubic metres. This is calculated to be achieved by extending the total approach length to 420 metres from shore, 250 metres of which would be in the form of a rock and fill causeway, leaving 170 metres to be spanned with a combination of a suspended deck jetty structure and a linkspan bridge. Such an arrangement effectively yields:

- a maximum solid causeway length of 250 metres
- a minimum separation of the dredge area from the nearest sensitive receptor.

It is these parameters that have been modelled in the coastal process study discussed in Chapter 10 – Coastal Processes. Together, they represent the worst contemplated case in terms of environmental impact and are therefore appropriate model inputs.

3.7.2 CONCEPT DESIGN OPTIMISATION

The original concept design for the in-water structures has been subject to further optimisation studies undertaken by KIPT in May and June 2018. These optimisation studies have been based on the following revised inputs:

- an increase in the design vessel draft from 10.8 metres (Handymax) to 11.75 metres (draft restricted Panamax). The change to the design vessel follows KIPT's acquisition of the New Forests plantation estates and allows for a significantly greater volume of woodchips to be exported from the facility with approximately the same number of vessel movements per annum
- ship motion analysis and under keel clearance assessment by OMC International (November 2016, Mooring Study Kangaroo Island, R8264 Rev E, unpub. report)
- wave modelling results and assessment from BMT WBM (February 2018, Smith Bay Design Wave and Water Level Assessment, R.B22454.001.01, unpub. report)
- updated (January 2018) bathymetric survey data (2 January 2018, Flinders Ports, drg. ref, FP4422)
- preliminary cost rates for the causeway and jetty construction and dredging.

The key objective of these optimisation studies was to determine the maximum potential solid causeway length (which would need to be considered for coastal processes and water quality plume modelling) (see Figure 3-2) and the closest potential dredge area location (to validate earlier dredge plume assessments and determine and model worst-case scenarios for dredge plume assessments).

The maximum approach length (i.e. causeway plus suspended jetty) would be determined in the final design, which would be refined after planning approval, having regard to factors such as the berth position and alignment.

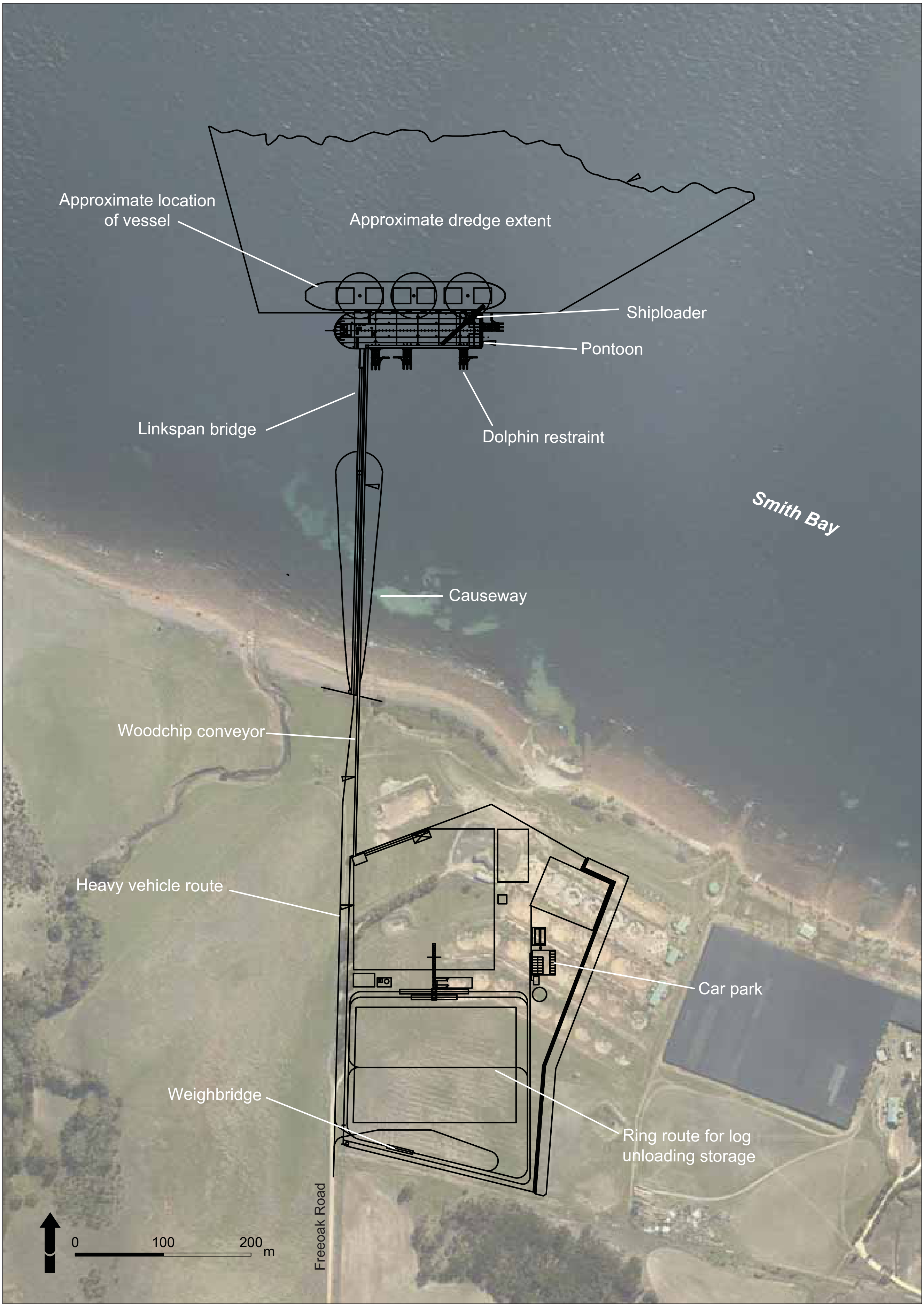


FIGURE 3-2 REVISED CONCEPT DESIGN FOR THE KI SEAPORT

3.8 CONCLUSION

KIPT followed a comprehensive, two-stage evaluation process to select the best site on Kangaroo Island to build and operate an export facility capable of handling logs and woodchips.

This process showed Smith Bay is the best location for such a facility, so KIPT acquired the site. A subsequent re-evaluation of the Ballast Head option in 2017 after KIPT acquired this site from New Forests confirmed the original conclusion.

The South Australian Government's long-standing objective of establishing a multi-user, multi-cargo facility on the Island requires a facility that can handle both logs and woodchips. The Smith Bay site offers the only cost-effective option to realise this objective. All other options would require significant government subsidies for both capital works and operating costs and may result in more significant impacts.

Development at Point Morrison or Smith Bay would provide less disadvantages to MNES, given that Cape Dutton and Ballast Head provides important habitat for the glossy black-cockatoo and white-bellied sea-eagle (at Ballast Head); and, given the quality of vegetation at both these locations, would also provide habitat for Kangaroo Island echidna and southern brown bandicoot (eastern).

The process of selecting the best concept design for the in-water structures involved assessing three different variables: the built form of the approach leading to the berth face; the built form of the berth face itself; and the length of the approach, which determines the extent and location of the area to be dredged. Of the 12 options assessed, the combination of a causeway leading to a suspended deck with a floating pontoon berth would have the lowest construction and environmental impacts.

This original concept design for the in-water structures has been optimised to accommodate larger Panamax-size vessels and account for new information obtained in the EIS process derived from wave modelling, ship motion analysis, revised bathymetry and updated cost estimates. The revised concept includes a maximum causeway of 250 metres, and a suspended jetty structure of at least 170 metres, which form a minimum total approach distance of 420 metres.

Guideline		Comment
1.18	Provide further detail on the social and economic costs and/or benefits of undertaking the proposed action, including basis for any estimations of costs and/or benefits, potential employment opportunities expected to be generated at each phase of the proposed action and details of any public and stakeholder consultation activities, including the outcomes.	See Sections 4.6.4, 7.6, 20.6.1 and 20.6.2
2.4	Describe coastal engineering requirements for the location, orientation and type of causeway and wharf structures.	See Section 4.4
2.5	Outline the materials that will be used to construct the causeway, including any treatment that the materials may have been subject to, prior to immersion in the water.	See Sections 4.4.4 and 4.4.5
2.7	Describe any dredging activity that will be undertaken during the construction phase.	See Sections 4.4.4 and 4.5.2
2.8	Describe the design and operational measures to protect water quality and prevent stormwater and other runoff from the site, and in particular harmful contaminants, entering the coastal and marine environment, during both construction and operation.	See Sections 4.4.4, 4.4.6 and 4.5.2
2.10	Detail measures for managing solid waste, black water and grey water from ships.	See Section 4.8.7
2.11	Describe how shiploading operations will minimise incidental timber spillage and dust emissions (point source and fugitive) during loading operations to avoid causing harm to marine and coastal flora and/or fauna species, including migratory species.	See Sections 4.4.6 and 4.6.4
3.1	Provide information on the proposed management techniques for incoming ship ballast and bilge waters.	See Sections 4.6.2 and 4.6.3
3.9	Outline strategies to monitor, control and manage biofouling of wetted surfaces.	See Sections 4.6.3 and 4.7
8.1	Outline the likely size and source of the construction workforce and associated employees, and how accommodation requirements for this workforce will be met.	See Section 4.8.4
8.2	Provide information on the time of year that construction is likely to occur and identify the impact this may have on tourist accommodation on the Island, especially if construction will occur during the tourist season.	See Sections 4.1.4, 22.5.3 and 22.6.2
10.8	Describe car parking provisions for staff and visitors, including how any potential future expansion that may be required as a result of multi-users of the port and facilities, will be accommodated and managed.	See Section 21.5.1

Guideline		Comment
11.1	Identify the sources of water, and estimated volumes required, to provide an adequate water supply for the proposed development. Include information on potable and other water requirements.	See Section 4.8.2
11.2	Describe the approach to water sustainability, including ways in which water use can be minimised or supplemented (inducing the use of rainwater) and opportunities for reducing water use and for recycling water, particularly stormwater and wastewater.	See Sections 4.8.2 and 4.8.6
11.3	Describe water sensitive urban design measures and uses of wastewater that will be adopted, include a description of how recycled water will be treated as part of any water sustainability measures.	See Section 4.8.2
11.4	Outline the measures proposed to manage stormwater runoff from hard surfaces that are not being used for harvesting water supply, especially access roads.	See Section 4.4.6
11.5	Outline the measures proposed to manage stormwater runoff/leachate from the timber product stockpile area.	See Section 4.4.6
13.2	Identify strategies to protect the causeway and wharf structures from extreme weather events, including a – in-50 year event.	See Section 19.4.4
14.3	Outline fumigation/pesticide methods to be used, if any, on the timber exports, including type, location and method of application. Include information on the disposal of any chemicals that will be used on site. Describe strategies to minimise spray drift onto the adjacent abalone farm and potential for contaminated runoff into the marine environment.	See Section 4.4.6
14.6	Detail measures and strategies for the management of hazardous, flammable or explosive materials, including risk contours.	Sections 4.4.6 , 4.6.6, Appendices U1 and U2
14.7	Outline the proposal for bunding of hazardous materials.	See Sections 4.4.6 and 4.6.6
14.9	For areas where liquids (other than rainwater) may be stored, describe measures (including bunding) to minimise the risk of environmental harm from spills and leaks.	See Sections 4.4.6, 4.5.2 and 4.6.6
14.11	Outline how timber pile separation will be undertaken in accordance with the South Australian Fire Services Built Environs Section Guideline No.13 – General Guidelines for Rubber Tyre Storage 2.	See Sections 4.6.4 and 4.6.6
14.12	Describe the emergency response plan in the event of an emergency, including evacuation measures.	See Chapter 26, Section 4.6.6 and Appendix U3
14.13	Describe strategies to ensure public safety during construction and operation.	See Sections 4.6.8 and 21.3
14.14	Outline the associated risks should the proposal not go ahead, or if the proposal is not completed, and identify measures to mitigate these risks.	See Sections 2.6 and 4.9.5

Guideline		Comment
15.1	Provide details of the proposed process, mechanisms, equipment and infrastructure that will be used to transport and load the timber products on site (include details of the estimated time that will be required to load each shipment). Outline the risks, benefits and constraints of the proposed process, mechanisms, equipment and infrastructure.	See Sections 4.4 and 4.6
15.2	Outline the requirements for an adequate supply, and the location of distribution networks for: gas, electricity, waste, potable water, sewerage, stormwater and wastewater management, communications systems and local and other roads. Identify the impact this will have on existing users of these networks.	See Section 4.8
15.3	Identify any infrastructure upgrade or augmentation that will be required to the existing distribution networks (as identified above) on the Island to support the development for the life of the project. Include information on how this will be managed and funded.	See Sections 4.6.1 and 4.8
15.4	Detail the ability of existing infrastructure to manage waste (including hard waste and wastewater) and recycling streams that will result from the proposed development.	See Section 4.8.7
15.5	Detail any road infrastructure improvements or upgrades that will be required to provide safe and efficient access to the port including any potential junction/intersections on the arterial road network.	See Section 4.4.6 and 4.6.1
15.7	Detail potential emergency services requirements and arrangements. Include information of discussions had with existing emergency service providers on the Island.	See Section 4.6.6, Section 7.7 and Appendix U3
18.1	Provide details of construction materials, colours and landscaping for all buildings and structures.	See Sections 4.4.6 and 4.4.1
18.3	Describe the rationale for the major design elements of the proposed development and measures to mitigate their visual impact	See Sections 4.4 and 23.6
18.6	Provide details of the shelter, shading and screening treatments for car parking areas.	See Section 4.4.6
19.3	Outline the timing of construction and the time of year it is likely to occur.	See Section 4.1.4
19.5	Assess the requirement for any hazardous exclusion zones around the proposed causeway and wharf during ship loading activities, including the tug harbour.	See Sections 4.5.1 and 4.6.8
19.6	Identify all sources of waste during construction and operation and describe how the State Waste Strategy will be implemented.	See Section 4.8.7
19.7	Describe measures proposed for the disposal of excavated material.	See Sections 4.5.2, 4.5.4, 4.8.6 and 4.8.7
19.8	Outline measures to minimise or reduce materials and construction resources used during the construction and operational phases.	See Section 4.8.6

Guideline		Comment
19.9	Describe the level of cut and fill required and the effect on the natural topography of the site, including the access and the storage areas.	See Sections 4.5.5 and 4.8.6
19.10	Where possible, identify the source and origin of construction materials for buildings and infrastructure (including roads) and the opportunity for the use of recycled materials.	See Sections 4.5 and 4.6.1
19.11	Provide information about the transport and storage of construction materials to minimise effects on the local environment.	See Sections 4.5 and 4.6.1
19.15	Provide details of potential other users of the wharf and/or port facilities. Describe likely timing of when these users are anticipated to use these facilities, and responsibilities for the management of this use.	See Sections 4.6.7 and 4.6.8
19.16	Detail long-term management/maintenance arrangements for the operation and decommissioning of the facility, including the ownership of land and infrastructure, sand management and any coastal protection measures.	See Sections 4.7 and 4.9
19.17	Describe the rehabilitation strategy to be adopted if the development ceases prior to completion, during any stage of the development or during its operational phase. Include details on funding for any rehabilitation that may be required.	See Sections 4.9.2, 4.9.3 and 4.9.5

04. PROJECT DESCRIPTION

4.1 INTRODUCTION

This chapter addresses elements of the DAC guidelines that are related to the design, construction, operation and closure of infrastructure associated with the proposed development. This chapter also describes the preceding forestry (plantation and harvesting) operations, noting that these operations have already been approved and are outside the scope of the EIS.

4.1.1 PROJECT OVERVIEW

KIPT's standing timber assets on the Island currently exceed 3.6 million tonnes and are expected to grow to at least 5.4 million tonnes by the time of harvest. The KIPT resource is sufficient to establish a sustainable plantation forestry industry on the Island based on the export of timber products (i.e. sawlogs, peeler logs and woodchips) to markets in Asia.

The export of harvested timber directly to markets overseas requires the development of Kangaroo Island's first deep-water port – to be called the KI Seaport. KIPT has acquired land at Smith Bay considered most suitable for the construction and operation of such a facility, which would be capable of exporting both logs and woodchips using Panamax vessel of up to 60,000 deadweight tonnes (DWT) and a draft of up to 11.75 metres. Smaller Handymax-size vessels would also be used, subject to operational requirements.

KIPT expects the new facility would be used for 30 to 75 days per annum for timber exports, which would be sufficient for the sustainable yield of the entire Kangaroo Island forestry estate, including trees owned by other parties. Based on current plantation species and yields, this equates to between 10 and 20 shipments a year in perpetuity.

The KI Seaport would consist of a pontoon, held in place by restraint dolphins (piled steel structures that extend above the water level and are not connected to shore). The wharf would be 168 metres long and 41 metres wide, with additional mooring structures provided for vessel head and stern lines. The berth face of the wharf would be positioned approximately parallel to shore along the 11.5-metre depth contour. The approaches would dredged to a depth of up to 13.5 metres to safely accommodate fully-laden Panamax vessels in a range of sea conditions. The wharf would be accessed from land by an approach consisting of a rock armoured causeway and suspended jetty deck structure, which connects the approach to the pontoon via a linkspan bridge at its seaward end.

The onshore timber storage area would be divided into two terraces to provide around 4.1 ha of flat space on the otherwise gently sloping site. This arrangement would be used to stockpile up to 56,250 tonnes of logs within the southern storage area (equal to around 150 per cent of maximum anticipated vessel capacity) and up to 80,000 tonnes of woodchips in the northern storage area. The southern storage area may also be used to store bulk agricultural cargo such as grain, and general container cargo destined for export in periods when logs were not being shipped in large quantities. The maturity profile of the timber estate means that there will be several years when there are few, if any, log exports and other years in which only limited quantity of logs would handled, so that it is expected that the log storage area would available when needed for other cargoes.

As currently proposed, timber export vessels would formally enter and leave Australia at an existing international port before and after loading at Smith Bay. KIPT intends to continue to liaise with relevant Commonwealth authorities and shipping service providers about point of entry requirements to determine the final status of the KI Seaport. In any case, the new seaport would be developed to comply with the *Maritime Transport and Offshore Facilities Security Act 2003* (Clth) which defines the regulatory framework for assessing the operational security risks at ports, and preparing a security plan to counter these identified risks.

To support the plantation operations and the KI Seaport, KIPT may also establish:

- an operations base at the existing Timber Creek sawmill site to manage and maintain the mobile vehicle fleet (comprising the haul trucks and site materials handling equipment) and oversee fleet operations
- a truck parking area with limited facilities at some point on the transport route. This facility would allow the staging of heavy vehicle movements along the transport corridor, and provide an overnight parking area and, possibly, a refuelling point.

These supporting activities and associated infrastructure are outside of the scope of the EIS and are subject to separate approvals processes. Figure 4-1 provides an overview of the KIPT operations.

4.1.2 PROJECT BACKGROUND

Silviculture on Kangaroo Island has a long history. The current tree crop began to be established in 1980 with the planting of a 20.6 ha Monterey pine (*Pinus radiata*) plantation. The intention was to build a sawmill to process this timber for local and mainland Australian markets. A sawmill was established at the site of the former Government Research Station on Timber Creek Road in 2004 to process pine logs. It operated sporadically from 2005 to 2013, until a fire damaged some of the infrastructure and halted milling. The main green mill and the secondary dry mill and kilns have not operated since then and there are no plans to reopen these lines. As far as KIPT is aware, the main sawmill has never operated profitably, due to outdated technology, high electricity generation costs and the costs of getting sawn timber to market. Currently, only the post peeler and treatment plant are operating.

Trial plantings of Tasmanian blue gum (*Eucalyptus globulus*) were established in the early 1990s, with more extensive trials undertaken in the early 2000s. These were sufficiently encouraging that extensive eucalyptus plantations were established from 2005 to 2008, encouraged at the time by State and Commonwealth government policies.

KIPT (previously RuralAus Ltd) established a number of plantations in the late 1990s and acquired others over the following 15 years. It then acquired the majority of the remaining plantations on Kangaroo Island in April 2017. KIPT now owns approximately 80 per cent of all plantation timber on the Island. In addition to the plantations, KIPT also owns 185 ha of land at Smith Bay, including 173 ha associated with the former 'Wandering Sheep' property and 11.7 ha of land that is the subject of this EIS. Should the proposed development be approved, an agreement is in place to purchase land south-west of the KI Seaport site at Smith Bay. KIPT also owns a 20.8 ha site at Ballast Head. KIPT has indicated that it will dispose of excess land subsequent to the approval of the KI Seaport at Smith Bay.

4.1.3 PROJECT LOCATION

KIPT's plantations are mainly located in the western part of the Island, as shown in Figure 4-3. Smith Bay is located on the north coast, approximately 20 km north-west of Kingscote.

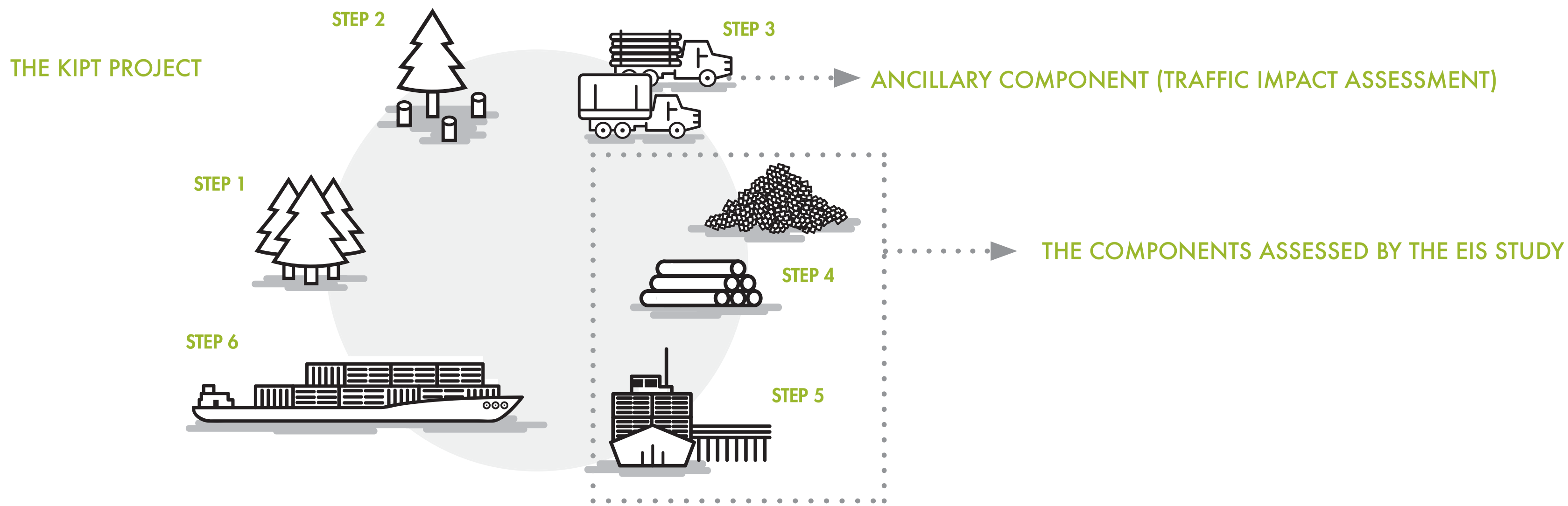
4.1.4 PROJECT SCHEDULE

Construction and on-ground works would commence after all relevant primary and secondary approvals have been granted, with construction expected to take no more than 20 months, broken down as follows:

- Day 0: commencement of dredge program, requiring up to approximately 75 days for the excavation of approximately 100,000 cubic metres of dredge spoil.
- Day 75: commencement of causeway construction upon the completion of dredging and following the dewatering of the dredge spoil and separation of coarse material sufficient for use in causeway construction. Approximately 75,000 cubic metres of coarse dredge spoil to be placed, together with approximately 20,000 cubic metres of rock and/or geotextile armour, over approximately 150–200 days.
- Day 75: commencement of marine construction works simultaneously with causeway construction. This would take approximately 200 days consisting of the following activities:
  - Day 75: installation of conveyor trestles (approximately 20–30 days).
  - Day 100: installation of restraint dolphins (approximately 110 days).
  - Day 210: construction of suspended deck (approximately 90 days).
  - Day 300: installation of pontoon and final pontoon finishing works (approximately 30 days).
  - Weather and/or interruption contingency of 35–45 days.
- Day 225: commence onshore civil works (roads, pavements, services, offices, materials handling and commissioning). This would take approximately 270 days.
- Day 365: marine works completed.
- Day 520: all construction completed.

The dredging works are the most weather dependent activity in the construction schedule. Therefore, the dredging works would ideally commence in spring or summer to limit the risk of weather-induced downtime and the associated standby costs; other works would be scheduled to follow thereafter. The marine piling works (mooring dolphins, barge restraint dolphins and piled jetty components) would be constructed using a jack-up barge to reduce the effects of bad weather on these construction activities. The causeway would be constructed using civil plant operating from the shoreline, and accordingly this work can be undertaken at any time and is less weather dependant.

Timber harvesting operations would begin one-to-two months before the KI Seaport is commissioned. This would allow a stockpile to be established at the facility before the first vessel arrives. In all likelihood, logs would be exported initially, while the woodchip handling system is being completed, although this remains uncertain and would be subject to market conditions and construction activity on the site.



STEP 1: FORESTRY Producing quality timber requires good growing conditions and proper maintenance. The management regime (including thinning and pruning) depends on the species and its establishment method. Blue gum plantations, established from the stumps of a previous crop, are coppice pruned at about three years of age. This process involves selecting one or two of the coppice stems for retention and removing all others.

STEP 2: HARVESTING, LOGGING AND CHIPPING Logs are de-limbed, cut to the required length and either loaded directly to haulage trucks, or woodchipped at the plantation before loading to haulage trucks. The waste material from the harvesting operations is then spread throughout the plantation as a part of the nutrient cycle, and the plantation either re-planted or coppiced.

STEP 3: HAULAGE Timber product would be hauled from the site of the plantation to the KI Seaport using heavy vehicles. Approximately 65 vehicle movements to site would occur per day, depending on the size of the haulage vehicles used. The transport route would vary depending on road and traffic conditions, however the preferred route would use the West End Highway (the continuation of Playford Highway west of Parndana), Stokes Bay Road, Bark Hut Road, McBrides Road and North Coast Road before turning into the KI Seaport site at Smith Bay.

STEP 4: STORAGE Once at the KI Seaport, trucks would be weighed and logs would be transferred from the haulage vehicles to a log stockpile. Woodchips would be tipped from the haulage vehicles onto a conveyor system and directed to a woodchip stockpile pending export.

STEP 5: SHIPLOADING A rock-filled causeway and piled jetty would connect the wharf to the onshore infrastructure. Logs destined for export would be reclaimed from the log stockpile and hauled to the wharf using trucks, where a vessel crane would unload the trucks and stack the logs on the deck of the export vessel. Woodchips would be reclaimed from the woodchip stockpile and transported to the wharf using a covered conveyor, and subsequently loaded to the holds of the export vessel using either a woodchip slinger or a telescopic chute arrangement.

STEP 6: EXPORT Woodchips and logs would be exported from the KI Seaport to other Australian ports, where customs procedures and other market-specific timber treatments (such as fumigation) may be undertaken prior to transport to customers. Up to 20 vessels per year may berth at the KI Seaport, each staying for several days as loading takes place. During these times, some restrictions to public access around the vessels would be established to ensure the safety of all people.

FIGURE 4-1 KIPT OPERATIONS

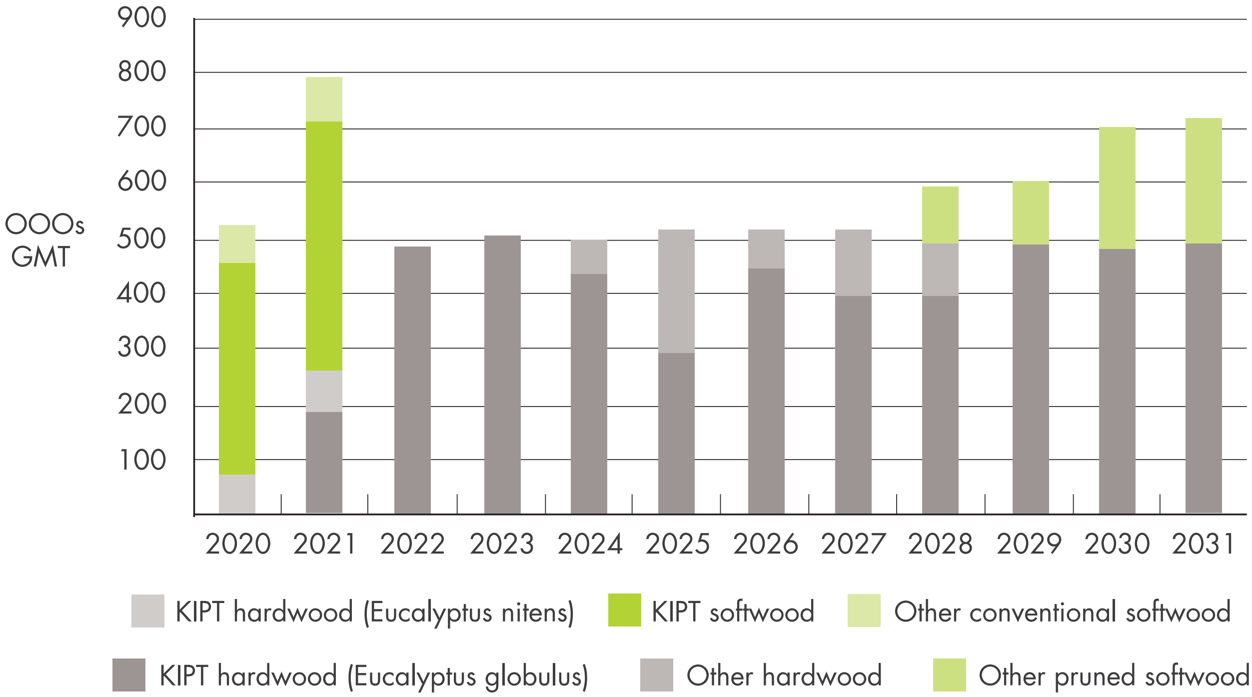


FIGURE 4-2 INDICATIVE TIMBER PRODUCT PRODUCTION (GREEN TONNES) FOR R1, INCLUDING THIRD-PARTY TIMBER (2020–31)

After the first harvest, the majority of the plantations would be coppice-rotated (i.e. regrown as shoots from stumps) or replanted to blue gum in a continual process; the next rotation or harvest cycle is expected to take between 12 and 15 years. A small proportion of the estate may be replanted to pines with a 25-to-30-year rotation length.

At present, there is no alternative use for the plantation land that could generate a financial return that is comparable to the return from plantation timber. Accordingly, the facility and its associated supporting infrastructure are expected to operate continuously as a timber export operation for many generations.

4.1.5 PROJECT PRODUCTION

Timber harvest operations

Harvest production is expected to be variable over the period of each rotation, generally varying between 400,000 and 800,000 tonnes (green) per annum during rotation 1 (R1), subject to silvicultural, workforce, market or operational constraints. Rotation 2 (the second harvest after 2032) and subsequent rotations are expected to average approximately 400,000–450,000 tonnes (green). The reduced production is a result of the age of the current plantings, and replacing the pine with blue gum in the subsequent rotations.

An indicative breakdown of R1 annual production by species and timber product is presented in Figure 4-2.

Timber export operations

The wharf facility would enable timber produced from the KIPT plantations to be exported to overseas markets. Production rates for the wharf depend on the nature of the operation and are summarised in Table 4-1.

The wharf facility would operate for as long as the export of timber products remained commercially viable. The design of the wharf (and associated) infrastructure has been based on a nominal 50-year operating life.

4.2 FORESTRY, HARVESTING, LOGGING AND CHIPPING

The following sections outline the production methodology and scheduling associated with the generation of the saw log and woodchip products. This material provides a context for understanding the KI Seaport facility, and is only provided for information. The KIPT forestry operations were established in accordance with relevant Kangaroo Island development plans and will be harvested in accordance with relevant approvals that are outside the scope of this EIS.

4.2.1 PLANTATIONS

KIPT operates plantations in accordance with relevant planning approvals, including the *Guidelines for Plantation Forestry in South Australia* (PIRSA 2009). These establish criteria for managing interactions between the physical environment, community expectations, and the efficiency and viability of forestry businesses. The key requirements include (but are not limited to):

- protecting soil resources and preventing land degradation. This includes any change in the quality of land, or any soil loss that has an adverse effect on water, native vegetation or other natural resources associated with, or reliant on, that land
- preventing or minimising harm to adjacent watercourses, wetlands and/or lakes. This includes damage to the bed and banks of the watercourse, wetland or lake and the ecosystems that depend on them
- identifying biodiversity assets, and protecting and managing them in accordance with relevant acts, and regulations and with reference to regional Natural Resources Management Plans
- identifying archaeological, palaeontological and heritage sites or values, and determining any protection and/or notification requirements
- managing forest operations to minimise unreasonable noise and dust that may impact on neighbouring land users or communities
- controlling declared animals and plants using accepted and lawful methods and having regard to their environmental impact
- adopting reasonable steps to protect property on the land from fire, including taking reasonable steps to prevent or inhibit the spread of fire through the land. To this end, all forest operations carried out, and vehicles, machinery and equipment used, must meet the requirements of the *Fire and Emergency Services Act 2005* (SA) during the fire danger season
- constructing and maintaining roads to a standard that allows vehicles to use the roads safely. In forests where harvesting operations are taking place, passing bays must be constructed and maintained, and bridges fitted with curb rails. Where stream or watercourse crossings are required, relevant approvals must be obtained. During the construction and maintenance of roads or drainage structures, the removal, burning or pruning of any existing native vegetation would require appropriate approval from the Native Vegetation Council.

A staging area or landing would be established at each plantation allowing for felled and de-limbed logs to be stored pending transport to the export facility. Access tracks within the plantation would be established if they have not already been established and/or located appropriately. These would allow access to the timber for felling operations.

In all cases, areas of native vegetation are separated from plantations by firebreaks that allow, as a minimum, for access by fire trucks. Firebreaks are kept clear of ground fuels, including from natural re-establishment of native vegetation from adjacent areas.

The firebreaks may be realigned or adjusted to allow more land to be planted during the second rotation. This would be to offset areas where R1 performance was demonstrated to be poor and replanting would not be justified. The areas associated with realignment and planting would be less than approximately 200 ha (i.e. less than 1.5 per cent of the area planted).

The current plantations are summarised Table 4-2.

TABLE 4-1 KI SEAPORT NOMINAL PRODUCTION RATES (TONNES PER HOUR)

Activity	Rate (tph)	Basis
Unloading of timber product to the port	up to 250	Up to 730,000 tonnes per annum (tpa) of timber product, delivered 24-hours-a-day, seven-days-a-week.
Loading of softwood chips to export vessel	up to 500	Sustained loading rate, assuming 95 per cent availability, 30–75 days of shiploading and 24-hour operation during shiploading.
Loading of hardwood chips to export vessel	up to 700	
Loading of logs to export vessel	500–600	Based on benchmarked data from other similar log handling operations.

TABLE 4-2 KIPT PLANTATION ESTATES

Plantation number	Plantation name	Area of title (ha)	Area planted by species (ha)		
			E. globulus	*E. nitens*	*P. radiata*
B1	Morlands	317.0	136.0		
B2	MacGill	1753.2	1231.0		
B3	Martin	499.7	343.0		
B4	Kelda Lea	578.3	330.0		
B5	Riley	146.1	96.0		
B6	Willmott	154.3	113.4		
B7	Alandale	566.9	303.6		
B9	Binnowie	455.1	242.3		
C1	Southern	601.0	356.0		
C2	Laterite Hills	665.3	253.8		
C3	Pentelow	483.7	283.2		
C5	Kellendale	512.5	360.1		
D10	Minnumarra	119.4	94.0		
D2	Stephens	489.0	207.1		
D3	Roo Lagoon South	495.3	351.0		
D4	Kangari Springs	1052.6	677.0		
D5	Anderson	512.0	321.0		
D6	More View	607.8	390.4		
D7	Aroona	610.2	344.0		
D8	Dewell	621.2	311.0		
D9	Trethewey	618.4	416.8		
E2	Stockdale	613.7	324.0		
E3	North East River	1104.0	496.6		
E4	Hillview	893.2	423.0		
E5	Stun'sail Boom	598.7	376.0		
E6	Carnarvon	601.0	374.5		
E7	Hammat	585.3	336.0		
F2	Kelly Hills	583.6	315.0		
F4	Wingara South	679.5	310.0		
F5	Greenslopes	689.2	324.0		
F6	Jarmyn	717.1	317.6		
A1	Research	112.1	2.6		54.6
A2	Huxtable	283.2			168.6
A3	Yerda South	222.2			157.7
A4	Kelly East	309.1			270.4
A5	Yerda North	156.6			138.8
A6	Kelly West	156.2			102.9
B8	Roo Lagoon	139.8			72.6
C4	Gosse West	358.7	1.8		236.6
C6	Gumridge	704.1			455.0
C7	Lycurgus	1393.2	118.6	203.7	179.7
D1	Coopers Couchman	605.4	274.1		
E1	Cronins	707.8	296.1		
F1	Wingara	749.6	214.0	200.8	
F3	Brookland Park	586.0	302.4		
	TOTAL	**25,408.3**	**11,967.0**	**404.5**	**1836.9**

4.2.2 PLANTATION MANAGEMENT

The production of quality timber products requires young trees to be managed to maintain the best growing conditions. The management regime depends on the species and the establishment method.

Eucalyptus globulus plantations grown from seedling stock do not require pruning or thinning. *Eucalyptus globulus* plantations established from the stumps of a previous crop are coppice pruned at about three years. This process involves selecting one or two of the coppice stems for retention and removing all others.

Pinus radiata can involve more complex thinning and (sometimes) pruning regimes.

Specific management actions covering the establishment of commercial crops and ongoing silviculture operations are summarised in the KIPT Forest Estate Regional Management Plan. These actions include:

- site preparation
- weed control
- hand planting
- coppice thinning
- insect control
- control of browsing animals
- fertilising
- harvesting.

4.2.3 CLEAR-FELLING

Plantation timber can be harvested using a number of processes. The two methods most likely to be employed by KIPT are:

- cut-to-length (CTL)
- feller buncher.

Harvesting would be carried out in accordance with established industry and government guidelines, in particular with respect to the care and protection of introduced koala populations that have colonised some of the eucalypt plantations.

Cut-to-length method

Pinus radiata and some *Eucalyptus globulus* would be felled using the CTL methodology. This is a mechanised harvesting system in which trees are de-limbed and cut to a specified length directly at the stump. CTL is typically based on a series of two-person, two-machine, operating teams, with a harvester felling, de-limbing and cutting trees to length (bucking).

After felling and cross-cutting, logs would be moved to a landing and stacked using a forwarder, a type of dedicated haulage truck designed for this purpose. The de-limbed logs would be cross-cut to particular lengths, depending on end use. Logs destined for woodchip would be cut into lengths of either six metres or 11 metres depending on the configuration of transport trucks. Logs destined for export would nominally be cut into six metre lengths, based on restrictions associated with hauling the logs on public roads and the capacity of the export vessel. Cross-cutting would be undertaken using mobile mechanical equipment. The stacked logs would be loaded onto trucks for transport to the wharf facility.

Felling would be arranged so two rows of trees fell into a single gap between rows, allowing continuous vehicle access to the adjacent row. The side-limbs, bark, leaves and treetop would be separated from the log and discarded on the ground where the tree was felled. This material would typically be left to decay in a nutrient recycling process that takes around two to three years. Recovery of some or all of this material for use as biomass to generate electricity and other products is also possible, providing appropriate measures are in place to replace lost nutrients such as through the application of additional fertiliser.

Feller buncher method

A feller buncher is a motorised vehicle with an attachment that can cut and gather several whole trees. KIPT would use a feller buncher in some circumstances to harvest hardwood species. The machine places the cut trees onto a stack suitable for a skidder or forwarder to relocate to a landing area, where de-limbing and chipping, or bucking and loading would occur. Because the side-limbs, tops, bark and leaves are isolated at the landing site, they could be collected more efficiently for use as biomass. Biomass may be used as a feedstock for power generation or mulch for landscaping. As noted above, where the biomass is removed from a plantation, fertiliser may be required in the planted area to compensate for the lack of nutrient return.

4.2.4 WOODCHIPPING

Depending on the end timber market, a mobile whole-tree chipper (woodchipper) may be established at the plantation landing and used to process the stockpiled logs into woodchip before transport to the wharf for export. The woodchipper would be either a disc, drum or tub grinder machine. Woodchips would typically be discharged from above directly from the chipper into trucks. Alternatively, woodchipping may be undertaken at an off-plantation woodchipping facility located along the core transport route between the plantation and Smith Bay, subject to separate approval. Following primary chipping, and prior to delivery to the KI Seaport, the woodchips would undergo quality control screening and re-sizing to ensurecompliance to customer specification. Woodchip quality control processes may be undertaken at the plantation following primary woodchipping, or at an intermediate facility. Ideally, these activities (currently outside the scope of this EIS) would be undertaken at the KI Seaport subject to obtaining the relevant approvals, if required. It is expected that resizing would be required for an insignificant proportion of the overall volume of woodchip stored at KI Seaport.

4.2.5 REPLANTING

The current KIPT plantations have performed (in silvicultural terms) at a level that justifies the continuing use of the land for plantation forestry. Plantation timbers have the potential to generate significantly more value per hectare over the long term than the main agricultural alternatives.

KIPT would consider the most appropriate and highest-value use of the land before each plantation is harvested. Where the harvested timber was *Eucalyptus globulus*, consideration would be given to coppicing the trees (i.e. growing a second rotation crop from the stumps of the first rotation trees). The factors that would determine whether coppice-rotation was appropriate include:

- tree survival from R1 planting
- stump survival/condition following harvesting
- R1 productivity
- the quality of the R1 genetics used
- whether an alternative set of genetics was likely to be materially better suited to the site.

If a plantation were coppice rotated, the coppice stems would be allowed to grow for two to four years, at which time one or two would be retained and the remainder manually removed as waste. The establishment cost of a coppice rotation is typically 50–70 per cent of the cost of replanting. A coppice rotation is typically one or two years shorter than a replanted rotation because the coppice tree develops using the substantial root system of the harvested R1 tree.

If any of these tests were unsatisfactory, it may be more productive to replant with stock that is likely to have better genetics. Trees would be 'replaced' (the plantation area would be replanted) if any of the following criteria were satisfied:

- KIPT does not wish to grow the same species for R2
- it is a species that does not coppice (e.g. *Pinus radiata*)
- the stump survival rate is lower that (say) 70 per cent
- the R1 performance of the trees was relatively poor.

4.2.6 SEQUENCING

The harvest schedule is influenced by many factors, including:

- maturity – are the trees ready for harvesting
- road works – have the necessary road preparations been completed to allow access to and throughout the plantation
- infrastructure – is the necessary infrastructure available at the wharf to store and export the timber products
- product flow – KIPT's desire to maintain a steady flow of work for harvest contractors throughout the year, from year to year, and across plantation rotations
- demand – the market conditions related to product types, volumes, timing and price
- weather – wet weather and fire risks are likely to cause temporary delays to harvest operations in some areas.

The current KIPT plantations are generally at the end or beyond the end of a typical rotation and could be harvested at any time. The R1 harvest operations would be expected to commence two to four months before wharf construction is completed. Logs would be stockpiled at the plantation or, subject to availability, within the wharf facility so vessels could arrive and be loaded as soon as the wharf was ready for operations.

There is approximately 3250 ha of mature plantation timber on Kangaroo Island owned by third parties. Subject to agreement on commercial terms with the 12 individual growers, this timber may be harvested as a component of KIPT's R1 harvesting operations, and this possibility has been reflected in both the harvest plan and assessments of maximum traffic volumes and wharf throughputs.

The timing of the harvest of R2 trees depends on what species is planted and what rotation length is adopted. This would be likely to consist predominantly of coppice rotating and replanting of *Eucalyptus globulus* on a 12–15 year rotation (harvest of R2 trees from 2032). It is probable that a small area will be replanted to *Pinus radiata* where it is materially better suited.

4.3 HAULAGE

Chapter 21 – Traffic and Transport describes and assesses the existing environment along current transport routes on Kangaroo Island which could be used for hauling timber products from forest areas to KI Seaport.

Section 2.1 outlines KIPT's preferred strategy to transport its timber products from the plantations to the KI Seaport along a defined transport route that minimises the potential impacts associated with traffic movements using high productivity vehicles (B-doubles and/or A-doubles).

4.4 KI SEAPORT INFRASTRUCTURE DESIGN

4.4.1 KEY PROJECT COMPONENTS

Timber products (logs and woodchips) would be transported to the KI Seaport, which would consist of a deep-water wharf and associated onshore facilities suitable for the handling and loading of logs and woodchips into Panamax vessels, with the option to load into smaller Handymax vessels as operational and/or customer requirements dictated.

The key components of the proposed KI Seaport are summarised in Table 4-3 and described in the following sections.

Conceptual site plans and illustrations of project components are provided throughout this chapter. Information on site elevations and cross sections of major structures is also provided. Some information, required by the guidelines, would be provided as part of detailed design and include:

- building elevations, cross-sections and floor plans
- specifications of materials, finishes and colours
- details and design of signage or external advertising displays.

TABLE 4-3 KI SEAPORT KEY PROJECT COMPONENTS

Parameter	Description
Port/offshore components (with a development footprint of approximately 11 ha)	Dredged berth pocket and dredged approach areas (9.2 ha)
	Navigation aids
	Floating pontoon wharf (0.66 ha) with wharf furniture (fenders, bollards, kerbs, etc).
	Restraint dolphins for restraint of pontoon
	Mooring dolphin at either end of wharf for vessel head and stern lines
	Linkspan bridge
	Approach (causeway (0.95 ha) and suspended deck)
	Tug mooring facility/pen
Onshore components (with a development footprint of approximately 11 ha with 0.1 ha being on Crown Land)	Storage areas for logs and woodchips, including any battered edges of the areas to achieve required tier storage area levels
	Internal access roads
	Site access road to North Coast Road. The intersection between this access road and North Coast Road designates the project boundary (including the intersection itself)
	Stormwater drainage and retention system
	Site security fencing and lighting
	Site offices, product testing room and crib/lunchroom
	Generator, diesel tanks and associated spill bunding
Materials handling components	Receival, stockpile, reclaim and export conveyor system, including: • receival and sampling facility • stockpile management system • reclaim hopper/s • export/causeway conveyor • shiploader feed conveyor • shiploader
	Truck weighbridge
	Truck wash facilities (if required)

TABLE 4-4 KI SEAPORT DESIGN CRITERIA

Parameter	Description
Operational life	Indefinite. Infrastructure has been designed to have an operational life prior to replacement as follows: • major marine structure (causeway, pontoon, navigation aids) – 50 years • shore-based civil infrastructure (bunds, retaining walls, culverts etc.) – 25 years • pavements – 10 years • hand rails and grating – 20 years • steel protection coating systems – 15 years • materials handling systems: - structural components – 50 years - major mechanical and electrical components – 25 years - other mechanical and electrical elements – 10 years - wear items – 2 years.
Design vessel	The design vessels for this project are bulk carriers with a maximum cargo capacity between 30,000 DWT (Handymax) and 60,000 DWT (Panamax). These vessels vary in length between 181 and 225 metres, have a draft of 10.8 to 11.75 metres, a beam of approximately 27 to 32.3 metres and a maximum displacement of between 37,700 and 72,550 tonnes.
Production rates	2.5 ha of hardstand area for the storage of up to 56,250 tonnes of logs. 1.7 ha of hardstand area for the storage of up to 80,000 tonnes of woodchips. Timber products are to be delivered from the plantations to site continuously (24-hours-a-day, seven-days-a-week). Materials handling systems for the reclaiming and shiploading of up to: • 500 tonnes/hour (t/h) of soft woodchips • 700 t/h of hard woodchips • 500–600 t/h of logs. The materials handling system at the KI Seaport would operate 24-hours-a-day, up to 30–75 days a year, with 95 per cent availability.
Structural design loads	The wharf structure will be designed to meet the following design loads: • live load rating – 25 kPa uniformly distributed load and 50 t concentrated load • vehicle load – dynamic factors between 0.1 and 0.25, ultimate limit states factor of 1.5–1.6 and serviceability limit states factor of 1.0 • wind loads – 1-in-200 probability of exceedance ultimate wind speed of 43 m/s (3-second gust) and serviceability wind speed of 37 m/s (3-second gust) • earthquake loads – 1-in-500 probability of exceedance earthquake, and hazard factor of 0.12 • current loads – to be determined during detailed design in accordance with AS4997 • wave loads – to be determined in accordance with AS4997 for 'normal structures' with a 50-year design life, with corresponding annual probability of exceedance of 1 in 500 years • berthing loads – to be determined in accordance with AS4997 and the World Association for Waterborne Transport Infrastructure (PIANC) guidelines for the selected design vessel • bollard/mooring loads – to be determined in accordance with AS4997 for the selected design vessel. Bollards will be sized for a maximum wind speed of 60 knots (~30 m/s) and the Handymax and Panamax vessels described earlier. Vessels are expected to leave the berth should wind speeds greater than 60 knots (30 m/s) be forecast.

4.4.2 DESIGN CRITERIA

The port infrastructure (onshore and offshore) will be designed to comply with relevant Australian Standards including:

- AS4997-2005 Guidelines for the Design of Maritime Structures
- AS1657-1992 Fixed Platforms, Walkways, Stairways and Ladders – Design, Construction and Installation
- AS2159-1995 Piling – Design and Installation
- AS1554-2004 Structural Steel Welding (Parts 1 to 5).

The nominated design criteria for the port is summarised in Table 4-4. Offshore geotechnical investigations of the study area were completed in November 2017 (see Appendix C1).

4.4.3 SITE LAYOUT

The layout of site infrastructure has largely been informed by attempts to maximise the distances between onshore operational activities and adjacent landholdings, with log and woodchip storage and reclaim areas to the west of the site and offices, and car parking and ablutions facilities to the east. Surface water management infrastructure would be adjacent to the coastline to facilitate management and reduce the need for pumping, and the causeway would be located so dredging requirements associated with vessel access to the wharf were minimised.

The key components of the port, onshore and materials handling facilities at the KI Seaport are shown in Figure 4-3.

4.4.4 WHARF

Pontoon structure

The wharf structure would consist of a barge, refurbished for use as a pontoon, with a nominal displacement of 37,600 tonnes, a freeboard of approximately 3.5 metres and a length and beam of 168 and 41 metres respectively. The barge deck would be reinforced and suitable for traversing by heavy vehicles to load logs, and by a shiploader for loading woodchips.

The barge would be towed to site, having been refurbished overseas. Once on site, it would be held in position by restraint dolphins to establish the pontoon structure of the wharf and enable it to rise and fall with tidal movement and various environmental conditions. The restrained pontoon would be approximately parallel to the shoreline, with the final orientation to be determined during detailed design.

The conceptual layout of the pontoon is presented in Figure 4-4.

Corrosion mitigating paints would be applied to the wharf, the suspended deck structure and other permanent piled structures (restraint dolphins etc.) to extend the infrastructure life.

Berth pocket

The berth pocket associated with the wharf would require dredging to allow the use of Handymax and Panamax-class vessels. The depth requirement for the berth pocket was determined for the restricted-laden design vessel operating at the berth at mean lower low water (MLLW). The depth requirement for the dredge approach would be determined based on the fully laden design vessel arriving or departing at a tide above mean sea level (MSL). The considerations with regards to the calculation of the berth pocket depth are summarised in Table 4-5 and the site's bathymetric survey is provided in Appendix C2.

Navigation aids

Navigation aids would be used to define the extent of the dredged approach area and would be mounted on fixed piled or tripod counterweighted structures, to be determined during detailed design. All navigation aid signs and lights would be established in accordance with Department of Planning, Transport and Infrastructure (DPTI) and International Association of Marine Aids (IALA) recommendations, and the navigation lights would be solar-powered. An indicative layout of the navigation aids is presented in Figure 4-5.

Mooring infrastructure

Restraint dolphins would be required at either end of the pontoon for vessel head and stern lines, as the design vessels are longer than the wharf. Bollards would be spaced evenly along the front of the wharf. The mooring line arrangement would normally consist of a pair each of head and stern lines, forward and aft breasting lines and forward and aft spring lines.

TABLE 4-5 BERTH POCKET DEPTH CONSIDERATIONS

Parameter	Description
Maximum vessel draft	11.75 metres (Panamax – restricted draft)
Gross under-keel clearance	1.45 metres (Panamax – restricted draft)
Sea-bottom factors	0.3 metres
Minimum berth pocket water depth	13.5 metres

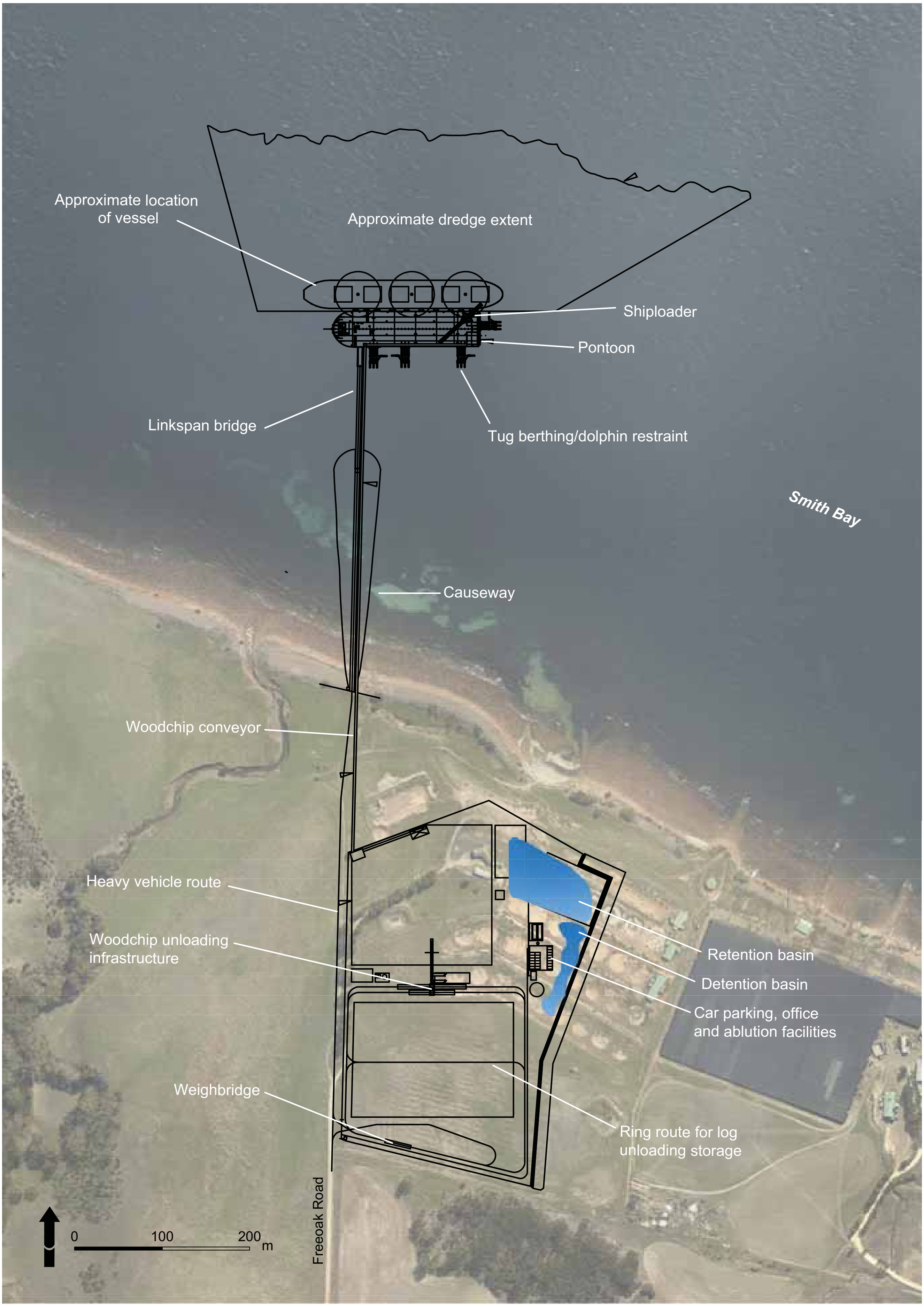


FIGURE 4-3 CONCEPTUAL LAYOUT OF THE KI SEAPORT INFRASTRUCTURE

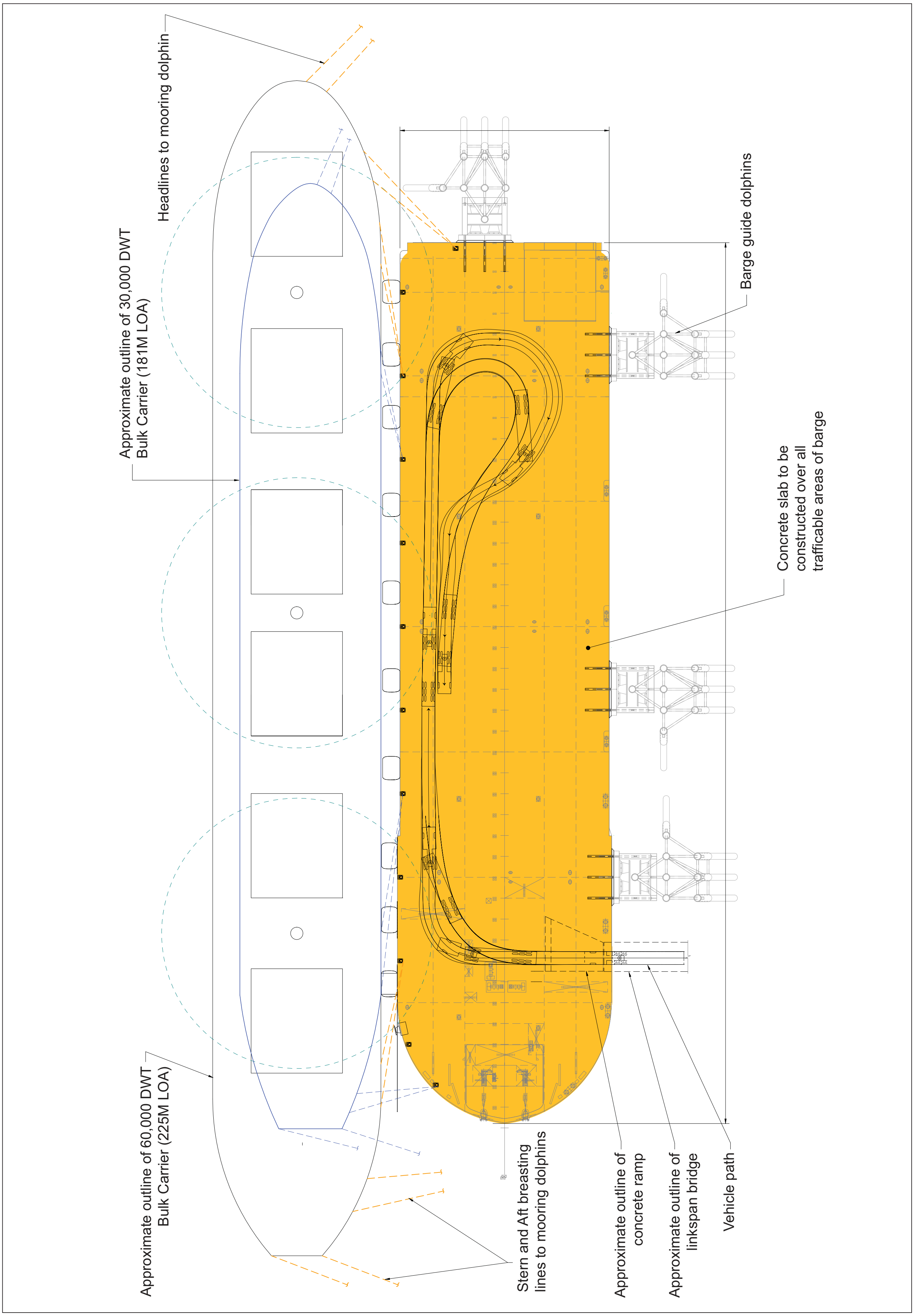


FIGURE 4-4 CONCEPTUAL PONTOON LAYOUT

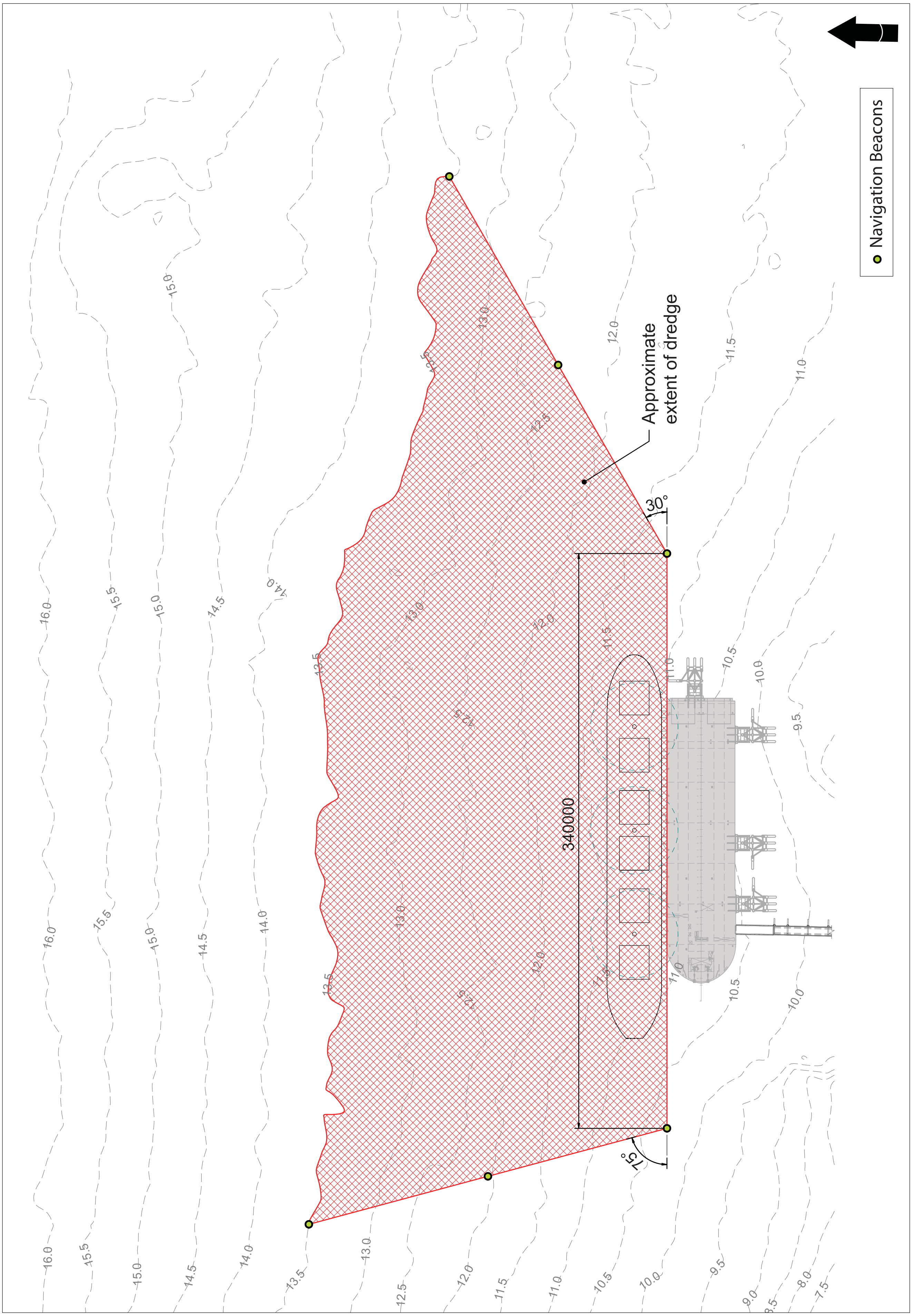


FIGURE 4-5 CONCEPTUAL NAVIGATION AID LAYOUT

Fenders

To accommodate berthing loads, energy absorption devices such as floating pneumatic fenders would be incorporated between the berthing vessel and the wharf. Additional energy absorption devices are also incorporated between the restraint dolphins and the wharf for final resolution of berthing energies. Consideration may be given to the combined energy absorption between these fenders and the front-of-wharf fenders in absorbing berthing energy (with energy absorption being shared by the primary fenders at the front of the pontoon and secondary fenders between the barge and restraint dolphins). These secondary fenders would be expected to provide a buffer for absorbing wave energy and reduce restraint dolphin wear and tear, in addition to contributing to the overall berthing energy absorption.

Surface water management

The floating wharf would comprise a surface of concrete that would be graded to prevent any runoff entering Smith Bay directly. The directed surface water flows would enter a series of grated inlet pits. Each pit would be fitted with a Ecosol litter basket to trap debris. An end-of-line gross pollutant trap and oil, grease and water separator (Spel Class 3 Ecoceptor) intercepts pollutants that enter the drainage system prior to discharge to Smith Bay. The management of the wharf requires maintenance regime to be actioned following each export process (see Appendix C3) to prevent the build-up of timber products on the wharf that may otherwise overwhelm the surface water management system.

The surface water management system associated with the floating wharf illustrated in Figure 4-6.

Linkspan and pontoon access ramp

Access to the pontoon from the end of the causeway would be provided by a custom-fabricated linkspan bridge, supported on hinges at a piled abutment at the end of the approach (see following section). At the pontoon end, the bridge would have rollers or sliding pins to allow for tidal variation and wharf movement. The rollers would land on above-deck support members.

It is anticipated that a ramp with a gradient of approximately 1 (vertical) to 8 (horizontal) would be installed, with entry and exit points designed to allow a smooth transition for expected design vehicles from the linkspan bridge to the pontoon. The ramp itself would be designed for the expected vehicle loadings.

4.4.5 APPROACH

The approach to the pontoon would be via a solid rock-armoured causeway, and suspended deck built on a piled jetty structure, approximately 320 metres in total length. A linkspan bridge would connect the pontoon to the jetty structure. See Figure 4-7.

As a result of the desire to balance dredge volumes with causeway core material requirements, and the unfavourable economics and seabed impact of constructing rockfill structures in water of >8–9 metres depth (the volume of material required to construct a causeway increases significantly as the depth of water increases beyond this point), the causeway is likely to be limited to no more than approximately 250 metres in length. It is anticipated that the optimal location for the berth face would be some distance further from shore, so that approximately 100 metres of suspended deck jetty would be needed to complete the approach.

Solid causeway structure

The causeway would consist of a core of compacted coarse material, contained within a geotextile fabric layer and primary and secondary armour rock. In some situations, it might be considered desirable to include a pier section across the intertidal and shallow subtidal zones to allow for any sand drift and seagrass movement across the shore, but the proposed design does not incorporate this feature. Longshore drift is known to be minimal (see Chapter 10 – Coastal Processes) and so this is not considered necessary. The layout and cross- and long sections of the causeway are presented in Figure 4-7.

The causeway design has been selected based on consideration of the following:

- geotechnical factors, including the stability of slopes, properties of the seabed material and likely settlement, the availability of locally sourced rock for armouring, and the properties of this material, and the properties and suitability of the coarse fractions of dredging spoil as a core material
- coastal morphology/processes, including design wave heights and existing seabed and land levels from available bathymetric and topographic surveys
- sufficient width for support of the reclaim conveyor and one-way vehicle access (with separated pedestrian access and appropriately spaced pullover lanes for passing of two-way traffic).

The causeway would be constructed from an outer shell of competent rock imported (sourced from a quarry located either on Kangaroo Island or from mainland South Australia) over an internal core consisting of a combination of rock and dredge spoil (clean sand) material from the berth pocket and seaward approach deepening operations.

Suspended deck structure

As the depth of water increases, the footprint on the seabed becomes greater and the corresponding volume of material

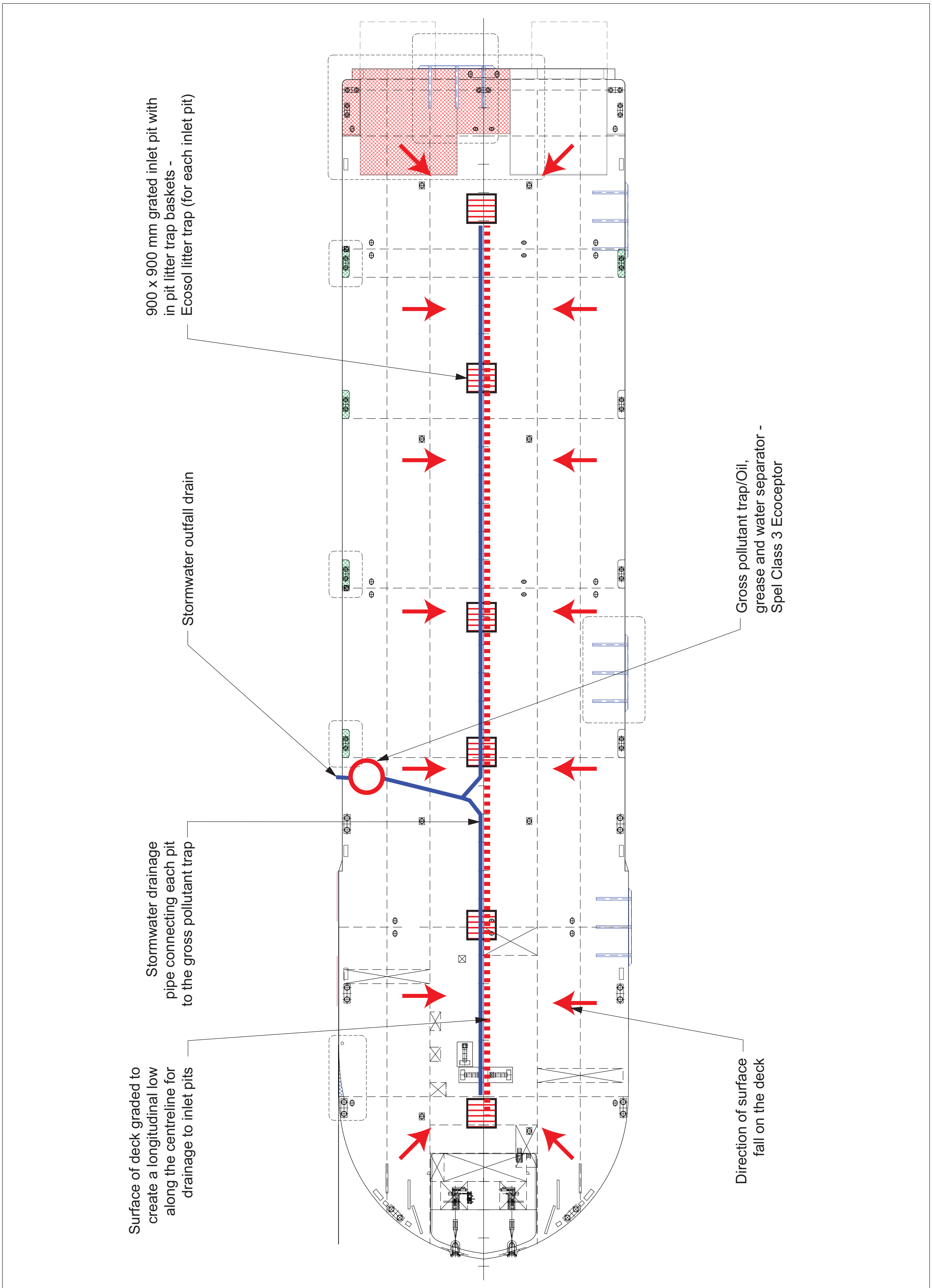


FIGURE 4-6 PONTOON SURFACE WATER MANAGEMENT SYSTEM

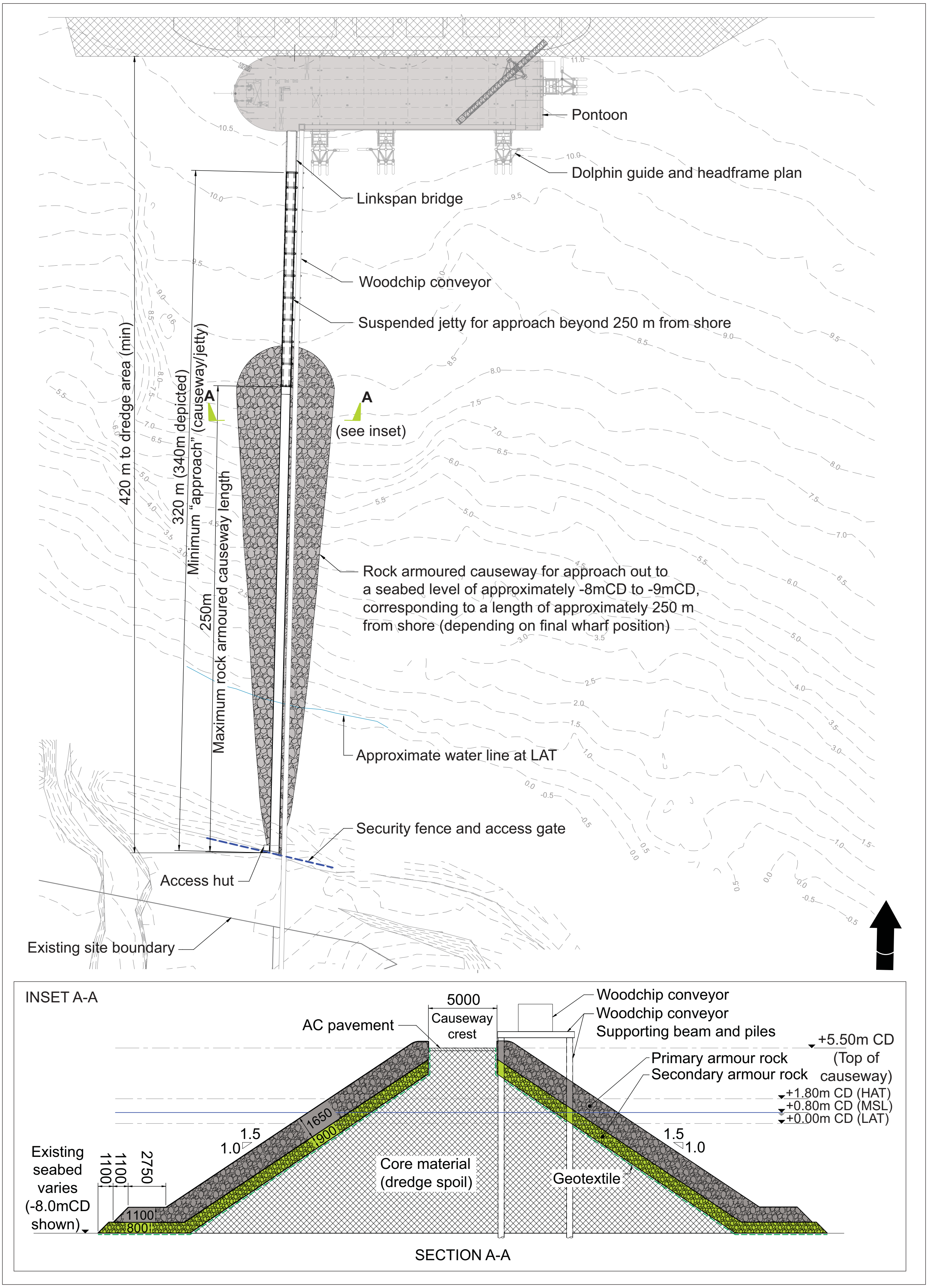


FIGURE 4-7 CONCEPTUAL CAUSEWAY LAYOUT AND SECTIONS

required to construct a causeway becomes economically unviable. At this point, a suspended deck structure is considered to have more favourable economics. For the KI Seaport, it has been determined that the causeway would be restricted to less than 250 metres in length, subject to the final location of the wharf. At this point, the access road and materials handling conveyor would become a suspended deck structure supported by piles.

The suspended deck structure would consist of driven tubular steel piles with welded in place steel beams connecting pile groups orientated perpendicular to the jetty alignment. This in turn would support longitudinal deck support members and a concrete roadway.

The jetty structure would be supported on piles placed approximately every 10 metres, and the finished deck level would nominally be consistent with top of causeway, which is five metres above sea level. Like the causeway road, the suspended deck would be five metres wide. An indicative plan and elevation view of the suspended deck is presented in Figure 4-8.

The suspended deck would be constructed using steel piles, supporting a steel headstock arrangement with pre-cast concrete panels spanning between steel headstocks. The construction material for the suspended deck construction would be delivered to site on floating plant and installed exclusively from marine plant.

Crest level and width

The crest level and width of the causeway have been established to ensure overtopping volumes meet operational and safety requirements, as well as to limit structural damage to the crest and assets behind it.

The causeway crest would be wide enough for one-way vehicular access, with two passing areas along the causeway length. A permanent woodchip conveyor structure would be offset from the crest, on the eastern side.

Surface water management

Management of surface water on the causeway would be through the separation of waters that have interacted with the operations from those that have not. To achieve this, the woodchip conveyors will be covered to prevent rainfall contacting the conveyor and reduce dust, and spill kits will be provided in case of emergencies.

Stability

The causeway structure would be designed for a 1-in-500-year storm event (that is, a 10 per cent encounter probability over the 50-year life of the structure) on the basis that the wave modelling undertaken demonstrates that the additional engineering required to meet this standard is not significantly greater than for lesser storm event frequencies. Causeway maintenance (for example, replacement of a small percentage of armour rocks) would be required after major storm events.

Climate change

Expected climate change impacts at the development site are described in detail in Chapter 19 – Climate Change and Sustainability. Under a worst-case emissions scenario, the predicted sea level rise at Smith Bay is up to 0.17 metres by 2030, up to 0.33 by 2050, up to 0.55 by 2070 and up to 0.83 by 2100.

In accordance with the Coastal Protection Board (CPB) Policy Document (dated 29 July 2016) a sea level rise of 0.3 metres to the year 2050 would be adopted in the desig n of the causeway. For the purposes of this project, substantiated sea level rise beyond the 0.3 metre prediction would necessitate upgrading, including raising of the causeway height and potential modifications of its profile. Piles established during the initial construction phase would be designed for predicted maximum sea level rise to 2100.

4.4.6 ONSHORE INFRASTRUCTURE

Site access

Access to the site is from North Coast Road via Freeoak Road to the KIPT land parcel. Both Freeoak Road and its intersection with North Coast Road would require upgrading for the use of heavy vehicles (up to and including the use of A-double trucks), including modifications to sight lines, signage and an increase in the width and quality of pavement of Freeoak Road. Final engineering design would be developed during the detailed design phase. However, some native vegetation adjacent to Freeoak Road would be likely to require clearing. A conceptual layout of the revised intersection and road is presented in Figure 4-9.

The export facility incorporates an internal ring route to allow for single-lane traffic. On entering the site, a truck would be weighed at the weighbridge on the south-western corner and travel down the western road. The truck would then travel clockwise, unload at the storage yards and be weighed again on a weighbridge before exiting the site.

Roads would be unsealed and designed to relevant Austroads guidelines or equivalent.

Weighbridge

A weighbridge would be installed on the south-western corner of the site, close to the entry point. It would comply with relevant Australian Government Department of Industry, Innovation and Science publications/guidelines for control systems and operations.

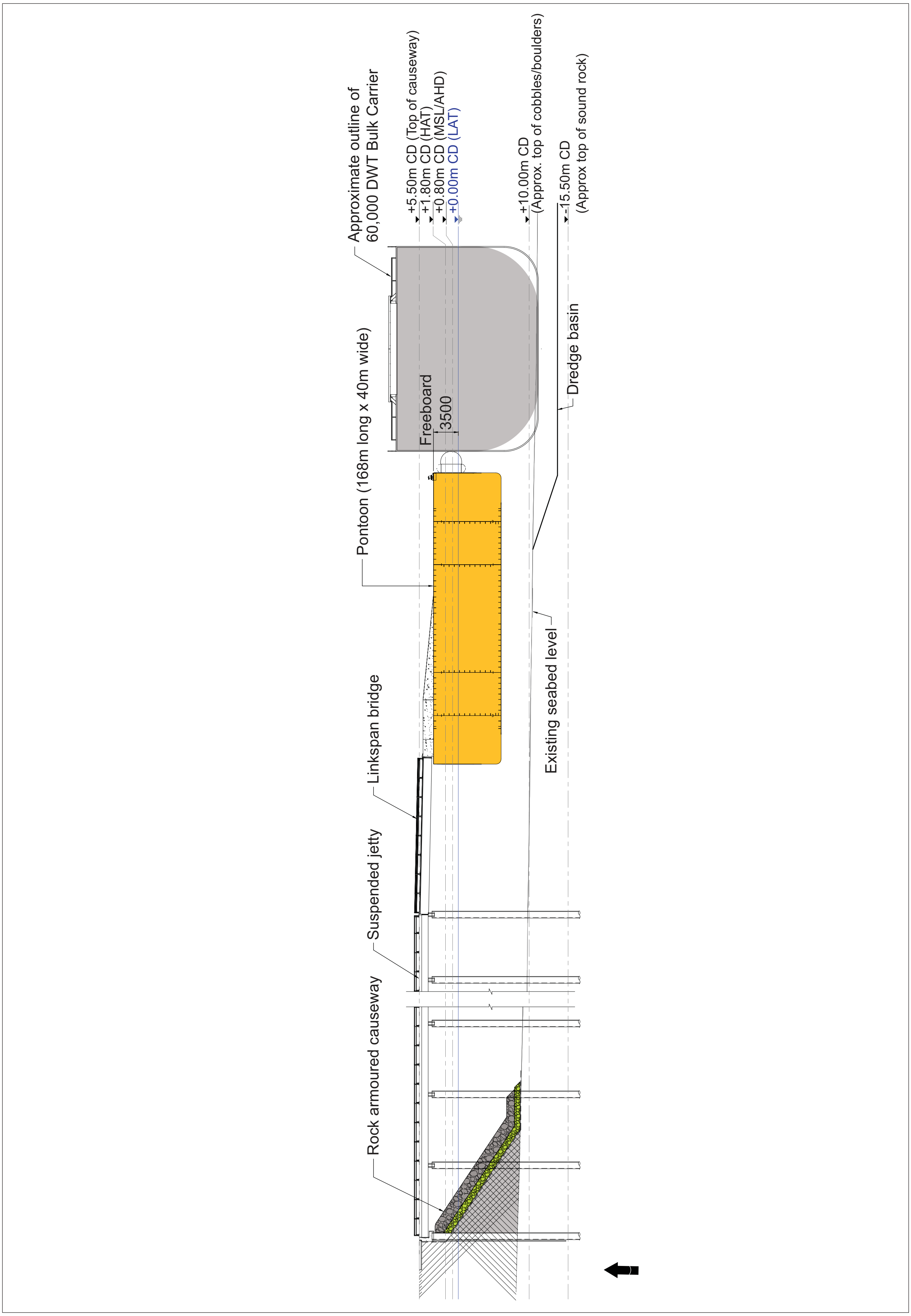


FIGURE 4-8 CONCEPTUAL JETTY STRUCTURE

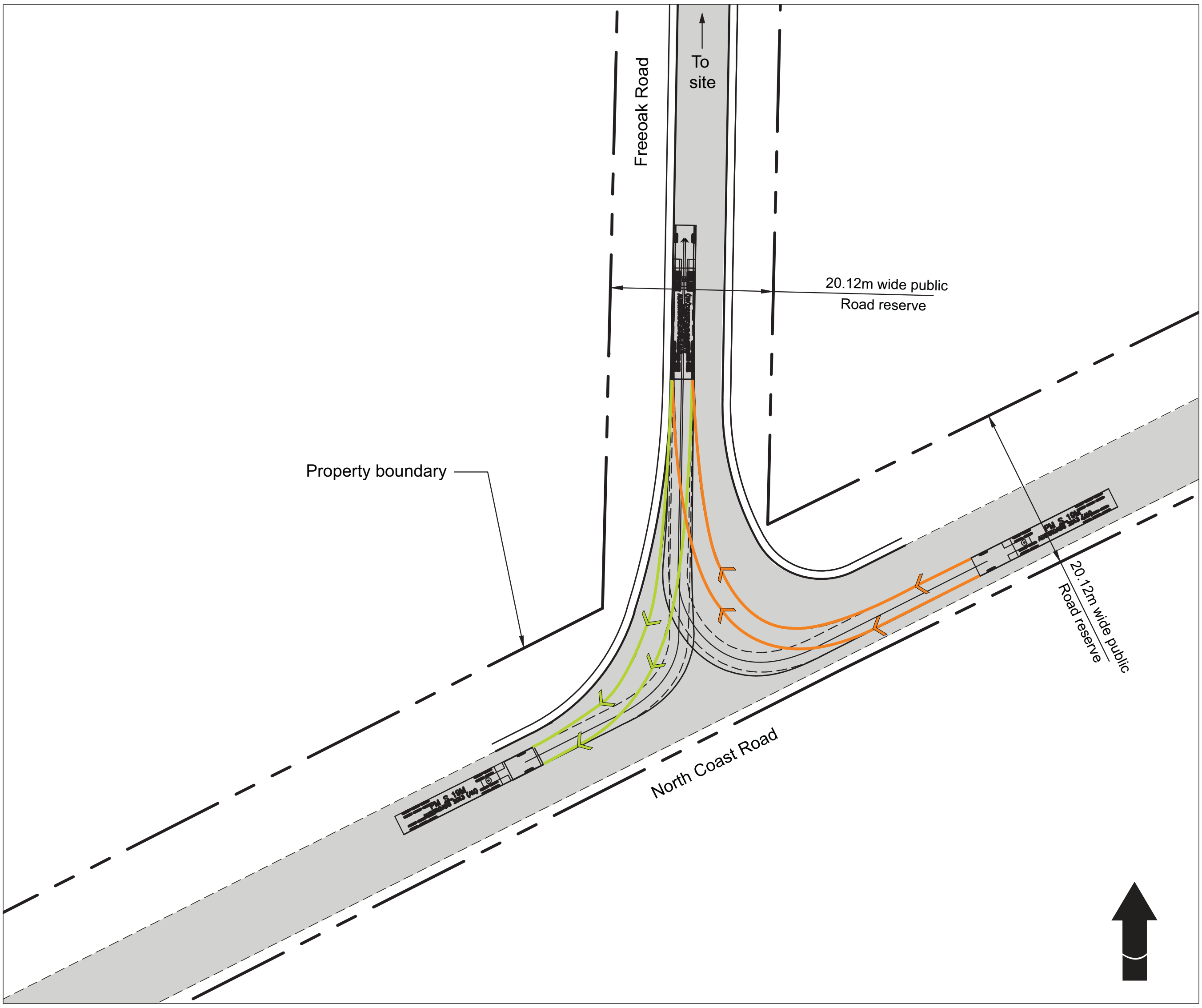


FIGURE 4-9 CONCEPTUAL NORTH COAST ROAD AND FREEOAK ROAD INTERSECTION LAYOUT

A small hut about 2.5 metres square would be located adjacent to the weighbridge for the monitoring of operations, as well as doubling as a site security gate, controlling access to the export facility.

Log and woodchip storage areas

Log and woodchip storage areas would be established for the on-site storage of timber products pending export. These areas would be sized to accommodate the following:

- 2.5 ha of hardstand area for the storage of up to 56,250 tonnes of logs
- 1.7 ha of hardstand area for the storage of up to 80,000 tonnes of woodchips.

The nominated woodchip stockpile area would be a concrete pavement designed in accordance with relevant standards and guidelines for the management of surface water runoff.

Materials handling infrastructure

Logs would be delivered to ships on designated roads, with logs loaded by the ships' cranes and woodchips loaded by a system of conveyors and a shiploader. The materials handling path for ship export is depicted in Figure 4-10. The key components include:

- woodchip reclaim system
- causeway conveyor and vehicle access ways
- shiploader feed conveyor
- shiploader
- vessel cranes.

The conveyor to the causeway from the onshore storage areas would be elevated to provide adequate clearance to a water supply pipeline and water storage dam easement within the KIPT land parcel. The elevated conveyor would

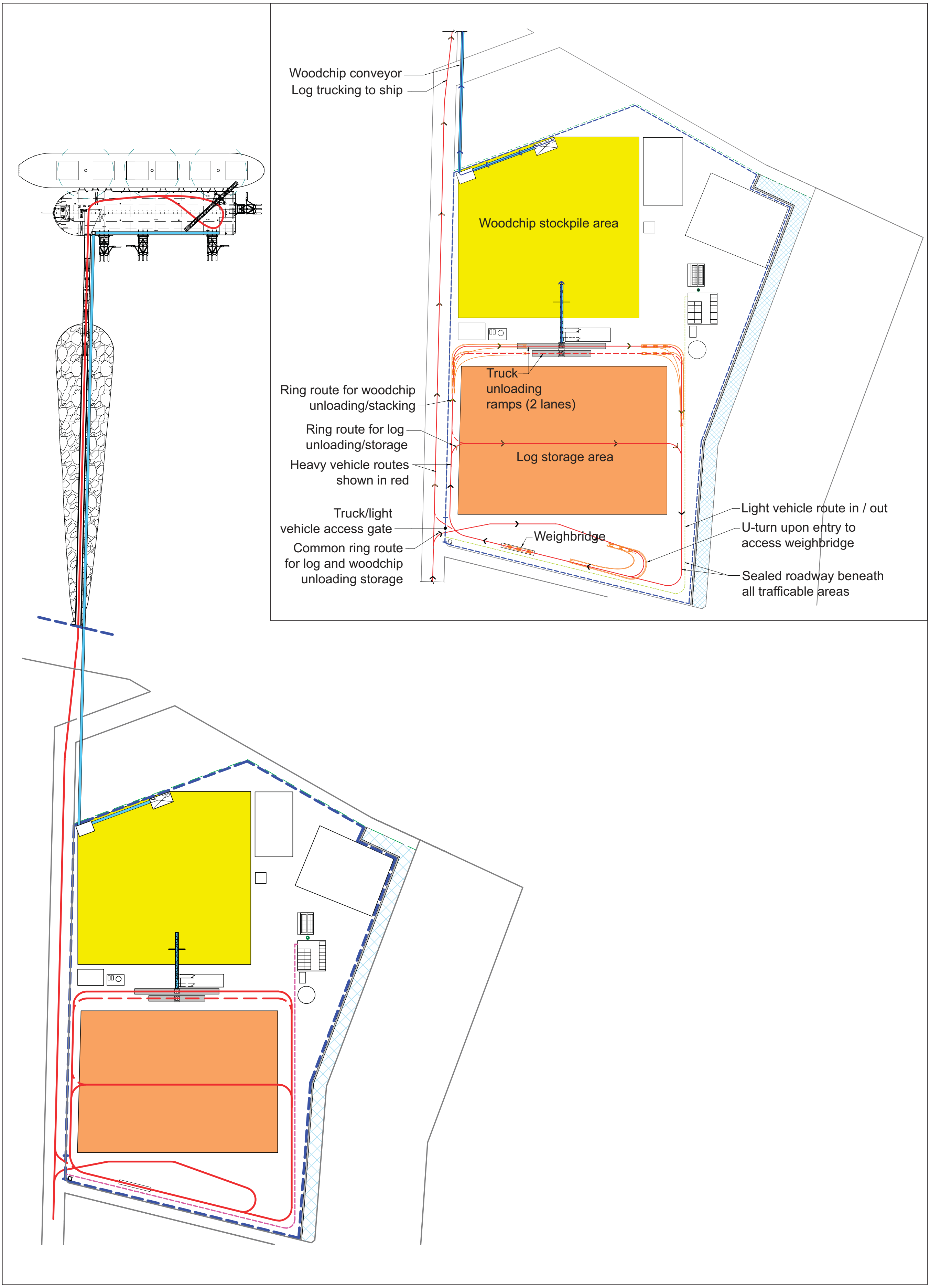


FIGURE 4-10 TIMBER PRODUCT LOADING PATHWAYS

span approximately 80 metres at a maximum height of around eight metres, and be supported by a number of pylons at 10–20 metre spacings, including on the water storage dam bank within the easement. These would be located so they did not interfere with water storage activities authorised by the easement.

The shiploader feed conveyor and causeway conveyors, including drive and take-up towers, would be fully enclosed, equipped with opening side panels to allow various discharge locations onto the shiploader, and designed to contain any spills and aid clean up. The conveyor systems would be fully automatic and be controlled from the site office.

The woodchip shiploader would be designed to provide sufficient freedom of travel to load all hatches of the vessel without the need for trim ballasting or vessel warping. The shiploader would require no more than one operator, and be equipped with a telescopic chute and demountable jet-slinger for loading efficiency.

Fumigation

Woodchips do not need to be fumigated. Depending on customer requirements, logs may need insecticidal fumigation, although this would not take place at Smith Bay but at another port, such as Portland in Victoria. As such, none of the fumgation chemical, methyl bromide, would need to be stored onshore at Smith Bay. It should be noted that methyl bromide is in the process of being phased out as a log fumigant and may no longer be in general use by the time the KI Seaport is operating.

Site warehousing, administration and ablutions

The site office, measuring approximately 240 square metres in floorplan, would be on the eastern margin of the site and accommodate administration personnel. Toilets would be in or adjacent to the office building. On-site buildings would nominally be white, and may be either portable (ATCO-style) units or would be constructed entirely or largely on site, using conventional materials. Construction materials would most likely be sourced from local and/or mainland South Australian suppliers and trucked to Kangaroo Island and the project site.

A 20-vehicle open car park (not enclosed or covered) would be established on hardstand adjacent to the site office, and a site vehicle and equipment storage shed established next to the office for the storage of spares, equipment and log moving machinery used on site.

Hydrocarbon storage

A diesel fuel storage tank of approximately 20,000 litres capacity would be located in a bunded area to contain any potential spills. This area would be designed in accordance with Australian Standard AS1940: The Storage and Handling of Flammable and Combustible Liquids (Standards Australia 2017), and bunding would be constructed to the requirements of EPA Guideline EPA 080/16: Bunding and Spill Management (EPA 2016b).

All refuelling would be completed using tanker trucks. The fuel unloading area would comply with the *Dangerous Substances Act 1979* (SA), and be bunded and sized in accordance with the associated Australian Dangerous Goods Code (ADGC) and Australian Standards.

Storage of diesel at KI Seaport will be licensed under the *Environment Protection Act 1993*.

Surface water management infrastructure

The requirements of the proposed surface water management system are:

- runoff rates should not exceed the rate of discharge from the site that existed pre-development
- water quality treatment reduction targets of the average annual load as follows:
  - total suspended solids (TSS) 80 per cent
  - total phosphorus (TP) 60 per cent
  - total nitrogen (TN) 45 per cent
  - retention of litter greater than 50 mm for flows up to a three-month Average Recurrence Interval (ARI) peak flow event
  - no visible oils for flows up to a three-month ARI peak flow
  - no discharge of organically loaded stormwater to the receiving environment
  - management and interception of oils, grease from operations resulting from the movement of plant and equipment, including both on and off shore operations
  - intercept and trap woodchip prior to any discharge of stormwater from onshore and off shore operations
  - adopt the treatment train approach to stormwater management
  - comply with the requirements of the Environment Protection Policy (Water Quality) 2015, under the *Environment Protection Act 1993* (SA), specifically:
    - total phosphorous – 0.5 mg/L
    - total nitrogen – 5 mg/L
    - suspended sediment – 20 mg/L.

In addition, water-sensitive urban design (WSUD) considerations included:

- improving quality of general stormwater runoff, and along the stormwater conveyance network leading to an end of line wetland system
- intercept stormwater runoff from sources where stormwater has come into contact with timber products. Retain stormwater on site in retention basin without discharge.
- managing the rates of runoff for regular rainfall events through attenuation via green systems

- managing the volume of general site runoff for less greater than three month ARI events and releasing as trickle flow
- utilise stormwater runoff captured in retention basin for onsite irrigation (to maintain heathy landscape buffer, mitigation of dust, hardstand washdown
- adoption of a treatment train approach that is robust and easy to maintain given the locality.

The stormwater management strategy to achieve the above considers the characteristics, constraints and opportunities within the proposed KI Seaport site as much as possible. In order to adequately manage surface water, the onshore area has been divided into two areas, each with their own methodology for managing surface waters. These are presented in detail in Appendix C3, and are summarised in the following sections.

General site surface water drainage and treatment

All site areas (with exception of timber and woodchip storage areas) would be directed to a proposed wetland basin incorporating detention storage. Surface cut off drains would be constructed at the upstream interface of the site to intercept any overland flow from the upstream catchment. A series of surface swale drains and a conveyance system throughout the site would also be installed to control and manage stormwater runoff to one-in-20-year ARI capacity. Surface water captured within the system would be directed to an ephemeral wetland pond with the following features:

- surface area of approximately 0.1 ha
- volume of approximately 1 ML
- unlined to allow for infiltration loss
- planted with indigenous vegetation
- attenuates the post development five-year ARI critical storm event to release the five-year predevelopment critical flow rate.

Hydraulic controls associated with the wetland pond include:

- discharge control pit – frequent flow management and detention storage control
- spillway – overflow for larger storms and if basin is full
- vegetated discharge swale with level spreader, also includes porous rock weir to dissipate stormwater towards to coastal zone
- vegetated swale (inlet to wetland system) - Incorporates pool and riffles sequence to reduce bed gradients, encourage infiltration and reduce velocity.

Timber log and woodchip storage areas

Stormwater runoff from the timber log and woodchip storage hardstands would be isolated from general stormwater runoff generated from the other areas of the site. This will be achieved by grading the hardstands to create a single drainage flow path and providing an upstand to ensure runoff is directed to a single outlet point. At the outlet point of each hardstand, stormwater would enter a concrete forebay sediment and debris trap. Stormwater will then enter the retention basin (holding pond), which would have the following features:

- 10 ML storage volume, determined after analysis of approximately 100 years of rainfall data to develop the site water balance (see Section 4.8.2)
- no discharge to stormwater or receiving environment
- lined to prevent infiltration. Water management would be achieved via evaporation losses and reclaim of the water for use in irrigation of adjacent landscape buffer and for dust suppression (noting that the irrigation system has a separate filter system to remove sediments and fine debris prior to use).

A schematic diagram of the proposed onshore surface water management system is presented in Figure 4-11.

Landscaping

In general, the site layout has been arranged to retain existing native vegetation. Additionally, it is proposed to establish a row of trees along the eastern boundary to provide a natural barrier between operational activities and neighbouring land uses. Dredge spoil that is excess to the causeway construction needs would be used to establish landscaping and/or noise bund structures around the perimeter of the facility, with replanting to resemble the surrounding established landscape.

4.5 INFRASTRUCTURE CONSTRUCTION

4.5.1 MARINE AND CONTRACTOR ACTIVITY ZONE

The proposed Marine Activity Zone (MAZ) is described in Figure 4-12, and outlines the footprint of the on-water construction. Details of the activity zone would be provided to DPTI, and KIPT would issue a Notice to Mariners advising other users of works that may affect the safe navigation of vessels.

The MAZ is a clearly defined area from which the public is excluded, to reduce navigational risks during construction. It has been designed to be slightly larger than the dredging area footprint to allow for anchor positioning outside of the dredging area when dredging close to the boundaries of the footprint. The MAZ would be occupied by floating plant and land-based civil construction plant during the construction period, comprising of dredging activities performed by a cutter suction dredge, causeway and wharf construction activities performed by both land-based and marine plant as well as construction setup and demobilisation activities.

The land-based Contractor Activity Zone (CAZ) would be established for the construction of the shore-based infrastructure, covering the entire site included in the works including the haul route from the dewatering site to the

FIGURE 4-11 ONSHORE SURFACE WATER MANAGEMENT SYSTEM

causeway. The CAZ also includes the access thoroughfare to and from the site via the public road and the dewatering site.

4.5.2 DREDGING

Dredging operations

The depth of the seabed at the proposed wharf location is approximately 11 metres below sea level, so dredging operations are proposed to ensure adequate berth and seaward approach depth (refer Section 4.3.4) is established and maintained.

The geotechnical and geophysical assessment of site confirms that a conventional cutter suction dredging approach is suitable for the dredging activity. Cutter suction dredging (CSD) dislodges the seabed materials with a rotating device equipped with cutting teeth. The loosened material is sucked into the cutter head's suction mouth located by a centrifugal pump installed on the pontoon or the dredge's ladder. The dredged material is then transported hydraulically via HDPE pipelines to the relocation or discharge site.

There would be no blasting during dredging works. If local areas of hard substrate not indicated in the geophysical or geotechnical assessment was found to be too strong for cutter suction dredging methods, a long-arm excavator mounted on a jack-up barge may be employed. The nominal geometry of the proposed dredging operations is shown in Figure 4-13.

Dredge spoil and dewatering management

During the construction phase, it is proposed to use the existing terraced areas of the site to establish a number of cells for the storing the dredge spoil during dewatering and prior to using the coarse material as core fill material for the causeway. These cells would be fitted with suitable bunding for the containment of the spoil and to allow for spoil dewatering activities (see Figure 4-14). Ponds would have a nominal depth of 2.5 m, and a total capacity of approximately 240,000 m^3.

The primary settlement pond (being the upper-most pond of 40,000 m^2 area) will be the point of discharge of the dredged material, with all dredged material being discharged into this pond. The discharge location of the dredge pipe into the pond

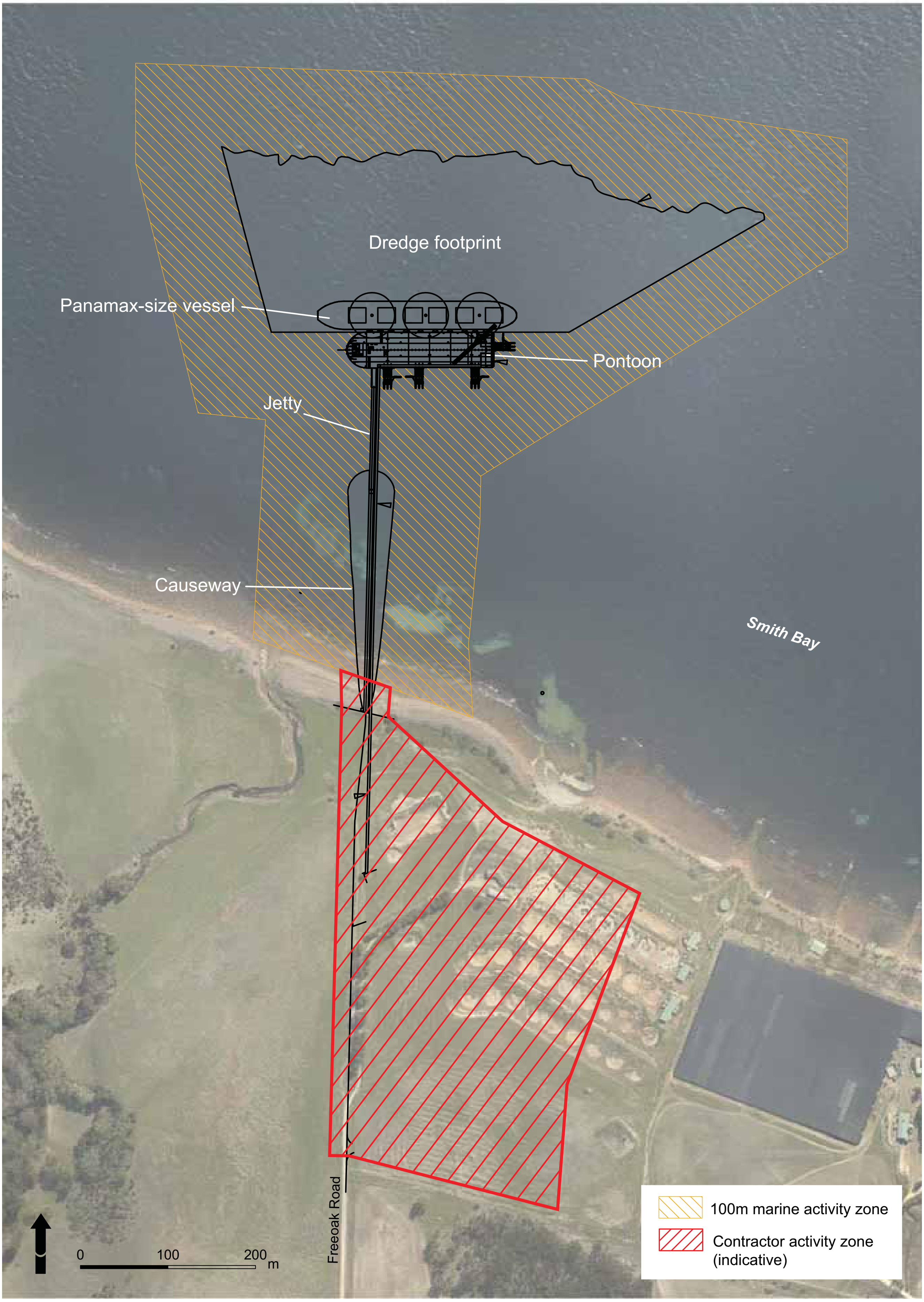


FIGURE 4-12 PROPOSED MARINE AND CONTRACTOR ACTIVITY ZONE

FIGURE 4-13 INDICATIVE DREDGING LAYOUT AND GEOMETRY

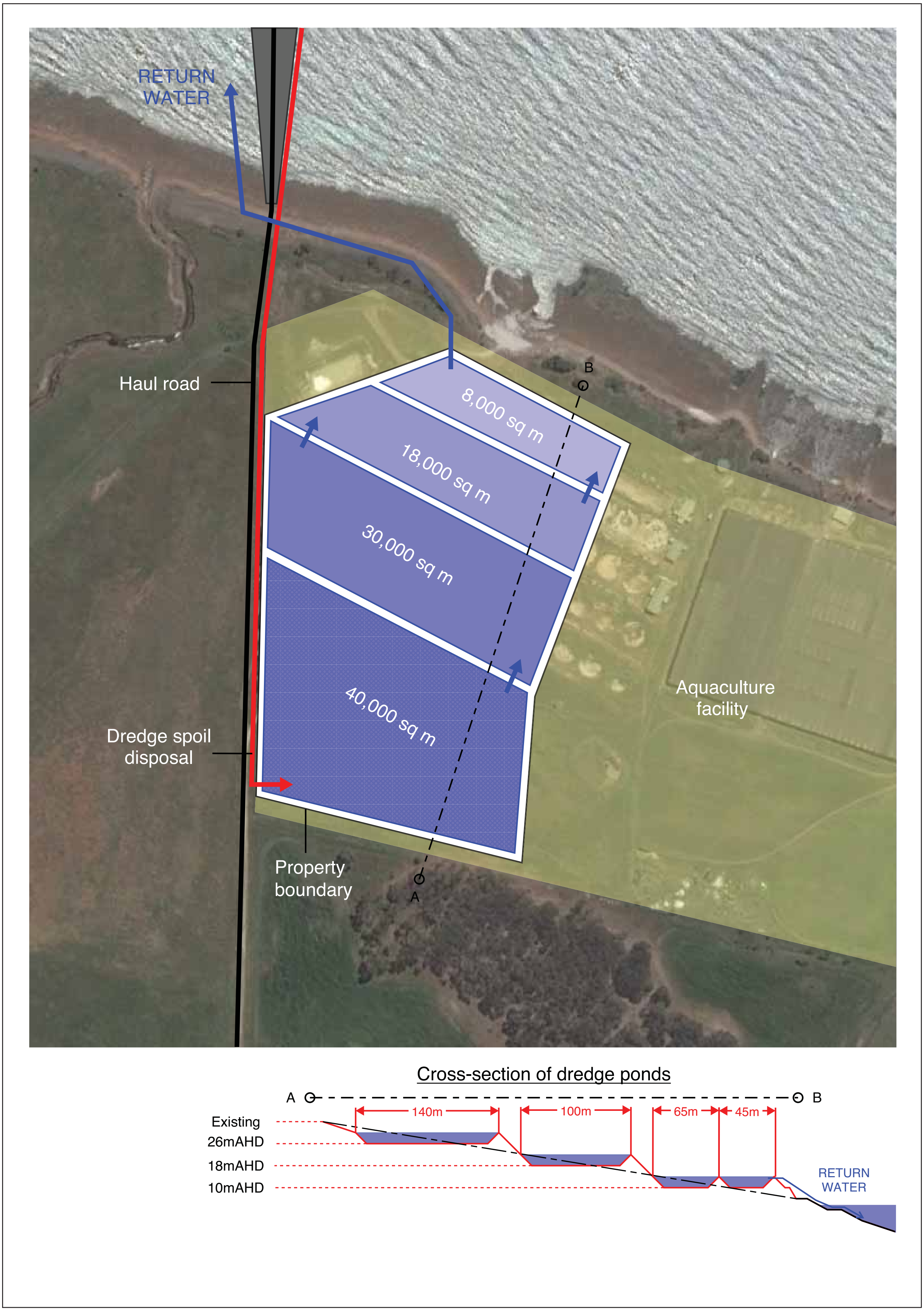


FIGURE 4-14 INDICATIVE DREDGE POND LAYOUT

will be continually relocated in order to distribute the dredged material evenly through the pond. The heaviest (and majority) of the dredged sediments will be removed from suspension in this pond.

A secondary settlement pond (30,000 m^2 in area) has been incorporated into the design and shall be entirely separated from the primary dredge pond and connected by five 450 mm diameter pipes located at the design water level of the primary settlement pond. These pipes would gravity feed water from the primary pond to the secondary pond. The purpose of the secondary pond is to remove the finer sediments which were not removed from suspension in the primary pond.

The final dewatering ponds (of sizes 18,000 m^2 and 8000 m^2, respectively) are separated from the secondary settlement pond and would remove any final sediments from suspension before the supernatant (clean) water is returned to the marine environment. This pond is connected to the previous pond via five 450 mm diameter pipes located at the design water level of the secondary settlement pond and is gravity fed. All water contained in the spoil, or used to slurry the spoil for pumping (the supernatant water), would be retained on site until its physical and chemical qualities conformed with the minimum criteria set by the Environment Protection (Water Quality) Policy 2015 for pollutant discharges to fresh and marine waters of South Australia.

The return water would be gravity fed from the final dewatering pond to Smith Bay. The return water will be discharged a distance of approximately 20 metres from the shoreline to prevent scouring of the coastline and would also be discharged a distance of at least 500 metres away from the adjacent aquaculture facility intake structure to the east of the return water site. The outflow water will return to the sea through approximately five pipes at a rate of approximately 3500 m^3/hr. The size and quantity of the return water pipes has been specifically selected in order to minimise the return water velocity (which would be approximately 1.2 m/s) and hence the probability of scour.

The disposal pond will be managed continually during the operations with civil plant. An excavator would be used to manage the dredge pipe disposal location and provide any necessary on-going pond maintenance as required. At completion of the dredging works the majority of the dredge spoil will be utilised as core material for the construction of the causeway. Material would be excavated from within the settlement ponds, loaded into articulated dump trucks and used to construct the causeway. After the dredge spoil has been utilised for causeway material, the dredge pond bund walls will be dozed and the site levelled and terraced as necessary to suit the onshore layout.

Dredging and earthworks drainage are prescribed activities of environmental significance and would be authorised by EPA.

4.5.3 WHARF

Restraint dolphins would be installed to secure the pontoon. The dolphins would be constructed off site, and installed by pile-driving pre-constructed steel piles into the seabed from a jack-up barge positioned above the construction area.

The pontoon would be towed to site from mainland Australia before being secured to the installed restraint dolphins. Once the barge had been secured between the dolphins, the linkspan bridge, linking the causeway with the pontoon, would be installed and dedicated wharf infrastructure commissioned.

4.5.4 APPROACH

Causeway

The causeway would be constructed using a combination of consolidated coarse dredge spoil material, with rock armouring to provide the appropriate level of stability and energy absorption capacity. Causeway construction would commence adjacent to the shore and progress offshore. Dewatered dredge spoil would be mechanically excavated and placed in articulated trucks for transport to the causeway construction site and off-loaded by back-tipping into profile. Once enough material had been placed in such a way, a hydraulic excavator would profile the material and prepare it for placement of primary and secondary rock armour.

Primary rock armour would contain rocks of approximately 1–1.2 metres in diameter, and would preferentially be sourced from established quarries on Kangaroo Island, such as those in the vicinity of Chapman River, about 1.5 hours by road from Smith Bay. This may be supplemented as required by larger diameter rock sourced from quarries on mainland South Australia (e.g. Southern Quarry, Sellicks Hill). Mainland rock would be trucked to a designated wharf and loaded onto flat-top barges for shipment to Smith Bay, where it would be off-loaded and placed immediately. The requirement for stockpiles would be minimised through the delivery of rock on an as-needed basis.

Secondary rock armour of less than one metre diameter would be sourced primarily from quarries on Kangaroo Island. After a section or sections of core placement were completed, the rock would be hauled from the temporary stockpile to the causeway construction site by articulated trucks. Hydraulic excavators and/or crawler cranes would place the rock into profile in accordance with the design of the rock protection works.

The causeway core would be constructed with the coarse fractions of dredge spoil material. The placement of dewatered dredge sands does not typically result in the release of large quantities of sediments. However, to mitigate the potential for any remaining sediments to result in an increase in the turbidity of local waters, the following construction methodology would be applied:

- when approximately 20–30 metres of causeway core has been hauled and placed, a long reach excavator would profile the slope in accordance with the construction drawings. The exposed length of core would be kept to a minimum in order to reduce the probability of core loss prior to geotextile lining, which would be done immediately after core profiling
- the method of core placement would be managed (typically by the rate of placement) in order to minimise the release of any remaining sediments
- if a significant and sustained increase in turbidity is observed (via monitoring) to extend beyond the MAZ, a silt curtain would be installed at the end of the previously-armoured section of causeway, extending approximately 30 metres beyond the previously constructed causeway and returning to the opposite face of the causeway. This would allow enough silt curtain length for the construction of a further 20–30 metres of causeway section.

Suspended deck

Structural steelwork including the jetty, linkspan bridge, piles, mooring dolphins, barge restraint dolphins etc. would be fabricated elsewhere and mobilised to Smith Bay from Port Adelaide by barge for assembly and installation. The construction sequence for the deck would consist of the driving of the steel tubular piles, the installation of steel headstocks over the driven piles with a grouted connection used between headstock and tubular pile, followed by the installation of precast concrete deck planks onto the steel headstocks, which would be grouted to the headstock.

4.5.5 LOG AND WOODCHIP STORAGE AREAS

The current storage area consists of narrow plateaus that were formed to create level surfaces for abalone tanks that previously covered approximately half of the area. As the current plateaus are not wide enough to store logs and woodchips, the area would be reshaped to provide suitable flat areas on the otherwise gently sloping site.

The intent for the completion of the onshore civil works would be to balance the site cut and fill quantity by developing a suitable terrace arrangement. At present, site elevation varies by approximately 18 metres from north to south, from 10 metres AHD to 28 metres AHD. In order to balance the cut and fill requirement, the conceptual design establishes the log storage area on a terrace at an approximate level of 23 metres AHD, and the woodchip stockpile area on a terrace at approximately 15 metres AHD. This should allow the establishment of infrastructure without a requirement for externally sourced material or a requirement to dispose of excess material offsite. However, there are areas of shallow soil over hard rock within the site, and the exact nature of the construction task would be determined during detailed design following more detailed geotechnical investigations.

4.5.6 MATERIALS HANDLING INFRASTRUCTURE

The materials handling infrastructure, including conveyors, hoppers and shiploading equipment, would be fabricated, assembled and tested off site. Equipment would then be disassembled and shipped to the site in containers from various ports, to be reassembled on site. Footings and foundations would be constructed on site.

4.5.7 OFFICES, WORKSHOPS AND ONSHORE FACILITIES

Site office and ablution facilities would be groups of portable 'ATCO-style' buildings transported to site from elsewhere on Kangaroo Island or shipped from the mainland on the SeaLink ferry. Approximately six buildings would be delivered during the construction period, some of which may require multiple vehicle movements prior to assembly on site, including:

- a gatehouse (which would be transported to site as a small ATCO-style hut)
- an equipment storage and maintenance shed (transported to site as a Stratco-style shed in components and assembled on site)
- a site office (nominally 12 metres x 20 metres) which would be transported to site as approximately six units of 3 metres wide x 12 metres long and assembled at site into a single site office
- a small office on the deck of the barge for operational use and shelter for materials handling equipment operators. This would likely be an appropriately fitted-out, repurposed 40-foot steel shipping container
- a small weighbridge office (transported to site as an ATCO-style hut)
- A small building housing a quality control monitoring laboratory.

Following land clearance and preparation such as levelling and cut and fill, minor site works would be required, including preparation of appropriate footings before building delivery, and connection of services (communications, water and electricity) after delivery.

4.6 INFRASTRUCTURE OPERATIONS

4.6.1 ROAD TRANSPORT STRATEGY

The preferred strategy for the transport of KIPT's timber products from the plantations to the KI Seaport is to:

- establish a defined transport route that minimises the potential impacts associated with traffic movements (e.g. noise, dust, habitat removal and fauna mortalities, and crashes)
- upgrade the defined transport route as required to permit the use of high productivity (B-double and/or A-double) heavy vehicles
- in consultation with the logistics provider, implement safety initiatives that reduce the potential for timber haulage vehicle accidents.

The road transport task external to the KI Seaport is considered outside of the scope of the project and is not described further in this chapter. However, the transport task, preferred routes and associated assessment of impacts are described in Chapter 21 – Traffic and Transport in accordance with transport-specific EIS guidelines issued by DPTI.

4.6.2 VESSEL MOVEMENTS

Responsibilities

A Port Management Officer would be appointed at KI Seaport, responsible for directing and controlling vessel movements in port waters for the purpose of safe navigation of vessels. This would include the following activities:

- movement of vessels into, within and out of port waters
- loading and unloading of vessels
- mooring, anchoring and securing of vessels within port waters (if required).

KIPT would ensure that adequate services and facilities are available to undertake these activities safely, and is in discussion with a number of experienced port operators in South Australia and Victoria to ensure that all operating requirements are met.

It is expected that all vessels would use established east coast shipping lanes for the voyage to and from north Asian ports. As they move along these east coast shipping lanes, they would be subject to the usual controls and protocols applying to that route.

Communications

A very high frequency (VHF) communication system would be established at Smith Bay, which would be manned at all times during vessel arrival, berthing and departure. This would allow ship-to-shore communications. All radio communications within the port would be conducted in standard marine navigation vocabulary. Cellular 3G or 4G mobile communications would also be established.

Tug operations

It is anticipated that arriving vessels would require up to two tugs for berthing, and a single tug for departure. Tugs would arrive from Port Adelaide, Port Lincoln or Portland, taking approximately 10 hours to arrive to Smith Bay. In some circumstances, tugs may arrive directly from assignments at nearer ports, such as Port Giles on the Yorke Peninsula.

Following berthing of the timber vessel, the tug(s) may depart for their home ports or other assignments, before a single tug returns to assist in de-berthing the vessel, or a single tug may remain moored on the lee side of the wharf for the duration of vessel loading operations, returning to its home port or next assignment following vessel departure. Tugs would not remain permanently berthed at the wharf, and no offshore anchoring of the tugs is proposed.

Navigation

International Rules for the Prevention of Collisions at Sea Regulations apply to all vessels in all State waters, including those within Smith Bay.

Vessel operations

Timber-carrying vessels would enter Smith Bay and broadly align themselves parallel to, and up to approximately 100 metres from the wharf. Tugs and/or bow and stern thrusters (if available) would bring the vessel into the wharf where it would be secured prior to shiploading activities. Shiploading activities are likely to take two to three days, whereupon the ship would depart the wharf, typically with the assistance of a tug. Once remote from the wharf, the vessel would commence the journey to the next port-of-call.

The number of vessels berthing per year depends on the stage of the plantation harvesting. Initially, during the early stages of the R1 harvesting operations, there is expected to be a relatively high proportion of pine log exports (and currently it is anticipated that up to 10–20 Handymax vessels of up to 22,000 tonne capacity would be used for export of pine logs). This would give way to approximately 8–10 Panamax vessels per year (loading up to approximately 60,000 tonnes per vessel) for the export of woodchip, with an additional 5–10 Handymax vessels required towards the end of R1 for the export of logs that are currently too immature for harvesting. These numbers represent likely maximums. The use of larger log vessels would mean fewer vessel movements. The sequencing is indicative only and may change due to market conditions, weather and other factors.

Management of discharges and emissions

Vessels associated with the construction and operation of the KI Seaport are subject to a range of Commonwealth and State legislation that regulates the discharge of pollutants into air, land and water.

The discharge of contaminated ballast water is a significant issue arising from the proposed KI Seaport. It is particularly important with respect to the discharge of pathogens and exotic aquatic organisms in ballast water that may pose a threat to the marine ecosystems into which it is discharged.

In the event that ballast water on board a vessel in Smith Bay were to contain impurities or contaminants other than aquatic diseases or exotic aquatic organisms (e.g. chemical or hydrocarbon contaminants) the Port Management Officer for the Seaport has the authority under the South Australian Harbors and Navigation Regulations to give the master of the vessel a wide range of directions about the management of that ballast water.

However, the more significant risk to the waters of Smith Bay regarding the uptake and discharge of ballast water is that of biosecurity, for which, since 2017 the Commonwealth government has assumed almost exclusive regulatory responsibility under the *Biosecurity Act 2015*.

4.6.3 BIOSECURITY

Ballast water discharge

Since September 2017, the Commonwealth Biosecurity Act has prescribed a ballast water management regime based on the International Convention for the Management of Ships' Ballast Water and Sediments 2004, to which Australia is a signatory. The goal of this Convention (and Chapter 5 of the Biosecurity Act) is to effectively manage the risk posed by the uptake of ballast water, with likely pathogens and exotic organisms, in a foreign port or waters and its subsequent discharge in other ports and waters where it may damage local marine ecosystems and aquatic commercial activities. KIPT would be using foreign-sourced international bulk carriers for the transport of its products from Kangaroo Island to the customer, this issue is significant.

The applicable ballast water management regulatory regime is addressed in detail in Chapter 15 - Biosecurity and in Appendix D2. In summary, international vessels transporting timber from the Seaport would be required to comply with the following:

i. As Smith Bay will not be a "first point of entry" under the Biosecurity Act, vessels will not be permitted direct access to the port. It will be necessary to berth at a first point of entry designated under the Act before proceeding to Smith Bay.

ii. It is at the first point of entry that officers of the Department of Agriculture and Water Resources may inspect ship's records (see below) to determine compliance with the ballast water management requirements of the Act.

iii. In the absence of an on-board ballast water treatment system, vessels entering Australian waters must normally undertake ballast water exchange (the discharge of foreign-sourced ballast water and its replacement) at least 200 nautical miles from the Australian shoreline: that is, on the high seas. That ballast water may then be discharged into Australian seas, including Smith Bay (subject to reporting requirements mentioned below).

iv. If a vessel leaves its port of origin without ballast or only partly with ballast, it may take up ballast water on the high seas and discharge it within Australian seas, provided at least 95 per cent of the water to be discharged was taken up on the high seas.

v. With some specified exceptions, any discharge or proposed discharge of ballast water into Australian territorial seas – that is, within 12 nautical miles of the shoreline – must be reported to the Director of Biosecurity. Smith Bay lies within Australian territorial seas.

vi. Vessels within Australian seas must have an approved ballast water management plan and certificate. A ballast water management record system must be held on board a vessel and records of ballast water operations kept in conformity with the Act.

Biofouling management

Biofouling is the 'accumulation of aquatic organisms (micro-organisms, plants and animals) on surfaces and structures immersed in or exposed to the aquatic environment'. This includes ship surfaces.

The Commonwealth Anti-fouling and in-Water Cleaning Guidelines (DAWR 2015) apply to vessels and other moveable structures in aquatic environments and reflect international conventions intended to protect the environments from invasive pest species and contaminants introduced by shipping. The guidelines are directed largely to managing the risks posed by different biofouling management measures and addressing both the environmental management of anti-fouling coatings and in-water cleaning and maintenance of vessels and moveable structures. Further, the National Biofouling Management Guidelines for Commercial Vessels outline procedures for operators of commercial vessels to follow to help prevent the introduction and spreading of marine pests. Both these guidelines apply to commercial shipping likely to service the proposed wharf, wherever these vessels may be located.

Anti-fouling coatings would not be applied to the wharf, the suspended deck structure and other permanent piled structures and marine growth on these structures is expected. It is anticipated that the wharf would be periodically cleaned and re-painted to extend its life.

4.6.4 MATERIALS HANDLING

Materials handling as part of bulk shipping activities is a prescribed activity of environmental significance and would be authorised by EPA. Any conditions for that authorisation would be complied with. Materials handling would also consider EPA's Code of Practice for Materials Handling on Wharves (EPA 2007).

Logs

Logs would be delivered to the site by truck and offloaded by mobile material handling machines (Sennebogen or similar), an example of which is depicted in Plate 4-1. The log bundles would be loaded in the log yard and, in due course, would be transported to the berth face for the vessel cranes to load them into the cargo hold. Logs would be transported to the berth face using the same log trucks as those used to transport logs from plantations to the site.

Woodchips

Woodchips would be delivered to the site by truck and discharged onto a concrete pad. A front-end loader would feed discharged woodchips into a receiving hopper. They would then be conveyed and stockpiled by a stacking conveyor. The fire risks associated with the woodchip stockpile would be managed in accordance with the objectives of the South Australian Fire Services Built Environs Section Guideline No.13:General Guidelines for Rubber Tyre Storage (South Australian Fire Authorities 2014), specifically:

- woodchips would be stored at a height and angle that maintained stockpile stability
- the stockpile would be arranged with suitable separation between it and surrounding infrastructure, to reduce the risk of fire spreading across the site
- access would be maintained around the stockpile to give firefighters greater access during emergencies
- the woodchip stockpile area would be kept at least 20 metres from the property boundary and from occupied buildings (offices) within the facility.

Vessels would be loaded by a separate reclaim and conveyor path, using a reclaim hopper and belt conveyor and shiploader.

The shiploader would be fitted with a slinger for loading the vessels. The slinger is a device that hangs from the end of the shiploading conveyor into the hold of the vessel. Woodchips are directed from the end of the conveyor into an enclosed discharge chute that ends at the slinger, which in turn propels the woodchips into the corners of the cargo holds, eliminating the need for a front-end loader within the hold to manage the available storage capacity and ensure good compaction of the cargo. Dust suppression (such as fogging sprays) may be used as required to manage dust generation should this be demonstrated to be an issue.

PLATE 4-1 TYPICAL LOG HANDLING MOBILE EQUIPMENT

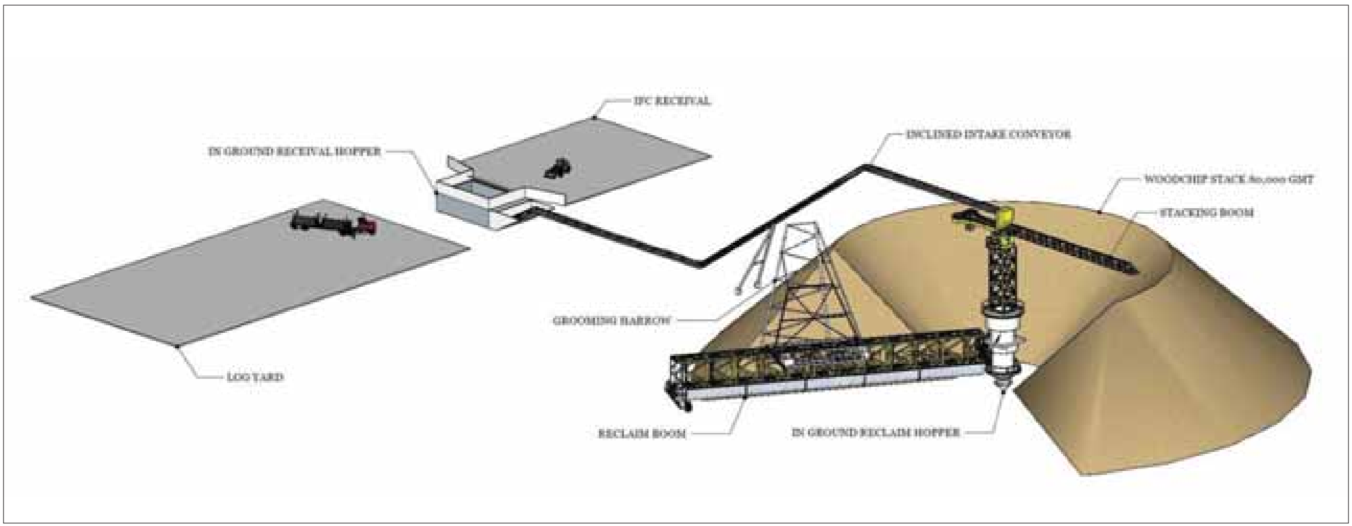


FIGURE 4-15 CONCEPTUAL WOODCHIP MATERIALS HANDLING SYSTEM

Figure 4-15 illustrates a conceptual woodchip materials handling system similar to the system planned for the site. This conceptual design is indicative only and is subject to detailed design.

4.6.5 DUST MITIGATION AND MANAGEMENT

Beyond engineered/design controls established to minimise dust emissions (such as covering of conveyors and enclosure of transfer points, refinement of the site layout, and/or telescopic chutes and slingers for shiploading operations), active dust management may be undertaken within the facility during operations. This would include:

- watering of on-site unpaved roads
- watering of cleared areas during construction/land clearing activities
- a reduced speed limit for vehicles on site.

In addition, possible mitigation measures to further reduce emissions during construction and operations include the use of water sprinklers/sprays:

- on cleared areas before infrastructure construction during adverse (hot and windy) weather
- during shiploading activities
- on the woodchip reclaim hopper during conveyor loading activities
- during woodchip and log unloading activities.

Typically, woodchip shiploading operations generate dust at each conveyor transfer point and at the point of discharge into the hold. As noted above, to manage this risk, these transfer points would be covered and, where necessary, dust collected by extractor fans. The aim is to limit the use of water as a dust suppressant on woodchips themselves, because woodchips are sold based on the dry weight, and the economic and environmental impact of transporting moisture by vessel is best avoided. Likewise, during shiploading, excessive dust can be controlled by the use of telescopic drop chutes when necessary.

4.6.6 EMERGENCY MANAGEMENT AND RESPONSE

Spill management

All hydrocarbon and chemical storages would be bunded in accordance with Australian Standard AS1940–2017: The storage and handling of flammable and combustible liquids (Standards Australia 2017) and the EPA Guideline 080/16 Bunding and Spill Management (EPA 2016b).

In the event of a spill, releases would be managed through the deployment of a floating oil boom (for in water spills) and/or the use of absorbent pads and/or via flushing with water to the vessel or onshore surface water management infrastructure.

Fire management

Fire management at the KI Seaport would be focused on the prevention of fires, and would include, subject to discussions with the South Australian fire authorities, compliance with the objectives of Built Environs Section Guideline 13 (Rubber Tyre Storage), which notes that emphasis should be placed on:

- maintaining adequate separation distance from site boundaries and buildings to restrict the spread of fire
- maintaining access around the stockpile to stop fire spreading and make firefighting more effective
- employing effective fire prevention practices to minimise the risk of a fire outbreak
- protecting the environment from damage in case of a fire (South Australian Fire Authorities 2014).

Further to this, the design would consider providing:

- low barrier walls around piles to define pile perimeter and prevent creeping

- physical protection to prevent heat sources such as steam lines, air lines, electric motors and mechanical drive equipment from becoming buried or heavily coated with timber material
- an appropriate number of suitable fire extinguishers
- automatic fire suppressing equipment on conveyor systems
- routine monitoring of woodchip pile temperature and routine visual inspections.

A firefighting water system would be established, consisting of a saltwater tank and pumping station for distribution across the site. The tank would comply with the South Australian fire authorities' Above Ground Water Storage Tanks for Fire Fighting Purposes Policy (2008). The size of the water storage would be determined during detailed design in consultation with the Country Fire Service (CFS) and Kangaroo Island Council. The site layout allows for unimpeded access of firefighting vehicles to the firewater tanks, with a hardstand area provided adjacent to the tanks to provide stability for firefighting vehicles with consideration to the potential for water spillage during emergency response activities.

Evacuation

Should the site be required to be evacuated, personnel would be directed via Freeoak Road to the intersection of North Coast Road or another muster point, to be determined during detailed design. Personnel would not be permitted to return to the site following evacuation until an all-clear was given by a suitably qualified person.

4.6.7 THIRD-PARTY OPERATIONS

Third-party access to the wharf may be granted for the export or import of other products (such as primary produce and extractive minerals) subject to the third-party undertaking relevant environmental and social impact assessments and following the granting of relevant government approvals.

Such access would be granted only to the extent that it did not interfere with KIPT operations and/or have a detrimental impact on KIPT's relationship with its key stakeholders, including independent timber growers, and neighbouring properties and operations. Third party users would be expected to either utilise the available parking within the KI Seaport (subject to availability and discussions with KIPT) and/or provide for their own car parking facilities on adjacent land should the KI Seaport facilities not be sufficient. This may be subject to further approvals that are outside of the scope of the KI Seaport EIS.

4.6.8 PUBLIC ACCESS

Public access to the onshore and offshore facilities would not be permitted. KIPT would approach the Kangaroo Island Council to close Freeoak Road, which currently provides access to the Smith Bay foreshore, from the southern boundary of Lot 51 to the foreshore. Temporary exclusion zones would be established around the offshore infrastructure during times when vessels are berthed at the KI Seaport, consistent with those established at other harbour facilities such as those at Outer Harbour. These would require third-party vessels to remain at least 50 metres from the wharf face, and at least 25 metres forward and aft of the berthed vessel (see Figure 4-16).

Signs attached to the wharf, causeway and land-side infrastructure would advise third-party vessels, such as recreational fishing boats, of the exclusion zone requirements.

All personnel at the facility would need a valid Maritime Security Identification Card (MSIC), a nationally consistent identification card which confirms that the holder has met the minimum background checking requirements to work in a maritime and/or offshore security zone. An MSIC is not an access control card, and possession of one does not provide the right of entry to the KI Seaport, access to which would be managed by KIPT and/or its appointed representatives.

4.7 INFRASTRUCTURE MAINTENANCE

The design life of the major elements of the proposed infrastructure was described in Table 4-4. Before operations commence, an Inspection and Maintenance Plan would be developed that incorporated the following:

- the expected time between each component's first use and first need for maintenance
- general inspection requirements
- expected planned and reactive maintenance tasks
- inspection tasks and requirements at specific intervals, including requirements for regular inspection and maintenance, annual inspection and condition assessment.

An indicative wharf facility inspection and maintenance plan is presented in Table 4-6.

Detailed preventive maintenance procedures and schedules would be developed before operations commence to ensure potential environmental and health and safety risks were mitigated and managed during these activities.

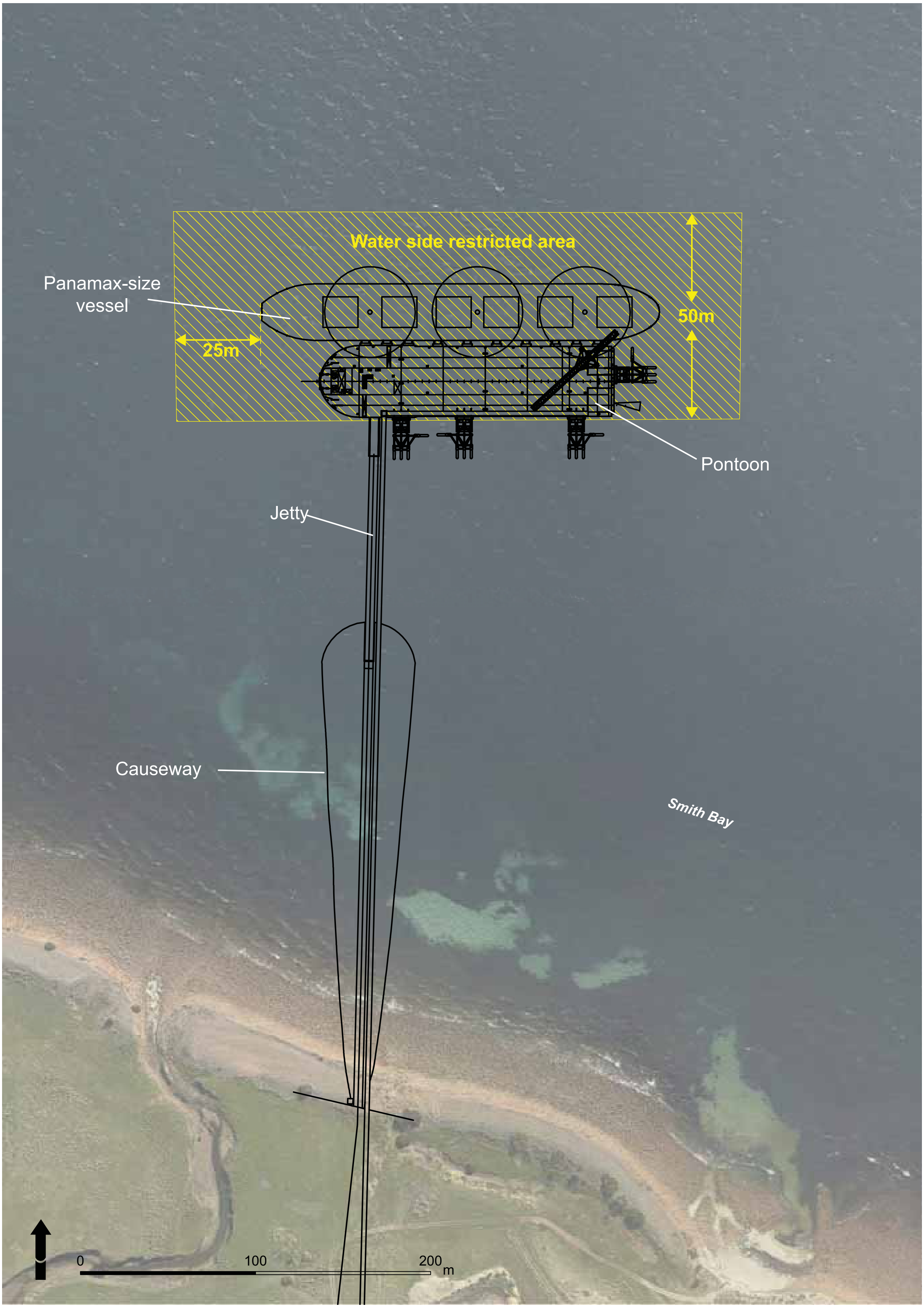


FIGURE 4-16 CONCEPTUAL TEMPORARY EXCLUSION ZONE LAYOUT

TABLE 4-6 INDICATIVE INSPECTION AND MAINTENANCE SCHEDULE

Facility component	Inspection tasks	Maintenance tasks	Frequency
Berth pocket	• inspect for adequate depth	• dredging as required to maintain adequate depth	• hydrographic survey undertaken annually • maintenance dredging every 5-10 years (approximately 5000 cubic metres per campaign)
Exposed wharf surfaces	• inspect paint for rust stains, damage to the paint system and vessel impact damage • measure wharf structure thickness	• touch-up painting • at end of paint design life, blast and repaint wharf	• annual inspections of paint condition, 5-yearly inspections of wharf thickness
Concrete structures	• hammer tapping survey to identify delaminated or spalled concrete • identify impact-damaged concrete	• local repair to damaged concrete • apply spray-on concrete impregnant (silane) to exposed concrete surfaces	• inspections at annual intervals, reapplication of impregnant at 5-yearly intervals
Pavements	• resurvey of the pavement after the first 12 months of operations to determine settlement and its impact on pavement drainage falls • inspection of pavement for wear and damage	• re-levelling of pavement with top-up layer if required • local pavement repairs in areas of wear or damage	• inspections at 2-monthly intervals, maintenance as required
Mooring bollards, ladders, fender support frames	• inspect paint for rust stains, damage to the paint system and vessel impact damage • inspect for loose connecting bolts • inspect for structural damage	• touch-up painting as required • replacement of ladders and fender support frames if damaged • tighten loose bolts	• inspections at 2-monthly intervals, maintenance as required
Restraint dolphins	• inspect for damage	• repair or replace as necessary	• inspections at annual intervals, maintenance as required
Navigation aids	• inspect for correct operation	• repair or replace as necessary	• monthly visual inspection from shore, annual close-in inspections from workboat, maintenance as required
Causeway structure	• inspection for damage and loose/ missing rock armour	• reinstatement of rock armour as necessary	• inspections every 12 months and after significant storm events

4.8 RESOURCES

4.8.1 ELECTRICITY DEMAND AND SUPPLY

Electricity would be required on site for the following major demands:

- all conveyors, stacker, hoppers and shiploaders required for the stockpiling, reclaiming and shiploading operations associated with woodchip handling
- offices, crib rooms, ablution facilities, shed and testing lab lighting and power requirements
- powered wharf infrastructure, such as mooring line retrieval capstans
- general site security and operational lighting.

The expected peak electricity demand is approximately 400 kW, with an annual consumption of approximately 350 MWh.

The Smith Bay site is close to a source of mains electricity consisting of an 11 kVA three-phase line. There is sufficient capacity within the mains electricity system for the provision of electricity to the KI Seaport. The electricity supply strategy for the development would consist of:

- a connection to the mains electricity system for the delivery of grid-sourced electricity

- solar panels fitted to office and maintenance buildings, together with associated battery storage (approximately 20 kW capacity)
- a 635 kVA diesel-fuelled electricity generation set (genset) to provide back-up electricity for the materials handling infrastructure
- a second generator would serve as an emergency back-up to the primary generator, and would be located with the other genset within a concrete bunded area, as described in Section 4.4.

The application of renewable electricity sources such as solar photovoltaic and/or wind turbines will be investigated during detailed design with a view to supplementing, and thereby limiting, the use of diesel generators for the materials handling infrastructure. Electricity would be distributed by aboveground cables.

4.8.2 WATER DEMAND AND SUPPLY

Water demand and sources

The facility would need water for uses including:

- dust suppression
- fire suppression (emergency)
- potable supplies for ablutions etc.

On-going water demands are expected to be minimal, with up to approximately 0.5 ha of roadways and up to 5 ha of timber storage areas requiring a peak of approximately 10,000 litres per day when required, fire suppression water only required in emergencies and training/readiness drills and up to approximately 500 litres per day of potable water associated with staff ablutions and drinking water. Storage for up to 54,000 litres of dust suppression water (in addition to storage within the site retention basin) would be provided in a high-density polyethylene tank (or series of tanks), with separate firewater storage as described in Section 4.5.6.

Dust suppression and firefighting water demands would be met through captured surface water runoff reclaimed from the lined site retention basin (10 ML capacity). This may be supplemented by fresh water imported to site via an appropriately licenced/approved third party provider and/or reclaimed seawater during extended periods without rainfall.

Potable water requirements would be met through the provision of separate tank storage of up to 46,000 litres of potable water, which would be captured from site rooftop runoff, supplemented as necessary by the delivery of rainfall runoff captured at the KIPT-owned Timber Creek Road operations base, which has approximately 5400 m^2 of roof area by way of a number of large machinery sheds. Average rainfall varies between approximately 15 mm/month in January and 70 mm/month in July (see Chapter 17 – Air Quality), implying that, with the installation of relevant infrastructure at the Timber Creek Road operations base, KIPT-captured rainfall could supply an average of between 81,000 litres and 380,000 litres per month, sufficient to meet the proposed potable water demand for the operation.

Alternatively, in extended periods of low rainfall, water may be imported to site either by appropriately licenced/approved providers on Kangaroo Island or via barge from the mainland.

Grey and black wastewater from the site would be directed to a septic system for disposal via an appropriately licenced third party service provider.

Water sensitive urban design

As part of the planning process (and as summarised in Section 4.3.6 and described in detail in Appendix C3), the following water-sensitive urban design (WSUD) opportunities have been identified and have been incorporated into the design of the KI Seaport:

- ephemeral wetland pond to provide stormwater treatment, biodiversity and habitat
- level spreader and porous rock weir at outlet
- vegetated swale to convey, treat and infiltrate stormwater runoff from general site areas
- forebay traps to intercept sediment and wood debris that enter stormwater from the log and woodchip storage yards
- inlet pits incorporating debris traps to intercept wood debris that either enter or are swept into the inlet pits on the floating wharf
- oil/grease water separator to provide final separation of pollutants that enter stormwater runoffs from the surface of the floating wharf
- retention basin to hold, store and retain stormwater runoff that has organic leachate content resulting from contact with woodchip and dust (log and woodchip storage areas only).

4.8.3 DIESEL DEMAND AND SUPPLY

Diesel fuel would be required to run the back-up electricity generator and the log handling and loading fleet. The anticipated on-site diesel-consuming equipment is presented in Table 4-7.

The anticipated diesel demand for the site-based equipment would be up to a peak of approximately 500,000 litres per annum, assuming no connection to the electricity grid. Local fuel suppliers would supply diesel and maintain storage systems under contract. The ability to draw reliable grid power from the existing South Australian Power Networks (SAPN) 11 kVA line would lead to a significant reduction in diesel usage.

TABLE 4-7 TYPICAL ON-SITE DIESEL CONSUMING EQUIPMENT

Equipment	Quantity
Bulldozer	1
Log land tugs (log stockpile to ship)	3
Log handlers	2
Generators	2
Crane	1

4.8.4 WORKFORCE DEMAND AND SUPPLY

An indicative workforce for the first six years of the operation (covering construction, ramp-up and steady-state operations) is detailed in Table 4-8 for the whole of the KIPT harvesting, transport and export operations.

These employment numbers are based on a timber harvesting plan that is subject to change due to market, weather and other conditions. One of the factors driving that plan will be the need to maintain relatively steady levels of on-Island employment. Additional indirect employment caused by the increases in economic activity is not included in Table 4.8.

During operations at the KI Seaport, site staffing (approximately three full-time equivalents, (FTE)) would consist of 24 hour maintenance, management and security coverage whenever a ship was in port, and 12 to 15 hours a day during log retrieval operations. During log receival operations there would be a marshalling team of around five FTE staff working on two shifts, each on a 12-hour-day, five-day-week basis throughout the year, except for during shiploading activities, when these resources would be diverted.

While a ship was being loaded with logs, the marshalling team would largely be redirected to loading operations, working 24-hours-a-day until operations were complete. This would require a second team of five FTE staff for the loading period. During this period, there would also be a stevedoring team, consisting of two teams of four FTEs plus a supervisor, providing 24-hour coverage. Woodchip loading operations may use the same team as above, but may require fewer people during the shiploading phase.

A summary of the indicative KI Seaport operational workforce is provided in Table 4-9.

A timber haulage workforce would support a program of continuous (24-hours-a-day, seven-days-a-week) transport of timber products from the various plantations to KI Seaport. Site-based personnel would generally work 12-hour shifts on a roster, the details of which are yet to be finalised.

The majority of the skilled workforce (including those for the timber product haulage operations) would be expected to be filled by workers relocating to Kangaroo Island from the mainland, although the preference would be to employ Kangaroo Island locals should they meet the relevant conditions of employment.

4.8.5 COMMUNICATIONS

In addition to the ship-to-shore VHF system, internet and telecommunications systems would be provided via mobile services, and no fixed land-based communications are proposed.

4.8.6 RESOURCE USE EFFICIENCY

The use of materials and construction resources would be minimised during the development and operation of the KI Seaport. Specific examples include:

- the balancing of causeway material demand (through managing the length of the causeway) and dredge spoil supply such that the causeway core can be constructed from all of the suitable dredge spoil material excavated, eliminating the need for bulk onshore dredge spoil disposal and reducing the need for the importation of causeway fill material

TABLE 4-8 INDICATIVE KIPT KANGAROO ISLAND OPERATIONS DIRECT WORKFORCE

Location	Direct employment (FTE)						
	Construction	2018–19	2019–20	2020–21	2021–22	2022–23	2023–24
Kangaroo Island	15	40	161	165	169	175	145
Rest of South Australia	30	N/A	N/A	N/A	N/A	N/A	N/A
Australia	0	N/A	N/A	N/A	N/A	N/A	N/A

TABLE 4-9 INDICATIVE KI SEAPORT DIRECT WORKFORCE

Activity	Direct employment (FTE)
Permanent	Up to 11
Shiploading (average 40 days a year)	Approximately 10-14 additional staff

- the use of dredge spoil material that is considered unsuitable for use in the causeway core for the construction of noise and aesthetic bunds
- the re-purposing of a barge for the establishment of a pontoon minimises the requirement for steelwork and concrete, saving approximately 6000 tonnes of steel and 2800 cubic metres of concrete that would otherwise be required if constructing a more traditional sheet-piled wharf facility. Further, a solid wharf would necessitate a further 100,000 cubic metres of earth fill, which has been avoided through use of a floating pontoon wharf structure
- the use of balance cut and fill for the land-based terracing works associated with the log and woodchip storage areas avoids the production of waste fill and the need to import significant quantities of additional earthen construction materials to site other than quarry material for concrete production and road base material
- site offices and ablutions buildings would likely be reused or repurposed ATCO-style portable buildings.

During operations, resource use would be optimised through measures that may include:

- opening up the KI Seaport for use by third parties, subject to current KIPT operations and having the necessary approvals established
- capture and reuse of stormwater for dust suppression and firewater purposes
- capture and reuse of rainwater from site buildings for use as drinking water and in ablutions, supplemented by the importation of captured rainwater from other KIPT sites (particularly the existing sawmill site, which has extensive roof area)
- use of two electricity generators to ensure that genset efficiency is maximised by tailoring genset usage to electricity demand during different operational phases.

4.8.7 WASTE MANAGEMENT

A limited range of waste materials would be produced as a result of the construction and operation of the KI Seaport. Where there is the potential for wastes to be generated, KIPT would adopt the waste management hierarchy adopted in South Australia's Waste Strategy (Zero Waste SA 2015), specifically (in order of preference) – avoid, reduce, reuse, recycle, recover, treat, dispose. This approach is reflected in the approach to resource usage described in Section 4.8.6, and specific waste management practices are described in the following sections.

Dredge spoil management

As described in Section 4.5.4, suitable excavated material generated during dredging would be used to construct the causeway core. The design intent is to balance the dredge spoil volume with the causeway core volume on the basis that approximately 65–70 per cent of the dredge spoil would be suitable for use as core material. Dredge spoil in excess of these requirements, or material that is not suitable for use in causeway construction, would be used in on-site construction works (as a supplement to cut-and-fill operations) and/or to construct noise and aesthetic bunds and landscaping around the proposed operations as described in Section 4.4.6.

Wood and bark waste management

Wood waste streams are likely to comprise of the following:

- wood fines
- wood shards
- bark
- errant woodchips contaminated with, for example, soil, dust and mud.

Wood fines would be managed in two main areas of the KI Seaport, specifically:

- at the woodchip truck unloading hopper
- at either end of the shiploader.

Considerable design effort is being applied to:

- minimising the creation of additional fines in the chip handling processes, for example:
  - by optimising the performance of the conveyor systems, and the associated maintenance regime
  - by investigating the use of an automatic stacker reclaimer to create and manage the chip stockpile, which avoids the use of bulldozers to maintain the stockpile, thereby eliminating the creation of fines generated from the trucks running over woodchips
- minimising the mobilisation of fines and containing those that are mobilised by various design interventions including shrouding conveyor junctions and setting up fines capture systems.

Other timber wastes include wood shards produced from the use of materials handling mobile equipment, during the management of timber in the log storage yard, and errand woodchip which may be produced at interchanges between conveyors and the shiploader. These chips cannot be returned to the stockpile as they may have become contaminated.

Periodically, wood wastes deposited in the log and woodchip storage areas would be collected for transport off site to minimise the potential for dust generation at Smith Bay.

Softwood sizing analysis found that woodchips comprise around 0.1 per cent fines (South East Fibre Exports 2011). At the throughputs described in Section 4.1.5, the fines generation may be up to approximately 700 tonnes a year during softwood materials handling. Hardwood fines are likely to be negligible once commissioning is complete and operations are stabilised.

Wood fines would be preferentially back-loaded into empty woodchip haulage trucks and returned to the plantations to compost in place as part of nutrient recycling. A portion of the fines may also be used as garden mulch in local landscaping, or may be a viable form of biofuel for industrial processes and/or local electricity generation activities that are being or may be undertaken on Kangaroo Island, subject to suitable screening and segregation facilities being available.

Vessel solid wastes and black and greywater management

Vessels would be responsible for the storage of wastewater and solid wastes generated while berthed at Smith Bay. It is not anticipated that any waste materials would be brought onshore at Smith Bay, and black and grey water would not be discharged unless such material met relevant water quality standards and biosecurity requirements.

General and hazardous waste management

Waste materials generated during construction, including concrete and similar inert construction and demolition wastes, would be disposed of at the Kangaroo Island Resource Recovery Centre. Recyclable construction materials (such as excess cabling, plastics, aluminium and other metals) may be collected and transferred to the Centre for storage before recycling. There is currently no landfill located on Kangaroo Island, and all collected wastes are transported to the mainland for disposal.

During operations, only small volumes of wastes are expected to be generated, including used equipment such as motors and pumps at the end of their service life, and putrescible wastes associated with the on-site workforce. Wherever possible, these wastes would be collected and delivered to the Centre so the recyclable materials could be separated and treated, with the non-recyclable materials being sent to an appropriately licensed landfill facility on the mainland, where sufficient capacity exists for these wastes.

The EPA guideline EPA842/09 Waste Definitions defines hazardous waste as a listed waste having a characteristic described in Schedule A List 2 of the National Environment Protection (Movement of controlled waste between states and territories) Measure (Clth). It includes any unwanted or discarded material which, because of its physical, chemical

TABLE 4-10 HAZARDOUS WASTE MANAGEMENT

Material	Description	Management
Waste oil and hydrocarbons	Leftover oils and fuels from site processes	• collected by licensed contractor and disposed of at the Kangaroo Island Resource Recovery Centre. May be temporarily stored within appropriately bunded areas around site pending transport
Oil rags and filters (listed waste)	Leftover oil rags and filters from site processes	• collected by licensed contractor and disposed of off-site
Hazardous chemicals	Waste hazardous chemicals produced/left over from site processes	• appropriately disposed of as per Safety Data/Sheet (SDS)
Batteries	Waste batteries left over from site processes	• waste services contractor to consolidate for periodic transport to off-site recycling processor
Tyres (listed waste)	Light and heavy vehicle tyres from KIPT vehicles only, and no longer suitable for use.	• Tyres would be removed from site immediately following change-over and would not be stockpiled on site. Tyres would nominally be transported to an off-site recycling processor.
Medical waste (listed waste)	Medical wastes, including sharps	• disposed of to a licensed medical waste disposal facility

or infectious characteristics, can cause significant hazard to human health or the environment when improperly treated, stored, transported, disposed of or otherwise managed, and includes any waste listed under Schedule 1, Part B of the *Environment Protection Act 1993* (SA). Only small volumes of these wastes are expected to be generated during construction and operation, with management measures detailed in Table 4-10.

Wastewater management

It is envisaged that a septic tank of working capacity 16,500 litres (with a tank capacity of 22,000 litres) would capture effluent, which would then be collected and removed by a waste truck. The Kangaroo Island Council requires all septic tanks, irrespective of type, to be desludged every four years in line with Department of Health requirements. Contractors desludging septic tanks are required to advise the council when tanks are desludged and pay a fee per tank desludged when disposed at the Kangaroo Island Resource Recovery Centre. A review of public registers (Kangaroo Island Council 2018) identified at least two septic cleaning services available on Kangaroo Island with the potential to provide the required services to the KI Seaport.

4.9 PROJECT CLOSURE

4.9.1 OVERVIEW

After operations ceased, project-related infrastructure would be removed and the site rehabilitated so the landscape function matched the pre-operational function and/or was returned to a condition similar to that of the surrounding landscape.

4.9.2 CLOSURE OBJECTIVES

The closure objectives for the project are summarised in Table 4-11.

4.9.3 FINAL LAND USE

After operations ceased and the project footprint was successfully rehabilitated, it is anticipated that the pre-operational land use (agriculture and/or aquaculture) may be resumed.

4.9.4 CLOSURE ACTIVITIES

At closure, the following activities would be undertaken:

- in the lead-up to closure, site timber product inventories, together with chemical, hydrocarbon and spare parts inventories, would be reduced to minimise the volume of materials requiring subsequent rehandling and/or return

TABLE 4-11 PRELIMINARY CLOSURE OBJECTIVES

Environmental aspect	Closure objective
Soil quality	Physical and chemical properties of surface soils compatible with agreed post-closure land uses.
Water quality	No reduction in beneficial use of natural water drainage systems, streams and rivers or groundwater as a result of project-related contamination.
Air quality	No human health impacts as a result of dust emissions. No nuisance impacts to local pastoralists or reduction in vegetation and habitat abundance and diversity as a result of post-closure dust emissions.
Groundwater resources	No adverse impacts to existing groundwater users (including groundwater-dependent ecosystems) as a result of changes to groundwater levels or flow patterns.
Surface water systems	Post-closure flow systems to reinstate pre-operation flow patterns, to a practicable extent. Post-closure flows do not cause instability of built landforms, release of contaminated sediment to natural drainage lines, waterlogging or flooding.
Safety	Engineered landforms are stable and/or made safe through effective access controls. No reactive, chemically toxic or radioactive materials are left on the land surface or put in locations where they could cause pollution that harmed the environment.
Landscape amenity	Permanent landforms are designed to be consistent with the surrounding landscape.
Social	Minimising disruption and/or impact on the community caused by infrastructure closure.
Economic	The South Australian community and future generations bear no residual liability or costs for land rehabilitation or post-closure maintenance.

- all land-based surface infrastructure would be removed and either transported to an appropriately licensed landfill for disposal, or salvaged and on-sold wherever possible
- the log storage areas may be reshaped to resemble the surrounding topography, where this would not result in increases to possible solid runoff to Smith Bay
- concrete footings would be removed to one metre below ground level, and hardstand areas reclaimed, and ripped to encourage revegetation
- the offshore infrastructure would be removed, with the pontoon wharf and linkspan bridge/ramp towed away for sale and reuse or for scrap, dolphins and associated navigational aids removed (these may be cut at seabed level where removal would be too difficult and/or disruptive)
- the causeway would remain a permanent structure and could, after rehabilitation, be opened for public use under the jurisdiction of the Kangaroo Island Council.

4.9.5 UNPLANNED CLOSURE

In the event of a temporary suspension of timber export activities, a care and maintenance plan would be prepared. Relevant government agencies would be notified of the nature of the suspension and measures in place to limit impact to the environment and to ensure health and safety requirements were met during the care and maintenance phase. The care and maintenance plan would not comprise a full rehabilitation plan and closure strategy but would incorporate interim measures. During the care and maintenance phase, a full rehabilitation plan would be prepared for implementation should the unplanned closure phase extend beyond two years from the end of operations.

05. LEGISLATIVE FRAMEWORK

05. LEGISLATIVE FRAMEWORK

5.1 INTRODUCTION

This chapter addresses the principal requirements of the South Australian and Commonwealth environmental legislation applying to the proposed KIPT development. (See Appendix D1 for a more detailed explanation of these laws and their relevance to the proposal.)

The chapter classifies environmental legislation by issue based on its relevance to the range of procedural, environmental, social, cultural and economic issues identified as arising from the proposal and addressed in the EIS. Each class of legislation is considered in a separate section of the chapter, each of which provides an introduction to that legislation and summarises it in tabular form.

The contents of this chapter (and Appendix D1) extend to Acts of Parliament and associated regulations, statutory policies such as Environment Protection Policies (EPPs) and statutory plans such as Natural Resource Management Plans. They do not address detailed non-statutory information such as government codes and guidelines, industry standards, Australian Standards and applicable international standards. These are referred to in other chapters of the EIS that address the particular issues to which such requirements apply.

5.2 MAJOR DEVELOPMENT ASSESSMENT

The proposed development is subject to both South Australian and Commonwealth environmental impact assessment legislation (see Table 5-1).

On 8 November 2016, the proposed facility (named by KIPT as the KI Seaport) was referred under the *Environment Protection and Biodiversity*[1] *Conservation Act 1999* (EPBC Act) to the then Commonwealth Minister for the Environment and Energy to determine whether the proposal was a controlled action for the purposes of the Act and, if so, at what level and in what form the proposal should be assessed. On 14 December 2016, the proposal was declared a controlled action, requiring the preparation of an EIS.

On 16 February 2017, the South Australian Minister for Planning declared the proposal to be a major development for the purposes of environmental impact assessment under South Australia's *Development Act 1993*. The Development Assessment Commission (DAC) later determined that the appropriate level of assessment was an Environmental Impact Statement (EIS).

5.3 POLLUTION, WASTE MANAGEMENT AND PETROLEUM STORAGE

Both marine and land-based elements of the development would be subject to South Australian pollution management legislation. Marine-based elements may also be subject to Commonwealth pollution management legislation. Generally, the Commonwealth legislation would apply only to Commonwealth waters. In some circumstances, however, the Commonwealth legislation may apply directly to Smith Bay, even though for jurisdictional purposes Smith Bay is within South Australian coastal waters (see Table 5-2).

[1] For the purposes of this Act 'biodiversity' is described in section 528 (General List of Definitions).

TABLE 5-1 MAJOR DEVELOPMENT ASSESSMENT LEGISLATION

Legislation	Purpose	Administering agency	Application to the development
Development Act 1993 (SA)	The Act establishes environmental assessment and approval processes for proposed major developments and projects.	Development Division, Department of Planning, Transport and Infrastructure (DPTI)	Declared a major development, it is therefore subject to assessment and approval processes under the Act.
Planning, Development and Infrastructure Act 2016 (SA)	To replace the existing *Development Act 1993* in or around 2019.	DPTI	As the proposed facility has been declared a major development under the *Development Act 1993*, the Environmental Impact Assessment (EIA) process under that Act will continue to apply to the development even if the EIA process under the new Act comes into effect before the assessment is completed. However, the Minister for Planning will make the final decision, not the Governor (as is currently the case under the *Development Act 1993*).
Environment Protection and Biodiversity Conservation Act 1999 (Clth)	If a proposed action may have a significant impact on a matter of national environmental significance (MNES) as defined under the Act, it will be declared a Controlled Action and therefore subject to assessment and approval processes specified under the Act.	Commonwealth Department of the Environment and Energy (DoEE)	Declared a Controlled Action under the Act (14 December 2016). Under a bilateral agreement between the Commonwealth of Australia and South Australia[2] assessment of controlled actions has been delegated to the State Government by the Commonwealth. However, Commonwealth approval is still required.

5.4 CLIMATE CHANGE AND GREENHOUSE GAS REDUCTION

Commonwealth and State government legislation applies to the related issues of reducing greenhouse gas emissions and managing the impacts of climate change, as shown in Table 5-3. The study area potentially could be damaged by rising sea level as a result of climate change. Conditions can be applied under State legislation to any proposed development that may be affected by such impacts. In the case of the KIPT proposal, relevant conditions derived from the Kangaroo Island Development Plan and the Coast Protection Board policy document of 2016 provide coastal development standards that would apply to any EIS approval.

5.5 NATURAL RESOURCES MANAGEMENT

The development is subject to environmental approval under the Commonwealth Government's EPBC Act, based on the identification of four listed species (as matters of national environmental significance or MNES) that may be significantly impacted. One of these species, the southern right whale, is subject to a recovery plan under the biodiversity conservation provisions of the EPBC Act. In this respect, Commonwealth natural resources management legislation applies directly to the proposed development.

However, it is principally State natural resources management legislation (see Table 5-4) that would apply to the marine and terrestrial environments potentially affected.

[2] Commonwealth of Australia and the State of South Australia. Bilateral Agreement made under section 45 of the *Environment Protection and Biodiversity Act* (Clth) relating to environmental assessment. September 2014.

TABLE 5-2 POLLUTION, WASTE MANAGEMENT AND PETROLEUM STORAGE LEGISLATION

Legislation	Purpose	Administering agency	Application to the development
Environment Protection Act 1993 (SA)	South Australia's principal pollution[3] control and waste[4] management legislation, this Act promotes the principles of ecologically sustainable development and, in that context, aims to ensure that all reasonable and practicable measures are taken to protect, restore and enhance environmental quality.	Environment Protection Authority (EPA)	KIPT would be required to: • comply with the general environmental duty under the Act • acquire authorisations for any 'prescribed activities of environmental significance' • comply with relevant Environment Protection Policies (e.g. the Environment Protection (Water Quality) Policy 2015; the Environment Protection (Air Quality) Policy 2016) • not cause any 'material' or 'serious' environmental harm or an environmental nuisance, as defined under the Act.
Protection of Marine Waters (Prevention of Pollution[5] from Ships) Act 1987 (SA)	In State waters (including Smith Bay, Investigator Strait and Backstairs Passage), this Act implements the International Convention for the Prevention of Pollution from Ships 1973 and its 1978 Protocol.	DPTI	'Shipping' subject to the Act includes bulk timber carriers. 'Ship' includes the proposed floating wharf, or pontoon. The Act also addresses the discharge into SA waters of oil or oily mixture from vehicles or apparatus.
Protection of the Sea (Prevention of Pollution by Ships) Act 1983 (Clth)	This Act implements in Commonwealth waters (those outside State waters) the International Convention for the Prevention of Pollution from Ships 1973 and its 1978 Protocol.	Australian Maritime Safety Authority (AMSA)	The Act would apply to shipping travelling to and from Smith Bay when these ships were outside State waters.
Protection of the Sea (Harmful Anti-fouling Systems) Act 2006 (Clth)	This Act implements the 2001 International Convention on the Control of Harmful Anti-Fouling Systems on Ships (the HAFS Convention), prohibiting the use of harmful anti-fouling paints.	Commonwealth Department of Infrastructure and Regional Development	Shipping associated with the project, including bulk timber carriers, would be required to comply with the Act, including acquiring an International Anti-Fouling System Certificate.

[3] The terms 'pollute' and 'pollution' have specific meanings for the purposes of the South Australian *Environment Protection Act 1993*. See section 3 of that Act.

[4] Similarly, the term 'waste' is given a specific meaning for the purposes of the *Environment Protection Act* (see section 3 of that Act).

[5] Under this Act 'pollution' includes oil, oil residues, noxious substances, packaged harmful substances and garbage.

TABLE 5-2 POLLUTION, WASTE MANAGEMENT AND PETROLEUM STORAGE LEGISLATION (CONT'D)

Legislation	Purpose	Administering agency	Application to the development
Environment Protection (Sea Dumping) Act 1981 (Clth)	This Act implements the 1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes[6] and Other Matter 1972. It is an offence under the Act to dump 'controlled material' into Australian waters from a vessel, aircraft or platform without a permit. There is no equivalent South Australia legislation that is operational, so the Commonwealth Act applies also to State waters. Sea dumping in State waters is regulated under the *Environment Protection Act 1993*.	DoEE	Any proposal by KIPT to dump 'controlled material' in the marine environment would be subject to the Commonwealth Act. KIPT has no such proposal.
Dangerous Substances Act 1979 (SA)	This Act regulates the keeping (retaining), handling, transport, conveyance and disposal of dangerous substances defined under the Act.[7] The Act imposes a general duty to take reasonable care in relation to the use, handling etc. of dangerous substances with respect to health and safety, damage to property and environmental harm. Depending on volume, the bulk storage and conveyance of dangerous substances prescribed by the regulations may require a licence under the Act.	SafeWork SA	KIPT must comply with the Act In keeping, using, transporting and otherwise dealing with dangerous substances associated with the project. The bulk storage and management of prescribed dangerous substances (including petroleum products associated with the project) may need to be licensed under the Act.

[6] 'Wastes and other matter' are defined in clause 8 of Article 1 of the 1996 Protocol to the Convention on the Prevention of Marine Pollution by the Dumping of Wastes and Other Matter 1972 (as amended in 2006) as meaning 'material and substance of any kind, form or description'.

[7] 'Dangerous substances' are defined under the Act as 'dangerous goods or any other substance or article that is toxic, corrosive, flammable or otherwise dangerous and declared by the regulations to be a dangerous substance' (see section 2 of that Act).

TABLE 5-3 CLIMATE CHANGE AND GREENHOUSE GAS REDUCTION LEGISLATION

Legislation	Purpose	Administering agency	Application to the development
Climate Change and Greenhouse Emissions Reduction Act 2007 (SA)	This Act promotes ecologically sound development in South Australia by addressing issues associated with climate change. It sets a target of reducing greenhouse gas emissions by 60 per cent (to an amount equal to 40 per cent of 1990 levels) by 2050.	Department for Environment and Water (DEW)	The Act has no direct application, but the proponent acknowledges relevant State government policy and climate change strategy.
National Greenhouse Energy Reporting Act 2007 (Clth)	This Act introduces a national framework for reporting and disseminating companies' information about greenhouse gas emissions, greenhouse gas projects, energy consumption and energy production.	Commonwealth Clean Energy Regulator and DoEE (NGER Scheme)	KIPT does not expect to reach any thresholds that would require registration and reporting under the Act.
Coast Protection Act 1972 (SA)	This Act provides for the conservation and protection of the South Australian coast. It addresses the issue of development and sea level rise through its Coast Protection Board policy document mentioned above.	Coast Protection Board	The Minister is likely to refer the Draft EIS to the Board for comment. KIPT would comply with any Major Development approval conditions regarding coastal development and sea level rise and be guided by the relevant provisions of the Coast Protection Board policy document.

5.6 MARINE CONSERVATION, FISHERIES AND AQUACULTURE

The southern right whale is listed as endangered under the Commonwealth's EPBC Act (see Natural Resources Management, Section 5.5 above). The Act and any relevant conditions of Commonwealth environmental approval would apply to the proposed development to the extent that any aspects of the development may affect these whales in Commonwealth marine waters.

Otherwise, the conservation of the resources of Smith Bay and surrounding State coastal waters is subject to the legislation addressed in Table 5-5.

TABLE 5-4 NATURAL RESOURCE MANAGEMENT LEGISLATION

Legislation	Purpose	Administering agency	Application to the development
Environment Protection and Biodiversity Conservation Act 1999 (Clth)	This Act provides for the environmental assessment of proposals that may have a significant impact on MNES. It also provides for the preparation of various plans relating to the recovery and management of threatened species and ecological communities.	DoEE	KIPT would comply with all approval conditions regarding the four species listed in the referral notice: • southern right whale • Kangaroo Island echidna • hooded plover (eastern) • southern brown bandicoot (eastern). A recovery plan exists for the southern right whale.KIPT would manage the construction and operation of the KI Seaport so as to minimise the risk of any consequential harm to southern right whales.
Native Vegetation Act 1991 (SA)	Native vegetation in South Australia may be cleared only with the approval of the Native Vegetation Council or, otherwise, in compliance with the Native Vegetation Regulations 2017.	The Native Vegetation Council, assisted by DEW	Any native vegetation clearance necessary at the site (including seagrass in Smith Bay) or required for roadside maintenance on timber transport routes would conform with the Act and Regulations.
National Parks and Wildlife Act 1972 (SA)	This Act is South Australia's primary nature conservation legislation. It establishes reserves and provides for their management. The Act designates plant and animal species as 'protected' species and it is an offence to 'take' such animals without a permit.	DEW	Three of the species identified in the referral notice under the EPBC Act (see above) are also protected under the National Parks and Wildlife Act. They are the southern right whale, hooded plover (eastern) and southern brown bandicoot (eastern). As marine mammals, whales have special protection under the Act's Regulations. KIPT would comply with all requirements of the Act.
Natural Resources Management Act 2004 (SA)	This Act is intended to achieve ecologically sustainable development of the State's land systems through the integrated management of water resources, soils and pest plants and animals. This objective is guided by the adoption of various natural resources management plans and water allocation plans. The current Kangaroo Island Natural Resources Management Plan was adopted in May 2017.	DEW and Natural Resources Management Boards	The Act would be unlikely to impose any obligations on KIPT critical to the development. However, KIPT would comply with any applicable obligations.

TABLE 5-5 MARINE CONSERVATION, FISHERIES AND AQUACULTURE LEGISLATION

Legislation	Purpose	Administering agency	Application to the development
Marine Parks Act 2007 (SA)	This Act aims to protect and conserve marine biological diversity and marine habitats in South Australia through the declaration and management of marine parks.	DEW	Smith Bay is not situated within a marine park declared under the Act. Encounter Marine Park lies east of Smith Bay and Southern Spencer Gulf Park lies to the west.
Fisheries Management Act 2007	This Act's purpose is to protect, manage, use and develop the State's aquatic resources consistent with principles of ecologically sustainable development. In addition to commercial fishery licensing, the Act permits the declaration of aquatic reserves.	Department of Primary Industries and Regions, South Australia (PIRSA)	Smith Bay is not within an aquatic reserve.
Aquaculture Act 2001 (SA)	This Act has been introduced to promote the development of ecologically sustainable marine and inland aquaculture in the State and to regulate this industry.	PIRSA	Three aquaculture licences have been issued under the Act in the western sector of Smith Bay, east of the development site. One is non-operational.

5.7 CULTURAL HERITAGE VALUES

A wide range of South Australian and Commonwealth legislation protects South Australia's Aboriginal and non-Aboriginal cultural heritage – artefacts, items and places (see Table 5-6). The concept of Aboriginal cultural heritage now encompasses recognition of native title over land and sea and the statutory processes associated with land title claims. No native title claims or Indigenous Land Use agreements (ILUAs) currently exist over the site area. There are no Aboriginal sites within the project area that are listed under the *Aboriginal Heritage Act 1988* (SA).

TABLE 5-6 CULTURAL HERITAGE LEGISLATION

Legislation	Purpose	Administering Agency	Application to the development
Aboriginal Heritage Act 1988 (SA)	This Act is designed to protect and preserve Aboriginal cultural heritage in South Australia. Pre-development assessment and consultation with Indigenous interests assists compliance with obligations not to damage, disturb or interfere with sites, objects or remains.	Department of the Premier and Cabinet (DPC)	KIPT has consulted with Indigenous interest groups to ensure compliance with the Act during construction and operation.
Native Title Act 1993 (Clth)	This Act recognises and protects native title and establishes mechanisms for dealing with activities affecting native title, for determining native title claims and for validating past acts that preceded recognition of native title.	Principally, the Commonwealth Attorney-General	There have been no successful native title claims over land on Kangaroo Island. Native title over the development site has been extinguished through its status as freehold land. However, native title over any Crown lands (including the waters of Smith Bay) associated with the development has not necessarily been extinguished. There are no existing or anticipated claims over Crown land (including waters) associated with the KI Seaport.
Native Title (South Australian) Act 1994	This Act complements and is consistent with the Commonwealth Native Title Act. However, native title claims are dealt with in the Federal Court under the Commonwealth Act. As an alternative to litigation, the State Government supports the negotiation of Indigenous Land Use Agreements (ILUAs).	South Australian Attorney-General	Native title over the site has been extinguished. No claims over Crown land (including the waters of Smith Bay) are anticipated.
Heritage Places Act 1993 (SA)	This Act is designed to identify, record and conserve places and objects of non-Aboriginal heritage significance. Damaging a state heritage place is an offence under the Act.	DEW	No heritage places or items directly associated with the site are entered on the State Heritage Register.
Historic Shipwrecks Act 1981 (SA)	This Act aims to protect certain shipwrecks and relics of historic significance in waters over which South Australia has jurisdiction.	DEW	The Act has limited application to Smith Bay. Any interference with a relic or shipwreck (other than on the shoreline) attributable to the proposed development would breach the Commonwealth Act (see below).
Historic Shipwrecks Act 1976 (Clth)	The purpose of the Act is to protect certain shipwrecks and relics of historic significance. Among other provisions, the Minister is required to keep an Australian Register of Historic Shipwrecks.	Commonwealth Minister for the Environment (and DEW, in part), as delegate of the Commonwealth Minister for the Environment	There is only one shipwreck relevant to Smith Bay (the Chum from 1942) listed on the Australian Register of Historic Shipwrecks. Any interference with this wreck as a consequence of construction or operation of the Smith Bay facility would breach the Act.

TABLE 5-7 HARBOR AND COASTAL MANAGEMENT LEGISLATION

Legislation	Purpose	Administering agency	Application to the development
Harbors and Navigation Act 1993 (SA)	This Act provides for the administration, development and management of harbours within South Australian waters and facilitates safe navigation.	DPTI	DPTI advise that the Smith Bay facility would become a port and harbor under the Act and therefore subject to relevant provisions of the Act and regulations.
Coast Protection Act 1972 (SA)	This Act provides for the conservation and protection of the South Australian coast. It addresses the issue of development and coastal processes through its Coast Protection Board Policy Document (see Section 5.3 above). Coast Protection Board policies are largely reflected in the Development Plan for Kangaroo Island, prepared under the Development Act.	Coast Protection Board	It is likely that the Minister would refer the Draft EIS to the Board for comment. KIPT would comply with any Major Development approval conditions regarding coastal processes and be guided by the relevant provisions of the Policy Document.

5.8 HARBOR MANAGEMENT AND COASTAL PROCESSES

The KI Seaport would be subject to legislation that regulates the development and management of ports and harbors and the navigation of South Australian coastal waters as well as legislation which governs a range of other coastal management issues. See Table 5-7 for this legislation.

5.9 BIOSECURITY – KANGAROO ISLAND

Biosecurity regulatory systems must be maintained to safeguard Kangaroo Island's agricultural, viticultural, horticultural and aquaculture industries and to protect the Island's biodiversity. Both Commonwealth and State legislation (see Table 5-8) address this issue.

5.10 CONCLUSION – KI SEAPORT AND ENVIRONMENTAL LAWS

The assessment, construction and operation of the proposed KI Seaport will attract a wide range of obligations under both South Australian and Commonwealth environmental legislation. They have been summarised above.

The preparation of the EIS is underpinned by KIPT's acknowledgment of its obligations to safeguard the environmental values of Kangaroo Island. Significant issues have been identified, associated risks assessed and environmental management strategies presented that will ensure compliance by KIPT with its obligations under environmental laws and protect the Island's valuable environmental qualities.

TABLE 5-8 BIOSECURITY LEGISLATION

Issue	Legislation	Purpose	Administering agency	Application to the development
Maritime activities	*Biosecurity Act 2015* (Clth)	This Act was established to manage diseases and pests that may harm humans, animals, plants and the environment. It is directed essentially to managing the likelihood of diseases or pests entering or becoming established in Australia.	Commonwealth Department of Agriculture and Water Resources (DAWR)	Goods and conveyances (vessels and aircraft) are subject to biosecurity control on entering Australian territory. Normally, ships must arrive at a 'first point of entry'. Smith Bay would not be a first point of entry. Ballast water[8] management (including discharge and exchange) is subject to the relevant provisions of the Act.
	Fisheries Management Act 2007 (SA)	This Act provides for the conservation and sustainable management of South Australia's aquatic resources and, broadly, the regulation of fishing within South Australia.	PIRSA	Without a permit, it is an offence under the Act to introduce or cause to be introduced into South Australia, noxious fish or aquatic plants by any means including via ballast water. Similarly, it is an offence to release 'exotic fish' into South Australian waters or to allow such fish to escape into state waters without a permit. It is also an offence to deposit exotic fish or exotic plants into South Australian waters without a permit.
Biofouling management	*Biosecurity Act 2015* (Clth)	See above.	See above.	The Act does not specifically address biofouling. However, DAWR utilises a range of powers under Chapter 4 of the Act (Managing Biosecurity Risks) to address the issue. A suite of Commonwealth guidelines contains information on management practices to minimise biosecurity risk from vessel biofouling. DAWR is investigating further biofouling management options for vessels arriving in Australian waters. Biofouling regulations are anticipated.

[8] 'Ballast water' means water with its suspended matter taken on board a ship to control the trim, list, draught, stability or stresses of the ship. Article 1, Annex, International Convention for the Control and Management of Ships' Ballast Water and Sediment 2004. This definition is adopted by the Commonwealth *Biosecurity Act 2015.*

TABLE 5-8 BIOSECURITY LEGISLATION (CONT'D)

Issue	Legislation	Purpose	Administering agency	Application to the development
	Environment Protection Act 1993 (SA)	See above.	EPA	The EPA's Code of Practice for Vessel and Facility Management (Marine and Inland Waters) applies to all vessels in South Australian coastal waters. It contains a series of mandatory and recommended practices to prevent and manage biofouling.
Terrestrial biosecurity	*Natural Resources Management Act 2004* (SA)	This Act is the principal State legislation for the control of pest plants and animals.	DEW and Regional Natural Resources Management Boards	In the construction and operational phases of the development KIPT would be subject to the provisions of the Act that control the introduction and management of declared pest plants and animals.
	Livestock Act 1997 (SA)	This Act regulates a wide range of matters regarding the livestock industry in South Australia.	PIRSA	The Act reserves Kangaroo Island for pure Ligurian bees and prohibits the introduction of other species of bees, second-hand beehives and second-hand apiary equipment. The Act is unlikely to have immediate application to the Smith Bay development. However, KIPT acknowledges its significance in protecting the Island's valuable bee industry.
	Plant Health Act 2009 (SA)	This Act protects agricultural plants from pests.	PIRSA	The Act is important in protecting the seed potato industry on the Island. KIPT could be affected by the provisions of the Act in certain circumstances: for example, the declaration of a quarantine area on the Island.

06. LAND USE AND PLANNING

Guideline		Comment
Section 3, page 6	In deciding whether the proposal will be approved and any conditions that will apply, the Governor must have regard to: • provisions of the appropriate Development Plan • the Development Act and Regulations • if relevant, the Building Code of Australia • The South Australian Planning Strategy, including the Integrated Land Use and Transport Plan • the EIS, Response Document and the Ministers Assessment Report • if relevant, the *Environment Protection Act 1993* • if relevant, the objects of the *Marine Parks Act 2007* • any other relevant government policy and/or legislation, including if relevant the *Fisheries Management Act 2007*	See Chapter 5 (for legislative aspects) and Section 6.3
Section 4, page 7	The *Development Act 1993* requires the EIS to state the consistency of the expected effects of the proposed development with the relevant Development Plan and Planning Strategy	See Section 6.3
Section 4, page 8	The description of the proposal should include the following information: • the relevant Development Plan zones.	See Section 6.3.3

06. LAND USE AND PLANNING

6.1 INTRODUCTION – SCOPE AND PURPOSE

This chapter summarises relevant land uses and tenure arrangements within the EIS study area and assesses the proposed development against the Kangaroo Island Plan, relevant development plans, and relevant planning policy and strategies. The chapter also identifies how the construction and operation of the proposed KI Seaport may affect how land within the study area can support envisaged future land uses.

The study area (or designated area) includes the land for which development approval is being sought for the construction and operation of the proposed wharf and supporting infrastructure at Smith Bay (see Appendix A5), plus other landholdings within the wider locality.

The study area includes land identified in the Government Gazette 23 February 2017 and comprises five defined Certificates of Title, road reserves and other land adjoining and servicing that land, and the marine waters adjoining or in the vicinity of the five titles. The onshore element of the designated area is outlined in Figure 6-1 below. There are no boundaries for the offshore elements.

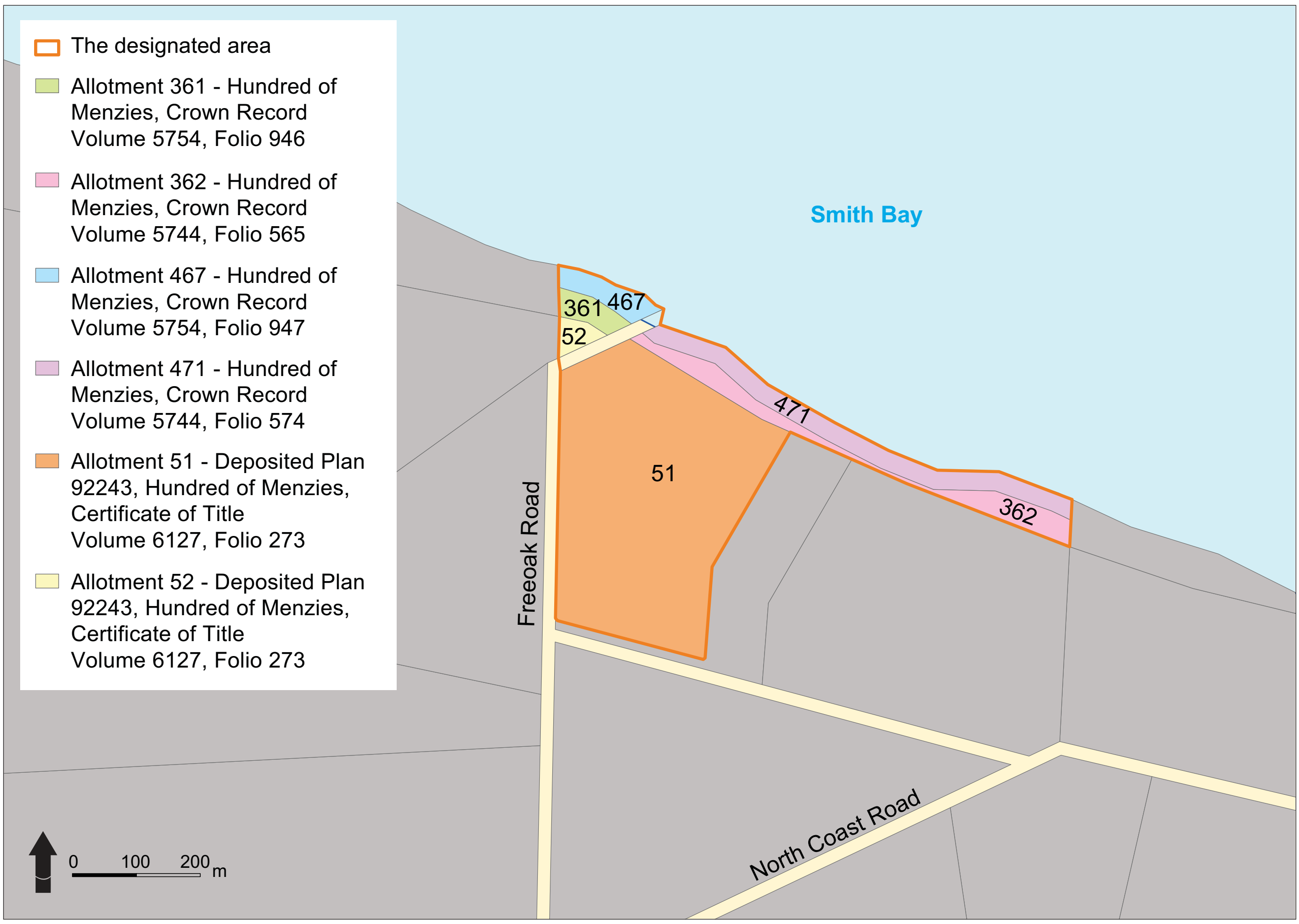


FIGURE 6-1 THE STUDY (OR DESIGNATED) AREA

6.2 LAND USE

6.2.1 ASSESSMENT METHODS

The existing land use and tenure within the study area was identified by a desktop review of:

- DAC's public register – Land Use (2010–present) and Land Division (2003–present)
- requests to Kangaroo Island Council for development application numbers and relevant details for land within the study area (includes applications from 1996 onwards)
- the PIRSA website <http://www.aginsight.sa.gov.au/?Bookmark=Ox473rlD> to identify all relevant aquaculture licences
- discussions with the Crown Lands Office and an examination of Crown leases over all Crown lands within the designated area
- all relevant titles and deposited plans, including detailed research into easements within the designated area, with copies of each easement document over the KIPT land obtained from the Land Services Group
- relevant land purchase contracts.

South Australian tenure and zoning information was obtained from Atlas SA, Lands Services and Lands Titles Office, and the Department of Planning and Local Government.

6.2.2 EXISTING TENURES

The existing environment comprises:

- four parcels of Crown land adjacent to the foreshore
- allotments 51 and 52, consisting primarily of vacant land accessed by Freeoak Road (a public road) from North Coast Road, with a small area of Allotment 52 developed with a single residence now known as Smith Bay House.

Remnant vegetation on this land has limited environmental or amenity benefits.

The onshore physical and ecological marine and terrestrial environment is fully analysed in Chapter 12 – Marine Ecology, Chapter 13 – Terrestrial Ecology and Chapter 16 – Geology, Soils and Water.

6.2.3 EASEMENTS

The designated area is subject to several easements (refer to Appendix A5), as detailed below. KI Seaport's onshore wharf infrastructure has been designed to ensure the rights conferred by these easements are not compromised.

Easement A

Easement A authorises ETSA and its successors:

a) to enter upon and pass either with or without motor or other vehicles laden or unladen along or over the subject land

b) to erect and lay on the subject land poles, towers, conductors and other works for the transmission of electricity and to inspect, repair, alter, remove and replace the same

c) to transmit electricity by means of such works.

Easements B and C

Easement B is in favour of Lot 50 (the land immediately adjoining the designated area to the east). The easement's purpose is 'for the return seawater drainage infrastructure and settlement dam associated with the former aquaculture activity on that land and relevant licensing'.

The scope of the easement extends to pipeline construction and maintenance, and to the maintenance, use and possible construction or rebuilding of a dam on the KIPT land that is subject to the easement.

Easement C, located at the northern boundary of Allotment 50, favours KIPT as the registered proprietor of Lot 51, and was created for 'the transmission of electricity by underground cable'.

Easement J

The easement is worded as follows:

> The applicant grants to the proprietor for the time being of Pieces 10 and 11 in DP (Deposited Plan) 58423 and their respective servants, agents, contractors and any person authorised by such proprietors for the time being at any time:
>
> a) to suspend cables across the land marked J in DP 58423 ('Subject Land') and construct supports for those cables
>
> b) to lay under the surface of the Subject Land ducts, pipes and cables
>
> c) to use the cables for the purpose of transmitting electricity
>
> d) to break the surface of, dig, open up and use the Subject Land for any of those purposes
>
> e) to enter the Subject Land at any time (if necessary with vehicles and equipment) for any of those purposes.

As the subsequent registered proprietor of the land, KIPT retains the benefit of Easement J, which is depicted as being located on land held by Yumbah (the proprietor of a land-based abalone farm adjoining the KI Seaport site) in DP 92343.

6.2.4 EXISTING LAND USES

Land uses on and within the vicinity of the study area, as outlined in the Australian Land Use and Management (ALUM) Classification Version 8 are:

- 'intensive animal production' on and immediately adjacent to the site (resulting from previous aquaculture operations)
- 'grazing modified pastures' adjacent to the site
- 'managed resource protection' adjacent to the site along the coastline.

Figure 6-2 show land uses from the ALUM Classification Version 8 database, which may not identify all current uses of land in proximity to the site.

An inspection of the site indicates that:

- the site itself is predominantly vacant land (with remnants of former aquaculture operations), with a wastewater dam and associated pipeline/pumps servicing the former abalone farming operation via an easement (easement B described in Section 6.2.3), and a single dwelling and associated water tanks and shedding, which is known as Smith Bay House and is used for short-stay accommodation
- fishing and recreational boating occurs in marine waters adjacent to the site
- sheep grazing and cropping occurs on the land to the west, south-west and south of the site
- Yumbah's operation is to the east (main facilities comprising numerous tanks, shedding, pump sheds, pipelines and associated infrastructure), and surrounding cropping activities within and outside their land (Figure 6-2 shows cropping activity only on the eastern allotment, but cropping was also observed on the western block).

Yumbah acquired Lot 50 (in March 2018) after the EIS declaration. Lot 50 is the land immediately to the east and south (access and track from Freeoak Road) of the study area and benefits from Easement B. Currently this land is vacant (with remnants of the former aquaculture operations). Yumbah Aquaculture has not yet commenced any aquaculture operations on that site, although it is licensed for that purpose under the Aquaculture Act and zoned for 'intensive animal production, as shown in Figure 6-2.

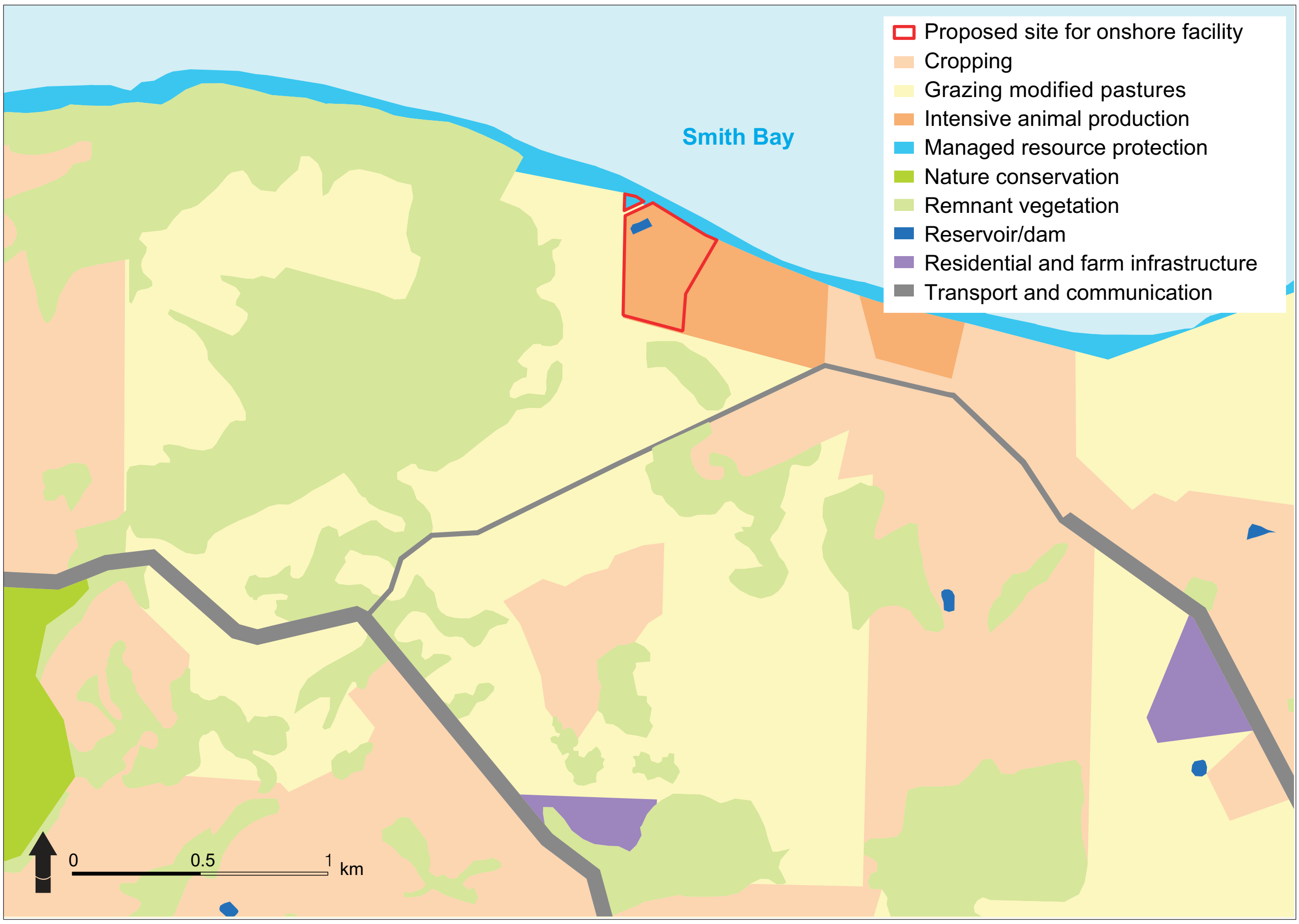


FIGURE 6-2 LAND USES

6.2.5 EXISTING LAND TENURE

The study area includes the following major tenure types:

- Crown land or South Australian Government land (other than pastoral leases)
- freehold land (including local government land).

Figure 6-3 shows land tenure within the study area.

6.2.6 STATE OR CROWN LAND

There are several sections of Crown land under the custody of the Minister for Sustainability, Environment and Conservation north of the onshore designated area.

The predecessor of the Department for Environment and Water issued Kangaroo Island Abalone Pty Ltd with a non-exclusive licence to occupy coastal Crown land within the designated area (Licence to Occupy Number OL21749) under the *Crown Lands Act 1999*. The licence took effect on 1 July 1996. It is assumed that it has been renewed, as required, and remains valid. Licence number OL021749 is noted on both Crown records that relate to Crown land north of Yumbah's land.

The licence is for the purpose of 'pump and pipeline' and appears to facilitate the construction and maintenance of pumps and pipelines associated with Yumbah's operations. This licence is subject to a number of standard conditions.

6.2.7 AQUACULTURE LICENCES

Aquaculture Licence FT00634 has been issued over the land adjoining the site to the east. The licence took effect on 1 July 2018 and will expire on 30 June 2021. The holder of the licence has an option to renew the licence.

Aquaculture licences FT00558 and FT00702 have been granted over land east of the designated area, permitting farming using 'tanks':

- Licence FT00558 was issued on 24 July 1995 and expires on 30 March 2021
- Licence FT00702 was issued on 23 August 2005 and expires on 30 March 2021.

The licences are subject to standard conditions and include the right to apply for renewal under the *Aquaculture Act 2001* (SA). The location of each of the licences is shown on Figure 6-4.

The impacts of the proposed development on the existing aquaculture operations have been considered in Chapter 11 – Land-Based Aquaculture.

FIGURE 6-3 LAND TENURE

6.3 STATE STATUTORY PLANNING FRAMEWORK

The *Planning, Development and Infrastructure Act 2016* will replace the *Development Act 1993* in stages over a five-year period. Prior to the implementation of the Planning, Development and Infrastructure Act, a further bill will be introduced into Parliament to provide for transitional arrangements, consequential amendments and related implementation measures. The bill has not yet been considered by Parliament.

The KI Seaport proposal will be assessed using the EIA provisions of the former Development Act see Table 5-1.

The 1993 Act and Development Regulations, however, currently provide the statutory basis for South Australia's land use planning and development control system, and apply to the assessment of the proposed KI Seaport.

As noted in Chapter 5 – Legislative Framework, any EIS prepared under the Development Act must contain a statement of the extent to which the expected effects of the development are consistent with the Planning Strategy (Kangaroo Island Plan) and relevant Development Plan, respectively, prepared under the Act. Accordingly, this chapter refers specifically to the relevant principles and objectives of the Kangaroo Island Plan (which is one of seven regional volumes that, together with the 30-Year Plan for Greater Adelaide, comprise the South Australian Planning Strategy), the Kangaroo Island Council Development Plan 2015 (KIDP) and the Out of Council Areas (Coastal Waters) Development Plan, as they apply to the proposed KI Seaport.

6.3.1 DEVELOPMENT PLANS RELEVANT TO THE SITE

The proposed development would be within the boundaries of two development plans: the KIDP and the Land Not Within a Council Area (Coastal Waters) Development Plan (DPTI 2017).

The onshore elements of the development are within the Coastal Conservation Zone (CCZ) of the KIDP and offshore elements are within an unzoned area of the Land Not Within a Council Area (Coastal Waters) Development Plan. Council-wide provisions from both development plans are relevant to the assessment of the proposal.

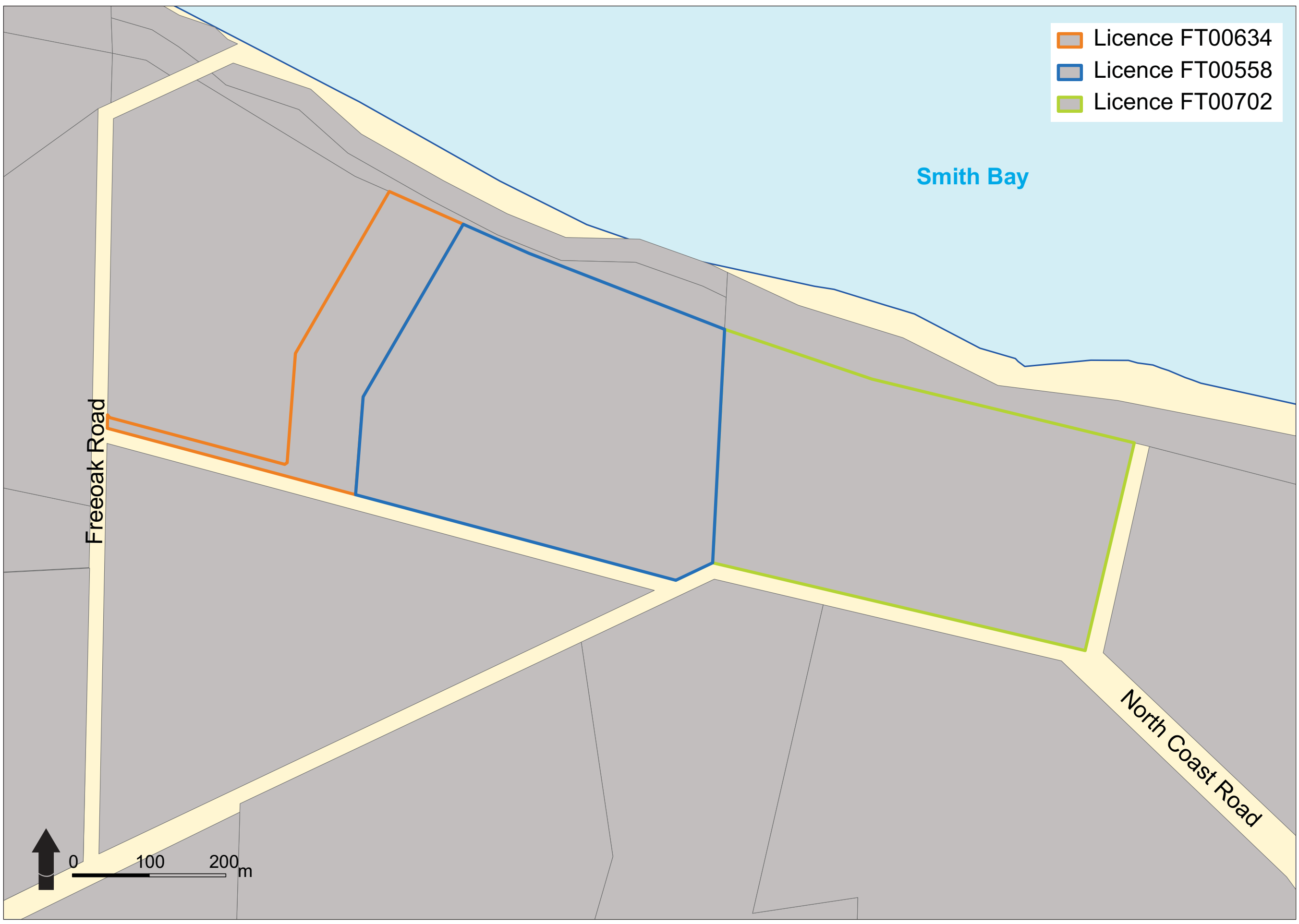


FIGURE 6-4 AQUACULTURE LICENCES

TABLE 6-1 ASSESSMENT OF THE DEVELOPMENT AGAINST THE KANGAROO ISLAND PLAN

Kangaroo Island Plan goals	Relevance to the EIS
Principle 1 Recognise, protect and restore Kangaroo Island's environmental assets. **Policies** 1.5 Protect natural coastal, marine and estuarine areas of high conservation, landscape or environmental significance by limiting development in these areas. Development may require such a location in limited circumstances – for example, a tourism development of state significance – in which case the development's social and economic benefits must be shown to outweigh the environmental and amenity impacts.	A number of potentially suitable locations for the KI Seaport were reviewed based on set criteria, and the Smith Bay site was chosen in part because it best reflects Principle 1.5. See Chapter 3 – Project Alternatives.
Principle 1 Recognise, protect and restore Kangaroo Island's environmental assets. **Policies** 1.9 Recognise areas of high biodiversity value, and locate and design development to prevent the loss, degradation and/or fragmentation of native vegetation and any loss of species and/or ecological communities.	A comprehensive review of marine and terrestrial ecology and matters of national environmental significance (MNES) within the Smith Bay locality has been undertaken and is discussed in Chapter 12 – Marine Ecology, Chapter 13 – Terrestrial Ecology and Chapter 14 – MNES. The location has been selected as the preferred site for a port facility as it is not an area of significant or high biodiversity value. Native vegetation at the onshore location is limited due to historical activities and degradation, and the marine communities are primarily associated with seagrass, which is extensive across Smith Bay. Construction of the wharf would not cause regional degradation of native vegetation or regional loss of any marine communities. Any loss would be offset and a commitment to do so is discussed below.
Principle 1 Recognise, protect and restore Kangaroo Island's environmental assets. **Policies** 1.11 Avoid any impact on biodiversity, where possible; if impact is unavoidable, it should be minimised and offset. A comprehensive offset scheme, based on existing offset provisions and drawing on models such as bio-banking, will be developed to provide for a net gain to biodiversity through flexible offsets. The offsets could be made across regions or by funding designated rehabilitation programs. The scheme will also encourage carbon offsets.	An overview of all environmental offsets is presented in Chapter 12 – Marine Ecology, Chapter 13 – Terrestrial Ecology and Chapter – 14 MNES.
Principle 1 Recognise, protect and restore Kangaroo Island's environmental assets. **Policies** 1.13 Acknowledge, protect and manage areas of significant landscape and amenity value (particularly coastal – see 'Scenic landscape' areas on Maps C1 and D1) and areas that form attractive backgrounds and entrances to towns and tourist developments.	The Smith Bay location is not an area of significant landscape or amenity value, in part because it has already been developed for large-scale onshore aquaculture. Consequently, and due to its distance from settlements, the locality does not form attractive background or entrances to towns or tourist developments. Visual amenity is discussed in Chapter 23.

TABLE 6-1 ASSESSMENT OF THE DEVELOPMENT AGAINST THE KANGAROO ISLAND PLAN (CONT'D)

Kangaroo Island Plan goals	Relevance to the EIS
Principle 1 Recognise, protect and restore Kangaroo Island's environmental assets. **Policies** 1.14 Avoid development in areas with significant landscapes that can be viewed from tourist routes, walking trails, the beach or the sea, unless the development requires such a location (such as a development of state significance), in which case the scale, height, design and siting of buildings must: - protect views to, from and along the ocean and scenic coastal areas - minimise the alteration of natural landforms - be visually compatible with the character of surrounding areas - restore and enhance visual quality in visually degraded areas, where feasible.	The Smith Bay location has historically been used for land-based aquaculture and, before that, for farming. Short-stay tourism accommodation in the area is limited to Molly's Run and Smith Bay House. Both overlook the Smith Bay area and the development site. Smith Bay House, which is owned by the proponent, would be demolished as part of the proposed development. Molly's Run which is surrounded by shelter trees, more directly overlooks the Yumbah facility. All structures associated with the proposed wharf would be designed to minimise their visual impact on the locality. KIPT owns additional land surrounding the proposed development which would be used, among other things, to provide buffers of native vegetation or purposeful landscaping. Chapter 23 – Visual Amenity provides an overview of visual changes to Smith Bay as a result of the proposed development and assesses these impacts.
Principle 1 Recognise, protect and restore Kangaroo Island's environmental assets. **Policies** 1.15 Avoid adverse impacts of development on landscapes through site selection and design alternatives. Note that landscape screening to mitigate the visual impacts of development is not a substitute for re-siting or redesign.	Alternative locations have been considered and are explained in Chapter 3 – Project Alternatives. A detailed assessment of the existing landscape amenity is discussed in Chapter 23 – Visual Amenity. The landscaping proposed in association with the proposed development would improve the amenity of the locality when compared to the existing site (see Appendix J1).
Principle 2 Protect people, property and the environment from exposure to hazards. **Policies** 2.1 Design and plan development to prevent the creation of hazards and to avoid naturally occurring hazards.	Sea level rise and hazard management have been addressed in Chapter 19 – Climate Change and Sustainability.

6.3.2 KANGAROO ISLAND PLAN (PLANNING STRATEGY)

The Kangaroo Island Plan (a volume of the South Australian Planning Strategy) (DPLG2011) guides future land use and development. Its key objectives include:

- attracting jobs and investment
- diversifying the economic base
- enhancing the attractiveness of the region to a diverse range of businesses
- retaining people in the region
- attracting more young Australians and foreigners to live on the Island.

The KI Seaport proposal has been assessed against the goals of the Kangaroo Island Plan (see Table 6-1).

6.3.3 THE KANGAROO ISLAND COUNCIL DEVELOPMENT PLAN

State strategic setting

The Kangaroo Island Council Development Plan 2015 (KIDP) favours or encourages economic initiatives and employment opportunities that support a robust and sustainable economic climate on the Island, which in turn contributes to the wellbeing of the local community.

In this context, the proposed development would provide critical infrastructure for, in the immediate term, bulk timber exports that currently are not possible, and, in the longer term, critical infrastructure which would potentially benefit other users and products.

Large-scale timber plantations on Kangaroo Island were established as a consequence of deliberate decisions by the South Australian government and the Kangaroo Island Council to facilitate the development of a new industry on the Island. The facility would allow the benefits of this government policy to be realised with the export of timber products to markets in Asia.

Zone provisions

The following zone provisions from the KIDP are relevant to the assessment of the proposed KI Seaport:

Coastal Conservation Zone

Objectives: 1, 2, 4

Desired Character Statement

Principles of Development Control: 1, 2, 3, 5, 6, 7, 8, 9, 11

The Coastal Conservation Zone (CCZ) Desired Character Statement seeks to preserve the natural features and scenic value of the coast and aims to ensure that development does not harm coastal dune systems, tidal wetlands, mangroves or other environmentally sensitive areas.

The proposed development would be on the north coast of Kangaroo Island and accessed by Freeoak Road, a public road that connects Smith Bay with North Coast Road. The development site has been mostly cleared of native vegetation and its natural visual amenity is affected by existing and former land-based abalone aquaculture operations. Smith Bay House has been used by KIPT for short-stay, small-scale tourism accommodation and is now used by KIPT for project and company short stays.

Council-wide provisions

The following General Development Plan provisions are relevant to the assessment of the wharf and associated infrastructure.

Bulk handling and storage facilities

Objectives: 1

Principles of Development Control: 1, 2, 3, 4

The bulk handling and storage facilities provisions seek to ensure that facilities minimise adverse impacts on both the receiving environment and affected transport networks. All marshalling, storage areas and internal roads would be designed to minimise impacts on the nearby road network and be managed to minimise air pollution associated with dust.

Coastal areas

Objectives: 1, 2, 3, 4, 5, 6

Principles of Development Control: 1, 2, 3, 4, 5, 9, 10, 13, 16, 17, 18, 19, 27, 28

The coastal areas provisions seek to ensure that development near the coast preserves the visual amenity of the natural environment, retains native vegetation and does not occur in locations subject to flooding or rising sea level. These provisions also recognise that existing aquaculture should be protected and public access maintained.

The proposed deep-water port facility would further develop the Smith Bay area and change its visual amenity. While the site's land area has minimal native vegetation, marine native vegetation (seagrass) would be affected where the seabed was disturbed to construct the causeway and the dredge pocket.

The facility's design considers natural flooding and the potential for rising sea level.

The neighbouring aquaculture operation forms the basis for scopes of work undertaken for marine surveys, studies, modelling and impact assessment. Management and mitigation measures have been devised for the proposed development to protect these operations.

Public access would be restricted along the northern part of Freeoak Road, and to some parts of the coastline and waters within Smith Bay. General public access to Smith Bay would be maintained from other public roads and from the Emu Bay public boat ramp.

Design and appearance

Objectives: 1, 2

Principles of Development Control: 2, 3, 5, 7, 11, 14, 18

The KIDP includes policy objectives for achieving a high standard in the design and appearance of buildings and structures. All structures associated with the wharf facility would be designed to have a minimal visual impact on the locality, as much as it was reasonably practicable. This would be supported by well-sited plantings (see Appendix J1). The chip stockpile, when full, would be visible from a number of vantage points, see Chapter 23 – Visual Amenity for more information.

All internal roads, timber storage areas and infrastructure would be designed and built to minimise visual impact. All buildings and infrastructure would be painted in colours to blend with the natural landscape.

Hazards

Objectives: 1, 2, 3, 4, 6, 8

Principles of Development Control: 1, 2, 3, 4, 5, 6, 7, 8

The KIDP promotes hazard minimisation through measures such as locating development outside hazardous areas and managing hazards appropriately.

All hazards such as erosion, tidal movement, flood and bushfire would be managed through engineering solutions or by implementing management plans where applicable (see Chapter 25 – Management of Hazard and Risk and Chapter 26 – Environmental Management Framework). Erosion and tidal movement would be managed by locating infrastructure outside erosion areas. Construction would incorporate floor levels well above sea level.

Infrastructure

Objectives: 1, 4

Principles of Development Control: 2, 3, 4, 9

The infrastructure provisions of the KIDP seek to ensure that the visual impact of infrastructure is minimised and that development does not occur without appropriate infrastructure.

The KI Seaport would be developed in a coordinated manner, with onshore and offshore infrastructure established and commissioned before port operations began.

Interface between land uses

Objectives: 1, 3

Principles of Development Control: 1, 2, 7, 8, 11

These provisions emphasise improving the interface between different land uses and minimising the effects of development on other locations nearby. Air quality, noise, vibration, light spill, hours of operation and traffic are all identified as potential nuisances that may affect how adjoining land is used in the future.

The existing environment has been assessed, sensitive receptors identified, and impact assessment undertaken for environmental aspects associated with the proposed development including how the proposed development interfaces with existing land uses. Chapter 8 – Key Issues provides an overview of key issues and how they have been prioritised for the impact assessment. Chapters 9 to 24 outline impact assessments for various aspects and Chapter 25 – Management of Hazard and Risk outlines the residual risk for potential impacts with appropriate management and mitigation measures implemented. Chapter 26 – Environmental Management Framework provides the framework for ensuring appropriate management and monitoring for KI Seaport.

Natural resources

Objectives: 1, 2, 3, 6, 8, 13

Principles of Development Control: 1, 2, 3, 4, 27, 28, 29, 33

A key objective of the KIDP is to retain, protect and restore natural resources and the environment.

All of the Smith Bay facilities would be sited and designed to protect the scenic and environmental qualities of the landscape as much as it was reasonably practicable to do so.

Transportation and access

Objectives: 1, 2, 5

Principles of Development Control: 1, 2, 8, 12, 13, 21

The KIDP nominates a series of objectives to foster safe and convenient vehicle movement via a road hierarchy that promotes efficient transportation.

Various studies associated with traffic and transport, and a Traffic Impact Assessment, have been undertaken for the proposed development (see Chapter 21 – Traffic and Transport). Negotiations between the proponent, the Kangaroo Island Council and the South Australian Government are progressing to ensure that impacts to safety and convenience are minimised. A transport management plan would be prepared to minimise the impact on the Kangaroo Island road network and on other road users.

Non-complying development

A port or export facility is not specifically identified in the KIDP as a non-complying development within the CCZ. Such facilities, of necessity, are located on the coast. However, elements of the facility – such as the set-down and timber storage areas which could be defined as a road transport terminal – would be categorised as non-complying development in the zone.

6.3.4 LAND NOT WITHIN A COUNCIL AREA (COASTAL WATERS) DEVELOPMENT PLAN

The offshore infrastructure would be located within the boundaries of this Development Plan, which seeks to preserve environmentally significant areas and ensure development does not detract from or reduce the ecological, economic, heritage, cultural, scientific, environmental or educational importance of a site. The provisions of the Development Plan discussed below are relevant to the assessment of the wharf.

Coastal waters

Objectives: 1, 3, 4, 8, 10, 11, 12, 13, 14, 15, 16

Coastal development

Objectives: 21, 22, 23, 24, 25, 26, 27, 28, 29, 30

Principles of Development Control: 2, 4, 5, 10, 14, 15

These objectives promote development that will not result in erosion or pollution of marine waters and seek to ensure that development avoids impacts on:

- national parks
- conservation parks
- conservation reserves
- marine parks and recreation reserves
- Indigenous, non-Indigenous and natural heritage sites, including shipwrecks
- sites of scientific importance, including geological monuments and habitats of rare species
- mineral reserves
- areas valued for their outstanding beauty or amenity.

The proposed site for the KI Seaport:

- is not within any national park, conservation park or reserve, or marine park or reserve
- does not have any listed heritage sites
- does not have sites of scientific importance or geological monuments
- does not support habitats of rare species
- does not contain known mineral reserves
- is not valued for outstanding beauty or amenity.

The KI Seaport is considered compliant with objectives of the Development Plan (Land Not Within a Council Area) with the exception of being an area where a shipwreck has been recorded (albeit the likelihood of it remaining is considered low given the details available).

Chapter 9 – Marine Water Quality outlines the assessment and management of any pollution to the marine environment.

Chapter 16 – Geology, Soils and Water outlines the assessment and management of any erosion, and land-based pollution to the marine environment.

Chapter 24 – Heritage outlines the assessment of Indigenous, non-Indigenous and natural heritage, including shipwrecks. Appropriate measures for avoiding impacts, are summarised in Chapter 26 – Environmental Management Framework.

The coastal waters Principles of Development Control also seek to ensure that offshore development blends visually with the environment and has a low profile; is constructed of non-reflective materials; uses only uniform, subdued colours suited to and in keeping with the local surrounding features; ensures that design and location of structures is in relation to surrounding features; positions structures so they protrude the minimum distance practicable above water; and avoids jeopardising visual amenity by incorporating unnecessary shelters and structures above cages and platforms.

The offshore infrastructure would be required to support large vessels (Handymax and Panamax size) and would result in major visual amenity changes for Smith Bay. The engineering design would incorporate features and finishes to ensure visual amenity impacts were minimised.

Maintenance of public access

Principles of Development Control: 20, 21, 22, 23

In the interests of public safety and security, public access to the proposed wharf and a small section of the coast would be restricted during the construction phase and wharf operations.

There would be long-term restrictions on public access to areas associated with the proposed development. However, the public can use other roads from North Coast Road to access Smith Bay, which is also accessible from nearby public boat ramps. If the development was approved, exclusion zones would be created with the establishment of the port (and under the Harbors and Navigation Regulations, a harbor).

Hazard risk minimisation

Principles of Development Control: 27, 28, 30, 32, 37

Each element of KI Seaport would be designed to ensure that visual, safety, security and environmental impacts were minimised. The Smith Bay site was chosen to minimise impacts to existing environments and values and optimise safety for berthed ships. The design of the proposed wharf and supporting onshore facilities takes into account the expected rise of sea levels. Risks have been identified and considered in Chapter 25 – Management of Hazard and Risk.

Protection of physical and economic resources

Principles of Development Control: 39, 40

The provisions to protect physical and economic resources aim to ensure that any developments minimise conflicts between tourism and aquaculture. Chapter 8 – Key Issues outlines the priorities for impact assessment. Chapters 9 to 24 outline impact assessments for aspects relevant to the proposed development. Chapter 25 – Management of Hazard and Risk outlines the risk assessment undertaken for the proposed development and Chapter 26 – Environmental Management Framework outlines the management framework and includes any specific plans to ensure impacts are avoided or minimised as much as reasonably possible and risks are managed.

Natural Resources

Objectives: 39, 47, 49

Principles of Development Control: 101, 102, 103, 109

These provisions encourage the retention, protection and restoration of natural resources and the environment.

KI Seaport would retain and protect terrestrial and marine environmental values and restore to a more natural state land not required for the operational areas of the onshore facility. Offset programs and strategies for unavoidable impacts or potential impacts of unknown consequences would ensure that natural resources and the environment in areas close to the site or elsewhere on Kangaroo Island were retained, protected or restored.

Guideline		Comments
1.6	Describe all the relevant impacts the proposal may have on the above listed MNES, include impacts during the construction (e.g. noise, habitat clearing or modification), operation (e.g. potential vehicle/vessel strike during road/shipping transport of timber product) and (if relevant) decommissioning phases of the project. Include information on…how Indigenous stakeholders views of the proposal's impacts to biodiversity and cultural heritage have been sought and considered.	See Chapter 14 and Section 7.3
1.16	Describe any consultation about the action, including any consultation that has already taken place, proposed consultation about relevant impacts of the action and – if there has been consultation about the proposed action – any documented response to, or result of, the consultation. Identify any affected parties, including a statement mentioning any communities that may be affected and describing their views.	Same as Guideline 8.07a See Sections 7.3, 7.7 and 7.8.1
1.18	Provide … details of any public and stakeholder consultation activities, including the outcomes.	Same as Guideline 8.07a See Sections 7.3 and 7.7
8.4	... Include details of discussions had with housing industry/suppliers, Kangaroo Island Council and/or Renewal SA in relation to this issue *{short- and medium-term rentals for construction employees, as well as affordable housing options for longer term employees}*.	See Chapter 20, Sections 7.3 and 7.7
8.7	Describe the consultation strategy adopted in the preparation of the EIS and identify the groups and individuals from whom comments will be sought to make written submissions in relation to the proposal.	See Sections 7.3, 7.7 and 7.8.1

Guideline		Comments
16.1	Describe the measures taken in consultation with the Department of State Development Aboriginal Affairs and Reconciliation (DSD-AAR) to identify the Aboriginal heritage in the project and surrounding area, including the outcomes of … • discussion with the relevant Traditional Owners, Aboriginal Organisations and interested Aboriginal parties …	DSD-AAR consulted for Register information – see Chapter 24 – Heritage See Section 7.3 for an overview of the strategy and approach adopted for engaging with stakeholders, including any indigenous stakeholders See Section 7.7 for an overview of engagement results with DSD-AAR and discussions with those who have asserted an interest relevant to the proposed development
16.2	Provide information on how the proposal is not in conflict with the distinct beliefs or cultural practices of the relevant Traditional Owners, Aboriginal Organisations or interested Aboriginal parties.	See Chapter 24 – Heritage, which outlines the disconnect of Traditional Owners with Kangaroo Island See Section 7.8.1 outlining which Aboriginal organisations and interested Aboriginal parties exist and Section 7.6 outlines consultation efforts with them

07. STAKEHOLDER CONSULTATION AND ENGAGEMENT

7.1 INTRODUCTION

KIPT and Environmental Projects have consulted and engaged with various stakeholders during the preparation of the Draft EIS.

This chapter provides an overview of these efforts and a plan for ongoing stakeholder engagement for the proposed development.

The strategy and approach adopted (see Section 7.3) will allow time and opportunity for stakeholders' views to be received and properly considered as the design and operational aspects for KI Seaport are further developed and refined.

7.2 REGIONAL SETTING

Kangaroo Island currently has a small (fewer than 5000) and ageing population. The predominant economic influences are primary industry (including exports of wool, grain, livestock and seafood), tourism and the public sector (including state and local government services). Further detail of Kangaroo Island's socio-economic environment is provided in Chapter – 20 Economic Assessment and Chapter 22 – Social Environment.

A number of major developments for Kangaroo Island have recently been announced, or begun, including:

- a $35 million resort development at American River, authorised on 27 January 2017
- a $30 million golf course, clubhouse and resort at Pennington Bay, initially authorised on 18 February 2016. A variation to the development authorisation was approved by the Minister for Planning in early June 2017
- an $18 million upgrade of Kangaroo Island Airport now complete
- a $25 million installation of a new 33 kV submarine cable from Fishery Beach to Cuttlefish Bay, underway.

The proposed KI Seaport development has a current estimated capital value of $40 million.

7.3 STRATEGY AND APPROACH

7.3.1 KIPT

KIPT acknowledges the importance of being an active member of Kangaroo Island's community and is committed to developing a sustainable timber business that considers and responds to community needs. KIPT is a longstanding member of Business KI (the local chamber of commerce) and of the KI Industry and Brand Alliance.

In May 2017, KIPT appointed a Kangaroo Island resident as Director of Community Engagement, with the key responsibilities of:

- seeking and understanding community concerns
- providing project information to the community
- ensuring KIPT can provide feedback
- promoting effective collaboration and cooperation.

KIPT has developed and implemented a comprehensive stakeholder consultation and engagement strategy which includes:

- community engagement, such as participating in the Kangaroo Island Field Day, Agriculture KI conference, Commissioner's Expo, Parndana Show and Kingscote Show; giving presentations to business and industry associations as well as specialty groups, such as KI Road Safety Committee; conducting public surveys; distributing newsletters; submitting articles for The Islander newspaper; providing regular news updates to website subscribers; and actively working with the community on matters contained in the Draft EIS, as well as other subjects such as forestry, freight, housing, skills and training
- investor relations as part of KIPT's charter and obligations, as a publicly ASX-listed company, to maintain ongoing dialogue with investors and promote effective and timely dissemination of information to them, including through:
  - corporate communications such as financial reporting, announcements, shareholder circulars and other disclosures through the ASX, plus presentations, publications and media releases

- a corporate website <www.kipt.com.au> where updated corporate and other information is available to the public
- shareholder meetings and a shareholder enquiries portal.

Other aspects of KIPT's engagement strategy, which are marketing and public relations activities, include:

- sponsorships, such as contributing to various community funds, environmental programs, art exhibitions, sports teams and community events
- establishing and managing a KIPT office in the main street of Kingscote which is open to the public
- engaging with local, State and Commonwealth governments
- providing access to its forestry plantations for community groups investigating and preserving wildlife, and other groups committed to feral animal control
- providing information and services, such as valuations, to the 12 independent timber growers on the Island.

The Director of Community Engagement, and other members of KIPT's executive team, have identified opportunities for local contractors and businesses to perform services and works for both the construction and operations phases of KIPT's operation.

7.3.2 ENVIRONMENTAL PROJECTS (EIS STUDY TEAM)

Environmental Projects has adopted an 'inform and consult' approach to stakeholder consultation and engagement:

- Inform: providing balanced and objective information to help stakeholders understand the proposed development, the EIS work, the approvals process and the opportunities for stakeholders to provide feedback.
- Consult: obtaining feedback about the proposal which can be considered as part of the EIS, and identifying stakeholders who should be approached to provide formal written submissions during the public consultation process.

Separately and independently of KIPT, Environmental Projects has undertaken its own stakeholder and community engagement activities, which include:

- developing, maintaining and monitoring the EIS website <www.smithbayeis.com>.
- providing on the website information in the form of fact sheets and notices on the processes and scope of the EIS, and findings of studies and surveys undertaken as part of the EIS
- convening a Stakeholder Reference Group (SRG), facilitating a workshop to obtain their views, and continuing to engage with participants
- working with neighbours of the development site to provide site access for various studies/surveys, requesting and providing information and recording concerns and feedback
- identifying whether traditional owners exist and consulting with Indigenous stakeholders and other Aboriginal organisations or groups
- distributing postcards that welcome feedback, while publicising the EIS website
- replying to questions emailed via the website or otherwise raised (and referred on) as a result of KIPT's own engagement efforts
- engaging with government officers at the assessment level of various government agencies and departments as part of preparing the Draft EIS
- working with KIPT to understand concerns raised during the company's engagement and consultation with the community, industry, business and government.

The purpose of the EIS team's engagement process is to:

- interpret the guidelines issued by the South Australian Government for preparation of the Draft EIS
- ensure impact assessment studies and data collection do not impact neighbours of the Smith Bay site
- explain the EIS process, the details of the proposed development and how the community can comment
- obtain early feedback on the proposed development which can be considered in preparation of the Draft EIS
- identify which key stakeholders should be invited to comment on the proposal.

7.4 IDENTIFIED STAKEHOLDERS

The KI Seaport development would affect stakeholders beyond the immediate vicinity of the development site, which means ongoing stakeholder consultation will be important for all aspects of KIPT's operations.

Apart from the involvement of business, industry and the community, all levels of government have an interest in the proposal:

- the Kangaroo Island Council has an interest in understanding how the development relates to the provisions of the Development Plan, its impact on the community, and its impact on infrastructure and services which the Council provides on the Island, especially the local road network
- the Department of Planning, Transport and Infrastructure (DPTI), the central agency responsible for the State Government's approvals process, which coordinated relevant state and Commonwealth agencies to develop the guidelines, will assess the Draft EIS against those guidelines and the relevant legislation and regulations, collate the development conditions imposed and prepare the Assessment Report for the Minister
- other state government departments and agencies, which prepared specific input into the guidelines for the Draft EIS, and will provide advice to DPTI in the assessment of the proposed development
- Commonwealth agencies, which will assess the proposed development against the provisions of the Environment Protection and Biodiversity Conservation Act.

At Smith Bay, site construction and operation activities would affect:

- direct neighbours:
  - Yumbah, located to the east
  - the Crown as a landholder to the west, with other western land adjacent to the development site owned by KIPT
  - a freehold landholder to the south-west whose land is used for grazing/cropping and family/private holiday stays
  - a freehold landholder to the south on land used for grazing/cropping.
- near-neighbours on the opposite side of North Coast Road (beyond the southerly neighbours) who include:
  - a freehold landholder to the south and south-west, on land used for grazing/cropping
  - a freehold landholder to the south-east, who provides tourist accommodation (Molly's Run).

7.5 STATUTORY PUBLIC AND AGENCY CONSULTATION

The formal public and agency consultation on the proposed development will immediately follow the public release of the Draft EIS by the Minister for Planning. The public exhibition period would be a minimum of 30 business days, during which time there will be at least one public forum on the Island facilitated by the State Government.

Feedback received during the public and agency consultation period will be provided to KIPT, which will be required to prepare a Response Document which is to be submitted to the State Government. The State Government will then assess this document, along with the Draft EIS, as part of the assessment process and prepare an Assessment Report. Refer to Figure 1-5 of Chapter 1 – Introduction for the full assessment process.

7.6 STAKEHOLDERS ENGAGED

An overview of stakeholders engaged by KIPT and Environmental Projects is provided in Table 7-1.

TABLE 7-1 OVERVIEW OF STAKEHOLDERS ENGAGED, ISSUES DISCUSSED AND ACTIONS/OUTCOMES

Stakeholder	Role/interests	Issues discussed		Actions/outcomes	
		KIPT	Environmental Projects	Ongoing consideration for the proposed development (KI Seaport)	Consideration for the EIS
Kangaroo Island Council	Development application discussions for: • road transport networks and timber haulage • 'green energy' opportunities utilising forestry waste stream • public boat ramp, public road access to Smith Bay.	Understanding appropriate approvals process, requirements for development application submission. Detailed liaison and discussion with council on matters associated with road networks and the public road and access to Smith Bay. Discussions on green energy opportunities with council's proposed biomass fuel power generation.	Invited Kangaroo Island Council representative to participate in the Stakeholder Reference Group (SRG) workshop.	Ongoing liaison and discussion in relation to: • road transport networks and timber haulage road network • harvesting and forestry activities • KI Seaport construction and operation • any additional development required to support KIPT's operations on Kangaroo Island.	Considered a key stakeholder (as per Guideline 8.07) to make a written submission in relation to the proposal.
Kangaroo Island Commissioner	Development application. Declaration of major development. Ongoing discussions on KI Seaport and other components of KIPT's operations on Kangaroo Island.	Understanding appropriate approvals process, requirements for development application submission. Understanding requirements for approvals process and any concerns. Liaison and engagement with state government departments and agencies.	Invited Kangaroo Island Commissioner to participate in the SRG workshop.	Continued ongoing communications with the Commissioner.	Considered a key stakeholder (as per Guideline 8.07) to make a written submission in relation to the proposal.
Various South Australian government agencies – Assessment level managers and higher	Development application. Declaration of major development. Ongoing discussions on KI Seaport and other components of KIPT's operations on Kangaroo Island.	Understanding appropriate approvals process, requirements for development application submission. Understanding requirements for approvals process and any concerns. Interactions with Ministers, their advisers and executives about KIPT's plans.	Understanding requirements for approvals process and any concerns.	Continued ongoing communications with State Government at all levels.	Key stakeholders (as per Guideline 8.07) expected to make written submissions in relation to the proposal – to be coordinated by DPTI.

TABLE 7-1 OVERVIEW OF STAKEHOLDERS ENGAGED, ISSUES DISCUSSED AND ACTIONS/OUTCOMES (CONT'D)

Stakeholder	Role/interests	Issues discussed		Actions/outcomes	
		KIPT	Environmental Projects	Ongoing consideration for the proposed development (KI Seaport)	Consideration for the EIS
Development Assessment Commission (DAC)	Guidelines preparation and release.	Hosted a site visit and provided a presentation on the proposed development during formulation of the guidelines.	Was available for queries from DAC during the site visit and KIPT's presentation.	Submit an EIS that adequately addresses the guidelines issued by DAC for the preparation of the EIS.	Prepare EIS in accordance with the guidelines issued by DAC for the preparation of the EIS.
Various South Australian government agencies – Assessment level officers	Assessing the proposed development.	Discussions on the proposed development, clarification on matters associated with the guidelines and approvals process; and discussing KIPT's intentions for KI Seaport and other components of its operations on Kangaroo Island. Detailed discussions on matters associated with: • timber haulage and road networks • aspects of the impact assessment associated with the marine environment • aspects of the proposed development and impact assessment as it relates to Yumbah aquaculture • local catchment at Smith Bay • koalas • glossy black-cockatoo.	Invited locally based representatives from relevant State Government agencies to participate in the SRG workshop. A number of separate discussions and presentations associated with impact assessment and adequacy check against guidelines issued for preparation of the Draft EIS with various state agencies, see brief summary in Section 7.7.3.	Submit an EIS with consideration of discussions held with government assessment officers in relation to satisfying the guidelines and expectations.	Prepare EIS with consideration of discussions held with government assessment officers in relation to satisfying the guidelines and expectations. Considered key stakeholder (as per Guideline 8.07) to make a written submission in relation to the proposal – to be coordinated by DPTI.

TABLE 7-1 OVERVIEW OF STAKEHOLDERS ENGAGED, ISSUES DISCUSSED AND ACTIONS/OUTCOMES (CONT'D)

Stakeholder	Role/interests	Issues discussed		Actions/outcomes	
		KIPT	Environmental Projects	Ongoing consideration for the proposed development (KI Seaport)	Consideration for the EIS
Relevant Australian government agencies – Department of Environmental and Energy (DoEE)	Assessing the proposed development for matters of national environment significance (MNES).	Discussions on the proposed development and KIPT's intentions for KI Seaport and other components of its operations on Kangaroo Island.	Discussions associated with MNES, impact assessment, offsets and adequacy check against guidelines issued for the preparation of the EIS related to EPBC Act.	Continued ongoing communications with DoEE for KI Seaport and other components of KIPT's operations which potentially trigger the EPBC Act.	Considered a key stakeholder (as per Guideline 8.07) to make a written submission in relation to the proposal.
Neighbours of the proposed KI Seaport	Directly affected by the proposed development.	As part of seeking permissions for seabed geotechnical investigation drilling. General discussion about the proposal and Smith Bay. Neighbour and near-neighbour concerns associated with the proposed development.	Notification of activities on or adjacent to KIPT's site at Smith Bay and ongoing liaison during surveys/studies. Feedback on the proposed development via verbal conversations, emails, the 'contact' email portal on the EIS website. Requested juvenile abalone (from Yumbah Aquaculture) for ecotoxicology studies.	Continued ongoing engagement with neighbours, particularly regarding concerns and agreements.	Considered key stakeholders (as per Guideline 8.07) to make a written submission in relation to the proposal.
Aboriginal groups/ organisations	Identification of interested parties and understanding issues of cultural significance for consideration.		Heritage assessment. Understanding of Aboriginal history and heritage of Smith Bay. Communications with Aboriginal Affairs and Reconciliation Division of Department of Premier and Cabinet. General discussion on the proposal and any concerns in relation to the proposed development at Smith Bay with Tribal Owners (Ramindjeri) (who have asserted an interest in Kangaroo Island). Ramindjeri Heritage Association has also asserted an interest in Kangaroo Island but was unable to contact a representative.	Ongoing engagement with relevant Aboriginal groups/organisations. Aboriginal heritage assessment (see Chapter 24 – Heritage) identifies groups of cultural significance as Ramindjeri (part of Ngarrindjeri) and Kaurna.	Tribal Owners (Ramindjeri) and Ramindjeri Heritage Association are considered key stakeholders (as per Guideline 8.07) to make a written submission in relation to the proposal. Include Kaurna aboriginal group, in addition to those who have formally asserted an interest. All are considered key stakeholders (as per Guideline 8.07) to make a written submission in relation to the proposal. In particular to confirm whether the proposed development is in conflict with any distinct believes or cultural practices (as per Guideline 16.2).

TABLE 7-1 OVERVIEW OF STAKEHOLDERS ENGAGED, ISSUES DISCUSSED AND ACTIONS/OUTCOMES (CONT'D)

Stakeholder	Role/interests	Issues discussed		Actions/outcomes	
		KIPT	Environmental Projects	Ongoing consideration for the proposed development (KI Seaport)	Consideration for the EIS
Kangaroo Island primary industries, business, tourism and environmental conservation representative organisations	Direct and indirect impacts associated with the proposed development. For KIPT only – direct and indirect impacts with KI Seaport and other components which are part of KIPT's proposed operation (forestry, harvesting, haulage).	Opportunities for non-timber primary industries to benefit from improved freight access. Positive economic impact of forestry for Kangaroo Island.	Invited representatives from various organisations that represent primary industry, business and tourism to participate in the SRG workshop.		Considered key stakeholders (as per Guideline 8.07) to make a written submission in relation to the proposal.
Private timberland growers	Forestry supply chain. Twelve independent growers.	Early discussion in relation to purchasing and supply agreements; use of KIPT operation to harvest and export private timber products. Valuation services provided and reports prepared at no cost to growers.	Representative from private timberland growers invited to participate in the SRG workshop.		Private timberland growers are considered key stakeholders (as per Guideline 8.07) to make a written submission in relation to the proposal.
Kangaroo Island community	Indirect effects from the proposed development, and direct/ indirect effects from other components of KIPT's operations on Kangaroo Island.	Various approaches to engage with the community, presenting information on KI Seaport and other components of KIPT's operation to the Kangaroo Island community. See Section 7.3.2 for methods adopted. Community engagement in relation to sponsorship, mutually beneficial projects and support for conservation programs.	Various approaches to engage with the community, providing information on the KI Seaport proposal and the EIS process. See Section 7.3.2 for methods adopted.	Continued ongoing engagement with the Kangaroo Island community.	Feedback from face-to-face, phone, postal mail and email communications considered as part of preparing the EIS. Printed and electronic EIS documents to be made available during the public consultation period for the Kangaroo Island community.

TABLE 7-1 OVERVIEW OF STAKEHOLDERS ENGAGED, ISSUES DISCUSSED AND ACTIONS/OUTCOMES (CONT'D)

Stakeholder	Role/interests	Issues discussed		Actions/outcomes	
		KIPT	Environmental Projects	Ongoing consideration for the proposed development (KI Seaport)	Consideration for the EIS
Mitsui	Role in distributing timber products to customers. Forestry supply chain.	Discussions in relation to: • commercial aspects associated with the proposed development, purchasing and supply agreements • shipping operations • requirements for shiploading and quality control of product.	Discussions in relation to: • due diligence requirements • materials handling and possible shipping activities.	Ongoing commercial relationship and engagement.	Considered a key stakeholder (as per Guideline 8.07) to make a written submission in relation to the proposal.
PF Olsen	Forestry supply chain.	Discussions in relation to: • commercial aspects associated with the proposed development, purchasing and supply agreements • forestry, harvesting and haulage operations • quality control of product.	Discussions in relation to Forestry Stewardship Certification (FSC) as it relates to the proposed development. Certification achieved for KIPT forests in July 2018.	Ongoing commercial relationship and engagement.	Considered a key stakeholder (as per Guideline 8.07) to make a written submission in relation to the proposal.
Service providers, suppliers and contractors	Forestry supply chain.	Early engagement to understand local capability and availability for current and future needs. Responding to queries from service providers, suppliers and contractors in relation to matters such as employment, training, housing, haulage and harvesting.		Ongoing engagement and communications in relation to KIPT's operation and needs and opportunities for service providers, suppliers and contractors.	

7.7 RESULTS

7.7.1 STAKEHOLDER REFERENCE GROUP WORKSHOP

The SRG workshop held in November 2017 provided an opportunity for invited representatives from numerous primary industries, business, tourism and conservation organisations to share ideas and raise concerns about the proposed development. The process was designed to be inclusive of groups known to have concerns about the proposed development, including Yumbah Aquaculture.

Stakeholders in attendance shared issues important to their organisation that related to all aspects of KIPT's project (i.e. forestry, haulage and KI Seaport). The workshop also facilitated constructive discussion on 'What stakeholders want to see happen', 'What stakeholders don't want to see happen' and 'What stakeholders think would be the best outcome for Kangaroo Island'.

The themes and issues discussed during the SRG workshop, and the outcomes of subsequent constructive discussions, are detailed in Appendix E1. Table 7-2 summarises issues, concerns or views that are relevant to the impact assessments and scope of the EIS.

7.7.2 ENGAGEMENT AND CONSULTATION

Issues and concerns relevant to the KI Seaport development, arising from engagement and consultation activities outside of the SRG workshop undertaken by KIPT and Environmental Projects are summarised in Table 7-3.

Issues and concerns associated with other components of KIPT's intended operations beyond KI Seaport – forestry, harvesting and haulage – were also discussed during engagement activities. These related to employment and training opportunities and resource availability to support any additional requirements. Other issues and concerns raised were:

- forestry/harvesting:
  - feral pigs
  - fencing around forestry
  - native wildlife – koalas, glossy black-cockatoos, bandicoots and echidnas
  - preference for agricultural use other than forestry
  - erosion and sedimentation
- haulage:
  - vegetation clearance
  - road conditions, upgrades and maintenance
  - funding availability for road upgrades
  - increased traffic volumes
  - increased noise, dust and vibration
  - fauna strike
  - impacts on tourists and other users.

7.7.3 GOVERNMENT AGENCY ENGAGEMENT AND CONSULTATION

Engagement with government agencies during preparation of the Draft EIS to consult on the guidelines and the information required for proper assessment of the proposed development was undertaken. Table 7-4 provides a brief summary of discussions and specific actions that resulted from discussions.

7.8 MANAGING ISSUES AND CONCERNS

The issues and concerns that have been raised will be considered in the approvals process, and should the proposal be approved, in the subsequent stages e.g. detailed planning, optimisation of designs, construction and operation.

7.8.1 IDENTIFIED KEY STAKEHOLDERS

Key stakeholders who should be invited specifically to comment through written submissions on the proposed development and the Draft EIS have been identified in Appendix E2 and include:

- neighbours
- organisations that represent business, primary industries (including aquaculture), recreational and commercial fishing, environmental conservation, community and tourism
- Kangaroo Island Council
- State Government agencies
- Commonwealth Government agencies
- Aboriginal organisations and groups
- organisations that have commercial arrangements with KIPT for KI Seaport
- independent timber growers.

TABLE 7-2 SRG WORKSHOP (NOVEMBER 2017) – SUMMARY OF CONCERNS/VIEWS EXPRESSED REGARDING KI SEAPORT DEVELOPMENT

Topic (in no particular order of importance)	Concerns/views raised:
Agriculture	• viability of the timber industry and availability of KI Seaport for agricultural sector • impacts to potential emerging agricultural businesses • recognised opportunities for freight synergies for existing and new agricultural businesses • increased traffic and truck use/volumes impacting agricultural activities • biosecurity risks
Alternative location	• clarification required for criteria used to choose Smith Bay • potential to pursue the proposed development at alternative sites • Vivonne Bay and Ballast Head were mentioned as potential alternative sites
Economy	• intertwined relationship between the environment and the economy on Kangaroo Island: the environment drives the Island's economy • potential job losses (in tourism and agriculture) as a result of KI Seaport's development • concern that employment supported by other Kangaroo Island businesses will be impacted by employment needs/changes caused by KI Seaport – both beneficial (increased employment opportunities) and detrimental (increase in demand, increases wages) • access to export opportunities • flow on effect of increased employment could be improvement to services, including schools, on Kangaroo Island • ensure economic benefits are put back into the western end of Kangaroo Island where forestry exists • economic impacts to tourism activities
Marine environment	• claims made that Smith Bay is a 'key habitat', a 'critical habitat' and biologically important area for southern right whales and blue whales; and that the area is a calving area • underwater noise impacts to marine mammals from construction and operation of KI Seaport • impacts on matters of national environmental significance under the EPBC Act • it was acknowledged that whales and dolphins are found along all of Kangaroo Island's coastline • co-existence of aquaculture and the port, with any challenges mitigated and verified with ongoing compliance • impacts to marine water quality in Smith Bay where intake pipes for Yumbah exist
Kangaroo Island's 'clean and green' brand	• impacts on 'clean and green' brand, which is considered to define Kangaroo Island's unique identity
Roads	• ability for existing roads to withstand increased volume of trucks • increased roadkill due to increased trucks using the existing road network and resulting impacts to 'clean and green' brand
Tourism	• use of KI Seaport for cruise ships would require further consideration for managing 'sense of arrival' (that is, would it cause impacts to tourism if tourists enter Kangaroo Island through a bulk shipping port?) and geographical location to key tourist locations which are located in the southern parts of Kangaroo Island • impact on possible future whale watching activities in Smith Bay

TABLE 7-3 GENERAL ENGAGEMENT AND CONSULTATION – SUMMARY OF CONCERNS/VIEWS FOR KI SEAPORT DEVELOPMENT

Considered beneficial	Considered detrimental	Other
Kangaroo Island community		
• employment opportunities (including for Aboriginal people) • training opportunities (including for Aboriginal people) • supplier/service provider opportunities • housing and small business development opportunities • independent timberland growers accessing KI Seaport • future freight and cargo opportunities • remediation and rehabilitation of degraded Smith Creek	• abalone farm impacts • increased traffic impacts • impacts to whales and dolphins • loss of seagrass • damage to sea floor • impacts to natural water flows • impacts to commercial and recreational fishing in Smith Bay • workforce requirements putting strain on Kangaroo Island's services and resources (training facilities, housing) • development requirements putting strain on available resources (such as on-island truck fleets) • independent timberland growers accessing KI Seaport • achieving adequate regulation and compliance checks if approved	• wharf design choice • the Smith Bay location • amending Development Plan and rules • misinformation • achieving co-existence of Yumbah and KIPT operations in Smith Bay • understanding what the development means for public access to Smith Bay waters • availability of information and knowledge on the proposed development
Neighbours		
• opportunity to sell land to KIPT for their operation	• risk to existing economic activity in Smith Bay • impacts to abalone from KI Seaport activities, particularly in relation to marine water quality, lighting, dust and vibration • impact on tourist accommodation business in Smith Bay from noise, light overspill, dust, traffic and visual amenity • visual amenity impacts for immediate and near-neighbours • risk to marine values such as rare/endangered species • concerns the impact assessment and EIS are biased (because the proponent pays for it)	

TABLE 7-4 GOVERNMENT AGENCY CONSULTATIONS

Department/ Office	Agency	Topics	
		Discussed	Specific investigative actions resulting from discussions
Department of Planning, Transport and Infrastructure	Development Division – Planning and Development	Approvals processes, guideline, agency engagement. Scope of proposed development and any variation to the scope.	Scope change detail included in Project Description of the EIS for the removal of public boat ramp and cruise ship use of KI Seaport, and to clarify 'multi-user' as the availability of KI Seaport to other approved third parties.
Department of Energy and Environment (Commonwealth)	Project Assessments West Section	MNES as per controlled action advice and requirements for adequately providing information for Guideline 1. Scope of proposed development any variation to the scope.	Whale strike predictions and impact assessment completed. Underwater noise baseline data collection and predictive modelling assessment completed. Kangaroo Island Echidna vehicle strike predictions and impact assessment completed. Bandicoot impact assessment completed. Hooded Plover impact assessment completed. Clarification of scope to include storage of both log and woodchip products at KI Seaport, volumes expected to be stored and exported, size of vessel to be loaded provided. Modification of scope to remove reference to cruise ship use of KI Seaport and public boat ramp and to clarify 'multi-user' as the availability of KI Seaport to other approved third parties.
Primary Industry and Regions SA	Aquaculture	Marine water quality, modelling, abalone farm (intake water and land-based impacts). Economic assessment.	Ecotoxicology (abalone) testing completed to determine effects of suspended sediment and wood dust. Marine water quality baseline data collection and predictive modelling. Air quality data research and predictive modelling assessment. Cost benefit analysis of the proposed development.
Primary Industry and Regions SA	Fishing	Protection of aquatic environment.	Ecotoxicology (abalone) testing completed to determine effects of suspended sediment and wood dust. Marine water quality baseline data collection and predictive modelling completed. Air quality data research and predictive modelling assessment completed.
South Australian Research and Development Institute	SA Aquatic Sciences Centre	Marine water quality, modelling, abalone farm (intake water and land-based impacts). SARDI commissioning and contractual arrangements to collect juvenile abalone from the wild for ecotoxicology testing.	Ecotoxicology (abalone) testing completed to determine effects of suspended sediment and wood dust. Marine water quality baseline data collection and predictive modelling completed. Air quality data research and predictive modelling assessment completed.
Department of Agriculture and Water Resources (Commonwealth)	Animal Biosecurity – Aquatics Marine Pests Unit	Marine biosecurity matters – pest plants and animals, biofouling and ballast water management (as it relates to *Biosecurity Act 2015*).	Development of specific protocols and management plans.
Primary Industry and Regions SA	Biosecurity	Biosecurity legislation and control for aquatic pests and diseases, biofouling and ballast water, (land-based) weed and pest animals.	Development of specific protocols and management plans.

TABLE 7-4 GOVERNMENT AGENCY CONSULTATIONS (CONT'D)

Department/ Office	Agency	Topics	
		Discussed	Specific investigative actions resulting from discussions
Natural Resources Kangaroo Island	Catchment to Coast	Marine biosecurity matters – pest plants and animals, biofouling and ballast water management.	Development of specific protocols and management plans.
Natural Resources Kangaroo Island	Feral Cat Eradication Program	Offset strategy for Kangaroo Island echidna impacts.	Acceptable contribution by KIPT to NRKI Feral Cat Eradication Program to appropriately offset predicted impacts on Kangaroo Island echidna (an MNES matter) agreed.
Natural Resources Kangaroo Island	Plants and animals Land and water	Impacts to native plants and animals, land and water resources.	Identification of permits or licences (issued by Department for Environment and Water) that might be required.
Environment Protection Authority	Strategy and Assessment – Planning and Impact Assessment	Clarification on various jurisdictional, development assessment and regulatory matters including air quality, noise, marine water quality, surface water, land (soils and groundwater).	
Environment Protection Authority	Science and Information – Environmental Science	Marine water quality, modelling, abalone farm intake water. Compliance to Environmental Protection (Water Quality) Policy. Compliance to Environmental Protection (Noise) Policy. Compliance to Environment Protection (Air Quality) Policy.	Ecotoxicology (abalone) testing completed to determine effects of suspended sediment and wood dust. Marine water quality baseline data collection and predictive modelling. Stormwater management study. Baseline noise (land) data collection and predictive modelling assessment. Air quality data research and predictive modelling assessment. Phase 1 Site investigation. Soil and groundwater investigation (site contamination assessment).
Department for Industry and Skills		Economic impact assessment requirements as it relates to Guideline 4. Skills and training for workforce capability on Kangaroo Island.	Economic Impact Assessment undertaken for the proposed development.
Department for Environment and Water	Heritage – Maritime Archaeology	Clarification of Commonwealth and South Australian jurisdictions with respect to shipwrecks.	Underwater cultural heritage assessment undertaken by specialist maritime heritage consultant.
Department for Environment and Water	Heritage – SA Heritage Register	Searches of heritage places.	Historical and heritage reports completed for the proposed development site.
Department for Environment and Water	Coastal Management Branch	Protection of coastal environments.	Coastal processes predictive modelling assessment completed.
Department for Environment and Water	Native Vegetation Management Unit	Native vegetation clearances – seagrass (dredge pocket, solid causeway) and small pockets of terrestrial vegetation clearances as part of site redevelopment.	Calculation of appropriate significant environmental benefit offsets for terrestrial and marine native vegetation clearances expected for the project required under the *Native Vegetation Act 1991*.

TABLE 7-4 GOVERNMENT AGENCY CONSULTATIONS (CONT'D)

Department/ Office	Agency	Topics	
		Discussed	Specific investigative actions resulting from discussions
Department for Environment and Water	Plants and animals	Protection of native fauna and flora.	Identification of permits or licences (issued by Department for Environment and Water) that might be required
Department of Premier and Cabinet	Aboriginal Affairs and Reconciliation	Clarification of Aboriginal peoples, communities or organisations that have asserted their interest in Kangaroo Island. Search of Aboriginal heritage registers.	Identification of key stakeholders for ongoing engagement and consultation.
Kangaroo Island Council		Traffic and transport. Roads on Kangaroo Island. Use of heavy vehicles. Upgrade of intersections and roads. Road safety.	Traffic Impact Assessment completed. Transport and road studies to determine a preferred route for timber product haulage from forests to KI Seaport. Assessment and determining preferred road route done in consultation with Kangaroo Island Council.
Department of Planning, Transport and Infrastructure	Development Division – Planning and Transport Policy Safety and Service Division	Traffic and transport. Roads on Kangaroo Island. Heavy vehicle regulations. Road safety.	Traffic Impact Assessment completed. Transport and road studies to determine a preferred route for timber product haulage from forests to KI Seaport. Consultations with road managers, i.e. Kangaroo Island Council and DPTI .
South Australian Country Fire Service		Bushfire and fire management. Emergency services requirements.	Development of bushfire and fire management strategies for the proposed development.

7.8.2 CONSULTATIONS WITH GOVERNMENT AGENCIES

Results from government agency consultations, which generally related to ensuring the Draft EIS provided adequate assessments and supporting information to satisfy the guidelines issued by the government (see Appendix A1 and Appendix V) were carefully considered during the compilation of the Draft EIS. Agencies will assess the information presented, in the context of the guidelines, during the Public Consultation period, to provide advice on the proposed development for the Minister's consideration as part of the approvals process.

7.8.3 ONGOING ENGAGEMENT AND CONSULTATION

Engagement with key stakeholders will continue throughout the life of KIPT's involvement in forestry on Kangaroo Island. Pending development of KI Seaport, communication and consultation strategies will be developed for stakeholders, using the programs and tools already established (refer to Section 7.3.1). KIPT is committed to open and transparent communication with the community and other stakeholders to ensure information is available, and feedback is obtained and considered to make ongoing improvements.

Future stakeholder consultation by KIPT will likely include:

- implementing a Community Engagement Plan
- developing a newsletter communicating key information regarding KI Seaport development, road transport and forestry activities
- establishing a website that details locations and dates for forestry harvesting and timber transport
- arranging community information days
- preparing media releases.

7.8.4 RESPONSE DOCUMENT

The statutory public and agency consultation (Section 7.5) aims to:

- share information among all stakeholders and Kangaroo Island community members
- facilitate the raising of concerns, ideas and questions for consideration by all stakeholders and community members
- meet with key stakeholder and special interest groups
- identify potential impacts, both positive and negative
- encourage options (such as changes, modifications or variations) that may enhance the benefits of the proposed development or eliminate or mitigate any possible adverse consequences.

All feedback, comments and concerns raised with the State Government during the statutory public and agency consultation process will be provided to Environmental Projects and KIPT. Environmental Projects will prepare a Response Document, which will be assessed as part of the approvals process for the proposed development.

7.9 CONCLUSIONS

Stakeholder engagement conducted to date provides an understanding of community feedback, issues and concerns associated with the proposed development and the key stakeholders who should be approached to provide written submissions.

Early consultation has resulted in scope changes to the proposed development which includes the removal of maintaining/building a public boat ramp at Smith Bay and considering KI Seaport for use by cruise ships. It has also enabled information to be provided to the general public and community organisations before formal statutory public and agency consultation for the EIS begins. It is evident, from the outcome of early consultation and engagement, that the EIS needs to:

- minimise any confusion about particular issues or aspects of the proposed development
- ensure clear and concise information is provided on identified matters of concern to increase general understanding
- provide adequate evidence to support statements of assessment and determination of management measures or controls required to prevent or minimise identified potential impacts.

KIPT has an established presence on Kangaroo Island and an advanced community engagement program that includes all stakeholders. KIPT is committed to engaging with stakeholders throughout the approvals process for the KI Seaport proposal and as the company transitions to a full-scale forestry harvesting and export program.

08. KEY ISSUES

08. KEY ISSUES

8.1 INTRODUCTION

The process of identifying and assigning priority to environmental, social and economic issues arising from the proposal by KIPT to develop a deep-water port at Smith Bay was initially undertaken by the South Australian Government's Development Assessment Commission (DAC). The Government determined the level of assessment required and established and released guidelines for the preparation of an EIS. These guidelines direct and focus the impact assessment.

The EIS study team also assessed, with serious consideration of the guidelines, the development proposal to identify key issues requiring impact assessment and the work required to address them.

Identifying key issues aids the scope for studies and investigations, which are required to anticipate the significant effects and factors that the EIS must study in detail and provide for decision making regarding the proposal.

The construction and operation of the proposed KI Seaport has the potential to change some factors of the existing physical and socio-economic environment in the study area at Smith Bay and, more broadly, Kangaroo Island, resulting in potential impacts to the environment and people. A potential impact is any predicted change to the environment, whether adverse or beneficial, wholly or partially resulting from aspects associated with the proposed development.

The main aspects of the development (refer to Chapter 4 – Project Description) which are considered to have potential impacts as a result of the proposal include:

- dredging of the seafloor to deepen the berthing basin
- silt plumes resulting from dredging operations, causeway construction, shipping movements and runoff from the site
- the construction of a causeway approximately 250 metres into Smith Bay
- site clearance and excavation for timber storage and associated infrastructure
- the mobilisation of sediments during dredging and onshore construction activities
- underwater noise and vibration from pile-driving operations during construction
- dust emissions, noise, vibration and lighting during construction and operation of the KI Seaport
- biosecurity associated with shipping and construction operations
- ship collisions with marine mammals
- diesel or chemical storage (and potential spillage) on site during construction and operation of the KI Seaport
- increased traffic to and from the study area and on local roads during the transport of timber and/or woodchips to Smith Bay
- the ancillary activity of upgrading roads for timber transport
- effects on the Kangaroo Island economy, utilities and community.

This chapter defines the EIS team's scope for impact assessments, which together provides the framework for consistent quantification of inherent and residual risks associated with any uncertainty related to the identified potential impact events.

8.2 METHODOLOGY

8.2.1 IDENTIFICATION OF KEY ISSUES

The potential for an activity of the project to result in a change to an environmental or socio-economic aspect that results in a negative or positive change to a sensitive receiver is a 'potential impact event'. Identified potential impact events were based on information provided in the guidelines, preliminary impact assessment and experience on other similar proposed developments; and were investigated as part of the EIS. In addition to this consideration, an issue which was evaluated as being important and/or of particular concern was identified as a 'key issue'. Key issues were identified collectively by:

- the impact assessment specialists working in the EIS study team
- project design engineers
- maritime and civil construction contractors
- KIPT personnel.

This process also considered the assessment undertaken by DAC (as presented in the guidelines for the preparation of the EIS), and by feedback received from consultation undertaken with stakeholders and the community.

8.2.2 ASSIGNING PRIORITIES

Priorities have been assigned to key issues to determine the level of assessment required and to:

- clarify issues in terms of their assigned level of importance
- define risk
- avert risk
- ensure that the proposed KI Seaport can function within the regulatory framework
- align with the Company's Corporate Governance requirements and social responsibilities.

An assessment of the potential impact (or consequence, see Table 8-1) and the probable frequency of an event occurring (i.e. 'virtually impossible' to 'virtually certain'), provides a priority rating using the matrix presented in Table 8-2. Categories of consequences are defined by the level of environmental/socio-economic, community/reputation and/or legal effects that could be experienced – aligning with KIPT's Corporate Governance.

Priorities assigned to key issues are provided in Table 8-3.

Priorities assigned reflect the level of effort and detail, which increases from 'Low' to 'Medium' to 'High', of studies and investigations required to enable a proper assessment of potential impacts.

TABLE 8-1 CATEGORIES OF CONSEQUENCES BASED ON ENVIRONMENTAL/SOCIO-ECONOMIC, COMMUNITY/REPUTATION AND/OR LEGAL EFFECTS

Category	Level	Environmental/Socio-economic	Community/Reputational	Legal
A	Negligible effect	Very short-term effects within the project area. Recovery will occur within days. No ecological or socio-economic consequences.	No media, regulator or community interest.	Minor non-compliance and/or breach of regulation. No legal consequences.
B	Minor effect	Short term effects within the project area. Recovery will occur within weeks. Minor ecological or socio-economic consequences. No changes to biodiversity or ecological function.	Local media coverage. Some interest by regulator(s) and local non-government organisations. One or two community complaints.	Breach of regulation with investigation or report to authority with possible prosecution and fine.
C	Moderate effect	Medium term effects within the project area. Recovery likely to occur within months. Moderate ecological or socio-economic consequences. Local changes to biodiversity, but no changes to ecological function.	Medium-term effects within the project area. Recovery likely to occur within months. Moderate ecological or socio-economic consequences. Local changes to biodiversity, but no changes to ecological function.	Breach of regulation with litigation and moderate fine. Involvement of senior management.
D	Major effect	Long term effects, potentially extending beyond the project area. Recovery is likely to take years and complete recovery may not occur. Major ecological or socio-economic consequences. Significant local changes to biodiversity and measurable changes to ecological function.	Long-term effects, potentially extending beyond the project area. Recovery is likely to take years and complete recovery may not occur. Major ecological or socio-economic consequences. Significant local changes to biodiversity and measurable changes to ecological function.	Major breach of regulation with litigation and substantial fine. Possible suspension of operating licence.
E	Disastrous effect	Very long-term effects extending beyond the project area. Recovery is likely to take decades and complete recovery may not occur. Severe ecological or socio-economic consequences. Loss of biodiversity on a regional scale, and significant loss of ecological function.	Very long-term effects extending beyond the project area. Recovery is likely to take decades and complete recovery may not occur. Severe ecological or socio-economic consequences. Loss of biodiversity on a regional scale, and significant loss of ecological function.	Major litigation or prosecution with very substantial fines. Possible cancellation of operating licence.

TABLE 8-2 MATRIX FOR ASSESSING PRIORITY

			Likelihood				
			1 Virtually impossible	2 Unlikely	3 Possible	4 Likely	5 Virtually certain
Consequence	A	Negligible effect	Low	Low	Low	Low	Low
	B	Minor effect	Low	Low	Medium	Medium	Medium
	C	Moderate effect	Low	Medium	Medium	Medium	High
	D	Major effect	Low	Medium	Medium	High	High
	E	Disastrous effect	Medium	Medium	High	High	High

8.2.3 IMPACT ASSESSMENT

The assessment of identified key issues outlined in Section 8.3 are presented in:

- Chapter 9 – Marine Water Quality
- Chapter 10 – Coastal Processes
- Chapter 11 – Land-Based Aquaculture
- Chapter 12 – Marine Ecology
- Chapter 13 – Terrestrial Ecology
- Chapter 14 – Matters of National Environmental Significance
- Chapter 15 – Biosecurity
- Chapter 16 – Geology, Soils and Water
- Chapter 17 – Air Quality
- Chapter 18 – Noise and Light
- Chapter 19 – Climate Change and Sustainability
- Chapter 20 – Economic Environment
- Chapter 21 – Traffic and Transport
- Chapter 22 – Social Environment
- Chapter 23 – Visual Amenity
- Chapter 24 – Heritage

Chapter 25 – Management of Hazard and Risk provides the outcome of risk assessments for the proposed development, applying the findings of impact assessments and mitigation and management measures. Risk assessments of the potential impact events was undertaken in two stages:

- Firstly – Studies to identify and understand 'key issues' were undertaken to provide an appreciation of the magnitude of the issue (i.e. its potential impact) and the risks associated with the effect of any uncertainties. This provided the 'inherent risk'.
- Secondly – A more robust understanding of the potential impacts, inherent risks and how they could be managed, provides an understanding of the 'residual risk'. The residual risk also includes the effects of mitigation and management measures that are designed to further reduce the magnitude of the potential impact and/or reduce the uncertainties that remain following the studies.

Chapter 26 – Environmental Management Framework outlines how the mitigation and management measures identified in impact assessments and the controls required to reduce the risks of unplanned events causing a negative impact, will be implemented.

8.3 VALUES AND ASSOCIATED KEY ISSUES

Identified values of the surrounding environment influence the impact assessments for the proposed KI Seaport. The identified issues, requiring further assessment to understand the magnitude of the potential impact, and/or to reduce uncertainties associated with the quantification of the impact are outlined below in the context of values to be protected. Key issues, and associated specific values to protect, are summarised in Table 8-3.

It is noteworthy that the key issues identified below have been identified without assessing potential impacts and without consideration or application of any mitigation and management measures. They are considered later in this EIS. The following have been identified as key issues by the EIS study team. They require assessment through EIS studies, with consideration to requirements of the guidelines.

8.3.1 LAND-BASED ABALONE FARM

Yumbah's land-based abalone farm is located in close proximity to the proposed KI Seaport and uses seawater from Smith Bay for input into its operations. The ability for the construction and operation of the KI Seaport to co-exist in Smith Bay with the continued operation of Yumbah's abalone farm needs to be assessed.

Seawater quality

During construction, dredging would create silt plumes that could adversely affect water quality in Smith Bay to some degree. The plumes would result mainly from the action of the dredge on the seafloor and potentially from tailwater from dewatering of the dredge spoil or reuse of dredge spoil in the causeway. Without appropriate mitigation measures, the plumes may on occasion extend as far as Yumbah's seawater intake pipes and could reduce the quality of water pumped into the farm.

Other potential effects on water quality, which have a subsequent (potential) impact on Yumbah's operations may result from:

- mobilisation of sediments (and potentially contaminated sediments), if any, in Smith Bay
- silt plumes associated with the construction of the causeway
- silt plumes associated with silt-laden runoff entering Smith Bay from the onshore construction site
- silt plumes associated with ship movements
- the causeway interrupting tidal currents along the shore and potentially affecting seawater temperature
- fuel or chemical spill entering the marine environment.

Dust, noise and light

Trucking and chip conveying and loading operations at Smith Bay, have the potential to create dust emissions that may deposit on the abalone farm. The most significant concern is potential effects on abalone health should significant amounts of dust enter abalone tanks.

Noise and light emissions from the KI Seaport may also adversely impact abalone health.

8.3.2 BIOSECURITY

Biosecurity is a significant issue on Kangaroo Island. KI Biosecurity Strategy (DEWNR 2017) states that effective biosecurity arrangements are crucial to protecting Kangaroo Island from the impacts that pests, weeds and diseases may impose on biodiversity, primary production and social amenity values. The financial impact on primary production and tourism could be significant if particular pests were to establish on Kangaroo Island.

Shipping has the potential to introduce marine pests to coastal waters through the uncontrolled disposal of ballast water and biofouling on ship hulls. Marine pests have the potential to displace local species and adversely affect aquaculture ventures. The most significant potential impacts were identified as:

- adverse effects on the abalone farm through the introduction of abalone viral ganglioneuritis (AVG) or the abalone parasite *Perkinsus*
- adverse effects on the Pacific oyster industry on Kangaroo Island through the introduction of the oyster disease Pacific Oyster Mortality Syndrome (POMS).

8.3.3 MARINE ECOLOGY

Marine ecology established within marine parks would not be impacted by the proposed development. The closest marine parks are the Southern Spencer Gulf Marine Park to the west and the Encounter Marine Park to the east, each of which are about 20 km from Smith Bay, and that the number of vessel calls associated with the proposed development would add a negligible increase to existing marine traffic with no more than 20 vessels per annum expected at KI Seaport.

Localised dredging of the seafloor would result in the direct clearing of seagrass communities. This is considered a key issue due to the high ecological value of seagrass communities and their slow recovery, particularly for the long-lived species *Posidonia* spp. and *Amphibolis* spp. Silt plumes generated during dredging may also adversely affect seagrass communities by reducing light levels at the seafloor and by smothering seagrass plants.

Impacts on seagrass communities may also result from:

- the release of nutrients from sediments during dredging
- silt plumes associated with the construction of the causeway
- silt plumes associated with silt-laden runoff entering Smith Bay from the onshore construction site
- silt plumes associated with ship movements.

8.3.4 THREATENED SPECIES

The proposed development has been assessed by the DoEE as a controlled action due to the potentially significant effects on the southern right whale, the Kangaroo Island echidna, the hooded plover, and the southern brown bandicoot.

Aspects of the development that may potentially affect these species include:

- shipping transport may result in collisions with, or disturbance to, southern right whales
- pile-driving during wharf construction may result in disturbance to southern right whales

- wharf construction may affect breeding of the hooded plover on the Smith Bay beach habitat
- road traffic associated with construction and the ancillary activity of timber transport may result in road kills of the Kangaroo Island echidna and the southern brown bandicoot.

8.3.5 TERRESTRIAL ECOLOGY

The study area consists of former farmland that has been largely cleared of native vegetation and is relatively weed-infested, which significantly reduces its ecological value. Nevertheless, aspects of the development that may potentially impact terrestrial flora and fauna include:

- site clearance resulting in the loss of remnant native vegetation at the site
- construction and operational traffic and activity that may result in mortality of native fauna
- noise and light emissions that may disturb native fauna and reduce the value of the habitat in the vicinity of the emissions
- dust emissions that may adversely affect the quality of native vegetation and its habitat value, particularly along roadsides
- clearance of native vegetation to widen roads for truck use
- the introduction of additional noxious weeds.

8.3.6 SOCIO-ECONOMIC ENVIRONMENT

The proposed KI Seaport is likely to result in significant direct and indirect economic benefits to the Kangaroo Island community by:

- significantly increasing the level of economic activity
- creating jobs during the construction and operational phases of the project
- providing a port that could be available for use by other commercial enterprises
- driving positive effects on a demand for housing and increased land prices
- increasing diversification of the Island's economy, which is currently reliant on two main industries, tourism and agriculture.

Positive social effects would be likely to result from:

- a gradual increases in population through migration and an increased retention of people of working age (and their families)
- providing a substantial number of non-seasonal jobs.

Aspects of the Smith Bay component of the project that may have adverse social effects include:

- dust, noise and light emissions that may have a nuisance effect on personnel at the adjacent land-based abalone farm and on nearby residents
- reduced visual amenity of Smith Bay
- difficulty in accessing the beach at Smith Bay.

Traffic and transport

Traffic and transport associated with haulage of timber to the KI Seaport is an ancillary activity to the proposed development that will not be assessed (or approved) by this EIS. However, traffic and transport scoping studies and investigations are required to establish an understanding of effects, to a level of detail that provides for further consideration, should the KI Seaport proposal obtain approval to proceed.

The use of local roads by KIPT haulage trucks to transport timber from the plantations to Smith Bay is likely to be one of the most significant issues associated with the proposed development.

The selection of the most appropriate haul route requires the co-operation and collaboration of KIPT, Kangaroo Island Council and DPTI. The costs and benefits of options will need to be assessed in terms of a range of criteria including:

- community safety
- distances
- costs for haulage
- habitat value
- potential fauna impacts
- vegetation clearance
- community disturbance and impacts to other users including tourists.

The use of the road network, with or without a selected timber haul route by KIPT timber trucks, may:

- compromise road safety through increased traffic volumes
- impact the amenity of dwellings adjacent to haul roads through dust, noise, vibration and light emissions
- affect land values along haul roads
- make some areas along the north coast less attractive to tourists
- impact habitat value adjacent to roads through increased dust, noise and light emissions
- result in significant numbers of roadkill of native fauna.

These potential effects need to be understood and mitigated where possible, and weighed against the costs and benefits of not using a designated route but instead using an open network model.

Services

Some services on Kangaroo Island are limited. The availability of services for the proposed development, including electricity, water and waste disposal, could put significant stress on existing services or infrastructure. The proposed development would result in increased employment opportunities, which may lead (at least in the short-term) to stress on community services, housing, education and health services. Hence, the availability of support services are a key issue to be understood and addressed.

8.3.7 OTHER

Other values which may have a potential impact and require assessment include:

- Indigenous and non-Indigenous heritage
- climate change and potential impacts of sea level rise on coastal developments.

TABLE 8-3 KEY ISSUES ASSOCIATED WITH KI SEAPORT

Ref.	Activity	Key issue	Assigned assessment priority	Impact to be assessed	Values to be protected
Construction					
1	Construction of berth pocket and approaches	Dredging of seafloor	High	Loss of seagrass communities	Healthy marine ecosystem
2			Medium	Impacts on marine heritage items (shipwrecks)	European heritage
3		Silt plumes	High	Loss of seagrass and other benthic communities due light reduction and smothering	Marine water quality Healthy marine ecosystem
4			High	Poor water quality (for abalone health) at Yumbah's seawater intake	Property (abalone)
5			Medium	Visible silt plume around construction site at Smith Bay	Visual amenity
6		Mobilisation of potentially contaminated material in sediments (including ammonia, hydrogen sulphide, chemical oxygen demand (COD) and biological oxygen demand (BOD))	Medium	Impacts on marine communities including seagrass	Healthy marine ecosystem
7			Medium	Poor water quality (contaminants) at Yumbah's seawater intake	Property (abalone)
8		Spill of fuel or hydraulic fluids during dredging operations	Medium	Impacts on marine communities	Healthy marine ecosystem
9		Dewatering (and return water losses) of potentially contaminated dredge spoil on land	Medium	Contamination of site (such that contaminated soil guidelines are breached)	Soil quality
10			High	Poor water quality (contaminants) at Yumbah's seawater intake	Property (abalone)

TABLE 8-3 KEY ISSUES ASSOCIATED WITH KI SEAPORT (CONT'D)

Ref.	Activity	Key issue	Assigned assessment priority	Impact to be assessed	Values to be protected
11	Pile-driving	Underwater noise and vibration	Medium	Whales and dolphins in particular may be harmed by excessive underwater noise	Marine biodiversity
12	Movement of construction materials	Barging materials from the mainland	High	Introduction of pests (including vermin) and/or diseases	Marine ecology
13	Movement of construction materials	Barging materials from the mainland	Low	Increase in marine traffic	Safety on marine waters
14	Movement of construction materials	Road transport of construction materials from the mainland	Low	Increase in road traffic	Safety on roads
15	Movement of construction materials	Road transport of construction materials from within Kangaroo Island	Low	Increase in road traffic	Safety on roads
16	Causeway construction	Silt plumes	Medium	Loss of seagrass and other benthic communities due to light reduction and smothering	Healthy marine ecosystem
17	Causeway construction	Interruption of coastal processes	Medium	Interruption of movement of seawater, sand and seagrass wrack (shed leaf material) along the coast; potential pooling of seawater and temperature effects	Recreational amenity Property (abalone)
18	Causeway construction	Silt plumes	High	Poor water quality (for abalone health) at Yumbah's seawater intake	Property (abalone)
19	Causeway construction	Use of potentially contaminated dredge spoil to construct causeway	Medium	Impacts on adjacent marine communities (exceed marine disposal guidelines for protection of marine communities)	Healthy marine ecosystem
20	Causeway construction	Use of potentially contaminated dredge spoil to construct causeway	High	Poor water quality (contaminants) at Yumbah's seawater intake	Property (abalone)
21	Onshore construction activities	Site clearance	Medium	Loss of remnant native vegetation Loss of habitat Loss of foreshore values Disturbance of native fauna	Terrestrial biodiversity
22	Onshore construction activities	Site clearance	Medium	Impacts on Aboriginal and non-Aboriginal heritage items	Heritage
23	Onshore construction activities	Excavation	Medium	Impacts on Aboriginal heritage items	Heritage
24	Onshore construction activities	Excavation	Medium	Exposure and inappropriate disposal of contaminated soil (such that contaminated soil guidelines are breached)	Soil quality

TABLE 8-3 KEY ISSUES ASSOCIATED WITH KI SEAPORT (CONT'D)

Ref.	Activity	Key issue	Assigned assessment priority	Impact to be assessed	Values to be protected
25	Onshore construction activities (continued)	Silt-laden runoff entering Smith Bay	Medium	Loss of seagrass and other benthic communities due to light reduction and smothering	Healthy marine ecosystem
26			High	Poor water quality (for abalone health) at Yumbah's seawater intake.	Property (abalone)
27		Noise	Low	Temporary disturbance to neighbours and Yumbah's abalone	Amenity Property (abalone)
28			Medium	Disturbance to fauna, in particular any protected species on or within the vicinity of the site	Terrestrial biodiversity
29		Fugitive dust	Medium	Temporary nuisance to neighbours and health affects to Yumbah's abalone	Visual amenity Property (abalone)
30		Construction traffic	Medium	Impacts on echidnas that occasionally forage on site causing a reduction to the Island's population	Terrestrial biodiversity
31		Light emissions	Medium	Temporary disturbance to abalone farm	Amenity Property (abalone)
32		Introduction of noxious weeds	Low	Further degradation of remnant vegetation communities and habitat at Smith Bay	Terrestrial biodiversity
33		Potential upgrading of some timber transport roads (whilst construction underway)	High	Loss of remnant native vegetation (particularly Kangaroo Island Narrow-leaf Mallee) and fauna habitat	Terrestrial biodiversity
34	On-site fuel/ chemical storage and use (onshore and offshore)	Fuel/chemical spillage	Medium	Soil contamination	Soil quality
35			High	Marine water pollution	Healthy marine ecosystem Property (abalone) Resource (fisheries)

TABLE 8-3 KEY ISSUES ASSOCIATED WITH KI SEAPORT (CONT'D)

Ref.	Activity	Key issue	Assigned assessment priority	Impact to be assessed	Values to be protected
Operations					
36	Wharf operations	Noise	Medium	Disturbance to abalone farm	Amenity Property (abalone)
37			Low	Disturbance to fauna, particularly any listed species nesting on or within close proximity to the site	Terrestrial biodiversity
38		Fugitive dust	Medium	Temporary nuisance to neighbours and health affects to Yumbah's abalone	Visual amenity Property (abalone)
39		Light emissions	Medium	Disturbance to land-based abalone farm/neighbouring farms/nearby residents	Visual amenity Property (abalone)
40		Wharf and causeway structures, timber stockpiles and ships	Medium	Lowering the visual amenity of Smith Bay	Visual amenity
41	Storage of logs and woodchips	Leachate generation	High	Soil contamination Groundwater contamination Marine pollution and effects on marine communities Poor water quality at intake for abalone farm	Soil quality Groundwater quality Healthy marine ecosystem Property (abalone)
42	On-site diesel storage and use	Diesel spillage	Medium	Soil contamination Marine pollution and effects on marine communities	Soil quality Healthy marine ecosystem
43	Shipping	Disposal of ballast water – International shipping	High	Introduction of marine pest species (including vermin) and diseases (particularly the abalone disease abalone viral ganglioneuritis (AVG) and the abalone parasite *Perkinsus*)	Healthy marine ecosystem Marine pest status of Smith Bay Property (abalone)
44		Ballast water disposal – domestic shipping		Introduction of marine pest species and diseases (particularly the abalone disease abalone viral ganglioneuritis (AVG) and the abalone parasite Perkinsus)	Healthy marine ecosystem Marine pest status of Smith Bay Property (abalone)
45		Biofouling – international and domestic shipping		Introduction of marine pests and aquatic diseases	Healthy marine ecosystem Marine pest status of Smith Bay Property (abalone)

TABLE 8-3 KEY ISSUES ASSOCIATED WITH KI SEAPORT (CONT'D)

Ref.	Activity	Key issue	Assigned assessment priority	Impact to be assessed	Values to be protected
46	Shipping (continued)	Stowaways and vermin		Introduction of pest animals (vertebrate and invertebrate)	Healthy marine and terrestrial ecosystem Property (abalone, crops and other agricultural assets) Public health and hygiene
47		Winnowing of sediments and generation of silt plumes	Medium	Seagrass decline due to reduction in light availability and smothering	Healthy marine ecosystem
48			Medium	Poor water quality (for abalone health) at Yumbah's seawater intake for abalone farm	Property (abalone)
49		Vessel movements	Low	Potential collisions with whales	Marine biodiversity
50	Transport of timber to Smith Bay	Dust	Medium	Impacts on roadside vegetation	Terrestrial biodiversity
51		Additional trucks using roads	High	Inconvenience/interactions between trucks and tourist and local traffic Disturbance to residences near haul roads	Tourism Social cohesion/amenity Local economy
52			Medium	Disturbance to fauna, particularly the glossy black-cockatoo (potential feeding and nesting habitat)	Terrestrial biodiversity
53			Medium	Road kills of native fauna (particularly echidnas)	Terrestrial biodiversity
54	Overall development	Greenhouse gas emissions	Low	Carbon footprint of the development and contribution to global warming	Global climate
55		Climate change	Medium	Sea level rise potentially impacting coastal developments	Economy and social amenity
56		Fire at Smith Bay	Medium	Timber stockpiles could catch fire should a bushfire, or other cause, occur in the area Site activities (during construction and operation) could be an ignition source for fire	Property Amenity
57		Employment (direct and indirect)	High	Increased population on Kangaroo Island	Socio-economic
58			High	Availability of skilled workforce and training	Socio-economic
59			High	Displacement of other employment	Socio-economic

TABLE 8-3 KEY ISSUES ASSOCIATED WITH KI SEAPORT (CONT'D)

Ref.	Activity	Key issue	Assigned assessment priority	Impact to be assessed	Values to be protected
60	Overall development (continued)	Demand for services (commercial, technical)	High	Availability of services vs needs	Socio-economic
61		Demand for housing	High	Effects on housing	Socio-economic
62		Demand for services (community, including health and education)	High	Availability of health, education and other community services	Socio-economic
63		Smith Bay's contribution to Kangaroo Island's economy	High	Effects on Yumbah, tourism and any other operations reliant on Smith Bay and the marine waters of Smith Bay	Economic

Note:

Items 33 and 50–53 are not assessed by this EIS, though they are discussed further in Chapter 21 – Traffic and Transport.

'Pests' refers to terrestrial and marine, plant and animal pests.

Guideline		Comment
2.7	Describe any dredging activity that will be undertaken during the construction phase. Outline impacts that dredging may have on sediment loads and the neighbouring commercial aquaculture operation. Detail measures for managing these impacts, including management of dredge spoil, noting that all dredging should be undertaken in accordance with the Environment Protection Authority's Dredging and Earthworks Drainage Guideline – June 2010	See Sections 4.4.4, 4.5.2, 9.5.1, 9.5.3, 9.5.4, 9.5.5, 11.5.1, 12.5.4, 16.5.2, Appendices F2, F3, H1, H2 and U1
2.10	Detail measures for managing solid waste, black water and grey water from ships.	See Sections 4.8.7, 9.5.7 and 9.6
2.12	Describe the impact of any incidental timber spillage and dust emissions (point source and fugitive) during ship loading operations on the marine environment, in particular on water quality and marine and coastal flora and/or fauna species, including migratory species. Outline the measures that will be taken in the event of a spillage.	See Section 9.5.7, 9.6, 11.5.4, 11.5.5 and 12.5.8
2.14	Describe the potential impacts of increased shipping traffic and activities in Smith Bay from offshore anchoring, transhipment or pilotage (especially on marine fauna, water quality, recreational activities and amenity), including effects on commercial aquaculture activities in the region.	See Chapter 14, Sections 9.5.6, 9.5.7, 9.5.8, 9.6, 11.5.1, 12.5.2, 12.5.4, Appendices F3 and I2
2.16	Outline measures to protect water quality and the marine environment from shipping activities, especially turbulence during docking and manoeuvring. Include turbidity impacts on any identified shell fish or other filter feeders and on macro algal habitats in the region.	See Sections 9.5.6, 9.5.7, 9.5.8 and 12.5.4
2.20	Identify the risks from the exposure of fine sediments or clays that would impact adversely on water quality (turbidity and light penetration) and contribute to the production of sediment plumes in the region during both construction and operation phases. Outline the impacts this may have on commercial aquaculture activities in the region.	See Sections 9.5.1, 9.5.2, 9.5.3, 9.5.4, 10.5.6, 11.5.1, 11.5.2, 11.5.3, Appendices F2, F3, H1 and H2
2.21	Describe, and provide baseline information on, the level of oceanic connectivity between the proposed development site and the intake areas used by commercial aquaculture ventures in the region (include observed information from hydrodynamic and coastal process modelling undertaken for a minimum of 6 months) and identify the impacts that the construction and use (including ship movements) of the proposed in-sea components of the proposal will have on this connectivity.	See Sections 9.5.1, 9.5.2, 9.5.8, 11.5.1, 11.5.2, 11.5.3, Appendices F2 and F3

09. MARINE WATER QUALITY

9.1 INTRODUCTION

Marine ecosystems have evolved in response to the prevailing seawater quality in particular areas, which can vary substantially on daily, weekly and monthly timescales, depending on wave energy, freshwater inputs from rivers, and seasonal weather conditions. Consequently, marine communities are adapted to tolerate particular ranges of water quality conditions. Although occasional sub-optimal water quality may stress marine communities to some degree, they generally recover quickly when the conditions abate. However, significant or prolonged changes in water quality can result in long-term adverse effects on marine communities when critical thresholds are exceeded.

The main features of the proposed KI Seaport that may potentially affect water quality in Smith Bay are:

- the dredging of a 9.2 ha berthing pocket adjacent to the wharf to a depth of 13.5 metres
- disposal of seawater associated with dredge spoil
- the construction of the causeway and jetty to a floating wharf moored approximately 400 metres offshore
- stormwater runoff from the onshore facilities during construction and operation of the facility
- winnowing of sediments by ship and tug movements during the operation of the facility.

The principal issues addressed in the assessment are:

- the effects of dredging on water quality in Smith Bay and, in particular,
  - the mobilisation of sediments and increased turbidity
  - the potential mobilisation and release of inorganic contaminants such as heavy metals
  - the potential mobilisation and release of organic matter and soluble organic compounds (with associated Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD), respectively)
- the effects of re-mobilisation of sediment on water quality during storm events
- the effects of propeller wash and the mobilisation of sediments on water quality
- the potential effects on water quality at the seawater intake for the adjacent land-based abalone farm.

The aim of this chapter is to:

- describe the oceanographic features of Smith Bay
- provide a baseline of water quality in Smith Bay
- assess whether the proposed development is likely to result in water quality thresholds being exceeded, and if so, the extent and duration of such effects
- summarise the potential effects on water quality using 'zones of impact' mapping
- provide recommendations on practical means to mitigate potential impacts on water quality.

9.2 REGIONAL SETTING

The north coast of Kangaroo Island is a relatively moderate to low energy environment as it is largely sheltered from the prevailing south westerly swells in the Southern Ocean (Edyvane 1999). However, Smith Bay does at times receive relatively small westerly swells that refract around the Island and decline in size and energy as a result of the processes of refraction, diffraction, bed friction and breaking as they travel east along the north coast.

The north coast is also sheltered from waves generated by strong south westerly winds in winter, and the prevailing south easterly winds and sea breezes in summer. It is, however, exposed to waves generated by occasional strong northerly winds that are generally of relatively short duration. It is likely that the largest waves at Smith Bay are wind generated waves from the north due to the relatively large fetch.

Kangaroo Island is located at the confluence of two major oceanic currents: the warm Leeuwin current originating in tropical Western Australia and the cold Flinders current flowing in from Tasmania (Kinloch et al. 2007).

The Smith Bay area and the adjacent hinterland have been largely cleared of native vegetation since European settlement and now support extensive cropping and grazing industries. These activities are likely to have had adverse effects on marine water quality along the north coast of Kangaroo Island through erosion processes within cleared catchments and along degraded creeks during rain events, resulting in the transport of silt into the marine environment via creeks, thereby increasing the turbidity of coastal waters. Similarly, runoff from farms during rain events is likely to transport nutrients and potentially other contaminants into the marine environment. Consequently, water quality along the north coast of Kangaroo Island is likely to have been degraded to at least some degree since European settlement.

Smith Bay is remote from any urban discharges to the marine environment, the nearest being Emu Bay and Kingscote, approximately 5 km and 20 km to the east, respectively.

In recent years, a land-based abalone farm has been operating in Smith Bay. The abalone farm takes in seawater for use in the farm via intakes located approximately 200 metres offshore, and discharges used seawater with elevated nutrient levels to the foreshore area of Smith Bay. Refer to Chapter 11 – Land-Based Aquaculture for specific impact assessment in the context of the land-based abalone farm.

9.3 ASSESSMENT METHODS

9.3.1 GEOPHYSICAL AND GEOCHEMICAL INVESTIGATIONS

A bathymetric survey of Smith Bay in the immediate vicinity of the proposed KI Seaport was conducted in 2014 as part of the preliminary design studies (see Chapter 4 – Project Description). This was supplemented by a bathymetric survey over a wider area of Smith Bay by BMT as part of their hydrodynamic modelling studies (see Appendix F2). An additional detailed bathymetric survey was undertaken by Hydro Survey in January 2018 to better define the bathymetry of Smith Bay (Hydro Survey 2018).

An offshore geophysical investigation was undertaken in 2015 using continuous seismic profiling and seismic refraction techniques, supplemented by three onshore boreholes to aid interpretation (see Chapter 4 – Project Description).

An additional investigation of the morphology and chemistry of the shallow (<3 metres) sediments underlying Smith Bay was undertaken by COOE Pty Ltd (Appendix F1) using:

- a vibroseis corer to provide sediment cores from 12 sites to a maximum depth of three metres (or until refusal)
- a diver hammered corer to provide sediment cores from an additional six sites to a maximum depth of 60 cm (see Plate 9-1).

The sediment cores were analysed by ALS for grain size and a suite of chemical parameters, including a range of potential contaminants (see Appendix F1).

Additional sediment cores to greater depths (five and 17.5 metres) were undertaken at 12 sites by CMW Geosciences for engineering design purposes (see Appendix C1).

PLATE 9-1 A DIVER TAKING A SEDIMENT CORE IN SMITH BAY (DEPTH 13 M)

9.3.2 SEDIMENT PLUME MODELLING

Overview

Sediment plume modelling has been undertaken using the TUFLOW FV ST software, which is developed and distributed by BMT (see Appendix F2). A detailed description of the development and validation of the TUFLOW hydrodynamic model for its use in the Smith Bay assessment is provided in Appendix F2.

TUFLOW was recently used by BMT to model sediment plumes associated with the channel widening at Outer Harbor for Flinders Ports (BMT 2017).

The aims of the sediment plume modelling and assessment were to:

- describe the baseline turbidity conditions within Smith Bay, including a description of the processes driving natural variability
- develop scenario/s describing the potential generation of silt plumes based on dredge footprint sediment properties and proposed construction methodology
- numerically model the construction scenarios to assess the spatial and temporal distribution of potential impacts to turbidity and sedimentation
- inform any Construction Environmental Management Plan (CEMP) measures that may be necessary to manage impacts.

Assumptions

The likely design with the wharf 420 metres offshore assumes a dredging volume of 100,000 cubic metres. However, a 'worst case' design scenario with the wharf 320 metres offshore and assuming a dredging volume of 200,000 cubic metres was also modelled to provide an upper bound of dredging volume.

It was assumed that dredging would occur to a depth of 13.5 metres at lowest astronomical tide (LAT). The total duration of the capital dredging campaign is expected to be at least 30 days (expected case) or 60 days (worst case), but may take longer (up to 75 days with increased delays) depending on operational methodologies and weather conditions.

The assumptions concerning sediment composition used in the model were derived from the geotechnical investigation described in Appendix F1. Analysis of sediment samples for particle size distribution provided the material classes for use in the sediment plume modelling.

It was assumed that the dredging would be undertaken using a Cutter Suction Dredge (CSD) pumping material into a confined Dredge Material Placement Area (DMPA) situated on adjacent Smith Bay land. Dredged material would be dewatered within the DMPA and suitable coarse material recycled as causeway core construction material. Treated tailwater from the DMPA would be returned to Smith Bay nearshore waters via a controlled discharge point, after passing through a series of settlement ponds.

The assumptions associated with CSD productivity, causeway construction and plume generation are described in Appendix F2.

Numerical Model Development

The water quality assessments rely on the development and application of the following numerical models:

- wave model – SWAN (Simulating WAves Nearshore), an industry standard numerical model developed by TU Delft (Delft University of Technology 2006)
- 3D hydrodynamic model – TUFLOW FV (BMT WBM 2013)
- sediment transport model – TUFLOW FV ST module (BMT WBM 2013).

SWAN is used to predict wave conditions at Smith Bay in order to couple with the sediment transport models (silt plume assessment) and to inform the littoral sediment transport calculations for the coastal process assessment.

TUFLOW FV (and TUFLOW FV ST module) predict water levels and currents at Smith Bay and are used to model the advection, dispersion and settlement of silt plumes from dredging and causeway construction.

Oceanographic Data Acquisition

Metocean Services International was engaged to collect data on the wave and current climate in Smith Bay. The primary purpose of the data is to develop a design wave for the site which is used to determine the wave loads on structures and vessels, rock wall sizing, berth availability, and the requirements for tugs. The data is also essential to populate and validate the wave and hydrodynamic models developed by BMT as part of the environmental assessment.

Metocean Services deployed an Axys Triaxys wave buoy fitted with dual satellite telemetry systems (Inmarsat DataPro as primary and Iridium as backup) at a depth of approximately 10 metres in Smith Bay in June 2016 (see Plate 9-2), and collected 12 months' data. The buoy was also fitted with an integrated Nortek Aquadopp acoustic doppler current profiler.

Data Collation

The following datasets were sourced, collated and processed for use in the numerical modelling and technical assessments:

- local hydrographic survey data
- broadscale bathymetry
- wharf design layout (autocad or GIS files)
- Smith Bay metocean data (raw and processed digital files)
- numerical model boundary condition datasets

- dredge footprint sediment properties (particle size distributions)
- the dredging and causeway construction methodology technical note (to facilitate silt plume model scenario development).

Model validation

Comparisons of model predictions with various measurements within the Smith Bay study area and wider region demonstrate that the modelling platform is capable of predicting, with the level of accuracy required in the context of this EIS, the following environmental conditions at Smith Bay:

- wave heights, periods and directions
- tidal water levels and currents
- non-tidal (residual) water levels and currents
- water column temperatures
- benthic photosynthetically active radiation (PAR) response to water column total suspended solids (TSS).

While there are inevitably discrepancies between model predictions and observed conditions, the level of agreement demonstrated by the model validation is considered sufficient (including by the peer reviewer Dr Jason Antenucci) for the purpose of robustly assessing impacts associated with the proposed development (Appendices F2 and F4). The modelling techniques used represent the best available science for the investigation of such effects.

TSS – Turbidity relationship

The continuous measurement of water column total suspended solids (TSS) in the field has typically been problematic as it is currently only possible to measure TSS using laboratory based analytical procedures. Consequently, instruments that measure light-scattering in the water column caused by suspended solids have traditionally been used as a practical means of continuously measuring turbidity in nephelometric turbidity units (NTU) as a proxy for TSS. A linear relationship between turbidity and TSS was derived by measuring TSS and turbidity in a series of samples of Smith Bay sediment in seawater at a range of concentrations and sediment sizes to facilitate the conversion of modelled TSS concentrations in mg/L into turbidity in NTU (and vice-versa) (Appendix F3).

Photosynthetically Active Radiation (PAR) attenuation

Sediment plumes generated during dredging and construction have the potential to increase TSS concentrations and hence reduce the amount of light available for the photosynthetic processes of benthic marine communities such as seagrasses (i.e. benthic Photosynthetically Active Radiation (PAR) levels). The rate of light attenuation is described by standard decay equations (see Appendix F2). Benthic PAR modelling has therefore been undertaken for Smith Bay using data collected during the January/February 2018 field deployment.

Ambient suspended sediment

A regression model for ambient suspended sediment was developed in order to estimate the Total Suspended Solids (ambient plus plume) as part of the water quality risk assessment. The regression model was based on the 12-month measured turbidity time series dataset along with modelled parameters representing the primary environmental drivers of suspended sediment (turbidity). The modelled parameters were current speed, wave height, period and bed shear stress. The ambient suspended sediment model was used to predict the time series of TSS at sensitive receptor locations (i.e. Yumbah's seawater intakes) that were added to the modelled outcomes (Appendix F2).

Propwash

Sediment plumes could be generated by ship propwash at the proposed facility. Vessel propulsion leads to localised velocity fields which may be capable of generating sufficient bed shear stress to resuspend sediment. The simulations are based on Panamax vessels with a draught of 11.6 metres, representing the deepest draft vessel likely to use the facility. In practice, most vessels would have much reduced draft requirements and their propellers would be consequently higher in the water column. Likewise, unladen vessels would sit much higher in the water column. The methods and assumptions used in the simulations are detailed in Appendix F2.

The calculated velocity fields for the vessels were converted to bed shear stress, which was applied to representative grain size sediments from the geotechnical assessment (Appendix F1).

The total load of fines assumed to be released by the propeller wash of an 11.6 metre draft vessel in the model was nine tonne (for a single berthing operation) (split evenly between clay and silt). Note that clay is known to form a lower proportion of the seafloor material than this assumption, which is therefore conservative.

The resulting time series of sediment resuspension were applied to the TUFLOW FV hydrodynamics model used for the sediment plume assessments, during the same time periods used for the causeway construction assessment.

Smith Creek hydrology

Hydrologic modelling of the Smith Creek catchment was undertaken to derive a representative 1-in-10-year flood flow for use in the TUFLOW FV model. The non-linear numerical Watershed Bound Network Model (WBNM) has been used to model the Smith Creek catchment (Appendix F2).

9.3.3 BASELINE WATER QUALITY MONITORING

BMT was engaged to undertake baseline water quality monitoring in Smith Bay to:

- improve the understanding of ambient water quality conditions at the site, including storm events and seasonal natural variability

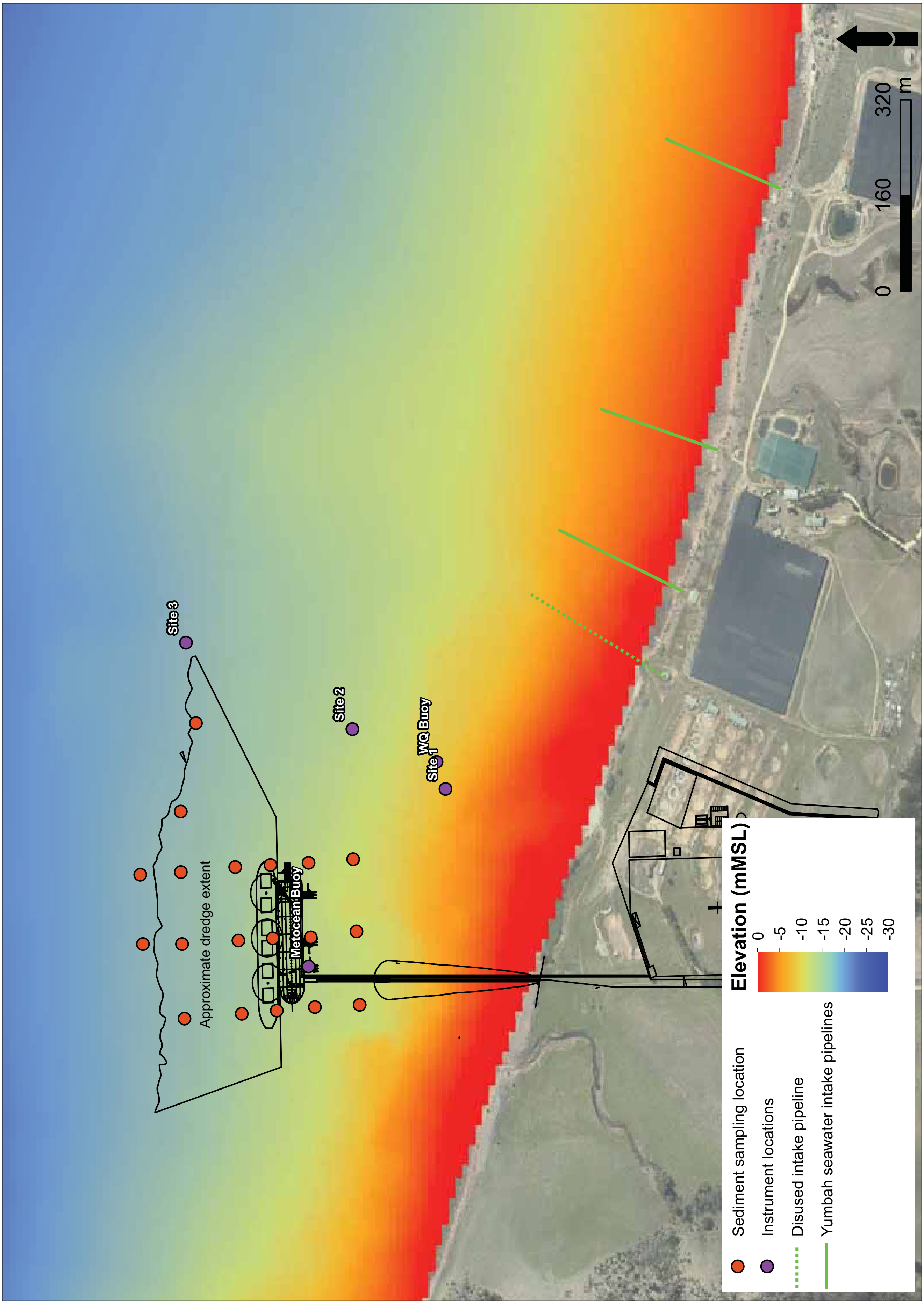


FIGURE 9-1 LOCATION OF OCEANOGRAPHIC AND WATER QUALITY INSTRUMENTS AND SEDIMENT SAMPLING SITES AT SMITH BAY

- increase certainty around silt plume impact assessments in the context of natural turbidity
- develop a robust approach to monitoring potential effects on water quality (see Appendix F3).

A review of existing water quality data for the Smith Bay area was undertaken, including:

- in situ water quality readings within Smith Bay by COOE Pty Ltd using a hand-held instrument during geotechnical drilling (Appendix F3)
- the collection of water samples within Smith Bay by COOE Pty Ltd and subsequent laboratory analysis of TSS, nutrients and metals (see Appendix F3)
- an assessment (Tanner and Bryars, 2007) of the impact of land-based abalone aquaculture discharges at Smith Bay on the adjacent marine environment
- the EPA's 2011 water quality data (turbidity and nutrients) for two sites near Smith Bay (Sam Gaylard, EPA, pers. comm).

A water quality monitoring buoy (with telemetry for remote access of data) was deployed in Smith Bay approximately 200 metres from shore at a water depth of approximately 7–8 metres (see Plate 9-2). Water quality measurements were recorded using a YSI EXO2 multi-parameter water quality sonde with antifouling wiper (https://www.ysi.com/exo2>), which was configured to log conductivity, temperature, depth and turbidity every 10 minutes. The sensors were located one metre below the surface.

During each servicing trip, water quality profiles were taken at the monitoring site, and water samples were collected adjacent to the monitoring buoy at the surface and near the seabed for subsequent analysis of TSS, nutrients, metals (total and dissolved) and particle size distribution (PSD).

Additional water quality instruments were deployed near the seabed in Smith Bay at three sites at depths of six metres, 10 metres and 14 metres for a six-week period during January and February 2018 (see Figure 9-1). The purpose of this instrument deployment was to collect a concurrent oceanographic and water quality dataset at Smith Bay and to provide greater spatial coverage of Smith Bay with respect to water quality.

The following instruments were deployed at each site:

- water quality instrument (YSI 6000) measuring temperature, conductivity and turbidity in 15-minute intervals (see Plate 9-2)
- benthic PAR sensors (Odyssey) with automatic wiper, logging measurements in 15-minute intervals
- an array of benthic PAR sensors at one site mounted one metre vertically apart in the water column to assess light attenuation
- sedimentation tubes to collect settled sediment particles to determine their approximate (average) settlement rate, particle size and origin (inorganic vs organic).

An additional PAR logger was also installed at the Smith Bay house to measure surface (terrestrial) PAR.

PLATE 9-2 WATER QUALITY MONITORING INSTRUMENT (YSI 6000) DEPLOYED IN SMITH BAY FOR ONE YEAR

Sedimentation tube sample analysis was undertaken by a certified laboratory, which included analysis of the PSD, including inorganic vs organic fractions.

During the instrument deployment trip, representative surface sediment samples were collected and mixed with seawater to prepare varying suspended sediment concentration samples. These samples were analysed for TSS and turbidity, with the results used to establish a TSS to turbidity relationship.

9.3.4 WATER QUALITY IMPACT ASSESSMENT METHODOLOGY

Overview

BMT was engaged to interpret the hydrodynamic modelling outcomes and marine water quality studies to determine the potential impacts on water quality. The main goals were to assess impacts on water quality at Yumbah's seawater intakes and on the health of the Smith Bay marine ecosystem.

BMT's assessment of potential water quality impacts used a risk-based approach that considered the consequences and likelihood of the impacts on water quality. A detailed description of the methods used and definitions of assessment categories is provided in Appendix F3. The risk assessment included consideration of the intensity, geographic extent and duration of impacts on water quality, the sensitivity of environmental receptors to the impact, and the probability of the impact occurring.

The approach assessed compliance against water quality guideline values. This method ensures the environmental values for the waters of concern are protected and/or enhanced. The most important water quality criterion was suspended sediments (turbidity), which is consistent with other dredging assessments, but all other relevant water quality criteria were also considered.

The assessment used two approaches:

- percentile exceedance plots of construction related turbidity were presented. These percentile plots are direct outputs from the modelling and provide an indication of excess suspended sediment from dredging activities and causeway construction
- project-specific threshold values were developed to assess potential impacts to marine water quality that are presented as 'zones of impact' derived using the percentile exceedance plots (see Appendix F3).

The 'zone of impact' approach is recognised as 'best practice' in dredging environmental assessments. It is built on the methodologies set out in the dredging environmental assessment guidelines produced by the WA EPA (2016) and is regularly used in dredging impact assessments throughout Australia (see Figure 9-2). As described in the modelling report (Appendix F2), it considers a number of scenarios in order to characterise the upper and lower bounds of potential impacts. The scenarios include two design options related to the distance of the wharf from shore, which largely relate to dredging volume, and a range of environmental conditions across both summer and winter. The modelling results are presented as 'expected' or 'average' case, and 'worst' case.

The zones adopted for the current assessment were as follows:

- zone of high impact: water quality impacts resulting in predicted mortality of ecological receptors with recovery time greater than 24 months, and/or likely adverse impacts to aquaculture
- zone of low to moderate impact: water quality impacts resulting in predicted sub-lethal impacts to ecological receptors and/or mortality with recovery between six and 24 months, and/or potential adverse impacts to aquaculture
- zone of influence: extent of detectable plume, but no predicted ecological impacts or impacts to aquaculture.

Water quality guidelines

The Environment Protection (Water Quality) Policy 2015 provides the structure for regulation and management of marine water quality in South Australian waters, and specifies the environmental values that apply in relation to marine waters in South Australia. At Smith Bay, the relevant environmental values are: a) aquatic ecosystems, b) recreation and aesthetics, and c) primary industries - aquaculture and human consumption of aquatic foods.

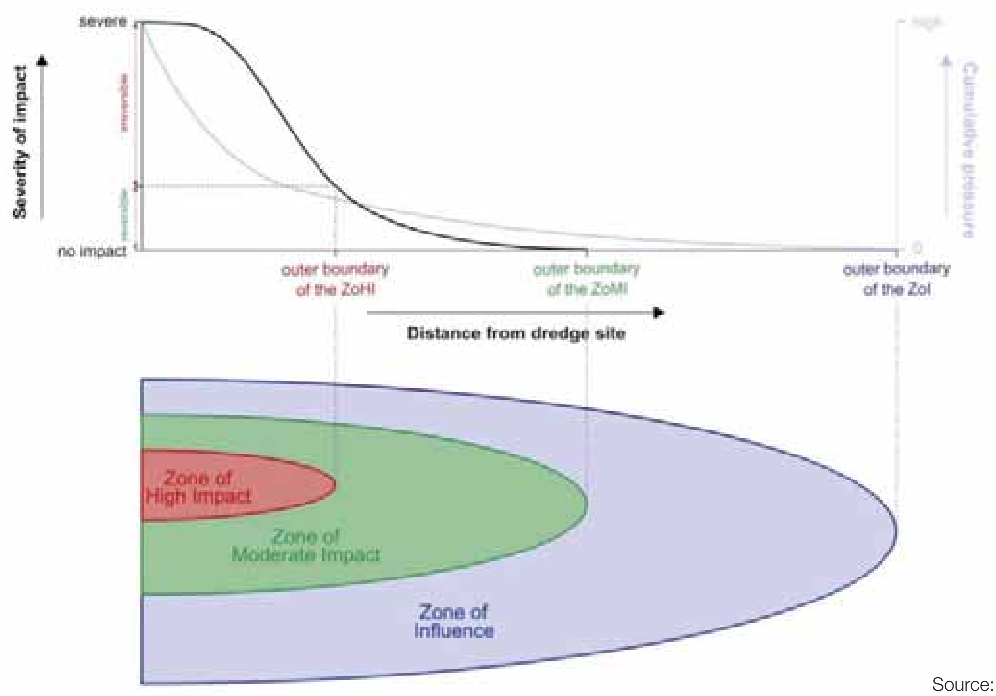
The ANZECC/ARMCANZ (2000) guidelines are used as trigger values for aquatic ecosystems and primary industries. These trigger values indicate where the receiving environment is potentially at risk of being harmed. The guidelines are not intended to be applied as mandatory standards but do provide guidelines for assessing, managing and protecting water quality in relation to designated environmental values.

The ANZECC/ARMCANZ (2000) water quality guideline values relevant to Smith Bay are included in Appendix F3 (see Table 2-2). The most relevant of these guideline values with respect to the proposed dredging program are:

- turbidity: 0.5 NTU (Aquatic Ecosytem Protection)
- TSS: 10 mg/L (Protection of Aquaculture).

Turbidity thresholds

Threshold values for turbidity were developed by analysing the 12-month baseline water quality (turbidity) monitoring data set and producing percentile curves that provide an indication of the natural range of turbidity, including duration/ frequency metrics, for a range of conditions (see Appendix F3). The analysis included a 30-day moving window with 10-day increments over the entire data-set to provide information on natural variability throughout the year.



Source: WA EPA 2016

FIGURE 9-2 CONCEPT DESIGN OF IMPACT ZONES

Threshold values for the protection of the marine ecosystem were derived from these percentile curves based on the natural variability around the 50th percentile (average conditions), the 80th percentile (poor conditions with moderate to high wind and waves) and the 99th percentile (storm conditions). As such, this method considers both acute and chronic impacts.

The 'zone of influence' was defined as the extent of detectable plumes due to the proposed dredging. Turbid plumes were assumed to become 'detectable' once they were approximately 30–50 per cent above background conditions. To determine the extent of this zone, the following criteria were used:

- greater than 0.2 NTU above 50th percentile conditions
- greater than 0.5 NTU above 80th percentile conditions
- greater than 2 NTU above 99th percentile conditions.

The approach used to determine the threshold level for the 'zone of low to moderate impact' (i.e. when water quality extends beyond natural variation and impacts to ecological receptors may begin to occur) involved using five standard deviations from the natural background mean at the 50th and 80th percentiles. Threshold levels for the 'zone of high impact' were determined using 10 standard deviations from the mean at the 50th and 80th percentiles.

Threshold values to protect seawater quality at Yumbah's intakes were based around the 99th percentile turbidity (near-maximum turbidity) and the existing ANZECC/ARMCANZ (2000) water quality guideline values for TSS for the protection of aquaculture (i.e. 10 mg/L). The 99th percentile threshold value for the 'zone of low to moderate impact' was derived from the TSS guideline value of 10 mg/L (i.e. 10 NTU). The threshold value for the 'zone of high impact' was assumed to be 50 per cent higher than this guideline value (i.e. 15 mg/L or 15 NTU).

An adjustment of 1 NTU was made to the 99th percentile thresholds to account for background turbidity as the modelling outputs are provided in excess sediment 'above background'. Background turbidity has been limited to 1 NTU in this adjustment as it has been assumed that dredging would only occur during relatively calm sea conditions when turbidity would not be expected to exceed approximately 1 NTU (i.e. approximately 80 per cent of the time). Therefore, the 99th percentile threshold values were adjusted to 9 mg/L (i.e. 9 NTU) and 14 mg/L (i.e. 14 NTU) for the 'zone of low to moderate impact' and the 'zone of high impact', respectively.

Descriptions of the zones of impact and how they relate to water quality (turbidity) thresholds and aquaculture thresholds are summarised in Table 9-1. The turbidity thresholds used in the assessment are summarised in Table 9-2.

The impact assessment threshold values developed for this project are more conservative than other similar dredging projects due to the low turbidity environment of Smith Bay, and the presence of an aquaculture facility adjacent to the proposed KI Seaport. Benchmarked thresholds for similar dredging projects in Western Australia (Chevron 2010) and Townsville (POTL 2016) are shown in Table 9-2.

TABLE 9-1 DESCRIPTION OF 'ZONES OF IMPACT' AND THEIR RELATIONSHIP TO TURBIDITY THRESHOLDS

Zone of impact	Water quality (Turbidity)	Aquaculture limits
Zone of high impact	Excess turbidity causes total turbidity to go beyond natural variation. Threshold value = excess turbidity greater than 10 standard deviations from the natural background mean.	99th percentile TSS/turbidity exceeds 14 mg/L (or 14 NTU) at the intake pipes – based on 50% higher than ANZECC/ARMCANZ (2000) aquaculture guideline value (minus background of 1 NTU).
Zone of low to moderate impact	Excess turbidity *may* push total turbidity beyond natural variation. Threshold value = excess turbidity greater than five standard deviations from the natural background mean.	99th percentile TSS/turbidity exceeds 9 mg/L (equivalent to 9 NTU) at the intake pipes - based on the ANZECC/ARMCANZ (2000) criteria (minus background of 1 NTU).
Zone of influence	Extent of detectable plumes. Dredging related turbidity exceeds 0.2 NTU above 50th percentile conditions, or 0.5 NTU above 80th percentile conditions.	99th percentile TSS/turbidity exceeds 2 mg/L (equivalent to 2 NTU).

TABLE 9-2 TURBIDITY THRESHOLD VALUES (ABOVE BACKGROUND) USED TO ASSESS IMPACTS IN SMITH BAY

Impact zone	Description	Method	Percentile and descriptor	Turbidity threshold (NTU)	Comparative benchmarked thresholds
Zone of high impact	Excess turbidity *definitely* pushes total turbidity beyond natural variation.	10 x standard deviations from 50th percentile mean.	50th percentile (exceeded 50% of the time).	2.5	10 (Chevron 2010), 5 (POTL 2016)
		10 x standard deviations from 80th percentile mean.	80th percentile (exceeded 20% of the time).	5.2	25 (Chevron 2010), 10 (POTL 2016)
		Dredging related turbidity exceeds 14 NTU.	99th percentile (exceeded 1% of the time).	14	
Zone of low to moderate impact	Excess turbidity *may* push total turbidity beyond natural variation.	5 x standard deviations from 50th percentile mean.	50th percentile (exceeded 50% of the time).	1.3	5 (Chevron 2010), 2 (POTL 2016)
		5 x standard deviations from 80th percentile mean.	80th percentile (exceeded 20% of the time).	2.6	10 (Chevron 2010), 5 (POTL 2016)
		Dredging related turbidity exceeds 9 NTU.	99th percentile (exceeded 1% of the time).	9	
Zone of influence	Full extent of detectable plumes (including resuspension).	Dredging related turbidity exceeds 0.2 NTU.	50th percentile (exceeded 50% of the time).	0.2	
		Dredging related turbidity exceeds 0.5 NTU.	80th percentile (exceeded 20% of the time).	0.5	
		Dredging related turbidity exceeds 2 NTU.	99th percentile (exceeded 1% of the time).	2	

Development of impact zones

Zones of impact were delineated by interpolating impact threshold values spatially across the study area using GIS mapping software to produce three-dimensional (3D) threshold grids. These threshold grids were then analysed against the 3D model output grids. This produced impact zone maps that show areas where modelled turbidity is higher than the relevant impact threshold value.

Sediment deposition thresholds

Currently the data available on sediment deposition thresholds for benthic communities, including seagrasses, is limited (see Appendix I4 for a review of the available data). There are indicative values developed by DHI (in Chevron 2010) that were applied to a dredging project in north west Australia (Table 9-3). These are based on the small seagrass *Halophila*, which is likely to be a good indicator for the benthic community in general, and have therefore been adopted here.

TABLE 9-3 SEDIMENT DEPOSITION THRESHOLDS (ABOVE BACKGROUND) FOR IMPACTS ON SEAGRASSES

Impact zone	50th percentile i.e. 15 days per month ($mg/cm^2/day$)	95th percentile i.e. 1.5 days per month ($mg/cm^2/day$)	Final deposition (mg/cm^2)	Final deposition depth+ (mm)
Zone of high impact	>70	>700	>700	>14
Zone of low to moderate impact	20–70	200–700	200–700	4–14
Zone of influence	3.0–20	30–200	30–200	0.6–4

+ Sediment depth assumes a dry sediment density of 500 kg/m^3, i.e. 500 mg/cm^2 is approximately equivalent to a sediment deposition depth of 10 mm.

9.3.5 RISK ASSESSMENT

A risk assessment of the effects on water quality was undertaken according to the risk management process ISO 31000:2009 (see Chapter 25 and Appendix F3).

9.4 EXISTING ENVIRONMENT

The detailed findings of the assessment of baseline water quality in Smith Bay are provided in Appendix F3.

The physical features of the Smith Bay marine environment that drive coastal processes and the hydrodynamic model, including bathymetry, winds, tides, waves, and currents, are described in Chapter 10 – Coastal processes, Section 10.4 and Appendix G1.

9.4.1 SMITH BAY SEDIMENT CHARACTERISTICS

The offshore drilling investigation revealed that the sediments in Smith Bay are relatively pristine, with no evidence of synthetic or natural pollutants. Specifically, the investigation revealed:

- coring could only occur to a maximum depth of 140 cm before hard substrate was encountered
- sediment samples consisted mostly of sand and gravel (70–90 per cent), with a smaller proportion (10–25 per cent) of fine sediments (silt and clay). Deeper sediment layers to the south of the dredge footprint in the deeper paleo channel had a higher proportion of fines (59 per cent) and organic matter content
- metals and metalloids were found in low concentrations at all sites, with concentrations well below sediment quality guideline levels
- no synthetic chemicals (including phenols, petroleum hydrocarbons and organotins) were detected in any sediment samples
- potential acid sulfate soils were not expected in the coarse sand sediments of Smith Bay. The pH of deeper organic marine sediments near the middle of the dredge footprint was near neutral (pH 6.5)
- nutrient concentrations in sediment samples were generally low in the dredge footprint, with total nitrogen mostly between 110 and 690 mg/kg. The exception was one sample in deeper organic sediments south of the dredge footprint which had higher concentrations (2850 mg/kg). Total phosphorus in all sediment samples ranged from <0.1 to 2.1 mg/kg
- organic matter content in sediment samples ranged from 0.17 mg/kg to 0.76 mg/kg, apart from deeper organic sediments near the middle of the dredge footprint had organic matter content of 4.47 mg/kg
- the site within the paleo-channel depression to the south of the dredge footprint was the only outlier, with the sediment results returning the thickest sediment layer, the highest percentage of fines and the highest concentration of total nitrogen and organic matter. It appears likely that the atypical results at this site are caused by the accumulation and decay of seagrass within the depression (see Appendix F1).

9.4.2 TURBIDITY

Turbidity in Smith Bay generally remained below 1 NTU for the 12-month monitoring period, which is considered to be very low. There were frequent elevated turbidity periods coincident with weather patterns, but turbidity did not exceed 10 NTU at any time. The turbidity data recorded in Smith Bay is summarised in Table 9-4.

Turbidity can be approximately related to water (clarity) or visibility in the following way (EPA 1997):

- 2 NTU 10 metres depth
- 5 NTU 4 metres depth
- 10 NTU 2 metres depth
- 25 NTU 0.9 metres depth
- 100 NTU 0.2 metres depth.

Near-bed turbidity was slightly higher than surface turbidity, with turbidity mostly being around 1–3 NTU. The nearshore shallower site had slightly higher turbidity than the deeper sites due to the increased wave action/resuspension.

Turbidity was lower during the spring and summer months (September to February) when rainfall is lower and the winds are predominantly from the south (i.e. offshore at Smith Bay).

During the winter months when rainfall is higher and winds are more frequently from the north (i.e. onshore), the turbidity was noticeably higher. Turbidity is typically influenced by wind-generated waves that cause resuspension of sediment particles into the water column (see Table 9-5).

Ambient turbidity levels in Smith Bay surface waters are typically below the ANZECC/ARMCANZ (2000) guideline value to protect marine ecosystems of 0.5 NTU (based on annual median) during summer and spring, but slightly exceed the guideline during autumn and winter. The near-bed turbidity, however, exceeded the guideline during summer at both the five metre and 10 metre depth contours (i.e. 1.7 and 1 NTU, respectively).

9.4.3 SEAWATER TEMPERATURE, SALINITY AND PH

Surface water temperature ranged from 14°C during winter to 21–22°C during summer, with occasional spikes to 25°C that coincided with low tidal movement and high atmospheric temperatures during heat waves. Temperature profiling data (in situ water quality readings through the water column), indicated a similar range of water temperature (i.e. 14°C in winter and around 21°C in summer).

Salinity ranged from 34–35 parts per thousand (ppt) during winter to 36–39 ppt during summer. Salinity profiling data (in situ water quality readings through the water column) showed the same pattern throughout the water column.

The pH of marine water in Smith Bay ranged from 7.9–8.6, which is similar to the typical pH of marine water of around 8.2.

9.4.4 TURBIDITY/TSS CORRELATION

TSS is an important parameter of concern with regard to water quality because it is typically measured and monitored to determine compliance with water quality objectives. Turbidity, however, is the parameter often used as a surrogate for TSS as it is easier and more cost-efficient to monitor. Therefore, the relationship between turbidity and TSS needs to be established so that the turbidity data can be converted to TSS concentrations without the need to monitor for TSS.

The analysis of TSS and turbidity in 16 sediment-water mixture samples, diluted from a single prepared sample of 100 mg/L TSS using representative sediments sourced from the seabed at Smith Bay returned 0.92 mg/L of TSS per 1 NTU of turbidity. However, analysis of various sediment-water mixtures from opportunistic water sampling in Smith Bay and samples derived from the sedimentation tubes returned a wider range of values following agitation, depending on the particle size distribution of the sediment. Whereas the fine sediment produced a turbidity:TSS relationship close to 1:1, the coarser sediment produced a turbidity:TSS relationship closer to 1:3 (see Appendix F3).

9.4.5 SUSPENDED SEDIMENTS

The TSS data were below the ANZECC/ARMCANZ (2000) aquaculture guideline value of 10 mg/L, with most values being less than 5 mg/L. The exception was a nearshore water sample collected during visibly turbid conditions following strong northerly winds on 22 February 2018, which had a TSS value of 41 mg/L.

TABLE 9-4 SUMMARY OF TURBIDITY DATA RECORDED IN SMITH BAY

Location	Measurement period	Median (NTU)	95th percentile	99th percentile
WQ buoy (near surface)	Feb 2017 to Feb 2018	0.4	1.8	3.1
WQ buoy (near surface)	Jan/Feb 2018	0.1	0.4	0.7
5 m depth contour (near bed)	Jan/Feb 2018	1.7	2.4	3.3
10 m depth contour (near bed)	Jan/Feb 2018	0.9	1.6	1.9

ANZECC/ARMCANZ (2000) guideline value to protect marine ecosystems = 0.5 NTU

TABLE 9-5 SUMMARY OF TURBIDITY DATA FOR VARIOUS WAVE HEIGHTS IN SMITH BAY

Location	Turbidity (NTU) percentiles			
	20th percentile	50th percentile (median)	80th percentile	100th percentile (maximum)
0 – 0.5 m	0.3	0.4	0.7	3.2
0.5 – 1.0 m	0.5	0.8	1.4	6.1
1.0 – 1.5 m	1.1	1.8	2.6	8.1
1.5 – 2.0 m	1.9	2.9	3.4	7.7

ANZECC/ARMCANZ (2000) guideline value to protect marine ecosystems = 0.5 NTU

Suspended sediment particle sizes in water samples ranged from 0.2 μm up to 3000 μm, with most particle sizes around 100–200 μm. There was a higher proportion of inorganic sediment particles (53–65 per cent) compared to organic sediment particles (34–46 per cent) in samples collected from the sedimentation tubes. The average sedimentation rates varied between 0.13 and 0.30 mg/cm^2/day, with the highest rates occurring at the inshore location.

9.4.6 NUTRIENTS

The data indicate that Smith Bay is characterised by relatively low levels of nutrients. All data were below the ANZECC/ ARMCANZ (2000) toxicity trigger values (TTVs) for ammonia and nitrate, and below the aquaculture guideline values for nitrate and nitrite. Ammonia concentrations were at the physico-chemical stressor guideline value of 0.05 mg/L on one occasion (19 October 2017) in surface and bottom waters at the monitoring buoy. Similarly, reactive phosphorus was at the physico-chemical stressor guideline value of 0.01 mg/L in surface waters on 19 October 2017 and bottom waters on 22 August 2017 at the monitoring buoy. However, all other data were below the relevant guideline levels.

9.4.7 PHOTOSYNTHETICALLY ACTIVE RADIATION

Benthic photosynthetically active radiation (PAR) (i.e. light available to seagrass) under ambient conditions in Smith Bay ranged from:

- 8–18 per cent surface irradiance (2–8 mol/m^2/day) at 6 metres depth
- 5–12 per cent surface irradiance (1–6 mol/m^2/day) at 9 metres depth
- 3–10 per cent surface irradiance (1–5 mol/m^2/day) at 10 metres depth
- 3–8 per cent surface irradiance (1–4 mol/m2/day) at 14 metres depth.

The light attenuation coefficient fluctuated between 0.18 and 0.6 m-1, with light attenuation increasing during periods of increased turbidity.

9.4.8 METALS/METALLOIDS

Smith Bay is characterised by relatively low levels of metals/ metalloids, with total and dissolved metals/metalloids mostly below laboratory limit of reporting (LOR). Although there were some slight detections of arsenic, copper and nickel, all concentrations were below the relevant ANZECC/ARMCANZ (2000) guideline values. The only exceedance above guideline values was dissolved zinc which exceeded the aquaculture guideline value of 0.005 mg/L on a number of occasions, but did not exceed the aquatic ecosystem protection guideline value of 0.015 mg/L.

9.5 IMPACT ASSESSMENT AND MANAGEMENT

A summary of the results of the assessment of risks to marine water quality is provided in Appendix F3, Table 5-1.

9.5.1 SEDIMENT PLUMES – CAPITAL DREDGING

Issues

The key concern regarding water quality is from the release of sediments into the water column during the capital dredging program and the formation of sediment plumes. Whilst coarse sediments are likely to quickly drop out of suspension, fine sediments may remain in suspension for a considerable time, particularly during periods of high wave energy. A secondary issue is the periodic resuspension of sediments during periods of high wave energy after initial settling to the sea floor.

Turbid plumes have the potential to migrate and impact upon adjacent sensitive receptors, such as seagrass communities, and seawater quality at the aquaculture intakes. The intensity, duration and extent of the plume would depend on a range of environmental factors, including wind strength and direction, tidal currents and sediment characteristics, and the dredging method, including dredge type, work method and dredging rate.

Ultimately, the turbidity plumes have to be considered within the context of natural variability in turbidity in Smith Bay.

Modelling outputs

The numerical dredge plume model has been configured to predict the dredging related TSS concentrations above the ambient conditions. Ambient TSS is not simulated by the model, which is a reasonable and commonly adopted assumption for dredge plume modelling assessments.

The following assessment of the impact of dredging on water quality relies heavily on dredge plume modelling results that consist of time series results and percentile contour plots of turbidity.

These plots indicate the areas where turbidity was elevated at some point during the dredge campaign, rather than being snapshots of the dredge plume at any particular time. The type of percentile plot (e.g. 50th, 80th or 99th percentile) indicates the amount of time that the turbidity was exceeded at a particular location.

The percentile contour plots used in the impact assessment are depth averaged turbidity (i.e. turbidity averaged vertically in the water column from surface to sea bed). Percentile plots also showing near-bed turbidity are presented in the modelling report (see Appendix F2).

Note that due to the TSS/turbidity correlation being close to 1 (see Appendix F3), TSS and turbidity in the modelling outputs can be considered to be interchangeable (i.e. TSS of 1 mg/L can be considered as approximately the same as turbidity of 1 NTU).

The complete modelling outputs and assumptions are provided in Appendices F2 and F3.

Scenarios

Although the likely design (i.e. a wharf 400 metres offshore) requires a dredging volume of 100,000 cubic metres, the modelling also included a 'worst-case' design scenario (i.e. a wharf 370 offshore) requiring a dredging volume of 200,000 cubic metres. Analysis of the sensitivity of the plume predictions to the two designs showed that the plume impacts are not strongly dependent on the volume or location of the dredging program (within the bounds of the two scenarios assessed) (see Appendix F2). The impact predictions proved to be more sensitive to the range of environmental conditions than the design assumptions.

In order to describe the range of impacts assessed by the full ensemble of plume modelling scenarios the predictions were aggregated into Expected (average) and Worst (upper-bound) case results as described below:

- **Expected** – For a given percentile, the mean level across all simulations was assessed as the 'expected' case. Given the distinct seasonality of the model predictions, summer and winter averages were assessed separately and the maximum level across both seasons was derived as the 'expected' case.
- **Worst** – For a given percentile, the maximum concentration of all ensemble simulations was taken as the 'worst' level at a given location.

Each scenario (expected and worst case) was modelled across both summer and winter to provide an indication of effects of seasonality on impact predictions (Appendix F2). However, the results presented below are for the 'summer and winter' combined scenarios, which provide 'worst-case' predictions.

Percentile plots

The depth averaged percentile contour plots of dredging-related turbidity above background levels for summer and winter are shown in Figures 9-3 through to 9-4. The plots presented are for expected case and worst case scenarios and include both summer and winter conditions. All plots, including separate summer and winter scenarios, are presented in Appendix F2.

Understanding the major drivers of variation that can be seen between the expected and worst case predictions becomes a basis for proposing mitigation and management measures that could be applied to the dredging program in order to improve environmental outcomes.

For sensitive receivers such as seagrass, chronic plume concentrations (e.g. 50th percentile plots) are typically of more importance to determining ecological impacts than acute (i.e. short term) concentrations. For receivers such as the Yumbah seawater intakes, however, both chronic and acute plume concentrations are likely to be relevant when determining impacts.

The following conclusions can be drawn from the TSS percentile maps:

- ***50th percentile (Figure 9-3)***
  - chronic TSS levels exceeding 2 mg/L above ambient are restricted to within 220 metres of the dredging footprint (worst-case)
  - TSS levels exceeding 1 mg/L above ambient are restricted to within 2400 metres of the dredging footprint (worst-case)
- ***80th percentile (Figure 9-4)***
  - chronic TSS levels exceeding 5 mg/L above ambient are restricted to within approximately 150 metres of the dredging footprint and immediately adjacent to the tailwater discharge (worst-case)
  - chronic TSS levels exceeding 3 mg/L above ambient are restricted to within 300 metres of the dredging footprint (worst-case)
- ***99th percentile (Figure 9-5)***
  - acute TSS levels exceeding 10 mg/L above ambient are restricted to within a few hundred metres of the dredging footprint for the expected case
  - TSS levels exceeding 10 mg/L above ambient extend up to 2 km east of the dredging footprint under worst-case conditions
  - TSS levels are predicted to increase at the Yumbah seawater intakes by approximately 4 mg/L for the expected case, and up to 7 mg/L under worst-case conditions.

The winter periods have significantly more influence to the east of the dredging footprint than the summer periods, as a result of the more prevalent wind-driven easterly residual currents. The winter periods also have a larger zone of influence than the summer periods, which is attributable to the higher energy wave and current conditions during the winter season. Acute TSS levels are expected to be in part driven by wave event resuspension of previously deposited dredge plume material.

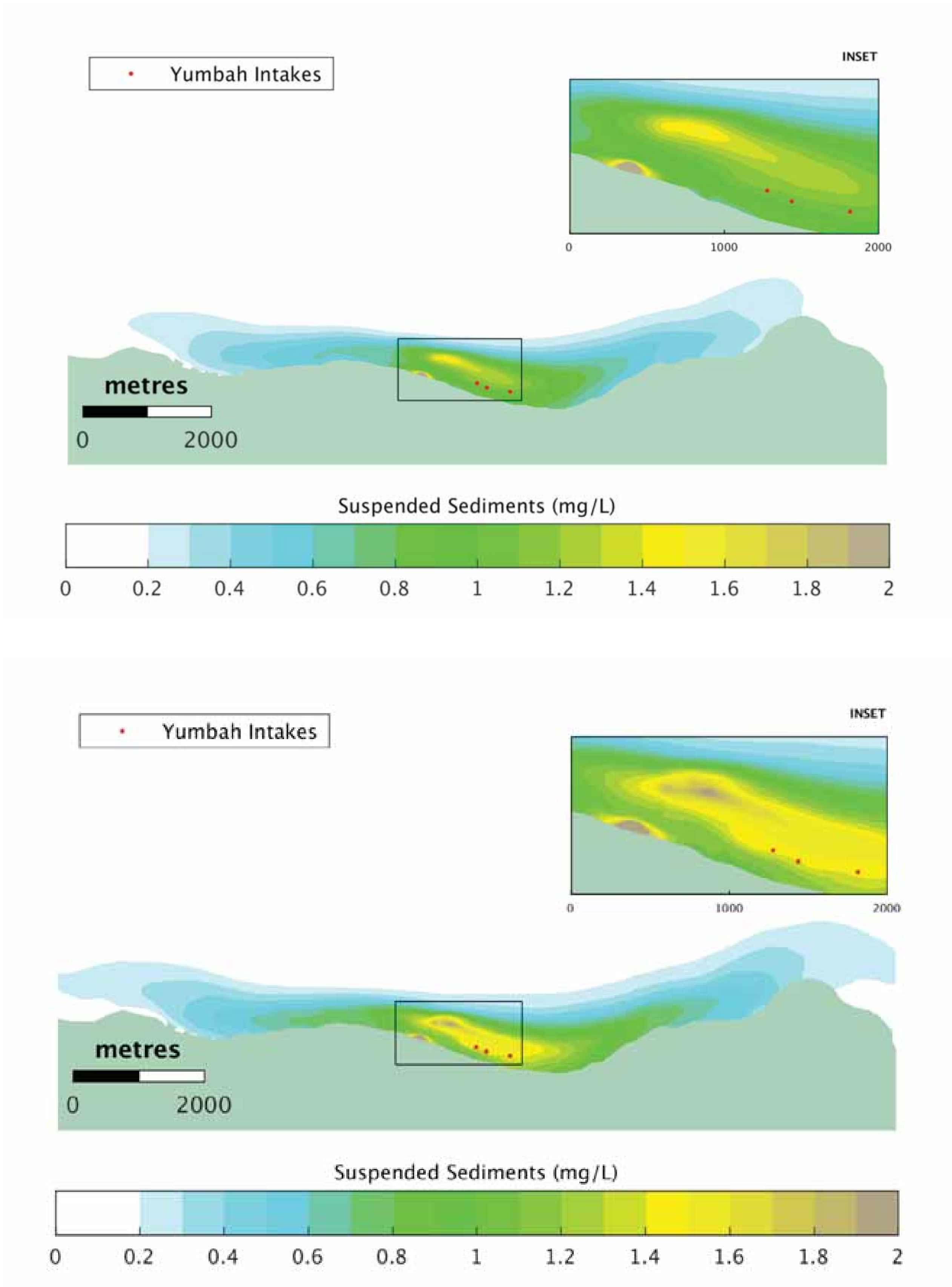


FIGURE 9-3 DREDGE PLUME DEPTH-AVERAGED TSS (ABOVE AMBIENT) 50TH PERCENTILE – EXPECTED CASE (TOP), WORST-CASE (BOTTOM) (SUMMER AND WINTER)

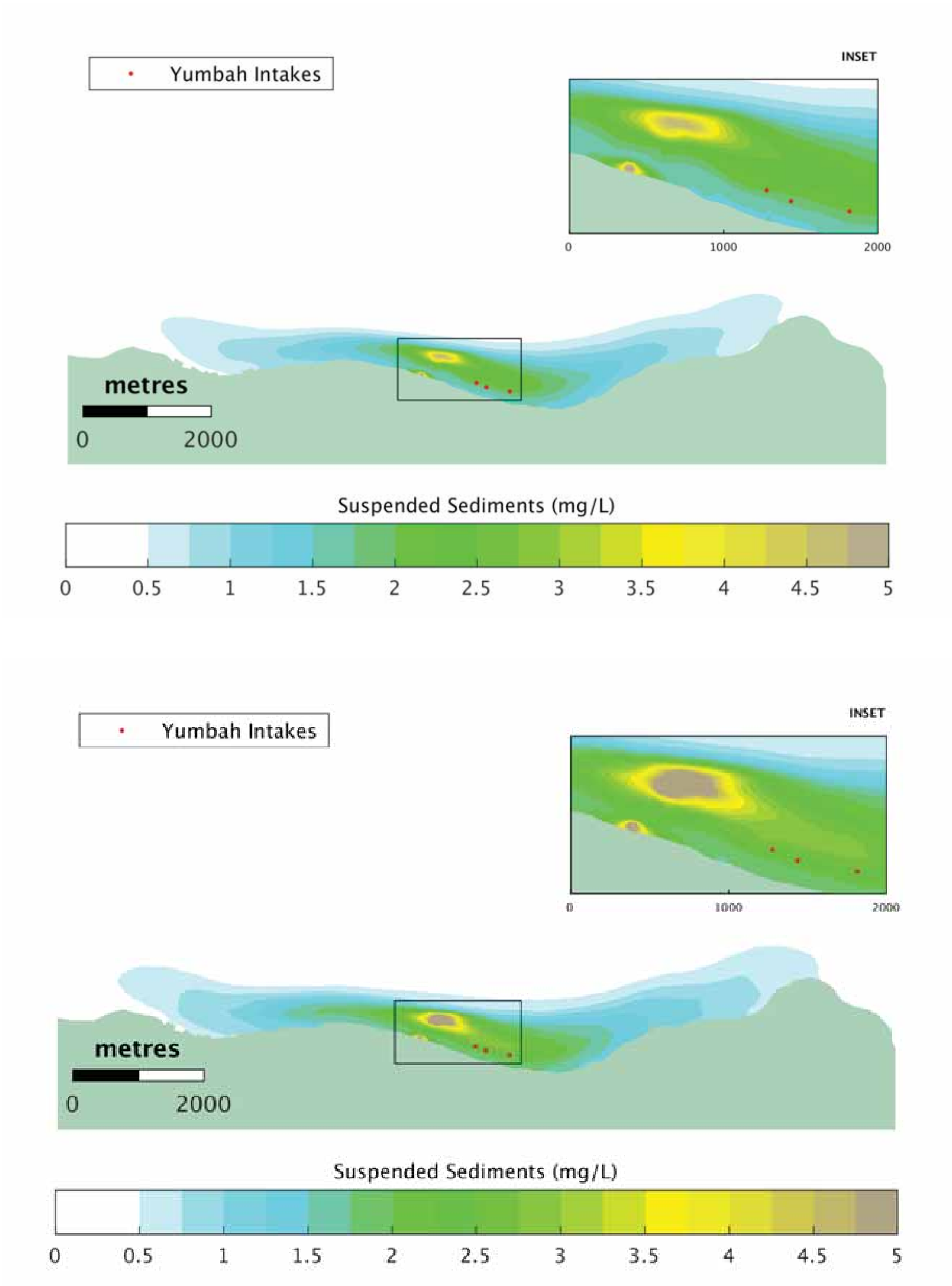


FIGURE 9-4 DREDGE PLUME DEPTH-AVERAGED TSS (ABOVE AMBIENT) 80TH PERCENTILE – EXPECTED CASE (TOP), WORST-CASE (BOTTOM) (SUMMER AND WINTER)

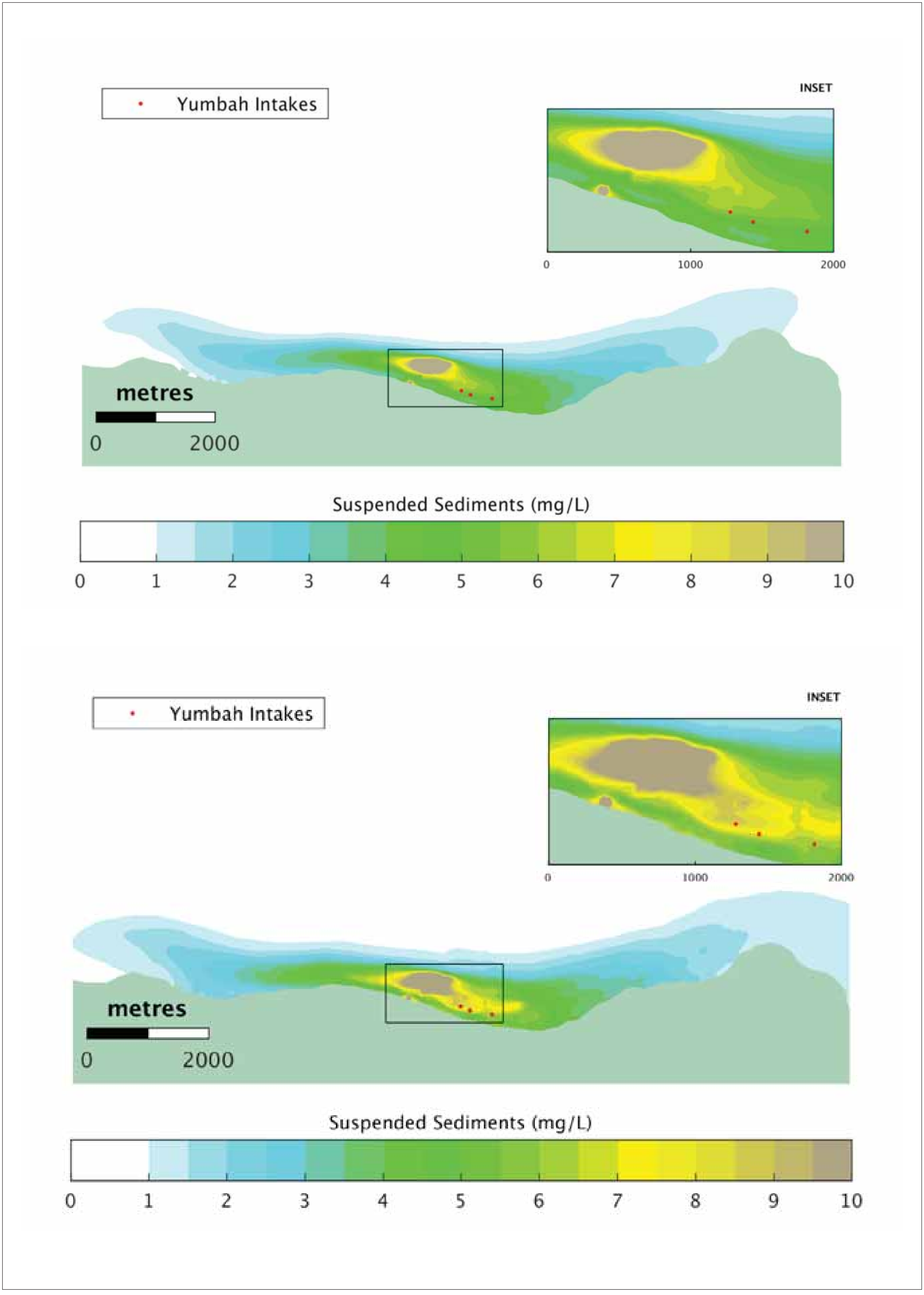


FIGURE 9-5 DREDGE PLUME DEPTH-AVERAGED TSS (ABOVE AMBIENT) 99TH PERCENTILE – EXPECTED CASE (TOP), WORST-CASE (BOTTOM) (SUMMER AND WINTER)

Yumbah seawater intakes

The Yumbah seawater intakes located approximately 500–1200 metres east of the dredging footprint are the most sensitive receivers in Smith Bay. More detailed analysis was therefore undertaken at Yumbah's seawater intakes.

The depth-averaged TSS concentrations (above ambient) at Yumbah's intakes derived from the percentile plots (above) were as follows:

- for at least 80 per cent of the time the TSS increase at the Yumbah seawater intakes is less than 3 mg/L
- for more than 99 per cent of the time the TSS increase at the Yumbah seawater intakes is less than the threshold of 10 mg/L
- the near maximum (99th percentile) TSS increase at the Yumbah seawater intakes is approximately 5 mg/L for the expected case, and up to 9 mg/L for the worst-case.

TSS concentrations were also derived from near the bottom of the water column since Yumbah's intakes are located 1-2 metres above the sea bed. The results are presented as summary statistics (Table 9-6) and as a time series (Figure 9-6). Two reference TSS levels are shown on the time series plots; 10 mg/L which relates to the ANZECC/ARMCANZ (2000) aquaculture guideline and 25 mg/L, which relates to the TSS threshold for greenlip abalone derived from project specific ecotoxicology studies. The detailed results are presented in Appendix F2.

The near-bed TSS concentrations (ambient and dredge plume) at Yumbah's intakes are summarised as follows:

- for 90 per cent of the time the near-bed TSS at the western intakes (i.e. closest to the dredging, which is the worst case) is predicted to range from 1.3 to 8.6 mg/L during the dredging program
- on rare occasions (less than 1 per cent of the time) the 10 mg/L ANZECC (2000) threshold is exceeded at the intakes
- the highest modelled TSS concentrations were 36.4 mg/L and 22.4 mg/L at the western intakes during the winter 2016 and summer 2016 scenarios, respectively
- the TSS exceedances above 10 mg/L are infrequent, occurring several times during the dredging campaign, and typically persisting for around two to five hours
- the acute plume events at the intakes correspond to periods of dodge tides and light to moderate westerly winds.

TABLE 9-6 DREDGE PLUME TSS SUMMARY STATISTICS AT YUMBAH'S SEAWATER INTAKES (NEAR-BED) DURING DREDGING (WORST-CASE SCENARIO)

Location	Period	50th percentile TSS (mg/L)	90th percentile TSS (mg/L)	99th percentile TSS (mg/L)	Maximum TSS (mg/L)
Inactive intake	Summer 2015	1.66	4.27	8.7	12.55
	Summer 2016	1.39	3.27	7.39	16.37
	Winter 2015	3.4	7.12	13.63	22.74
	Winter 2016	3.61	8.06	17.49	23.33
Intake west	Summer 2015	1.61	4.46	9.29	15.1
	Summer 2016	1.34	3.27	7.48	22.42
	Winter 2015	3.52	7.6	15.41	23.01
	Winter 2016	3.67	8.56	19.26	36.43
Intake mid	Summer 2015	1.5	3.84	6.49	9.41
	Summer 2016	1.25	2.84	6.21	14.38
	Winter 2015	3.3	6.38	10.52	16.76
	Winter 2016	3.29	7.98	16.13	28.55
Intake east	Summer 2015	1.4	3.49	6.37	8
	Summer 2016	1.2	2.7	5.69	13.64
	Winter 2015	3.29	6.25	9.44	14.62
	Winter 2016	3.24	7.35	14	18.52

Orange shading = 25 mg/L abalone threshold exceeded

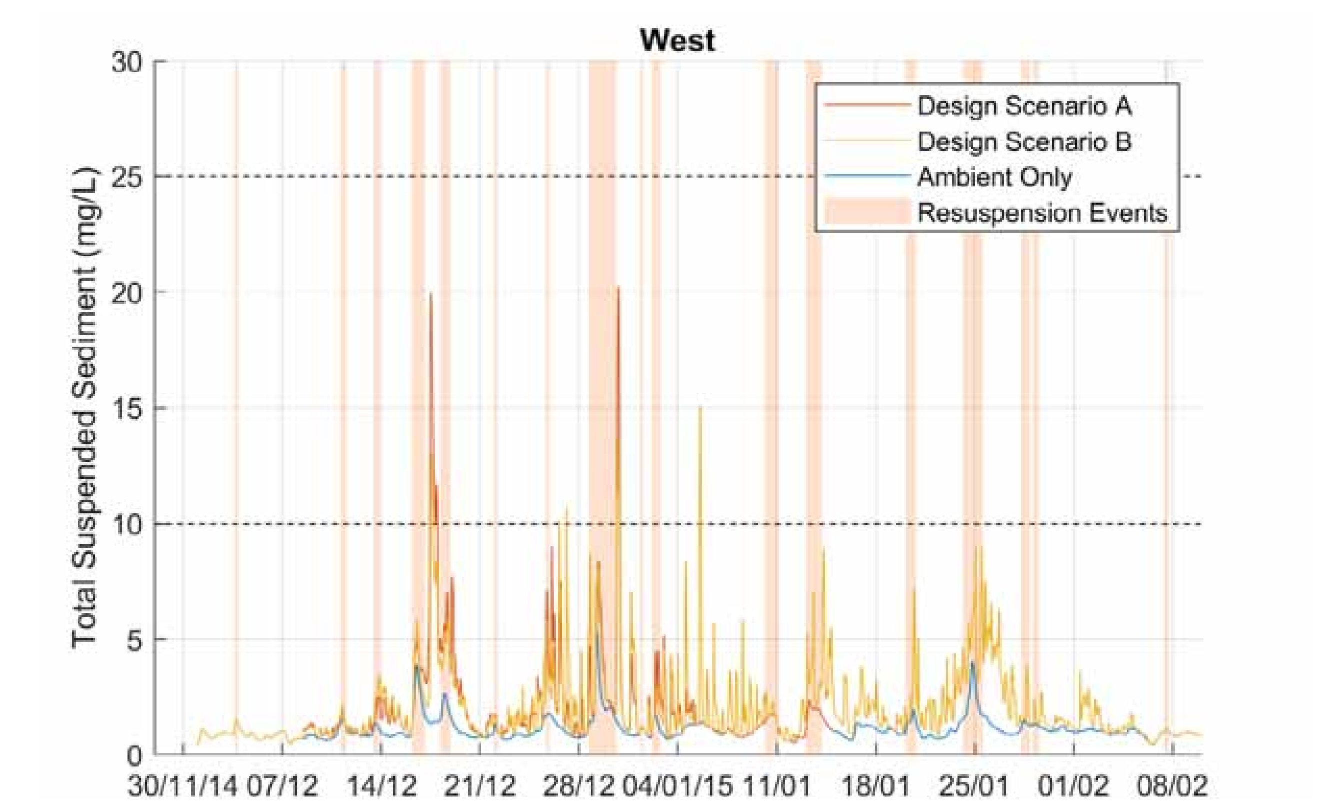


FIGURE 9-6 BOTTOM 1 M TSS TIME SERIES (AMBIENT PLUS DREDGE PLUME) AT THE YUMBAH WESTERN INTAKE – SUMMER 2015 CONDITIONS. THE 10 MG/L ANZECC/ARMCANZ (2000) TSS AQUACULTURE GUIDELINE AND THE 25 MG/L GREENLIP ABALONE TSS GUIDELINE ARE SHOWN

Zones of impact

Spatial zones of predicted impact were developed using project-specific impact threshold values (see Section 9.3.4). The impact zone maps (see Figures 9-7 and 9-8) indicate areas where modelled TSS/turbidity is higher than the relevant impact threshold value. In these figures, expected case and worst-case are shown to provide an indication of the lower and upper bounds of impact predictions associated with capital dredging.

The impact zone maps indicate the following:

- the zone of influence (i.e. extent of detectable plumes but no predicted ecological impact) is predicted to extend east and west along the coastline for approximately 5–6 km for the expected case (Figure 9-7) and approximately 8 km for the worst case (see Figure 9-8)
- the 'zone of low to moderate impact' is predicted to be restricted to within 200 metres of the dredge footprint for the expected case, as well as a small area adjacent to the coastline at the tailwater discharge point (see Figure 9-7)
- the Yumbah seawater intakes are not predicted to be within any zones of impact for the expected case
- under worst-case conditions, however, the 'zone of low to moderate impact', is predicted to extend approximately 2 km to the east of the dredge footprint encompassing the Yumbah seawater intakes (see Figure 9-8)
- the 'zone of high impact' under both expected and worst-case conditions is predicted to be restricted to the dredge footprint and areas directly adjacent to the footprint.

Based on the zones of impact and the relatively short duration of the capital dredge campaign (~30–60 days), it is predicted that the turbid plumes from capital dredging would result in a temporary minor impact to marine water quality.

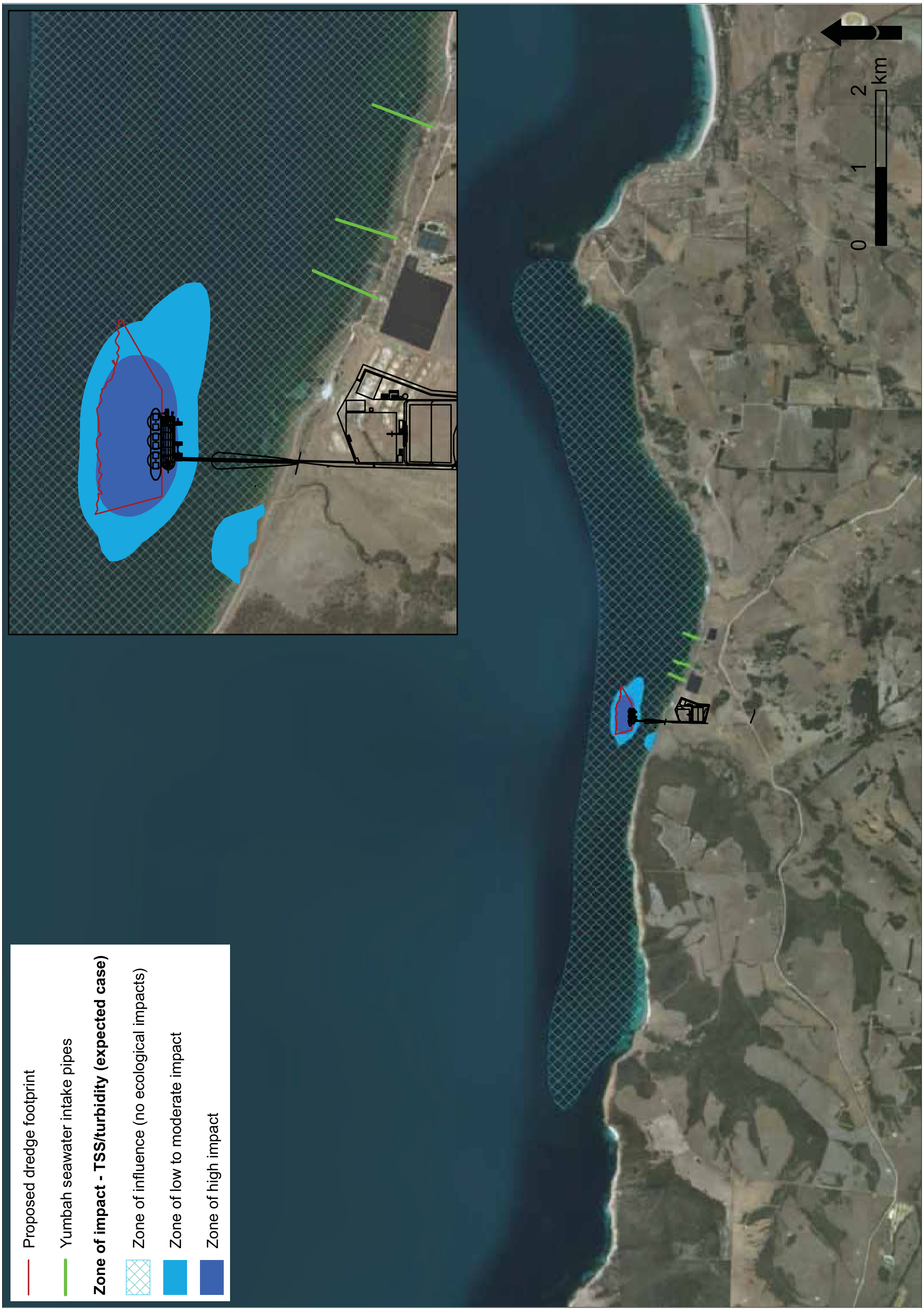


FIGURE 9-7 ZONES OF IMPACT – TSS/TURBIDITY – EXPECTED CASE (SUMMER AND WINTER)

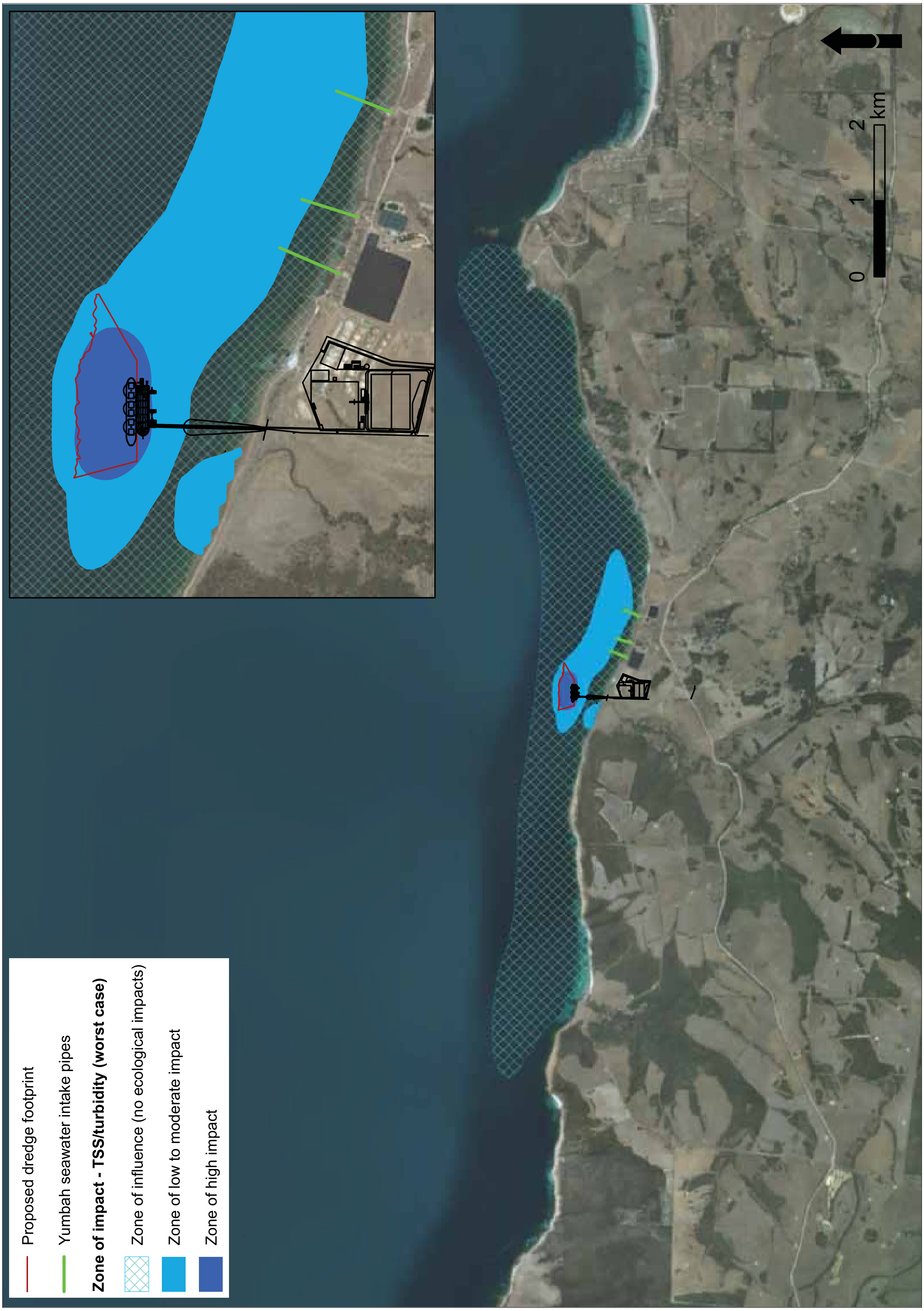


FIGURE 9-8 ZONES OF IMPACT – TSS/TURBIDITY – WORST CASE (SUMMER AND WINTER)

Management and mitigation measures

Dredge footprint location and volume

Comparing the dredge plume impact results for the two footprint locations and dredge volumes (i.e. 100,000 cubic metres and 200,000 cubic metres), it is evident that the inshore location (200,000 cubic metres) represents only a marginally higher dredge plume risk. The substantially higher volume of dredging associated with this scenario marginally increases dredge plume risk, because this is largely determined by the dredge productivity. That is, the intensity of plume generation is linked to the dredge rate rather than the total volume of material to be dredged. Within the bounds assessed, there is no reason to suggest that the dredge plume impacts would be exacerbated by increasing the volume above the likely case or by changing the distance of the footprint from shore.

Dredging window (season)

Comparing the dredge plume impact results for the summer and winter seasons clearly shows seasonality has a strong influence on hydrodynamics within Smith Bay. The potential plume impacts to the east of the dredge footprint are minimised in summer, which is also likely to be the preferred season for operational efficiency reasons.

Avoid 'high connectivity' environmental conditions

For short periods under certain tide and wind combinations, a high degree of connectivity can occur by way of currents travelling between the dredge footprint and the Yumbah seawater intakes. Plumes may travel directly from the footprint to the intakes under these high connectivity conditions and short periods of relatively high dredge plume TSS may occur.

A review of the environmental conditions corresponding to the highest peak TSS levels at the Yumbah seawater intakes during the summer period indicates that these occur during dodge tides with light to moderate westerly winds. Under these conditions, a relatively steady eastward flow from the dredge footprint towards the Yumbah seawater intakes can occur.

It is therefore recommended that the Dredge Management Plan (DMP) consider measures to predict and cease dredging during potential high connectivity conditions. With sufficient notice, these periods may be used for routine dredge maintenance operations, minimising delays to the dredge program and the associated loss of overall productivity. As noted below, intermediate real-time monitoring of turbidity would provide a further safeguard, allowing dredging to cease or slow down during periods of high connectivity.

Tidal dredging

Dredging only during westerly current periods would be the most effective means of mitigating plume impacts to the east of the dredge footprint, including the Yumbah seawater intake locations. However, this would increase the dredge plume impacts to the west of the footprint. This would also double the overall duration of the dredging project, which would have substantial cost implications. Tidal dredging may be considered as a last resort management option in a tiered DMP.

Realtime monitoring and reactive management

Realtime monitoring of turbidity at a location between the dredge footprint and the sensitive receptor locations (i.e. Yumbah seawater intakes) would provide a mechanism to manage the impacts of dredge plumes. Due to the relatively close proximity of key receptors and the dredge plume source (i.e. approximately 500 metres), turbidity trigger exceedances would need to be closely monitored and the timescale for management response actions would need to be short (~30 minutes) in order to be of practical benefit in mitigating acute plume impacts.

Other measures

The use of silt curtains was considered, but it was concluded that they would be impractical in Smith Bay due to the relatively strong currents (up to 0.4 m/s) and moderate wave regime. It is likely that silt curtains would only be effective for a relatively small percentage of the time when tidal currents and waves were low.

Similarly, the use of a coffer dam around the causeway construction area was considered to be unnecessary as silt plumes associated with the placement of the coarse material to construct the causeway core were shown by the modelling to be minimal. Furthermore, bedding of piles to form a coffer dam into the calcrete reef adjacent to the shore was considered to be impractical.

Dredging management plan

A Dredging Management Plan would be prepared in accordance with the EPA dredging licence. The DMP is likely to include the following components:

- forecast plume predictions to identify and avoid dredging during 'high connectivity' environmental conditions
- real-time monitoring and reactive management (detailed in the DMP) to provide protection against acute plume impacts at key sensitive receptors, including:
  - monitoring water quality at the Yumbah seawater intakes and at a location halfway between the dredge and the seawater intakes
  - water quality monitoring sensors that provide 'real time' data on water quality via telemetry

- assessing monitoring data in 'real time' against threshold triggers
- providing the monitoring data in 'real time' to the dredge operator, KIPT environmental management personnel, and the EPA
- triggering audible stop work alarms on the dredge if thresholds are exceeded
- dredge work ceases until turbidity levels return to acceptable levels and have stabilised (these levels to be defined in the DMP).

Residual risk

With implementation of the above management measures, the residual risk to water quality as a result of capital dredging would be low (see Appendix F3, Table 5-1).

9.5.2 SEDIMENT PLUMES – CAUSEWAY CONSTRUCTION

The core of the proposed causeway would be constructed from the dewatered and settled coarse fraction of dredged material.

Causeway construction may affect water quality as residual fines are likely to be released into the water column during the initial placement of the core material, and may be eroded from the exposed core during large wave events before the core is protected and armoured by geotextile and rocks.

Accordingly, a model simulation of silt plumes generated during causeway construction was undertaken, including during adverse weather events in both summer and winter. The model results are presented in Appendix F2, and key outcomes are shown in Figure 9-9 (above ambient) and Table 9-7 (ambient plus plume). A TSS time series (ambient plus plume) is provided in Appendix F2.

The above ambient results at the Yumbah seawater intakes showed that:

- the median TSS concentrations at the Yumbah seawater intakes did not exceed 0.5 mg/L
- the 99th percentile TSS concentrations did not exceed 1.5 mg/L
- the maximum TSS concentration modelled was 2 mg/L.

The ambient plus plume (seabed) results at the Yumbah seawater intakes showed that:

- the median TSS concentrations at the Yumbah seawater intakes did not exceed 2.4 mg/L
- the 99th percentile TSS concentrations did not exceed 15 mg/L
- the maximum TSS concentration modelled was 17.96 mg/L.

Comparison of the two sets of results show that ambient TSS would make a significantly greater contribution to total TSS at the Yumbah seawater intakes than the plume generated during causeway construction.

Zones of impact for TSS/turbidity associated with causeway construction were developed from the model outputs using the same approach used to model the turbid plumes from capital dredging (refer Section 9.3.4).

The zones of impact mapping shows that the turbid plumes generated during causeway construction are likely to be much less significant than those generated during dredging (see Figure 9-10). The modelling indicates that water quality effects are likely to be confined to a 'zone of influence' (i.e. extent of detectable plumes, but no predicted ecological impact) extending away from the causeway construction area approximately 1 km east and west along the coastline. The modelling reveals no 'zone of low to moderate impact' or 'zone of high impact' associated with causeway construction.

Based on the modelled zones of impact and the relatively short duration of the causeway construction (~30 days), turbid plumes associated with causeway construction are likely to have a temporary negligible impact on marine water quality.

TABLE 9-7 DREDGE PLUME TSS (AMBIENT PLUS DREDGE PLUME) SUMMARY STATISTICS AT YUMBAH'S SEAWATER INTAKES (NEAR-BED) DURING CAUSEWAY CONSTRUCTION

Location	Period	50th percentile TSS (mg/L)	95th percentile TSS (mg/L)	99th percentile TSS (mg/L)	Maximum TSS (mg/L)
Inactive intake	Summer	0.95	1.57	3.88	4.76
	Winter	2.37	8.11	14.83	17.82
Intake west	Summer	0.95	1.61	4.06	4.95
	Winter	2.45	8.04	14.97	17.96
Intake mid	Summer	0.93	1.58	3.97	5.04
	Winter	2.4	7.99	14.94	17.9
Intake east	Summer	0.87	1.47	3.49	4.8
	Winter	2.24	7.9	14.68	17.67

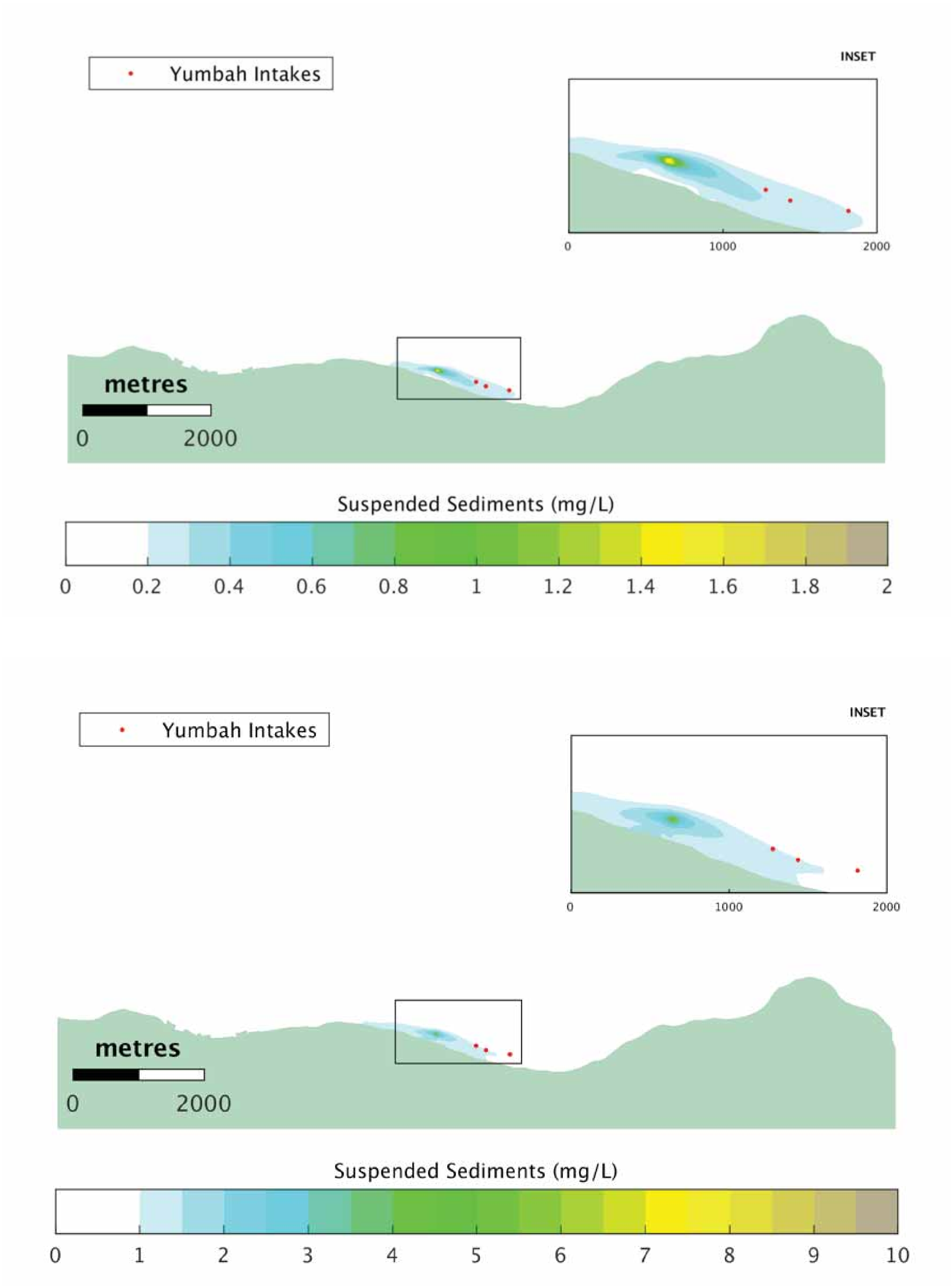


FIGURE 9-9 CAUSEWAY CONSTRUCTION PLUME DEPTH-AVERAGED TSS (ABOVE AMBIENT) – 50TH PERCENTILE (TOP) AND 99TH PERCENTILE (BOTTOM)

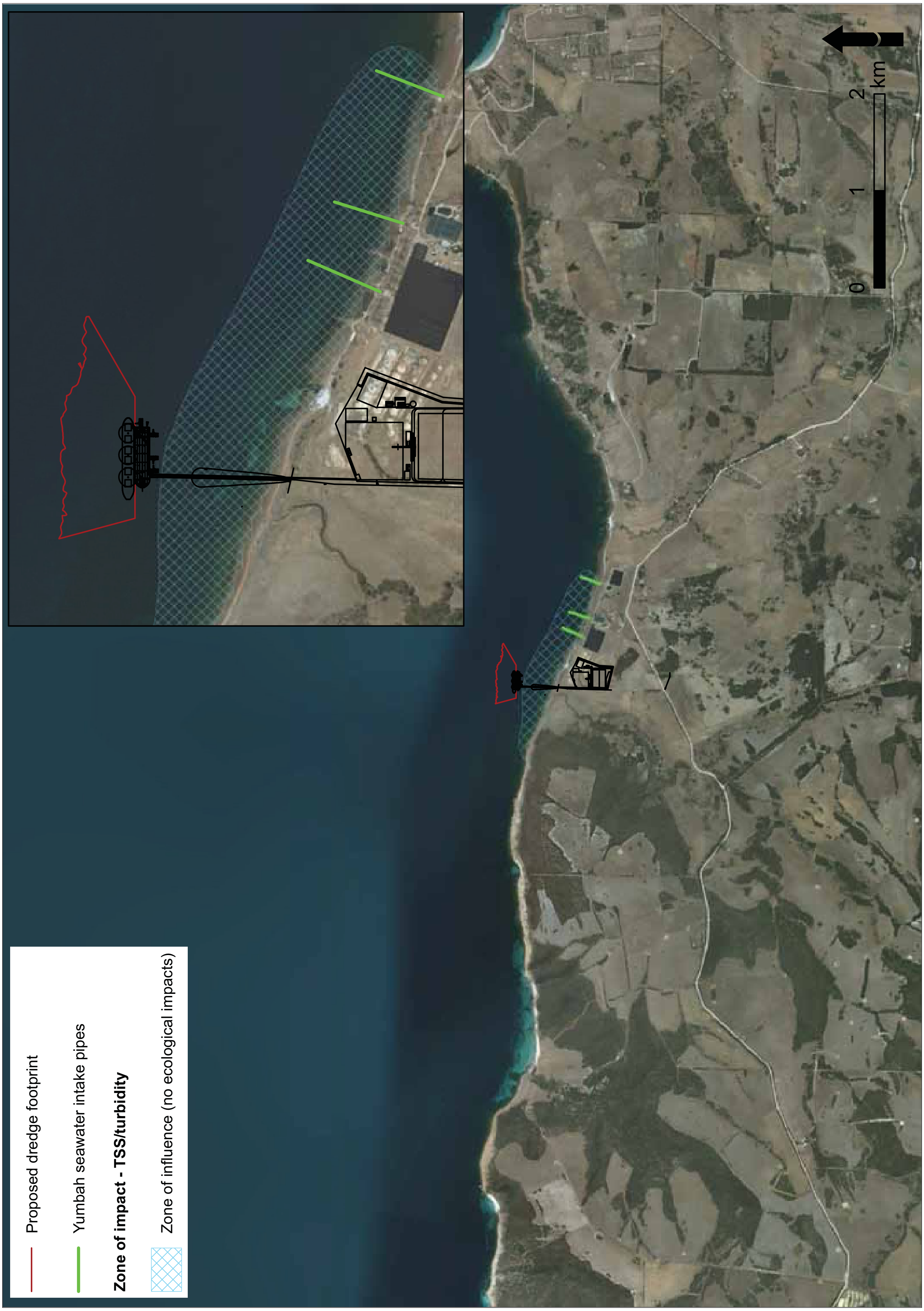


FIGURE 9-10 ZONES OF IMPACT – TSS/TURBIDITY – CAUSEWAY CONSTRUCTION (SUMMER AND WINTER)

Management measures and residual risk

The results indicate that causeway construction plumes are likely to pose a lower level of risk to Smith Bay water quality than the capital dredging activities. Nevertheless, the impact of the plume due to adverse sea states during causeway construction would be minimised by:

- minimising the fines content of material used in the causeway core construction
- minimising the length of exposed causeway core before placing the geotextile fabric and armour rock.

With implementation of the above management measures, the residual risk to water quality associated with causeway construction would be low (see Appendix F3, Table 5-1).

9.5.3 SEDIMENT DEPOSITION

Inevitably, the sediment in the plumes settles to the sea floor. The magnitude and spatial extent of the sediment deposition is assessed in this section and compared with seagrass health thresholds.

Final sediment deposition spatial plots and time series plots are shown in the hydrodynamic modelling report (see Appendix F2). The plot of final sediment deposition for the worst-case winter simulation is shown in Figure 9-11. The following conclusions can be drawn from the final deposition and time series plots:

- final sediment deposition exceeding 50 mm is restricted to within 140 metres of the dredging footprint
- final sediment deposition exceeding 10 mm (500 mg/cm^2) is restricted to within 240 metres of the dredging footprint
- final sediment deposition exceeding 1 mm (50 mg/cm^2) is restricted to within 4700 metres of the dredging footprint
- there is less sediment remaining deposited within Smith Bay following the winter simulation scenarios due to the higher energy wave and current conditions during the winter season
- even within 200 metres of the dredge footprint the maximum rate of sediment deposition does not exceed 10 mg/cm^2/day
- previously deposited dredge plume sediment is resuspended and dispersed during wave resuspension events.

The significance of the sediment deposition results as they relate to *Posidonia* seagrass is interpreted using sediment deposition zones of impact thresholds as described in Section 9.3.4. These sediment deposition zones of impact consider both sediment deposition rates (mg/cm^2/day) and final deposition at the end of the model simulation (mg/cm^2).

The sediment deposition zones of impact are shown in Figure 9-12 for the worst case. The 'zones of impact' were very similar for the 'expected case' and 'worst case', and for the 'summer and winter' and 'summer only' simulations (see Appendix F2). These simulations show that there are no zones of 'low to moderate impact' or 'high impact' for either the expected or worst-case scenarios. A 'zone of influence' associated with sediment deposition is likely to extend only about 200 metres from the dredge footprint. Within this zone the final sediment deposition is likely to be less than 10 cm.

Therefore, based on the zones of impact and the relatively short duration of the capital dredge campaign (~30 days), sediment deposition from capital dredging is predicted to present a temporary negligible impact. The risks to benthic communities are discussed in more detail in Chapter 12 – Marine Ecology.

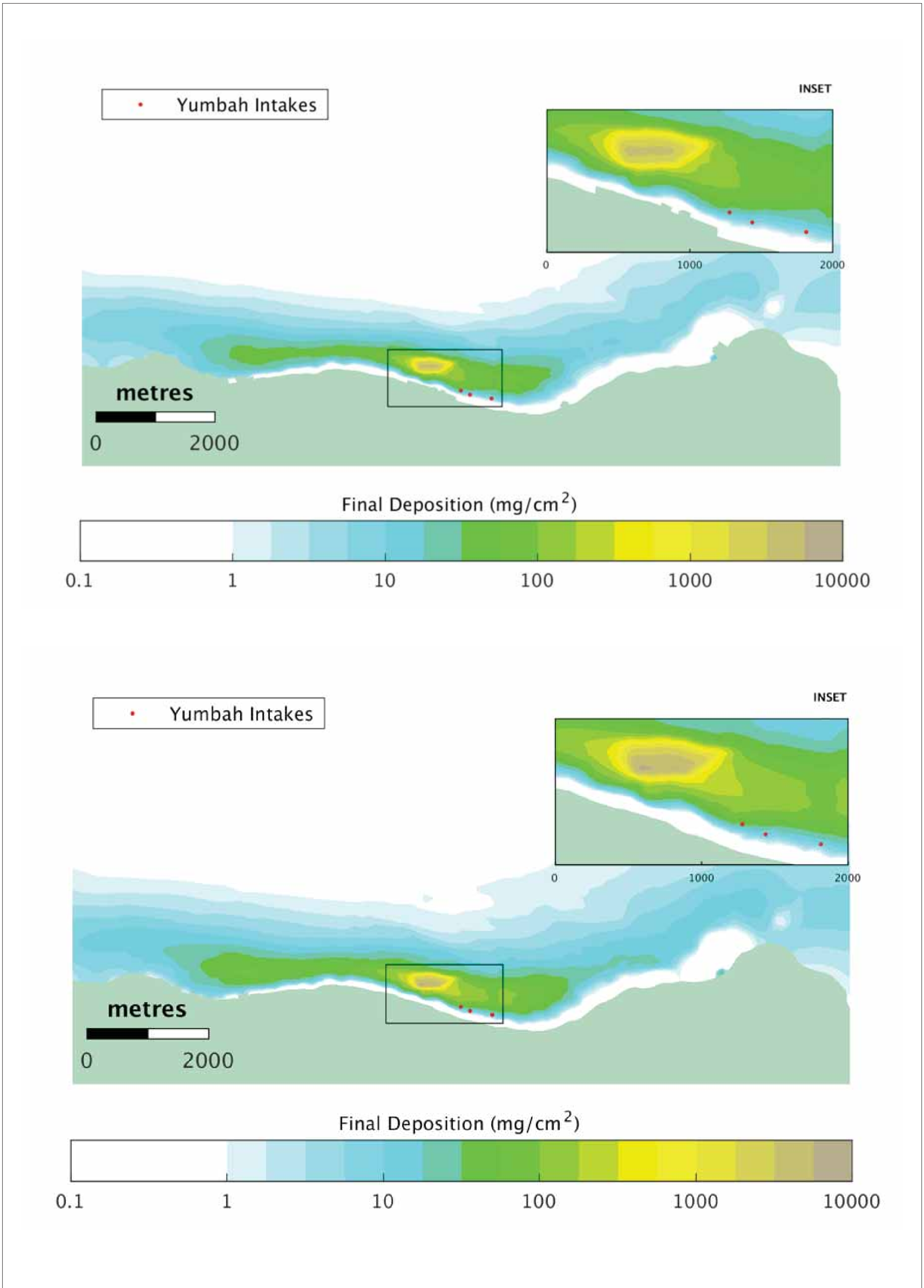


FIGURE 9-11 DREDGE PLUME FINAL SEDIMENT DEPOSITION (MG/CM²) – EXPECTED CASE (TOP), WORST CASE (BOTTOM)

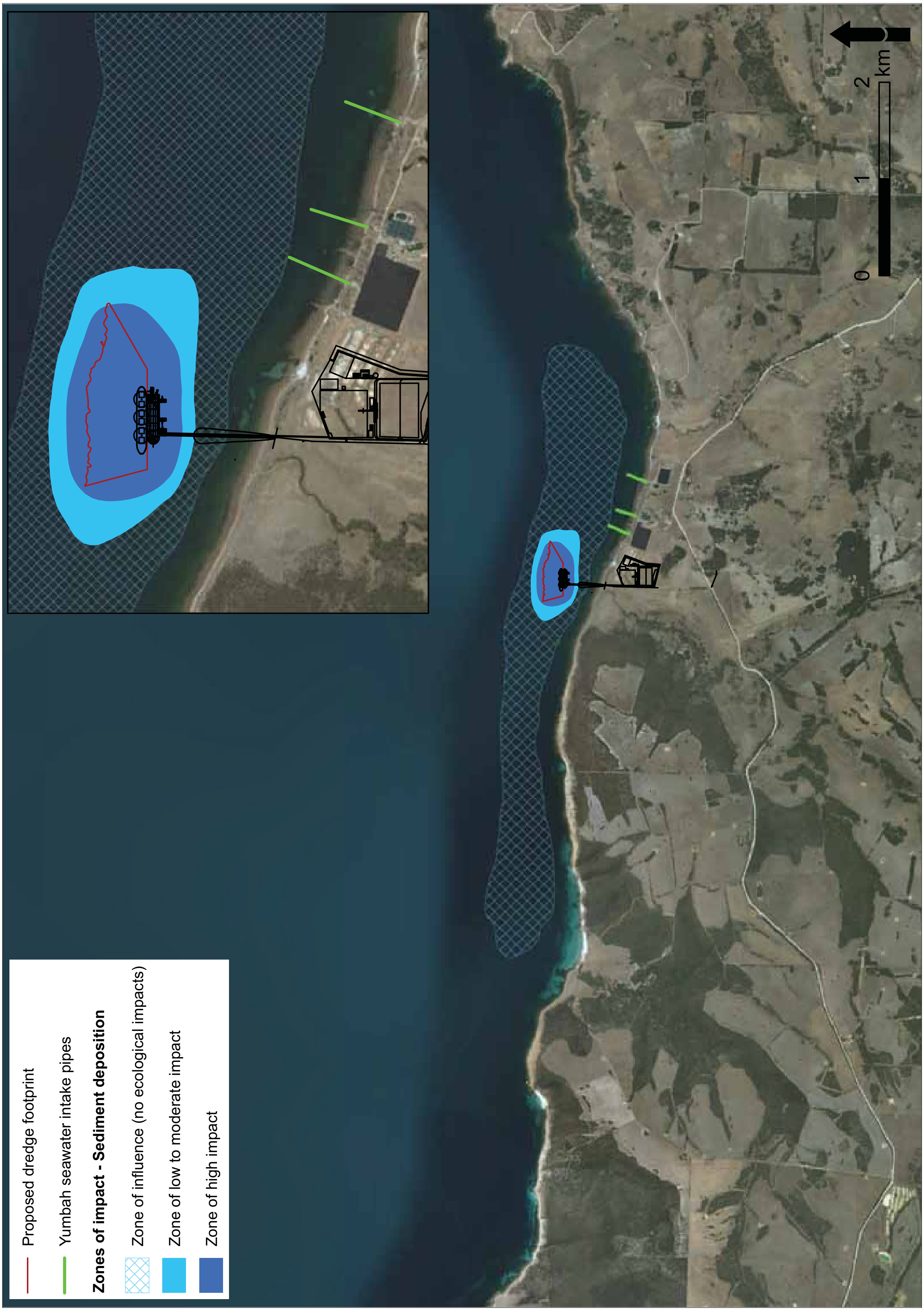


FIGURE 9-12 ZONES OF IMPACT – SEDIMENT DEPOSITION – WORST CASE (SUMMER AND WINTER)

9.5.4 BENTHIC LIGHT REDUCTION

Simulations of the impact of the dredge plume on PAR levels on the sea floor during summer and winter are presented in Appendix F2. The outcomes for the summer simulation are presented in Figure 9-13. The outcomes for the winter simulation are similar.

In this assessment benthic PAR has been expressed in units of the percentage of surface irradiance (percentage SI). The benthic PAR impacts are presented as the maximum change to a 30-day average benthic PAR. The predicted PAR impacts are also presented spatially as the seabed zone that changes from having a 30-day average benthic PAR that is greater than 10 per cent SI to being temporarily below this threshold.

The simulation shows that there is only a small region of seagrass within Smith Bay that is likely to experience temporarily reduced habitat suitability in terms of PAR exposure. The risks to seagrass communities are discussed in more detail in Chapter 12 – Marine Ecology .

9.5.5 MOBILISATION OF CONTAMINANTS FROM SEDIMENTS

Mobilisation of contaminants such as nutrients and metals/metalloids is a potential impact that could result from disturbance or dredging of marine sediments.

Sediment samples were collected to a depth of up to 140 cm from 12 locations within and to the south of the proposed dredge footprint. These samples were analysed for a comprehensive suite of physical and chemical parameters (see Section 9.4.1 and Appendix F1).

The analyses showed that the proposed dredge footprint in Smith Bay is relatively pristine, with the sediment chemistry showing nothing of concern when compared with sediment quality guideline levels.

Therefore, the potential mobilisation of contaminants during capital dredging is likely to result in a temporary negligible risk to water quality.

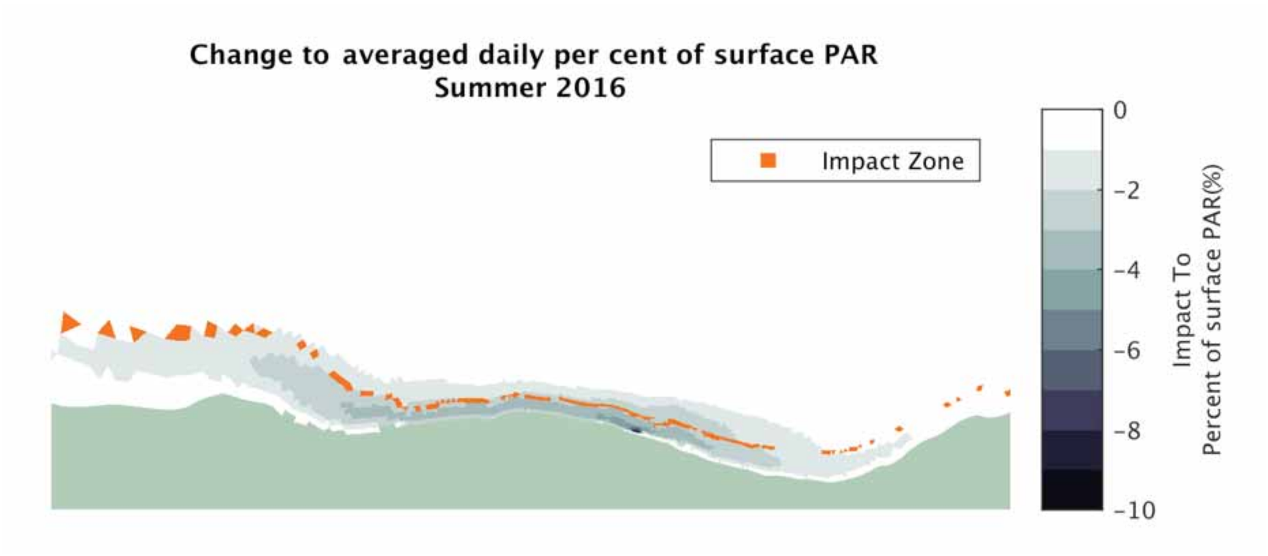


FIGURE 9-13 MODELLED PAR IMPACTS DUE TO DREDGE PLUMES*

* The 'impact zone' was derived for locations where PAR was greater than 10 per cent SI under ambient conditions, but becomes less than 10 per cent SI during dredge conditions.

9.5.6 FUEL/OIL AND CHEMICAL SPILLS

The use of dredging plant and equipment may potentially result in spills of fuel, oil and other contaminants, which could pollute marine waters if not appropriately managed.

The law requires dredge operators and construction contractors comply with established fuel/oil storage and handling standards and protocols to reduce the risk of such incidents. Appropriate operational procedures are included in the Construction Environmental Management Plan (CEMP) (see Appendix U1) and the DMP, which describe management measures and procedures that would be adopted to minimise the risk of fuel, oil and contaminant spills during dredging operations. They also describe emergency control, management and clean-up procedures should a spill occur.

With appropriate management measures in place, fuel/oil spills during the construction phase of the project are likely to result in a temporary negligible risk to marine water quality.

Management measures and residual risks

Standard operational mitigation measures would be implemented to reduce the risk of fuel and oil spills and other contaminants entering the marine waters, as follows:

- a CEMP would be developed and implemented. It would include established management procedures covering vessel maintenance, reporting of leaks and use of spill kits in the event of a spill
- a DMP would be developed and implemented. This document would be kept on-board dredge equipment and be readily accessible to dredge staff. It would clearly describe management measures to be followed by dredge staff
- a hydrocarbon spill kit would be located on the dredge and transport barges. This spill kit would contain absorbent material for spills on deck and also floating booms to contain hydrocarbon slicks if spills enter the water. This spill kit would be maintained regularly to ensure contents are fully stocked and in good condition
- first strike spill response equipment and appropriately trained staff would be on stand-by and able to respond to events and have access to more spill response resources if the event escalates
- all fuel and chemical supplies on the dredge and transport barges would be stored in bunded areas as per the requirements of AS1940:2004 (the storage and handling of flammable and combustible liquids 2004), and applicable statutory requirements.

With the implementation of the above management measures, the residual risk to water quality associated with fuel and chemical spills would be low (see Appendix F3, Table 5-1).

9.5.7 SHIPPING CONTAMINANTS

Marine vessel activities during construction and operation have the potential for the following contaminants to enter the marine environment and affect water quality:

- hydrocarbons
- ballast water
- antifouling compounds
- black water and grey water
- other wastewater
- airborne contaminants from exposed materials (such as woodchips and dust) which enter the water column
- solid waste such as packaging materials.

Ballast water, antifouling, waste and wastewater are regulated by the following conventions and legislation with which vessels operating in Australia must comply:

- International conventions relevant to the KI Seaport are:
  - International Convention for the Prevention of Pollution from Ships 1973 (MARPOL)
  - International Convention on the Control of Harmful Antifouling Systems on Ships (IMO-AFS Convention) 2001 (AFS Convention)
  - International Convention for the Control and Management of Ship's Ballast Water and Sediments 2004 (BWM Convention).
- Commonwealth legislation:
  - the *Biosecurity Act 2015* for management of introduced pests and diseases in ballast water, managed by the Department of Agriculture and Water Resources (DAWR).
- State legislation:
  - *Environment Protection Act 1993*
  - Environment Protection Water Quality Policy 2015
  - *Fisheries Management Act 2007*.

South Australia's Environment Protection Authority (EPA) also has in place recommended practices for biofouling and ballast water as part of its Code of Practice for Vessel and Facility Management (Marine and Inland Waters).

Impacts and management issues associated with ballast water and biofouling are addressed in Chapter 15 – Biosecurity.

Procedures to manage potential marine contaminants associated with shipping activity would be developed as part of the OEMP (Appendix U2). These potential impacts would be mitigated by complying with the legislation and codes outlined above, and implementing the wharf's operational procedures.

Assuming that the procedures are effectively developed and implemented, the potential for introduced contaminants from increased shipping presents a long-term minor impact to marine water quality.

Management measures and residual risk

Ships using the KI Seaport would be required to comply with all relevant maritime legislation as part of standard mitigation measures.

The following additional mitigation measures would be adopted to further reduce the potential risk to marine water quality at Smith Bay:

- a Fuel and Chemical Storage and Handling Plan would be prepared and implemented
- containment bunds would be placed around fuel storage tanks and drums, and bunds would be lined with impervious material
- any spills would be cleaned up in a timely manner
- spill kits would be provided on site
- correct ballast disposal protocols would be followed (see Chapter 15 – Biosecurity)
- vessels would come to Smith Bay directly from a controlled port
- a strict Pest/Disease Control Management Plan would be prepared and implemented in consultation with BioSecurity SA.

With the implementation of the above management measures, the residual risk to water quality associated with shipping contaminants would be low (see Appendix F3, Table 5-1).

9.5.8 OPERATIONAL PROPWASH

Winnowing of sediments during ship berthing and departure operations would inevitably result in some degree of sediment mobilisation at Smith Bay, which has the potential to adversely affect water quality through increased turbidity.

The effects on water quality are likely to be of short duration as the sea floor at depths greater than 10 metres at Smith Bay consists of relatively coarse silt/sand, rubble, rhodoliths and shell grit, which would tend to rapidly settle to the sea floor after disturbance.

The modelling of turbid plumes caused by propwash from shipping traffic arriving at and departing from the wharf is described in Appendix F2. The key results are presented in Figure 9-14.

The results are presented as aggregated 99th and 100th percentiles of depth-averaged TSS during the operational plume simulation/s. These percentiles were calculated over a modelled period of seven days.

The 99th percentile figure fails to show any plume above the minimum scale limit shown (i.e. 1.0 mg/L) because the sediment plume occurs for such a short duration that it is not observable for these percentiles. The 100th (maximum) percentile figure shows that local plumes in the berth area may reach 10 mg/L for short periods, and that no plumes extend to the Yumbah seawater intakes.

Operational propwash would result in a long-term negligible impact to marine water quality in Smith Bay. Potential effects on seagrass and other benthic communities are discussed in Chapter 12 – Marine Ecology.

No additional management measures are considered necessary beyond those routinely used during ship arrivals and departures. The ongoing risk to water quality would be low (see Appendix F3, Table 5-1).

9.5.9 MAINTENANCE DREDGING

As discussed in more detail in Chapter 10 – Coastal Processes, sedimentation in Smith Bay is generally low due to the minimal suspended sediments in the water column during most of the year. Consequently, the need for future maintenance dredging to maintain dredged depths is likely to be minimal and infrequent.

If maintenance dredging is required, the impacts on marine water quality are likely to be much less than those predicted for capital dredging due to smaller maintenance dredge volumes and shorter dredging timeframes.

Accordingly, maintenance dredging is likely to result in a short-term minor impact to marine water quality in Smith Bay. The risk to water quality would be low (see Appendix F3, Table 5-1).

9.6 CONCLUSIONS

The following conclusions are drawn from the assessment:

Capital dredging:

- For 50 per cent of the time sediment plumes exceeding 2 mg/L TSS above ambient would be restricted to within 220 metres from the dredging footprint.
- For 95 per cent of the time sediment plumes exceeding 10 mg/L above ambient would be restricted to within 170 metres of the dredging footprint (i.e. do not overlap the Yumbah seawater intakes).
- For approximately 1–2 per cent of the time sediment plumes exceeding 10 mg/L above ambient would extend up to 600 metres from the dredging footprint (i.e. without mitigation overlap the Yumbah seawater intakes).
- The highest TSS modelled at the western intakes (ambient plus dredge plume) was 36.4 mg/L during winter and 22.4 mg/L during summer.

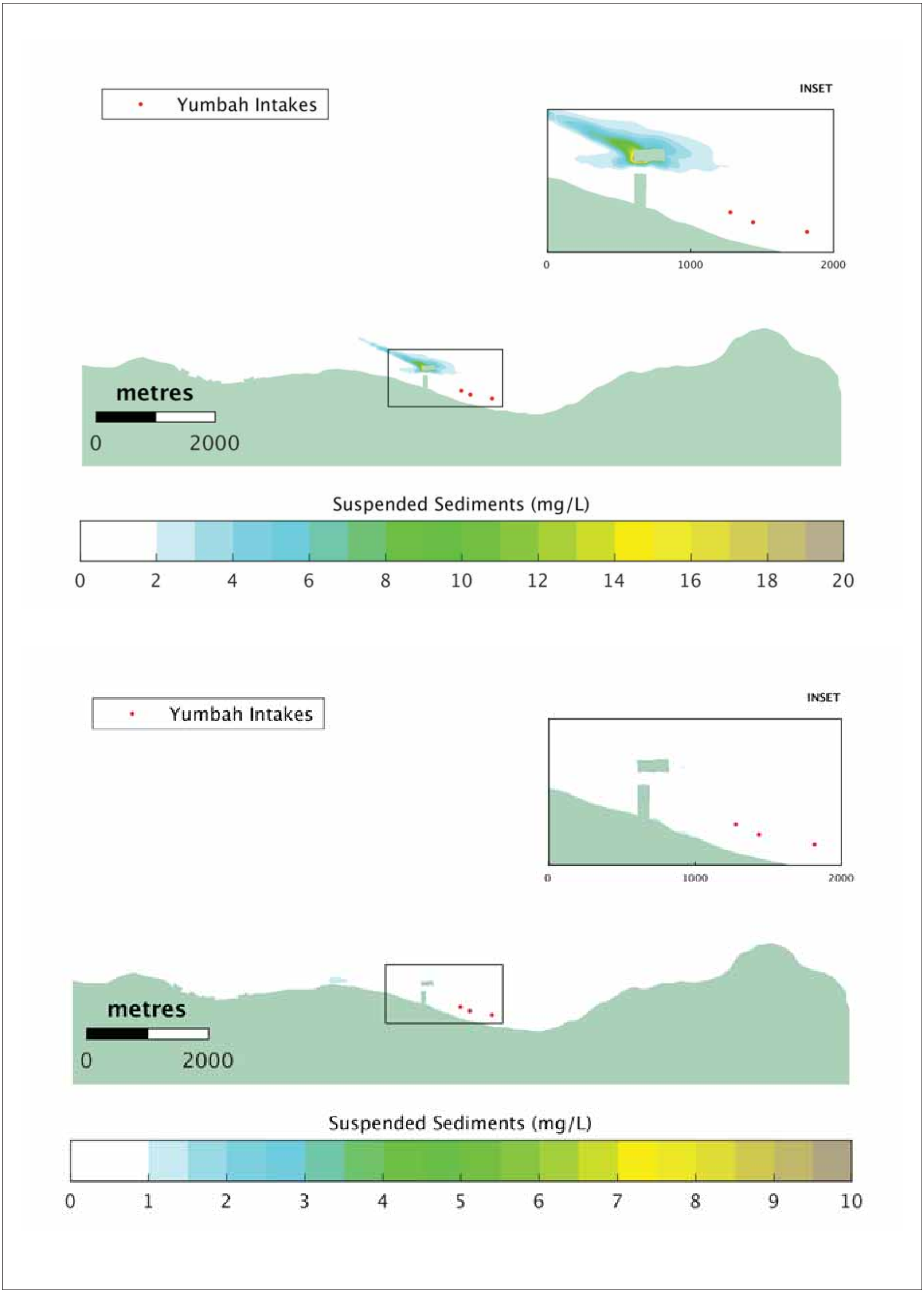


FIGURE 9-14 DEPTH-AVERAGED OPERATIONAL PROPWASH PLUME TSS – 100TH PERCENTILE (MAXIMUM) TSS (TOP) AND 99TH PERCENTILE (BOTTOM)

- The zone of influence (i.e. extent of detectable plumes but no predicted ecological impact) is predicted to extend east and west along the coastline for approximately 5–6 km for the expected case and approximately 8 km for the worst case.
- The 'zone of low to moderate impact' is predicted to be restricted to within 200–300 metres of the dredge footprint and tailwater discharge point for the expected case.
- The Yumbah seawater intakes are not predicted to be within any zones of impact for the expected case.
- Under worst-case conditions, however, the 'zone of low to moderate impact', is predicted to extend approximately 2 km to the east of the dredge footprint and overlap the Yumbah seawater intakes.
- The 'zone of high impact' under both expected and worst-case conditions is predicted to be restricted to an area within 100–200 metres of the dredge footprint.
- On the rare occasions when the TSS threshold is at risk of being exceeded at the seawater intakes, dredging would cease in response to alarms being triggered by live monitoring of water quality at a site half way between the dredge footprint and the Yumbah seawater intakes.
- With appropriate reactive management of the dredging program, the risk of sediment plumes exceeding TSS thresholds at Yumbah's intakes is considered to be low.
- It is concluded that the capital dredging program would have a temporary minor impact to marine water quality at Smith Bay.

Causeway construction:

- Sediment plumes generated during causeway construction are likely to be much less significant than those generated during dredging.
- For 50 per cent of the time sediment plumes exceeding 1 mg/L above ambient would be restricted to within approximately 100 metres of the causeway.
- For 95 per cent of the time sediment plumes exceeding 1.5 mg/L above ambient would be restricted to within approximately 700 metres of the causeway.
- The median and 95th percentile TSS concentrations above ambient at the Yumbah seawater intakes did not exceed 0.5 mg/L and 1 mg/L, respectively.
- The highest TSS modelled at the western intakes (ambient plus plume) was 17.96 mg/L, which indicates that ambient TSS would make a significantly greater contribution to total TSS at the intakes than the plume generated during causeway construction.
- Water quality effects associated with causeway construction are likely to be confined to a 'zone of influence' (i.e. extent of detectable plumes, but no predicted ecological impact) extending approximately 1 km east and west of the causeway.
- The modelling revealed no 'zone of low to moderate impact' or 'zone of high impact' associated with causeway construction.
- It is concluded that sediment plumes associated with causeway construction are likely to have a temporary negligible impact on marine water quality at Smith Bay.

Sediment deposition:

- Final sediment deposition exceeding 10 mm (500 mg/cm^2) is likely to be restricted to within 240 metres of the dredging footprint.
- Final sediment deposition exceeding 1 mm (50 mg/cm^2) is likely to be restricted to within 4700 metres of the dredging footprint.
- The ecological effects associated with sediment deposition are likely to be confined to a 'zone of high impact' within 100 metres of the dredge footprint, and a zone of 'low to moderate impact' within 200–300 metres of the footprint.
- It is concluded that sediment deposition from capital dredging would present a temporary minor impact to benthic communities in Smith Bay.

Benthic light reduction:

- The assessment of benthic PAR, expressed as a per cent of surface irradiance, demonstrated that the reduction in PAR as a result of sediment plumes would be minimal.
- The simulation showed that there is only a small band of seagrass within Smith Bay where PAR would be reduced to below the 10 per cent surface irradiance threshold.
- The duration of reduced benthic PAR would be limited to the duration of the dredging construction program and is therefore likely to have only a temporary minor impact on benthic communities.

Mobilisation of contaminants from sediments:

- The analysis of marine sediments at Smith Bay revealed nothing of concern when compared with sediment quality guideline levels.
- The potential mobilisation of contaminants during capital dredging is therefore likely to result in a temporary negligible risk to water quality.

Fuel/oil and chemical spills:

- The risk of fuel, oil or chemical spills would be minimised through mandated compliance with established fuel/oil storage and handling standards and protocols.
- With the adoption of appropriate management measures, fuel, oil and chemical spills during construction are likely to result in a temporary negligible risk to marine water quality.

Shipping contaminants:

- The risk of shipping contaminants being discharged to the marine environment at Smith Bay would be minimised through mandated compliance with international conventions, Commonwealth and State legislation, shipping codes of practice and the operational procedures that would be implemented.
- With the adoption of appropriate management measures, the discharge of shipping based contaminants to Smith Bay is likely to result in a long-term minor risk to marine water quality.

Operational propwash:

- Effects on water quality are likely to be minor as the sediments on the sea floor at Smith Bay are relatively coarse and would therefore tend to settle rapidly to the sea floor after disturbance.
- The 100th percentile (maximum) modelling outputs show that local plumes in excess of 10 mg/L TSS would occur for short periods, but would be confined to the berth pocket and not extend to the Yumbah seawater intakes.
- It is concluded that operational propwash would result in a long-term negligible impact to marine water quality in Smith Bay.

Maintenance dredging:

- The need for future maintenance dredging to maintain dredged depths is likely to be minimal and infrequent.
- The impacts to marine water quality associated with maintenance dredging are likely to be much less than those predicted for capital dredging due to smaller maintenance dredge volumes and shorter dredging timeframes.
- Maintenance dredging is therefore likely to result in a short-term minor impact to marine water quality in Smith Bay.

10. COASTAL PROCESSES

Guideline		Comment
2.17	Detail measures to protect foreshore areas during and after construction, including potential marine and terrestrial protection areas and associated buffers.	See Chapter 11, Sections 10.5.1, 10.5.6, 10.5.7 and Appendix G
2.18	Describe, and provide baseline information on, the existing seabed profile, bathymetry, sedimentary profiles (including particle sizes), sand movement, water flow and tidal movement patterns through and around the proposed causeway, rock wall and wharf structure area.	See Sections 10.4.1, 10.4.2, 10.4.3, 10.4.6, 10.5.1, Appendices F1 and G
2.19	Identify any possible changes to the seabed, bathymetry, sedimentary profiles (including particle sizes), and sand movement water flow and tidal movement patterns as a result of the development during both the construction and operational phases (include information on potential pooling of water upstream from the proposed causeway). Identify the impacts this may have on sensitive marine flora and fauna (including seagrasses, macro algae and other reef habitat), and commercial aquaculture activities in the region, and outline mitigation strategies.	See Sections 10.5.2, 10.5.3, 10.5.4, 10.5.5, 10.5.6, 10.5.7, 11.5.1, 11.5.2, 11.5.4, 11.5.5, 12.5.4 and Appendix G
2.20	Identify the risks from the exposure of fine sediments or clays that would impact adversely on water quality (turbidity and light penetration) and contribute to the production of sediment plumes in the region during both construction and operation phases. Outline the impacts this may have on commercial aquaculture activities in the region.	See Sections 9.5.1, 9.5.2, 9.5.3, 9.5.4, 10.5.6, 11.5.1, 11.5.2, 11.5.3 and Appendices F2, F3, H1 and H2
17.5	Identify geological, seabed and substrate impacts that may occur as a result of any dredging activity that will be undertaken during the construction phase. Detail measures for managing these impacts.	See Sections 9.1, 9.5.1, 9.5.3, 9.5.5, 9.6, 10.5.6, 10.5.7, 10.6, Appendices F1, F2, F3 and G

10. COASTAL PROCESSES

10.1 INTRODUCTION

The development of the KI Seaport has the potential to affect coastal processes by altering wave energy and interrupting the movement of tidal and wind generated currents along shores. Flow-on effects often occur, including changes to the movement of sand, seagrass wrack and sediment along shores.

Brisbane-based BMT assessed the effect of the development on coastal processes. BMT is a global engineering company with extensive experience undertaking hydrodynamic and sediment transport modelling and assessing coastal developments throughout Australia and overseas, including the recent assessment of the Outer Harbour Channel Widening Project Development Application (Flinders Ports 2017).

The main aspects of the development that have the potential to affect coastal processes in Smith Bay are:

- the proposed rock armoured causeway extending approximately 250 metres offshore
- the 168-metre pontoon
- the berth pocket and approaches, dredged to a depth of 13.5 metres.

The aims of the coastal process modelling and assessment are to assess potential effects including:

- potential coastal erosion in response to construction activities along the shore
- the pooling of water in the lee of the causeway, potentially causing seawater temperatures to increase to some degree during heat waves and at times of low tidal movement
- the potential effect of the causeway in interrupting longshore sand drift along the Smith Bay coast
- the potential effect of the causeway in changing hydrodynamic conditions in Smith Bay such that sediment and seagrass wrack would accumulate adjacent to the causeway
- potential seabed erosion caused by altered current flows and wave energy in the vicinity of the causeway and dredged berth pocket.

Mitigation measures that may be necessary to manage potential impacts are also described.

10.2 REGIONAL SETTING

The regional setting for coastal processes is described in Chapter 9 – Marine Water Quality.

The north coast of Kangaroo Island is a relatively moderate to low energy environment because it is largely sheltered from the prevailing south-westerly swells in the Southern Ocean (Edyvane 1999).

Smith Bay is also sheltered from waves generated by strong south-westerly winds in winter, and the prevailing south-easterly winds and sea breezes in summer. It is, however, exposed to waves generated by occasional strong northerly winds that occur relatively frequently during winter.

The Smith Bay area and the adjacent hinterland have been largely cleared of native vegetation since European settlement and now support extensive cropping and grazing industries. The relatively degraded Smith Creek discharges freshwater into Smith Bay during rainfall events.

The land-based abalone farm at Smith Bay, operated by Yumbah, takes in seawater for use in its farm via intakes located approximately 200 metres offshore, and discharges wastewater to the foreshore area of Smith Bay.

10.3 ASSESSMENT METHODS

The coastal process modelling has been undertaken by BMT in parallel with the marine water quality modelling described in Chapter 9 – Marine Water Quality. Similarly, the geotechnical investigations relevant to both the coastal processes and water quality assessments are described in Chapter 9 – Marine Water Quality.

The detailed description of the development, calibration and validation of the hydrodynamic and sediment transport models is described in Chapter 9 and Appendix F2. The application of the models for coastal processes modelling is described in Appendix G1.

The coastal process assessment has also been informed by the Smith Bay Design Wave and Water Level Assessment undertaken by BMT to inform the project design (BMT 2018).

The coastal process modelling relies on the development and application of the following numerical models:

- wave model – SWAN (Simulating Waves Nearshore), an industry standard numerical model developed by TU Delft (Delft University of Technology 2006)
- 3D hydrodynamic model – TUFLOW FV (BMT WBM 2013)
- sediment transport model – TUFLOW FV ST module (BMT WBM 2013).

SWAN is used to predict wave conditions at Smith Bay, based on meteorological input data, and is used with the sediment transport models (silt plume assessment) to inform littoral sediment transport calculations for the coastal process assessment. TUFLOW FV (and TUFLOW FV ST module) are used to predict water levels and currents at Smith Bay and to model current flows and sediment transport around the development site. These models have been based on, and calibrated against, observational data from sensor buoys deployed to Smith Bay that have measured hydrodynamic processes and water quality in real time over many months.

Resuspension, dispersion and settling of the natural (ambient) bed sediments throughout the study area has not been included within the sediment transport model as there was considered to be too little mobile sediment in the littoral zone within Smith Bay to warrant inclusion in the model (see Plate 10-1). The sediment transport model assesses the additional resuspension, dispersion and settling of sediment released into the water column and placed on the bed by proposed dredging activities.

A risk assessment of the effects on coastal processes was undertaken according to the risk management process ISO 31000:2009 (see Chapter 25 and Appendix G1).

10.4 EXISTING ENVIRONMENT

10.4.1 COASTAL AND SEAFLOOR GEOMORPHOLOGY

The results of the coastal and marine geotechnical investigations are provided in Appendices C1 and F1. The shallow (< 1 metre) sediments consist mostly of sand and gravel (70–90 per cent), with a smaller proportion (10–25 per cent) of fine sediments (silt and clay) (Appendices C1 and F1).

The intertidal beach area of Smith Bay consists almost entirely of red to orange sandstone and basalt cobbles and boulders that have been weathered and rounded by wave action (Plate 10-1). There are two small sections of beach where the rocks and boulders have been cleared to expose sand and thereby form a small area from which it is possible to launch boats. At the back of the shoreline, the cobbles and boulders have been formed up into a linear mound, parallel to the coastline, with a small sand dune behind the beach.

The sub-aerial beach and dune system at Smith Bay is formed by predominantly cobble-sized sediments. The substrate at Smith Bay (<10 metres deep) consists mainly of rock and reef with a relatively thin veneer of sand that has accumulated in places over the rock. The nearshore section of reef consists of both sheet silcrete reef and loose rock.

Offshore of the inter-tidal beach the seabed is generally covered by dense macroalgae and seagrass assemblages. Further offshore (10–12 metres depth) the seafloor consists mainly of a mixture of rubble, rhodoliths (coralline algae) and shell fragments (Plate 10-1).

These characteristic features of the Smith Bay littoral zone will tend to strongly limit the active littoral sediment transport within this coastal compartment.

10.4.2 BATHYMETRY

The results of the bathymetric survey of the development site in Smith Bay are shown in Figure 10-1. The survey revealed that the 11-metre contour is located approximately 400 metres from shore, and that at this depth, the contour lines are approximately parallel to shore. It also shows the presence of a probable paleo-channel where a 100-metre wide section of the Smith Bay seafloor near the shore is up to 2.5 metres deeper than the adjacent seafloor.

10.4.3 TIDES

The closest site with reported tidal levels is Emu Bay, which is approximately 10 km east of Smith Bay and therefore likely to be representative of tides at Smith Bay. The tidal levels for Emu Bay are shown in Table 10-1.

10.4.4 WIND SPEED AND DIRECTION

The prevailing winds at Smith Bay during the summer are light to moderate from the south (south-west to south-east direction). During the winter months, the wind directions are more variable, but strong northerly (onshore) winds can occur during passing frontal systems (see Figure 10-2). Outputs from the Climate Forecast System Reanalysis (CFSR) global model dataset for Investigator Strait indicate that for the period 2007 to 2017 the 10-minute average median wind speed was 5.7 m/s, and the greatest wind speed was 23.6 m/s.

10.4.5 WAVES

Smith Bay faces north into Investigator Strait and is therefore directly exposed to wind generated waves with a ~50 km fetch across the Strait to Yorke Peninsula. Greater fetch distances (~150 km) extend to the north-west and north-east into Spencer Gulf and Gulf St Vincent. Smith Bay is not directly exposed to the Southern Ocean, but is influenced by Southern Ocean swells refracted around Cape Borda, some 80 km to the west, and then Cape Cassini, which is about 10 km west of the development site.

a) Rocky foreshore

b) Reef with dense macroalgae (depth 5 metres)

c) Dense seagrass on sand/gravel (depth 10 metres)

d) Sparse seagrass on cobbles (depth 13 metres)

PLATE 10-1 TYPICAL COASTAL AND SEA BED MORPHOLOGY AT SMITH BAY

TABLE 10-1 BASE TIDAL LEVELS AT EMU BAY

Tidal plane	Base level
Highest Astronomical Tide (HAT)	+1.8 m CD
Mean High High Water (MHHW)	+1.5 m CD
Mean Low High Water (MLHW)	+1.0 m CD
Mean Sea Level (MSL)	+0.8 m CD
Mean High Low Water (MHLW)	+0.7 m CD
Mean Low Low Water (MLLW)	+0.2 m CD
Lowest Astronomical Tide (LAT)	0.0 m CD

CD = Chart datum (or lowest astronomical tide (LAT))

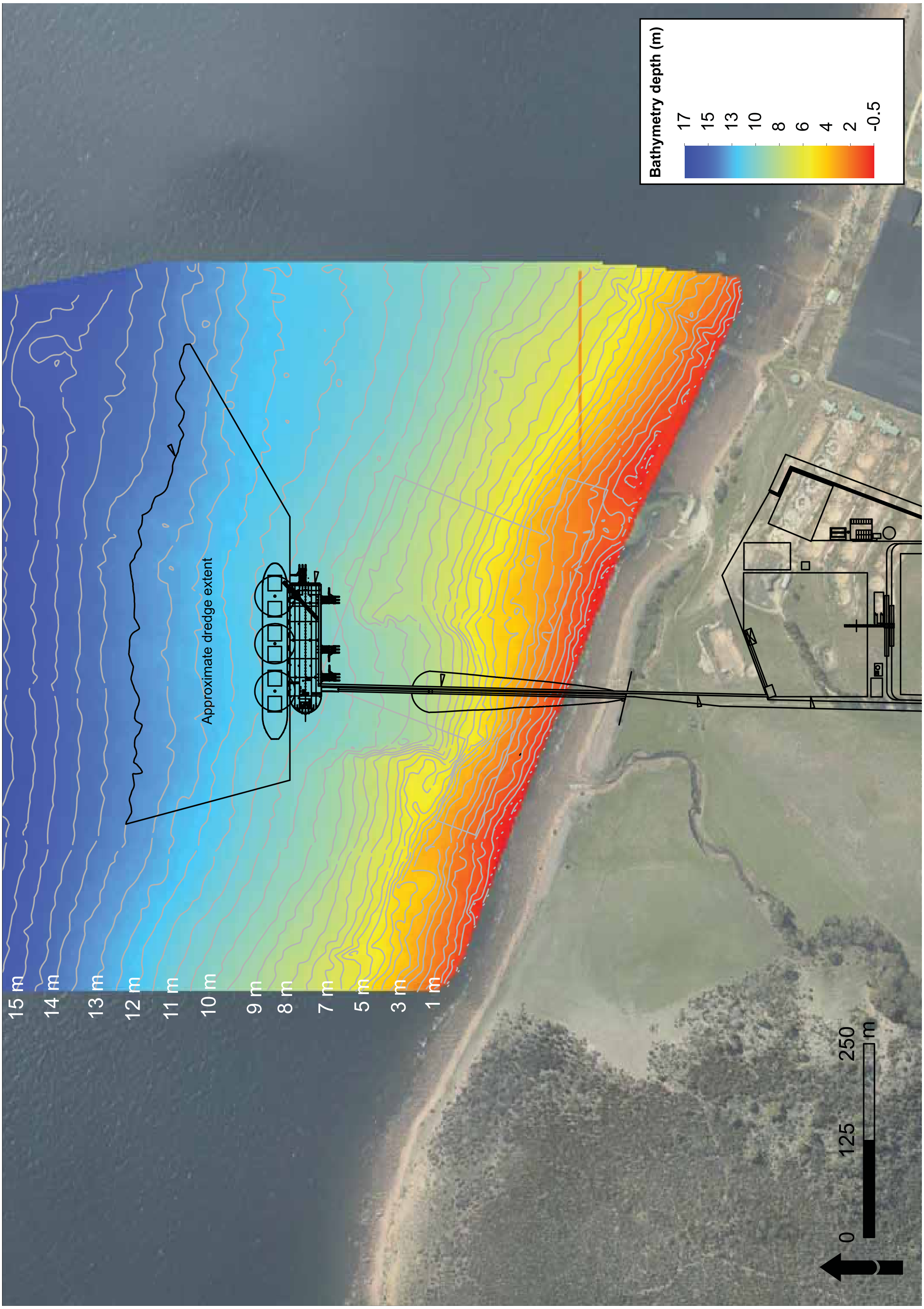


FIGURE 10-1 BATHYMETRY OF SMITH BAY

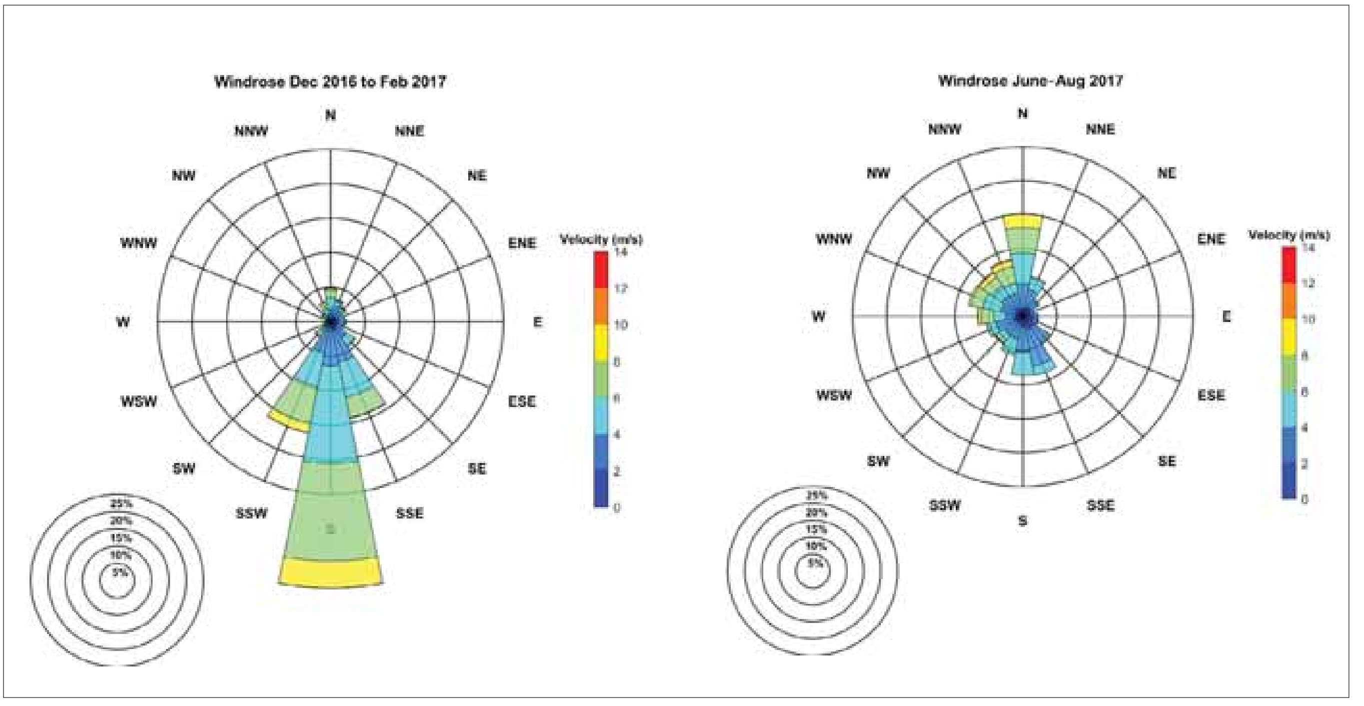


FIGURE 10-2 TYPICAL WIND PATTERNS AT SMITH BAY – SUMMER (LEFT) AND WINTER (RIGHT)

The plot of waves measured in Smith Bay over a one-year period during 2017–18 is shown in Figure 10-3. The waverose shows that the ambient wave climate at the waverider buoy deployed in Smith Bay is dominated by waves from the north-north-west, with 70 per cent coming from the 300–360 degree sectors. The remaining 30 per cent of the time waves come from the north-north-east.

A hindcast simulation of waves at Smith Bay revealed that the median significant wave height at Smith Bay is 0.52 metres. The 99th percentile significant wave height (exceeded on-average for 3.65 days per year) is 1.51 metres. During storm conditions in the simulation period the largest predicted significant wave height at Smith Bay was 2.75 metres. The Metocean buoy was deployed during this simulated event and recorded a peak significant wave height of 2.30 metres.

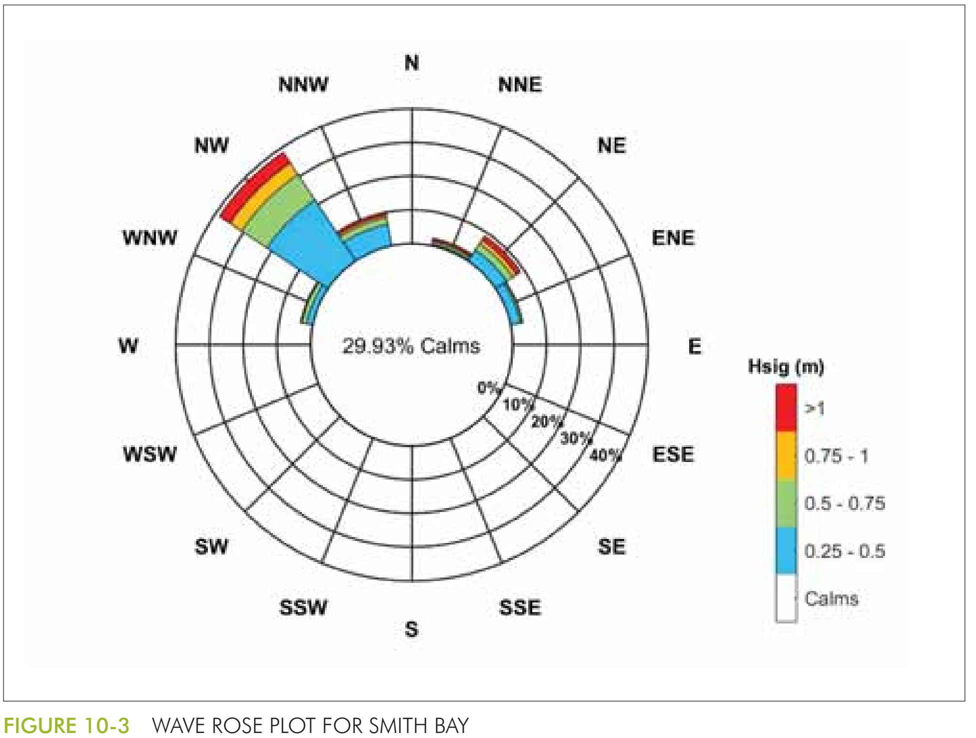


FIGURE 10-3 WAVE ROSE PLOT FOR SMITH BAY

10.4.6 CURRENTS

Currents in Smith Bay are driven by a combination of tides, local winds and storm surges. In addition, the direction of the currents in Smith Bay is influenced by the bathymetric contours within the bay.

A depth averaged scatter plot of current speed and direction at the MSI buoy in Smith Bay is shown in Figure 10-4. The plot reveals that currents predominantly flow parallel to the coast, with currents flowing west-north-west (~300 degrees) during flood tides, and east-south-east (~100 degrees) during ebb tides. Current speeds were generally less than 0.4 m/s, with mean current speeds being 0.15 m/s. The maximum current speed recorded was 0.55 m/s.

The net effect is that of a very slight overall west-north-west movement, albeit heavily overlain by mainly tide-driven oscillation.

10.5 IMPACT ASSESSMENT AND MANAGEMENT

A detailed description of the results of the coastal processes modelling is provided in Appendix G1. A summary of the results of the assessment of risks to coastal processes is provided in Appendix G1, Table 4-1.

Impacts on the Smith Bay coastline and coastal processes are likely to be mitigated to a significant extent by the rocky nature of the beach, the extensive sub-tidal reef to a depth of about 8 m, the limited extent of sand in the nearshore coastal environment, and the dense seagrass cover in areas where there is sandy substrate (Plate 10-1).

10.5.1 EROSION

The foreshore at Smith Bay would be directly impacted by the construction of the rock armoured causeway across the low coastal dune and rocky intertidal zone. Potential impacts to intertidal communities and remnant dune vegetation and habitat are addressed in Chapters 12 – Marine Ecology, and 13 – Terrestrial Ecology, respectively.

The shoreline at the development site would be highly resistant to erosion during construction and operation of the facility as it is naturally armoured by boulders that would be left undisturbed (Plate 10-2). The boulders extend about 1 metre above the typical high tide level. Furthermore, as discussed in the following section, the causeway and pontoon would result in a lowering of wave energy reaching the shore at the development site, which would further protect the shoreline from potential erosion during storms.

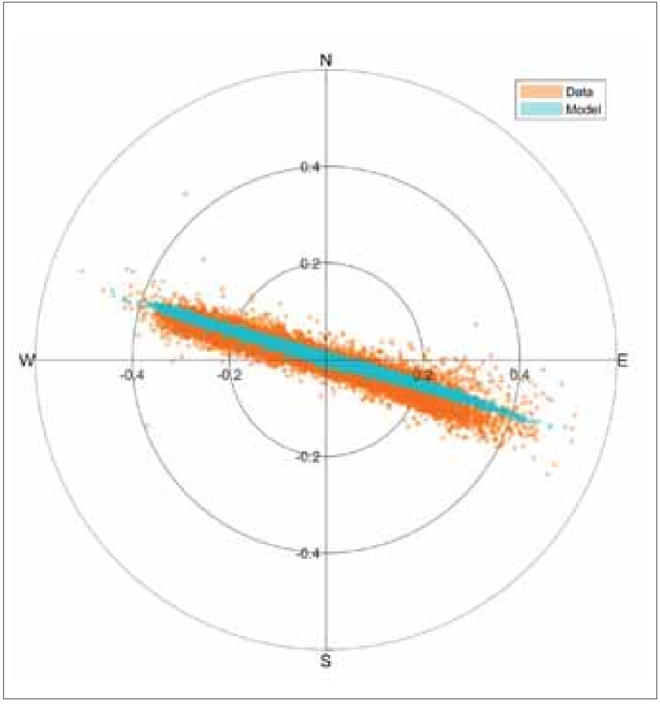


FIGURE 10-4 DEPTH AVERAGED CURRENT SPEED (M/S) AND DIRECTION MEASURED AND MODELLED IN SMITH BAY DURING 2016–17

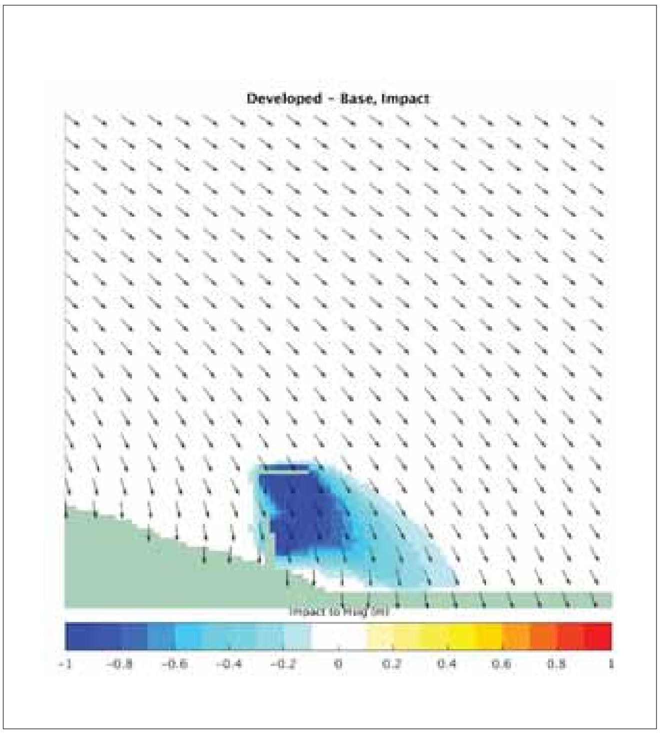


FIGURE 10-5 EFFECT OF THE CAUSEWAY AND WHARF ON WAVE HEIGHTS

Dewatered coarse dredge spoil would be used to construct the core of the causeway, and therefore has the potential to be eroded by waves immediately after placement and prior to rock armouring. Turbidity and siltation impacts would be minimal due to the coarse nature of the material (see Chapter 9 – Marine Water Quality).

Management measures

The risk of the causeway being eroded during construction would be minimised by covering each newly constructed 20–30-metre section of causeway using enviro-textile to provide initial protection from erosion prior to rock armouring. Rock armouring would also occur progressively as the causeway is constructed.

Should sea level rise result in the need for additional protection of the shore from erosion, suitable rock armouring would be sourced and placed along the shore in consultation with Coastal Management Branch.

The construction process and erosion mitigation strategies would be detailed in the Construction Environmental Management Plan.

10.5.2 WAVES

The causeway and floating wharf structures would generate a localised zone of reduced wave height near the shoreline due to blockage of incoming wave energy.

The impact on the significant wave height during an event in June 2016 is shown in Figure 10-5. This shows that the most significant impacts occur in the immediate lee of the causeway and floating wharf structure, where the wave heights are reduced. Some small directional changes are also observed for the residual wave energy, due to refraction around in-water structures. The zone of reduced wave height conditions extends approximately 500–750 metres eastwards from the causeway and wharf.

PLATE 10-2 BOULDER LINED BEACH THAT WOULD BE RESISTANT TO EROSION

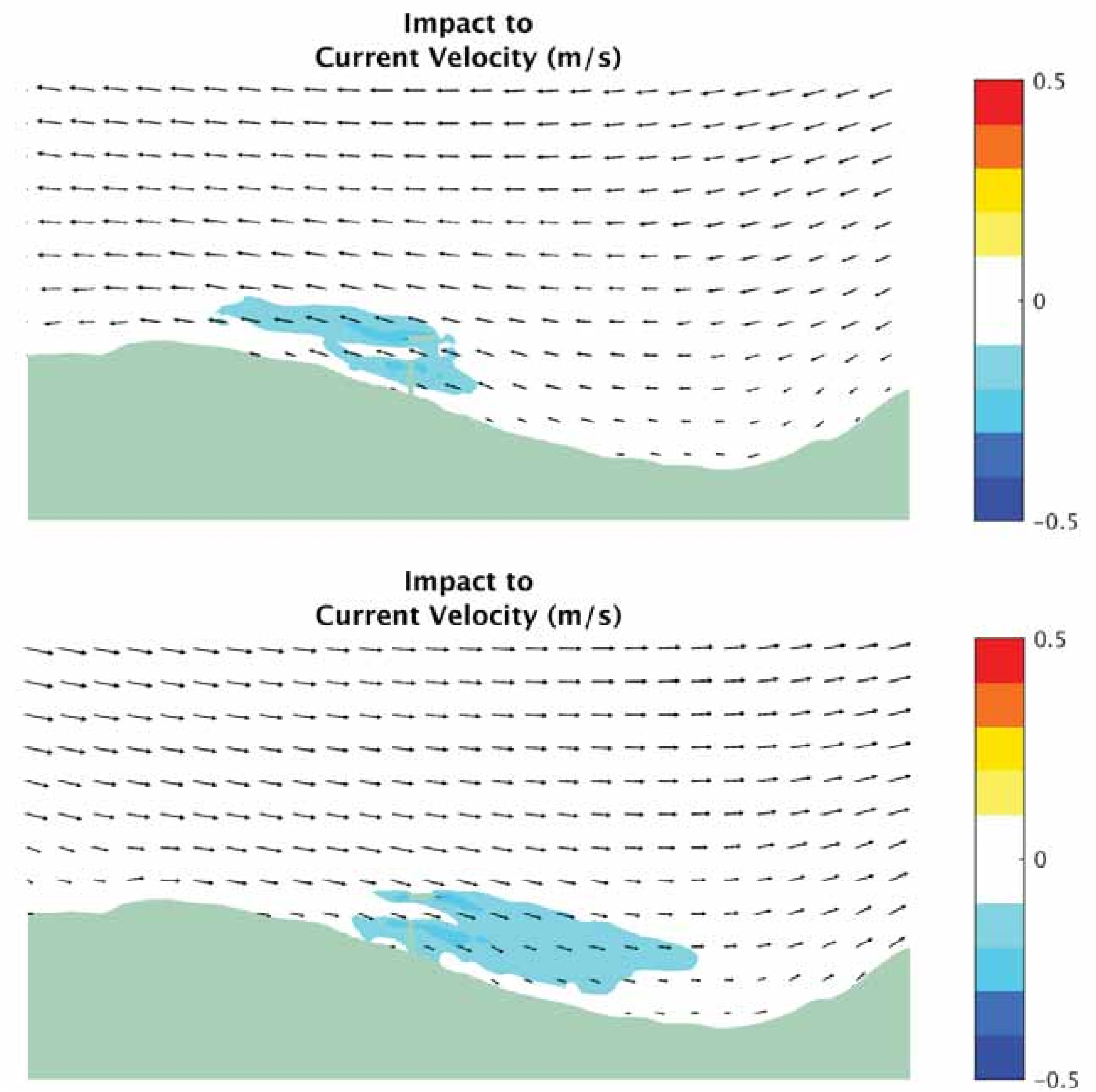


FIGURE 10-6 EFFECTS OF THE CAUSEWAY AND WHARF ON CURRENTS IN SMITH BAY DURING TYPICAL FLOOD TIDES (BELOW) AND EBB TIDES (ABOVE)

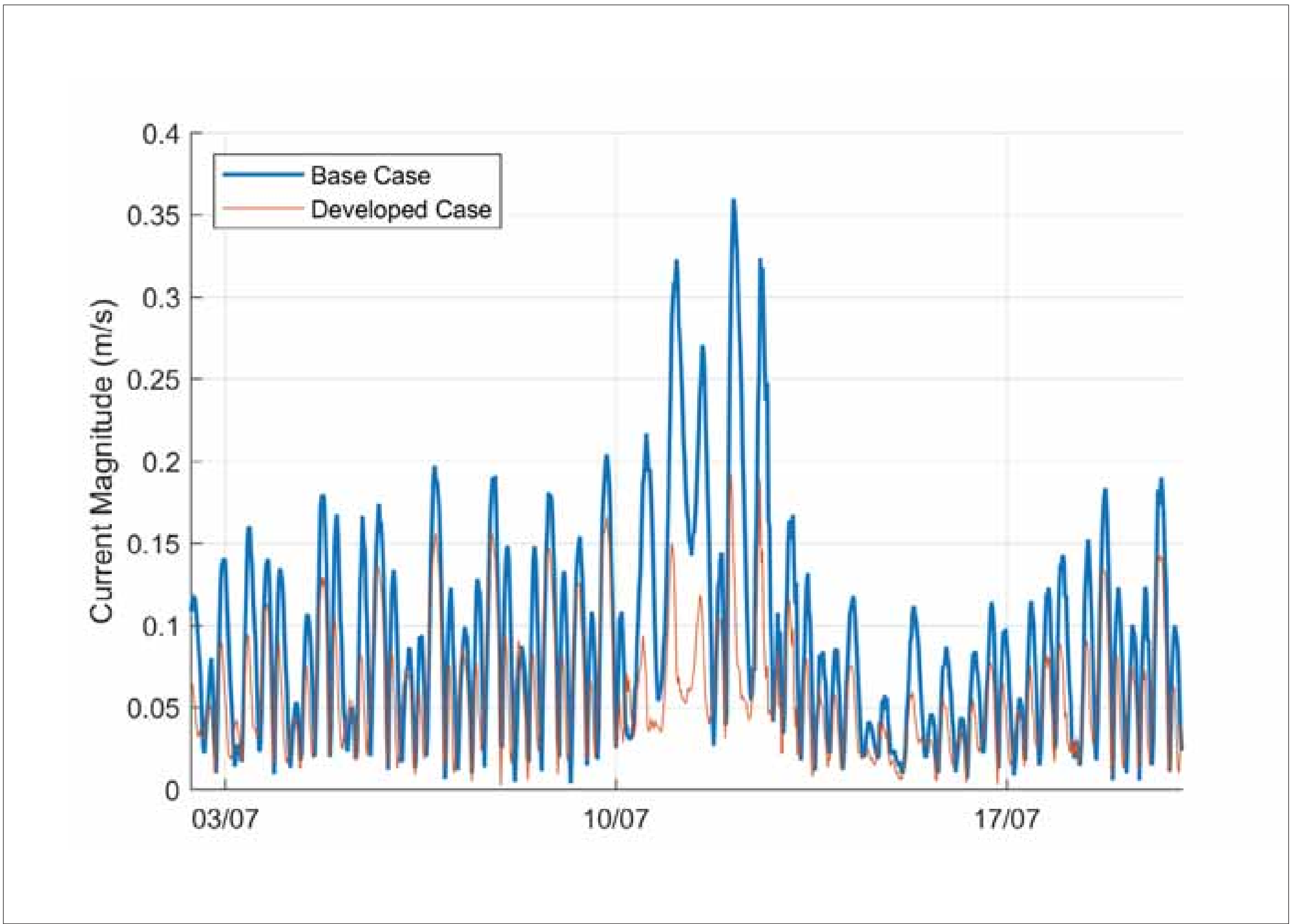


FIGURE 10-7 EFFECTS OF THE CAUSEWAY AND WHARF ON DEPTH-AVERAGED CURRENTS AT YUMBAH'S WESTERLY SEAWATER INTAKES

The wave height is typically reduced by around 30–50 per cent in the immediate lee of the structures, and by less than five per cent at the nearest Yumbah seawater intake. The resulting risk level is assessed as being medium (Appendix G1, Table 4-1).

10.5.3 CURRENTS

The impact of the causeway and floating wharf on current speeds throughout Smith Bay and at Yumbah's westerly seawater intakes are shown in Figure 10-6 and in Figure 10-7, respectively. The time series plot shown in Figure 10-6 is for typical spring flooding and ebbing tides. The causeway and floating wharf block the flow of currents near the coastline and reduce the peak current magnitudes by approximately 0.1 m/s, predominantly in the lee of the structures. The reduction in current speed at Yumbah's westerly seawater intakes is approximately 30 per cent of the base case under typical tidally dominated conditions. The resulting risk level is assessed as being medium (Appendix G1, Table 4-1).

10.5.4 SEAWATER TEMPERATURE

The water temperature over the entire summer simulation was modelled and spatially mapped for both the base and developed cases (i.e. with and without the port infrastructure), with the maximum temperature change shown in Figure 10-8. The comparison shows that maximum temperatures are likely to increase slightly in nearshore waters to the east of the proposed causeway, with a corresponding slight decrease predicted to the west. The predicted temperature increases are typically less than 0.2°C in shallow nearshore waters and even less, further offshore, where the aquaculture intakes are located.

A timeseries comparison of modelled water temperature at Yumbah's westerly seawater intake is shown in Figure 10-9. The comparison shows that the base and developed case predictions are essentially identical, indicating that temperature changes at the intakes would be negligible. The resulting risk level is assessed as being low (Appendix G1, Table 4-1).

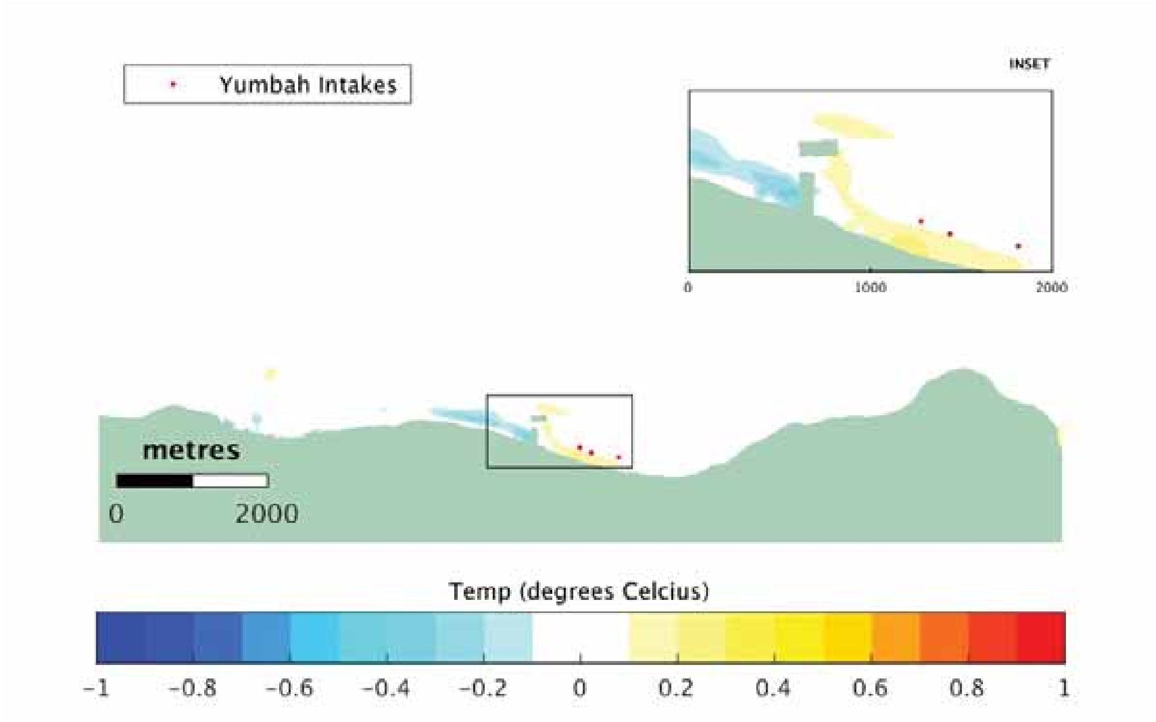


FIGURE 10-8 MAXIMUM CHANGES IN DEPTH-AVERAGED TEMPERATURE CAUSED BY THE CAUSEWAY AND WHARF (SUMMER SIMULATION)

FIGURE 10-9 COMPARISON OF DEPTH-AVERAGED TEMPERATURE AT YUMBAH'S WESTERLY SEAWATER INTAKES OVER SUMMER WITH AND WITHOUT THE PROPOSED DEVELOPMENT

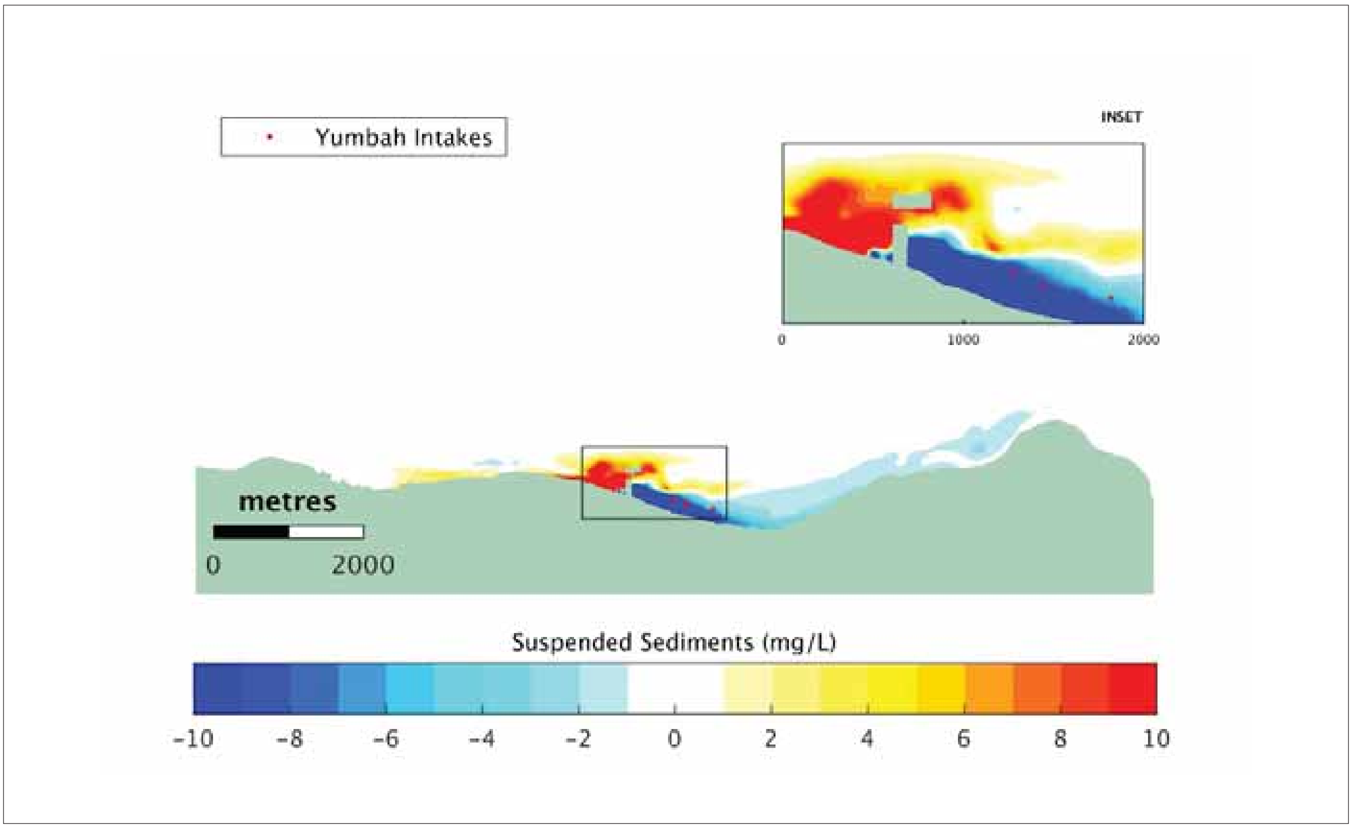


FIGURE 10-10 THE EFFECT OF THE CAUSEWAY AND WHARF ON DEPTH-AVERAGED TSS (95TH PERCENTILE) RESULTING FROM THE DISCHARGE OF FLOODWATER FROM SMITH CREEK

10.5.5 SMITH CREEK SEDIMENT PLUMES

The proposed causeway lies immediately adjacent and to the east of the mouth of Smith Creek and may therefore affect how flows and potential sediment plumes from the creek disperse into nearshore waters.

The impact of the causeway on the dispersion of sediment plumes from Smith Creek was modelled and is shown in Figure 10-10. The simulation shows that the causeway causes the flood plume to be constrained near the creek mouth and directed further offshore than is currently the case. This results in an increased total suspended solids (TSS) to the west of the causeway and further offshore in Smith Bay, but a decreased TSS in the nearshore zone to the east of the causeway, including at Yumbah's seawater intakes, where a TSS reduction of approximately 8 mg/L may occur, which is likely to be a beneficial impact.

10.5.6 SEDIMENT TRANSPORT

Littoral sediment transport

As discussed above, the rocky nature of the nearshore coastal environment and the dense macroalgae and seagrass communities at Smith Bay are likely to strongly limit active sediment transport along the coast. Consequently, numerical modelling of littoral sediment transport quantities along the coast was considered to be of limited value in assessing the risk from the causeway to nearshore morphological changes and not therefore undertaken.

Although the proposed solid causeway extending approximately 250 metres offshore has the potential to block active littoral zone sediment transport, there is no evidence of significant longshore sediment drift occurring in Smith Bay. The risk of the proposed causeway interrupting longshore sediment transport in Smith Bay appears to be low.

This conclusion is supported by an aerial image of the coastline approximately 1.5 km east of the site (Plate 10-3). At this location groyne structures were constructed between the world wars by shifting beach cobbles to provide a sheltered vessel landing area. There does not appear to have been substantial sand accumulation over the intervening 80–100 years in response to these man-made changes to the littoral zone.

PLATE 10-3 ROCK GROYNES IN SMITH BAY SHOW NO SIGN OF INTERRUPTING LONGSHORE SEDIMENT TRANSPORT

Seabed sediment transport (bed shear stress)

The potential for coastal sediment transport impacts and associated changes to seabed sediment characteristics was assessed based on modelling of combined wave and current bed shear stresses.

Bed shear stress provides an indication of the susceptibility of sediments to be resuspended and transported or deposited, depending on the prevailing wave and current energy. The potential changes in sediment transport and seabed sediment characteristics were assessed by modelling combined wave and current bed shear stresses in Smith Bay. Modelled changes in bed shear stress are shown in Figure 10-11.

The assessment shows that bed shear stress in the offshore areas of Smith Bay generally exceeds 0.5 pascals (Pa), which is consistent with the predominantly coarse sand and cobble size of the sea bed sediments. Bed shear stress typically exceeds 1 Pa in the shallower offshore reef areas and in the immediate nearshore zone (depths <5 metres), which is typical of areas with depth-limited (breaking) waves.

The assessment shows that the causeway and floating wharf result in a region of reduced bed shear stress in the lee of these structures. However, the bed shear stresses remain in excess of 0.5 Pa in the lee of the causeway and floating wharf, which is too high for fine sediment fractions to settle and form stable deposits (see Appendix G1).

Maintenance dredging

The modelling of bed shear stress revealed very minimal changes to bed shear stress within the dredge footprint. This suggests that net fine sediment deposition is unlikely to occur within the dredged footprint and that regular or substantial maintenance dredging would not be required. Further evidence for this conclusion is provided by the ongoing presence of the distinct paleochannel in the nearshore area of Smith Bay (refer Figure 12-1), showing the paleo channel beginning at the end of the causeway. The morphology of the paleochannel is very similar to that of a dredged basin.

Management measures and residual risk

In the event of shoreline accretion of sediment occurring against the causeway, it may be necessary to occasionally mechanically bypass the material to the other side of the causeway using an excavator and dump truck.

Although considered unnecessary, there is potential to include culverts in the causeway or a jetty section across the nearshore coastal zone to facilitate the longshore movement of sediment, should it be determined that such management measures are required.

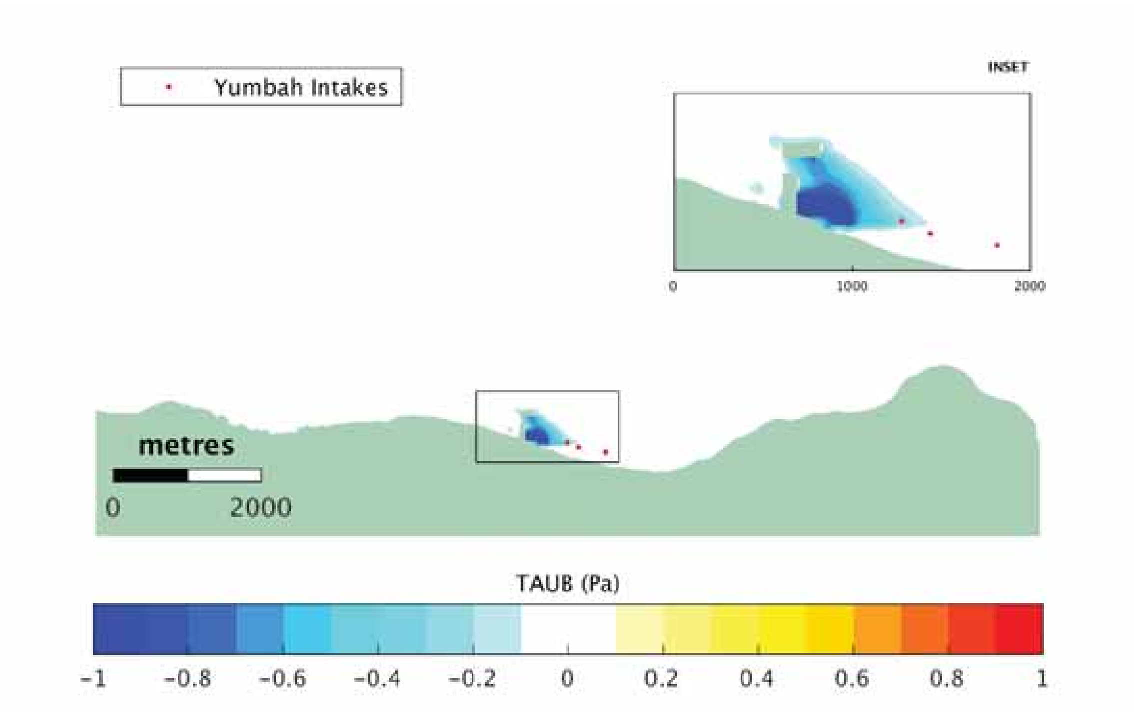


FIGURE 10-11 CHANGES IN BED SHEAR STRESS (95TH PERCENTILE) CAUSED BY THE CAUSEWAY AND PONTOON

The resulting risk associated with sediment transport is assessed as being low (see Appendix G1, Table 4-1).

10.5.7 SEAGRASS WRACK

Drift seagrass and macroalgae (wrack) may sometimes accumulate against the causeway in response to prevailing winds and currents. However, it is also likely that combinations of storm events, high tides and suitable winds and currents would re-mobilise and disperse accumulated wrack. The situation would be monitored and managed as required.

Management measures and residual risk

Should the accumulation of wrack become excessive, it may occasionally require removal and relocation. Potential management measures, should they be required, would be determined in consultation with DEW and the EPA. As with sediment, this may include mechanically bypassing the accumulated wrack to the other side of the causeway using an excavator and dump truck.

Alternatively, as discussed above, there is also potential to include culverts in the causeway or a jetty section across the nearshore coastal zone to facilitate the movement of wrack, should such management measures be required.

The resulting risk associated with wrack is assessed as being low (Appendix G1, Table 4-1).

10.6 CONCLUSIONS

The modelling of coastal processes has shown that the causeway and wharf are likely to have the following effects on coastal processes:

- the shoreline at the development site would be highly resistant to erosion during construction and operation of the facility as it is naturally armoured by boulders that would be left undisturbed
- wave height is likely to be typically reduced by around 30–50 per cent in the immediate lee of the structures, and by less than five per cent at the nearest Yumbah seawater intake. The zone of reduced wave height conditions extends approximately 500–750 metres from the causeway and wharf
- current speeds are likely to be typically reduced by approximately 0.1 m/s in the lee of the structures. The reduction in current speed at Yumbah's westerly seawater intakes is approximately 30 per cent under typical conditions
- seawater temperatures during summer are likely to increase by a maximum of approximately 0.2°C in the shallow water to the east of the causeway and inshore of the Yumbah seawater intakes. The temperature change at the nearest seawater intakes would be negligible (i.e. less than 0.1°C).

- sediment plumes associated with flood flows from Smith Creek would be directed further offshore by the causeway, resulting in a significant reduction in TSS in the nearshore zone to the east of the causeway, including at the Yumbah seawater intakes
- bed shear stress would be reduced to the east of the causeway, but would remain too high for fine sediment fractions to settle and form stable deposits
- bed shear stress showed minimal change within the dredge footprint, suggesting that net fine sediment deposition is unlikely to occur within the dredged footprint and that regular or substantial maintenance dredging would not be required
- the rocky nature of the nearshore coastal environment at Smith Bay is likely to result in very little net transport of sediment along the coast. The proposed causeway is therefore unlikely to interrupt active littoral zone sediment transport within Smith Bay. If accretion of sediment were to occur, it could be managed using excavators and trucks to by-pass the causeway
- drift seagrass and macroalgae (wrack) may sometimes accumulate against the causeway in response to prevailing winds and currents, but is likely to disperse naturally. The situation would be monitored and managed if and when required.

Discussion of the predicted changes to coastal processes in the context of the land-based aquaculture farm is provided in Chapter 11 – Land-Based Aquaculture.

11. LAND-BASED AQUACULTURE

Guideline		Comment
N/A	A description of the current commercial activities occurring in the area and marine environment (including land-based aquaculture and fisheries activities)	See Sections 11.4, 12.4.4, Appendices H1 and I3
2.7	Outline impacts that dredging may have on sediment loads and the neighbouring commercial land-based aquaculture operation. Detail measures for managing these impacts, including management of dredge spoil.	See Sections 4.4.4, 4.5.2, 9.5.1, 9.5.3, 9.5.4, 9.5.5, 11.5.1, 11.5.2, 11.5.3, Appendices F2, F3, H1, H2 and U1
2.9	Describe the contaminants and toxicants that may accumulate on the property and the risks during stormwater events (where not managed) to the adjacent aquatic environments and commercial industries (e.g. fisheries and aquaculture) that rely on those environments.	See Sections 11.5.4, 16.5.2, Appendices H1 and H2
2.12	Describe the impact of any incidental timber spillage and dust emissions (point source and fugitive) during ship loading operations on the marine environment, in particular on water quality and marine and coastal flora and/or fauna species, including migratory species. Outline the measures that will be taken in the event of a spillage.	See Sections 9.5.7, 9.6, 11.5.4, 11.5.5 and 12.5.8
2.13	Describe the impact of dust emissions on the nearby aquaculture industry and identify mitigating measures that will be used to manage these impacts.	See Chapter 17, Section 11.5.5, Appendices H1, H2 (Part C) and U2
2.14	Describe the potential impacts of increased shipping traffic and activities in Smith Bay from offshore anchoring, transhipment or pilotage (especially on marine fauna, water quality, recreational activities and amenity), including effects on commercial aquaculture activities in the region.	See Chapter 14, Sections 9.5.6, 9.5.7, 9.5.8, 9.6, 11.5.1, 12.5.2, 12.5.4, Appendices F3 and I2
2.19	Identify any possible changes to the seabed, bathymetry, sedimentary profiles (including particle sizes), and sand movement water flow and tidal movement patterns as a result of the development during both the construction and operational phases (include information on potential pooling of water upstream from the proposed causeway). Identify the impacts this may have on sensitive marine flora and fauna (including seagrasses, macro algae and other reef habitat), and commercial aquaculture activities in the region, and outline mitigation strategies.	See Sections 10.5.1, 10.5.2, 10.5.3, 10.5.4, 10.5.5, 10.5.6, 11.5.1, 11.5.2, 11.5.4, 11.5.5, 12.5.4, Appendices G, H1 and H2
2.20	Identify the risks from the exposure of fine sediments or clays that would impact adversely on water quality (turbidity and light penetration) and contribute to the production of sediment plumes in the region during both construction and operation phases. Outline the impacts this may have on commercial aquaculture activities in the region.	See Sections 9.5.1, 9.5.2, 9.5.3, 9.5.4, 10.5.6, 11.5.1, 11.5.2, 11.5.3, Appendices F2, F3, H1 and H2

Guideline		Comment
2.21	Describe, and provide baseline information on, the level of oceanic connectivity between the proposed development site and the intake areas used by commercial aquaculture ventures in the region (include observed information from hydrodynamic and coastal process modelling undertaken for a minimum of 6 months) and identify the impacts that the construction and use (including ship movements) of the proposed in-sea components of the proposal will have on this connectivity.	See Sections 9.5.1, 9.5.2, 9.5.8, 11.5.1, 11.5.2, 11.5.3 and Appendix F2
2.22	In addition to the above, outline all other potential impacts on the nearby commercial aquaculture ventures, their likelihood and severity, and identify mitigation measures that will be used and their effectiveness (include efficiency reports on silt curtains and sand filters if proposed).	See Section 11.5 and Appendix H
4.13	Describe the impacts (economic, social & environmental) of use of the upgraded public boat ramp. Outline potential users, the impacts expected from increased public access to and use of Smith Bay (including on the water quality in relation to the existing aquaculture operation in the vicinity). Describe measures that will be undertaken to mitigate these impacts.	A public boat ramp is no longer proposed and is not considered in the EIS. See Appendix H
5.2	Outline the impacts of dust and/or particle generation on the existing commercial operations and any other identified nearby sensitive receivers in the vicinity of the proposed development, in particular the existing abalone farm.	See Chapter 17, Sections 11.5.5, 17.5.3 and Appendix H

11. LAND-BASED AQUACULTURE

11.1 INTRODUCTION

Yumbah Kangaroo Island Pty Ltd operates a land-based abalone farm at Smith Bay under two abalone licences (FT00558 and FT00702) (see Figure 11-1). The farm grows mainly greenlip abalone (*Haliotis laevigata*) but may produce a small number of tiger abalone (greenlip/blacklip hybrids).

Although precise figures are not publicly available, it is presumed that the Smith Bay farm currently produces around 100–170 tonnes of abalone annually, most of which is exported (see Appendix H1).

The successful operation of the Smith Bay farm depends upon the provision of an adequate supply of fresh seawater with appropriate quality characteristics (including temperature, salinity and nutrients). This water is pumped from the marine environment and reticulated around the farm. The water provides the abalone with oxygen and carries waste materials away, including unconsumed feed, exudates and faeces that are discharged back into the sea.

The construction and operation of the KI Seaport has the potential to affect water quality in Smith Bay and this could present several potential risks to the operation of the Yumbah abalone farm. These risks therefore need to be assessed by the EIS and managed.

FIGURE 11-1 SATELLITE IMAGE SHOWING THREE AQUACULTURE LICENCES ISSUED BY PIRSA TO YUMBAH KANGAROO ISLAND PTY LTD

The key issues relating to the potential effects on the operation of the abalone farm are considered to be:

- sediments mobilised by dredging operations, the disposal of dredge tail water, the construction of the causeway, and shipping movements to and from the berthing facility. These sediments may adversely affect ambient water quality in Smith Bay and potentially the quality of water taken into the abalone farm. The main concerns are:
  - increased suspended sediment concentrations which may directly affect abalone
  - associated increases in water turbidity that may decrease light available to support growth of cultured algae to feed to abalone in the nursery phase of the operation
  - the mobilisation of anoxic sediments and/or sediments with high biochemical oxygen demand causing a drawdown in oxygen concentration in the water, and thereby limiting the supply of oxygen to abalone
  - the mobilisation of sediment-bound toxicants including chlorinated hydrocarbons and heavy metals that may affect either the physiology of the abalone or the quality of the product
  - the mobilisation of sediment-bound nutrients that have the potential to cause blooms of harmful or toxic algae
- coastal hydrodynamics (i.e. the movement of seawater in Smith Bay) may be altered by the causeway and the shipping channel, potentially resulting in:
  - the interruption of tidal flows and localised pooling of water in the vicinity of the causeway which may result in increased water temperatures and concomitant decreases in dissolved oxygen concentrations in water taken into the farm
  - the accumulation of sediment and drift seagrass in the lee of the causeway that has the potential to affect water quality during resuspension and re-mobilisation events
- airborne particulates (dust) may settle onto the farming infrastructure including the raceways and nursery tanks, potentially affecting seawater quality within the facility
- noise and vibration from construction and operations including from truck movements and the operation of machinery may potentially affect abalone growth
- light emanating from infrastructure in the hard-stand area, along the wharf/causeway and from vehicles, may potentially affect abalone growth.

The aim of this chapter is to assess these potential impacts from the construction and operation stages of the proposed KI Seaport on Yumbah's land-based abalone farm and propose, where necessary, suitable measures to manage and mitigate potential impacts.

The conclusions presented in this chapter are informed by an extensive literature review as well as analysis of the findings from the other studies undertaken for the EIS. The detailed underpinning for the subsequent conclusions is presented in Appendix H1.

11.2 REGIONAL SETTING

A detailed description of land-based abalone farming systems, including a review of the operation of the Smith Bay abalone farm is provided in Appendix H1.

The Smith Bay abalone farm is one of four land-based farms operated by Yumbah; the company's other farms are located at Port Lincoln (South Australia), Narrawong (adjacent to the port of Portland in Victoria) and Bicheno (Tasmania).

Apart from a number of experimental abalone farming systems in Louth Bay, the Yumbah farms at Smith Bay and Port Lincoln are reportedly the only operating abalone farming facilities in South Australia. There are two other land-based farms that are licensed to farm abalone in South Australia – the Streaky Bay farm (which was placed into Administration in 2017), and the Clean Seas operation at Arno Bay which does not currently produce farmed abalone.

The site of the proposed development was also once the site of another land-based abalone farm that became insolvent. In addition, aquaculture leases and licences have been issued for a number of experimental in-sea abalone farming operations in South Australia.

Yumbah claims (in an article published on 15 August 2017 in *The Weekly Times*) that collectively the four farms operated by its company grow-out 15 million abalone annually. From this number of animals, Yumbah claims to produce 7 million animals per year into the market (with the balance being lost through culling and mortality, and some being sent to markets where small abalone, marketed as 'abalini', are valued). Yumbah has stated that total production across the four farms is around 700 tonnes of abalone currently worth around $29 million a year. This production would represent approximately 92 per cent of Australia's total farmed production (based on ABARES 2017 figures). Although the actual figures have not been made available, it is likely that the Smith Bay farm contributes between 100–170 tonnes of the total production with a current value of around $4 million to $7 million per year (~20 per cent of Yumbah's production across all farms) (see Appendix H1). Yumbah has stated publicly that it plans to expand production at Smith Bay to 400 tonnes annually.

The only other significant aquaculture ventures on Kangaroo Island are Pacific oyster farms adjacent to Ballast Head near American River, and several land-based farms producing yabbies, marron and barramundi. There are a number of other marine-based aquaculture lease areas along the Kangaroo Island coast for the production of subtidal molluscs (including oysters, scallops and abalone) and, while these are listed as 'Active' on the SA Aquaculture Public Register, there is no known commercial production from these sites.

11.3 ASSESSMENT METHODS

This assessment draws extensively on the hydrodynamic, coastal processes, air and noise modelling studies described in Chapters 9 – Marine Water Quality, 10 – Coastal Processes, 17 – Air Quality and 18 – Noise and Light, respectively. Each of these chapters describes the potential effects of the development on physical aspects of the Smith Bay environment, including seawater quality, air quality and noise levels. The methods used to collect data to describe the existing environment and to derive the modelling outputs are described in each of those chapters.

This chapter interprets these results to determine the potential impacts on Yumbah's abalone farm. Professor Anthony Cheshire, former Chief Scientist at SARDI Aquatic Sciences, was engaged to undertake the assessment, and his detailed analysis of these issues is contained in Appendix H1.

This analysis includes a review of the scientific literature, a comprehensive review of data published by Yumbah (2018) on the ambient water quality characteristics for their Narrawong farm in Victoria as well as new information obtained from targeted ecotoxicology studies undertaken on juvenile greenlip abalone. Collectively the literature and analysis of the Yumbah (2018) ambient water quality data have provided a context against which the ecotoxicology results have been discussed.

The literature review was undertaken to provide an understanding of:

- land-based abalone farming operations in Australia
- the biology of the greenlip abalone
- the tolerance of greenlip and other abalone to relevant water quality parameters
- the thresholds at which abalone are adversely affected by physical changes to the environment (including a meta-analysis providing NOEC data for the Pacific abalone (*Haliotis discus*) (Stringer 2018a).

The review of the Yumbah (2018) ambient water quality data provided:

- quantitative data on water quality (collected over a 17-year period) that provides insights on the resilience of farmed abalone to suspended sediments in a commercial abalone farming operation
- additional data on issues such as the sensitivity of farmed abalone to noise and vibration.

The ecotoxicology studies (undertaken by Intertek – a NATA registered ecotoxicology laboratory in WA – Stringer 2018b; Stringer 2018c) provided quantitative data on NOEC (No Observable Effect Concentration) thresholds for juvenile greenlip abalone in response to elevated levels of suspended sediments as well as data that were used to determine NOEC values for exposure to hardwood wood dust (associated with atmospheric deposition).

The outputs from the modelling studies at key receivers within the abalone farm, including seawater intakes and grow-out areas, were compared with the abalone thresholds derived from this body of work.

Where management measures were recommended to mitigate potential impacts, additional modelling was undertaken to determine the predicted effectiveness of the management measures.

Opportunities to improve ambient water quality in Smith Bay, to offset potential impacts on the quality of seawater taken into the abalone farm, were also investigated.

11.4 ABALONE FARMING AT SMITH BAY

11.4.1 YUMBAH AQUACULTURE OPERATION

An overview of the Smith Bay aquaculture operation is provided in Appendix H1.

Yumbah's Smith Bay operation grows mainly greenlip abalone (*Haliotis laevigata*) but may also produce some 'tiger' abalone which are hybrids of greenlip and blacklip abalone (*Haliotis rubra*).

The abalone farm consists of four major parts:

- a broodstock holding system where mature abalone are held for breeding purposes
- a hatchery where larval abalone are produced
- a nursery where juvenile (post-larval) abalone are raised (typically to 15–20 mm in shell length)
- a grow-out area where sub-adult (through to adult) abalone are grown-out to market size (typically 80–120 mm in shell length).

Much of the Smith Bay farm consists of flat concrete raceways that provide an artificial habitat for the abalone to grow to market size. Yumbah reports that it can produce such animals in 2.5–3 years (down from 3–4 years, which has previously been considered typical for abalone farming in Australia). Yumbah claims that this reduction in time to market is a result of improved husbandry. Irrespective of the time taken for grow-out, animals need to be carefully husbanded across their entire lifecycle, which includes providing food and fresh sea water and removing waste materials.

While some facilities – such as the hatchery – are enclosed within buildings, the nursery tank system and raceways where the adults are grown-out are covered by shadecloth.

The abalone farm sources seawater from Smith Bay via 15 intake pipelines (in three locations) extending up to 220 metres into Smith Bay to a depth of approximately six metres (see Figure 11-2). The intakes consist of 'risers' that extend approximately two metres above the seafloor (see Plate 11-1). Other than coarse filters covering the intakes to exclude fish, the intake seawater is not filtered. Although no definite information is available, it is likely that an abalone farm of this size takes in seawater at a rate of up to 1500–2000 litres per second (L/s).

Seawater that has been used on the farm is subsequently discharged onto the beach via several pipelines at the edge of the Yumbah property; this water flows across the beach into Smith Bay. In effect, Yumbah relies upon dilution into seawater to ensure that the discharge of its wastewater into the intertidal zone does not result in these contaminated waters re-entering the farm system via the intake pipes that are placed offshore.

The only section of an abalone farm that does not use the flow-through seawater system is the hatchery, which generally operates on a recirculation or static system. Seawater used in abalone hatcheries is sourced from the intake pipes but is then filtered, (generally to at least 10 µm to remove fine suspended matter), and ultra-violet (UV) sterilised.

Standard practice is to run the water used in the nursery tanks through a bank of rapid sand filters (RSFs) which would remove most of the larger particulates (i.e. those in the >20 µm size range) from the influent water.

The principal source of food for animals across the bulk of their life on a farm is from manufactured feeds in the form of dried pellets. Yumbah produces its own pelleted feed at a factory in Lonsdale, South Australia. Nursery stock are generally fed on diatoms and a variety of other algal species that are intensively cultured on PVC plastic sheets. Growth of algae (diatoms or cultured filamentous species such as *Ulvella* sp.) is enhanced by using added nutrients (fertilisers) The plastic plates upon which the algae grow are then placed in the nursery tanks to provide food for the juvenile animals.

PLATE 11-1 YUMBAH SEAWATER INTAKES (RISERS) IN SMITH BAY

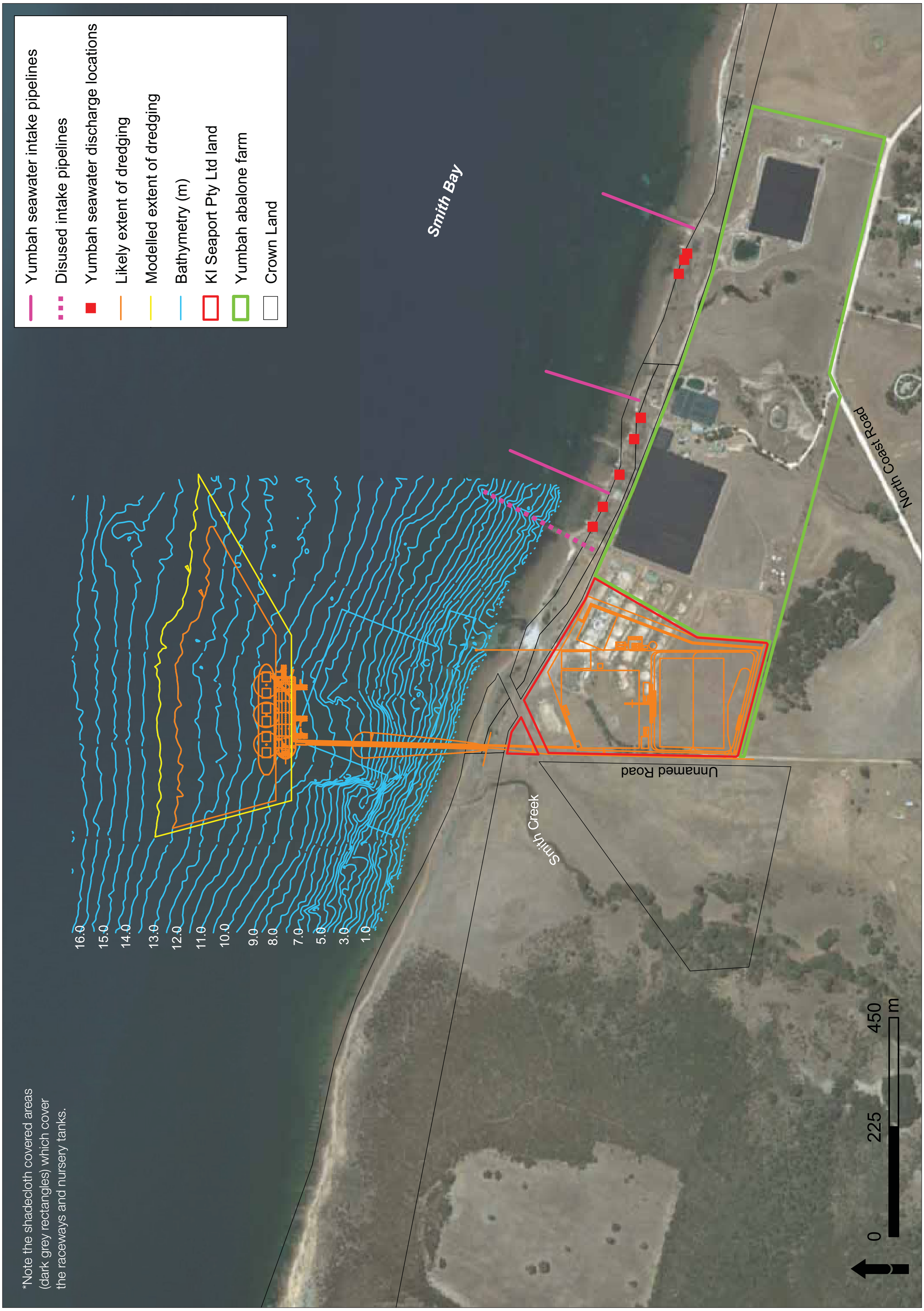


FIGURE 11-2 YUMBAH ABALONE FARM FACILITIES IN RELATION TO THE PROPOSED KI SEAPORT*

11.4.2 EXISTING SMITH BAY ENVIRONMENT

Physical features of the Smith Bay marine environment that are relevant to the operation of the abalone farm are: ambient suspended sediment loads (or turbidity), temperature, seafloor sediment characteristics, nutrients, chemical contaminants and dissolved oxygen; these are described in Chapter 9 – Marine Water Quality.

Dust deposition is also likely to be relevant to the Yumbah operation (see Chapter 17 – Air Quality). Dust modelling has shown that Smith Bay is likely to experience atmospheric dust deposition at background rates of around 2 g/m^2/month, which is equivalent to the typical average rates for coastal and agricultural/pastoral sites in South Australia (See Chapter 17 – Air Quality).

Although the general quality of the seawater in Smith Bay is considered to be high, there is evidence to suggest that it may, at times, be compromised during storm events by inputs of suspended sediment from the highly degraded Smith Creek (and other creeks). Smith Creek (see Figure 11-2) has unstable, eroding banks and is at times enriched with nutrients due to agricultural runoff and uncontrolled access to the watercourse by sheep (EPA 2013 Aquatic Ecosystem Condition Report). Relatively large amounts of sediment are likely to enter Smith Bay during severe rain events and produce turbid conditions. Subsequent settlement and resuspension processes during times of high wave energy could produce ongoing periods of relatively high turbidity that are unlikely to have occurred before the Smith Creek catchment was cleared and developed for farming.

The existing levels of suspended sediment (i.e. turbidity) in Smith Bay were found to be variable during the period of monitoring, ranging from <1 NTU during calm conditions to 5–6 NTU in surface waters during storm events (see Chapter 9 – Marine Water Quality).

Another water quality parameter of potential concern for the operation of the abalone farm is seawater temperature. A major risk to the abalone aquaculture industry in South Australia is the increase in average water temperature as a result of climate change. Increases in temperature affect abalone in a number of ways; the capacity for water to hold oxygen decreases as the water temperature increases but abalone also illustrate a wide variety of physiological responses to increased temperature (Vandepeer 2006). South Australian abalone farms have, almost since inception, struggled to manage elevated rates of summer mortality (Vandepeer 2006) and this risk will increase as climate changes.

Data collected for the EIS throughout 2017, using moored data buoys that were equipped with a suite of water quality and hydrodynamic sensors (detailed in Chapter 9 – Marine Water Quality), shows the mean seawater temperature during the monitoring period at Smith Bay within 300 metres of shore during summer is generally reported around 21–22ºC, but there were spikes up to 25ºC recorded during heatwaves (see Chapter 9 – Marine Water Quality). While the critical thermal maximum for greenlip abalone is reported to be 27.5ºC, many farms across South Australia have reported substantial mortality events at much lower temperatures (22–23ºC; Vandepeer 2006). On this basis, the existing thermal profile observed in Smith Bay over the summer months must be considered a current high-risk factor for the abalone operation.

11.5 IMPACT ASSESSMENT AND MANAGEMENT

The detailed assessment and management of the potential impacts of the proposed KI Seaport on the operation of the abalone farm at Smith Bay is provided in Appendix H1 and is summarised in the following text.

11.5.1 MOBILISATION OF MARINE SEDIMENTS

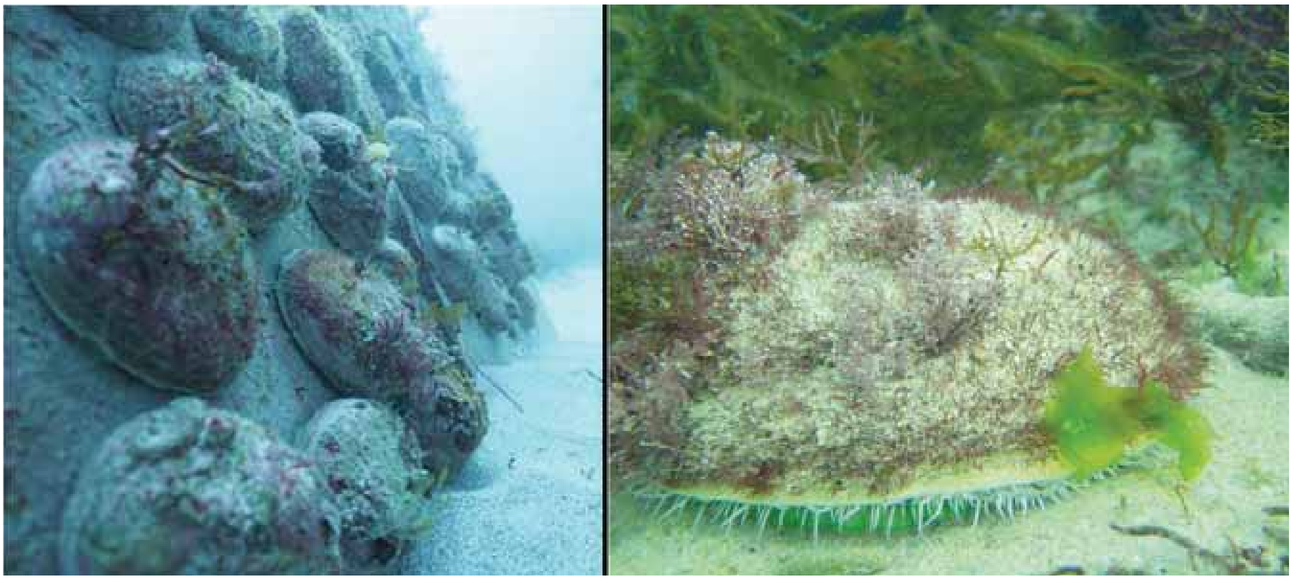
Sources of sediment

A range of construction and operational activities have the potential to mobilise sediments and thus elevate the concentrations of suspended sediments in the water column and thereby affect water quality at the Yumbah seawater intakes. These sources comprise:

- sediments suspended at the dredge head during construction of the access channel and berth pocket
- materials discharged with tailwater from sediments that have been pumped ashore
- sediments mobilised during construction of the causeway, particularly those sediments used to fill the core of the causeway
- sediments suspended by prop-wash and pressure waves generated during ship movements into and away from the facility
- sediments suspended at the dredge-head during maintenance of the access channel and berth pocket.

Abalone tolerance and vulnerability to suspended sediments

Most southern Australian abalone species, and particularly the greenlip abalone (*H. laevigata*), live in environments where they are periodically exposed to high levels of suspended sediments. Shepherd (1973) describes the habitat, feeding behaviour, food and ecological relationships of five species of abalone that occur in South Australia, noting that *Haliotis laevigata* (i.e. the species grown at Smith Bay) and the blacklip abalone (*Haliotis rubra*;



Source: (L) fis.com from Ocean Grown Abalone in WA and in a natural habitat (R): Department of Economic Development, 2015

PLATE 11-2 IMAGES OF GREENLIP ABALONE GROWING IN AN IN-SEA AQUACULTURE SETTING*

*Note that the animal naturally inhabits areas where it is exposed to very high sediment levels as evidenced by the sediment accumulation on the shell and characteristics of the substratum.

a species that may be grown at Smith Bay) frequently live on exposed coastal reef systems. Greenlip abalone typically inhabit low-profile reefs and boulders, often adjacent to the sand line, where sediment resuspension due to wave action is a regular feature of the natural environment (see Plate 11-2).

Blacklip abalone occupy similar areas but generally adopt a more cryptic[1] lifestyle, inhabiting rock crevices and other areas that have less direct exposure to wave force.

In broad terms, the literature considers the following impacts from sediments on abalone:

- physical burial and smothering of wild abalone (Marshall & McQuaid 1989; Sainsbury 1982)
- the loss of attachment due to sediments settling onto the substratum (Chew et al. 2013)
- the impacts of suspended sediments on larval development and survival (Lee 2008; Chung et al. 1993; Phillips & Shima 2006)
- the impacts of suspended sediments on the physiology and survival of juvenile, sub-adult and adult abalone (Sainsbury 1982; Yoon & Park 2011; Chew et al. 2013)
- possible mechanisms for impacts from suspended sediment (Marshall & McQuaid 1989; Chung et al. 1993).

Haliotis spp. (abalone) populations in the wild are vulnerable to both the direct and indirect effects from sedimentation processes (Chew et al. 2013) and these effects include lethal, sublethal and behavioural responses (Newcombe & Macdonald 1991). By and large, most of the documented impacts occur during the larval and early juvenile (post- metamorphosis) phases of the abalone lifecycle and there are few documented impacts on sub-adult or adult animals. Indeed, experimental studies using adult or sub-adult animals show that for those abalone species that have been studied they are well adapted to elevated suspended sediment loads (Yoon & Park 2011; Chew et al. 2013).

Physical burial

Sediment mobilisation may result in the direct burial of abalone and smothering of the reef habitat. Sainsbury (1982) found that a major cause of mortality of juvenile *Haliotis iris* in New Zealand was burial due to sudden, localised changes in sediment level in response to severe storms. Smothering of crustose coralline algal communities on reef habitat by sediment has also been shown to reduce habitat suitability for abalone (Aguirre & McNaught 2010). Similarly, a field study of the impact of dredge spoil disposal on juvenile *H. iris* has shown behavioural changes of the abalone, which move in an effort to avoid areas of spoil accumulation, although no direct effects on their health or mortality were found (Chew et al. 2013). Smothering and burial, at the levels documented in these studies, cannot occur in aquaculture systems because these processes rely upon bed-flow transport of sediments not the deposition of suspended materials.

[1] In the context of abalone, the word 'cryptic' means that animals occupy areas where they can remain hidden; this protects them from predators.

Impacts of suspended sediments on larval development and survival

Abalone larvae have been found to be considerably more sensitive to suspended sediments than juveniles or adults. Phillips & Shima (2006) undertook an experimental study of the effect of suspended sediments on 72–96 hours old larvae of the abalone *Haliotis iris* in New Zealand. Their study showed that abalone larvae were relatively sensitive to sediment stress, and that mortalities were directly related to suspended sediment concentration. This finding is however of little relevance to this assessment because farmed larvae are reared within tanks of filtered (<10 µm) and UV sterilized seawater and animals are not exposed to any suspended sediments that may potentially occur in the intake water.

In any event, most abalone farms only spawn abalone on a few days each year which means that the vulnerability of larvae is of short duration. It is, therefore, easy to manage through the implementation of appropriate controls.

Impacts of suspended sediments on adult animals

Abalone have evolved to live in an environment where, in order to feed and grow, they need to be able to deal with the associated suspension of sand and other forms of detritus (see e.g. Melville-Smith et al. 2017). It is evident from the very nature of the environment that abalone must be adapted to suspended sediments simply because they rely upon drift algae, suspended in the water column, as their principal source of food. The very processes, wave action and current flow, that break off algae and then suspend and transport them to abalone, also suspend and transport sediments. In essence, if there were no sediments suspended in their environment then there would also be significant limits on the food available for them to eat.

While there are few studies that specifically address the impacts of suspended sediments on more mature (sub-adult or adult) abalone, those papers that do address the issue all conclude that abalone are robust in terms of their ability to deal with high levels of suspended sediments. The results from the most relevant of these studies are detailed in Table 11-1.

Based on these studies, Dr Tristan Stringer (Principal Ecotoxicologist – Intertek) has provided an expert opinion concerning an indicative TSS guideline value for the Pacific abalone *Haliotis discus hannai* in Appendix H2. Dr Stringer concluded that an appropriate interim guideline value for the Pacific abalone is 25 mg/L TSS (i.e. at this concentration no sub-lethal or chronic effects are expected to occur).

TABLE 11-1 SUMMARY OF STUDIES COMPARING EFFECTS OF SUSPENDED SEDIMENTS ON VARIOUS ABALONE SPECIES

Species[2]	Treatments	Period	Finding	Source
Haliotis discus hannai	TSS at: 0, 1000, 1500 and 2000 mg/L	96 hours	No effect on mortality	Lee 2008
Haliotis diversicolor	TSS at: 100, 200, 300, 400 mg/L	96 hours	No effect on mortality, weaker motility at higher concentrations	Wang et al. 2007
Haliotis discus	TSS (silt and clay): 50 mg/L	48 hours	No effect on mortality	Chung et al. 1993
Haliotis discus	TSS (silt and clay): 50 mg/L	96 hours	0–7.5% mortality	Chung et al. 1993
Haliotis discus	TSS (silt and clay): 1000 mg/L	96 hours	up to 82.5% mortality	Chung et al. 1993
Haliotis discus hannai	TSS at: 250, 500, 1000, 2000 & 4000 mg/L	7 days	LOEC[3] = 500 mg/L, Lc50[4]=1888 mg/L	Yoon & Park 2011
Tigriopus japonicas (copepod)	TSS at: 250, 500, 1000, 2000 & 4000 mg/L	7 days	LOEC = 31 mg/L, Lc50=61 mg/L	Yoon & Park 2011
Paralichthys olivaceus (flounder fry)	TSS at: 250, 500, 1000, 2000 & 4000 mg/L	7 days	LOEC = 125 mg/L, Lc50=157 mg/L	Yoon & Park 2011
Haliotis iris	Synthetic particles 100 mg/L		No significant effect on growth or mortality	Allen et al. 2006

Note: Yoon & Park (2011) compared *Haliotis discus hannai* to two other aquaculture species, a benthic copepod and a flounder fry.

[2] Animals used in these various experiments were aquaculture bred.

[3] LOEC – Lowest Observed Effect Concentration for the experimental protocol.

[4] Lc50 – TSS concentration at which 50 per cent mortality occurred.

While none of these studies (see Table 11-1) used Australian abalone species it should be noted that the shell morphology and other characteristics of the greenlip abalone (*Haliotis laevigata*) suggests that it requires higher water velocities over its shell when compared to other abalone species to adequately ventilate its mantle cavity (Tissot 1992; Vandepeer 2006). This implies that the species is well adapted to high energy environments where currents are strong and suspended sediment levels are likely to be higher thus providing further evidence that *H. laevigata* is likely to be at least as resilient to impacts from suspended sediments as any of these other abalone species.

The Yumbah abalone farms, in and of themselves, also represent a robust test of the extent to which abalone in an aquaculture setting are vulnerable to suspended sediments. The Smith Bay farm, for example, has been in operation for some 23 years over which time there have been a large number of seasonal storm events (including a one-in-50-year storm in September 2016) all of which would have caused an elevation in suspended sediments in the influent seawater.

While it has been claimed (McShane 2017) that the resuspension of sediments within Smith Bay during storm events is associated with mass mortality events on the Yumbah farm, no evidence of such events has been provided. McShane (2017) refers to a veterinary report by Dr Richmond Loh (Loh 2017 referred to in McShane 2017) but Yumbah has not made that report available to support claims about the association between turbidity and mortality.

Turbidity levels in Smith Bay routinely reach 5–6 NTU, which would likely correspond to suspended sediment loads in the range 10–20 mg/L depending on when and where the measurements are made[5]. Given what we know about other abalone species (refer Table 11-1) and what can be inferred about the biology of the greenlip abalone relative to these other species (e.g. Tissot 1992) it would seem highly unlikely that the abalone farmed at Smith Bay are indeed susceptible to such events. Furthermore, it seems probable that the land-based abalone farm at Smith Bay would struggle to remain viable if the routine resuspension of coastal sediments during such weather events were to consistently cause mass mortalities.

No evidence has been provided that the mortality events, that McShane (2017) claimed were associated with storm induced sediment resuspension, triggered the mandatory reporting required by PIRSA, which should have occurred if there had been a 20 per cent rise in the average daily mortality rate[6]. PIRSA, as the regulatory authority, have advised that they are not in a position to confirm whether or not any such reports have been received from Yumbah.

Although the post-mortem report (Loh 2017) is not publicly available and has not been made available for the EIS, it is entirely possible that the mortalities referred to by McShane (2017) were caused by any number of factors (other than suspended sediments). This could include elevated levels of bacteria (e.g. *Vibrio*), which would have a similar pathology, and which have been associated with mortalities on other abalone farms in South Australia (Theil et al. 2004; see Appendix H1). The occurrence of these pathogens in Smith Bay may be associated with rainfall induced flows from Smith Creek, however there are no data to support this contention.

Notwithstanding these claims in relation to the Smith Bay farm, Yumbah have published detailed information about water quality for their farm at Narrawong in Victoria (Yumbah 2018) and those data are informative in the context of the water quality requirements for abalone aquaculture. The Yumbah documentation comprises a Works Approval Application (Yumbah 2018) seeking approval from the Victorian EPA and Glenelg Shire Council to construct a new abalone farm at Portland in Victoria (to be called Yumbah Nyamat and requiring an investment of some $60 million). The documentation has been prepared to support their case for the development of the new farm and it provides a comprehensive summary of the farming operation currently at Portland (the Yumbah Narrawong farm) and thus is a relevant source of water quality data that can be compared to water quality data from Kangaroo Island from the perspective of abalone farming requirements.

In outlining their choice of location for the Yumbah Nyamat proposal the company has stated that the site is adjacent to a source of clean oceanic water that they define as ‘perfect’ for the abalone that they are proposing to farm (Yumbah 2018, Page 3). Ambient TSS loads from the Narrawong

[5] Noting that turbidity is not a direct measure of total suspended sediments but rather a measurement of the extent to which light, travelling through a water sample, is reflected by particles suspended in the water column. As such the relationship between turbidity and total suspended solids varies with sediment type and depends on a range of issues including the particle size distribution and the shapes of the particles suspended. Direct conversions therefore need to take account of the sources and nature of sediments.

[6] The requirement to report is defined under Aquaculture Regulations (2016) and applies in cases where the cause of the mortality is not immediately known. In this context it is intended to control the transmission of diseases; the requirement to notify applies in any situation where a disease has occurred or where ‘the cause of an unusually high mortality rate for aquatic organisms farmed under a licence is not immediately apparent’. The fact that these animals were sent for veterinary examination indicates that the cause of death was unknown and therefore would have triggered the requirement to report even if subsequent veterinary advice was received that the cause of mortality was not disease related or could not otherwise be determined.

farm have ranged from 3.3 mg/L (median value) to 9.4 mg/L (90th percentile) with a maximum observed value of 37 mg/L (Yumbah 2018). The raw data that form the basis of these estimates can be fitted to a log normal distribution function which allows one to generalise their observations from the sample data set as provided to produce quantitative estimates of the likely long term trends in water quality as defined by TSS (Figure 11-3).

These data and the associated analysis demonstrate that, over time, one expects to see frequent low turbidity events with some 47 per cent of observations at the 0–3 mg/L level; there are significantly fewer higher turbidity events. Turbidity is below 6 mg/L for 75 per cent of the time and below 15 mg/L for around 95 per cent of the time. Conversely, values will typically exceed 15 mg/L for 5 per cent of the time and thus, such higher turbidity events may occur on 15–20 days per year.

Higher turbidity events are unlikely to be persistent, in that they would not be expected to extend over multiple days, but rather they would peak for a period of some hours during storm and bad weather events before calmer conditions lead to the suspended sediments settling out of the water column.

The data from the Narrawong farm can be compared to monitoring data obtained from Smith Bay. Smith Bay data were obtained using a series of fixed monitoring buoys (including both surface and bottom mounted turbidity sensors) and allow an estimation of ambient TSS loads over the course of a year at the seawater intakes to the Smith Bay farm. The data set comprises in excess of 54,000 records and is thus much more highly resolved over time than the data from Yumbah (2018) which comprised some 86 records over a 17-year period. On this basis one would expect that the Yumbah (2018) data would be more variable as it would likely capture both annual and inter-annual variability. Conversely, the Smith Bay monitoring data has more or less captured turbidity for every 10-minute period over an entire year. Nevertheless, the data do provide the basis for a scope and scale comparison of the water quality (TSS loads) at the two sites (Figure 11-3).

The Yumbah Narrawong farm would typically see many more events with high levels of TSS than were seen over the 12-month monitoring period at Smith Bay. At Smith Bay around 98.7 per cent of observations were less than 6 mg/L TSS while at Narrawong only 75 per cent were below this level. On this basis it can be concluded that Narrawong typically experienced around 15–20 days per year (on average) where ambient TSS loads exceeded 15 mg/L while such events would be expected on only one day (or less) per year at Smith Bay.

Superficially these results might be taken to mean that the Smith Bay environment is more suitable for abalone farming

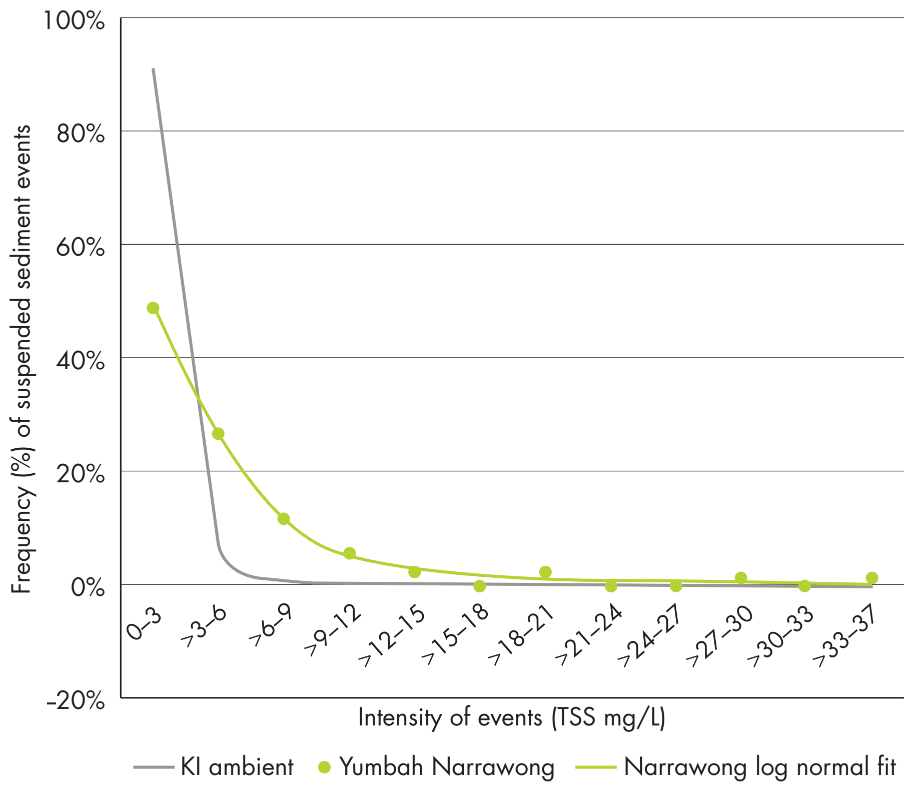


FIGURE 11-3 COMPARISON OF THE FREQUENCY OF TURBIDITY EVENTS (TSS MG/L) AT YUMBAH KANGAROO ISLAND

Note: The grey line indicates Yumbah at Kangaroo Island and the green line and points indicate Yumbah Narrawong. The green line and points are the bin frequencies for each TSS level derived from Yumbah (2018, Appendix G); the curve is a log normal model fitted to these. The model provides an excellent fit to the data (r^2=0.998).

however this is not the case. Yumbah (2018) have stated that the water at the proposed Victorian farm site is 'perfect' for growing abalone hence these differences in suspended sediment loads would not be expected to have any material effect on abalone production. Rather, as with the results from other studies (see above), these data support the conclusion that abalone are relatively insensitive to higher levels of suspended sediments and that the differences in TSS loads between the two sites are not material. Furthermore, these data provide additional evidence that elevated levels of suspended sediments that occur during storm events are not likely to be the cause of elevated mortalities, at least not at the levels routinely experienced at the Narrawong farm which would otherwise experience much more frequent and presumably more debilitating mortality events.

Ecotoxicology of greenlip abalone

The preceding sections collectively provide:

- a comprehensive review of what has been published in the scientific literature about the effects of suspended sediments on abalone
- data on the water quality characteristics of a successful abalone farm particularly as this relates to ambient suspended sediment loads.

Whereas the scientific literature is limited in that none of the previous studies has looked specifically at the impact of suspended sediments on the greenlip abalone (*Haliotis laevigata*), it can be argued that the water quality data from existing farms provides a very robust test that validates the inferences one can make based on observations on these other species. Notwithstanding, it is desirable to strengthen these assumptions with practical studies on the target species itself.

To address this issue Environmental Projects commissioned SARDI (Aquatic Sciences) to collect juvenile greenlip abalone from the wild[7] and these animals were then provided to Intertek to be used in a series of targeted ecotoxicology studies. The results of these studies have been published (Appendix H2; Stringer 2018b; Stringer 2018c) and are summarised below.

Juvenile animals were used because studies on other species (e.g. Yoon & Park 2011) have shown that this is the most vulnerable phase in the life history. Juvenile greenlip abalone (average shell length 15-20 mm) were acclimated over a period of four days at a temperature of 18ºC (collection temperature was 16.7ºC).

Sediments used in the tests were obtained from Smith Bay but were dried and then sieved through a 64 µm sieve to ensure that the material used for testing comprised only the finer sediment fraction which would both remain in suspension (i.e. not settle out) and has a particle size that is more likely to have an adverse effect on animals exposed to the sediments. These finer sediments are also representative of the fraction that would be transported from the dredging operations to the abalone farm intakes because the coarser, heavier particles, would settle more rapidly and would not remain in suspension long enough to reach the seawater intakes.

The experimental design used 32 animals; four animals in each of four replicate groups across each of two treatments: an exposure group (16 animals) and a control group (16 animals). The exposure group were exposed for 24-hours to suspended sediments at a concentration of 250 mg/L while the control group was placed in the same experimental set up but exposed to normal (0.43 µm filtered) seawater with no additional suspended sediments.

Following the 24-hour exposure period animals were subsequently transferred back to the holding tanks and observed for a further 48-hour period (Stringer 2018b). No mortalities were observed in either the treatment or control groups.

This result demonstrates that for a 24-hour exposure juvenile greenlip abalone have a NOEC of at least 250 mg/L against which a ten times safety factor has been applied to account for acute vs chronic effects. This provides a water quality guideline of 25 mg/L at which neither chronic nor acute effects would be expected.

The same experimental design was used to test for effects of exposure to wood dust (Stringer 2018c). The treatment group in this case was exposed for 24 hours to 35 mg/L of fine hardwood dust (<63 µm) obtained from *Eucalyptus globulus* (the main hardwood species to be used at Kangaroo Island). No mortalities were observed in either the control or treatment groups which, after employing a ten times safety factor to account for chronic vs acute effects, confirms that animals exposed to wood dust at 3.5 mg/L would not be expected to experience any toxic effects.

An important aspect of the wood dust exposure was that it took over two hours for the wood dust to become water logged and go into suspension after which time the water changed colour as tannins and other materials leached from the wood and into the water. Prior to that time the dust simply floated on the surface of the water. This observation is important because the estimated transit time of water down an abalone raceway is less than 1000 seconds (less than

[7] Environmental Projects initially attempted to purchase animals from an aquaculture farm but no aquaculture farm in Australia was able to supply any animals to support the testing.

20 minutes); on this basis alone one can infer that wood dust will float on the surface of the water for the entire period that the water is on the raceway and will then be discharged from the farm without ever causing an effect on water quality for the farmed animals. Notwithstanding, even if the dust did leach into the water within the transit period it would not be expected to have a toxic effect on animals at the guideline value of 3.5 mg/L.

Summary

All available evidence indicates that greenlip abalone (*Haliotis laevigata*) have a robust capacity to deal with high levels of suspended sediments in their environment. While larval abalone are vulnerable to elevated levels of suspended sediments, such animals are protected in an aquaculture setting through the use of filtered and sterilized water. Such vulnerabilities are not experienced over the remainder of their lives.

There are strong lines of evidence that abalone in general and greenlip abalone in particular have evolved to cope with elevated suspended sediment levels in their natural environment (e.g. Tissot 1992). This is further supported by a range of studies that have demonstrated abalone (particularly aquaculture grown animals) are insensitive to quite high levels of suspended sediments with NOEC values likely to be in the range of 250 mg/L or higher (e.g. Yoon & Park 2011; Stringer 2018a). Indeed, it appears that abalone have a substantially higher tolerance to elevated levels of suspended sediments than other aquaculture species (Yoon & Park 2011).

There is also good evidence (Yumbah 2018) that aquacultured abalone thrive in waters where suspended sediments routinely reach 8–10 mg/L and may range as high as 37 mg/L.

These findings are further supported by direct experimental studies that demonstrated that juvenile greenlip abalone were unaffected by a 24-hour exposure to 250 mg/L of fine suspended sediments collected from Smith Bay. Given that the end-point for the study was acute (percent mortality), a ten times safety factor was used to adjust for chronic effects. On this basis the NOEC value is assumed to be 25 mg/L (Stringer 2018a; Stringer 2018b).

In conclusion it is expected that greenlip abalone farmed by Yumbah on Kangaroo Island would not be expected to show any adverse effects (either in terms of mortality or effects on growth and overall fitness) from levels of suspended sediments that were less than 25 mg/L.

Water quality targets to protect aquaculture of greenlip abalone should therefore be set such that the 50th percentile value for total suspended sediments is 10 mg/L and the 99th percentile is 25 mg/L. While exceeding the simple 10 mg/L threshold recommended by ANZECC/ARMCANZ (2000) these thresholds are consistent with the literature and the experimental evidence which has shown that abalone are substantially more resilient to elevated suspended sediment loads than other aquaculture species. Furthermore, these values are consistent with the ambient water quality data for Yumbah's Narrawong farm in Victoria where the 99th percentile value is estimated at 22 mg/L (Table 11-2).

These results (Table 11-2) also demonstrate that under summer dredging scenarios (when waters would be warmer) maximum TSS loads are not expected to approach the 25 mg/L threshold with the 99th percentile values of 11.5 and 7.7 mg/L under the expected and worst case scenarios respectively. As such, no estimates of any potential synergistic effects of increased water temperature and elevated suspended sediments were deemed neccessary.

Impact of dredging on water quality

The impact of dredging on water quality is largely a function of the size of the dredging program, the type of dredging equipment used, the rate at which dredging occurs, and the type of sediment being dredged (Erftemeijer & Lewis 2006).

The potential impact of dredging on suspended sediment loads in Smith Bay was modelled to determine the likely impact of dredging on water quality at the seawater intakes for the Yumbah abalone farm. The modelling was used to analyse an ensemble of different dredging scenarios (WBM BMT 2018a). From the ensemble the **Expected** (i.e. average) and **Worst** (i.e. upper bound) levels of the dredge plume were assessed on the basis that the:

- **Expected case** was developed such that a given percentile comprised the mean level across all simulations. Given the distinct seasonality of the model predictions, summer and winter averages were assessed separately and the maximum level across both seasons was derived as the 'expected' case.
- **Worst case** was developed such that for a given percentile, the maximum concentration of all ensemble simulations was taken as the 'worst' level at a given location.

Suspended sediment loads generated through dredging (which included suspended sediments derived from tailwater discharges) were modelled across the entirety of Smith Bay. These predictions were then used in conjunction with data on ambient suspended sediment loads to predict total loads at the Yumbah seawater intakes (including the disused intake associated with licence FT000634).

Suspended sediment loads were modelled over four time periods comprising the summer and winter seasons of both 2015 and 2016 respectively. These summer and winter periods were chosen to illustrate seasonal differences in the dredging program as well as the likely scale of inter-annual variability from one year to another. In assessing these results from the perspective of the likely impact on water quality at the Yumbah seawater intakes (see below), the worst case for each of the summer and winter periods has been used. Essentially this comprises a worst-case analysis of both the expected and the worst-case assessments presented in WBM BMT (2018a).

In all cases the results have been compared to:

- the ambient suspended sediment loads at Smith Bay based on the 12-month ambient water quality monitoring program conducted by WBM BMT (2018b) taking account of differences between surface and bottom (one metre from seabed) values
- the water quality data for the Yumbah Narrawong abalone farm (Yumbah 2018) which comprise data collected over a 17-year period.

These datasets bracket the range of conditions across which abalone are known to thrive with Yumbah (2018) describing the water quality conditions at the Narrawong location as being 'perfect' for the aquaculture production of abalone.

The results from the modelling of suspended and ambient sediment loads demonstrate that, even in the absence of a dredge management plan that could act to stop dredging during higher risk periods, the predicted sediment loads at the Yumbah seawater intakes are generally well below the 10 mg/L threshold ANZECC/ARMCANZ (2000) and almost always below the 25 mg/L threshold that has been determined for aquacultured abalone (Table 11-2).

In only one case (winter dredging for the worst-case assessment) does any predicted value at Smith Bay exceed the ambient water quality conditions that have been observed at the Yumbah Narrawong farm in Victoria. In that case the exceedance is at the 50th percentile value (3.5 mg/L vs 3.3 mg/L). Such an exceedance is trivial in this context as it does not come close to the 10 mg/L ANZECC/ARMCANZ (2000) water quality guideline for the general protection of waters for aquaculture and as such would not have an adverse impact on abalone.

For most dredging scenarios the 99th percentile values exceed the 10 mg/L threshold ANZECC/ARMCANZ (2000) but none of these values exceeds either the 22 mg/L value seen for Yumbah Narrawong (Yumbah 2018), nor do they exceed the 25 mg/L NOEC value determined for greenlip abalone (Appendix H1, Stringer 2018a).

In only a single instance (winter dredging for the worst-case ensemble) does the maximum value (26.7 mg/L) exceed the 25 mg/L threshold value and even then, this value is below the maximum value observed for Yumbah Narrawong (maximum value of 37 mg/L).

The time of year during which dredging operations are conducted has a substantial influence on suspended sediment loads with summer values being substantially lower than the winter values (Table 11-2; typically between half and two thirds the levels). These summer / winter differences are due to an overall shift in water movement patterns (net westward flow in summer vs net eastward flow in winter) which changes the degree of connectivity between the dredge and the seawater intakes for the abalone farm (WBM BMT 2018a). Ambient suspended sediment loads are also lower in summer because there are fewer storm events that cause sediment resuspension (WBM BMT 2018a).

On the basis of these predictions and assuming that the capital dredging program is managed in such a way as to ensure that higher excursions in suspended sediments (e.g. above 25 mg/L) do not occur (other than through storm induced fluctuations in ambient levels which are not a function of dredging), it is highly improbable that the dredging program

TABLE 11-2 COMPARISON OF SUSPENDED SEDIMENT LOADS UNDER VARIOUS DREDGE SCENARIOS

Percentile	Smith Bay ambient single year	All intakes at bottom				Narrawong ambient 17-year average‡
		Expected case		Worst case		
		Summer	Winter	Summer	Winter	
50th	1	1.5	2.9	1.5	3.5	3.3
90th	3.7	4.4	6.2	4	8	9.4
99th	6.3	11.5	15.6	7.7	16.7	22†
Max	16.3	14.4	18.7	16.7	26.7	37

‡ Data from Yumbah (2018, Table 19).

† Narrawong data is 13.8 for the 95th percentile and this has been interpolated to 22 for the 99th percentile based on a log normal fit to the data (see Figure 11-3).

Note: Light green shaded cells indicate values that exceed the 10 mg/L ANZECC/ARMCANZ (2000) water quality guideline for the protection of aquaculture. Green shaded cells indicate water quality values that exceed the 25 mg/L NOEC for abalone (Cheshire 2018; Stringer 2018). Orange shaded cell is the only value where the predicted suspended sediment loads from any Smith Bay dredge scenario exceed the ambient value for Yumbah Narrawong.

would have adverse effects on water quality that would affect the aquaculture production of abalone.

Hydrodynamic modelling of siltation rates has shown that:

- smothering effects are only likely to occur within a very close proximity (i.e. 100 metres) to the dredging operations in Smith Bay (see Appendix F2)
- assuming the implementation of an appropriate dredge management program, there is no potential for smothering of abalone within the abalone farm due to the proposed dredging.

Impact of tailwater discharge on water quality

The tailwater discharge occurs in tandem with the capital dredging program and therefore the analysis of the impact of dredging on water quality at the abalone seawater intakes has accounted for the additional material that is mobilised from sediments in the tailwater discharged to the sea. There is, therefore, no additional input from this source as the potential for impact has been addressed in the analysis of the capital dredging program.

Impact of causeway construction on water quality

Causeway construction will begin after the dredging program has been substantially completed and, consequently, the effects of the dredging program and causeway construction on water quality will occur sequentially, and not concurrently.

Modelling results indicate that the 50th and 95th percentiles of depth-averaged total suspended solids (TSS) at the Yumbah intakes associated with causeway construction are not likely to exceed 0.5 and 1.0 mg/L respectively. Furthermore, these levels would only occur under worst case conditions if the core materials of the causeway were to be exposed to wave erosion during a storm event. Under normal operating conditions, the material would be stabilised with geotextile coverings and rock armour. Irrespective, these levels, even when added to ambient values, are still well below the tolerance levels reported for abalone and would not be expected to have any adverse effects on water quality that would affect the production of abalone.

Impact of shipping operations and propeller wash on water quality

Sediments are likely to be resuspended during shipping operations due to the action of displacement waves and propeller wash, which may be exacerbated by the accumulation of sediments in the dredged basin. These impacts, however, are typically highly localised in both time (during ship operations) and space (along the shipping approach) and would not reflect the sort of resuspension that would typically occur during storm events (see Appendix F2).

Hydrodynamic modelling of sediment concentrations at the abalone farm seawater intakes resulting from shipping operations (see Appendix F2) shows:

- that neither the median nor the 95th percentile maps show any plume that is above the minimum scale limit (0.2 and 1.0 mg/L respectively). This is because the sediment plume occurs over such a short duration that it is not observable for these percentiles
- the maximum concentration observed in any scenario shows that local plumes in the berth area are about 10 mg/L and that no plumes extend to the Yumbah intakes.

Therefore, marine vessel operations would not be expected to have any sediment-related adverse effects on water quality that would affect the production of abalone.

Impact of maintenance dredging on water quality

The need for future maintenance dredging to maintain channel depths is likely to be minimal and infrequent (see Appendices F2 and F3). The analysis of seabed sheer stress indicated that even with the causeway and floating wharf in place, benthic sheer stresses are still above 0.5 Pa and, as such, silt deposition in access channels is not likely.

Furthermore, maintenance dredging, if it were to be required, would likely be conducted using infrastructure and management arrangements similar to the initial dredging program and would need to comply with regulatory requirements and any license/permit condition set for the activity. The impact of a maintenance dredging program on water quality is likely to be similar to the initial program but would be of much shorter duration due to the substantially reduced dredge volumes. Consequently, given the findings from the assessment of the capital dredging program, any subsequent maintenance dredging would not be expected to have any adverse effects on water quality that would affect the production of abalone.

Impact of elevated turbidity for algal production

Elevated suspended sediment loads in seawater taken into the abalone farm have the potential to reduce the light transparency of the water and, as a consequence, affect the amount and quality of light available to algae (a food source [see Section 11.4.1]) grown on the nursery sheets used to feed juvenile abalone. Such changes resulting from the proposed KI Seaport development, however, are not of sufficient magnitude to cause a material change in algal productivity in shallow aquaculture systems.

Using the ambient attenuation in Smith Bay of 0.29/metre (Appendix F3) and comparing this to the predicted 50th and 95th percentiles for Smith Bay attenuation under dredging (0.32 and 0.39/metre respectively), it is possible to assess the impact this would have on photosynthetic production of algae in the nursery tanks. Using well established models for photosynthetic production in response to light intensity (Appendix H1), the estimated effect on net 24-hour algal photosynthesis (i.e. the net production over any 24-hour period taking account of both photosynthesis and dark respiration) is a reduction of 1.5 per cent and 4.9 per cent, respectively. Importantly this calculation takes no account of the fact that algae can adapt very quickly (typically in time periods of 24–72 hour) to changes in both the quality and quantity of light available to support photosynthesis through quantitative adjustments and physical reorganisation of the light harvesting pigments (see Appendix H1).

Suspended sediments, at the levels anticipated, would not have a material effect on the photosynthetic production of algae grown in the Yumbah abalone farm. Similarly, there is no evidence that increases in turbidity of the magnitude anticipated will have any material effect on micro-algal and specifically diatom production within Smith Bay itself (see Appendix H1).

Impact of elevated sediment loads on farm infrastructure

Elevated suspended sediment loads in seawater taken into the farm have the potential to increase the rate at which filtration systems are loaded and thereby require more frequent back-flushing.

It is probable that the Yumbah farm uses rapid sand filters to filter the seawater used in the nursery section of the farm. Sand filters are designed to handle influent flows with elevated levels of particulate material (both organic and inorganic). Influent water is run, under pressure, through a filter bed that removes particulates. Modern filters have in-built pressure sensors on the in-flow and out-flow in order to measure the pressure differential which then automatically switches individual filter units into backflush mode to clean the filter. As such these systems are designed to be low maintenance. Changes in input sediment loads would be likely to cause more frequent back-flushing, but this is unlikely to materially impact on the operating efficiency of such systems.

Assuming that Yumbah uses appropriately configured filtration systems, it is unlikely there would be any impact on the operation of such systems and hence mitigation would not be required.

Suspended sediments may also deposit on raceways; most farms manage this through the use of tippers that flush the raceway at regular intervals. Tippers are also used to remove uneaten food and faeces from raceways so provide a multiplicity of benefits to the farming operation.

Most of the additional sediments that come from dredging will comprise the finer fractions (<63 μm) that will not deposit on raceways but rather will remain in suspension and flow out of the farm along with the effluent water. As such this would not impact on the efficiency of existing solid waste handling systems within the farm.

Given that the sediment loads at Smith Bay, even with additional loads from dredging, will be below the ambient levels experienced on other Yumbah farms, it is reasonable to infer that the existing infrastructure (filters and tippers) will adequately deal with these materials with no adverse effects on the farming operation.

Management and mitigation of impacts from suspended sediments

The results from the extensive in situ data collection program, coupled with the analysis provided through the hydrodynamic modelling, indicate that the suspended sediment loads, generated during the capital dredging program and causeway construction would increase the TSS loads at the Yumbah seawater intakes.

The analysis has provided quantitative estimates of how suspended sediment loads would differ between seasons (summer vs winter), across tidal cycles (neap vs spring tides) and in response to weather events (e.g. during westerly winds). Given that these can be predicted in advance (acknowledging that weather can be more variable than forecast) this would allow the development of a dredge management program (that takes account of the potential differences in risk under the varying seasonal, tidal and weather conditions) and thereby allows KIPT to manage the risk of adverse impacts on water quality at the Yumbah seawater intakes.

This dredge management plan should include the use of an in situ, real-time, turbidity monitoring system, at an appropriate location between the dredging operations and the Yumbah intakes, which would strengthen management controls and allow timely management interventions (e.g. slowing or ceasing dredge operations) should the suspended sediment levels exceed pre-defined criteria. Placement of such a system at an appropriate location between the dredging operations and the Yumbah intakes will highlight potential problems in water quality and thereby allow timely management interventions before any effects reach the nearest Yumbah intakes.

11.5.2 MOBILISATION OF POLLUTANTS AND NUTRIENTS

No evidence was found for the presence of any pollutants or toxicants, or excessive levels of nutrients within the sediments in Smith Bay (see Appendices F1 and F3). Consequently, there is a very low risk that such materials would be mobilised during dredging and this is not expected to have any adverse effects on water quality that would impact on the production of abalone at the Smith Bay farm.

11.5.3 SUSPENSION OF ANOXIC SEDIMENTS

Sediment coring revealed a relatively small area where sediments showed evidence of anoxia (Appendix F1). This area is inshore of the dredge footprint and would not be disturbed by dredging. There is therefore a negligible risk that the oxygen content of the seawater adjacent to the dredging operations would be depleted by suspension of such sediments. As a consequence, it is highly unlikely there would be any adverse effects on water quality that would impact on the production of abalone.

11.5.4 LEACHATE FROM WOODCHIP AND LOGS

Leachate from the storage and handling of woodchips and logs is likely to contain tannins, phenols and high biochemical oxygen demand (BOD) and chemical oxygen demand (COD). Direct release into the marine environment would cause localised impacts on water quality.

Stormwater diversion channels, compacting proposed storage areas, construction of first-flush ponds and the use of closed conveyors and telescopic shiploaders, would reduce the potential impacts to negligible at the farm intake area.

11.5.5 DUST DEPOSITION

Source of airborne dust

An additional source of sediments that could affect water quality within the Yumbah farm is dust generated by on-shore activities that is subsequently deposited onto farm infrastructure and potentially into the seawater flowing through the farm. The dust is likely to include silica generated by construction activity on land, and wood dust released during loading of woodchips onto ships.

Wind-blown dust is currently deposited onto the shadecloth which covers the existing raceway and nursery tank systems. Some of this dust is subsequently blown away. However, particularly during rain events, some of this dust inevitably passes through the shadecloth onto the raceways and into the nursery tanks. While much of the additional dust from the proposed development, particularly the fine wood dust, would float on the surface of the water and flow out of the farm, it is possible that some of the dust would become mixed with the seawater flowing down the raceways and thereby increase the total suspended sediment loads experienced by abalone or act as a source of leachates which may have a toxic effect on farmed animals.

Impact of airborne dust deposition

Dust modelling has shown that dust generated from the construction and operation of the KI Seaport would result in an additional deposition of about 0.4 g/m^2/month onto the Yumbah farm (at its closest point). This deposition would be in addition to the background deposition rate of 2 g/m^2/month, which would result in total deposition rates of 2.4 g/m^2/month (Appendix M1).

While some of this would be blown away it is conservative to assume that all of this dust will mix with water flowing through the raceways. Under such circumstances this would result an increase in TSS of around 0.03 mg/L (assuming that the dust that is deposited were to filter through the shadecloth on a more or less continuous basis). Such an increase would have no effect on the health of abalone at any stage of their life-cycle as it is close to 1000 times lower than the reported tolerance of any abalone species (25 mg/L) and more than 300 times below the ANZECC/ARMCANZ (2000) water quality guideline value for aquaculture protection of 10 mg/L.

A worst-case scenario, however, would occur if all of the dust accumulated on the shadecloth and was then washed into the farm in a single pulse during rain events; the longer the gap between rainfall events, the more intense would be the pulse of dust. The potential impact under this scenario was calculated using local rainfall records between 1980 and 2017 (Appendix H1). The analysis showed:

- for the 90th percentile case, the suspended sediment load was 1.27 mg/L
- for the 99th percentile case, the suspended sediment load was 8.02 mg/L
- in either case the additional dust associated with the KI Seaport represented a 25 per cent increase over the background deposition rates (which, under this more conservative scenario, would have been 1.02 and 6.42 mg/L respectively; see Appendix H1).

Of the total dust coming from the KI Seaport construction and operations, 54 per cent is likely to be wood dust (Winterburn 2017) with the balance being inorganic (silica based) material. To address the potential risk that wood dust may be toxic to abalone, Stringer (2018c) (Appendix H2) undertook an ecotoxicology test and concluded that the NOEC value for fine hardwood dust derived from *Eucalyptus globulus*, the main forestry species on KI, was 35 mg/L which with a ten times safety factor was converted to a NOEC value of 3.5 mg/L to account for both chronic and acute impacts.

The worst-case scenario (as above) would result in a wood dust input of 0.14 and 0.87 mg/L (90th and 99th percentiles respectively). These values are well below the conservative NOEC value of 3.5 mg/L. Importantly, Stringer (2018c) noted during the ecotoxicology experiment that the wood dust took around two hours to become water logged and then actually move into suspension. Prior to that the material floated on the surface and did not mix with the water. Noting that the typical transit time for water on an abalone raceway is in the order of 20 minutes it is very unlikely that any dust will actually go into suspension and thus the level of protection is arguably much higher than that suggested by the ecotoxicology study alone.

It should be noted that these are very conservative estimates because it is extremely unlikely that all the dust falling on the shadecloth would remain in place between rainfall events. The scenario of dust passing relatively continuously through the shadecloth is more likely.

It is concluded that the small increase in the rate of dust deposition on the Yumbah facility as a result of the proposed development would have only a very marginal effect on water quality within the farm and would have no effect on the health of abalone. Furthermore, the farm has experienced the background levels of dust deposition over many years, without evidence of any adverse impacts, indicating that there is unlikely to be any real risk from this source and dust deposition would not be expected to have any adverse effects on water quality that would affect the production of abalone.

Management and mitigation measures for airborne dust

A variety of operational management strategies could be employed to limit dust generation, including the cessation of dust generating activities (both during construction and subsequent operations) when there are strong westerly winds. Similarly, standard dust guards could be engineered around chip conveyors, loaders etc. Dust suppression systems, including water damping, could be used to minimise dust mobilisation particularly around roads and access tracks.

Physical screening could also be used (e.g. shade mesh fences) and strategic vegetation buffers could be established which would likely reduce dust suspension (at least from passive wind-blown sources) and would similarly assist with extraneous light transmission (see below).

11.5.6 EXTRANEOUS LIGHT

Sources of extraneous light

Light generated by night-time operations of vehicles and lighting infrastructure, erected along the causeway and around the hard-standing area, are all potential sources of light spill that may affect the abalone farm. It should be noted that the abalone farm currently uses a number of large, bright lights around the farm presumably to improve night time security.

Abalone tolerance and vulnerability to impacts from extraneous light

There is very little published about the effect of light on abalone, but the following results have been reported:

- no measurable effect of light vs dark conditions on the oxygen consumption rates (used as a direct index of stress) for early life stages of *H. rubra* and *H. laevigata* hybrids (Alter et al. 2016)
- conversely, when *Haliotis discus discus, H. gigantea, H. madaka* and their hybrids were kept in the dark they showed lower rates of oxygen consumption and ammonia excretion rates relative to those kept under light (suggesting that animals kept in the dark had reduced metabolic rates compared to those exposed to light) (Ahmed et al. 2008) which would have negatively affected the growth rates of animals kept in the dark
- abalone kept permanently in the dark did not grow as well as those exposed to light (Periera et al. 2007).

In all cases, these experiments suggest that light, per se, does not have a negative effect on abalone, and may in fact benefit their growth.

Impact of extraneous light

No formal assessment of light impacts has been undertaken because there are relatively few sources of extraneous light from the proposed operation, and because all of these sources can be managed to avoid any potential impact.

Management and mitigation measures for extraneous light

The potential light impacts from wharf operations can be mitigated with standard light baffles and strategically placed screening vegetation to minimise light spill on the abalone farm.

11.5.7 NOISE AND VIBRATION

Sources of noise and vibration

Vehicle movements and the use of on-site machinery are all potential sources of noise and vibration.

Abalone tolerance and vulnerability to impacts from extraneous noise and vibration

The impact of noise and vibration on abalone is not well understood with no research papers tackling the issue. It is notable that the subtidal marine environment where abalone live is a naturally noisy environment (Fisher-Pool et al. 2016). The wave-induced movement of rocks and boulders creates a constant environment of bangs and rumbles along with the sound of marine creatures interacting with the environment (clicking and cracking of shells and pincers etc. see e.g. Fisher-Pool et al. 2016).

Impact of noise and vibration

Henrys (2018) predicts that noise levels associated with on-land operations of the KI Seaport would be in the order of 40–50 dB on the Yumbah Kangaroo Island farm. Noise levels would dissipate with increasing distance from the KI Seaport facility. While these levels meet with guideline values, they can also be compared to the likely noise levels on a typical abalone farm. Yumbah (2018) include an extensive report that models the noise levels on and around their proposed new farm near Portland in Victoria (Yumbah Nyamat). Those data are informative as they relate directly to the expected noise levels on their proposed farm and provide a good indication of acceptable noise levels from the context of an abalone aquaculture facility.

The measured background (i.e. pre-existing) noise levels predicted for Yumbah Nyamat are broadly equivalent (although slightly higher) than those at Smith Bay (Yumbah 2018). The measured noise levels (sound power levels) of noise-generating equipment within the buildings at Yumbah Nyamat would be significant, varying between 70–110 dB (noting that noise levels of greater than 80 dB require hearing protection). Such equipment is however generally housed in besser-block style buildings separate from the abalone raceways and this would provide significant attenuation. The associated modelling predictions (Yumbah 2018) assume there would be a significant attenuation of noise through the separate building facade, such that noise external to the building (at the nearest receivers) would meet relevant criteria. This would be consistent with the baseline noise measurements from Smith Bay, which don't show a significant impact from the Yumbah KI farming operations.

The noise contours for Yumbah Nyamat (Yumbah 2018) show that noise levels around the abalone raceways are in the order of 40–45 dB generally and up to 50 dB at the raceways nearest to the pump-set buildings and along and between-tank pipelines. These levels are consistent with those predicted for the Kangaroo Island farm (Henrys 2018) with peak levels of up to 50 dB at the point closest to the KI Seaport facility and decreasing with distance (35–45 dB). In practice, taking account of dampening from built infrastructure, KIPT-related noise within the Yumbah farm would be expected to be reduced from the modelled peak of 50 dB and are likely to be inaudible against the background of their own noise-generation (given that noise levels need to be 3dB higher to be detectable).

Irrespective, the data from Yumbah Nyamat demonstrate that design values of 50 dB for noise levels is acceptable for an abalone farming operation (Yumbah 2018).

Management and mitigation measures for noise and vibration

It is highly unlikely that noise and vibration would affect the abalone farm and therefore no specific mitigation strategies have been recommended, although the use of screening vegetation (to minimise light and dust impacts) would likely help minimise the transmission of noise (see Appendix N1).

11.5.8 SEAWATER TEMPERATURE

Causes of elevated seawater temperatures

Hydrodynamic modelling has shown that there is potential for a very small increase (less than 0.1ºC) in water temperature around the Yumbah intakes during summer (Appendix G1; see also Figure 11-4). This increase is caused by the propensity for water to pool in the lee of the proposed causeway under some tidal conditions.

Abalone tolerance and vulnerability to elevated seawater temperature

Greenlip abalone have a modest tolerance to variations in water temperature, with a preference for water around 18ºC, but are viable over the range from 14–23ºC. Once the temperature exceeds 25ºC, and certainly when it reaches 27ºC, animal mortality on farms increases substantially.

It is notable that Vandepeer (2006) reports that many abalone farms experience problems when temperatures exceed 21ºC (a relatively frequent occurrence at Smith Bay during summer), which highlights the very real risks for the Yumbah operation under normal summer operating conditions.

The major drivers of increases in water temperature are prolonged periods of high air temperatures (typically days over 35ºC), coupled with low levels of tidal movement (neap or dodge tides). The problem is exacerbated by the water flowing through the farm absorbing heat as it passes through pumps, pipes and raceways, which results in further temperature increases of the order of one to two degrees above ambient. At Smith Bay, the problem is likely to be further exacerbated by the location of the intakes close to shore (generally 200–220 metres) in relatively shallow water (around six metres), where the seawater would tend to heat up more during heatwaves than in deeper water.

The more extended and frequent heat waves associated with climate change therefore pose a threat to the viability of the abalone industry in South Australia over the coming decades (Doubleday et al. 2013). A recent Climate Council publication demonstrates that Adelaide has already experienced (over the period 2000–09) a 30 per cent increase in heatwave days (Steffen et al. 2014). Indeed, the data show that the number of heatwave days (when measured against the period 1950–80) has almost doubled (from five to nine) and the longest heatwave event has increased from four to six days, with the peak heatwave days being 4.3ºC hotter. These changes foreshadow serious consequences for the abalone aquaculture industry over coming years.

Potential increases in the ambient seawater temperatures in Smith Bay associated with interrupted tidal flows caused by the proposed causeway in Smith Bay have been investigated using hydrodynamic modelling (see Chapter 10 – Coastal Processes). The modelling shows:

- small changes in temperature of coastal waters including an increase of up to 0.2ºC (depth averaged) inshore of the Yumbah intakes (see Figure 11-4)
- actual changes at the intakes are predicted to be less than 0.1ºC.

Even given the vulnerability of South Australian coastal abalone operations to summer temperatures, such an impact is unlikely to be measurable against the natural variation in water temperature or the background rate of warming that

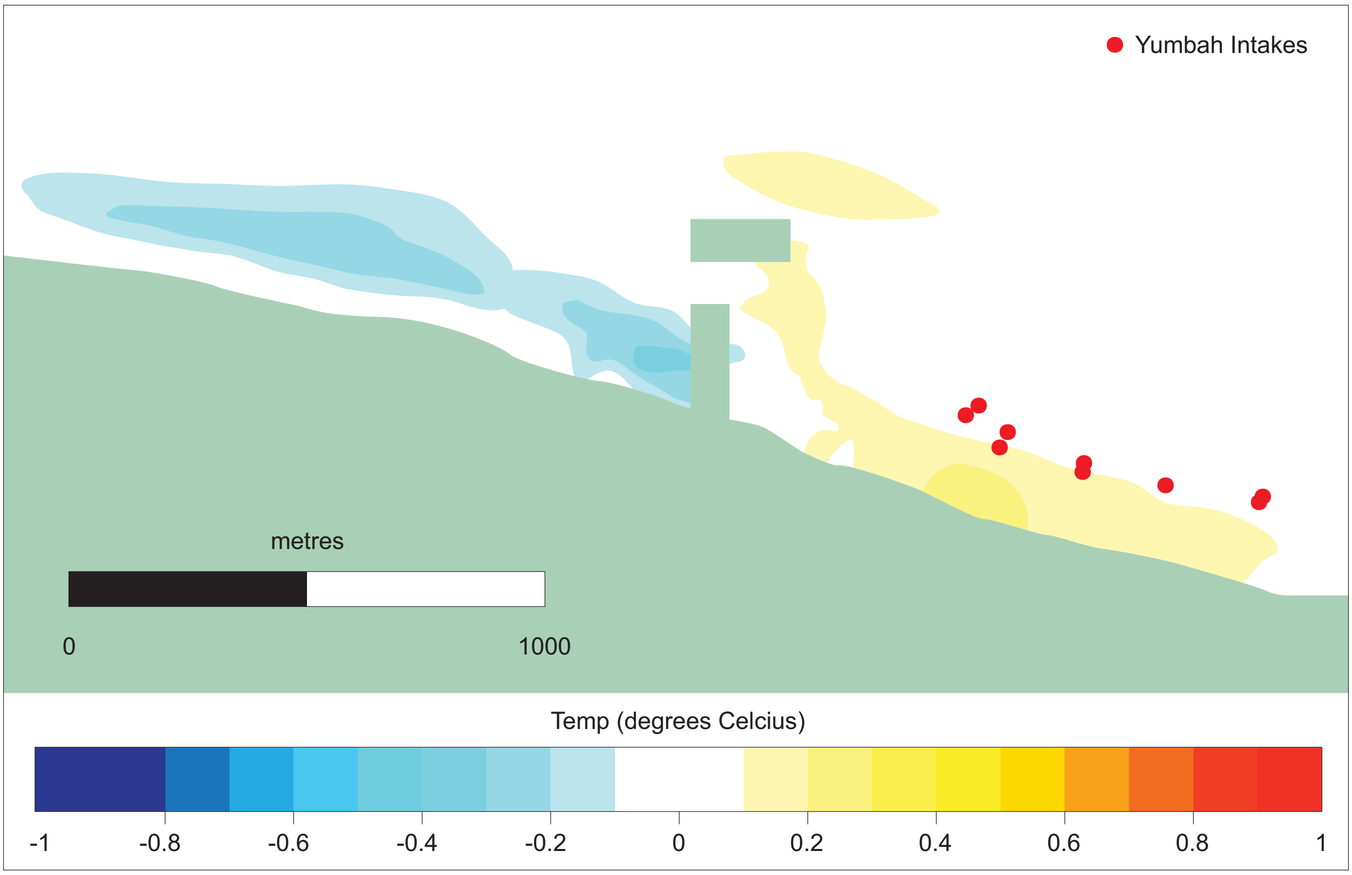


FIGURE 11-4 PREDICTED MAXIMAL DEPTH AVERAGED TEMPERATURE CHANGES ASSOCIATED WITH THE CAUSEWAY DEVELOPMENT*

* Adapted from Figure 6-13 in Appendix F2.

Note: Changes around the Yumbah intakes are predicted to be less than 0.1ºC.

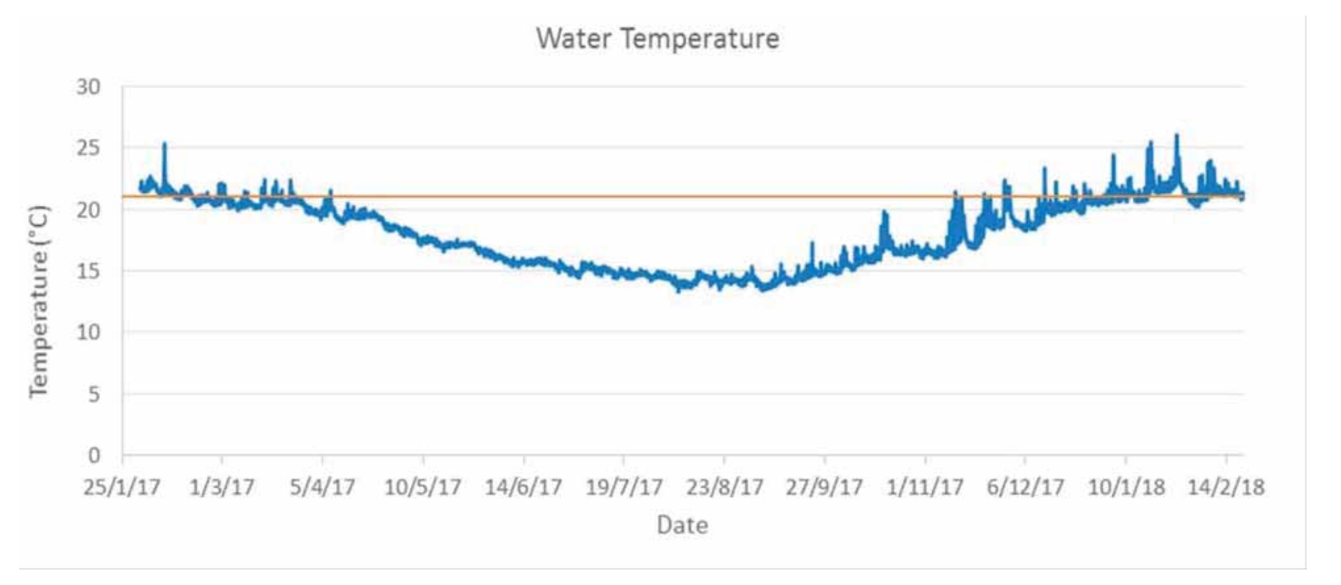


FIGURE 11-5 PLOT OF SURFACE WATER TEMPERATURE FOR SMITH BAY AS RECORDED VIA THE MONITORING BUOY*

* After Figure 2-18 in Appendix F3.

Note: The orange line represents the 21ºC critical temperature and highlights the existing risks to the Smith Bay operation from elevated temperatures over the summer period (particularly December through to April).

has been experienced. It is inevitable that farm operators will need to implement a variety of technologies (including breeding programs and management of water supply) to address the exposure to the climate change risk that has already begun to manifest.

Management and mitigation measures for elevated seawater temperatures

If considered necessary, an open bypass system could be installed in the near-shore section of the causeway to minimise the interruption to tidal currents. This could comprise either large culverts or a pier, the size of which would be determined by hydrodynamic modelling. Given the small predicted maximum increase such a measure is not considered essential and it needs to be recognised that the benefit of such a bypass system may be offset by compromising the protective barrier formed by the causeway in relation to effluent from the degraded Smith Creek during rainfall events.

It may be possible to engineer a gated culvert through the causeway that could fulfil a dual function by allowing through-flows during summer (thereby managing the risk of temperature increases) the gate could then be closed during other months and thereby facilitate the redirection of Smith Creek discharges further offshore during major flow events (particularly during autumn and winter) thus improving nearshore water quality.

11.5.9 RED TIDES

Sources of impacts from red tides

Red-tide algae are generally introduced via the disposal of ballast water with the result that most introductions around the world have occurred in ports and harbours.

Given the implementation of appropriate ballast water management strategies there should be a low risk of introductions of red tide algae.

Assessment of likely impacts from red tides

Red tides are caused by blooms of harmful microalgae commonly called dinoflagellates. South Australia has had a long history of red-tides in the Port River (Cannon 1990; Cannon 1993). They are generally associated with sheltered embayments with high levels of nutrient pollution. Red-tides can cause fish-kills due to de-oxygenation of the water body, and also present risks to humans from consuming shellfish (particularly oysters) that have been feeding on red-tide algae, which has the potential to cause paralytic shellfish poisoning.

The risk of red tides at Smith Bay is considered to be negligible because the conditions that would promote red tides (high nutrient levels and still waters) are unlikely to occur in Smith Bay. The hydrodynamic modelling has shown the effect of the causeway on tidal flows would be minimal (see Chapter 10 – Coastal Processes). Furthermore, the exchange of ballast water will be strictly controlled.

Management and mitigation measures for red tides

The risk of red tide algal blooms would be managed through the implementation of appropriate ballast water management systems (see Chapter 15 – Biosecurity and Appendix I5).

11.5.10 OFFSETS

The location of the causeway to the east of Smith Creek is likely to mitigate the potentially adverse effects that silt-laden discharges from Smith Creek may have on water quality at the abalone farm seawater intakes, during rainfall events.

Hydrodynamic modelling of stormflows from Smith Creek demonstrates that, during ebb tides:

- creek discharges currently flow almost directly past the Yumbah seawater intakes and typically result in suspended sediment loads of 5–10 mg/L above the ambient conditions
- a solid causeway would direct discharges several hundred metres out to sea before being entrained by tidal currents, providing a reduction of up to 50 per cent (2–4 mg/L) in the average concentration of creek water reaching the Yumbah intakes (see Chapter 10 – Coastal Processes).

While these levels of suspended sediment are not likely to be problematical (in and of themselves), they are indicative of the loads of other materials that might be entrained in the runoff including, for example, agricultural chemicals, pathogenic bacteria, nutrients and other terrigenous toxicants. By diverting the bulk of this water offshore, and away from the Yumbah intakes, the potential for this land-based runoff to have an adverse impact on the farming system is substantially lessened.

It should be noted that should there be a requirement to install pass-through sections in the causeway, this could negate the benefit of directing the Smith Creek discharge offshore. The use of a gated culvert could be investigated (see above). Failing this there would be a trade-off between realising the benefit of redirecting the creek discharges against the potential for a very small increase in temperature of the influent water (acknowledging that the abalone industry will face major future problems with seawater temperature rises and already have a need to implement technologies to protect themselves from this risk; Doubleday et al. 2013).

11.6 CONCLUSION

The information and analysis presented in this review has provided evidence that abalone have a robust capacity to deal with suspended sediments in the water column. In particular, the results indicate that it is highly unlikely that the Yumbah land-based abalone farm would be impacted by this development if an appropriate dredge management plan is developed to manage the risk from periods when suspended sediment levels exceed water quality criteria (Table 11-2). A summary risk assessment is provided in Appendix H1.

Analysis of the literature leads to the conclusion that abalone are more resilient to suspended sediments than other aquaculture species having adapted to environments that routinely see them exposed to elevated levels of suspended sediments. Any dredge management plan should aim to ensure that suspended sediment loads (99th percentile) do not exceed 25 mg/L with median levels not exceeding 10 mg/L. A key element of the dredge management plan would be pro-active prediction of suspended sediment loads using tidal and weather data and the incorporation of real time monitoring of in situ turbidity, at an appropriate location, between the dredging and construction activities and the Yumbah seawater intakes, with turbidity thresholds to trigger appropriate management interventions.

The analysis has also illustrated the vulnerability of abalone aquaculture facilities in southern Australia to climate change and particularly to increasing sea water temperatures, coupled with ocean acidification, that is now occurring. In this context, the predicted changes in water flow on the leeward side of the causeway may result in a very slight (maximum effect less than 0.1°C) increases in water temperature in the vicinity of the seawater intakes. This increase is unlikely to be detectable particularly against the existing background of climate change induced changes to seawater temperature (and associated acidification) however, mitigation strategies (e.g. culverts through the causeway) are available should this be deemed necessary.

The analysis further highlighted the potential impact of discharges from Smith Creek on coastal water quality. A solid causeway (with a gated culvert) would provide ancillary benefits to the aquaculture farm by directing flows from Smith Creek further offshore and thereby reducing the extent to which discharges from Smith Creek mix with the intake water flowing onto the abalone farm.

12. MARINE ECOLOGY

Guideline		Comment
2.1	Provide baseline information on, and undertake a comprehensive risk analysis that identifies, the key ecological assets of the site (including, but not limited to, any communities and species of conservation significance, migratory species, seagrasses, macro algae and other reef habitat).	See Sections 12.4.1, 12.4.2, 12.4.3, 12.5.5 and Appendix I1
2.2	Identify how the major aspects of construction and operation might impact upon the identified ecological assets (as identified from 2.1 above). Outline mitigation strategies associated with the process and identify any residual risks that will need to be managed.	See Chapter 14, Section 12.5, Appendices I2, I4 and I5
2.3	Describe the impacts of the port and wharf construction (including causeway, associated berthing pocket, rock wall, retaining structures and mooring dolphins) on the foreshore, intertidal, seabed and benthic communities (especially any nursery/spawning areas). Describe measures that will be undertaken to mitigate these impacts.	See Section 12.5, Appendices I4 and I5
2.6	Describe the impacts of drilling or screw piling activities on marine communities, in particular turbidity, disturbance (including of any harmful soil types or contaminants), vibration and underwater noise on vulnerable or sensitive receptors and any mitigating measures that may be used.	See Sections 12.5.4, 12.5.5, 12.5.6, 18.4, Appendices I2, I4 and N
2.7	Describe any dredging activity that will be undertaken during the construction phase. Outline impacts that dredging may have on sediment loads and the neighbouring commercial aquaculture operation. Detail measures for managing these impacts, including management of dredge spoil, noting that all dredging should be undertaken in accordance with the Environment Protection Authority's Dredging and Earthworks Drainage Guideline – June 2010	See Sections 4.4.4, 4.5.2, 9.5.1, 9.5.3, 9.5.4, 9.5.5, 9.6, 11.5.1, 12.5.4, Appendices F2, F3, H1, H2 (Part C) and U1
2.12	Describe the impact of any incidental timber spillage and dust emissions (point source and fugitive) during ship loading operations on the marine environment, in particular on water quality and marine and coastal flora and/or fauna species, including migratory species. Outline the measures that will be taken in the event of a spillage.	See Section 9.5.7, 11.5.4, 11.5.5 and 12.5.10
2.14	Describe the potential impacts of increased shipping traffic and activities in Smith Bay from offshore anchoring, transhipment or pilotage (especially on marine fauna, water quality, recreational activities and amenity), including effects on commercial aquaculture activities in the region.	See Chapter 14, Sections 9.5.6, 9.5.7, 9.5.8, 9.6, 11.5.1, 12.5.2, 12.5.4, Appendices F3 and I2
2.16	Outline measures to protect water quality and the marine environment from shipping activities, especially turbulence during docking and manoeuvring. Include turbidity impacts on any identified shell fish or other filter feeders and on macro algal habitats in the region.	See Sections 9.5.6, 9.5.7, 9.5.8 and 12.5.4

2.19	Identify any possible changes to the seabed, bathymetry, sedimentary profiles (including particle sizes), and sand movement water flow and tidal movement patterns as a result of the development during both the construction and operational phases (include information on potential pooling of water upstream from the proposed causeway). Identify the impacts this may have on sensitive marine flora and fauna (including seagrasses, macro algae and other reef habitat), and commercial aquaculture activities in the region, and outline mitigation strategies.	See Sections 10.5.1, 10.5.2, 10.5.3, 10.5.4, 10.5.5, 10.5.6, 11.5.1, 11.5.2, 11.5.4, 11.5.5, 12.5.4, Appendices G and H1
9.1	Quantify and detail the extent, condition and significance of native vegetation (individual species and communities) that currently exist on site, and within the immediately adjacent sites, including the coastal and marine environment (in particular seagrasses, macro algae and other reef habitat).	See Sections 12.4.1, 12.4.2, 12.5.4 and Appendix I1
9.3	Quantify and detail the extent, condition and significance of native vegetation (individual species and communities) that may need to be cleared or disturbed during construction and the ability of communities or individual species to recover, regenerate or be rehabilitated.	See Section 12.5.4
9.4	Describe measures to deliver any significant environmental benefit that is required by the *Native Vegetation Act 1991*. Identify measures to minimise and mitigate vegetation clearance, including incorporating any remnant stands in the layout design, and to compensate for any loss of native vegetation and habitat.	See Section 12.5.4
9.5	Identify impact avoidance, minimisation and mitigation measures and detail their effectiveness.	See Chapter 15, Sections 12.5.4, 13.5.2, Appendices I4 and I5
9.6	Quantify and detail the extent, condition and significance of native fauna (individual species and communities) that currently exist on site, and within the immediately adjacent sites, including the coastal and marine environment.	See Chapter 14, Sections 12.4.1, 12.4.2, 12.4.3, 13.4.2, Appendices I1, I2, I3, J2 and K2
9.8	Quantify and detail the extent, condition and significance of potential native fauna habitat loss or disturbance during the construction and operation phases (both on and around the site) and the ability of communities and individual species to recover, especially for resident or migratory shore birds and threatened or significant species (including those listed under the EPBC Act and the South Australian *National Parks and Wildlife Act 1972*).	See Chapters 14, 15, 18, Sections 12.1, 12.5, 12.6, 13.5.3, 18.5.5, Appendices I2, I5 and N
9.9	Describe the measures that will be taken to address displaced native fauna (if any).	See Sections 12.5, 13.5.3, 18.5.5, Appendices I2, I5 and N

9.10	Detail the potential impact, including cumulative impacts, on marine fauna, both during construction and operation, including ecologically and economically important species (e.g. fisheries)	See Sections 12.1, 12.5, 12.5.11, 12.6, Appendices I2, I4 and I5
9.11	Detail appropriate buffer distances that would be required between the proposed development and threatened species, including feeding areas, nesting sites and roosting sites.	See Sections 12.5.2, 12.5.3, 12.5.6, 13.5.3, 18.5.5 and Appendix N
9.12	Identify all potential sources of noise emissions, vibration and light pollution from the construction and operation of the proposed development. Describe their impacts on native fauna, including nocturnal species, and how these impacts will be managed.	See Chapter 18, Sections 12.5.6, 13.5.3, 13.6.2 and Appendix N
9.13	Identify impact avoidance, minimisation and mitigation measures and detail their effectiveness.	See Chapter 15, Sections 9.5, 10.5, 11.5, 12.5, 13.5.3, 18.5.5, Appendices I2, I5 and N

12. MARINE ECOLOGY

12.1 INTRODUCTION

The north coast of Kangaroo Island supports a relatively pristine marine ecosystem dominated by both reef and seagrass communities. As such, it also supports a diversity and abundance of marine species, including numerous fish, shellfish and crustacean species of commercial importance, and species of conservation significance. Of particular conservation interest in the region are the southern right whales that migrate along the north coast of Kangaroo Island every winter.

The proposed development of the KI Seaport has the potential to adversely affect some aspects of the marine ecosystem at Smith Bay. The features of the development that are most relevant to the assessment of effects on marine communities are:

- dredging a 9 ha berthing pocket and approaches adjacent to the wharf to a depth of 13.5 metres (see Figure 12-1)
- the construction of a causeway and piered jetty to a floating wharf moored approximately 370 metres offshore at a natural depth of 11 metres at its seaward edge
- international shipping accessing Smith Bay
- additional shipping traffic around the south coast of Australia.

The principal marine ecological issues associated with the proposed development are:

- the direct loss of seagrass and other marine communities as a result of dredging and wharf construction
- indirect effects on seagrass and other marine communities as a result of dredging operations and shipping movements mobilizing sediments, increasing turbidity and causing siltation effects
- potential effects on listed species, and in particular ship collisions with southern right whales
- effects of underwater construction noise on marine fauna, particularly marine mammals
- the potential introduction of marine pests and diseases to Smith Bay.

The aims of this chapter are to:

- describe the marine ecology of Smith Bay
- assess both direct and indirect effects on seagrass and other marine communities resulting from dredging and construction of the causeway and wharf facilities
- assess the potential effects on state and EPBC Act-listed marine species
- recommend practical means of mitigating potential impacts
- provide advice on a significant environmental benefit (SEB) to offset the loss of seagrass.

Risks associated with the potential introduction of marine pests and/or diseases to Smith Bay via shipping, and potential effects of construction noise on marine species, are addressed in Chapter 15 – Biosecurity and Chapter 18 – Noise and Light, respectively. Summaries of the findings are provided in this chapter.

12.2 REGIONAL SETTING

Smith Bay is on the north coast of Kangaroo Island, about 20 km west of Kingscote, between Emu Bay and Cape Cassini. It lies within the Cassini biounit of the Gulf St Vincent bioregion (Edyvane 1999).

The north coast is a relatively moderate- to low-energy environment as it is largely sheltered from the prevailing south-westerly swells in the Southern Ocean (Edyvane 1999). The relatively sheltered conditions along the north coast have supported the development of isolated but extensive seagrass communities in sheltered bays where there is sandy substrate. Reef communities have developed in the areas with rocky substrate.

The marine habitats of the region have been mapped at a scale of 1:100,000 using satellite imagery (DEW 2018a; Edyvane 1999). This shows continuous reef habitat extending about 800 metres offshore, with bare sand further offshore (see Figure 12-2). The maps are, however, of limited use at the scale of the present study, as they do not capture any of the complexity of the mixed reef, sand and seagrass habitats at Smith Bay. Extensive seagrass communities have been

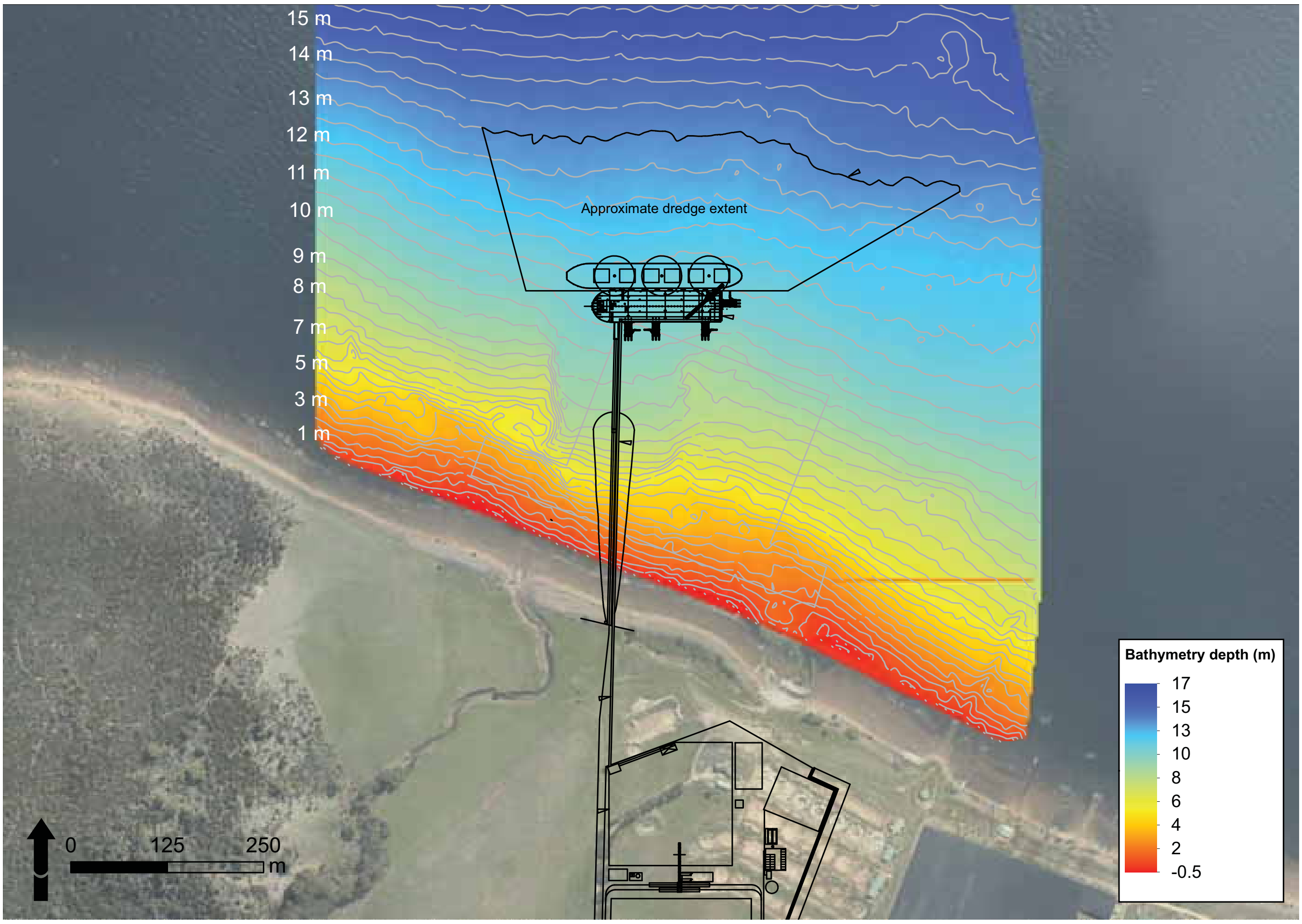


FIGURE 12-1 WHARF LAYOUT SHOWING THE PROPOSED EXTENT OF DREDGING

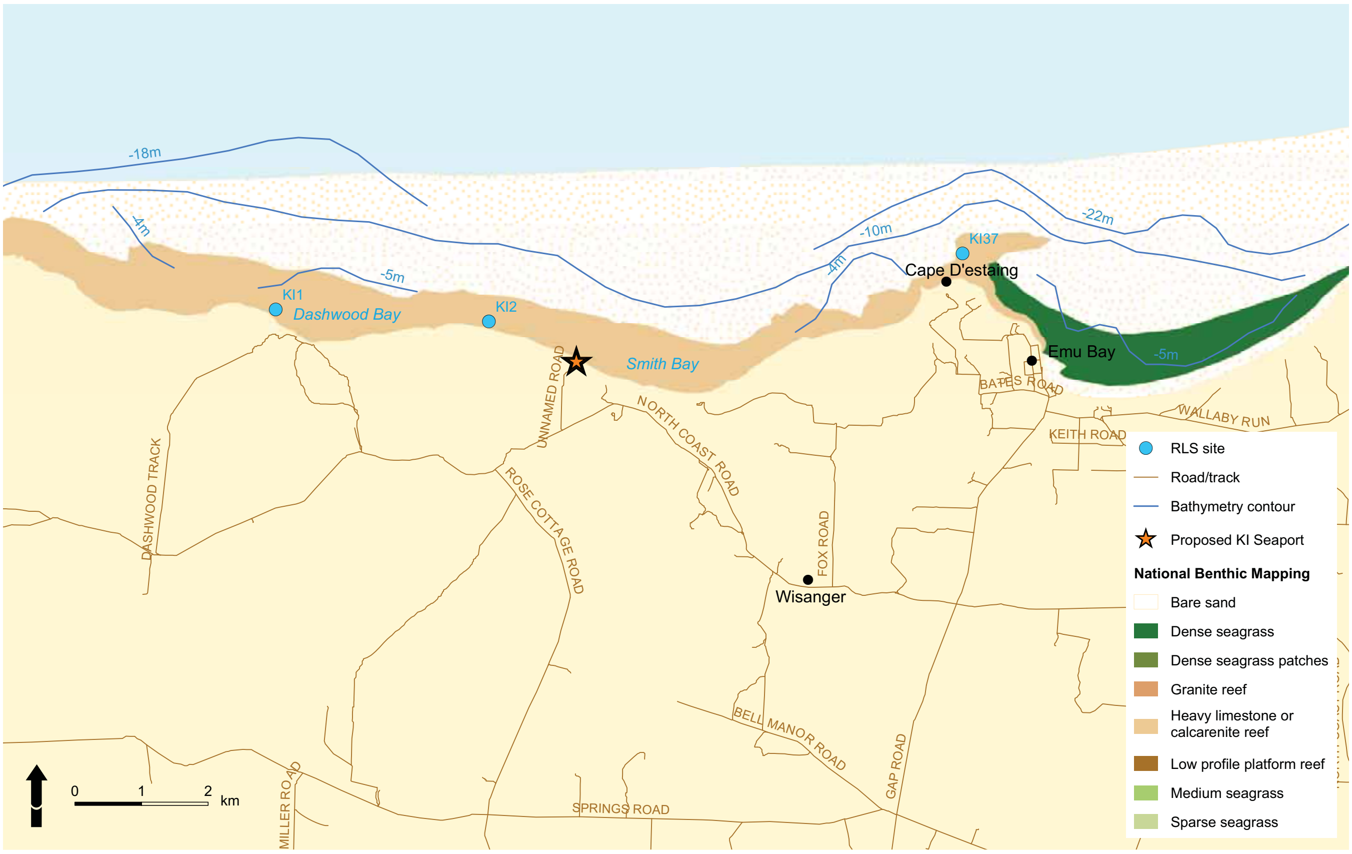


FIGURE 12-2 EXISTING HABITAT MAPPING FOR THE CENTRAL NORTH COAST OF KANGAROO ISLAND.

Source: DEW 2018A and B

mapped at a similar scale in Emu Bay, west of Smith Bay (see Figure 12-2). This shows the depth limit of seagrass in Emu Bay is about five to eight metres. It should be noted that the bathymetry mapping based on navigation charts (DEW 2018b), shown in Figure 12-2, is inaccurate at Smith Bay because the 10-metre contour is actually only 200–250 metres from shore, rather than more than 1 km.

Seagrass communities in South Australia are generally confined to relatively shallow water where there is sufficient light for photosynthesis. The depth limit of the seagrasses *Posidonia* spp. and *Amphibolis* spp. in Spencer Gulf and Gulf St Vincent is reported to be about eight metres (Irving 2014). They are invariably denser and more robust in relatively shallow water, and decline in density in deeper water (greater than eight metres). In clearer water, however, these seagrasses can grow to greater depths (at least 10–12 metres).

Southgate (2005) studied the seagrass cover, diversity and epiphytic load (i.e. the load of small algae growing attached to seagrass) in several bays east of Smith Bay. When excessive amounts of epiphytic algae grows on seagrass leaves (i.e. a high epiphytic load) in response to high nutrient levels, less light is thought to reach the leaves, causing die-off (Shepherd et al. 1989). The seagrass in Emu Bay was found to be healthy, with good cover and relatively little epiphytic load. Seagrass further to the east in Nepean Bay, however, was found to be in poor health and showed signs of high epiphytic load and declining cover linked to high nutrient loads resulting from agricultural runoff (Southgate 2005).

Seagrass communities are generally thought to be a critical component of coastal marine ecosystems for the following reasons:

- they are the primary source of productivity within the detritus-based food chain
- seagrass leaves provide an enormous surface area for colonisation by epiphytic algae and epizoic fauna, which greatly increases the habitat diversity and productivity of the system
- the dense leaf canopy baffles (i.e. deflects or reduces) the action of waves, thereby preventing erosion and the re-suspension of sediments. Suspended sediments tend to be trapped by seagrasses and bound by their fibrous roots, resulting in increased water clarity
- they are considered to support the larval, juvenile and adult life stages of a number of commercially and recreationally important fish species, such as King George whiting (*Sillaginoides punctate*), southern garfish (*Hyporhamphus melanochir*) and Western Australian salmon (*Arripis truttacea*) (Edgar 2001; McDonald & Tanner 2002; Jones et al. 2008).

The fauna associated with seagrass communities on Kangaroo Island were surveyed in Nepean Bay and two other bays further east using beam trawls in summer 2005–06 and winter 2006 (Kinloch et al. 2007). The samples were dominated by small shrimps (decapods), slaters (amphipods), sea lice (isopods) and snails, crabs, syngnathid fish (pipefish and seahorses), weedy whiting, scorpionfish and clingfish, and the odd sea star, polychaete worm and sea cucumber. The study showed that the seagrass meadows support a diverse and abundant range of mobile epifauna (i.e. animals living on the surface of the seabed); 70 species of fish and 87 species of mobile invertebrates were found. It was suggested that the Kangaroo Island seagrass meadows have relatively high species diversity compared with other temperate seagrass ecosystems, possibly due to the confluence of two major oceanic currents: the warm Leeuwin current originating in tropical Western Australia and the cold Flinders current flowing in from Tasmania (Kinloch et al. 2007).

The rocky reef habitat along the north coast of Kangaroo Island supports invertebrate communities that are generally diverse and extensive relative to those in other parts of the state. Reef fish, invertebrate and/or macroalgal communities have been surveyed on the north coast (although not in Smith Bay) by various community-based programs supported by professional scientists (McArdle et al. 2015; Shepherd et al. 2002; Shepherd et al. 2009; Shepherd and Brook 2007; Reef Life Survey 2016). Reef species of particular conservation or commercial significance (McArdle et al. 2015) recorded during these surveys include western blue groper (*Achoerodus gouldii*), harlequin fish (*Othos dentex*), western blue devil (*Paraplesiops meleagris*), queen snapper (*Nemadactylus valenciennesi*), long-snouted boarfish (*Pentaceropsis recurvirostris*), southern rock lobster (*Jasus edwardsii*) and blacklip abalone (*Haliotis rubra*).

The marine parks closest to Smith Bay are the Southern Spencer Gulf Marine Park to the west and the Encounter Marine Park to the east, each of which are about 20 km from Smith Bay (see Figure 12-3).

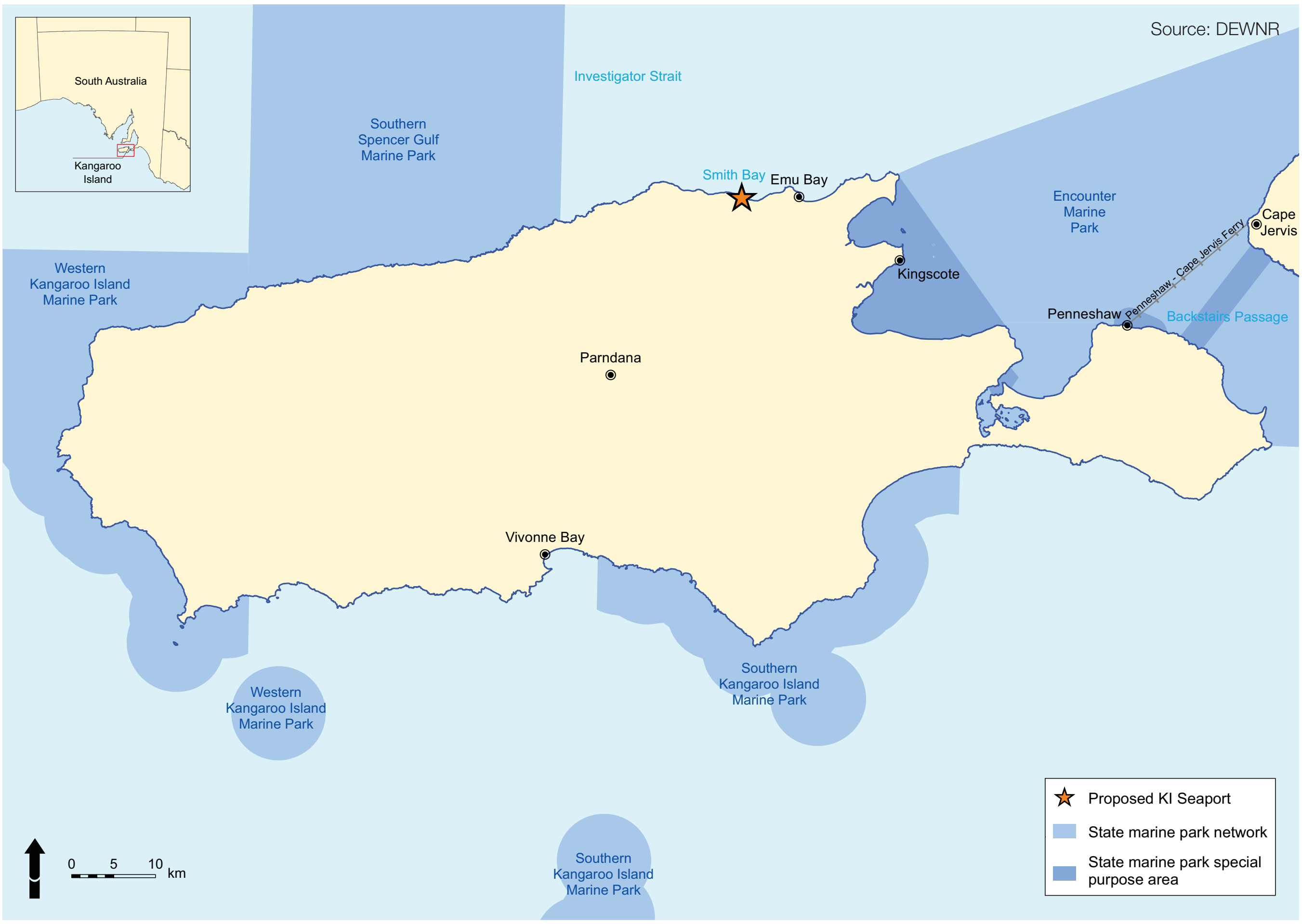


FIGURE 12-3 MARINE PARKS AROUND KANGAROO ISLAND

12.3 ASSESSMENT METHODS

12.3.1 BENTHIC COMMUNITIES

Habitats in the vicinity of the development site were surveyed by divers on three occasions using scuba equipment and underwater cameras as follows

- **First survey** – Two transects were swum perpendicular to the shore to a depth of about 10 metres, followed by a transect parallel to the shore at a depth of 11–12 metres. The survey focused on the location of the proposed causeway, floating platform and dredged pocket and approaches.
- **Second survey** – The divers examined 15 sites along a one-kilometre section of Smith Bay centred on the proposed wharf. These were arranged in three rows representing shallow, medium and deep sites (see Figure 12-5). Communities within one metre of a 30-metre transect laid on the seafloor due north (magnetic) from the GPS mark were surveyed.
- **Third survey** – Spot dives and timed surveys were undertaken at five sites within the deeper section of the dredge footprint.

During each survey, the type and approximate percentage cover of habitats, and the identity and approximate abundance of organisms, were noted, along with the presence of any introduced species. A species list was generated for fish, large mobile invertebrates, sessile invertebrates, macroalgae and seagrass. Taxa were generally identified to the lowest taxonomic level possible in the field (typically genus or species). It should be noted that the small (<0.5 metre) swell present during the first survey caused significant re-suspension of sediment which reduced visibility to less than five metres. Reef fish typically shelter within the reef habitat rather than forage in the water column when visibilities are below this threshold (Barrett & Buxton 2002). The water was very clear, however, during the second and third surveys.

12.3.2 LISTED SPECIES

Under the Commonwealth EPBC Act, the potential effect of the development on matters of national environmental significance (MNES) must be considered.

A literature review was undertaken of marine fauna, seagrasses, macroalgae and marine habitats recorded in the vicinity of the development to identify:

- under the EPBC Act:
  - listed threatened species
  - listed migratory species
  - listed marine species
- under the Native Plant and Wildlife Act:
  - native plants
  - protected animals
- under the Fisheries Management Act
  - protected species.

The major sources of information to identify listed species included:

- Department of the Environment and Energy Protected Matters Search Tool (extracted February 2016) using a 10 km buffer
- Department for Environment and Water (DEW) Biological Database of South Australia (BDSA)
- Impacts of land-based abalone aquaculture discharges on the adjacent marine environment (Smith Bay) (Chapter 4 – Project Description) (Tanner & Bryars 2007)
- Seagrass Biodiversity on Kangaroo Island (Kinloch et al. 2007)
- An Inventory of Important Coastal Fisheries Habitats in South Australia (Bryars 2003)
- Reef Fish Biodiversity on Kangaroo Island (Brock & Kinloch 2007)
- Reef Life Survey Data Portal (Reef Life Survey 2016)
- Diving deeper: a community assessment of Kangaroo Island's rocky reefs (McArdle et al. 2015)
- Towards a System of Ecologically Representative Marine Protected Areas in South Australian Marine Bioregions – Technical Report (Baker 2004)
- Summary of Reef Fish Surveys on Northern Kangaroo Island, 2002–08 (Shepherd et al. 2009)
- Conservation Status of Endangered Marine Algae (COSEMA) (Cheshire et al. 2000).

12.3.3 RISK ASSESSMENT

A risk assessment of the key ecological assets of Smith Bay was undertaken according to the risk management process ISO 31000:2009 (see Chapter 25 – Management of Hazard and Risk).

12.4 EXISTING ENVIRONMENT

12.4.1 OVERVIEW

The species recorded during the benthic surveys is listed in Table 12-1. A schematic cross-section of typical marine habitats at Smith Bay is shown in Figure 12-4. The distribution of marine habitats in Smith Bay is shown in Figure 12-5. Photographs of typical habitats in Smith Bay are provided in Plate 12-1.

The substrate within approximately 150 metres of the shore at Smith Bay consists mainly of rock and reef with a relatively thin veneer of sand that has accumulated in places over the rock. The near-shore section of reef consists of both sheet silcrete reef and loose rock. Further offshore (>10 metres depth) the seafloor consists of a mixture of rubble, shell grit and sand.

The marine communities within approximately 150 metres of shore consist of mixed reef and seagrass communities. The seagrasses *Posidonia sinuosa* and *Amphibolis* spp. (*A. antarctica* and *A. griffithii*), which are long-lived species and considered to be particularly important ecologically, grow in patches among the rocks in depths up to 10 metres, and continuously over a mixed substrate of sand, pebble and shell fragment at greater depths (i.e. approximately 11–12 metres). There are isolated, small patches of *Zostera nigricaulis*, which is a relatively short-lived primary coloniser that tends to recover from disturbance much more rapidly than *Posidonia* spp. and *Amphibolis* spp.

In the zone <10 metres deep, the seafloor cover is approximately 60 per cent macro-algae, 30 per cent seagrass and 10 per cent bare rock or sand. In the deeper water (>10 metres) the cover is initially dense seagrass (80–100 per cent cover), decreasing with increasing depth to a sparse cover (10 per cent) at a depth of 15 metres. The seafloor in the deeper water (15 metres) is predominantly bare rubble, shell grit and sand.

A single unidentified seal was seen about 100 metres from shore in Smith Bay.

TABLE 12-1 TAXA RECORDED DURING THE MARINE SURVEYS

Species	Common name (after Edgar 2008 unless denoted by #)	Reef/Mixed habitat (0–9 m)	Dense to medium seagrass (9–12 m)	Medium to sparse seagrass (12–16 m)
Macroalgae				
Acrocarpia paniculata	Bushy tangleweed	1		
Avrainvillea clavatiramea	Giant lobes#		1	
Botryocladia sonderi	Red grapeweed	1–2	1	1
Caulerpa brownii	Brown's caulerpa	2		
Caulerpa cactoides	Cactus caulerpa	1		1–2
Caulerpa flexilis	Fern caulerpa	1		
Caulerpa flexilis var. muelleri	Mueller's fern caulerpa	1–2		
Caulerpa sedoides	Bubble caulerpa	1–2	1	1
Cladosiphon filum	Brown spaghetti weed		3	3
Codium pomoides	Sea apple	2	1–2	2
Codium spongiosum	Green spongeweed			1
Colpomenia sinuosa	Sinuous bullweed		1–2	3
Cystophora brownii	Brown's cystophora	1		
Cystophora expansa	Expansive cystophora	1–2		
Cystophora monilifera	Three-branched cystophora	2–3		
Cystophora moniliformis	Zigzag cystophora	1–2		
Cystophora retorta	Open-branched cystophora	1		
Cystophora siliquosa	Slender cystophora	2–3		
Cystophora subfarcinata	Bushy cystophora	2		
Dictyosphaeria sericea	Liverwort seaweed	2–3	1	
Gloiosaccion brownii	Poseidon's fingers	1–2		
Gracilaria sp.	Yellow antlers#	1–2		
Haliptilon roseum	Rosy coralline	1–3	1–2	
Laurencia spp.	Laurencias#	1		
Lobophora variegata	Peacockweed	1–3	1	
Metagonionlithon sp.	Articulated corallines#	1–2	1	
Osmundaria prolifera	Twisted red strapweed	1		
Peyssonnelia spp.	Lobed red algae	1–2	1	
Rhodophyta spp.	Filamentous red algae			2
Sargassum subgenus Arthrophycus	Sargassums#	1–3		
Sargassum subgenus Phyllotrichia	Sargassums#	1		
Sargassum subgenus Sargassum	Sargassums#	1-2		
Scaberia aghardii	Brown fingerweed	1–3		
Sporolithon durum	Rhodolith			2
Zonaria spiralis	Spiral fanweed	1		

TABLE 12-1 TAXA RECORDED DURING THE MARINE SURVEYS (CONT'D)

Species	Common name (after Edgar 2008 unless denoted by #)	Reef/Mixed habitat (0–9 m)	Dense to medium seagrass (9–12 m)	Medium to sparse seagrass (12–16 m)
Seagrasses				
Amphibolis antarctica	Wire weed	2	1–3	1–2
Amphibolis griffithii	Griffith's sea nymph	2	1	
Halophila australis	Southern paddlegrass	1		1
Posidonia coriacea	Thin-leafed strapweed	1	1	
Posidonia sinuosa	Smooth strapweed	1–2	3	1–3
Zostera nigricaulis	Black-stemmed eelgrass	1	1–2	1
Fish				
Acanthaluteres brownii	Spiny-tailed leatherjacket	2		
Achoerodus gouldii	Western blue groper	2		
Aetapcus maculatus	Warty prowfish	1		
Austrolabrus maculatus	Black-spotted wrasse	1		
Cheilodactylus nigripes	Magpie perch	1		
Chelmonops curiosus	Western talma	1		
Dactylophora nigricans	Dusky morwong	1		
Dotolabrus aurantiacus	Castelnau's wrasse	1		
Enoplosus armatus	Old wife	1		
Girella zebra	Zebra fish	2		
Helcogramma decurrens	Black-throated threefin	1		
Kyphosus sydneyanus	Silver drummer	2		
Meuschenia hippocrepis	Horseshoe leatherjacket	1–2		
Notolabrus parilus	Brown-spotted wrasse	1	1	
Notolabrus tetricus	Blue-throated wrasse	1–2		
Omegaphora armilla	Ringed toadfish		1	1
Othos dentex	Harlequin fish	1		
Parascyllium ferrugineum	Rusty catshark		1	
Parascyllium variolatum	Varied catshark	1		
Parequula melbournensis	Southern silverbelly		1	
Pictilabrus laticlavius	Senator wrasse	1		
Pseudocaranx sp.	Trevally	3		
Scorpis aequipinnis	Sea sweep	2		
Siphonognathus beddomei	Pencil weed whiting	1		
Stipecampus cristatus	Ringed-back pipefish			1
Tilodon sexfasciatus	Moonlighter	2		
Trachurus novaezelandiae	Yellowtail scad		3	

TABLE 12-1 TAXA RECORDED DURING THE MARINE SURVEYS (CONT'D)

Species	Common name (after Edgar 2008 unless denoted by #)	Reef/Mixed habitat (0–9 m)	Dense to medium seagrass (9–12 m)	Medium to sparse seagrass (12–16 m)
Mobile invertebrates				
Acrosterigma cygnorum	Western heart cockle			1
Amblypneustes sp.	Egg urchin			2
Anthaster valvulatus	Mottled sea star	1		1–2
Astralium squamiferum	Seagrass star	1		
Austrodomidia octodentata	Bristled sponge crab			1
Calliostoma armillatum	Pink top shell		1	
Cenolia trichoptera	Orange feather star	3		
Centrostephanus tenuispinus	Western hollow-spined urchin		1	1
Coscinasterias muricata	Eleven-armed sea star		1	1–2
Echinaster arcystatus	Pale mosaic sea star	1		
Echinaster glomeratus	Orange reef star	1	1	1–2
Equichlamys bifrons	Queen scallop	1		2–3
Fusinus australis	Southern spindle	1	1	
Goniocidaris tubaria	Stumpy pencil urchin			1
Haliotis laevigata	Greenlip abalone	1		
Haliotis scalaris	Grooved abalone	1	1	2
Heliocidaris erythrogramma	Purple urchin			1
Jasus edwardsii	Southern rock lobster	1		
Luidia australiae	Southern sand star		1	1
Meridiastra gunii	Gunn's six-armed star	1		1
Mimachlamys asperrimus	Doughboy scallop	2		1–3
Nectocarcinus integrifrons	Seagrass swimmer crab			1
Nectria pedicelligera	Multi-spined sea star	1	1	1
Pagurid sp.	Grey hermit	1		
Paguristes frontalis	Southern hermit crab	1		1
Pentagonaster dubeni	Vermilion biscuit star	3	1–3	1–3
Petricia vernicina	Cushion sea star	1		1
Phasianella australis	Painted lady	3	1	3
Phasianella ventricosa	Swollen pheasant shell	1–2	1	
Phasianotrochus eximus	Giant kelp shell	1		
Phyllacanthus irregularis	Western slate-pencil urchin	1–2		
Pinna bicolor	Razor clam		1	1
Plagusia chabrus	Red bait crab	1		
Plectaster decanus	Mosaic sea star	1		1
Pleuroploca australasia	Tulip shell	1	2	1–2
Sepia apama	Giant Australian cuttlefish			1
Stchopodid spp.	Sea cucumbers	1–2	1	1–2
Tellina victoriae	Rough tellin#	1		
Thyone okeni	Burrowing holothurian#		1	
Tucetona flabellata	Fan-like dog-cockle			1
Uniophora granifera	Granular sea star	1		

TABLE 12-1 TAXA RECORDED DURING THE MARINE SURVEYS (CONT'D)

Species	Common name (after Edgar 2008 unless denoted by #)	Reef/Mixed habitat (0–9 m)	Dense to medium seagrass (9–12 m)	Medium to sparse seagrass (12–16 m)
Sessile invertebrates				
Ascidiacea spp.	Unidentified ascidians	1		1
Botrylloides magnicoecum	Magnificent ascidian	1		
Bryozoa spp.	Erect byozoans		2	2–3
Clavelina spp.	Colonial ascidians	1	1	
Erythropodium hicksoni	Encrusting soft coral	1		
Herdmania grandis	Red-mouthed ascidian	2	1	1–2
Iodictyuum phoeniceum	Purple bryozoan	1		
Orthoscuticella ventricosa	Orange filamentous bryozoan	1		
Parmularia smeatoni	Little fan bryozoan		1	
Phallusia obesa	Obese ascidian			1
Plesiastrea versipora	Green coral	1		
Polycarpa clavata	Club ascidian	1	1–2	
Polycarpa viridis	Mauve-mouthed ascidian	1–3	2–3	2
Porifera spp.	Sponges	2–3	1–2	1
Pyura spp.	Sea tulip	1–2	1	2
Sycozoa ceribriformis	Brain ascidian		1–2	1–2
Sycozoa murrayi	Murray's ascidian	2		2

^Mixed habitat refers to mixed reef, seagrass and sand habitat to 8 m. Abundances are expressed as categories: 1 = 1 or 2 individuals or small patches; 2 = 3–10 individuals or patches, 3 = >10 individuals or patches, or a continuous distribution.

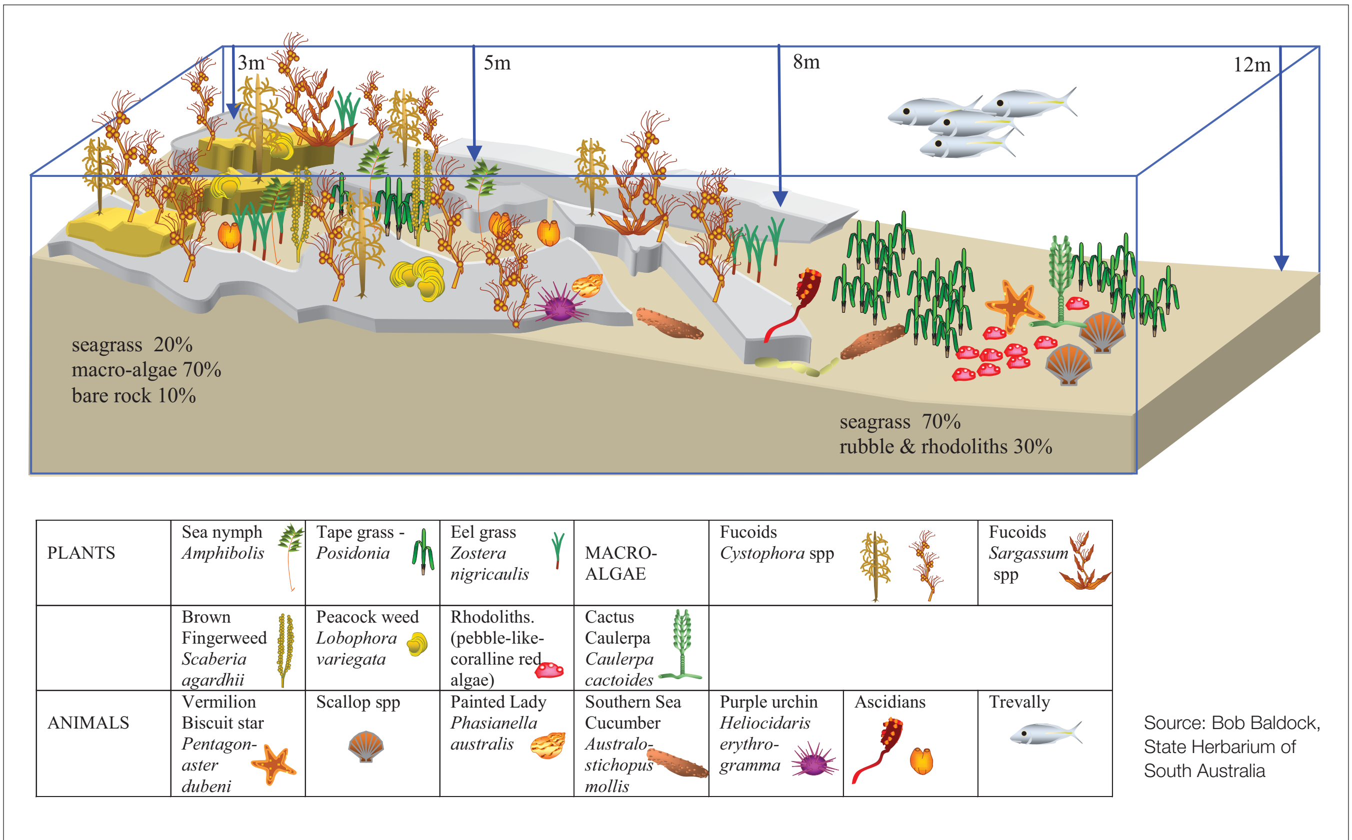


FIGURE 12-4 SCHEMATIC PROFILE OF MARINE HABITATS IN SMITH BAY

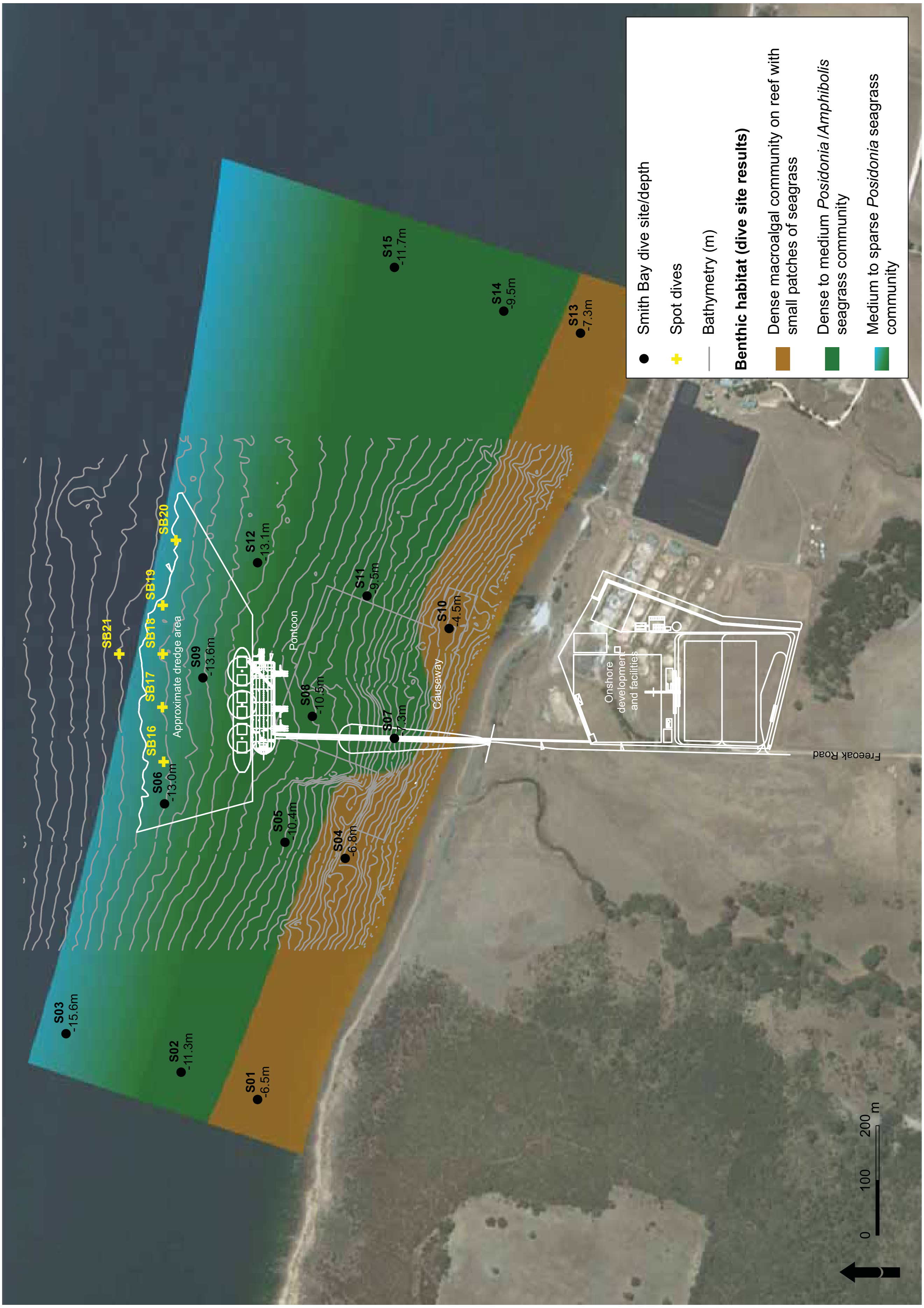


FIGURE 12-5 DISTRIBUTION OF MARINE HABITATS IN SMITH BAY

a) Depth 2–3 metres: brown macroalgae *Cystophora* spp. and *Scaberia aghardii*

b) Depth 6–7 metres: brown macroalgae *Cystophora* spp.

c) Depth 10 metres: the seagrasses *Posidonia sinuosa* and *Amphibolis antarctica* and razor clams *Pinna bicolor*

d) Depth 10 metres: dense seagrass *Posidonia sinuosa*

e) Depth 13 metres: sparse seagrass *Posidonia sinuosa* on rubble

f) Depth 15 metres: sparse *Posidonia sinuosa* on rubble/sand substrate

PLATE 12-1 PHOTOGRAPHS OF TYPICAL MARINE HABITATS IN SMITH BAY (28 NOVEMBER 2017)

12.4.2 MARINE HABITATS

Intertidal beach habitat

The intertidal beach area of Smith Bay (i.e. the area above the level of the low tide and below the level of the high tide) consists almost entirely of round rocks and boulders that have been weathered and smoothed by wave action. There is only one section of beach where the rocks and boulders have been cleared to form a small area from which to launch boats. The intertidal communities typically consist mainly of molluscs, including *Nerita*, *Bembicium* and *Austrocochlea*, the polychaete *Galeolaria*, and cructaceans including the barnacles *Chthamalus*, and the crabs *Leptograpsus variegatus* and *Ozius truncatus*.

Mixed reef and seagrass habitat (to 10 metres depth)

The subtidal habitats to 10 metres depth were patchy with areas of reef, seagrass, bare sand and mixed reef/seagrass.

Areas of reef to three metres depth consisted mainly of boulders 0.5–1 metre high that support canopy-forming fucoid macroalgae including *Cystophora siliquosa* and *Cystophora moniliformis*, with an understorey including *Osmundaria prolifera*, *Caulerpa flexilis* and the red coralline *Haliptilon roseum*. Small patches of the seagrass *Posidonia sinuosa* were also present.

From about four metres depth there were areas of bare sand and dense stands of seagrass comprising *Posidonia sinuosa*, *Amphibolis antarctica* or *A. griffithii*, or mixed stands of pairs or all of those species. *Posidonia coriacea* was also observed. The seagrass communities are very healthy and vigorous, which probably reflects the normally clear water in the area.

Further offshore to a depth of 10 metres areas of platform reef and rubble support a less dense but more diverse canopy of macro-algae consisting of several species of *Cystophora*, *Scaberia aghardii* and *Sargassum* spp. Patches of *Lobophora variegata* and the seagrass *Amphibolis* spp. occupied gaps in the canopy, and isolated, small patches of *Zostera nigricaulis* were also present. The mobile invertebrate fauna was dominated by gastropods and echinoderms, particularly sea stars, which is typical of reefs in the area.

Seagrass habitat (10–14 metres)

The substrate at depths of 10–14 metres consisted of rubble, rhodoliths, shell fragments and silty sand, with initially a dense (80 per cent) cover of *Posidonia sinuosa* that progressively thins to a sparse (10–20 per cent) cover at 14 metres. The occurrence of *Posidonia sinuosa* in relatively deep water at Smith Bay (compared with communities in Spencer Gulf and Gulf St Vincent) is probably due to the clearer water along the north coast of Kangaroo Island.

The mobile fauna comprised species typically associated with reef, seagrass or both habitats, and was dominated by doughboy scallop (*Mimachlamys asperrimus*), queen scallop (*Equichlamys bifrons*), painted lady (*Phasianella australis*), vermilion biscuit star (*Pentagonaster dubeni*) and southern sea cucumber (*Australostichopus mollis*). The most common sessile invertebrate was the stalked ascidian (*Pyura* sp.).

12.4.3 LISTED SPECIES

Forty-six listed threatened or listed migratory species have been recorded within 10 km of Smith Bay (see Appendix I1). These included:

- eight threatened (endangered or vulnerable) marine species, which comprise mainly whales and turtles
- 32 nationally listed marine species, which include three seal species, three turtles and 26 syngnathid species (seahorses and pipefish)
- 12 species of whales or dolphins
- 12 migratory marine species.

The nationally threatened species included the southern right whale (*Eubalaena australis*), humpback whale (*Megaptera novaeangliae*), blue whale (*Balaenoptera musculus*), Australian sea-lion (*Neophoca cinerea*), great white shark (*Carcharodon carcharias*), loggerhead turtle (*Caretta caretta*), leatherback turtle (*Dermochelys coriacea*) and green turtle (*Chelonia mydas*).

In addition to the nationally listed species, state-listed marine species potentially occurring in the area include the cetaceans pygmy right whale (*Caperea marginate*), pygmy sperm whale (*Kogia breviceps*), dusky dolphin (*Lagenorhynchus obscurus*) and strap-toothed whale (*Mesoplodon layardii*), all of which are listed as rare.

It is considered that only five marine mammals, one shark and 15 species of pipefish are likely to occur, or may possibly occur at times, in Smith Bay (Table 12-2). Descriptions of each of these species are provided in Appendix I1.

12.4.4 COMMERCIAL AND RECREATIONAL FISHERIES

Commercial and recreational fishing occurs in the vicinity of Smith Bay. The nearest ports/ramps from which commercial and recreational fishers operate are Kingscote and Emu Bay, which are respectively approximately 20 km and 5 km east of Smith Bay. Beach launching of boats at Smith Bay is possible at two locations where the rocks have been cleared aside to create sandy beaches.

The main commercial marine species caught in reporting areas that include Smith Bay and associated fisheries are given in Table 12-3 (see Appendix I3 for sources).

TABLE 12-2 LISTED MARINE SPECIES ASSESSED AS LIKELY TO OCCUR OR POSSIBLY OCCURRING IN SMITH BAY

Scientific name	Common name	EPBC status	SA status
Mammals			
Arctocephalus forsteri	Long-nosed fur-seal	Ma	
Delphinus delphis	Common dolphin	Ma, W	P
Eubalaena australis	Southern right whale	E, Mi, Ma, W	V, P
Neophoca cinerea	Australian sea lion	V, Ma	V, P
Tursiops aduncus	Indian Ocean bottlenose dolphin	Ma, W	
Sharks			
Carcharodon carcharias	Great white shark	V, Mi, Ma	P
Fish			
Campichthys tryoni	Tryon's pipefish	Ma	P
Hippocampus abdominalis	Eastern potbelly seahorse	Ma	P
Hippocampus breviceps	Short-head seahorse	Ma	P
Histiogamphelus cristatus	Rhino pipefish	Ma	P
Hypselognathus rostratus	Knifesnout pipefish	Ma	P
Kaupus costatus	Deepbody pipefish	Ma	P
Leptoichthys fistularius	Brushtail pipefish	Ma	P
Lissocampus caudalis	Australian smooth pipefish	Ma	P
Phycodurus eques	Leafy seadragon	Ma	P
Pugnaso curtirostris	Pug-nosed pipefish	Ma	P
Stigmatopora argus	Spotted pipefish	Ma	P
Stigmatopora nigra	Wide-bodied pipefish	Ma	P
Stipecampus cristatus	Ring-backed pipefish	Ma	P
Vanacmapus phillipii	Port Phillip pipefish	Ma	P
Vanacampus poecilolaemus	Long-snouted pipefish	Ma	P

Status: under EPBC Act (E = Endangered, V = Vulnerable, Mi = listed migratory species, Ma = listed marine species, W = whales and other cetaceans); and under the South Australian *National Parks and Wildlife Act 1972* (E = Endangered, V = Vulnerable, R = Rare), or SA *Fisheries Management Act 2007* (P = Protected)

With the exception of the Southern and Eastern Scalefish and Shark Fishery, which is managed by the Australian Government, these fisheries are managed by the South Australian government. Catch and effort for these fisheries are typically reported for sub-areas within each fishery that vary in size from about 100–2000 square kilometres (i.e. much larger than the vicinity of Smith Bay).

The large sub-areas that encompass Smith Bay are relatively unimportant for the high-value fisheries as they generally account for less than five per cent of the total catch for the fishery (refer to Table 12-3). The exception is silver trevally, with 10–35 per cent caught in the approximately 200 square kilometre zone that includes Smith Bay.

Several charter boat operators are based on the north coast of Kangaroo Island. Between 2009–10 and 2011–12, Kingscote was used as a port by only one operator. Western River Cove (40 km to the west of Smith Bay) and American River were each used by three operators (Tsolos 2013). It is likely that licence holders departing from mainland ports also use the north coast of Kangaroo Island at times.

Each year, about 7000–8000 fishers (i.e. two per cent) of South Australia's recreational fishers use the north coast of Kangaroo Island, targeting mainly King George whiting, snapper, Australian salmon, silver trevally, southern rock lobsters, greenlip abalone and blacklip abalone (Giri & Hall 2015; Jones 2009; Jones & Doonan 2005).

TABLE 12-3 COMMERCIAL SPECIES AND ASSOCIATED FISHERIES IN THE VICINITY OF SMITH BAY

Fishery	Common name	Scientific name	Percentage of total fisheries catch in zones covering Smith Bay
Marine Scalefish	King George whiting	*Sillaginodes punctata*	1.6–4.8
	Snapper	*Pagrus auratus*	0.2–1.4
	Southern calamary	*Sepioteuthis australis*	0.2–1.1
	Silver trevally	*Pseudocaranx georgeanus*	10–35
	Snook	*Sphyraena novaehollandiae*	2.2–8.8
	Australian salmon	*Arripis truttacea*	0.5–2.3
	Gummy shark	*Mustelus antarcticus*	0.9–4.6
Sardine	Australian sardine	*Sardinops neopilchardus*	0.03–0.2
Gulf St Vincent Prawn	Western king prawn	*Penaeus latisulcatus*	0
Northern Zone Rock Lobster	Southern rock lobster	*Jasus edwardsii*	0.5
Central Zone Abalone	Greenlip abalone	*Haliotis laevigata*	0.9
	Blacklip abalone	*Haliotis rubra*	0
Southern and Eastern Scalefish and Shark Fishery	Gummy shark	*Mustelus antarcticus*	0.5

More detailed descriptions of the commercial and recreational fisheries operating in the vicinity of Smith Bay are provided in Appendix I3.

12.5 IMPACT ASSESSMENT AND MANAGEMENT

Risks to the most important features of marine environment are summarised in the overall risk assessment presented in Chapter 25 – Management of Hazard and Risk, and Appendix T.

12.5.1 LISTED SPECIES RISK ASSESSMENT

Three EPBC Act matters were identified as pertaining to the potential effects of the development on the marine environment. These are:

- listed threatened species
- listed marine species
- listed migratory species.

Vulnerable and protected species under state legislation were identified.

This assessment examines the effect the proposed development is likely to have on the relevant controlling provisions of the EPBC Act. Specifically, it includes assessments of:

- the species listed in the EPBC Act Protected Matters Report (see Appendix I1)
- the likelihood of their occurring in the study area
- the significance to the species of the habitat in the study area
- the risk to each species posed by the development
- the potential impacts on the species identified from the Protected Matters Report.

The following criteria were used in assessing the risk to each species (see Appendix I1):

- mobility/alternative habitat: a = mobile species, b = sedentary or not particularly mobile species, c = species with extensive alternative habitat in the area, d = species with limited habitat on the north coast of Kangaroo Island
- distribution: 1 = regularly recorded in or near the study area, 2 = occasional records in or near the study area, 3 = rarely recorded in or near the study area
- credible risk, which takes into account:
  - their occurrence in the Smith Bay region
  - the availability of alternative suitable habitat around Smith Bay
  - their mobility (i.e. ability to temporarily emigrate from the area of impact)
  - the potential for construction activities to affect the habitat available to these species
  - the likely sensitivity of these species to construction and operations.

The potential risk to each species is shown in Appendix I1.

Twenty-two of the listed species have been recorded around Kangaroo Island only on rare occasions. These include the blue whale, killer whale and loggerhead turtle. The likelihood of many of these species being in the study area at the time of construction is therefore remote.

None of the listed species is considered to have limited habitat along the north coast of Kangaroo Island. Therefore, the temporary loss of habitat would comprise a minute proportion of the available intertidal, seagrass, and open water habitat available in the area, and would not affect the viability of any of the listed species.

Twenty-two of the listed species are highly mobile and able to move from the area of impact to adjacent unaffected habitat. These include the threatened southern right whale, humpback whale, Australian sea-lion, great white shark and green turtle.

The sessile or less mobile species include 26 syngnathid species (seahorses and pipefish). Syngnathids generally inhabit relatively low-energy seagrass environments such as American River and Pelican Lagoon. Tiger pipefish (*Filicampus tigris*) is an exception in that it inhabits sandy/muddy substrates rather than seagrass habitat (Baker 2008). Being relatively sessile, syngnathids would be vulnerable to impact during the development.

The risk assessment presented in Appendix I1 has shown that the construction and operation of the wharf at Smith Bay is unlikely to fragment or decrease the size of populations of any of the listed species, affect critical habitat or disrupt breeding cycles.

More detailed assessments of the species identified in Table 12-2 as likely to occur or possibly occurring at times in Smith Bay are presented below.

12.5.2 THE SOUTHERN RIGHT WHALE

Under Section 75 of the EPBC Act, the proposed KI Seaport has been designated a controlled action by the (then) Department of the Environment and Energy, as it was considered likely to have a significant impact on the endangered and migratory southern right whale (EPBC Referral Number 2016/7814, 14/12/16).

Concerns raised by DoEE are that:

- South Australia's coastal waters provide important breeding and nursery habitat for southern right whales
- the south-east Australian population of the species is increasing at a much slower rate than the population in general
- the loss of a single animal from the south-eastern group would have a significant impact on the population of southern right whales.

Genetic studies suggest that the south-western population includes WA and SA, and the south eastern population encompasses Victoria, Tasmania and NSW, and that there may be some level of inter-breeding between the two groups (Carroll et al. 2011). The work by Carroll et al. (2011) specifically includes samples from Encounter Bay, near Victor Harbor, in its south-western population. It is possible therefore that the SA population of southern right whales may to at least some degree be part of the faster-growing south-western population, the implication being that the loss of a single whale would be a less significant issue at a population level.

The Conservation Management Plan for these whales identified 'vessel disturbance' including collisions, entanglement in or ingestion of 'marine debris' and 'noise interference' from infrastructure and vessels as threats, all of which were considered by DSEWPaC (2012) to have minor consequences and a moderate level of risk for the south-western population of the whales, which use the South Australian coastline.

It has been suggested that these whales are particularly susceptible to vessel collisions due to the greater proportion of the time they spend on the surface compared with other species such as the more abundant humpback whales (Peel et al. 2016).

The available records suggest that vessel collisions are relatively infrequent, although numerous incidents are likely to go undetected or not reported (DoEE 2016). Records show that:

- between 15 and 40 whale strikes globally have been reported to the International Whaling Commission each year in recent years (DoEE 2016)
- in Australian waters, 109 vessel strikes have been reported between 1840 and 2015, with at least 10 of those involving southern right whales (Peel et al. 2016)
- three collisions between vessels and southern right whales have been reported in South Australia since 1981 (Kemper 2008; Spencer Gulf Port Link 2013).

There is no evidence that Smith Bay is an important site for southern right whales. Although Smith Bay lies within an area described as the 'current core coastal range' for these animals (DSEWPaC 2012), it is not near a known aggregation area and is at the edge of a 'historic high use' area. Records of southern right whale sightings around Kangaroo Island provide evidence that they visit Smith Bay only infrequently.

Of the more than 400 sightings from Kangaroo Island included in the *Atlas of Living Australia*, none were from Smith Bay; the nearest were at Dashwood Bay to the west and Emu Bay to the east.

Of the 110 sightings from Kangaroo Island recorded by the South Australian Whale Centre at Victor Harbor, 16 were from the north coast and only one was from Smith Bay.

It is considered that vessel collisions with southern right whales associated the KI Seaport development would pose negligible risk to the whale population for the following reasons:

- they visit Smith Bay infrequently and the area is not a known breeding or nursery habitat
- the annual number of vessel calls associated with the KI Seaport is not expected to exceed 20, compared to about 2000 at existing South Australian ports, which would comprise a negligible (one per cent) increase in the state total
- shipping activity in South Australia is considered to be of less concern than busier ports such as Melbourne (DoEE 2016)
- modelling has shown there is a low probability of whale strikes (one in 300 years) associated with vessels travelling to and from the KI Seaport along the southern Australian coastline (see Appendix I2)
- established shipping routes that would be used by KIPT vessels do not pass near areas where records show whales aggregate or visit frequently
- the population of southern right whales in south-western Australia is growing at its maximum biological rate despite the presence of several major port developments in the region, indicating that shipping and ports are not harming the population.

The impact of the Smith Bay development on southern right whales from entanglement in or ingestion of harmful marine debris is considered negligible because:

- the relative increase in the volume of shipping-based debris to which migrating whales would be exposed is negligible
- whales are unlikely to feed in Australian coastal waters (DSEWPaC 2012).

It is recognised that underwater noise associated with the construction of the KI Seaport and shipping operations could potentially impact marine fauna, including southern right whales, through hearing damage or changes to migration, breeding or social behaviour. Detailed background information on this issue and an assessment of likely impacts is presented in Chapter 18 – Noise and Light and Appendix N1. The results of the impact assessment show that piling could potentially cause permanent hearing damage to whales within 900 metres of piling operations and temporary hearing damage within 6.5 km. Dredging could potentially cause temporary hearing damage within 500 metres of dredging operations.

The impact of construction noise at Smith Bay on southern right whales is expected to be negligible for the following reasons:

- it is likely that southern right whales would avoid Smith Bay if they were distressed by construction noise (including piling and dredging). Adverse ecological consequences would be unlikely because the bay is neither an important aggregation area nor an historic high use area for them
- the frequency of southern right whales visiting Smith Bay during construction and/or operation of the wharf would be low. Sighting records suggest they visit the bay only rarely during their annual migration and it is of no special importance compared with other bays along the north coast
- a number of mitigation measures (see Chapter 18 – Noise and Light and Appendix N1) would be adopted to minimise the risk of whales being in Smith Bay during piling (i.e. observer monitoring with shutdowns, soft-start procedures, only piling in conditions of good visibility), or reduce the severity of piling impacts (lower impact piling methods).

Similarly, the impact of noise associated with KIPT vessels on southern right whales is expected to be negligible for the following reasons:

- the impact of vessel noise would be limited to behavioural responses within 2 km, which are expected to be temporary
- the additional shipping traffic associated with operation of the KI Seaport would result in a negligible (no more than one per cent) increase in shipping traffic at South Australian ports.

Management measures and residual risk

Should a whale approach within 1 km of the construction site, construction operations at the wharf would cease, in line with construction environmental management plan (CEMP). Additional measures to manage the impact of noise on whales and other marine fauna are discussed in Section 12.5.6, Chapter 18 – Noise and Light and Appendix N1.

The risk of whale strike is managed primarily through the Australian Maritime Safety Authority's (AMSA) shipping notices to shipowners and operators. In response to the International Maritime Organisation's (IMO) 2009 circular on minimising the risk of whale strike to member countries, AMSA released notices in 2011 and 2016. AMSA's Marine Notice 15/2016 (*Minimising the risk* of *collisions with cetaceans*) provides guidance to shipowners and operators on reducing the risk of collision with cetaceans, provides information on the location and migration periods of threatened whale species in Australian waters and reminds shipowners, operators and seafarers of their obligations to report all whale strikes within Commonwealth waters. The notice urges seafarers to:

- maintain a lookout for cetaceans, especially during key times and at key locations mentioned in the Marine Notice
- in the event of sightings, warn other vessels using all appropriate means of communication
- consider reducing vessel speed in areas where cetaceans have been sighted
- consider modest course alterations away from sighting locations (AMSA 2016).

With implementation of the above management measures, the residual risk to the southern right whale would be low (see Chapter 25 – Management of Hazard and Risk).

12.5.3 OTHER LISTED SPECIES

Pipefish

During the marine survey, one ring-backed pipefish (*Stipecampus cristatus*) was recorded in *Posidonia* seagrass habitat in Smith Bay. Population characteristics that may increase the vulnerability of this species to impact include:

- apparently restricted distribution of populations in South Australia (known mainly from the gulfs)
- low population densities
- strong habitat association
- probable small home range and low mobility
- probable monogamy
- site-attached reproduction with small brood sizes (Reef Watch 2014).

Dredging would result in the direct loss of approximately 5 ha of seagrass habitat and possibly some pipefish. Although pipefish have limited mobility, some are likely to be able to move a short distance away from the area of direct impact during construction. Furthermore, there is abundant similar habitat in Smith Bay, Emu Bay and other bays along the north coast which would be expected to support a similar density of pipefish.

A study of the mobile epi-fauna inhabiting seagrass meadows on the north coast using beam trawls recorded 119 pipefish comprising 10 species (Kinloch et al. 2007). Although the ring-backed pipefish was not recorded, its overall density within the seagrass meadows was found to be about one per 20 square metres.

The loss of a small amount of pipefish habitat and of potentially some pipefish during construction would have a negligible effect on the overall population or viability of the species in Smith Bay and on the north coast.

Management measures and residual risk

The loss and displacement of pipefish during dredging would result in a negligible impact to the pipefish population in Smith Bay, and is therefore not considered to warrant the implementation of management measures.

The loss of pipefish habitat would be offset as part of the seagrass offset proposal (see Section 12.5.4).

With implementation of seagrass offsets, the residual risk to seagrass communities (and associated pipefish) would be low (see Chapter 25 – Management of Hazard and Risk).

Sharks, dolphins, seals and sea-lions

The great white shark (*Carcharodon carcharias*), common dolphin (*Delphinus delphis*), Indian Ocean bottle-nose dolphin (*Tursiops aduncus*), long-nosed fur seal (*Arctocephalus forsteri*) and Australian sea-lion (*Neophoca cinerea*) are all likely to traverse Smith Bay at times as they forage along the north coast. There is no evidence, however, to suggest that Smith Bay has important or critical feeding, breeding or nursery habitat for any of these species.

During construction and operation of the wharf each of these species may avoid the wharf area and relocate to similar marine habitats that are very abundant in the Smith Bay region and along the north coast. Consequently, they are unlikely to be adversely affected by the loss of a very small amount of marine habitat adjacent to the wharf.

It is concluded that the project poses no credible risk to the listed marine species that occur from time to time in Smith Bay.

Management measures and residual risk

Should a great white shark, dolphin, seal or sea-lion approach within 500 metres of the site, construction operations at the wharf would cease, in accordance with the CEMP. Additional measures to manage the impact of noise on marine fauna are discussed in Section 12.5.6, Chapter 18 – Noise and Light and Appendix N1.

With implementation of the above management measures, the residual risk to sharks, dolphins, seals and sea-lions would be low (see Chapter 25 – Management of Hazard and Risk).

12.5.4 SEAGRASS AND OTHER BENTHIC COMMUNITIES

Assessment background

Seagrass and other benthic communities (i.e. those living on the sea floor) are susceptible to being adversely affected by the KI Seaport development as they are in most instances incapable of moving away from the source of impact. Furthermore, Smith Bay has relatively extensive seagrass communities, which are considered important components of marine ecosystems (Edgar 2001; McDonald & Tanner 2002; Jones et al. 2008).

Benthic communities would be affected as a result of the dredging of approximately 9 ha of the sea floor to create a berthing pocket and approaches for ships and the construction a causeway covering approximately 1 ha of the sea floor. Less significant impacts may occur through winnowing, or disturbance, of seabed sediments by ship movements, smothering of benthic biota by deposition of sediment during dredging, and the discharge of turbid stormwater from the site during construction and operation of the facility.

Scientific literature records many instances of dredging programs having significant adverse effects on benthic communities, and in particular on seagrass communities (Airoldi 2003; Cheshire & Miller 1999; Erftemeijer & Lewis 2006; Thorhaug & Austin 1976 (see Appendix I4). In their review of dredging programs, Erftemeijer and Lewis state that the main effects relate to:

- physical removal of benthic vegetation and biota at the dredging site
- burial of benthic vegetation and biota at the spoil disposal site
- increased turbidity and light reduction in the water column, thereby reducing the productivity of seagrass and algae communities and potentially leading to their decline and loss
- increased sedimentation and smothering or scouring of adjacent seagrass and reef communities, leading to their decline and loss
- clogging and damaging the filter feeding and breathing organs of marine organisms such as fish and shellfish, potentially leading to their death
- the release of chemical pollutants from sediments
- hydrographic changes that can have indirect effects on seagrasses through increased rates of seabed erosion (see Appendix I4).

Erftemeijer and Lewis draw the following conclusions regarding the environmental impacts associated with dredging:

- the significance and extent of damage to seagrass communities caused by dredging appeared to be a function of:
  - the scale of the dredging operation
  - the proximity of the seagrass beds to the dredging operation
  - the type and composition of the sediment being dredged
  - the type and mode of operation of the dredging equipment
  - the rate at which dredging is undertaken
  - the effectiveness of the mitigating measures applied during dredging
- although many studies have reported significant adverse impacts on seagrass beds from dredging, several other (mostly recent) studies have reported no impacts on nearby seagrasses due to greater environmental safeguards being in place
- some of the case studies have shown that even large-scale dredging operations do not always have significant impacts on seagrass beds
- development of criteria to protect seagrasses must acknowledge that they tolerate periods of naturally high turbidity and can withstand some increase in the frequency of turbid events
- in areas that experience large natural fluctuations in background turbidity, seagrasses and other benthic communities often display a greater resilience than in areas where natural turbidity fluctuations are minimal
- turbidity changes induced by dredging would only result in adverse environmental effects when the turbidity generated is significantly larger than the natural variation of turbidity and sedimentation rates in the area
- dredging activities often generate no more increased suspended sediments than commercial shipping operations, bottom fishing or severe storms.

The studies of Cheshire and Miller (1999) and Turner (2004) of the effects of four dredging events at Port Stanvac, south of Adelaide, found that one of the events, which was three times larger and was completed three times quicker than the others, had had a significant impact on adjacent seagrass and reef communities up to 500 metres and several kilometres, respectively, from the dredging site. The remaining events were found to have had a much less significant impact. It was concluded that impacts on adjacent marine communities could be significantly mitigated by a maximum dredging rate of 2600 cubic metres a day (Cheshire & Miller 1999). The Port Stanvac dredging program was more than 10 times larger than the program proposed at Smith Bay.

The study of Victory et al. (2010) of the relatively small Adelaide Desalination Plant dredging program concluded that, with careful management and treatment of the dredge water and spoil, it was possible to effectively eliminate the adverse environmental effects associated with dredging (see Appendix I4).

Direct loss of benthic communities

The construction of a causeway (0.95 ha) and the dredging of the berthing pocket and approaches (9.2 ha) would result in the direct loss of about 10.2 ha of mixed habitat, including the seagrasses *Posidonia sinuosa*, *Amphibolis antarctica* and *A. griffithii*, macroalgae inhabiting the reef and invertebrate communities consisting mainly of gastropods, echinoderms, ascidians and sponges. Each of these communities and species is common on both a local and regional scale.

The ecological significance of the loss of seagrass and reef communities and habitat would be minor as there is a large amount of similar habitat within Smith Bay, at Emu Bay and elsewhere along the north coast. A further mitigating factor is that the dredging would occur in water from 11–13.5 metres deep where *Posidonia sinuosa* (which comprises approximately 90 per cent of the seagrass that would be lost) is relatively sparse in the deeper sections of the dredge footprint, probably due to the lack of light reaching the sea floor.

Shading effects

The pontoon would shade approximately 0.5 ha of seafloor in Smith Bay at a depth of 10–11 metres which would result in the potential decline of seagrass beneath the pontoon due to reduced light availability. Since the seagrass growing at a depth of 10–11 metres is already likely to be close to the depth at which light becomes limiting, it is likely that the shading effect may cause the dieback of 0.5 ha of seagrass beneath the pontoon.

Sedimentation

Sedimentation associated with the plume generated during dredging may adversely affect adjacent seagrass, macro-algae and other benthic communities through smothering effects.

A number of studies have provided thresholds for sedimentation effects on seagrass and macro-algae communities, as follows:

- *Amphibolis* appears to be resilient to sedimentation and burial, with growth rates being unaffected after burial by 10 cm of aerobic sediment off the Adelaide coast (Clarke 1987)
- burial of *Posidonia* by 5 cm of sediment resulted in reduced biomass, and burial by 15 cm for 50 days resulted in 50–100 per cent mortality (50 per cent for *P. sinuosa*) (Short et al. 2017)
- burial of *Posidonia* oceanica in Spain by a sedimentation rate of 5 cm a year resulted in significant mortality (Manzanera et al. 1998)
- burial of *Cymodocea serrulata* and *Enhalus acoroides* in the Philippines by a sedimentation rate of 10–13 cm a year caused little mortality (Vermaat et al. 1997)
- burial of *Zostera marina* for 24 days by 4 cm of sediment (25 per cent of their height) resulted in greater than 50 per cent mortality; burial by 16 cm (75 per cent of their height) resulted in 100 per cent mortality (Mills & Fonseca 2003)
- deposition of 1 cm of fine sediment on reef communities near Port Stanvac primarily affected newly recruiting macro-algae, with few juveniles surviving to one year (Turner 2004).

At the proposed scale of the dredging operation (100,000 cubic metres over three months) sediment deposition is not considered likely to be of a sufficient extent or duration to result in significant effects on marine communities over a large area (beyond approximately 240 metres from the dredged area). Hydrodynamic modelling of the dredge plume has indicated that marine communities are likely to be subjected to no greater than a total of 50 mm of sediment deposition beyond 130 metres of the dredge footprint, no greater than 10 mm of sediment deposition beyond 240 metres of the dredge footprint, and no greater than less than 1 mm beyond 4700 metres of the dredge footprint (see Chapter 9 – Marine Water Quality). Rather than simply accumulating during dredging operations, sediment would be dispersed by wave action, particularly during storms.

Although sediment deposition on the seagrasses *Posidonia* and *Amphibolis* within 200 metres of the dredge footprint (approximately 10–50 mm) is likely to temporarily reduce their productivity, it is unlikely to result in their death in shallower areas (<12 metres) where the seagrass is dense and robust. There may be small areas of mortality, however, in the deeper water (12–14 metres) where the seagrass is naturally sparse and stunted due to lack of ambient light. Moreover, as both *Posidonia* and *Amphibolis* are relatively large species with few epiphytes to weigh them down, a significant proportion of their leaves would remain above the deposited sediment and therefore able to continue photosynthesis despite partial burial. Both species also have large carbohydrate reserves that should sustain them for relatively long periods (i.e. up to one to two months) of reduced light when sediments may coat their leaves during periods of little water movement.

Sediment deposition is likely to result in reduced recruitment of macroalgae within several hundred metres of the dredge footprint through alteration of the substrate on which spores settle. However, this effect would probably be restricted to a single year of recruitment due to the relatively small depth of sedimentation (i.e. generally less than 10 mm except within 240 metres of the dredge footprint), and the probable rapid dispersion of sediment during winter storms.

The dominant macroalgae are *Cystophora* spp., which were found to be less susceptible to impact than other canopy-forming species during dredging at Port Stanvac (Cheshire & Miller 1999; and Turner 2004). Some *Cystophora* species, however, have some life history characteristics (slow growth, long lifespan) that may increase their vulnerability to the effects of dredging. The understorey species *Lobophora* variegata is an opportunistic species that would be expected to recolonise quickly if impacted by the dredging. Recovery of macro-algae communities is likely to occur within one to two years.

Sediment deposition may interfere with the feeding and breathing organs of filter-feeding invertebrates such as the solitary ascidian *Polycarpa viridis* and the scallop *Mimachlamys asperrimus* (Turner et al. 2006). Sessile organisms such as *P. viridis* may be more sensitive to sediment effects as they are unable to reorient themselves to mitigate sediment accumulation. Sediment deposition is also likely to affect larval settlement of broadcast spawners such as the gastropod *Phasianella australis*. The impacts on invertebrates, however, would probably be relatively minor based on the scale of the dredging operation, and the level of sediment deposition likely to occur in the vicinity of the dredging area (i.e. less than 10 mm in total beyond 240 metres of the dredge footprint, and less than 1 mm beyond 5 km).

On completion of the dredging program, deposited sediment would be gradually dispersed by re-suspension during storms and entrainment by tidal currents, a process that is likely to be completed within a year.

Turbidity

Increased water turbidity would inevitably occur during dredging operations, including dewatering of the dredge spoil, and construction of the causeway. It may also potentially occur as a result of silt-laden stormwater runoff from the onshore site entering Smith Bay, unless adequate management measures are in place. Note that such runoff probably occurs to some extent already, due to the substantially degraded nature of parts of the site and the lack of any stormwater management measures.

Increased turbidity is likely to adversely affect the productivity and health of local seagrass and macro-algae communities as less light would be available for photosynthesis. The effects are likely to be greater in water deeper than 10 metres, where seagrass communities may already be under some stress due to lack of light. The reduction in light due to turbidity has been identified as a major cause of seagrass loss (Shepherd et al. 1989).

Several studies have provided light thresholds for adverse effects on seagrasses:

- shading *Posidonia sinuosa* in Western Australia to 2–24 per cent of surface irradiance (unshaded at 29 per cent) for 198 days resulted in adverse health effects with increased shading level and time, with minimal recovery after 400 days and a recovery time of 3.5–5 years (Collier et al. 2009)
- shading *Posidonia sinuosa* off Adelaide resulted in a loss of leaves over the first six months, followed by community decline (Neverauskas 1988)
- shading *Posidonia sinuosa* in Western Australia to zero to 10 per cent of surface irradiance for 148 days resulted in reduced shoot density, primary production and leaf production per shoot, with no recovery after 245 days (Gordon et al. 1994)
- *Posidonia sinuosa* has relatively high light requirements (seven to 24 per cent of surface irradiance) compared with *Posidonia coriacea* (7–8 per cent) (Short et al. 2017)
- shading *Amphibolis griffithii* in Western Australia for three months resulted in biomass losses of up to 72 per cent, but recovery occurred during the following 10 months. However, six to nine months of shading resulted in seagrass loss with no recovery after two years (McMahon et al. 2011)
- *Zostera nigricaulis* appears to have a relatively low minimum light requirement of only 2–9 per cent of surface irradiance (Duarte 1991; Bulthuis 1983; Campbell et al. 2003).

There is no evidence in the literature above to suggest that macroalgae are sensitive to a reduction in light availability through turbidity effects.

Hydrodynamic modelling of the sediment plume created during dredging has shown that the median increase in turbidity exceeding 2 mg/L above ambient is restricted to within 220 metres of the dredging footprint, and exceeding 1 mg/L within 2400 metres (see Chapter 9 – Marine Water Quality and Appendix F2). Although this would result in regular exceedances of the ANZECC/ARMCANZ (2000) water quality guidelines for turbidity, it also occurs more than half the time during natural conditions.

Impacts arising from increased turbidity are most likely to occur when the light available to benthic communities is reduced below ambient conditions for extended periods. The modelling of benthic photosynthetically active radiation (PAR) revealed that PAR under ambient conditions ranged from:

- 8–18 per cent surface irradiance over dense seagrass and macro-algae communities at 6 metres depth
- 3–10 per cent over dense seagrass communities at 10 metres depth
- 3–8 per cent over sparse seagrass communities at 14 metres depth.

It can therefore be inferred that a drop in PAR to below 10 per cent could result in a reduction of seagrass vigour. Modelling presented in Appendix F2 of the 30-day average benthic PAR shows that only a small proportion of seagrass within Smith Bay would be likely to undergo such a reduction in PAR.

Moreover, due to the tidally-influenced currents operating in Smith Bay, periods of increased turbidity due to marine construction activity would tend to be episodic, rather than sustained. The effects of light reduction would therefore be mitigated to some degree by the intermittent nature of the effect, with the sediment plume moving east and west of the site in response to ebbing and flooding tides, the none-continuous nature of the dredging program (due to adverse weather effects), and the relatively short duration of the dredging program (30–75 days). Furthermore, the *Posidonia* and *Amphibolis* seagrasses communities of Smith Bay are healthy and are therefore likely to have sufficient energy reserves to cope with episodes of reduced light during the dredging period.

It is concluded that turbidity effects associated with the dredging program are likely to have temporary minor impacts on seagrass communities within Smith Bay.

Mobilisation of sediments by ships

Ship berthing and departure operations would inevitably result in some degree of sediment mobilisation in Smith Bay, which could adversely affect adjacent benthic communities, including seagrasses, through increased turbidity and sediment fallout. Although the potential effects would be similar to those described above for dredging operations, hydrodynamic modelling has shown that the size of the impact is likely to be at least two orders of magnitude less (i.e. 100 times less) (see Chapter 9 – Marine Water Quality, Section 9.5.8).

The modelling demonstrates that potentially ecologically significant turbidity effects would not occur. Maximum turbidity increases of up to 10 NTU would occur, but would be confined to the immediately vicinity of the wharf. Turbidity increases at the 95th percentile are less than 1 mg/L at all locations (i.e. only exceeded five per cent of the time (see Chapter 9 – Marine Water Quality, Section 9.5.8 and Appendices F2 and F3).

With only approximately two shipping movements a month at Smith Bay at most, it is considered that the turbidity plumes would be insignificant in the context of natural variation. Tidal flows would quickly disperse the plumes, probably within an hour of the shipping movement. Sediment deposition associated with the plumes would be negligible.

It is concluded that the impact of turbidity and sediment deposition on the benthic communities in Smith Bay associated with shipping movements would be negligible.

Stormwater runoff

It is unlikely that silt discharges from the onshore construction and operational sites would contribute to turbidity in Smith Bay as the adoption of standard stormwater control practices would ensure that runoff was controlled and retained onshore, except during extreme storms when a 1-in-10-year rain event is exceeded. There are currently no significant stormwater detention measures in place on the development site or at any point along Smith Bay.

Release of contaminants from sediments

Dredging can potentially release dissolved naturally occurring and/or anthropogenic contaminants from sediments into the water column. These may include:

- sediments with high biological and/or chemical oxygen demand (BOD and COD) resulting in reduced dissolved oxygen concentrations in the water column, which can result in the death of fish and other marine biota
- nutrients that can adversely affect seagrass communities
- inorganic and organic chemicals such as heavy metals and pesticides.

The sediments at Smith Bay were screened and assessed using an approach and methods consistent with the National Assessment Guidelines for Dredging (DEWHA 2009, see Appendix F1). Sediment cores were analysed for the following parameters:

- the National Environment Protection Measures (Assessment of Site Contamination) (ASC NEPM) suite of contaminant metals
- total organic carbon (TOC)
- sulphates and sulphides
- pH (acidity)
- nutrients.

The results revealed that none of the ASC NEPM trigger values were exceeded (see Appendix F1). Consequently, it is concluded that there is no evidence to suggest that the release of chemical contaminants from the sediments during dredging or shipping movements would adversely affect the local benthic communities.

Seabed erosion

Dredging has the potential to destabilise the sea floor by initiating erosion where the dredged area meets seagrass meadows. Wave action at these edges can undercut seagrasses by eroding sediment from the root zone, which results in the plants breaking off and being carried away.

At the depths where dredging would occur in Smith Bay (11–13.5 metres), it is unlikely that wave energy on the seafloor would be sufficient to undercut seagrass and cause erosion. Seabed erosion and ongoing seagrass loss through erosion is therefore considered unlikely to occur.

Management and mitigation measures

The loss of approximately 7.5 ha of seagrass during construction through both direct removal and indirect effects would need to be offset as all native vegetation in South Australia (including seagrass) is protected under the provisions of the *Native Vegetation Act 1991*. Clearance of native vegetation is prohibited unless approved by the Native

Vegetation Council (NVC). In most circumstances the NVC would approve the clearance of a small amount of vegetation subject to an acceptable management plan that describes a significant environmental benefit (SEB) to offset the loss.

KIPT proposes to offset the seagrass loss by making an appropriate financial contribution to a Natural Resources Kangaroo Island extension program, which would aim to arrest the existing substantial seagrass decline in Western Cove and promote the regeneration of seagrass beds by optimising fertiliser use in the Cygnet River catchment, and reducing nutrient inputs to Western Cove. The financial contribution would be paid to the Native Vegetation Council, and Natural Resources Kangaroo Island would apply for the funds.

A strict program of measures would be adopted to mitigate the potential impact of dredging on adjacent marine communities. These would relate to the type of dredge and its mode and rate of operation, and turbidity limits. Management measures defined in the Construction Environmental Management Plan (CEMP) and Operational Environmental Management Plan (OEMP) are likely to include:

- setting a maximum daily dredging rate of 2600 cubic metres per day (Cheshire & Miller 1999)
- setting turbidity limits in terms of maximum allowable exceedance (in percentage terms) above the best estimates of natural ambient turbidity
- closely monitoring turbidity levels during dredging to ensure that limits are not being exceeded at key prescribed locations in Smith Bay
- triggering a management response if such levels are exceeded (e.g. a temporary halt or modification of dredging or disposal works or further restrictions on dredging rates and/or methods).

Management measures would be taken to mitigate potential turbidity impacts associated with the dewatering of dredge spoil and the return of seawater to Smith Bay. These would include:

- pumping the dredge spoil to a series of onshore settling dams of sufficient size and design to enable dewatering according to the EPA (2010) guidelines
- retaining supernatant seawater for sufficient time and treating it to bring suspended solids and potential dissolved pollutants below guideline concentrations at the point where the water is discharged to Smith Bay.

Measures would be taken to mitigate the potential turbidity impacts associated with stormwater runoff from the construction site entering Smith Bay. Best practice construction techniques on land would be adopted to prevent silt from being discharged to Smith Bay from the site during rain storms. These would include the use of silt fences where appropriate, and establishing a suitably sized stormwater retention basin where first-flush runoff would be stored to remove sediment before discharge. The basis of design for the stormwater retention pond is described in Chapter 4 – Project Description.

The basin would be retained after completion of construction to control stormwater and sediment discharge during the operational life of the facility.

Environmental management plans, including a Dredging Management Plan (DMP), CEMP and OEMP would be produced in consultation with government regulators before construction began. The DMP would prescribe environmental management and monitoring procedures that would be adopted during dredging operations. The CEMP and OEMP would prescribe the measures that would be adopted to control and minimise silt runoff from the site during construction and operation of the facility.

Residual risk

With implementation of the above management and mitigation measures, the residual risk to seagrass and other benthic communities would be low (see Chapter 25 – Management of Hazard and Risk, and Appendix T).

12.5.5 OTHER SPECIES AND COMMUNITIES

The construction of the causeway would result in the loss of about 0.1–0.2 ha of rocky intertidal habitat supporting mainly molluscs, including *Nerita*, *Bembicium* and *Austrocochlea*, the polychaete Galeolaria, and cructaceans including the barnacles Chthamalus, and the crabs *Leptograpsus variegatus* and *Ozius truncates*, all of which are very common on a local and regional scale. The loss would be of negligible ecological consequence.

Mobile species such as fish, crustaceans and cephalopods are likely to be disturbed by construction noise and move away from the immediate vicinity of the construction site. Impacts would be negligible, however, as there is a large amount of similar habitat both east and west of Smith Bay. Populations of these species would invariably return to the development site after construction ceases.

Smith Bay is not known to provide breeding or nursery habitat for any commercially or recreationally important marine species, or species of conservation significance. Consequently, no adverse effects to the breeding or nursery habitats are expected to occur.

12.5.6 UNDERWATER NOISE AND VIBRATION

Construction and operational noise at Smith Bay may potentially have physical or behavioural impacts on marine fauna, many of which rely on hearing for communication, navigation and detection of predators and prey.

TABLE 12-4 DISTANCES AT WHICH NOISE MAY IMPACT MARINE FAUNA

	Organ damage	Permanent hearing damage	Temporary hearing damage
Whales	–	900 m (piling)	6.5 km (piling) 10 m (vessels)
Seals/Sea lions	–	–	110 m (piling) 25 m (dredging)
Great white shark	6 m (piling)	6 m (piling)	680 m (piling) 100 m (dredging/vessels)
Turtles	20 m (piling)	100 m (piling)	100 m (piling) 100 m (dredging/vessels)

A modelling-based assessment of the effect of underwater noise and vibration on marine fauna at Smith Bay is provided in Chapter 18 – Noise and Light, and Appendix N1, and summarised below. The assessment focussed on the effects of noise and vibration associated with pile driving, dredging and shipping. A summary of the results of the marine noise modelling is in Table 12-4.

Without mitigation, the overall risk of adverse noise effects on the relevant marine species was found to be low, with the exception of a medium level of risk associated with impact piling potentially resulting in permanent hearing damage to southern right whales within 900 metres of the piling, and temporary hearing damage within 6.5 km of piling.

Damage to the hearing of marine fauna is considered to be unlikely as the normal behavioural response to loud noise would be to move away. Behavioural changes in response to noise, including vessel noise, are expected to be temporary and ecologically inconsequential as Smith Bay is not known to provide important feeding or breeding habitat for any species likely to be affected by construction or operational noise.

Management measures and residual risks

The following management and mitigation measures would be adopted to mitigate the impact of pile driving on marine fauna (DPTI 2012):

- using a 'soft start' in which the piling impact energy would be gradually increased over 10 minutes to deter fauna from remaining close enough to risk injury after operations reached normal levels
- establishing a 1 km shut-down zone around the site, equivalent to the most conservative distance threshold to prevent permanent hearing damage
- monitoring of this zone, with an additional buffer area, by marine mammal observers, perhaps complemented by acoustic equipment to detect mammals. Pile driving would stop if a marine mammal was sighted in the zone
- no pile driving at night, when it might be difficult to detect marine fauna.

With the implementation of the above management measures, the residual risk associated with underwater noise would be low (see Chapter 18 – Noise and Light and Chapter 25 – Management of Hazard and Risk).

12.5.7 MARINE PESTS AND DISEASES

A potential risk associated with the construction and operation of the Smith Bay seaport is the introduction of marine pests and diseases via shipping from overseas and mainland Australian ports to Smith Bay via the marine disposal of ship ballast water, and as biofouling (encrusting organisms) on ship hulls.

A detailed assessment of the biosecurity risks and measures to manage risks is provided in Chapter 15 – Biosecurity and Appendix I5, and summarised below.

Although more than 250 introduced marine species have been recorded in Australia, and 20 species on Kangaroo Island (Wiltshire et al. 2010), none have been recorded near Smith Bay.

Species of particular concern include the European fan worm (*Sabella spallanzanii*) and the vase tunicate (*Ciona intestinalis*) that are already established in Kangaroo Island waters, and the aquarium weed (*Caulerpa taxifolia*) and the European green shore crab (*Carcinus maenas*) that have become established elsewhere in South Australia. The two most significant abalone diseases relevant to Smith Bay are abalone viral ganglioneuritis (AVG), and the parasite *Perkinsus* (see Appendix I5).

In light of growing concerns about the significance of the problem of marine pests and diseases, there have been numerous recent national and state statutory and policy developments in relation to their control, the most important of which are:

- Chapter 5 of the Commonwealth *Biosecurity Act 2015* which adopts the *International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004*

- Australian Ballast Water Management Requirements, Version 7 (DAWR 2017)
- National Biofouling Management Guidelines for Commercial Vessels (Australian Government 2009)
- EPA – Code of Practice for Vessel and Facility Management (Marine and Inland Waters) (Ballantine 2017)
- Kangaroo Island Natural Resources Management Board's Biosecurity Strategy for Kangaroo Island (KINRM Board 2017).

Management measures and residual risk

All vessels using the wharf would be required to comply with the most recent State and Commonwealth legislation, policies and guidelines relevant to the management of biofouling and ballast water disposal.

DAWR and Biosecurity SA would be consulted to determine the most appropriate operating procedures to ensure compliance by shipping with all relevant biosecurity policies and guidelines.

Detailed CEMP and OEMP would be produced before construction began. They would include or adopt the marine pest management plan produced in consultation with DAWR, Biosecurity SA and the Biosecurity Advisory Committee of the Kangaroo Island Natural Resources Management Board.

Specific measures (to be explained in detail in the CEMP and OEMP) that would reduce the risk of marine pests being introduced to Smith Bay include the following:

- the pontoon (purchased in Korea) would be sandblasted and repainted with anti-fouling paint before arrival at Smith Bay. The paint used will comply with the antifoulant provisions of the Environment Protection (Water Quality) Policy 2015
- a small number of known log and woodchip vessels – rather than unknown ships contracted on the spot market – would be used exclusively to transport logs and woodchips to north Asia
- vessels would normally be ballasted when arriving at Smith Bay, but the ballast water would have been sourced from the high seas before arrival, complying with the Commonwealth Biosecurity Act.

It is considered that compliance with the biosecurity standards and operating practices prescribed by the Commonwealth Department of Agriculture and Water Resources (DAWR) under the Biosecurity Act and adoption of measures required by Biosecurity SA to manage shipping at Smith Bay, will reduce to an acceptable level the risk of introducing marine pests and/or diseases to Smith Bay. The residual risk of introducing marine pests and/or diseases to Smith Bay would be low (see Chapters 15 and 25).

12.5.8 DUST DEPOSITION

As discussed in Chapter 17 – Air Quality, dust deposition during construction and operations would result in a 15 to 20% increase over background several hundred metres from the facility. Effects on the marine ecology of Smith Bay would be negligible for the following reasons:

- the contribution to turbidity (and TSS) in Smith Bay would be extremely small compared with resuspension of sediments by wave action and tidal currents
- the additional dust would be rapidly dispersed by tidal currents
- with the predicted increase in TSS as a result of ongoing dust deposition within the Yumbah facility being around 0.03 mg/L, it can be assumed that the increase within Smith Bay would be at least a factor of 1000 times less due to the much greater volume of water in Smith Bay (see Chapter 11 – Land-Based Aquaculture)
- ecotoxicology studies showed that 24 hours of exposure of juvenile greenlip abalone to 35 mg/L of wood dust had no detectable effect on the abalone. This concentration of wood dust would be at least 1000 times more than the biota in Smith Bay would be exposed to.

It is concluded that additional dust deposition would have no effect on the ecology of Smith Bay.

12.5.9 PROVISION OF ARTIFICIAL REEF

Construction of the causeway, piles, mooring dolphins and pontoon retaining structures would form additional reef habitat that would be colonised by a diversity of reef fish, including snapper, blue groper and harlequin fish, and may result in a more diverse and abundant reef community than currently exists in Smith Bay.

12.5.10 MARINE PARKS

Vessels associated with the Kangaroo Island Seaport would traverse the General Use Zone of the Encounter Marine Park, the nearest section of which is 20 km east of Smith Bay. The annual number of vessel calls associated with the Smith Bay port is not expected to exceed 20, which would comprise a negligible (one per cent) increase in the number of vessels traversing the Encounter Marine Park.

The only conceivable issue associated with vessels traversing the Marine Park is considered to be the risk of collisions with southern right whales. As discussed in Section 12.5.2. KIPT vessels would pose negligible risk to the southern right whale population.

Issues associated with ballast water disposal are addressed in Chapter 15 – Biosecurity. Issues associated with unplanned events, such as oil spills, would be addressed in the

Emergency Response Management Plan, which would be prepared during secondary permitting, should the project be approved.

12.5.11 CUMULATIVE IMPACTS

Although some of the impacts on marine communities during construction would occur concurrently, cumulative impacts are likely to be insignificant as the individual impacts are expected to be of relatively minor consequence ecologically, and upon completion of construction, the Smith Bay ecosystem would quickly return to pre-construction conditions. The exceptions would be the dredge footprint that would be colonised by benthic invertebrates rather than seagrass, and the rock causeway that would be colonised by reef species.

During operations, individual and cumulative impacts on marine communities would be negligible.

12.6 CONCLUSIONS

The following conclusions have been drawn from the assessment.

Effects on listed species:

Forty-eight listed threatened species, listed migratory species and listed marine species potentially occur in the study area

Of these, 22 have been recorded around Kangaroo Island only on rare occasions, none is considered to have limited habitat along the north coast of Kangaroo Island, and 22 are highly mobile and would therefore be able to move from an area of impact to adjacent unaffected habitat

It is considered that none of these species is at credible risk from the proposed development

The one possible exception is the marine-listed ring-backed pipefish (*Stipecampus cristatus*), which was found at the development site in *Posidonia* seagrass at a depth of about 11 metres during the marine survey. There is therefore a credible risk of individuals being impacted during dredging

There is, however, an abundance of similar *Posidonia* habitat in Smith Bay, Emu Bay and other bays along the north coast that would be expected to support a similar density of pipefish. It should also be noted that pipefish are not listed as rare

The loss of a very small amount of pipefish habitat and potentially some pipefish during construction would have a negligible effect on their overall population in the Smith Bay area.

Direct seagrass loss:

The construction of a causeway and the dredging of the berthing pocket and approaches would result in the direct loss of about 10 ha of mixed habitat, including the seagrasses *Posidonia sinuosa*, *Amphibolis antarctica* and *A. griffithii*, and associated invertebrate communities.

The ecological significance of the loss of this habitat, and in particular the seagrass communities, would be minor as there is a vast amount of similar habitat within Smith Bay, at Emu Bay and elsewhere along the north coast.

Seagrass loss during construction would be offset by providing financial support to an extension program to optimise fertiliser use in the Cygnet River catchment, whose primary goal would be to encourage the recovery of seagrass in Western Cove by reducing nutrient inputs.

Secondary seagrass loss via turbidity effects and sedimentation:

- Secondary impacts on seagrass communities adjacent to the development site are likely to result from increased turbidity and sedimentation during dredging.
- Although the health of seagrass within several hundred metres of the dredge footprint may be compromised to some degree by turbidity and sedimentation effects during construction, recovery is likely to rapid after construction is completed.
- Sediment plumes generated by propwash would have a negligible effect on seagrass and other benthic communities as they would be infrequent, of short duration, of relatively low intensity and of limited extent.

Noise and vibration:

- Damage to the hearing of marine fauna is considered to be unlikely as the normal behavioural response to loud noise would be to move away.
- Behavioural changes in response to noise, including vessel noise, are expected to be temporary and ecologically inconsequential as Smith Bay is not known to provide important feeding or breeding habitat for any species likely to be affected by construction or operational noise.
- With the adoption of standard mitigation measures such as 'soft starts' when piling, and shutting-down piling should a whale be sighted within 1 km of the construction site, impacts from underwater noise are likely to be minimal.

Biosecurity:

- All vessels using the wharf would be required to comply with the most recent state and Commonwealth policies and guidelines relevant to the management of biofouling and ballast water disposal.
- Biosecurity SA would be consulted to determine the most appropriate operating procedures to ensure compliance by shipping with all relevant biosecurity policies and guidelines.
- It is considered that the risk of introducing marine pests and/or diseases to Smith Bay could be reduced to an acceptable level to the regulator by adopting the most rigorous biosecurity standards prescribed by Biosecurity SA.

13. TERRESTRIAL ECOLOGY

Guideline		Comment
1.4	Describe the scope, timing/effort (survey season/s) and methodology for studies or surveys used to provide information on the above listed species/communities/habitat at the site (and in areas that may be impacted by the proposal). Include details of: - best practice survey guidelines applied; and - how they are consistent with (or a justification for divergence from) published Australian Government guidelines and policy statements	See Sections 12.3, 13.3 and 14.2
9	The proposed site is in an area that is mostly cleared of native vegetation, however patches of vegetation remain, and although fragmented these may provide critical habitat for fauna. Investigation into vegetation on surrounding properties and within the adjacent marine environment should also be undertaken to determine if the proposed development and associated activities will impact upon these habitat areas and the species, including migratory species, that may be reliant upon them.	
9.1	Quantify and detail the extent, condition and significance of native vegetation (individual species and communities) that currently exist on site, and within the immediately adjacent sites.	See Section 13.4.1
9.2	Provide details of any existing Heritage Agreements, if any, to conserve native vegetation on and/or adjacent to the site.	See Section 13.2
9.3	Quantify and detail the extent, condition and significance of native vegetation (individual species and communities) that may need to be cleared or disturbed during construction and the ability of communities or individual species to recover, regenerate or be rehabilitated.	See Section 13.5.1
9.4	Describe measures to deliver any significant environmental benefit that is required by the *Native Vegetation Act 1991*. Identify measures to minimise and mitigate vegetation clearance, including incorporating any remnant stands in the layout design, and to compensate for any loss of native vegetation and habitat.	See Sections 13.5.2 and 13.6.3
9.5	Identify impact avoidance, minimisation and mitigation measures and detail their effectiveness.	See Section 13.5.2
9.6	Describe the use of amenity/landscape plantings and potential broad scale revegetation, including the opportunities for the use of locally endemic species.	See Section 13.5.2 and Appendix J1
9.7	Quantify and detail the extent, condition and significance of native fauna (individual species and communities) that currently exist on site, and within the immediately adjacent sites, including the coastal and marine environment.	See Section 13.4.2

Guideline		Comment
9.8	Quantify and detail the extent, condition and significance of potential native fauna habitat loss or disturbance during the construction and operation phases (both on and around the site) and the ability of communities and individual species to recover, especially for resident or migratory shore birds and threatened or significant species (including those listed under the EPBC Act and the South Australian *National Parks and Wildlife Act 1972*).	See Chapter 14 and Section 13.5.3
9.9	Describe the measures that will be taken to address displaced native fauna (if any).	See Chapter 14, Sections 12.5.2 and 12.5.3
9.10	Detail the potential impact, including cumulative impacts, on marine fauna, both during construction and operation, including ecologically and economically important species (e.g. fisheries) .	See Chapter 12 – Marine Ecology
9.11	Detail appropriate buffer distances that would be required between the proposed development and threatened species, including feeding areas, nesting sites and roosting sites.	See Section 13.5.3
9.12	Identify all potential sources of noise emissions, vibration and light pollution from the construction and operation of the proposed development. Describe their impacts on native fauna, including nocturnal species, and how these impacts will be managed.	See Chapter 18, Sections 12.5.5, 13.5.3, 13.6.2 and Appendix N
9.13	Identify impact avoidance, minimisation and mitigation measures and detail their effectiveness.	See Sections 13.5.3 and 13.6
18.4	Describe the use of amenity/landscape plantings and potential broad scale revegetation, including the opportunities for the use of locally endemic species.	See Section 13.5.2

13. TERRESTRIAL ECOLOGY

13.1 INTRODUCTION

This chapter addresses Guideline 9 (terrestrial aspects), which stipulates that the EIS should provide information on native vegetation and fauna and how the proposed development will impact these species and their habitat.

Terrestrial ecology is the study of land-based organisms and how they interact with each other and the environment. This chapter addresses impacts from the proposal on terrestrial flora and fauna and impacts on the marine flora and fauna are addressed in Chapter 12 – Marine Ecology. Biosecurity risks from sea transport and importation of construction equipment and materials are addressed in Chapter 15 – Biosecurity.

EBS Ecology undertook an ecological assessment of the terrestrial environment of the proposal site, including flora and fauna, in August 2016 and February 2018 (see Appendix J2). The following sections present information drawn from this report, unless otherwise indicated.

The objectives of this study were to determine which terrestrial species are likely to inhabit the study area and the immediately adjacent area. This information would help develop mitigation measures to avoid creating unacceptable risks to those species.

Activities undertaken as part of this investigation included:

- database searches to identify threatened species that might inhabit the study area
- research into whether these threatened species might potentially occur in the area
- a review of relevant literature and existing spatial data
- an on-ground terrestrial flora and fauna survey, which included recording vegetation associations and scattered trees, flora species, vegetation condition and location of threatened flora species; identifying areas of weed infestations; recording fauna species observed and potential habitat for fauna; and determining which areas should be avoided
- identifying and searching for species of national, state or local conservation significance identified or likely to occur within the area and determining possible impacts of the proposal on these species
- producing a technical report, presenting the results of background research and the field survey including vegetation descriptions; potential impacts on native vegetation; a summary of flora and fauna species identified or likely to occur in the area (including pest plants and animals); and descriptions of species and environmental areas of significance.

13.2 REGIONAL SETTING

Smith Bay is located on the north coast of Kangaroo Island, about 20 km west of Kingscote, between Emu Bay and Cape Cassini. The study area lies within the Kangaroo Island Natural Resources Management (NRM) Board Region (see Figure 13-1).

The parks or reserves nearest to Smith Bay are:

- Lathami Conservation Park, approximately 20 km west
- Parndana Conservation Park, approximately 20 km south-west
- Busby Islet Conservation Park, approximately 17 km east
- Cygnet Estuary Conservation Park, approximately 16 km south-east.

There is also one property under a Heritage Agreement (HA864) approximately 2.5 km south-west of the study area. There are no Heritage Agreements within the study area, and no protected areas or wetlands of national significance within or close to the area.

Interim Biogeographic Regionalisation for Australia (IBRA) is a landscape-based approach to classifying the land surface across a range of environmental attributes to assess and plan for the protection of biodiversity. The study area falls within the Kanmantoo IBRA bioregion and Kangaroo Island IBRA sub-region and Stokes Bay IBRA Environmental Association (see Figure 13-2, DEWNR 2011).

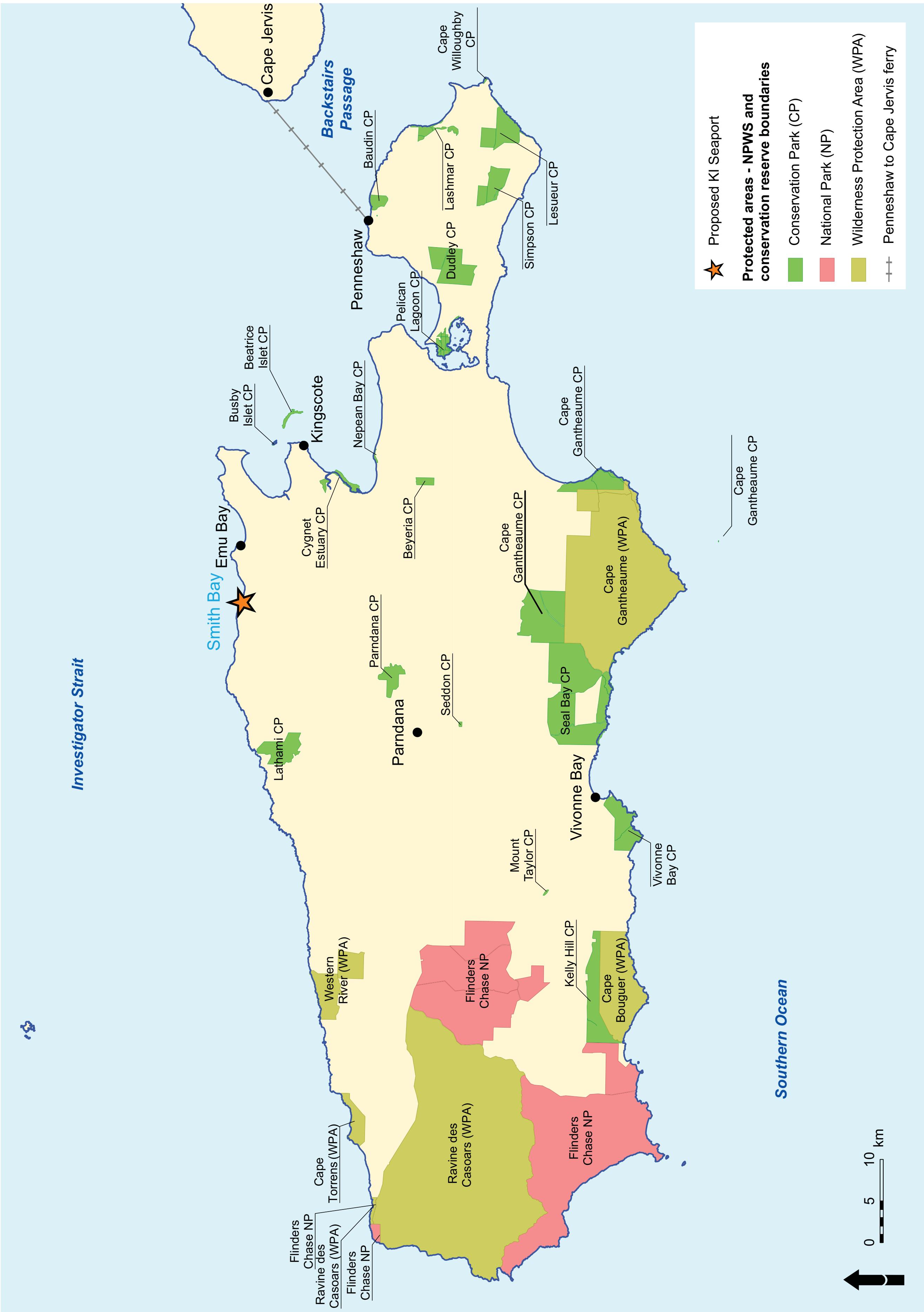


FIGURE 13-1 PARKS AND RESERVES

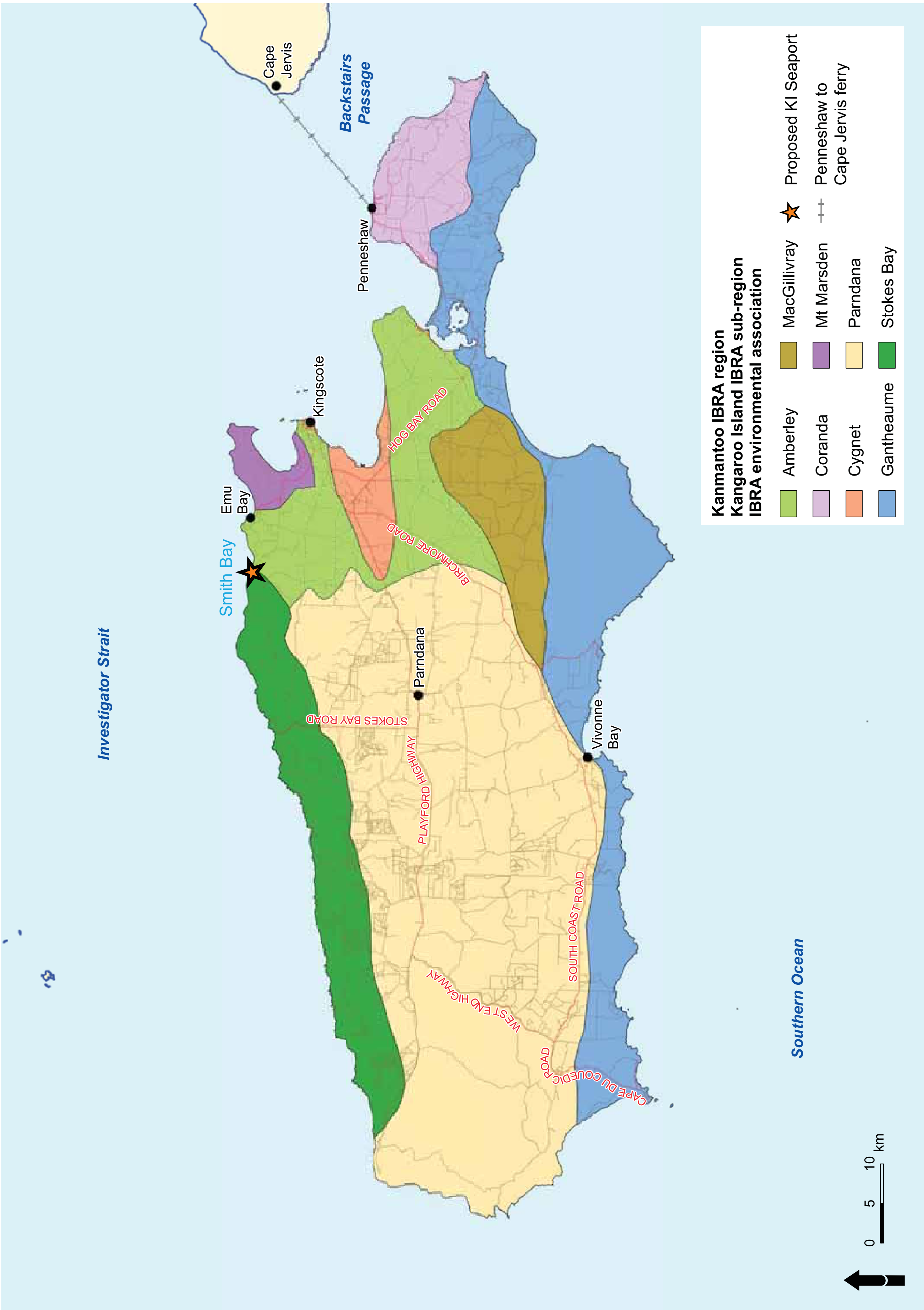


FIGURE 13-2 REGIONAL ENVIRONMENTAL ASSOCIATIONS

Kangaroo Island vegetation generally comprises mallee heath and scrublands. Stokes Bay IBRA Environmental Association is described as low open forest or open scrub of brown stringybark, cup gum and coastal mallee, open scrub of cup gum and broombrush and open heath of coast daisy bush and coastal bearded heath. Approximately 54 per cent (22,949 ha) of the Stokes Bay IBRA Environmental Association is mapped as remnant native vegetation, of which 44 per cent (10,167 ha) is formally conserved (DEWNR 2011).

Kangaroo Island is notable for the absence of European rabbits (*Oryctolagus cuniculus*) and red foxes (*Vulpes vulpes*) (KINRMB 2009). Introduced species such as koalas, goats, pigs, deer, house mice, black rats and feral cats pose problems for biodiversity conservation and agricultural production (NRKI 2015; KINRMB 2017). The Commonwealth Department of the Environment and Energy declared Kangaroo Island free from feral goats and the effective eradication of feral deer from the Island has also been achieved (Press statement by The Hon. Melissa Price MP, then Assistant Minister for the Environment and Energy 2018). Natural Resources KI and the Kangaroo Island Council plan to eradicate feral cats on the Island in a 15-year project and phase out domestic cats by 2030 (NRKI 2015).

13.3 ASSESSMENT METHODS

13.3.1 DATABASE SEARCHES

Existing spatial datasets, relevant literature, aerial imagery and any relevant survey information reviewed included:

- a Protected Matters Report generated on 3 April 2018 using a 10 km buffer zone to identify matters of national environmental significance, as listed under the EPBC Act (DoEE 2018)
- a Biological Databases of South Australia (BDSA) search obtained from DEWNR on 8 August 2016 to identify flora and fauna species previously recorded within and around the study area (BDSA 2016).

This information was used to build a picture of:

- native vegetation cover within the study area and immediate surrounds
- previous surveys of the area
- vegetation associations present (including associations of significance) and their condition
- flora and fauna species present (including species of national or state conservation significance known of or likely to occur in the area).

Any threatened species previously recorded within the area, or highlighted as potentially occurring there, were researched, if necessary, to determine whether suitable habitat for these species existed.

13.3.2 FIELD SURVEYS

EBS Ecology carried out a field survey of the study area on 17 August 2016, in late winter. An additional field survey on 15 February 2018, in late summer, covered the vegetation south of the study area.

Field survey 2016

The assessment was undertaken by an accredited consultant (EBS Ecology) endorsed by the South Australian Native Vegetation Council (NVC). The flora survey methodology was adopted from the Guide to the Roadside Vegetation Survey Methodology for South Australia (Stokes et al. 2006). Native vegetation was assessed under the *Native Vegetation Act 1991* for any potential clearance of such vegetation, unless it was covered by a specific exemption contained with the Native Vegetation Regulations 2003.

The Kangaroo Island narrow-leaved mallee (*Eucalyptus cneorifolia*) woodland is a nationally protected threatened ecological community (TEC) and was assessed using the criteria provided in the Kangaroo Island narrow-leaved mallee (*Eucalyptus cnerifolia*) woodland: a nationally protected ecological community guideline (DoE 2014).

The study area was traversed on foot. The vegetation communities and flora species were recorded with reference to Table 13-2.

The following information was recorded for the study area:

- flora species (identification to species level where possible)
- identification of vegetation communities
- location and coverage (metres or hectares) of each vegetation association using hand-held GPS
- photographs of each vegetation association.

The adopted methodology for the field survey (fauna) focused on identifying potential fauna habitat and then recording any fauna observed in that particular habitat type. Birds were opportunistically recorded and identified using The New Atlas of Australian Birds (Barrett et al. 2003).

No dedicated fauna surveys, such as trapping, or night-time surveys were conducted due to the degraded nature of the site and dominance of weed species. All location data were recorded using a hand-held GPS.

The following activities were undertaken during the fauna survey:

- mapping of a general search of each vegetation association
- recording of numbers of individual fauna species observed opportunistically
- recording of activity (including signs of fauna) and location of the individual fauna species, observed opportunistically.

Field survey 2018

The assessment was undertaken by an accredited consultant (EBS Ecology) endorsed by the South Australian NVC. Changes to the methodology to assess native vegetation for clearance under *Native Vegetation Act 1991* came into effect 1 July 2017. The field survey in 2018 was therefore conducted using methodology from the Native Vegetation Council (NVC) Bushland Assessment Manual (Government of SA 2017).

The Manual uses biodiversity 'surrogates' or 'indicators' to measure biodiversity value against benchmark communities. Each area to be assessed is termed an application area ('Block'), within which different vegetation associations ('sites') are identified and compared to the Nature Conservation Society of South Australia's 'benchmark' vegetation communities. A representative one hectare quadrat is surveyed for each site.

Three components (vegetation condition, conservation value and landscape context) of the biodiversity value of the site are measured and scored (Table 13-1). These three component scores are then combined to produce a Unit Biodiversity Score per hectare, which is then multiplied by the size of the site in hectares to provide a Total Biodiversity Score for the site. This score is then used to calculate an SEB area and value for payment into the Native Vegetation Fund if the vegetation is subject to clearance (Government of SA 2017).

This methodology can also be used to assess vegetation for biodiversity value.

13.3.3 SEB/OFFSET CALCULATIONS

Each vegetation community was assigned a significant environmental benefit (SEB) condition rating (see Table 13-8 and Appendix J2). The SEB requirement for remnant vegetation clearance was calculated based on the NVC document Guidelines for a Native Vegetation Significant Environmental Benefit Policy for the clearance of native vegetation associated with the minerals and petroleum industry (DWLBC 2005).

13.4 EXISTING ENVIRONMENT

13.4.1 VEGETATION OF THE STUDY AREA

The study area was cleared almost entirely of native vegetation for previous agricultural and industrial use, and now supports limited native flora and fauna. Only small remnant patches of native vegetation – mainly coastal mallee (*Eucalyptus diversifolia*) and common boobialla (*Myoporum insulare*) – remain on the dunes along the foreshore. Most of the area is now exotic grassland/herbland.

The intertidal beach area of Smith Bay consists almost entirely of red to orange sandstone and basalt cobbles and boulders that have been weathered and rounded by wave action (see Plate 13-1 and Plate 13-2 see Section 10.4.1 for further detail).

TABLE 13-1 COMPONENTS OF THE BIODIVERSITY VALUE OF A SITE THAT ARE MEASURED USING THE BUSHLAND ASSESSMENT METHODOLOGY

Parameter	Data recorded
Vegetation condition	• native species diversity • number of native lifeforms and their cover • number of regenerating species • weed cover and the level of invasiveness of dominant species • cover of bare ground, fallen timber and exotic species in the understorey • tree health and the number of individual trees supporting hollows
Conservation value	• the presence of federal or state listed threatened ecological communities and their conservation rating • number of threatened plant species recorded at the site and their conservation rating • number of threatened fauna species for potential habitat that occur within the site and their conservation rating
Landscape context	• percentage vegetation cover within 5 km • block shape • distance to remnant vegetation area of greater than 50 ha • identity of the IBRA Association that the area is located in • remnancy figure for the IBRA Association • percentage of vegetation protected within the IBRA Association • the presence of riparian vegetation, swamps or wetlands

PLATE 13-1 FORESHORE OF THE STUDY AREA SHOWING WHERE SMITH CREEK DISCHARGES INTO SMITH BAY (PHOTO TAKEN 12 APRIL 2018)

PLATE 13-2 VEGETATION OF THE COASTAL FORESHORE (PHOTO TAKEN 12 APRIL 2018)

The adjacent dunes are predominantly cleared, with only small patches of native vegetation (mainly coastal mallee (*Eucalyptus diversifolia*) and common boobialla (*Myoporum insulare*)) remaining within the coastal reserve.

Five vegetation associations were recorded within the study area (see Table 13-2 and Figure 13-3). The condition of the vegetation was mostly very poor, with only 1.44 ha of vegetation considered to be in moderate condition (see Table 13-2 and Figure 13-4). The vegetation associations recorded within the study area do not have conservation status under the *Native Vegetation Act 1991*.

Two vegetation associations were recorded to the south of the study area (see Table 13-3 and Figure 13-3). The patch of Kangaroo Island narrow-leaved mallee (vegetation association 6) meets the thresholds to qualify as a threatened ecological community under the EPBC Act (EBS Ecology 2018).

Kangaroo Island narrow-leaved mallee threatened ecological community

The Kangaroo Island narrow-leaved mallee (*Eucalyptus cneorifolia*) woodland is a nationally protected threatened ecological community (TEC) listed as critically endangered under the EPBC Act (DoE 2014).

In 2014 the department developed simple minimum condition thresholds for this woodland ecological community, based on patch widths of 60 metres. Patches at least that wide tend to retain intact native vegetation and qualify as the listed community. Patches narrower than 60 metres along most of their length and featuring low native species diversity and high weed cover tend to be degraded and are excluded from the listing (DoE 2014). This description excludes most stands of Kangaroo Island narrow-leaved mallee on farms that serve as windbreaks or shelter belts, as well as narrow remnants along road verges.

A small patch of this community occurs adjacent to, but outside, the study area, near the southern fence line (refer Figure 13-3). This patch meets the requirements of a protected ecological community under the TEC listing. A single patch of the species grows beside Freeoak Road, but does not meet the requirements of a protected ecological community under the TEC listing as it is not 60 metres wide. No threatened ecological communities were recorded within the study area.

Other remnant patches of Kangaroo Island narrow-leaved mallee are known to exist beside public roads surrounding the area (see Figure 13-5).

Threatened and protected flora

Database searches indicate that 13 state-listed threatened flora species grow within 10 km of the study area, and also identified seven nationally listed threatened flora species as possibly occurring or having potential habitat near the study area. Based on the results of the field survey, however, EBS Ecology considers it unlikely that any of these species would exist within the area due to the numbers of exotic species observed, historic land use, the degraded nature of the site and a lack of suitable habitat for threatened flora species.

TABLE 13-2 VEGETATION ASSOCIATIONS ON THE STUDY AREA (INCLUDING ADJOINING COASTAL FORESHORE AREA)

ID	Vegetation association	Condition	Area (ha)
1	Exotic grassland/herbland (grazing pasture paddock)	Very poor	11.95
2	Ruby saltbush (*Enchylaena tomentosa*) low open shrubland	Very poor	1.49
3	Planted *Eucalyptus* spp./planted garden species	Very poor	0.41
4	Coastal white mallee (*Eucalyptus diversifolia*), common boobialla (*Myoporum insulare*), low open woodland	Moderate	0.96
5	Kangaroo Island narrow-leaved mallee (*Eucalyptus cneorifolia*), tall open forest	Moderate	0.48
		Total	**15.28**

TABLE 13-3 VEGETATION ASSOCIATIONS IMMEDIATELY SOUTH OF THE STUDY AREA

ID	Vegetation association	Vegetation condition score	Unit biodiversity score	Area (ha)	Total biodiversity score
6	Kangaroo Island narrow-leaved mallee (*Eucalyptus cneorifolia*), woodland	19.25	29.38	4.75	139.53
7	Sugar gum (*Eucalyptus cladocalyx* ssp. *crassa*) woodland	17.55	21.04	0.63	13.47
	Total			**5.38**	

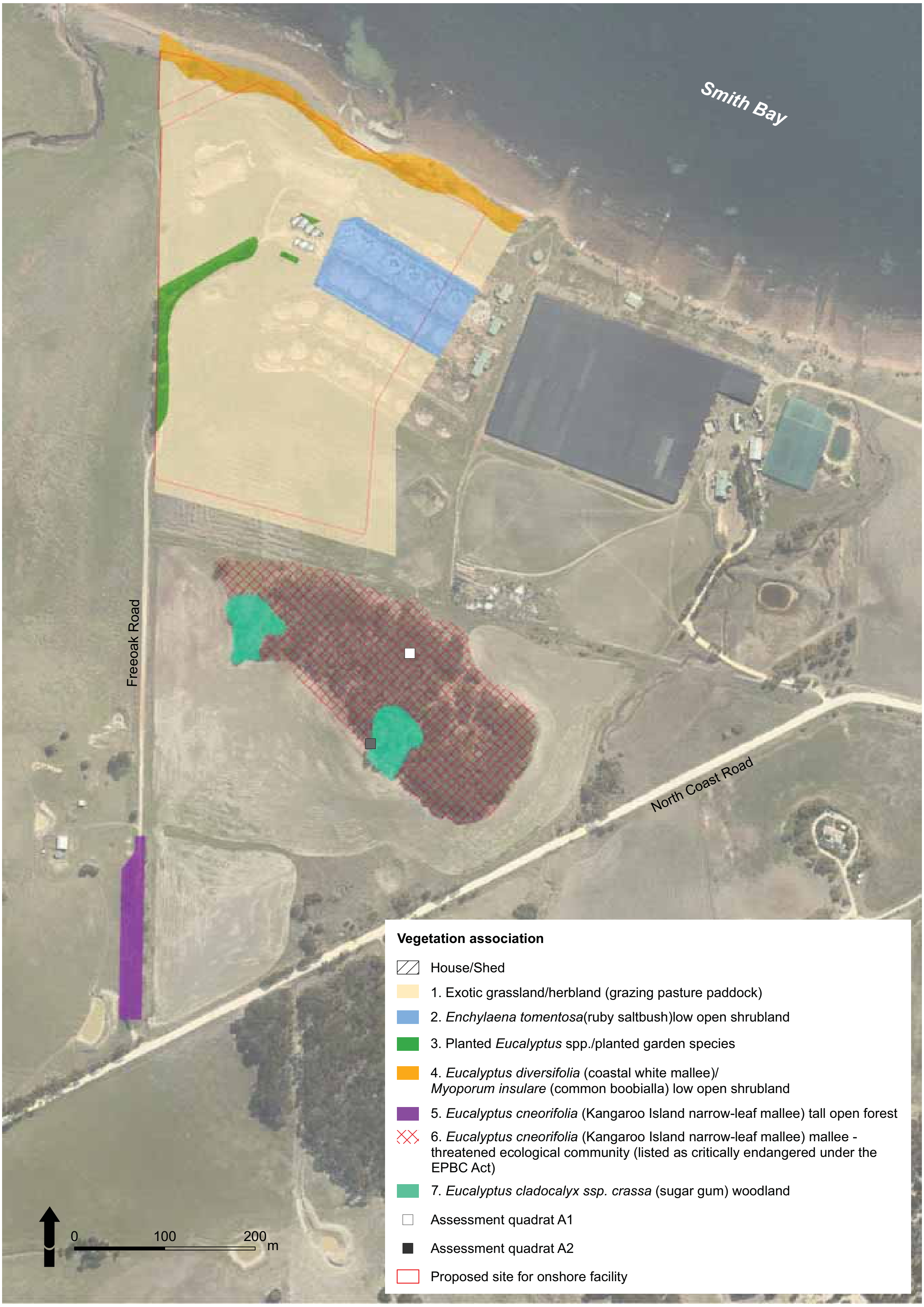


FIGURE 13-3 VEGETATION ASSOCIATIONS

FIGURE 13-4 VEGETATION CONDITION

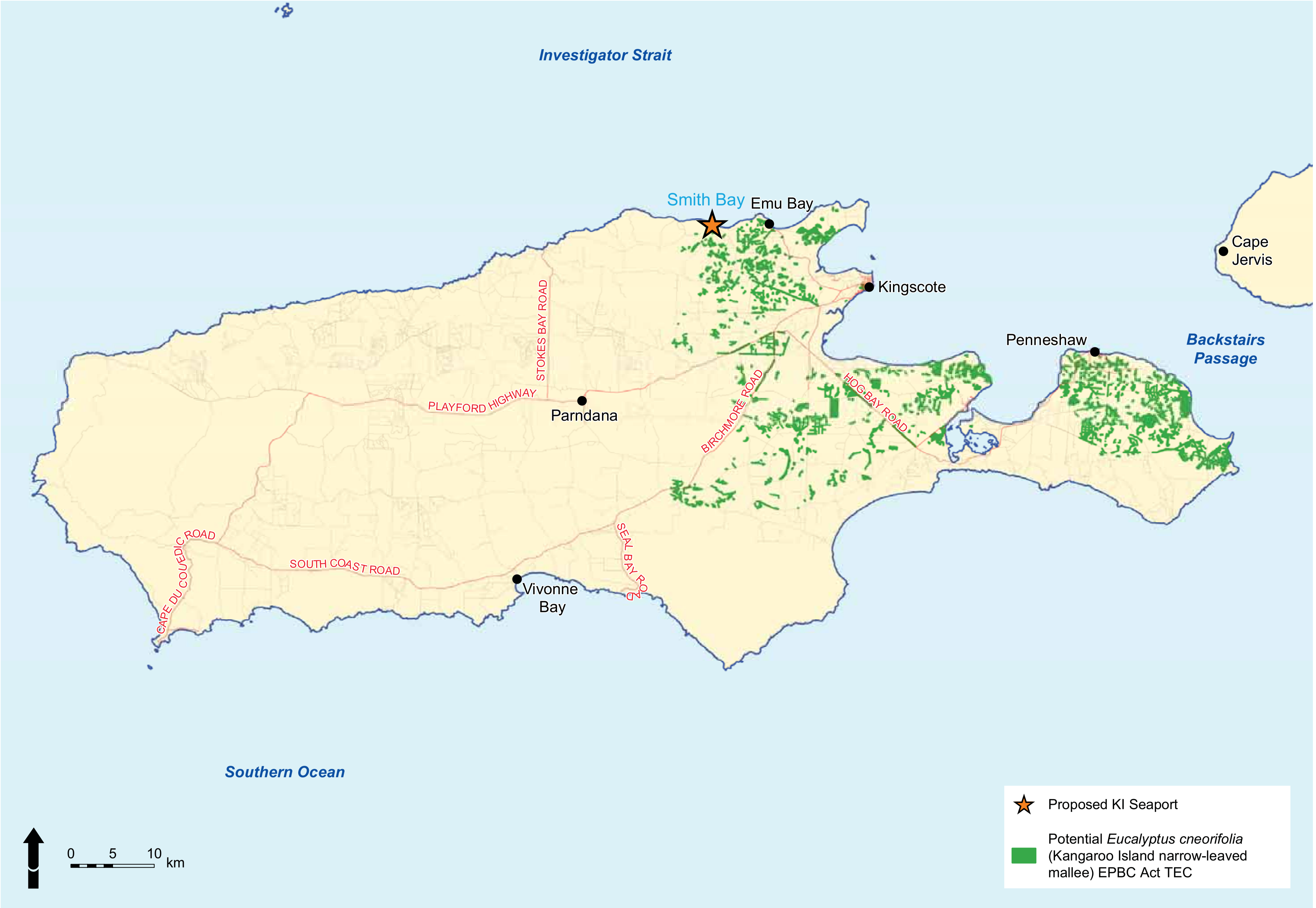


FIGURE 13-5 KANGAROO ISLAND NARROW-LEAVED MALLEE WOODLAND ECOLOGICAL COMMUNITY

The ecological survey of the site recorded 30 flora species – 19 exotic species (weeds) and 11 native species (see Table 13-4). No threatened species (nationally or state-listed) were recorded on the site at the time of the survey.

Weeds and pathogens

The study area was found to be dominated by weed species at the time of the survey, reflecting the overall degraded nature of the vegetation. Of the 19 weed species recorded within the area, four are listed as declared under the *Natural Resources Management Act 2004* (NRM Act). These are:

- African boxthorn (*Lycium ferrocissimum*)
- bridal creeper (*Asparagus asparagoides f. asparagoides*)
- horehound (*Marrubium vulgare*)
- soursob (*Oxalis pes-caprae*).

Bridal creeper is also a Weed of National Significance (WoNS). This species was found on the study area as scattered individuals within vegetation associations 1, 3 and 5 (refer Table 13-2 for vegetation association IDs and Appendix J2). This species, and the other three listed as declared, would require ongoing on-site management.

Phytophthora is a soil-borne parasitic fungus that attacks the roots of plants and can cause significant death in affected vegetation communities. Dieback caused by phytophthora has been found within a number of high-rainfall areas, including Kangaroo Island (Government of South Australia 2006). There is no record of phytophthora on the study area; however, it has been recorded within the local area (DEWNR 2012) and the study area is considered a moderate risk area for the pathogen (Government of South Australia 2006).

13.4.2 FAUNA OF THE STUDY AREA

A total of 23 fauna species were observed within the study area during the field survey, comprising 18 native birds, three introduced birds and two native mammals (see Table 13-5). Further discussion of these species can be found in Appendix J2. Two fauna species of conservation significance recorded at the site were the white-bellied sea-eagle and signs (diggings) of the Kangaroo Island echidna. The white-bellied sea-eagle was observed flying over the coast and the study area during the field survey. The echidna diggings were observed along the access track within vegetation association 3 (see Figure 13-6). No individual Kangaroo Island echidnas were observed on site during the field survey.

No introduced fauna species were recorded on site; however, it is likely that a number of species, such as cats, rats and mice, use the area. These species are often found on Kangaroo Island (KINRMB 2009).

Seven nocturnal fauna species have been recorded within 10 km of the study area (DEWNR 2016a) (see Table 13-6) and may at times inhabit the study area.

Twenty-two nationally and/or state-listed terrestrial fauna species have been identified as having the potential to inhabit the study area. The BDSA search revealed that 18 state-listed threatened fauna species – 13 birds, four mammals and one reptile – have been recorded within 10 km of the area. EBS Ecology (2018) considers that nine species listed under the *National Parks and Wildlife Act 1972* (NPW Act) may at times potentially occur within the study area (see Table 13-7). See Appendix J2 for more detail.

In addition to the state-listed fauna species that could occur in the region, four terrestrial fauna species listed as threatened under the EPBC Act and 14 bird species listed as migratory and/or marine protected species were identified as potentially inhabiting or having potential habitat near the study area.

13.5 IMPACT ASSESSMENT AND MANAGEMENT

13.5.1 POTENTIAL RISKS

Activities anticipated to have potential risk to flora and fauna during construction, operation and decommissioning of the KI Seaport include:

- native vegetation clearance (construction)
- removal of potential habitat for native fauna species (construction)
- direct or indirect mortality (fauna and conservation significant species) (construction, operation and decommissioning)
- introduction of pest plants and diseases (construction, operation and decommissioning)
- noise disturbance (fauna) (construction, operation and decommissioning)
- light disturbance (fauna) (construction, operation and decommissioning)
- bushfire impacts to flora and fauna (construction, operation and decommissioning).

TABLE 13-4 FLORA SPECIES RECORDED IN THE STUDY AREA

Family	Species	Common name
Agavaceae	**Agave attenuata*	Spineless century plant
Casuarinaceae	*Allocasuarina verticillata*	Drooping sheoak
Chenopodiaceae	*Atriplex cinerea*	Coast saltbush
	Enchylaena tomentosa	Ruby saltbush
	Rhagodia candolleana subsp. *candolleana*	Sea-berry saltbush
Compositae	**Arctotheca calendula*	Cape weed
	**Cirsium vulgare*	Spear thistle
	**Onopordum acaulon*	Stemless thistle
Cruciferae	**Sinapis arvensis*	Charlock
Cyperaceae	*Ficinia nodosa*	Knobby club-rush
Euphorbiaceae	**Euphorbia paralias*	Sea spurge
Fumariaceae	**Fumaria muralis*	Wall fumitory
Gramineae	**Avena* sp.	Wild oats
	**Gastridium phleoides*	Nit-grass
	**Hordeum* sp.	Barley grass
	**Phalaris* sp.	Canary grass
Iridaceae	**Romula rosea* var. *australis*	Common onion-grass
Labiatae	***Marrubium vulgare*	Horehound
	**Lavandula* sp.	Lavender
Leguminosae	**Medicago polymorpha* var. *polymorpha*	Burr medic
	**Trifolium dubium*	Suckling clover
Liliaceae	***Asparagus asparagoides* f. *asparagoides*	Bridal creeper
	**Asphodelus fistulosus*	Onion weed
	Wurmbea dioica	Early nancy
Malvaceae	**Malva parviflora*	Small-flower marshmallow
Myoporaceae	*Myoporum insulare*	Common boobialla
Myrtaceae	*Eucalyptus cnerifolia*	Kangaroo Island narrow-leaved mallee
	Eucalyptus diversifolia subsp. *diversifolia*	Coastal white mallee
	**Eucalyptus globulus* subsp. *globulus*	Tasmanian blue gum (planted)
	Eucalyptus leucoxylon subsp. *leucoxylon*	South Australian blue gum (planted)
	Eucalyptus cosmophylla	Cup gum (unconfirmed)
Oxalidaceae	***Oxalis pes-caprae*	Soursob
Polygonaceae	*Muehlenbeckia gunnii*	Coastal climbing lignum
Scrophulariaceae	**Kickxia* sp.	Toadflax
Solanaceae	***Lycium ferocissimum*	African boxthorn
	Solanum nigrum	Black nightshade
Urticaceae	**Urtica urens*	Small nettle

* Introduced species
** Declared pest plant under the NRM Act

13.5.2 VEGETATION OF THE STUDY AREA

Significant environmental benefit

Clearance of native vegetation requires approval under the *Native Vegetation Act 1991* subject to providing a significant environmental benefit (SEB) either on-ground or through payment. See Section 6.2 in Appendix D1.

The SEB condition matrix (see Appendix J2) has been devised by EBS based on the South Australian Government's Guide to the Roadside Vegetation Survey Methodology in South Australia (Stokes et al. 2006, p.21) and Guidelines for a Native Vegetation Significant Environmental Benefit Policy for the clearance of native vegetation associated with the minerals and petroleum industry (DWLBC 2005, Table 1). The matrix devised by EBS was endorsed by the Native Vegetation Unit in DEW.

The SEB offset area for vegetation patches is derived by multiplying the clearance area by the appropriate SEB ratio. The ratio is assigned according to the condition of the vegetation (refer Table 13-2) and whether the clearance varies or seriously varies from the Principles of Clearance of the SEB Policy (DWLBC 2005). This includes factors such as whether the vegetation is considered intact and whether it provides habitat for threatened species.

TABLE 13-5 FAUNA RECORDED DURING THE FIELD SURVEY OF THE STUDY AREA

Species name	Common name	EPBC Act status	NPW Act status
Birds			
**Alauda arvensis*	Eurasian skylark	N/A	N/A
Anthochaera carunculata	Red wattlebird	N/A	N/A
Aquila audax	Wedge-tailed eagle	N/A	N/A
Chroicocephalus novaehollandiae	Silver gull	N/A	N/A
Coracina novaehollandiae	Black-faced cuckoo-shrike	N/A	N/A
Corvus coronoides	Australian raven	N/A	N/A
Coturnix pectoralis	Stubble quail	N/A	N/A
Falco cenchroides	Nankeen kestrel	N/A	N/A
Gymnorhina tibicen	Australian magpie	N/A	N/A
Haliaeetus leucogaster	White-bellied sea-eagle	Marine	Endangered
Hirundo neoxena	Welcome swallow	N/A	N/A
Larus pacificus	Pacific gull	Marine	N/A
Malurus cyaneus	Superb fairy-wren	N/A	N/A
**Passer domesticus*	House sparrow	N/A	N/A
Phalacrocorax varius	Australian pied cormorant	N/A	N/A
Platycercus elegans	Crimson rosella	N/A	N/A
Rhipidura leucophrys	Willie wagtail	N/A	N/A
**Sturnus vulgaris*	Common starling	N/A	N/A
Tadorna tadornoides	Australian shelduck	N/A	N/A
Vanellus miles	Masked lapwing	N/A	N/A
Zosterops lateralis	Silvereye	N/A	N/A
Mammals			
Macropus fuliginosus fuliginosus	Western grey kangaroo (Kangaroo Island sub-species)	N/A	N/A
Tachyglossus aculeatus multiaculeatus	Kangaroo Island echidna	Endangered	N/A

* Introduced species

FIGURE 13-6 LOCATION OF ECHIDNA DIGGINGS WITHIN THE STUDY AREA

TABLE 13-6 NOCTURNAL FAUNA SPECIES RECORDED IN THE BIOLOGICAL DATABASE OF SOUTH AUSTRALIA (BDSA) WITHIN 10 KM OF THE STUDY AREA

Species	Common name	EPBC Act status	NPW Act status
Ninox boobook	Southern boobook	N/A	N/A
Cercartetus concinnus	Western pygmy-possum	N/A	N/A
Isoodon obesulus obesulus	Southern brown bandicoot	Endangered	Vulnerable
Macropus eugenii	Tammar wallaby	N/A	N/A
Pseudocheirus peregrinus	Common ringtail possum	N/A	N/A
Sminthopsis aitkeni	Kangaroo Island dunnart	Endangered	Endangered
Trichosurus vulpecula	Common brushtail possum	N/A	Rare

TABLE 13-7 LISTED FAUNA ASSESSED AS HAVING POTENTIAL TO OCCUR WITHIN THE STUDY AREA

Species	Common name	EPBC Act status	NPW Act status
Arenaria interpres	Ruddy turnstone	Migratory (wetland)	Rare
Calyptorhynchus funereus	Yellow-tailed black cockatoo	N/A	Vulnerable
Calyptorhynchus lathami halmaturinus	Glossy black-cockatoo (Kangaroo Island)	Endangered	Endangered
Haematopus fuliginosus	Sooty oystercatcher	N/A	Rare
Haematopus longirostris	Australian pied oystercatcher	N/A	Rare
Haliaeetus leucogaster	White-bellied sea-eagle	Marine	Vulnerable
Trichosurus vulpecula	Common brushtail possum	N/A	Rare
Sternula nereis nereis	Australian fairy tern	Vulnerable	N/A
Tachyglossus aculeatus multiaculeatus	Kangaroo Island echidna	Endangered	N/A
Thinornis rubricollis rubricollis	Hooded plover (eastern)	Vulnerable, Marine	Vulnerable
Varanus rosenbergi	Heath goanna	N/A	Vulnerable
Actitis hypoleucos	Common sandpiper	Migratory (wetland), Marine	N/A
Apus pacificus	Fork-tailed swift	Migratory (marine)	N/A
Ardea alba	Great egret, white egret	Marine	N/A
Ardea ibis	Cattle egret	Marine	N/A
Calidris acuminata	Sharp-tailed sandpiper	Migratory (wetland)	N/A
Calidris ferruginea	Curlew sandpiper	Critically endangered, Migratory (wetland), Marine	N/A
Calidris ruficollis	Red-necked stint	Migratory (wetland)	N/A
Larus pacificus	Pacific gull	Marine	N/A
Pandion haliaetus	Osprey	Migratory (wetland)	N/A
Phalacrocorax fuscescens	Black-faced cormorant	Marine	N/A
Tringa nebularia	Common greenshank	Migratory (wetland), Marine	N/A

If a payment into the Native Vegetation Fund is the preferred option to satisfy the required SEB, a formula (see Appendix J2) is used to convert the required set-aside area into a dollar value.

The shore-based component of the development would predominantly be on cleared agricultural land, some of which has previously been used for commercial abalone farming (industrial). A total of 2.93 ha of very poor to moderate condition native vegetation would be cleared for the proposal (see Table 13-8 and refer Figure 13-3).

Mitigation hierarchy

The mitigation hierarchy is used by NVC in vegetation clearance impact assessment. Assessments against the hierarchy should demonstrate that there is no other practicable alternative that involves less clearance, or clearance of less significant vegetation, or clearance of vegetation that has been degraded more than the vegetation proposed to be cleared (DEWNR 2017). Assessment against the mitigation hierarchy is provided in Table 13-9.

It is unlikely that the single patch of the nationally protected ecological community of Kangaroo Island narrow-leaved mallee (*Eucalyptus cneorifolia*) woodland in the block of land south of the study area (refer Figure 13-3) would be impacted by the proposal (see Appendix J3).

As previously noted, no nationally or state-listed flora species were found within the study area; therefore, there would be no impact on listed threatened flora species due to vegetation clearing for the proposal.

Nineteen weed species, including four species listed as declared under the *Natural Resources Management Act 2004* and one listed WoNS, have been recorded in the study area. Weed infestations are a key threatening process identified for many threatened flora species and fauna habitats.

Given the cleared and degraded nature of the site, proposed construction activities would be unlikely to contribute significantly to the spread of weeds within the site. Rather, weed management activities undertaken as part of the landscaping program could be expected to reduce the current level of infestation. As outlined in the Construction Environmental Management Plan (CEMP) (see Appendix U1), standard hygiene practices to prevent weeds spreading would be employed throughout the construction, operation and decommissioning phase and there would be ongoing management of declared weeds on site to stop them from spreading.

Although there are no known infestations of the soil-borne parasitic fungus phytophthora in the study area, dieback remains a threat to remnant vegetation on the site. Phytophthora may be introduced through contaminated soil on vehicles, construction equipment and landscaping materials, including plants. The risk of introducing phytophthora would be greatest during the construction period and would be managed using standard hygiene protocols outlined in the CEMP.

Bushfires are a natural occurrence, although human activity can increase their frequency, leading to impacts on the ecology of an area. Although such impacts could occur as a result of the proposal, the consequences for local ecology are considered to be minor, given that bushfires also occur naturally and as such play an important ecological role. Refer to the CEMP for bushfire management and Appendix U4.

Management and mitigation measures

Vegetation to be retained within the study area would be protected during construction by implementing a CEMP (see Chapter 26 – Environmental Management Framework). The proposal footprint has been minimised where possible to limit the proposed extent of vegetation clearance.

TABLE 13-8 EXTENT OF NATIVE VEGETATION CLEARANCE FOR THE STUDY AREA AND EQUIVALENT SEB OFFSET

ID	Vegetation association	SEB Condition ratio	Area (ha)	SEB offset (ha)	Mngt fee ($/ha)	Land value ($/ha)	SEB ($)
2	Ruby saltbush (*Enchylaena tomentosa*), low open shrubland	1:1	1.49	1.49	$800	$803	$2400
4	Coastal white mallee (*Eucalyptus diversifolia*), common boobialla (*Myoporum insulare*), low open woodland	5:1	0.96	4.79	$800	$803	$4600
5	Kangaroo Island narrow-leaved mallee (*Eucalyptus cneorifolia*), tall open forest	6:1	0.48	2.85	$800	$803	$2700
Total			**2.93**	**9.13**			**$9700**

Note: Vegetation associations 1 and 3 are not included above as they do not constitute native vegetation.

Construction for the proposal would result in the clearing of up to 2.93 ha of native vegetation. Under the *Native Vegetation Act 1991*, clearing a small amount of terrestrial native vegetation would require the preparation of an offset strategy developed in consultation with the NVC (see Chapter 26 – Environmental Management Framework). The offset package would likely include an on-ground SEB to protect an area of vegetation and provide fauna habitat.

A planting guide, including a recommended species list of local native plants, would be adopted (see Appendix J1) and inform an on-site revegetation plan. Where possible, planting materials, such as seeds and tubestock, used in landscaping would be sourced on Kangaroo Island to minimise potential biosecurity risks. Species-specific weed management measures, where appropriate, would be undertaken as part of the landscaping program.

The risk of introduction and spread of weeds (including declared weeds) and pathogens during construction operation and decommissioning would be managed by implementing the CEMP (Appendix U1) and Operational Environmental Management Plan (OEMP) (Appendix U2), which would include vehicle and marine vessel biosecurity hygiene measures (see Chapter 26 – Environmental Management Framework). Declared weeds within the study area would be managed as required.

All reasonable precautions would be taken throughout construction and operation to prevent bushfires resulting from human activity associated with the proposal. The potential for fire at Smith Bay impacting the KI Seaport has been considered and an Emergency Response Management Plan (Appendix U3) and a Bushfire Hazard Management Plan have been developed for the site (Appendix U4). Appropriate firebreaks would be maintained where necessary for the protection of property and vegetation onsite.

The proposed mitigation measures to address weeds and pest species are considered to be effective. The existing vegetation of the study area is degraded. The landscape plantings and proposed offset package for vegetation removal is considered effective at managing the impacts on native vegetation. The offset package would improve existing stands of native vegetation outside the study area and therefore provide better-quality habitat for native fauna.

TABLE 13-9 ASSESSMENT AGAINST THE MITIGATION HIERARCHY

Mitigation hierarchy	Response
(a) Avoidance – measures should be taken to avoid clearance of native vegetation wherever possible.	Alternative sites were investigated in the early stages of project planning. A key advantage of the study area was that it was mostly cleared and the remaining vegetation is highly degraded, while other sites such as at Ballast Head are heavily vegetated (see Chapter 3 – Project Alternatives).
(b) Minimisation – if clearance of native vegetation cannot be avoided, measures should be taken to minimise the extent, duration and intensity of impacts of the clearance on biological diversity to the fullest possible extent (whether the impact is direct, indirect or cumulative).	Vegetation clearance required for the proposal has been planned for the entire site. Potential opportunities for retaining vegetation were explored during the concept design phase, however, due to the size of the site and operational requirements, it was not feasible to retain any stands of remnant vegetation. Appropriate precautions would be taken to reduce the risk of off-site impacts to vegetation from dust, spills or introduction of weeds and pathogens. This would include management measures outlined in the CEMP (see Chapter 26 – Environmental Management Framework).
(c) Rehabilitation or restoration – measures should be taken to rehabilitate ecosystems that will be degraded, and to restore ecosystems that will be destroyed, due to the impacts of clearance that cannot be avoided or minimised.	Most of the study area is previously cleared or otherwise degraded. Nineteen introduced species were recorded on the site, including four declared weeds and one Weed of National Significance (WoNS). Weed control implemented as part of the landscaping plan is likely to reduce the current density and diversity of weeds on the site. A landscaping plan for the site would include use of local native species (see Appendix J1). This is likely to add habitat value for species such as native birds and increase the overall biodiversity and amenity value of the site.
(d) Offset – any adverse impact on native vegetation or ecosystems that cannot be avoided or minimised should be offset by implementing an SEB that outweighs that impact.	KIPT is committed to implementing an appropriate SEB offset, to be agreed with NVC and DEW. KIPT has engaged with DEW to explore options for meeting the SEB offset requirements, and a summary of potential offset options is provided in Chapter 14 – MNES.

13.5.3 FAUNA OF THE STUDY AREA

Effects on listed species

Twenty-two nationally and/or state-listed terrestrial fauna species have been identified as potentially inhabiting the study area. These include nine species listed as threatened under the NPW Act, four species listed as threatened under the EPBC Act, and 14 listed as migratory or marine under the EPBC Act (there is some overlap between these categories). None of the fauna species identified as possibly inhabiting the area are likely to use the site as important or critical habitat.

An impact assessment of the proposal on each of these species is presented in Appendix J3 summarised in the following text.

Echidna diggings were recorded during the 2016 survey along the western boundary of the site and on adjacent properties, indicating that there is probably a resident population of echidnas in the relatively large stand of remnant vegetation approximately 500 metres west of the site (refer Figure 13-6). No echidnas were observed on the site during the survey. There is a risk that echidnas may be killed by trucks along Freeoak Road. However, the magnitude of the impact from vehicles on the population is uncertain (see Chapter 14 – MNES). Echidnas are susceptible to heat stress and tend to be more active at night. They have an acute sense of hearing and any unusual sound will make them freeze or take cover underground or in leaf litter (Augee et al. 2006). Vibration, noise and light pollution would be generated by construction, operation and decommissioning activities. It is likely that the noise and vibration would deter echidnas from entering the study area and they would seek shelter in surrounding leaf litter.

Vegetation removal and fragmentation of habitat are not likely to have a significant impact on the Kangaroo Island echidna as a community or individuals due to the small amount of vegetation that would be removed and it is unlikely that echidnas would have a major portion of their home range in the study area. Further discussion of potential impact to the Kangaroo Island echidna is provided in Chapter 14 – MNES.

Several bird species, including the glossy black-cockatoo (Kangaroo Island) and the Australian fairy tern, may occasionally fly over the study area or use the remnant habitat in the area. The glossy black-cockatoo may fly over the area to access remnant patches of drooping sheoak (*Allocasuarina verticillata*) feeding habitat along the North Coast Road 600 metres and 2 km from the site (EBS Ecology 2018). The Australian fairy tern may forage occasionally on the coastal beach created by the boat ramp within the area. The study area itself, however, is not an important or critical habitat for these species. Being highly mobile, they would relocate to alternative habitat that is abundant throughout the region.

Hooded plovers may forage occasionally on the small patches of sandy beach within the study area as they move to other foraging and breeding beaches along the north coast. This is likely as a pair of hooded plovers was recorded at Smith Bay in 2010, 2014 and 2016 (EBS Ecology 2018). The three sightings were all in the eastern section of the bay, 1.8–2.0 km from the study area. The birds were foraging on the rocks during the sightings (G. Maguire 2017, pers. comm., 10 July).

Given that the area is not a known breeding site and does not have the characteristics of a breeding site for hooded plovers, it is unlikely that the proposal would impact critical habitat for this species. Potential impacts to the hooded plover are discussed further in Chapter 14 – MNES.

Although a number of bird species may occasionally fly over the site or use the adjacent beach, it is likely that the habitat at the site is of minor or no importance to these species due to the fragmented nature of existing native flora and the absence of native species.

Several marine shorebirds, such as the Pacific gull and black-faced cormorant, may forage or rest on the beach habitat at the site. Being highly mobile, they would move to the abundant alternative beach habitat in the area during construction and operation of the wharf, so would be virtually unaffected.

The habitat at the site would be of little value to wetland species such as the two egrets, common greenshank and red-necked stint, which would only fly over the site en route to their preferred wetland habitat. They would probably continue to fly over the site during construction and operation of the wharf.

Coastal raptors such as the white-bellied sea-eagle and osprey would fly over while foraging along the coast. Although both species are also known to nest mainly on cliffs along the north coast both east and west of Smith Bay, the site itself does not provide suitable nesting habitat. The birds' closest known nests are 4.1 km (for white-bellied sea-eagle) and 12.4 km (for osprey) from Smith Bay (see Figure 13-7). A buffer zone is not required for these nests as they are outside the study area and would not be affected.

Both species would probably continue to fly over the site during construction and operation of the wharf, but may not forage in the general vicinity. Since the wharf area would only cover about 500 metres of the foraging habitat along the north coast (which is approximately 100 km long), the reduction in foraging habitat would not affect either species.

Similarly, the increase in shipping activity (approximately 10–20 ships a year) is unlikely to affect the foraging or nesting behaviour of either species of raptor. Nesting would not be affected by shipping movements as ships would always approach and leave the wharf directly from and to deep

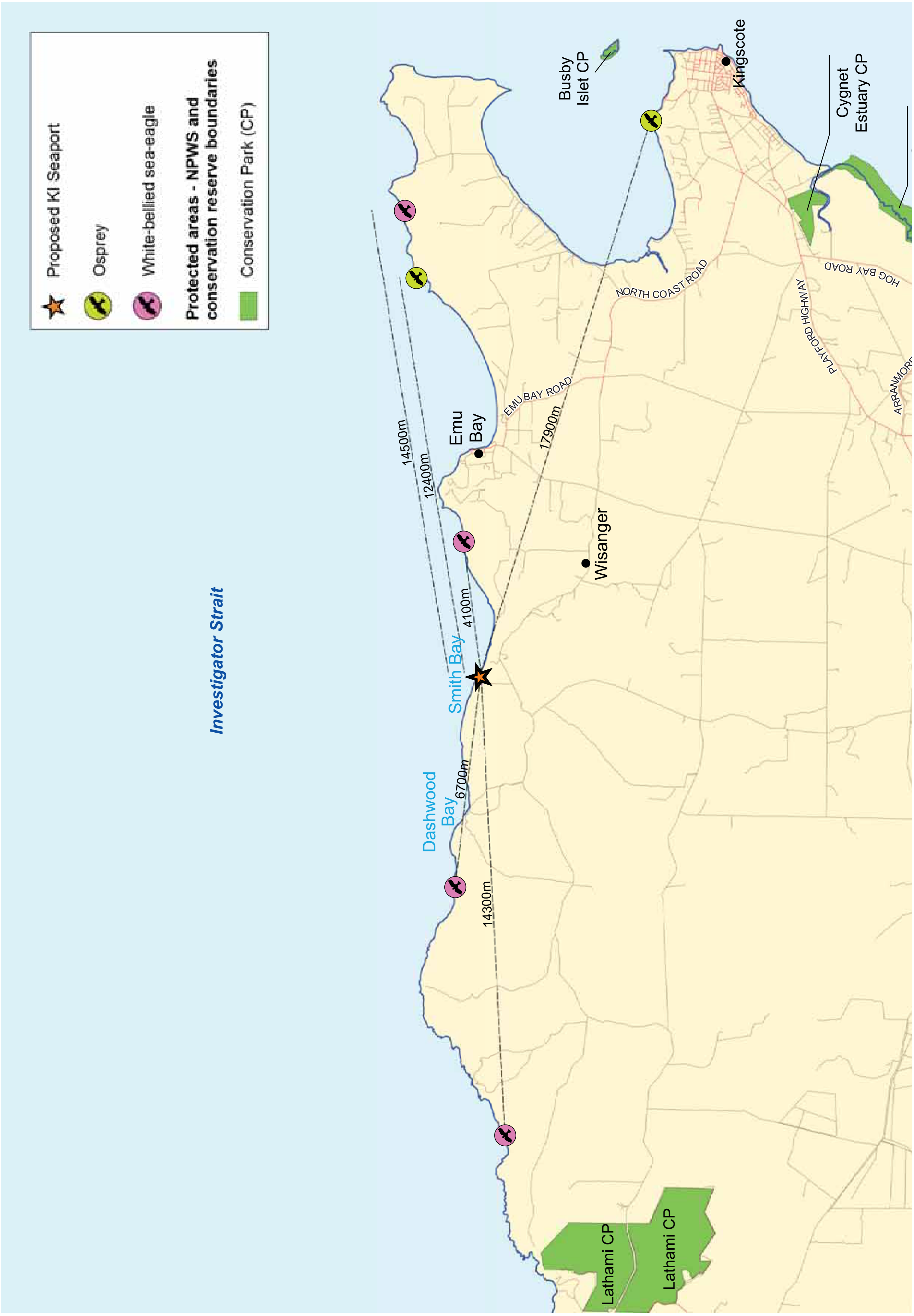


FIGURE 13-7 DISTANCE OF SMITH BAY TO KNOWN RAPTOR NESTS

offshore water rather than travel along the coast. Ships are therefore unlikely to pass any closer than about 3–4 km from a nesting site. Power boats that regularly traverse the north coast close to the cliffs could disturb these birds far more than distant ships.

The proposal is unlikely to pose an unacceptable risk to any of the threatened, migratory or marine terrestrial fauna that may inhabit the area.

Effects on fauna species

Common brushtail possums are found in eucalyptus and sheoak woodlands (NRAMLR n.d.(a)). Heath goannas generally inhabit heath, wet and dry forest and temperate woodlands, usually with sandy soils and termite mounds present (NRAMLR n.d.(b)). The heath goanna and common brushtail possum may inhabit the study area but are unlikely to use it as important or critical habitat because there are suitable alternatives throughout much of Kangaroo Island.

General effects from construction and operation

Light, noise and vibration associated with construction of the KI Seaport may have short-term impacts on fauna use of the study area (See Chapter 18 – Noise and Light). Nocturnal species that have been recorded within a 10 km radius of the study area are shown in Table 13-6.

Potential sources of noise, vibration and light pollution would be:

- earthmoving equipment (construction)
- excavation activities (construction)
- unloading of timber product at the wharf facility (truck and forklift movements)
- security lighting during operation (nocturnal)
- shiploading activities (nocturnal noise, vibration and light emissions).

Artificial light from construction and operation of the KI Seaport infrastructure could affect the behaviour of fauna on and offshore. Lighting can disturb foraging behaviour, predator/prey interactions, reproduction, migration and social interactions of local fauna, particularly nocturnal species. Increases in background noise during construction and operation could also affect the behaviour of local fauna. Lighting would be required during construction and operation of the wharf, and there would be more background noise both during construction and active operations.

Security and safety lighting would be required during operation of the site. Additional lighting may also be required during ship-loading activities, which are anticipated to occur 24-hours-a-day for an average of 30–75 days a year. There is existing light spill onto the site from security lighting installed off-site.

Taking into account the limited number of fauna species currently using the site and the likelihood of these individuals relocating to nearby habitat during construction, the impact of additional artificial lighting and additional noise on fauna is considered to be low (see Appendix J3).

Sometimes human activity can increase the presence of feral animals. Cats, rabbits and mice are likely to appear in the study area from time to time and their numbers may increase following construction due to changes in habitat resulting from landscaping efforts, provision of water sources, or inappropriate disposal of wastes. Construction activity, the importation of foods and the importation of construction and forestry equipment can also potentially increase the presence of exotic species (see Chapter 15 – Biosecurity).

The impact assessment (see Appendix J3) demonstrates that the proposal is unlikely to have a significant impact on fauna species that may inhabit the area with the exception of the potential increase in vehicle-related deaths of the echidna.

Management and mitigation measures

Potential opportunities for retaining vegetation were explored during the detailed design phase; however, due to the size of the site and operational requirements, it is not feasible to retain any stands of remnant vegetation. Construction would require up to 2.93 ha of native vegetation to be cleared. The proposal footprint would be minimised where possible to limit required clearance.

Under the *Native Vegetation Act 1991*, clearing a small amount of terrestrial native vegetation at the site would require an offset strategy to be prepared. This would be developed in consultation with the NVC (see Chapter 26 – Environmental Management Framework). The offset strategy would include consideration of fauna habitat values for listed threatened species.

The closest known raptor nesting site (white-bellied sea-eagle, as shown on Figure 13-7) is approximately 4.1 km from the study area and would not need a buffer zone.

The area would be assessed before construction began to determine whether any resident fauna needed to be relocated by a wildlife professional. If required, necessary permits under the *National Parks and Wildlife Act 1972* would be obtained from NRKI. It is considered that fauna that may use the study area for foraging would relocate following disturbance by equipment and construction operators. If a hooded plover (eastern) nesting site was found during construction or operation of the proposal, a buffer zone – the extent of which would be determined in consultation with the Department for Environment and Water (DEW) – would be implemented around the nest during the breeding season.

Measures would be taken to avoid, or at least minimise, road-kills of fauna – particularly of echidnas – on Freeoak Road leading into the study area. These precautions are likely to include warning signs for truck drivers about the presence of echidnas and other fauna and the need to remain vigilant, especially during periods of low light. Vehicle speed restrictions along Freeoak Road and within the site would be enforced. The induction program for construction and operation would include an echidna awareness talk and operators would be encouraged to download and use the Echidna CSI (Conservation Science Initiative) mobile application to report any vehicle strikes. The most appropriate measures would be determined in consultation with DEW.

Design and operation measures to minimise the potential impacts of lighting and noise as far as practicable would be employed. Trenching guidelines would be set to ensure that uncovered trenches did not pose a risk to fauna during construction. Directional lighting would be used during ship-loading activities to minimise any light spill off site.

Feral animals would be controlled as required, depending on site-based monitoring as outlined in the CEMP and OEMP. Waste and rubbish would be minimised on site to reduce the likelihood of attracting predators and causing injury. Measures to prevent the introduction of pest species to a port facility are addressed in Chapter 15 – Biosecurity.

In addition to the above environmental management and offset strategies, KIPT proposes to continue providing significant ongoing support to the glossy black-cockatoo recovery program on Kangaroo Island to ensure that the Company's activities result in a net environmental benefit to the species (see Chapter 14 – MNES).

The proposed mitigation measures are considered effective at reducing the impact on fauna species that may inhabit the study area, with the exception of measures to reduce echidna fatalities. Population numbers on the Island are decreasing and the effectiveness of the proposed mitigation measures is uncertain. Increased traffic is correlated with an increase in road-kill which has been observed on the Kangaroo Island road network (Rismiller, P 2018, pers. comm, 15 July). See Chapter 14 – MNES for further detail on the proposed offset strategy.

13.6 CONCLUSIONS

13.6.1 VEGETATION OF THE STUDY AREA

The study area has been almost entirely cleared of native terrestrial vegetation for previous agricultural and industrial use. Only small remnant patches of native vegetation – mainly coastal mallee (*Eucalyptus diversifolia*) and common boobialla (*Myoporum insulare*) – remain on the dunes along the foreshore. The area is dominated by weeds, reflecting the overall degraded nature of the vegetation.

In summary:

- no nationally or state-listed flora species are known to inhabit the study area, so no listed threatened species would be affected by vegetation clearance
- no nationally or state-listed threatened ecological communities have been recorded within the area, so no listed threatened ecological communities would be affected by vegetation clearance
- no more than 2.93 ha of native vegetation in moderate to very poor condition would be cleared
- considering the cleared and degraded nature of the site, construction activities are unlikely to contribute significantly to the spread of weeds. Weed management activities undertaken as part of the landscaping program and during operation would probably reduce the current level of infestation
- a CEMP would be implemented before construction to manage the risk of introducing and spreading weeds within the area (see Chapter 26 – Environmental Management Framework and Appendix U1).

- an OEMP would be implemented during operation to continue to manage weeds and pests (see Chapter 26 – Environmental Management Framework and Appendix U2)
- when construction was finished, a landscape plan incorporating planting of local native species in the study area would be implemented.

13.6.2 FAUNA OF THE STUDY AREA

A total of 22 nationally and/or state-listed terrestrial fauna species have been identified as having the potential to inhabit the study area. None of these is likely to use the site as important or critical habitat.

In summary:

- the area would be assessed before construction began to determine whether any existing fauna needed to be relocated by a wildlife professional
- if a hooded plover (eastern) nest was found during construction or operations a buffer zone – the extent of which would be determined in consultation with DEW – would be implemented during the breeding season
- measures would be taken to avoid, or at least minimise, road-kills of fauna – particularly the Kangaroo Island echidna on Freeoak Road
- several bird species may occasionally fly over the site or use the adjacent beach or remnant habitat in the area. However, the study area is not important or critical habitat for these species
- coastal raptors such as the white-bellied sea-eagle and osprey would fly over the site while foraging along the coast. Although both species are also known to nest mainly on cliffs along the north coast east and west of Smith Bay, the site itself does not have suitable nesting habitat
- light and noise during construction and operation would be minimised wherever practicable through design, lighting equipment selection and directional settings.

13.6.3 OFFSETS

An offset strategy would be developed in consultation with NVC to address the clearing of a small amount of terrestrial native vegetation at the study area. This would include consideration of fauna habitat values for listed threatened species, particularly the glossy black-cockatoo (Kangaroo Island), southern brown bandicoot and the Kangaroo Island echidna (see Chapter 26 – Environmental Management Framework).

In addition to the above offset strategies, KIPT also proposes to provide significant ongoing support to the glossy black-cockatoo recovery program on the Island.

13.6.4 MONITORING

Monitoring activities for construction, operation and decommissioning would include:

- numbers of fauna fatalities (vehicle strike) on Freeoak Road and the study area (to be reported via the Echidna CSI mobile application which provides additional data for research on Kangaroo Island)
- fauna fatalities directly related to the development
- weed management activities on site during operation
- locations of declared weed species.

14. MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

Guideline		Comments
1	The Commonwealth Minister for the Environment and Energy has determined (EPBC no.2016/7814) that the proposed action is likely to, or may have, a significant impact on the following controlling provisions (matters of national environmental significance (MNES)): • Listed threatened species and communities (sections 18 and 18A) including but not limited to: - the endangered and migratory southern right whale (*Eubalaena australis*) - the endangered Kangaroo Island echidna (*Tachyglossus aculeatus multiaculeatus*) - the vulnerable hooded plover (eastern) (*Thinornis rubricollis rubricollis*) - the southern brown bandicoot (eastern) (*Isoodon obesulus obesulus*) • Listed migratory species (sections 20 and 20A) including but not limited to: - the endangered and migratory southern right whale (*Eubalaena australis*) • Commonwealth marine areas (sections 23 and 24A) – while it is understood the action is proposed to be taken outside a Commonwealth marine area, the assessment documentation must consider if there is a real chance or possibility that the action will impact a Commonwealth marine area, for example, because the action will have a substantial adverse effect on a population of a marine species such as a cetacean including its life cycle (e.g. breeding, feeding, migration behaviours, life expectancy) and spatial distribution.	See Chapters 1, 2, 4, 14 and 26
	To enable the proposal to be assessed through the South Australian assessment process under the State/Commonwealth Bilateral Agreement, consistent with the requirements of Schedule 4 of the Environment Protection and Biodiversity Conservation Regulations 2000, the following matters addressing the assessment requirements under the EPBC Act MUST be included in the EIS. This will provide the Commonwealth Minister for the Environment and Energy, or his/her delegate, with sufficient information to make an informed decision whether or not to approve the proposed action under Part 9 of the EPBC Act.	
1.1	Describe the background of the proposal including the title of the action, the full name and postal address of the designated proponent and a clear outline of the objective of the action.	See Chapter 1, Sections 2.3 and 2.4 (obj.) See inside cover for postal address
1.2	Describe how the proposal relates to any other actions under the EPBC Act (that the proponent is reasonably aware) that have been, or are being, taken or that have been approved in the region.	See Section 14.4.1 and Appendix K3

Guideline		Comments
1.3	Describe the environment and management practices of the proposal site and the surrounding areas and other areas that may be affected by the proposal.	See Chapters 9 to 24, 26, Appendices U1 and U2
1.4	Describe the scope, timing/effort (survey season/s) and methodology for studies or surveys used to provide information on the above listed species/communities/habitat at the site (and in areas that may be impacted by the proposal). Include details of: • best practice survey guidelines applied; and • how they are consistent with (or a justification for divergence from) published Australian Government guidelines and policy statements.	See Sections 12.3, 13.3 and 14.2
1.5	Describe in detail all components of the proposal (including the background to the proposal, construction, operation and, if relevant, the decommissioning). Include the precise location of all works to be undertaken (including associated offsite works and infrastructure), structures to be built or elements of the proposal that may have impacts in the above listed MNES. Include details on how the works are to be undertaken and design parameters for those aspects of the structures or elements the proposal that may have relevant impacts.	See Chapters 1, 4 and Section 14.4
1.6	Describe all the relevant impacts the proposal may have on the above listed MNES, include impacts during the construction (e.g. noise, habitat clearing or modification), operation (e.g. potential vehicle/vessel strike during road/shipping transport of timber product) and (if relevant) decommissioning phases of the project. Include information on:	See Sections 12.5.2, 14.4 and Appendix J3
	• the nature and extent of the likely direct, indirect and consequential impacts (short-term and long-term) (refer to the Significant Impact Guidelines 1.1 – Matters of National Environmental Significance, Commonwealth of Australia, 2013)	See Tables 14-2, 14-3, 14-4, 14-5, 14-6, 14-7, 14-8, 14-9 and 14-10
	• whether any relevant impacts are likely to be unknown, unpredictable or irreversible	See Tables 14-2, 14-3, 14-4, 14-5, 14-6, 14-7, 14-8, 14-9 and 14-10
	• technical data and/or other information used to make a detailed assessment of the relevant impacts	See Chapters 12, 13, 21, Appendices I2, I4, J2, J3, K1, K2, K3 and K6
	• how Indigenous stakeholders' views of the proposal's impacts to biodiversity and cultural heritage have been sought and considered.	See Section 7.3
1.7	Identify and address cumulative impacts, where potential impacts are in addition to existing impacts of other activities (including known potential future expansions or developments by the proponent and other proponents in the region and vicinity).	See Section 14.4.1 and Appendix K3

Guideline		Comments
1.8	Provide information (substantiated, specific and detailed descriptions) on proposed avoidance and mitigation measures, based upon best available practices, to avoid and manage the relevant impacts of the proposal on the above listed MNES. Include a description of the outcomes that the avoidance and mitigation measures will achieve and an assessment of the expected or predicted effectiveness of the avoidance and mitigation measures (including the scale and intensity of impacts of the proposal and the on-ground benefits to be gained through each of these measures).	See Section 14.4 and Appendix K3
1.9	Provide a consolidated list of mitigation measures proposed to be undertaken to prevent, minimise or compensate for the relevant impacts of the action, including mitigation measures proposed to be undertaken by State governments, local governments or the proponent.	See Appendices K5, U1 and U2
1.10	Provide information of any statutory or policy basis for, the mitigation measures.	See Appendix K3
1.11	Provide a detailed outline of a plan for the continuing management, mitigation and monitoring of the impacts on the above listed MNES. Include provisions for any independent environmental auditing. Include the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program.	See Appendices K5, U1 and U2
1.12	Provide details of the likely residual impacts on the above listed MNES that are likely to occur after the proposed measures to avoid and mitigate all impacts are taken into account. Include reasons as to why the avoidance or mitigation of impacts is not reasonably achieved and identify the significant residual impacts on the above listed MNES. If residual impacts are likely, include details of the proposed offset package to be implemented and an analysis of how the proposed offset meets the requirements of the *Environment Protection and Biodiversity Conservation Act 1999* Environmental Offsets Policy (2012).	See Sections 14.4.3, 14.4.4, 14.4.5 and 14.4.6 See Section 14.5 and Appendix K6
1.13	Describe how the proposal is consistent with any relevant EPBC Act guidelines, recovery plans, management plans, threat abatement plans, Marine Bioregional Plans and conservation advice for the above listed MNES (species and communities).	See Sections 14.4.3, 14.4.4, 14.4.5, 14.4.6 and Appendix K3
1.14	Provide information on feasible alternatives to the proposal including: • taking no action • a comparative description of the impacts of each alternative on the above listed MNES • sufficient detail to make clear why any alternative is preferred to another (short, medium and long-term advantages and dis-advantages of each alternative are to be discussed).	See Sections 2.6 and 3.6

Guideline		Comments
1.15	Provide details on the current status of the proposal and the consequences of not proceeding with the proposal.	See Section 2.6
1.16	Describe any consultation about the action, including any consultation that has already taken place, proposed consultation about relevant impacts of the action and – if there has been consultation about the proposed action – any documented response to, or result of, the consultation. Identify any affected parties, including a statement mentioning any communities that may be affected and describing their views.	See Chapter 7
1.17	Provide an overall conclusion as to the environmental acceptability of the proposal on each of the above listed MNES, including:	See Section 14.7
	• discussion on the considerations with the requirements of the EPBC Act (including the objectives of the Act, the principles of ecological sustainable development and the precautionary principle)	See Section 14.6
	• reasons justifying undertaking the proposal in the manner proposed, including the acceptability of the avoidance and mitigation measures	See Section 14.4 and Appendix K3
	• if relevant, a discussion of residual impacts and any offsets and compensatory measures proposed or required, and the relative degree of acceptability. Include the reasons why residual impacts are not avoidable.	See Section 14.5 and Appendix K6
1.18	Provide further detail on the social and economic costs and/or benefits of undertaking the proposed action, including the basis for any estimations of costs and/or benefits, potential employment opportunities expected to be generated at each phase of the proposed action and details of any public and stakeholder consultation activities, including the outcomes.	See Sections 4.6.4, 20.6.1, 20.6.2, 20.8.1 and 7.6
1.19	Provide an environmental record of the person(s) proposing to take the action. Include details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment of the conservation and sustainable use of natural resources against: the person proposing to take the action; and if the person proposing to take the action is a corporation – details of the corporation's environmental policy and planning framework.	See Chapter 26

14. MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE

14.1 INTRODUCTION

This chapter addresses Guideline 1, which stipulates that the EIS should provide sufficient information on the following controlling provisions (matters of national environmental significance (MNES)) to make an informed decision whether or not to approve the proposed action under Part 9 of the *Environment Protection and Biodiversity Conservation Act 1999* (Clth) (EPBC Act). This chapter also provides an overall assessment of other MNES potentially present in the study area and determines whether significant impacts on those species and/or communities would be likely.

The objective of the *Environment Protection and Biodiversity Conservation Act 1999* is to prevent significant impacts to MNES, including threatened species listed under Schedule 1 of the Act, by assessing proposed actions against the Matters of National Environmental Significance: Significant Impact Guidelines (DoE 2013a).

The guidelines indicate nine MNES:

- World Heritage properties
- National Heritage places
- wetlands of international importance (also known as 'Ramsar' wetlands)
- nationally threatened species and ecological communities
- migratory species
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mining)
- water resources, in relation to coal seam gas development and large coal mining development.

The Department of the Environment and Energy (DoEE 2014a) determined that the proposal is a 'controlled action' under the EPBC Act (EPBC/2016/7814, Appendix A4 and Appendix K4). A 'controlled action' is defined as a proposed action that is likely to have a significant impact on: a Matter of National Environmental Significance; the environment of Commonwealth land (even if taken outside Commonwealth land); or the environment anywhere in the world (if the action is undertaken by the Commonwealth) (DoEE 2018a). To be consistent with the other chapters in this EIS, the 'controlled action' is referred to as 'the proposal' in this chapter.

14.2 ASSESSMENT METHODS

14.2.1 LISTED THREATENED SPECIES AND COMMUNITIES

EBS Ecology completed a terrestrial ecology field survey of the study area on 17 August 2016, (i.e. in late winter). An additional field survey on 15 February 2018, (late summer), covered the vegetation south of the study area (see Appendix J2).

The field surveys were supported by desktop assessments including database searches, reviews of relevant literature and previous survey data. A marine ecology survey was also completed, the results of which are discussed in Chapter 12 – Marine Ecology. Information from the terrestrial ecology report and from the marine ecology field survey was used to prepare the Smith Bay Wharf EPBC Act Referral EPBC/2016/7814 (see Appendix K1).

Desktop research

Existing spatial datasets, relevant literature, aerial imagery and any relevant previous survey information reviewed for the EBS Ecology assessment included:

- a Protected Matters Report generated on 3 April 2018 using a 10 km buffer zone to identify MNES as listed under the EPBC Act (DoEE 2018b) (see Appendix K2)
- a search of the Biological Databases of South Australia (BDSA) obtained from the Department of Environment, Water and Natural Resources (DEWNR) on 8 August 2016 to identify flora and fauna species previously recorded within and around the study area (DEWNR 2016).

Data from the Protected Matters Search includes all species or communities that have a modelled distribution within the search area (in this case, within a 10 km radius of the central point of the study area). As a result, the list includes species or communities actually recorded within the search area, as well as species or communities that may occur based on inferences drawn from broad-scale habitat and climatic mapping.

For the EIS, the determination of whether a species is likely to occur within the study area is based on a comparison of the specific habitat requirements of each species or community with the actual conditions of the site, which is informed by field surveys and historical records.

This information was used to build a picture of:

- native vegetation cover within the study area and immediate surrounds
- previous surveys of the area
- vegetation associations present (including associations of significance) and their condition
- flora and fauna species present (including species of national or state conservation significance known or likely to occur in the area).

Field survey 2016

Research was undertaken for every threatened species previously recorded within the study area, or highlighted as potentially occurring in the area, to determine whether there was suitable habitat within the area.

An accredited EBS Ecology consultant, endorsed by the South Australian Native Vegetation Council (NVC) conducted the field survey in August 2016, traversing the study area on foot, mapping and recording the vegetation communities and flora species, and photographing each vegetation association; where possible, the flora species were identified to species level. The consultant used GPS to record the location and coverage of each vegetation association. This survey methodology was adopted from the South Australian Government's Guide to the Roadside Vegetation Survey Methodology in South Australia (Stokes et al. 2006).

Each vegetation community was assigned a significant environmental benefit (SEB) condition rating (see Chapter 13 – Terrestrial Ecology and Appendix J2). EBS Ecology devised the SEB condition matrix based on the Department of Water, Land and Biodiversity Conservation's (DWLBC) 2005 Guidelines for a Native Vegetation Significant Environmental Benefit Policy (DWLBC 2005 – Table 1). The matrix was endorsed by the Native Vegetation Unit in DEWNR.

The timing of the field survey was adequate for assessing this type of vegetation given the rain that fell in the previous season (a total of 263 mm in May, June and July 2016, compared with the median rainfall of 219.2 mm) (BOM 2018). The survey was performed within the flowering time for two orchids – the spiral sun-orchid and the greencomb spider-orchid – identified by the Protected Matters Search Tool (DoEE 2016 in EBS Ecology 2018) as potentially being present in the study area. The survey methodology accords with the Australian Government's Draft survey guidelines for Australia's threatened orchids: Guidelines for Detecting Orchids Listed as 'Threatened' under the *Environment Protection and Biodiversity Conservation Act 1999* (DoEE 2013b).

The methodology for the field survey (fauna) was developed in accordance with the Australian Government's Survey Guidelines for Detecting Mammals Listed as Threatened under the EPBC Act (DSEWPaC 2011).

Fauna species observed during the vegetation survey were recorded without using specific fauna survey techniques such as trapping. The study area was found to be mostly cleared, and EBS Ecology determined that dedicated fauna surveys were unlikely to yield any significant results given the relatively degraded vegetation remnants.

EBS Ecology conducted a general search of each habitat type and searched specific native habitat communities in daylight, recording numbers of individual fauna species and activity, including signs of activity and the location of each species. The location data was recorded using GPS.

Field survey 2018

In February 2018, an EBS Ecology consultant endorsed by the South Australian NVC conducted a terrestrial ecology survey of the patch of vegetation located on a neighbouring property south of the study area (Figure 13-3). Changes to the methodology used to assess native vegetation for clearance under the *Native Vegetation Act 1991* came into effect on 1 July 2017, so the field survey applied the methodology from the NVC Bushland Assessment Manual (2017), which uses biodiversity 'surrogates' or 'indicators' to measure biodiversity value against benchmark communities. Each area to be assessed is termed an application area ('block'), within which different vegetation associations ('sites') are identified and compared to the Nature Conservation Society of South Australia's 'benchmark' vegetation communities. A representative 1 ha 'quadrat' is surveyed for each site.

Three components of the biodiversity value of the site are measured and scored, namely the vegetation condition, conservation value and landscape context (Table 14-1). These three component scores are combined to produce a Unit Biodiversity Score per hectare, which is multiplied by the size of the site in hectares to provide a Total Biodiversity Score for the site. This score is used to calculate a SEB area and value for payment into the Native Vegetation Fund if the vegetation is subject to clearance. This methodology can also be used to assess vegetation for biodiversity value.

14.2.2 LISTED MIGRATORY SPECIES

Engineering and environmental consultants BMT WBM conducted probability modelling in January 2017 to investigate the risk of potential collisions between ships and whales in the southern Australian coastline resulting from regular movements of cargo vessels to and from the proposed KI Seaport (Appendix I2). Two methods were used to quantify the likelihood of whale strike: a theoretical probability formulation and a stochastic Monte-Carlo simulation to validate the theory.

The number of whales expected to be travelling along the southern Australian coastline and their movement patterns were determined from Bannister 2001 and 2007. The population estimate used was for the southern Australian population, i.e. not a sub-population.

The theoretical model calculates the expected number of collisions when a whale crosses the track of a ship's bow. The model assumes 260 whales traverse the southern Australian coastline twice a year during their annual migration, and combines this with the number of ships expected to travel through the area and their average speed, to determine the likelihood of whale strike.

The Monte-Carlo model was developed to validate the theoretical model outlined above. The Monte-Carlo model simulates 260 whales at random starting locations along the southern Australian coastline, migrating north from a random time in a two-month period and returning six months later. The model includes a ship making an east west crossing every 14 days, or 26 vessels calling at Smith Bay per year (one per fortnight). A whale strike was recorded if the ship and the whale were calculated to lie within the same 10 metre square area (i.e. it was assumed that neither the animal nor the vessel would take any evasive action).

14.3 EXISTING ENVIRONMENT

The existing environment associated with the study area and surrounding areas is outlined in various sections of this EIS:

- Chapters 9–12 for the marine environment (water quality, sediments, coastal processes and ecology), and the neighbouring aquaculture (land-based abalone farm)
- Chapter 13 for the terrestrial ecology
- Chapter 16 for the geology, soils and water (surface water and groundwater).

The economic and social environments are discussed in Chapter 20 and Chapter 22, respectively.

14.3.1 MNES POTENTIALLY PRESENT IN THE STUDY AREA

Table 2 in Appendix J3 lists MNES (threatened ecological communities, threatened species and migratory species) identified in the Protected Matters Search (DoEE 2018b,

TABLE 14-1 COMPONENTS OF THE BIODIVERSITY VALUE OF A SITE THAT ARE MEASURED USING THE BUSHLAND ASSESSMENT METHODOLOGY

Parameter	Data recorded
Vegetation condition	• native species diversity • number of native life forms and their cover • number of regenerating species • weed cover and the level of invasiveness of dominant species • cover of bare ground, fallen timber and exotic species in the understorey • tree health and the number of individual trees supporting hollows
Conservation value	• ecological communities and their conservation rating • number of threatened plant species recorded at the site and their conservation rating • number of threatened fauna species for potential habitat that occurs within the site and their conservation rating
Landscape context	• percentage vegetation cover within 5 km • block shape • distance to remnant vegetation area of greater than 50 ha • identity of the Interim Biogeographic Regionalisation for Australia (IBRA) association in which the area is located • remnancy figure for the IBRA association • percentage of vegetation protected within the IBRA association • the presence of riparian vegetation, swamps or wetlands

Appendix K2) and summarises the likelihood of these MNES being present in the study area. It also assesses the significance of any potential fauna habitat within the area. Appendix J3 lists 78 MNES, including one threatened ecological community, eight threatened plants, and 69 threatened and/or migratory fauna species comprising 48 birds, 15 mammals, four reptiles and two sharks.

The majority of species listed in Appendix J3 were assessed as either 'not present' within the study area (as in the case of the one threatened ecological community (TEC) and eight flora species listed), or 'unlikely to be present' (many of the listed fauna, particularly those considered transient or occasional visitors to the site). Some fauna species, such as coastal birds and mammals, were identified as 'potentially present but unlikely to be affected by the proposal'. The assessment concluded that the study area does not contain critical habitat for these species and the proposal would be unlikely to have a significant impact on habitat availability. No further assessment has been undertaken on any of these species.

Four species identified as potentially at risk of significant impact have been included in the impact assessment:

- southern right whale (*Eubalaena australis*)
- Kangaroo Island echidna (*Tachyglossus aculeatus multiaculeatus*)
- hooded plover (eastern) (*Thinornis rubricollis rubricollis*)
- southern brown bandicoot (eastern) (*Isoodon obesulus obesulus*).

The detailed assessment of these species, including their current status on Kangaroo Island, assessment of potential impacts, mitigation and management is presented in the following sections.

14.3.2 SOUTHERN RIGHT WHALE

The southern right whale (*Eubalaena australis*) is listed as endangered under the EPBC Act, as a migratory species under the Bonn Convention on migratory species (DoEE 2018a) and is listed as vulnerable under the *National Parks and Wildlife Act 1972*.

Genetic studies suggest there are two distinct Australian sub-populations: south-western (incorporating Western Australia and South Australia) and south-eastern (Victoria, Tasmania and New South Wales), with some level of ongoing or recent historical interbreeding (Carroll et al. 2011).

Background information on the southern right whale is provided in Appendix K3 and Appendix I2.

Records at Smith Bay

Southern right whale sightings are frequently reported close inshore on the southern and northern coasts of Kangaroo Island during the winter months, and females with calves have been observed in some of the more sheltered bays (Ling 2002).

The National Conservation Values Atlas (DoEE 2014b) identifies the entire coastline, to a distance of 1.5 km offshore, of Kangaroo Island as a biologically important area (BIA) which is used as seasonal calving habitat. Although BIAs do not have legal standing under the EPBC Act, they are used to inform the decision-making process (DoEE 2018).

The study area lies within an area described as the 'current core coastal range' for southern right whales (DSEWPaC 2012a, see Figure 1 in Appendix I2). In September 2017, an adult southern right whale and a calf were sighted in Smith Bay. However, it is not near any of the known aggregation areas and is outside the 'historic high use' area. A defined near-shore coastal migration corridor is unlikely based on the lack of any predictable directional movement of southern right whales (DSEWPaC 2012a). Two datasets suggest that the Smith Bay site is no more important to migrating whales than any other site along the north coast of Kangaroo Island:

- The Atlas of Living Australia (ALA 2018) includes more than 3000 South Australian records of southern right whale sightings since the early 1980s, predominantly sourced from the SA Museum. These include more than 400 sightings around Kangaroo Island, divided approximately evenly between the north and south coasts. About 170 of these sightings were within the area of historic high use (on Dudley Peninsula), including about 60 near Cape Willoughby. There are 50 records spread reasonably evenly along the north coast west of Dudley Peninsula. There are no records in this dataset for Smith Bay, with the nearest sightings being at Dashwood Bay to the west and Emu Bay to the east.
- The South Australian Whale Centre at Victor Harbor has maintained a log of whale sightings since 1997 (SA Whale Centre 2017). The log lists about 3000 sightings in State waters between 1997 and September 2016, but there is an obvious reporting bias because more than 80 per cent of these sightings are from Encounter Bay, where the centre is based. Nevertheless 110 sightings have been reported from Kangaroo Island, of which about 70 were from the area of historic high use. The 16 sightings from the north coast, west of Dudley Peninsula, are spread along the coast, and include one southern right whale sighting at Smith Bay.

Conservation programs in South Australia

Current conservation programs for the southern right whale in South Australia mainly comprise monitoring and research. Monitoring of abundance, population trends and habitat occupancy across Australian waters is ongoing, according to the Department of Environment and Energy (DSEWPaC 2012a). Reporting requirements around whale strandings and mortality events, including vessel strikes, facilitate biological and life history research. Current research also includes investigating how to reduce the impact of vessel strikes on whales and other marine mega-fauna (DoEE 2016).

14.3.3 KANGAROO ISLAND ECHIDNA

Conservation status

The Kangaroo Island echidna (*Tachyglossus aculeatus aculeatus*) is listed as endangered under the EPBC Act (DoEE 2018c), although it is not listed under State legislation. The listing is linked to the echidna's restricted range of a single population within the Island's total area of about 4400 square kilometres (Woinarski et al. 2014). In a 2015 assessment of the echidna's viability, the Threatened Species Scientific Committee (TSSC) noted that its prospects for survival were precarious because it was restricted to a single location – Kangaroo Island – and that breeding was not keeping up with the rate of natural and other echidna deaths, so the population continued to decline. The number of mature individuals is estimated at fewer than 5000 and the reduction in numbers is approaching 30 per cent in 75 years, that is, three generations (Woinarski et al. 2014).

Description

Like the platypus, the echidna is a monotreme, or egg-laying mammal. Adult Kangaroo Island echidnas are 30–45 cm long and weigh between 2 and 5 kg (TSSC 2015). The back is covered with cream coloured spines, which are modified hairs up to 50 mm long. Fur growing between the spines ranges in colour from honey to a dark reddish-brown and even black.

Echidnas are toothless and highly specialised, using their forepaws and snouts to break into ant or termite nests and extract the insects with a long sticky tongue. Females lay a single egg in a rudimentary pouch and construct burrows for incubating the egg and suckling their young. The baby hatches after 10 days and emerges from the burrow after about six months when it becomes too large and spiky for the pouch. Largely nocturnal and solitary animals, echidnas exhibit a pattern of back-to-back stretches of torpor similar to hibernation. During torpor echidnas will be inactive and their body temperature and metabolic rate will decrease. The bouts of torpor are interspersed with episodes of periodic arousal. They live up to 48 years in the wild.

Distribution and habitat preference

The Kangaroo Island echidna is found only on the Island. It is relatively common throughout most of the remaining natural vegetation, but at a lower density than before European settlement due to habitat loss (Rismiller 1999).

The echidna is found in various types of vegetation and feeds on a wide variety of invertebrates, including ants and termites (Rismiller 1999 and 2003). Echidnas extract invertebrates from soil, rotting vegetation and nests using their powerful claws and beak. They are generally found in vegetated areas and seeks shelter under thick bushes, hollow logs or occasionally in burrows, but will venture into open areas to forage (Augee 1995).

Records at Smith Bay

Echidna diggings were recorded along the western boundary of the study area and on adjacent properties during the EBS Ecology field assessment in 2016 (see Figure 14-1), although no echidnas were observed on the site. The study area is surrounded by suitable habitat for this species, particularly to the west (see Figure 14-1).

Threats

The key threats to the Kangaroo Island echidna are predation by feral cats and pigs, habitat loss and fragmentation, and being struck by vehicles, TSSC noted in 2015. It also claimed they are at risk of being killed by electric fences and by eating invertebrates affected by herbicides and pesticides.

Cats are believed to kill about 25 per cent of young echidnas, as well as some adults (Rismiller & McKelvey 2000). An average of 35 echidna road deaths are reported each year, with many more going unreported (Woinarski et al. 2014).

Vehicle strikes of echidnas are increasing on Kangaroo Island as road traffic increases, according to Dr Peggy Rismiller, an environmental physiologist and wildlife biologist who has lived and studied echidnas on the Island for 30 years. She noted in August 2017 that the Echidna Watch program recorded at least 35 road kills a year, and in one year recorded 40 deaths on a single road – the newly sealed South Coast Highway – although this could be attributed to a one-off change in road conditions. As noted by Woinarski et al. (2014), road kills of echidnas are likely to be underestimated due to the number of incidents presumed unreported, so it is difficult to accurately assess the overall impact on the Kangaroo Island echidna population. However, the number of reported vehicle strikes along Playford Highway and Gosse, Parndana and Stokes Bay roads has increased over recent years (Rismiller, P 2017 pers. comm., 14 August). Dr Rismiller said the majority of strikes occur between May and August during the courtship and breeding season, when male echidnas travel great distances and are highly active.

Conservation programs in South Australia

The primary conservation objective for the Kangaroo Island echidna is to maintain its current range and abundance (TSSC 2015). DoEE has determined that a recovery plan is not required for this species because the approved conservation advice provides sufficient direction to implement priority actions and mitigate against key threats. Similarly, DoEE has said

FIGURE 14-1 LOCATION OF ECHIDNA DIGGINGS WITHIN THE STUDY AREA

no Threat Abatement Plan is relevant for this species (TSSC 2015). Conservation and management actions are provided in Appendix K3.

Although no specific conservation programs have been identified for the Kangaroo Island echidna, ongoing feral animal control by Natural Resources Kangaroo Island (NRKI 2015), particularly as part of the program targeting cats (a joint initiative of Kangaroo Island Council and NRKI), is likely to have a positive impact. Likewise, revegetation projects and programs to improve habitat quality, such as thorough targeted weed control within the echidnas' range are likely to be beneficial.

Ongoing research is being conducted by Dr Rismiller and associated researchers at the Pelican Lagoon Research Station. This work entails investigating echidna deaths, including road kills as reported through the Echidna Watch program, as well as numerous studies on ecology, behaviour and conservation.

14.3.4 HOODED PLOVER (EASTERN)

Conservation status

The hooded plover (eastern) (*Thirnornis rubricollis rubricollis*) is listed as vulnerable under the EPBC Act (DoEE 2018d), and the hooded plover (*Thirnornis rubricollis*) species is listed as vulnerable under the *National Parks and Wildlife Act 1972*. The vulnerable listing of the subspecies under the EPBC Act is linked to its limited extent of occupancy, severely fragmented distribution and continuing decline in population and area of occupancy (TSSC 2014). Both species listings are assumed to refer to the same population of birds present on Kangaroo Island, and are referred to as the hooded plover (eastern) for the remainder of this document.

Description

The hooded plover (eastern) is a stocky, medium-sized wading bird about 20 cm long and weighing around 100 grams (TSSC 2014). Adult males and females look identical and have no seasonal variation in plumage. Adult birds have a black 'hood' and a white 'collar' bordered at the base by a thin black strip that extends across the base of the neck and shoulders to the sides of the breast, with pale brownish-grey upperparts and white underparts. When flying, they display black and white colouring on the front and rear of the upper surfaces of the wings. Adult birds also have a red bill with a black tip, red rings around the eyes, brown irises and dull orange-pink legs and feet.

Distribution and habitat preference

The hooded plover (eastern) is widely dispersed on or near sandy beaches in south-eastern Australia. Its range extends from around Jervis Bay in New South Wales to the western reaches of Eyre Peninsula in South Australia, and includes Tasmania and various offshore islands such as Kangaroo Island, King Island and Flinders Island (Barrett et al. 2003; Garnett & Crowley 2000; Marchant & Higgins 1993; Matthews 1913–14). In 2014, TSSC estimated there were around 620 individuals in South Australia, two-thirds of which are concentrated on Kangaroo Island and Yorke Peninsula.

Kangaroo Island is home to about one-third of the South Australian population of the eastern subspecies hooded plover. There is evidence of movement between the Kangaroo Island and mainland populations, with three colour-banded birds known to have traversed Backstairs Passage, the 16 km stretch of open sea separating the Island from the mainland (Baker-Gabb & Weston 2006).

The birds mainly inhabit high-energy sandy beaches and their adjacent dunes, although they are sometimes found in habitats other than beaches; for example, on rock platforms and reefs. They are generally seen close to shore but may occasionally visit nearby inland sites such as lakes and lagoons (EBS Ecology 2018; Marchant & Higgins 1993; Garnett et al. 2011).

They build solitary nests and lay two to three eggs in depressions in the sand on flat beaches above the high-tide mark, on stony terraces adjacent to beaches, or on the sides of sparsely vegetated dunes. The eastern subspecies generally breeds from August to March (Marchant & Higgins 1993; Baird & Dann 2003; TSSC 2014; Garnett et al. 2011).

They eat polychaetes, molluscs, crustaceans, insects, turions and seeds, foraging during the day and night, on beaches from the water's edge to the base of the foredunes, and on lagoons and saltpans (TSSC 2014; Marchant & Higgins 1993; Weston 2003).

On Kangaroo Island, their breeding sites are mostly associated with beaches less than 10 km long and 20 metres wide, with more headlands and complex dune systems and remote from settlements and sites frequented by walkers, fishers and dogs. They generally avoid narrow, steep beaches where there is little seaweed and waves wash up to the base of the dunes, and extensive rocky or pebble-covered shores (Baker-Gabb & Weston 2006).

Records at Smith Bay

Smith Bay has been surveyed eight times since 2002 as part of the biennial Kangaroo Island hooded plover census. A pair was sighted in 2010, 2014 and 2016 (see Figure 14-2) all located in the eastern section of the bay, 1.8–2.0 km away from the study area (i.e. east of the onshore aquaculture facility). The birds were foraging and feeding on the rocks at the time, and this area is likely to be prime foraging habitat (Maguire G 2017, pers. comm., 10 July).

Nesting behaviour was not recorded. However, given the difficulty of locating nests and the timing of the surveys, this does not mean the plovers do not nest at Smith Bay. The beach and foredune of the eastern part of the Bay does not look like their typical nesting habitat, as it is lower-energy, flatter and does not have much of an unvegetated foredune. The birds are known to breed on some similar beaches on Yorke Peninsula and on the southern Fleurieu, such as Yilki at Victor Harbor, however, so breeding at Smith Bay cannot be ruled out (G Maguire 2017, pers. comm., 10 July).

Threats

The TSSC in 2014 identified a number of threats to the hooded plover (eastern) (see Appendix K3). These threats may significantly reduce breeding success, result in loss of territories and fragmentation of habitat, and ultimately lead to local extinctions. The plovers are most vulnerable in their egg and chick stages.

The draft South Australian Recovery Plan for the hooded plover (Baker-Gabb & Weston 2006) identified several key threats that were likely to have high impacts on these birds in South Australia, relative to other risks.

- **Humans, dogs and vehicles:** The presence of beachgoers, dogs and vehicles can disturb nesting birds causing them to leave the nest and reducing nesting success. People and vehicles can unwittingly crush eggs and chicks, while predation by dogs is also evident. The plovers can sometimes breed successfully on beaches that are regularly visited if visitation is appropriately managed. Adult birds also risk being struck by vehicles on beaches.
- **Introduced predators:** Uncontrolled domestic dogs are known to disturb, maul and kill chicks and adult birds. Cats and rats have been seen near nests, but the impacts of these mostly nocturnal animals are difficult to assess.
- **Habitat modification:** Dune rehabilitation, including planting, has led to habitat modification and reduction in breeding sites due to resulting structural changes to dune systems. Unrestricted access to beaches by sheep and feral goats has affected breeding habitat on Kangaroo Island. Kelp harvesting can also affect breeding habitat and should only be undertaken outside the breeding season.

Other threats identified in the draft Recovery Plan included communication gaps, flooding of nests (particularly in relation to future rises in sea level), information gaps, and oil spills (Baker-Gabb & Weston 2006).

Conservation programs in South Australia

The primary conservation objectives for the hooded plover (eastern) are to:

- stabilise numbers of adults in the population, and maintain a stable number of occupied and active breeding territories
- improve breeding success by increasing fledgling rates (a combination of improving egg and chick survival rates), by:
  - reducing the destruction of nests and chicks, and the disturbance of breeding pairs, by human and human-related activities
  - reducing predation by feral animals and overabundant native predators
- maintain, enhance and restore habitat, and integrate the subspecies' needs into coastal planning (TSSC 2014).

DoEE has determined that a Recovery Plan is not required for this species because there is significant research and management actions are being undertaken at national, state and local levels (TSSC 2014). A threat abatement plan for foxes has been prepared (DEWHA 2008) and is relevant to the hooded plover (eastern); however, as there are no foxes on Kangaroo Island the plan's applications for the Island's plovers are limited. Ongoing efforts by NRKI and the Kangaroo Island Council to prevent foxes entering the Island, and to manage domestic dogs, are important in maintaining plover populations.

The Threatened Species Strategy, launched in July 2015, sets out the Australian Government's approach to protecting threatened animals and plants and helping the species recover. It includes commitments to improving conservation outcomes for 20 threatened bird species by 2020. When launched, the strategy identified the first 12 bird species for priority conservation, one of which was the hooded plover. For this species, action is focused on education and reducing human-induced pressures on nesting sites. There is strong alignment to the National Landcare Program and the Green Army, which could undertake works that protect nesting habitat. The level of community involvement and State Government partnerships is high (DoEE 2015).

Since 2006 Birdlife Australia has been coordinating a national conservation effort across South Australia, Victoria, New South Wales and Tasmania for the hooded plover (eastern) in partnership with land managers, government departments, volunteers and research institutes (TSSC 2014). Biennial surveys to monitor plover populations are undertaken on Kangaroo Island as well as the Fleurieu Peninsula, south-eastern South Australia and other interstate locations (Baker-Gabb & Weston 2006).

14.3.5 SOUTHERN BROWN BANDICOOT (EASTERN)

Conservation status

The southern brown bandicoot (eastern) (*Isoodon obesulus obesulus*) is listed as endangered under the Commonwealth EPBC Act (DoEE 2018b) and as vulnerable under the *National Parks and Wildlife Act 1972*. The endangered listing under the EPBC Act is linked to severe range contractions and historical

FIGURE 14-2 RECORDS OF THE HOODED PLOVER (EASTERN) IN THE VICINITY OF THE STUDY AREA

population declines. The TSSC noted in its 2016 assessment of this subspecies that it used to be extremely abundant across much of its range, but numerous subpopulations have disappeared, and it is now uncommon in many remaining areas.

Description

The southern brown bandicoot (eastern) is a medium-sized, ground-dwelling marsupial about 30 cm long with a long, tapering snout, hairless nose, small, rounded ears and small, black eyes. It has a compact body with short forelegs and longer hind limbs that resemble those of a macropod – such as a kangaroo – and a short tail about 110—120 mm long (DEC 2006; Paull 2008).

Distribution and habitat preference

These bandicoots are found from areas south of the Hawkesbury River in New South Wales to Kangaroo Island in South Australia, predominantly in coastal areas. In South Australia, apart from on Kangaroo Island, they inhabit the south-east, particularly along the Mount Burr Range, the Mount Lofty Ranges and Fleurieu Peninsula.

The animals are nocturnal and rarely venture far from cover, preferring areas of dense vegetation, including wetland fringes and heathland and exotic shrubs such as blackberry. They feed on earthworms and other invertebrates, as well as fungi and other subterranean plant material. They do not dig burrows, but may use the burrows of other animals, although they will usually nest on the ground under vegetation. Breeding may occur throughout the year but peaks in spring (Braithwaite 1995; Woinarski et al. 2014; Paull 2008; Packer 2013).

Records at Smith Bay

TSSC noted that surveys in 2008 suggest that the subspecies is widespread on Kangaroo Island, but trends in distribution are unclear. These bandicoots have been recorded at Cape Cassini, Lathami Conservation Park, Parndana Conservation Park and a number of Heritage Agreement properties within a 10 km radius of Smith Bay, but there are no records within Smith Bay itself or the adjacent properties (see Figure 14-3). The nearest recorded sighting is approximately 2 km south-west of the study area, in bushland adjacent to North Coast Road on 26 September 2011.

Threats

The key threats to Kangaroo Island's bandicoots have been identified as predation by feral cats, habitat loss and degradation, and inappropriate fire regimes as well as road traffic and the disease toxoplasmosis.

Although environmental weeds are a recognised cause of habitat degradation, some weeds such as blackberry, broom and gorse can provide habitat for bandicoots, and there are anecdotal reports of bandicoot populations disappearing following broad-scale weed control (TSSC 2016).

Conservation programs in South Australia

A draft national recovery plan for the southern brown bandicoot (eastern) has been prepared by the Victorian Department of Sustainability and Environment, but the plan has not been finalised or adopted under the EPBC Act. A recovery plan has been prepared for these bandicoots in the Mount Lofty Ranges of South Australia.

Conservation and management actions recommended by TSSC (2016) for this species are provided in Appendix K3.

Natural Resources Kangaroo Island (NRKI) has been working with the community to gather information on the bandicoots' distribution. Camera traps have also been used to monitor populations in and around Parndana and Flinders Chase National Park.

Ongoing feral animal control by NRKI, particularly targeting cats, is likely to have a positive impact on bandicoots. Efforts by NRKI and the Kangaroo Island Council to keep the Island fox-free, and to manage domestic dogs, are also important in maintaining bandicoot populations. Likewise, revegetation projects and programs to improve habitat quality, such as through weed control, within the bandicoots' range are likely to be beneficial.

14.4 IMPACT ASSESSMENT AND MANAGEMENT

In the Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (the Significant Impact Guidelines), a 'significant impact' is defined as:

> *an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.* (DoE 2013a)

Chapter 4 – Project Description discusses the proposed development and associated activities, some of which may impact MNES. The Significant Impact Guidelines require that the proposed development is assessed in its broadest scope for potential impacts on MNES.

Chapter 21 – Traffic and Transport outlines the road transport and the shipping activities, associated with the proposed development, which may impact MNES.

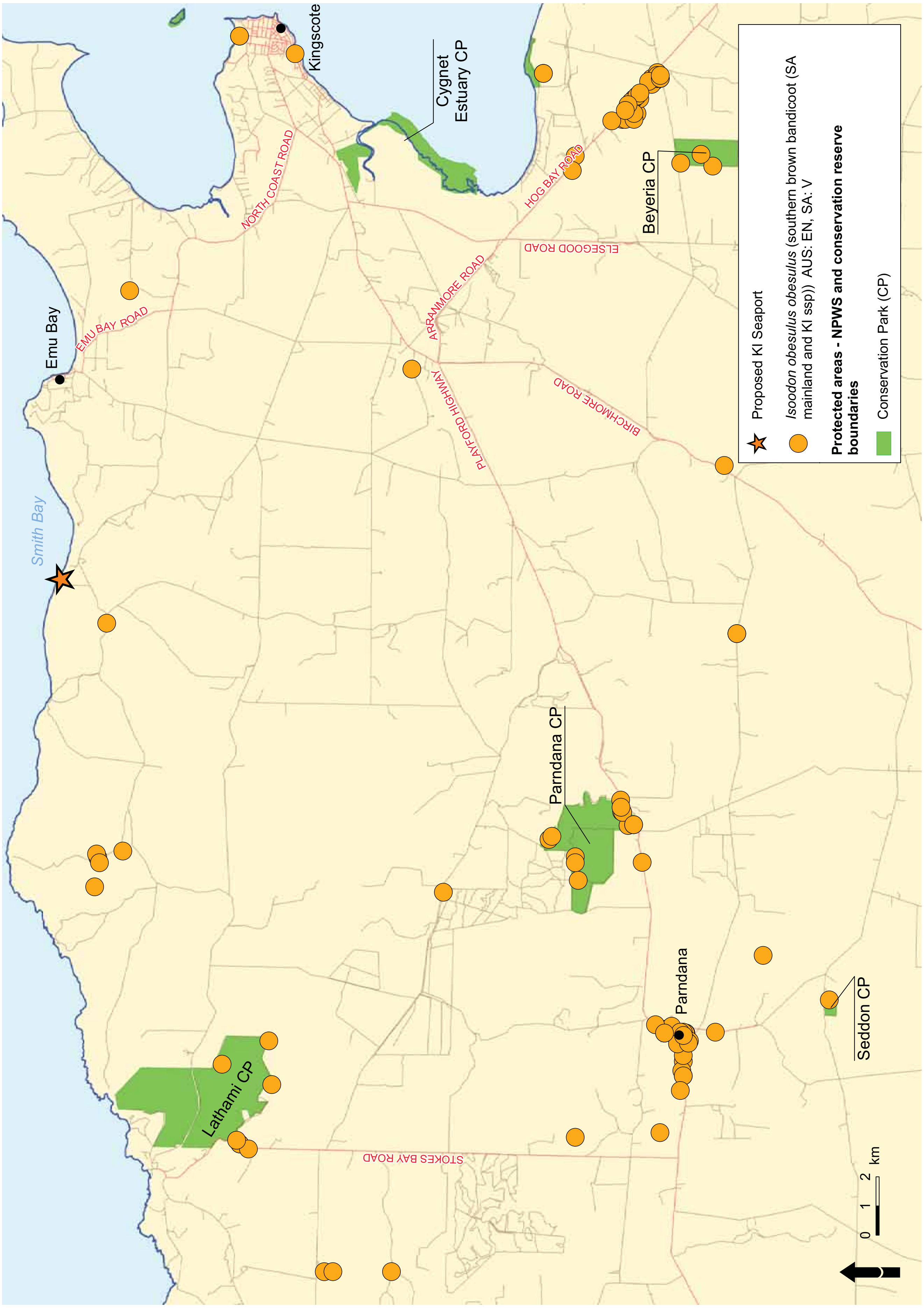


FIGURE 14-3 RECORDS OF THE SOUTHERN BROWN BANDICOOT (EASTERN) IN THE VICINITY OF THE STUDY AREA

The main potential sources of impact on MNES resulting from the Smith Bay development are:

- vegetation clearance and modification of the beach zone during construction, resulting in loss or fragmentation of fauna habitat and consequently the displacement of fauna
- vehicle and heavy machinery movement during construction, operation and decommissioning, resulting in death or injury to individual fauna
- shipping strikes to whales during operation
- noise/vibration/light from construction and operations including from shipping.

Significant impact criteria have been developed with the intention of helping to determine whether the predicted impacts of a proposed action on any MNES are likely to be significant (DoE 2013a). Criteria are established for each category of MNES and each level of threat for listed threatened species.

The significance of the potential impacts on each MNES is presented in the following sections. Potential impacts have been assessed as either direct, indirect or consequential, as well as unknown, predictable or irreversible. The precautionary principle formed the basis of the impact assessment and is defined as:

> *the lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there are threats of serious or irreversible environmental damage.* (s391(2) of the EPBC Act)

Consequential impacts (referred to as facilitated impacts in the DoEE Significant Impact Guidelines) are impacts that result from reasonably foreseeable further actions (by third parties) which would be made possible by the development.

An assessment of cumulative impacts resulting from the development is presented in Section 14.4.1.

14.4.1 CUMULATIVE IMPACTS

Cumulative impacts are defined as the successive and combined impacts, positive or negative, of one or more activities on society, the economy and the environment (Franks et al. 2010). The cumulative impacts of the development have been assessed in combination with other proposed developments on Kangaroo Island.

Other actions under the EPBC Act on Kangaroo Island

Other actions under the EPBC Act that have been, or are being taken, or have been approved on Kangaroo Island since the EPBC Act was introduced are summarised in Appendix K3. Proposals that have been approved under the EPBC Act in the region are shown in Appendix K3.

Seven of the 17 proposals listed relate to prescribed burns carried out by the Department for Environment and Water (formerly DEWNR, formerly DEH, formerly NPWS). Of the remaining 10 projects, five are directly related to development of the tourism industry, including the American River Hotel (not yet constructed), Kangaroo Island golf course (not yet constructed), Seal Bay tours (which did not go ahead), Hanson Bay helicopter joyrides and the Southern Ocean Lodge. There have also been two proposed developments at American River (neither of which progressed to development), two infrastructure upgrades (Middle River Reservoir spillway and sealing of West End Highway), and one resource exploration project (2D seismic survey by Woodside Energy).

14.4.2 POTENTIAL CUMULATIVE IMPACTS ON MNES

An assessment of the proposed development's contribution to cumulative impacts on the four MNES species is provided in Appendix K3. The development's contribution to cumulative impacts is considered to be negligible.

14.4.3 SOUTHERN RIGHT WHALE

Assessment of likely direct and indirect impacts

Table 14-2 identifies the development's potential impacts on the southern right whale. Management measures would address these impacts where practicable and necessary.

Vessel strike

In recent years between 15 and 40 whale strikes globally have been reported to the International Whaling Commission (IWC) each year (DoEE 2016). Data on vessel strikes of large cetaceans in Australian waters to date are limited. What is known has been compiled from reports given to the IWC global database and a more recent report by Peel et al. (2016). In Australian waters 109 vessel strikes have been recorded between 1840 and 2015 distinguishing between modern and historical data sets. This distinction is primarily the data source: records before 1997 (historical) are generally from newspaper articles and post-1997 (modern) are predominantly from the IWC database. Records from 1997 to 2015 show that 10 of the 88 whale collisions were with southern right whales, but at least some of the 22 collisions with an unidentified species (Peel et al. 2016) may have also been with a southern right whale. The southern right whale strikes occurred between July and November (Peel et al. 2016).

Vessels and southern right whales have collided three times in South Australian waters since 1981, killing at least two whales (Kemper et al. 2008; Spencer Gulf Port Link 2013) (see Figure 14-4). This includes an incident in 2001, when a ferry travelling between Cape Jervis on the South Australian mainland and Penneshaw on Kangaroo Island struck and killed an adult southern right whale (DoEE 2016). Shipping intensity in relation to important areas for southern right whales is shown in Figure 14-5.

TABLE 14-2 IDENTIFICATION OF POTENTIAL IMPACTS ON THE SOUTHERN RIGHT WHALE

Hazard	Direct/Indirect	Phase of project	Potential impact	Impact status (unknown, unpredictable, irreversible)
Vessel collision	Direct	Operation Decommissioning	Mortality	Irreversible
Vessel disturbance	Direct	Operation Decommissioning	Behaviour disruption (avoidance of vessels)	Short term
Noise and vibration pollution – dredging	Direct	Construction	Behaviour disruption Hearing damage – temporary threshold shift Hearing damage – permanent threshold shift	Short term Short term Long term
Noise and vibration pollution – piling	Direct	Construction	Behaviour disruption Hearing damage – temporary threshold shift Hearing damage – permanent threshold shift	Short term Short term Long term
Installation of a fixed solid structure (causeway)	Direct	Operation	Behaviour disruption	Long term
Shipping noise	Direct	Operation	Behaviour disruption Hearing damage – temporary threshold shift Hearing damage – permanent threshold shift	Short term Short term Long term
Marine debris	Direct	Operation	Ingestion of debris leading to health impacts	Irreversible
Introduction of marine pests and diseases – shipping activity	Direct	Operation	Mortality Diseases	Irreversible
Introduction of marine pests and diseases – third party shipping activity	Consequential	Operation	Mortality Diseases	Irreversible
Third party use of the port facility leading to increased shipping activity	Consequential	Operation	Mortality Behaviour disruption Ingestion of debris leading to health impacts Hearing damage – temporary threshold shift Hearing damage – permanent threshold shift	Long term Irreversible Long term Short term Long term
Third party use of the port facility leading to increased shipping activity	Cumulative	Operation	Mortality Behaviour disruption – short and long term Hearing damage – temporary threshold shift Hearing damage – permanent threshold shift	Long term Irreversible Short term Long term

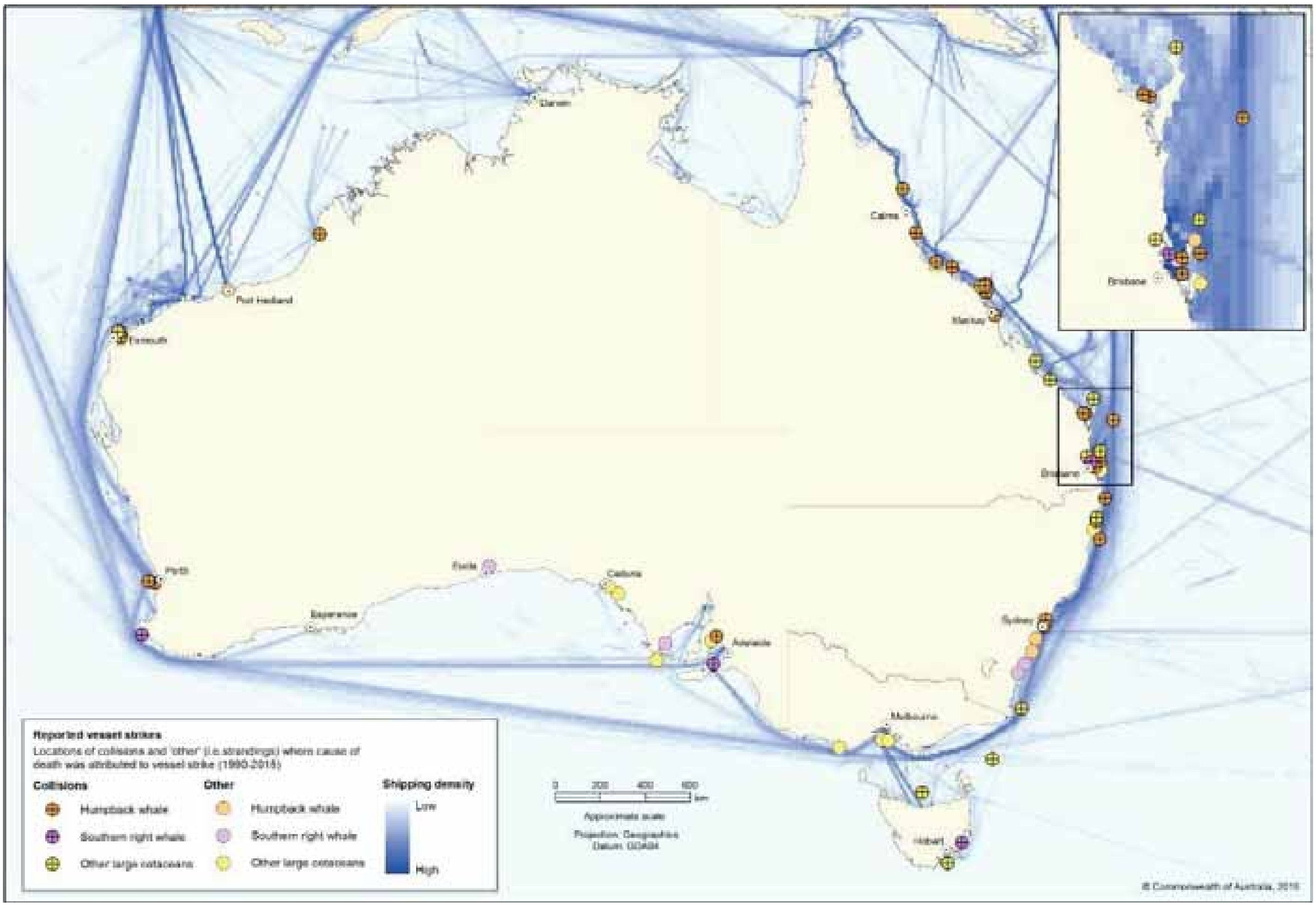


FIGURE 14-4 LOCATION OF REPORTED VESSEL COLLISIONS, OR STRANDINGS WHERE DEATH WAS ATTRIBUTED TO VESSEL COLLISION (DoEE 2016)

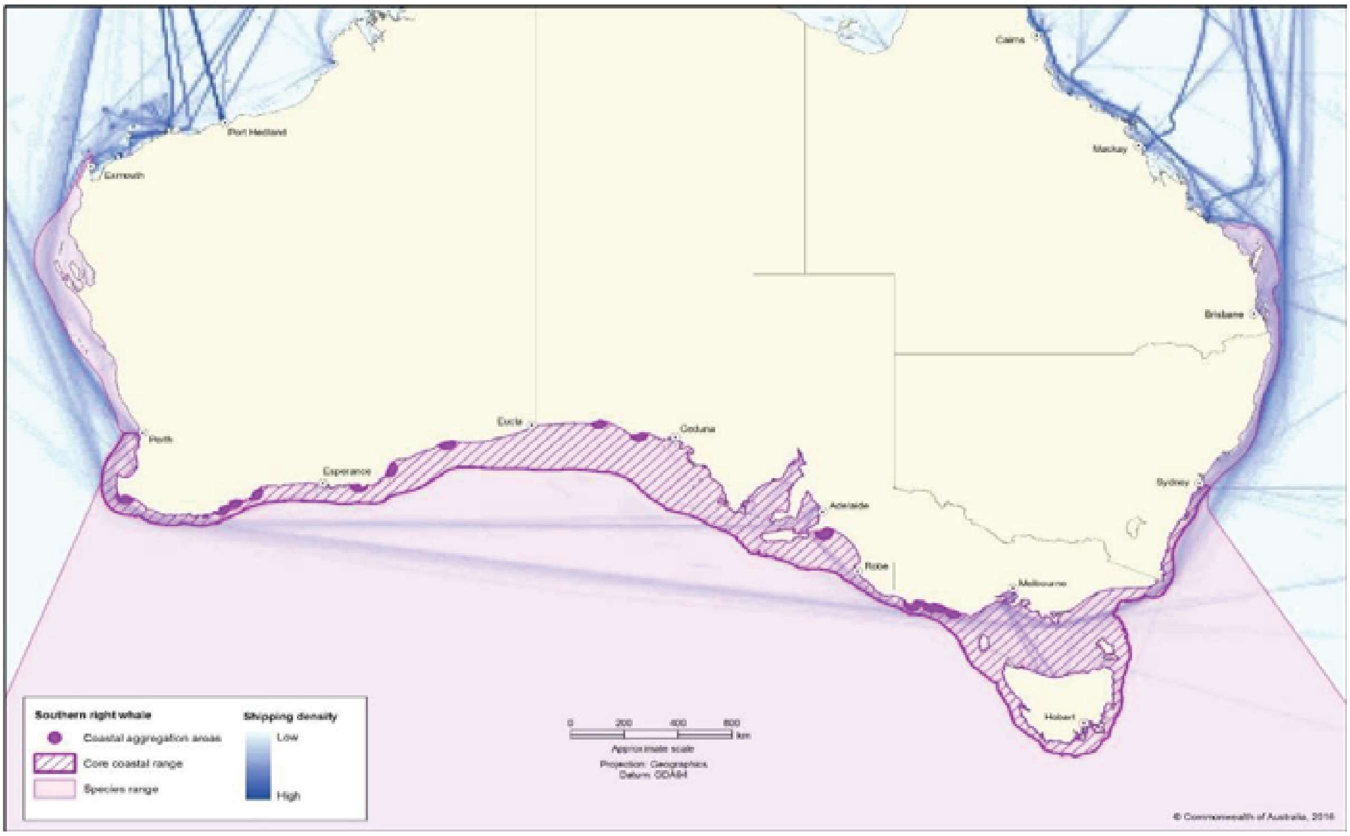


FIGURE 14-5 SHIPPING INTENSITY IN RELATION TO IMPORTANT AREAS FOR SOUTHERN RIGHT WHALES (DoEE 2016)

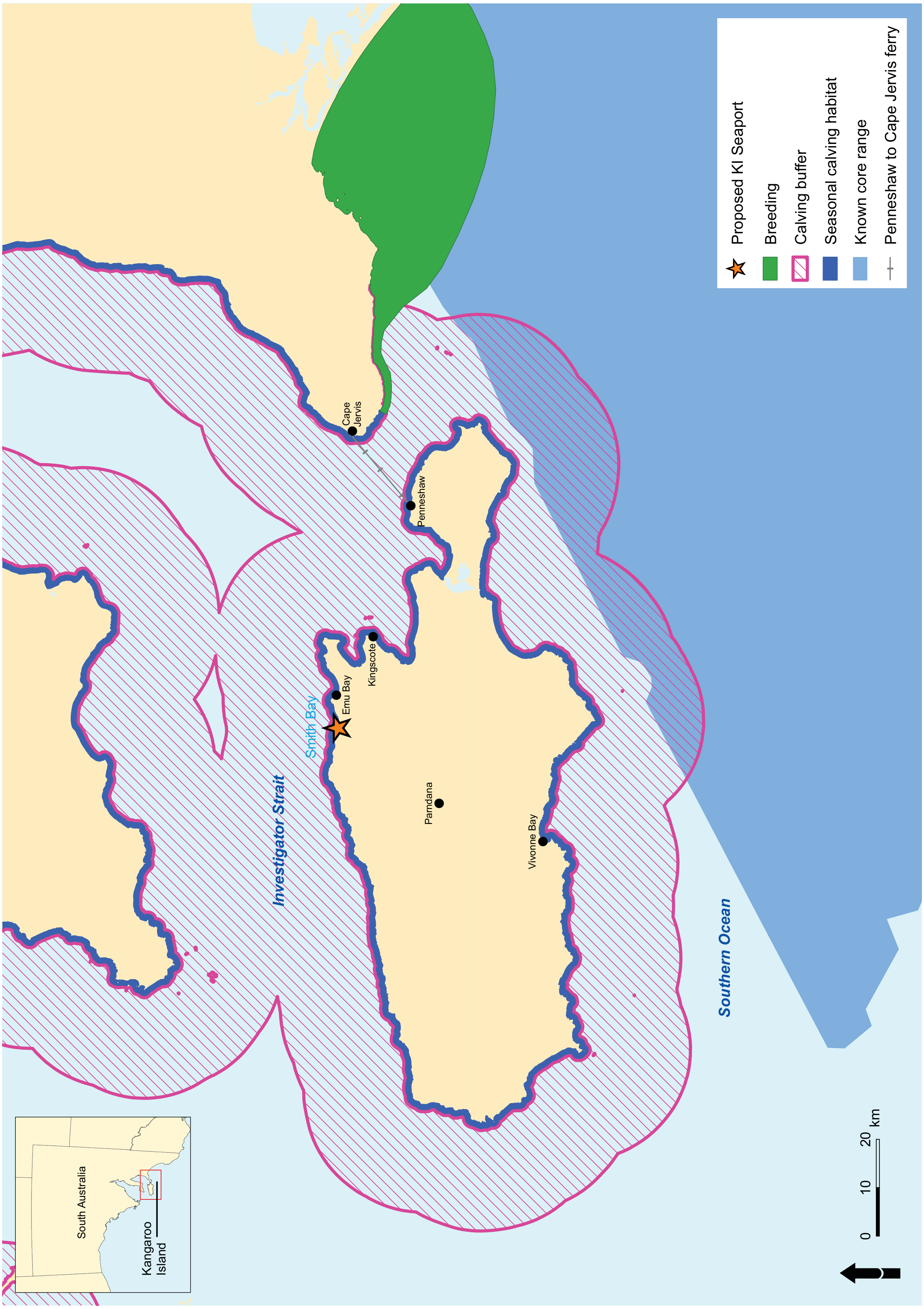


FIGURE 14-6 BIOLOGICALLY IMPORTANT AREAS FOR THE SOUTHERN RIGHT WHALE (DoEE 2014)

BMT WBM conducted whale strike probability modelling to investigate the risk of potential vessel impact in resulting from regular shipping movements associated with KIPT timber products moving to and from Smith Bay along the southern Australian coastline (see Section 14.2.2). Two methods were used to quantify the likelihood of whale strike: a theoretical probability formulation and a stochastic Monte-Carlo simulation to validate the theory.

BMT WBM's theoretical model found the average number of whale strikes resulting from increased shipping from KIPT's operations is 0.00334 a year (about one every 300 years), with a standard deviation of 0.058 strikes a year. The model was run over 10 million simulated years to determine an expected long-term average. This resulted in an average of 0.00326 whale strikes a year, or one every 306 years. The results validated the theoretical model, based on the assumptions made.

The problem with records of collisions to date is the vast knowledge gaps, especially concerning true numbers of vessel strikes on different species. Despite the obligation under the EPBC Act to report any collisions that may result in a cetacean being injured or killed, it is likely that some are undetected or not reported (DoEE 2016). It is problematic deriving conclusions about the rate of vessel strike in Australia using data that is incomplete and potentially biased and non-representative (Peel et al. 2016).

The steady increase over the past decade in shipping activity in Australia and the predicted escalation in the future, coinciding with the growth in the size of the south-west Australian sub-population of the southern right whale suggests the probability of vessel strikes involving these species will also increase (DoEE 2016).

The impact of the proposed development on southern right whales through ship strike during operations is considered to be negligible for the following reasons:

- the annual number of vessel calls associated with the KIPT wharf is expected to be only 10–20, compared to about 2000 vessel calls at existing South Australian ports, and use of coastal waters by approximately 50,000 recreational vessels registered in South Australia
- shipping activity in South Australia is not considered to be of the same level of concern as other busier ports including Fremantle and Melbourne (DoEE 2016)
- given the migratory nature of many large cetaceans, defined 'areas of concern' may be relevant only on a time-related or seasonal basis when whale movement through a region is high. Areas surrounding major Australian ports, primarily along the east and west coasts where shipping activity is highest, may be cause for concern. Melbourne, Brisbane, Newcastle, Dampier, Sydney, Port Hedland, Fremantle, Darwin and Gladstone harbours or ports had the most ship calls during 2013–14 and all except Darwin lie on migratory routes and/or are close to areas where whales aggregate
- modelling has shown there is a low probability of whale strikes (one-in-300 years) associated with vessels travelling to and from the KI Seaport along the southern Australian coastline (see Appendix I2)
- within South Australia it has been reported that the greatest threat to southern right whales from human interaction comes from entanglement with fishing lines, nets, buoys, pots and/or shark nets, rather than vessel strike (Kemper et al. 2008). Although such incidents resulted in two deaths during the study period, there were many more non-fatal entanglements
- the population of southern right whales in the south-west Australian sub-population, which is considered to include the whales seen along the South Australian and Western Australian coastline, is growing at their maximum biological rate (Carroll et al. 2011) despite the presence of several major port developments in Western Australia. This indicates there would appear to be no significant impacts from shipping or ports, despite ship strike being listed as a major threat to this species (Bannister 2007).

Noise

Little is known about the sensitivity of southern right whales to anthropogenic noise (DSEWPaC 2012a).

Baleen whale sounds are a combination of low frequency 'moans', impulsive 'grunt' or 'ratchet' calls and complex 'whale song' (National Research Council 2003; Spencer Gulf Ports Link 2013). Very little data is available about the hearing capabilities of baleen whales and no audiograms have been published in the available literature. However, studies based on the physiology of their hearing mechanisms suggests that they can hear sound frequencies as low as approximately 20 hertz (Kitten 1997; Spencer Gulf Ports Link 2013).

An environmental noise impact assessment was undertaken by Resonate (Appendix N1) using underwater noise criteria that were based on the National Oceanic and Atmospheric Administration (NOAA) Marine Mammal Acoustic Technical Guidance 2018, see Table 14-3. The adopted criteria are generally more stringent than the DPTI Underwater Piling Noise Guidelines. The southern right whale is part of the low frequency cetacean group.

Examples of calculated separation distances for recent projects include:

- for the Port Bonython Bulk Commodity Export Facility, it was calculated that temporary hearing damage could occur within 10 metres for whales, 20 metres for pinnipeds (such as seals or sea lions) and 100 metres for humans and cephalopods (such as octopus or squid) (Spencer Gulf Ports Link 2013)

- for the Central Eyre Iron Project's port at Cape Hardy, it was calculated that permanent hearing damage could occur within 470 metres for baleen whales, pinnipeds and fish, and 30 metres for toothed whales and dolphins (Jacobs 2015).

The Underwater Piling Noise Guidelines prescribe safety zones spanning 100 to 300 metres if the sound exposure level has reduced to 150 dB within the respective distance, or 1 km otherwise (DPTI 2012).

The underwater impact assessment calculated separation distances for the proposal which include:

- temporary threshold shift could occur within 500 metres of dredging activity for southern right whales
- permanent threshold shift could occur within 900 metres of piling activities for the southern right whale and
- temporary threshold shift could occur within 6.5 km of piling activities for the southern right whale (Resonate 2018).

During piling, the proposed development's noise impact to low frequency cetaceans was determined to be moderate for permanent threshold shift before the implementation of mitigation measures (Resonate 2018). A threshold shift decreases auditory sensitivity which makes hearing sounds harder. This hearing damage can affect the whales' ability to detect prey as well as predators.

During construction and decommissioning, the proposed development's noise impact from dredging activity is considered likely to be negligible for the following reasons:

- the study area is not near an aggregation area, but is in close proximity to an historic high-use area
- southern right whales are unlikely to be present during construction
- the entire coastline of Kangaroo Island is considered seasonal calving habitat (see Figure 14-6) and suitable habitat for the whales exists adjacent to the study area
- the study area is not near a known breeding area (DoEE 2014) (see Figure 14-6).

During operation, the proposed development's noise impact is considered likely to be negligible for the following reasons:

- the study area is not near an aggregation area and southern right whales are unlikely to be present during shipping activity which will occur on about 40 days a year
- there is existing vessel movement through Investigator Strait and within Smith Bay
- additional shipping activity (10-20 vessel movements) is unlikely to contribute to a significant increase in vessel noise levels.

Marine debris

During construction and decommissioning, and during operation, the proposed development's impact on southern right whales from the ingestion of harmful marine debris is considered likely to be negligible because:

- whales are unlikely to be feeding in Australian coastal waters (DSEWPaC 2012a)
- the relative increase in shipping-based debris to which migrating whales would be exposed is negligible.

Avoidance, mitigation, management and monitoring measures

Vessels using the KI Seaport at Smith Bay would be either Handymax or Panamax, which are up to 225 metres long. It is unlikely vessels of this size would be able to change course to avoid striking marine fauna, but the port operator would impose speed restrictions to minimise the risk of collision.

Measures to control the incidence of collisions between ships and southern right whales include vessel compliance with AMSA notice Marine Notice 15/2016 (Minimising the risk of collisions with cetaceans AMSA 2016), which reminds ship owners, operators and seafarers of their reporting obligations and urges seafarers to maintain a lookout for cetaceans, having regard to key times and locations and, in the event of sightings, to warn other vessels and consider speed reductions and modest course alterations.

TABLE 14-3 UNDERWATER NOISE PREDICTIONS SHOWING THRESHOLD DISTANCES

Species	Source character	Organ damage	Permanent threshold shift	Temporary threshold shift	Behavioural response
Low frequency cetacean Southern right whale	Continuous	> SPL 200 dB	SELc 199 dB (Mlf)	SELc 199 dB (Mlf)	SPL 120 dB
	Impulsive	> SPL 200 dB	Peak 219 dB SELc 183 dB (Mlf)	Peak 213 dB SELc 168 dB (Mlf)	SPL 160 dB

Notes: SPL – sound pressure level (expressed in units of dB re 1 μPa), SEL_C – sound exposure level, cumulative (expressed in units of dB re 1 $μPa^2s$), Mlf – M-weighted curve for low frequency cetaceans. Source: Resonate 2018

Specific mitigation measures for piling activities would include:

- conducting piling only during daylight hours
- implementing a soft-start procedure for the commencement of piling activity to gradually increase noise levels, enabling affected animals to leave the area
- evaluating alternative piling methodologies that have lower noise emissions
- implementing safety zones which comprise a shut-down zone and an observation zone:
    - the observation zone would be monitored for marine species and determine whether they are entering the shut-down zone
    - the shut-down zone would require cessation of piling, as soon as practicable, if a marine species was sighted within the shut-down zone
- trained marine mammal observers (MMO) should be used to monitor the safety zones.

In addition:

- the Construction Environmental Management Plan (CEMP) would include measures to reduce the noise impact of construction activity
- appropriate management of waste on ships would minimise any potential increase in marine debris, that might harm southern right whales
- biosecurity controls would be developed for the KI Seaport to reduce the risk of introducing aquatic diseases to the marine environment (see Chapter 15 – Biosecurity)
- the Operational Environmental Management Plan (OEMP) would include measures to prevent oil and chemical spills from the pontoon, including developing spill response plans to protect the marine environment.

Monitoring during construction, operation and decommissioning would include:

- reporting sightings of whales during construction and decommissioning and during shipping activity
- reporting strikes on whales in Australian waters by vessels associated with KIPT's operations to the appropriate authorities, including DEW and DoEE
- reporting any marine spill and pollution incidents to the Australian Maritime Safety Authority (AMSA)
- implementing the marine pest monitoring plan (see Chapter 15 – Biosecurity and Chapter 26 – Environmental Management Framework).

See Appendix K5 for the Draft MNES Monitoring Plan for further detail.

Effectiveness of mitigation measures

The avoidance and mitigation measures proposed for the development are considered effective (see Appendix K3).

MNES impact significance

An assessment under the MNES Significant Impact Guidelines (DoE 2013a) is provided in Table 14-4.

Assessment of residual impacts

Based on the above assessment, there would be no residual significant impacts on the southern right whale as a result of the proposal.

Consistency with relevant plans

The proposed development is consistent with relevant plans and advice summarised in Appendix K3 based on the following:

- the development is not located in a known aggregation area and is outside the whales' historic high-use area
- an emerging coastal aggregation area has been identified by DoEE at Encounter Bay, which is approximately 65 km east of the development site
- shipping activity associated with KI Seaport would add 10–20 vessels a year, based on KIPT requirements, to the existing marine traffic
- management measures would be implemented to minimise the risk of vessels striking whales and contributing to marine debris
- noise pollution would be minimised during construction and noise-generating construction activity would cease when whales were detected in the immediate area.

14.4.4 KANGAROO ISLAND ECHIDNA

Assessment of likely direct and indirect impacts

Most of the vegetation in the study area is highly degraded, with reduced biodiversity and high levels of weed incursion (EBS Ecology 2018). Of the 20 flora species recorded on the site, only 11 were native, and grew in small patches or as scattered individuals. Echidnas are known to forage for invertebrates in agricultural paddocks. It is unlikely the study site encompasses a large portion of the home range for the Kangaroo Island echidnas, which can be as large as 400 ha (Rismiller, P 2018, pers. comm., 15 July), however it could be used for foraging.

An increase in overall road traffic on Kangaroo Island would be likely to increase the risk of vehicles striking echidnas. KIPT's activities will increase road traffic.

Traffic and transport aspects of the proposed developments are outlined in Chapter 21 – Traffic and Transport, which is an ancillary activity to the KI Seaport.

TABLE 14-4 ASSESSMENT OF THE DEVELOPMENT AGAINST SIGNIFICANT IMPACT CRITERIA: SOUTHERN RIGHT WHALE

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Background	Relevant aspects of proposal	Assessment of impact
lead to a long-term decrease in the size of a population	A small increase in shipping along the southern Australian coastline has the potential to result in death of an individual whale through vessel strike. However, the probability of this happening has been estimated at just once in 300 years (BMT WBM 2017), and thus the risk of vessel strike is unlikely to lead to a long-term decrease in the size of the population. Current plans do not include any vessel movements across the Great Australian Bight, except for the sea tow of the pontoon itself prior to deployment at Smith Bay. Genetic studies suggest there are two distinct Australian sub-populations: south-western (incorporating Western Australia and South Australia) and south-eastern (Victoria, Tasmania and New South Wales), with some level of ongoing or recent historical interbreeding (Carroll et al. 2011). There is some ambiguity in the description of the Australian sub-populations in the available documentation. DSEWPaC (2012a) refers to a south-western population extending from Cape Leeuwin in Western Australia to Ceduna in South Australia and a south-eastern population as inhabiting waters between Ceduna and Sydney. However, the work by Carroll et al. (2011) to delineate the sub-populations, and cited by DSEWPaC (2012a), includes samples from Encounter Bay, near Victor Harbor, in its south-western group. There is limited data on demographics of the south-east sub-population and numbers are considered to be low (AMMC 2009), however the total Australian population is estimated at below 3000 (Bannister et al. 2016). Southern right whales have a long lifespan and a relatively low productive rate and mortality of an adult female is potentially significant (DSEWPaC 2012a). The additional shipping movements generated by the development (10-20 vessels a year) is not likely to lead to any significant cumulative shipping impacts on the southern right whale population.	Shipping activity during operation along the entire shipping route could encounter individuals from either of the Australian sub-populations.	Unlikely to have a significant impact.

TABLE 14-4 ASSESSMENT OF THE DEVELOPMENT AGAINST SIGNIFICANT IMPACT CRITERIA: SOUTHERN RIGHT WHALE (CONT'D)

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Background	Relevant aspects of proposal	Assessment of impact
reduce the area of occupancy of the species	The National Conservation Values Atlas identifies the entire coastline to a distance of 1.5 km offshore, of Kangaroo Island as a biologically important area, which is used for seasonal calving habitat by southern right whales (DoEE 2014a). Presence of the port is unlikely to reduce the whales' use of this area. Similarly, a small increase in shipping along the southern Australian coastline is unlikely to reduce the whales' use of area because the shipping routes would be some distance offshore, while this whale species prefers to breed within 2 km of the shoreline. Current plans do not include any vessel movements across the Great Australian Bight, except for the sea tow of the pontoon itself prior to deployment at Smith Bay. The solid causeway would extend 250 metres into Smith Bay, including the pontoon, and would have a footprint of approximately 1.6 ha. This infrastructure is unlikely to significantly reduce the area of occupancy for southern right whales.	Shipping activity during operation. Operation – additional infrastructure.	Unlikely to have a significant impact.
fragment an existing population into two or more populations	Southern right whales are known to travel vast distances and will have no trouble bypassing Smith Bay if they wish to avoid the development area. There is no evidence that southern right whales avoid areas with marine infrastructure but, even if they did, the development is not large enough to cause fragmentation of existing populations.	Shipping activity during operation.	Unlikely to have a significant impact.
adversely affect habitat critical to the survival of a species	The National Conservation Values Atlas identifies the entire coastline of Kangaroo Island as a biologically important area that is used for seasonal calving by the southern right whale (DoEE 2014). The bay is not considered to be habitat critical to these whales' survival.	Shipping activity during operation.	Unlikely to have a significant impact.
disrupt the breeding cycle of a population	The National Conservation Values Atlas identifies the entire coastline of Kangaroo Island as a biologically important area that is used for seasonal calving by the southern right whale (DoEE 2014), and there are no records of breeding in this area. The presence of the port is unlikely to impact breeding at other sites, such as Encounter Bay and Fowlers Bay, as they are too far away to be affected.	Shipping activity during operation.	Unlikely to have a significant impact.
modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The National Conservation Values Atlas identifies the entire coastline of Kangaroo Island as a biologically important area that is used for seasonal calving by the southern right whale (DoEE 2014). It is unlikely that the development would decrease the availability or quality of southern right whale habitat in any meaningful way.	Shipping activity during operation.	Unlikely to have a significant impact.

TABLE 14-4 ASSESSMENT OF THE DEVELOPMENT AGAINST SIGNIFICANT IMPACT CRITERIA: SOUTHERN RIGHT WHALE (CONT'D)

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Background	Relevant aspects of proposal	Assessment of impact
result in invasive species that are harmful to a critically endangered or endangered species becoming established in this species' habitat	There are no known invasive species that affect the southern right whale and that may be introduced as a result of the development. Biosecurity controls under the *Biosecurity Act 2015* would be enforced by the Department of Agriculture and Water Resources (DAWR) to minimise the risk of introducing pests and diseases to the marine environment.	Shipping activity during operation. Importation of equipment and materials from the mainland and international waters.	Unlikely to have a significant impact.
introduce disease that may cause the species to decline	There are no known diseases that affect the southern right whale and that may be introduced as a result of the development. Biosecurity controls under the *Biosecurity Act 2015* would be enforced by the Department of Agriculture and Water Resources (DAWR) to minimise the risk of introducing pests and diseases to the marine environment.	Shipping activity during operation. Importation of equipment and materials from the mainland and international waters. Biosecurity measures, ballast water management and biofouling management for shipping.	Unlikely to have a significant impact.
interfere with the recovery of a species	The National Conservation Values Atlas identifies the entire coast of Kangaroo Island as a biologically important area that is used for seasonal calving by the southern right whale (DoEE 2014). The presence of the wharf is unlikely to interfere with the recovery of a species as it is likely to increase in number and expand in range within the many other identified areas of suitable habitat along the coast.	Shipping activity during operation.	Unlikely to have a significant impact.

Potential impacts on echidnas resulting from expected increased traffic due to the proposed development are detailed in Table 14-5. Mitigation and management measures would address these impacts where practicable and necessary.

Vehicle strike

Chapter 21 – Traffic and Transport indicates that approximately 57 million kilometres are currently travelled on the main road routes of Kangaroo Island each year (see Section 21.5.3). Heavy vehicles generally account for approximately 7–15 per cent of all vehicle traffic. KIPT expects its trucking fleet would travel approximately 3.4 million kilometres annually at peak timber production years – a six per cent increase in the overall kilometres travelled on Kangaroo Island.

A review of scientific literature found very little peer-reviewed information or published data on the rates of roadkill especially species-specific data including for echidnas. Appendix K6 provides detailed summaries of relevant studies, with the key findings being:

- rates of roadkill for native species were significantly higher on the Island than the mainland with echidnas accounting for 0.3 per cent of the total number of roadkill recorded (two echidnas out of a total sample size of 774) (Leeuwenburg 2004)
- data recorded by the Echidna Watch Program found that over the last 10 years an average of 40 echidna mortalities per year occurred as a result of vehicle strikes on Kangaroo Island, with 65 per cent recorded during the echidna breeding season of June, July, August and September
- echidna activity thus varies seasonally, which has a correlation with months when road deaths are more likely to occur

TABLE 14-5 IDENTIFICATION OF POTENTIAL IMPACTS ON THE KANGAROO ISLAND ECHIDNA INDIVIDUALS

Hazard	Direct/indirect consequential	Phase of proposal	Potential impact	Impact status (unknown, unpredictable, irreversible)
Open trenches	Direct	Construction	Mortality	Irreversible Long term
Vehicle movement along Freeoak Road	Direct	Construction/operation/ decommissioning	Mortality	Irreversible Unknown Long term
Dust	Direct	Construction	Habitat degradation Reduction of food source and habitat	Short term
Habitat disturbance	Direct	Construction	Disruption of foraging and breeding activity	Long term
Habitat loss	Direct	Construction	Disruption of foraging and breeding activity	Long term
Human activity	Direct	Construction/operation/ decommissioning	Increase in predators (feral cats, domestic dogs or scavenging birds)	Long term
Introduction and/or spread of environmental weeds	Direct	Construction/operation/ decommissioning	Habitat degradation	Long term
Noise and light pollution	Direct	Construction/operation	Behaviour and abundance impacts	Short term
Woodchip storage (potential that echidnas will dig into the stockpile if no deterrence barriers)	Direct	Operation	Mortality	Long term
Use of herbicides and pesticides	Direct	Operation	Mortality	Long term
Increased vehicle movement on the transport route	Cumulative Indirect (upstream of proposal)	Operation	Mortality	Irreversible Unknown Long term
Vegetation clearance along transport route	Consequential Indirect (upstream of proposal)	Operation	Habitat loss Fragmentation of habitat Disruption of foraging and breeding activity Mortality	Irreversible Long term

- echidna roadkill was observed to occur more along roads which dissect open paddocks and well-vegetated areas compared to roads which dissect two well-vegetated areas or two open paddocks (Leeuwenburg 2004).

Appendix K6 outlines the variables, assumptions and potential traffic-related factors that were considered in estimating the number of echidna mortalities that could be associated with vehicle strikes as a result of KIPT's haulage trucks.

It is difficult to calculate potential echidna mortalities that may result from the anticipated additional road use by KIPT's haulage trucks. The paucity and lack of reliable statistical data on current roadkill deaths limits this correlation, for example, a lack of a validated understanding about whether trucks pose a higher risk to echidnas than light vehicles, or whether the haulage trucks' schedule poses a higher risk compared to other road users, such as tourists. Limited data available regarding any correlations between the areas and times of year when echidna roadkill is highest currently suggests that there is a likely spatial and temporal correlation between roadkill and tourist season.

Worst-case estimates (Appendix K6) for potential annual echidna deaths as a result of KIPT haulage trucks range from six to 21 per annum (which equates to 0.1–0.4 per cent of the estimated total population of echidnas on the Island). The higher estimated number (of 21) has been adopted for the purpose of determining a suitable offset (see Section 14.5).

Avoidance, mitigation, management and monitoring measures

KIPT anticipate that forestry haulage vehicles will increase the number of vehicles on the Island's traffic routes by six vehicles per annum. As mentioned, an increase in road traffic may increase the risk of vehicle strikes to echidnas. This risk would be reduced by:

- adopting the preferred route for forestry vehicles (see Chapter 21 – Traffic and Transport). This would minimise the time and distance travelled
- minimising the number of vehicles required to transport timber products by using high productivity vehicles such as B-doubles and A-doubles
- implementing driver education and awareness training (anecdotal reports by Dr Rismiller indicate that this reduces the potential for incidents)
- installing echidna awareness signage for road users at the proposed site's access road
- encouraging drivers to report echidna/vehicle strikes during timber haulage
- regularly inspecting the transport route for roadkill. Deceased echidnas are a food source for feral cats, which are also a threat to echidnas.

It is proposed that a small amount of vegetation in the vicinity of the study area would be removed for upgrade of the site's access road although the development's footprint would be minimised to limit vegetation clearance. Any proposal to clear vegetation along a proposed timber haul route would require a separate assessment of impacts on echidnas and would be subject to a separate approvals process.

Adjacent to the study area (to the west) KIPT own land that offers a suitable habitat for echidnas. The proponent propose that this general area would be inspected before construction begins. If echidna individuals were observed, an authorised professional would be engaged to determine the best possible management option for the individual, which may include relocation. Particular care would be taken not to relocate lactating females as they may have young in burrows.

During construction and decommissioning a number of management actions would be undertaken to minimise risks to echidnas in the study area:

- trenching guidelines would be set to ensure that uncovered trenches did not pose a risk to fauna
- speed limits would be established in the study area and Freeoak Road to reduce the risk of vehicle strikes
- echidna signage would be installed along Freeoak Road which provides access into the site
- waste and rubbish would be minimised and managed to avoid attracting echidnas and echidna predators
- standard vehicle hygiene protocols would be followed to reduce the risk of introducing or spreading weeds and pathogens.

During operations a number of additional management measures would be undertaken to minimise risk to echidnas in the study area:

- the base of woodchip piles would be inspected for echidnas during shiploading activities in case any have been able to infiltrate physical or nuisance barriers (such as fencing) which would ordinarily perturb echidnas from migrating to the site
- weeds would be managed, and herbicides and pesticides would be applied in consultation with NRKI and Dr Rismiller to minimise the risk of echidnas ingesting soil or invertebrates that have been treated
- standard biosecurity controls would be in place during operation (see Chapter 15 – Biosecurity).

Monitoring activities would include:

- as much as practicable, recording vehicle strikes using the Echidna CSI (Conservation Science Initiative) mobile application
- reviewing incidences of vehicle strike and identifying any trends (e.g. location, season, time of day)
- monitoring vehicle speeds on Freeoak Road and in the study area.

See Appendix K5 for the Draft MNES Monitoring Plan for further detail.

Effectiveness of mitigation measures

The number of mature echidna individuals is estimated at 5000 and population numbers have been decreasing over the last 50 years (TSSC 2015). A small increase in mortality due to vehicle strikes could have a significant impact on echidna numbers.

The avoidance and mitigation measures proposed for the KI Seaport activities are considered effective to minimise impacts to as low as reasonably practicable. The installation of echidna-proof fencing has been assessed as part of the impact assessment process. Echidnas are efficient at burrowing under fences as well as climbing up and over chain mesh fences (Wildcare Australia n.d.). Their strong forelimbs are also capable of pulling apart poorly-constructed fences. Additional measures such as installation of corrugated iron to a depth of 60 cm would possibly be required to deter echidnas from digging under the fence as well as an apron of up to 30 cm either side of the fence to deter echidnas from accessing the fence. It was concluded that the significant cost as well as ongoing repairs to fencing would not be effective at excluding echidnas from Freeoak Road.

There is uncertainty, however, around measures to reduce the number of vehicle strikes (see Appendix K3) due to haulage trucks on the road network. Inadequate information is available to determine the scale of impacts to echidna populations from the anticipated small increase in mortality due to vehicle strikes. Because of this uncertainty, and in accordance with applying the precautionary principle (i.e. when scientific uncertainty exists as to whether an activity raises a threats of harm to the environment), precautionary measures should be taken. Accordingly (as stated in the MNES Significant Impact Guidelines (DoE 2013a)) 'a lack of scientific certainty about the potential impacts of an action will not itself justify a decision that the action is not likely to have a significant impact on the environment.' Therefore, as residual impacts that may be considered significant to the Island's echidna population cannot be ruled out, a proposed offsets package is presented and discussed in Section 14.5.

MNES impact significance

An assessment under the MNES Significant Impact Guidelines (DoE 2013a) is provided in Table 14-6.

Evaluation of the various options for transporting logs and woodchips to the KI Seaport at Smith Bay showed that, based on an average annual production rate of 600,000 tonnes, the number of Average Annual Daily Traffic (AADT) truck movements ranges from 55 (for A-double vehicles) to 110 (for semi-articulated trucks). The risk of vehicle strike increases with the number of vehicle movements. Minimising vehicle movements therefore minimises the potential for vehicle strike. Using higher-capacity trucks instead of semi-articulated trucks, to move the same volumes, is therefore a recommended measure.

Assessment of residual impacts

As mentioned, limited data restricts an assessment of the potential impact to echidnas due to increased road use and vehicle strikes.

Consistency with relevant plans

The proposal is consistent with relevant plans and advice (Appendix K3) based on the following:

- vegetation clearance would be minimised
- NRKI would be consulted to determine whether or not feral cat trapping would be required for the site
- inductions for construction staff would include echidna awareness
- inductions for operational staff (including truck drivers) would include echidna awareness.

14.4.5 HOODED PLOVER (EASTERN)

Assessment of likely direct and indirect impacts

For the hooded plover (eastern), all breeding territories and non-breeding flocking sites are of high conservation significance. Kangaroo Island contains important stretches of coast for this species and is home to approximately six per cent of the total population (TSSC 2014). The plover's most important habitat is open ocean beaches, sand dunes adjacent to beaches, tidal bays and estuaries, near-coastal saline and freshwater lakes and lagoons, rock platforms, and rocky or sandy reefs close to shore (Marchant & Higgins 1993; Weston 2003).

The study area comprises a rocky foreshore within which approximately 10 metres has been artificially cleared of boulders to form a sheltered sandy section, which is used occasionally as a public boat ramp. The remainder of the bay, including the

TABLE 14-6 ASSESSMENT OF DEVELOPMENT AGAINST SIGNIFICANT IMPACT CRITERIA: KANGAROO ISLAND ECHIDNA

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Background	Relevant aspects of proposal	Assessment of impact
lead to a long-term decrease in the size of a population.	There is a risk that the Kangaroo Island echidna may be killed by truck movements along Freeoak Road, or by falling into exposed trenches during construction. If management controls were in place, however, it is expected that only a small number would be affected, and a long-term decrease in the size of the population would be minimised. At the peak Annual Average Daily Traffic (AADT) movement rate (corresponding to 700,000 tonnes per annum of timber product movement plus return trip), an A-double truck with a load capacity of 60 tonnes would be expected to pass along the transport route every 22 minutes. There is a risk that these trucks would cause an increase in the number of Kangaroo Island echidna deaths. There is a lack of scientific certainty over the number of vehicle strike incidents per year in addition to a lack of traffic count data for the Island. The echidna is widespread over Kangaroo Island but has a relatively small population size, which is believed to be decreasing, and any mortalities would have a long-term significant impact. Vehicle strike is an issue across the entire island and increased traffic and traffic speeds after sealing roads is believed to be correlated with an increase in numbers of roadkill (Rismiller, P 2018 pers. comm., 15 July). Continued monitoring of vehicle strikes would enable research to further clarify the nature of this risk. Limiting the speed of haulage vehicles, for safety reasons, would have corresponding benefits in reducing roadkill.	Traffic route option analysis. Vegetation clearance on site, including access to site. Vegetation clearance for transport route (upstream impacts). Construction activity.	Potential for a residual significant impact. Uncertainty exists over the magnitude of the impact. Potential for residual significant impact.
reduce the area of occupancy of the species.	Echidnas are unlikely to have a major portion of their home range in the study area. It is unlikely that the development would reduce the area of permanent habitation, although a small reduction in foraging habitat may occur. Given the availability of habitat in the surrounding area, this is unlikely to be significant to the local population. Echidnas are found all over Kangaroo Island in all types of habitat.	Traffic route option analysis. Vegetation clearance on site, including access to site. Vegetation clearance for transport route (upstream impacts).	Unlikely to have a significant impact.
fragment an existing population into two or more populations.	Echidnas are unlikely to have a major portion of their home range in the study area. Given the availability of habitat in the surrounding area, the development would not result in fragmentation of an existing population.	Traffic route option analysis. Vegetation clearance on site, including access to site. Vegetation clearance for transport route (upstream impacts).	Unlikely to have a significant impact.

TABLE 14-6 ASSESSMENT OF DEVELOPMENT AGAINST SIGNIFICANT IMPACT CRITERIA: KANGAROO ISLAND ECHIDNA (CONT'D)

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Background	Relevant aspects of proposal	Assessment of impact
adversely affect habitat critical to the survival of a species.	Echidnas are unlikely to have a major portion of their home range in the study area. Echidnas are found all over Kangaroo Island in all types of habitat. Vegetation in the site is not considered habitat critical to the survival of the species.	Traffic route option analysis. Vegetation clearance on site, including access to site. Vegetation clearance for transport route (upstream impact).	Unlikely to have a significant impact.
disrupt the breeding cycle of a population.	Echidnas are unlikely to have a major portion of their home range in the study area. Breeding is unlikely to occur on the site. Echidnas avoid the heat, so are not as day active in open areas during summer. The majority of vehicle strikes occur from May through August in the courtship and breeding season (Rismiller, P 2017 pers. comm., 15 July). Any proposal to remove vegetation would also need to consider that September to February, when females nurture their young in a nursery burrow, is a critical time of the year.	Traffic route option analysis. Vegetation clearance on site, including access to site. Vegetation clearance for transport route (upstream impacts). Forestry activity including logging (upstream impacts).	Unlikely to have a significant impact.
modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Echidnas are unlikely to have a major portion of their home range in the study area. A small reduction in foraging habitat may occur; however, given the availability of habitat in the surrounding area, this is unlikely to be significant to the local population.	Traffic route option analysis. Vegetation clearance on site, including access to site. Vegetation clearance for transport route (upstream impacts). Forestry activity including logging (upstream impacts).	Unlikely to have a significant impact.
result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	Standard weed hygiene protocols and management would reduce the risk of weeds being introduced during the construction phase. Application of herbicides and pesticides has the potential to leave toxic residues in the soil and invertebrates which can then be ingested by echidnas and cause mortalities (TSSC 2015). Waste management protocols would limit the potential for attracting introduced species such as cats. Roadkill is a potential food source for feral cats. Roads near the study site would be inspected and any roadkill would be collected and disposed of to reduce the food source.	Construction activity. Operation of the site. Transport to the study site. Importation of equipment and items from the mainland. Landscaping activity post construction.	Unlikely to have a significant impact.
introduce disease that may cause the species to decline.	There are no known diseases affecting the Kangaroo Island echidna that are likely to be introduced as a result of the development. Vehicle hygiene protocols would be used during construction to limit the risk of introducing *phytophthora* and other plant diseases, and standard biosecurity controls for shipping would be in place during operation.	Construction activity. Operation. Importation of equipment and items from the mainland. Implementation of biosecurity measures.	Unlikely to have a significant impact.
interfere with the recovery of a species.	The study area is not the subject of a targeted recovery program. The proposal would not affect any current recovery activities such as habitat restoration or pest animal control.	Construction activity. Operation of the site.	Unlikely to have a significant impact.

study area, is mainly boulders and rocks (Plate 14-1). The study area has also been subject to human activities such as return water discharges from pipes, vehicle and foot traffic, and noise and light from the operating land-based aquaculture farm.

Given the recent records of sightings at Smith Bay, hooded plovers may forage occasionally within the study area. There is no evidence to suggest they use Smith Bay for breeding. The area is not a known flocking site, is not considered to contain important or critical plover habitat and has been subject to human activities which would generally disturb foraging, nesting and breeding.

The plover breeding season is from mid-November to late January. Construction activities outside this period would be unlikely to affect the species' population. The beach habitat that would be affected during construction and operation of the wharf comprises only a relatively small proportion of similar beach habitat along the north coast of Kangaroo Island. Being highly mobile, this species would move to alternative habitat that is abundant throughout the region.

The potential impacts on hooded plovers (eastern) resulting from the proposal are summarised in Table 14-7. Management measures would address these impacts where practicable and necessary.

Avoidance, mitigation, management and monitoring measures

A number of management actions would be taken during construction and decommissioning to minimise risks to the hooded plover (eastern):

- the study area footprint would been minimised where possible to limit the required vegetation clearance.
- if a plover nest was discovered at the site, a protection zone (determined in consultation with DEW) would be imposed around the location for the entire breeding season.
- vehicle speed limits would apply in the study area to reduce the risk of vehicle strikes.
- waste and rubbish would be minimised and managed to avoid attracting predators and scavengers.
- standard vehicle hygiene protocols would be followed to reduce the risk of introducing or spreading weeds and pathogens.
- weeds would be managed as required.
- inductions would include information to help operators identify plovers and their nests.
- the CEMP would include measures to prevent oil and chemical spills from dredging equipment, including spill response plans to protect the marine environment.

PLATE 14-1 PHOTOGRAPH OF BEACH ZONE IN THE STUDY AREA (PHOTO TAKEN 6 AUGUST 2017)

TABLE 14-7 IDENTIFICATION OF POTENTIAL IMPACTS ON THE HOODED PLOVER (EASTERN)

Hazard	Direct/indirect consequential	Phase of proposal	Potential impact	Impact status (unknown, unpredictable, irreversible)
Vehicle movements	Direct	Construction/operation/ decommissioning	Mortality	Irreversible
Habitat disturbance	Direct	Construction	Disruption of breeding activity	Long term
Habitat loss	Direct	Construction/operation/ decommissioning	Disruption of foraging and nesting activity	Long term
Human activity	Direct	Construction/operation/ decommissioning	Increase in predator numbers (feral cats, domestic dogs or scavenging birds)	Long term
Introduction and/ or spread of environmental weeds	Direct	Construction/operation/ decommissioning	Habitat degradation	Long term
Marine pollution – increased shipping activity (by third parties)	Consequential Indirect (downstream users of the wharf)	Operation	Behaviour disruption (foraging, breeding, nesting) Abundance impacts	Long term
Noise and light pollution	Direct	Construction/operation	Behaviour disruption (foraging, breeding, nesting) Abundance impacts	Short term
Dust	Direct	Construction	Habitat degradation Reduction of food source and habitat	Short term
Access to the foreshore	Direct	Construction	Increase in predator numbers (feral cats, domestic dogs or scavenging birds) Habitat degradation	Long term
Marine pollution (oil spills and ingestion of debris)	Direct	Construction/operation/ decommissioning	Mortality	Irreversible Long term

A number of management actions would be taken during operation:

- if a nest was discovered at the site, a protection zone (determined in consultation with DEW) would be imposed around the location for the duration of the breeding season
- vehicle speed limits would apply in the study area to reduce the risk of vehicle strikes
- waste and rubbish would be minimised and managed to avoid attracting predators and scavengers
- inductions would include information to help operators identify plovers and their nests
- biosecurity controls would be implemented to reduce the risk of introducing disease to the marine environment (see Chapter 15 – Biosecurity)
- the OEMP would include measures to prevent oil and chemical spills from the wharf, including developing spill response plans to protect the marine environment
- measures to appropriately manage waste on ships would minimise any potential increase in marine debris that might harm plovers
- oil and chemical spills would be reported to the relevant authority (AMSA and/or the EPA).

Monitoring activities would include:

- the presence of plover nests at Smith Bay
- any deviation from the identified access tracks to be used for construction activity
- waste management practices during construction and operation, as part of the CEMP and OEMP
- any spill and pollution incidents (marine and terrestrial) and any trends in their occurrence.

See Appendix K5 for the Draft MNES Monitoring Plan for further detail.

Effectiveness of mitigation measures

The avoidance and mitigation measures proposed for the development are considered effective (see Appendix K3).

MNES impact significance

An assessment under the MNES Significant Impact Guidelines (DoE 2013a) is provided in Table 14-8.

Assessment of residual impacts

Based on the above assessment, there would be no residual significant impacts to the hooded plover (eastern) as a result of the proposal.

Consistency with relevant plans

The proposal is consistent with relevant plans and advice (summarised in Appendix K3) based on the following:

- the CEMP (Appendix U1) and OEMP (Appendix U2) would prohibit the introduction of pest species onto the Island such as dogs and cats
- the CEMP and OEMP would include waste management practices to minimise attracting scavengers
- inductions for construction staff would include awareness of local fauna and materials to help them identify plovers and their nests
- vehicle movements on the beach during construction would be strictly controlled
- vehicle movements on the beach during operation would be controlled with fencing
- the OEMP would manage oil spills and marine debris from shipping activity.

14.4.6 SOUTHERN BROWN BANDICOOT (EASTERN)

Assessment of likely direct and indirect impacts

The southern brown bandicoot (eastern) is known to live in a variety of habitats including heathland, shrubland, sedgeland, heathy open forest and woodland. Although it is usually associated with infertile, sandy and well-drained soils, it can be found in a range of soil types (DSEWPaC 2011). Within these habitats, the bandicoot prefers areas of dense ground cover between 20 cm and one metre high and of greater than 50 per cent average foliage density (DSEWPaC 2011). The presence of such dense understorey is a key factor in the assessment of potential bandicoot habitat.

TABLE 14-8 ASSESSMENT OF THE DEVELOPMENT AGAINST SIGNIFICANT IMPACT CRITERIA: HOODED PLOVER (EASTERN)

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Background	Relevant aspects of proposal	Assessment of impact
lead to a long-term decrease in the size of an important population.	There is a small risk of individual deaths from vehicle strike; however, the hooded plover (eastern) is a highly mobile species and the risk of vehicle strike would be confined to the preferred habitat of the beach zone, where operational vehicle access is unlikely. Any reduction in the availability of non-critical habitat as a result of the development would be too small to affect the size of the plover population on Kangaroo Island.	Beach access during construction.	Unlikely to have a significant impact.
reduce the area of occupancy of an important population.	The dispersed nature of breeding distribution means that all plover populations are important (EBS Ecology 2018). The study area is not a known breeding site, however, and the development would be unlikely to fragment populations.	Beach access during construction.	Unlikely to have a significant impact.
fragment an existing population into two or more populations.	The development's scale would not be large enough to fragment existing populations. The plover can fly between beaches on either side of the site. The surrounding area is generally undeveloped and relatively remote.	Beach access during construction.	Unlikely to have a significant impact.
adversely affect habitat critical to the survival of a species.	The development would not affect any habitat critical to the plover's survival. Although a small amount of beach habitat may be affected, the study area is not a known breeding or flocking site.	Beach access during construction.	Unlikely to have a significant impact.
disrupt the breeding cycle of an important population.	The study area is not a known breeding site. The development would be unlikely to affect any known sites.	Beach access during construction.	Unlikely to have a significant impact.

TABLE 14-8 ASSESSMENT OF THE DEVELOPMENT AGAINST SIGNIFICANT IMPACT CRITERIA: HOODED PLOVER (EASTERN) (CONT'D)

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:	Background	Relevant aspects of proposal	Assessment of impact
modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Although the development might affect a small amount of beach habitat the site is not a known plover breeding or flocking site (critical habitat for this species). Many other beaches in the surrounding region provide similar or better foraging habitat. It is unlikely that activities at Smith Bay would reduce habitat to the extent that the species declined.	Beach access during construction.	Unlikely to have a significant impact.
result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	A number of common coastal weeds have been cited as potential threats to plover habitat. Standard weed hygiene protocols would reduce the risk of these weeds being introduced during the construction phase. Weeds would be managed if necessary. Waste management protocols would limit the potential for attracting introduced species and other scavengers.	Vehicle access to beach during construction. Importation of equipment and materials for construction. Landscape plantings.	Unlikely to have a significant impact.
introduce disease that may cause the species to decline.	No known diseases affecting the hooded plover (eastern) are likely to be introduced as a result of the development. Vehicle hygiene protocols would be used during construction to limit the risk of introducing *phytophthora* and other plant diseases, and standard biosecurity controls for shipping would be in place during operations.	Vehicle access to beach during construction. General construction activity. Importation of equipment and materials for construction. Shipping activity.	Unlikely to have a significant impact.
interfere substantially with the recovery of a species.	The study area is not considered critical habitat and is not the subject of a targeted recovery program. The proposal would not affect any current recovery activities such as habitat restoration or pest animal control.	Vehicle access to beach during construction.	Unlikely to have a significant impact.

Most of the vegetation in the study area is highly degraded, with reduced biodiversity and heavy weed incursion (EBS Ecology 2018). Of the 20 flora species recorded at the site, 11 were native and grew as small patches or scattered individuals. Given the degraded nature of the vegetation and the patchy distribution of the remaining native species, EBS Ecology concluded that the bandicoot was unlikely to inhabit the study area.

The potential impacts on southern brown bandicoots (eastern) resulting from the proposal are summarised in Table 14-9. Management measures would address these impacts where practicable and necessary.

Avoidance, mitigation, management and monitoring measures

Any increase in road traffic is likely to increase the risk of vehicles striking bandicoots, but this risk would be reduced by:

- choosing the preferred route for forestry vehicles to minimise the time and distance travelled, thus minimising the opportunities for bandicoots to be struck
- minimising the number of vehicles required to transport timber products by using high productivity vehicles such as A-doubles and B-doubles
- implementing driver education and awareness training
- encouraging drivers to report bandicoot/vehicle strikes during timber haulage
- regularly inspecting the transport route for roadkill and collecting deceased bandicoots for disposal. This would also remove a food source for feral cats, which are a threat to bandicoots.

Traffic and transport aspects of the proposed development is subject to further assessment and separate approvals.

A number of management actions would be undertaken during construction and decommissioning to minimise risks to the southern brown bandicoot (eastern):

- the study area footprint has been minimised where possible to limit the required vegetation clearance

- trenching guidelines would be set to ensure that uncovered trenches did not pose a risk to fauna
- vehicle speed limits would apply in the study area and on Freeoak Road to reduce the risk of vehicle strikes
- signage would be installed along Freeoak Road to increase driver awareness of native fauna
- waste and rubbish would be minimised and managed to avoid attracting predators
- standard vehicle hygiene protocols would be used to reduce the risk of introducing or spreading weeds and pathogens
- feral cat sightings would be reported via the Feral Cat Scan mobile application.

A number of management actions would be undertaken during operation:

- weeds within the study area would be managed as required
- standard biosecurity controls (terrestrial and marine) would be in place
- vehicle speed limits would apply in the study area and on Freeoak Road to reduce the risk of vehicle strikes
- waste and rubbish would be minimised and managed to avoid attracting predators
- standard vehicle hygiene protocols would be used to reduce the risk of introducing or spreading weeds and pathogens
- feral cat sightings would be reported via the Feral Cat Scan mobile application.

TABLE 14-9 IDENTIFICATION OF POTENTIAL IMPACTS ON THE SOUTHERN BROWN BANDICOOT (EASTERN)

Hazard	Direct/Indirect consequential	Phase of proposal	Potential impact	Impact status (unknown, unpredictable, irreversible)
Open trenches	Direct	Construction	Mortality	Irreversible Long term
Vehicle movement along Freeoak Road	Direct	Construction/ operation/ decommissioning	Mortality	Irreversible Long term
Dust	Direct	Construction	Habitat degradation Reduction of food source and habitat	Short term
Habitat loss/disturbance	Direct	Construction/ operation/ decommissioning	Disruption of foraging activity and breeding activity	Long term
Human activity	Direct	Construction/ operation/ decommissioning	Increase in predator numbers (feral cats, domestic dogs or scavenging birds)	Long term
Introduction and/or spread of environmental weeds	Direct	Construction/ operation/ decommissioning	Habitat degradation	Long term
Noise and light pollution	Direct	Construction/ operation	Behaviour and abundance impacts	Short term
Vegetation clearance along transport routes	Consequential Indirect (upstream impact)	Construction/ operation	Habitat loss Fragmentation of habitat Disruption of foraging and breeding activity Mortality	Long term
Vehicle movement along the transport route	Consequential Indirect (upstream impact)	Operation	Mortality	Irreversible Long term
Logging of forestry assets	Consequential Indirect (upstream impact)	Operation	Habitat degradation and destruction Mortality	Irreversible Long term

Monitoring measures would include:

- the spread and introduction of new weed species
- bandicoot sightings
- vehicle strikes
- feral cat sightings.

See Appendix K5 for the Draft MNES Monitoring Plan for further detail.

Effectiveness of mitigation measures

The avoidance and mitigation measures proposed for the development are considered effective (see Appendix K3).

MNES impact significance

An assessment under the MNES Significant Impact Guidelines (DoE 2013a) is provided in Table 14-10.

Assessment of residual impacts

Based on the above assessment, there would be no residual significant impacts to the southern brown bandicoot (eastern) as a result of the proposal.

Consistency with relevant plans

The proposal is consistent with relevant plans and advice (summarised in Appendix K3) based on the following:

- the CEMP and OEMP would prohibit the introduction of pest species such as dogs and cats
- the CEMP and OEMP would include waste management practices to minimise attracting scavengers
- inductions for construction staff would include awareness of local fauna, in the study area as well as on adjacent roads
- the CEMP and OEMP would include implementation of phytophthora control.

14.5 PROPOSED OFFSET STRATEGY

Offset strategies (as required by the EPBC Environmental Offsets Policy 2012) seek to replace environmental values which may be lost as a result of a development. Specifically, the strategy requires the proponent to set aside an area or take actions that has the potential to provide a protective habitat or reduce existing impacts for the echidna, thereby increasing its long-term viability.

The study area footprint has been minimised where possible to limit the required vegetation clearance. Consultation with relevant stakeholders would continue throughout the development of the detailed offsets package. The draft offsets plan would be provided to the relevant government agencies for approval before implementation.

There has been little success breeding echidnas in captivity. Although some recent success was observed at the Perth Zoo when 13 puggles were born to four females over a period of four years (2011–14) (Wallage et al. 2015). This is not considered a viable option to increase the echidna population of Kangaroo Island. A more efficient way to affect the population would be to decrease the magnitude of the two major threats: predation by feral cats and roadkill.

14.5.1 DIRECT OFFSETS

The objective of the direct offsets package would be to reduce the threat posed by feral cats.

Due to the decreasing number of echidnas, seasonal variations in local populations and the unknown magnitude of the potential impacts from KIPT haulage trucks, the extent of a direct offset would need to be calculated in consultation with the Department of Environment and Energy. The EPBC Offsets Assessment Guide (DSEWPaC 2012c) is primarily aimed at vegetation removal and is not directly transferable to vehicle impacts.

It is not possible to stop haulage trucks from striking animals, however, different transport options have been considered and assessed to minimise the potential for impacts on native fauna (see Table 14-10).

Feral Cat Eradication Program

The Kangaroo Island Feral Cat Eradication Program is a joint program, led by NRKI and the Kangaroo Island Council, with the aim of eradicating feral cats from the Island by 2030. The State and Commonwealth governments are collaborating in this three-stage initiative:

- Stage 1. 2015–2018: trial feral cat control techniques, establish baseline monitoring programs and establish a process for gradual phasing out of all cat ownership.
- Stage 2. 2018–2023: eradicate feral cats from the Dudley Peninsula and monitor success of control actions.
- Stage 3. 2023–2020: eradicate feral cats from Kangaroo Island, monitor the success of controls (NRKI 2018).

Stage 1 of the program is near completion. Trials of control techniques on the Dudley Peninsula have been completed and results will be published following peer review (NRKI 2018a). The preliminary results included the following:

- non-toxic trials of the Felixer ® grooming trap were successful at identifying feral cats as targets 72 per cent of the time
- a trial of a detector dog was able to locate its target in over 90 per cent of the trials
- additional information on the ecology of feral cats was gained which will be used to develop the eradication plan (NRKI 2018b).

TABLE 14-10 ASSESSMENT OF THE DEVELOPMENT AGAINST SIGNIFICANT IMPACT CRITERIA: SOUTHERN BROWN BANDICOOT (EASTERN)

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Background	Relevant aspects of proposal	Assessment of impact
lead to a long-term decrease in the size of a population.	Given that the study area does not contain habitat suitable for the southern brown bandicoot (eastern), and there are no records of this species on the site, the proposal would be unlikely to lead to a long-term decrease in the size of a bandicoot population. The transport route analysis would minimise the removal of dense understorey Bandicoots are omnivorous and generally prefer habitat with a dense understorey. They are predominantly nocturnal but have been seen during the day (Braithwaite 1995). Bandicoots are secretive and prefer cover (TSSC 2016) Biological Databases of South Australia (BDSA) records of bandicoots along the transport route options were reviewed. They showed 36 records for the length of option 2 route, and four for the length of option 1 (ALA 2018) (see table notes for route description) At the peak Annual Average Daily Traffic (AADT) movement rate (corresponding to 700,000 tonnes per annum of timber product movement plus return trip), an A-double truck with a load capacity of 60 tonnes would be expected to pass along the transport route every 22 minutes.	Vegetation clearance during construction Traffic route option analysis (upstream impacts). Vegetation clearance for transport route (upstream impacts).	Unlikely to have a significant impact.
reduce the area of occupancy of the species.	Given that the study area does not contain bandicoot habitat and there are no records of this species on the site, the development would be unlikely to reduce bandicoots' area of occupancy.	Vegetation clearance during construction. Traffic route option analysis (upstream impacts). Vegetation clearance for transport route (upstream impacts).	Unlikely to have a significant impact.
fragment an existing population into two or more populations.	Although bandicoots might live on nearby properties, the development site contains no habitat suitable for them and there are no records of the species on the site. Based on this information, the development would be unlikely to fragment an existing population.	Vegetation clearance onsite including along Freeoak Road. Vegetation clearance for transport route (upstream impacts).	Unlikely to have a significant impact.
adversely affect habitat critical to the survival of a species.	Given that the study area does not contain suitable bandicoot habitat and there are no records of this species on the site, the development would be unlikely to adversely affect habitat critical to the species' survival.	Vegetation clearance onsite including along the Freeoak Road. Traffic route option analysis (upstream impacts).	Unlikely to have a significant impact.
disrupt the breeding cycle of a population.	Given that the proposal does not contain habitat suitable for the southern brown bandicoot (eastern), and there are no records of this species on the site, the proposal would be unlikely to disrupt the breeding cycle of a population.	Vegetation clearance onsite including along Freeoak Road.	Unlikely to have a significant impact.

TABLE 14-10 ASSESSMENT OF THE DEVELOPMENT AGAINST SIGNIFICANT IMPACT CRITERIA: SOUTHERN BROWN BANDICOOT (EASTERN) (CONT'D)

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:	Background	Relevant aspects of proposal	Assessment of impact
modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Given that the study area does not contain suitable bandicoot habitat and there are no records of this species on the site, the development would be unlikely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species was likely to decline.	Traffic route option analysis. Vegetation clearance onsite including along Freeoak Road.	Unlikely to have a significant impact.
result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat.	Habitat degradation resulting from weed incursion is a known risk to the bandicoot. However, standard weed hygiene protocols would reduce the risk of weeds being introduced during the construction phase and of existing weeds being spread outside the site. Weed management would be undertaken if required. Waste management protocols would limit the potential for attracting introduced species such as cats and domestic dogs.	Importation of equipment and materials from the mainland. Landscaping activity post-construction.	Unlikely to have a significant impact.
introduce disease that may cause the species to decline.	No known diseases affecting the bandicoot are likely to be introduced as a result of the development. Vehicle hygiene protocols would be followed during construction to limit the risk of introducing *phytophthora* and other plant diseases, and standard biosecurity controls for shipping would be in place during operation.	Construction activity. Operation – waste management practices. Importation of equipment and materials from the mainland. Implementation of biosecurity measures.	Unlikely to have a significant impact.
interfere with the recovery of a species.	The study area is not considered critical habitat and is not the subject of a targeted recovery program. The development would not affect any current recovery activities such as habitat restoration or pest animal control.	Vegetation clearance for transport route (upstream impacts).	Unlikely to have a significant impact.

Notes: Option 1 consists of Playford Highway, Stokes Bay Road, Bark Hut Road, McBrides Road and North Coast Road. Option 2 consists of Playford Highway, Ropers Road, Gum Creek Road, Gap Road and North Coast Road.

Sponsorship of the feral cat eradication initiative would directly assist the recovery of a number of animal species potentially impacted by the development, including the echidna and bandicoot. The following activities have been identified as additional to the existing (and already funded) aspects of the feral cat eradication program (in consultation with NRKI):

- funding for training of additional detector dogs
- funding for the purchase of additional devices (e.g. aversion technology and control devices) and equipment
- funding for contractors to implement trials of new technologies
- funding for contractors to roll out additional aspects of the program that are currently not funded.

An integral part of the offset strategy would be monitoring and recording any roadkill incidents along the transport route. This will provide data for any adaptive management response that may be required during implementation of the offset strategy.

These measures would have a direct impact on reducing the predation of echidnas and can therefore be used as a 'direct offset'. Although, it is difficult to determine how many echidnas a feral cat can kill over its lifetime, they can kill 25 per cent of the young echidna population each year (Rismiller & McKelvey 2000).

The activities that would receive funding would be refined further with ongoing stakeholder consultation.

An assessment of the proposed offsets package against the mechanisms provided in the EPBC Environmental Offsets Policy 2012 is provided in Table 14-11.

Baseline data on echidna fatalities as a result of vehicle strike would be collected during the construction and operational phases of the development. This would be undertaken in conjunction with existing research programs, such as research by the Monotreme Resource Centre which is part of the Grützner Lab of the University of Adelaide. The Echidna CSI (Conservation Science Initiative) project is run by the Grützner Lab and aims to improve knowledge of echidnas in the wild by using citizen science to record sightings and retrieve scat samples.

Echidna CSI uses a combination of field work and molecular genetics that can be used to determine a more accurate distribution of the subspecies as well as for the first time being able to investigate diet and gastric health, breeding, stress and accumulation of chemicals in echidnas all at the molecular level. This project is a result of ongoing discussions and previous collaborations between Dr Rismiller of the Pelican Lagoon Research and Wildlife Centre and Professor Grützner on molecular genetics, ecology and conservation of echidnas.

Baseline data could contribute to future potential areas of study into some of the major threats to the echidna population on Kangaroo Island as part of the existing Echidna CSI project, such as:

- identification of hot spots for echidna roadkill
- native and introduced predators of the echidna – molecular studies on predator scats to identify echidna DNA
- the effects of environmental change on the echidna including revegetation planting and forestry activity
- accumulation of harmful chemicals (e.g. insecticides) which echidnas obtain through the soil and invertebrate diet
- genetic diversity within the sub-species.

14.5.2 EPBC OFFSET REQUIREMENTS

An assessment of the proposed offsets package against the requirements of the EPBC Environmental Offsets Policy 2012 (DSEWPaC 2012b) is provided in Table 14-12.

TABLE 14-11 CONSERVATION GAINS FROM DIRECT OFFSETS

Mechanism to achieve conservation gain	Applicability to Kangaroo Island echidna
Improve existing habitat for the protected matter	This option is not considered viable as the echidna does not have any specific habitat requirements.
Creating new habitat for the protected matter	This option is not considered viable due to the significant cost implications.
Reducing threats to the protected matter	A quantitative assessment of the impacts to the echidna population from vehicle strike has been calculated with a number of assumptions (Appendix K6). There is uncertainty about population estimates, lack of traffic count data for Kangaroo Island and limited baseline data for vehicle strikes per traffic movement. Threats to the echidna are listed in Appendix K3. An existing program to manage feral cats is currently being implemented on the Island (NRKI 2018). This would form the direct offsets package (Appendix K6).
Increasing the values of a heritage place	Not applicable to this protected matter.
Averting the loss of a protected matter or its habitat that is under threat	The development would not clear any critical echidna habitat.

TABLE 14-12 ASSESSMENT OF THE PROPOSED OFFSETS PACKAGE AGAINST THE EPBC OFFSET PRINCIPLES (BOX 1 OF THE EPBC OFFSETS POLICY)

EPBC Offset Principles. These require a proposed development to:	Proposed offsets package
1. deliver an overall conservation outcome that improves or maintains the viability of the aspect of the environment that is protected by national environment law and affected by the proposed action.	The proposed package would address the reduction of a threat (cat control is considered a high-priority conservation action by the TSSC 2015). Awareness of echidnas on the road network would be part of all induction training relating to the development (limiting road deaths of fauna by regulation, enforcement and education is identified as a medium-priority conservation action by the TSSC 2015) (see Appendix K3).
2. be built around direct offsets but may include other compensatory measures.	The proposed package would include a contribution to the feral cat eradication program by providing additional funding to implement additional aspects of the overall program that are not covered by existing funding arrangements. The offset plan would also include monitoring impacts and obtaining crucial data on roadkill from the proposed KI Seaport's traffic.
3. be in proportion to the level of statutory protection that applies to the protected matter.	The proposed offsets package is considered appropriate for the current level of protection (endangered) that applies to the target species.
4. be of a size and scale proportionate to the residual impacts on the protected matter.	Due to the uncertainties around the number of echidnas likely to be killed on roads, the residual impact cannot be determined. However, the offset package would be adequate to address any actual impact.
5. effectively account for and manage the risks of the offset not succeeding.	The feral cat eradication program is in its third year of implementation and is an existing program subject to scientific peer review. Data collected on roadkill incidents would be made available to NRKI for all reporting requirements under existing funding arrangements.
6. be additional to what is already required, determined by law or planning regulations or agreed to under other schemes or programs (this does not preclude the recognition of state or territory offsets that may be suitable as offsets under the EPBC Act for the same action, see section 7.6).	The offsets package would provide additional funding for an existing program. The funding would be used to increase the effectiveness of feral cat eradication on the Island.
7. be efficient, effective, timely, transparent, scientifically robust and reasonable.	Contributions from KIPT to the eradication program would be reported on in parallel to the existing reporting requirements of the program.
8. have transparent governance arrangements, including being able to be readily measured, monitored, audited and enforced.	All financial contributions made by KIPT (an Australian Stock Exchange listed company) would be subject to the company's existing financial reporting processes.

14.6 REQUIREMENTS OF THE EPBC ACT

Table 14-13 identifies which EIS chapter addresses the objects of the EPBC Act.

Principles of ecological sustainable development

Ecologically sustainable development (ESD) is defined in the National Strategy for Ecologically Sustainable Development (NSESD) as development which aims to meet the needs of Australians today, while conserving our ecosystems for the benefit of future generations. The strategy was adopted by all levels of government in Australia in 1992 and its key objectives are to:

- enhance individual and community wellbeing and welfare by following a path of economic development that safeguards the welfare of future generations
- provide for equity within and between generations
- protect biological diversity and maintain essential ecological processes and life-support systems (COAG 1992).

The guiding principles of ESD and the relevant section of the EIS are provided in Table 14-14.

TABLE 14-13 OBJECTIVES OF THE EPBC ACT ADDRESSED IN THE EIS

Objectives of the EPBC Act	EIS section
(a) To provide for the protection of the environment, especially those aspects that are matters of national environmental significance.	This chapter addresses protection of MNES. Further detail on mitigation measures is provided in Chapter 26 – Environmental Management Framework.
(b) To promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources.	Chapter 2 – Project Justification and Chapter 4 – Project Description outlines the details of the sustainable nature of KIPT's plantation, forestry activities and use of natural resources. No old-growth forests will be harvested. Ecologically sustainable development is addressed in Chapter 19 – Climate Change and Sustainability.
(c) To promote the conservation of biodiversity.	Landscape plantings would use native species (Appendix J1). Mitigation measures to protect biodiversity are provided in Chapter 14 – MNES, Chapter 13 – Terrestrial Ecology and Chapter 12 – Marine Ecology.
(c-a) To provide for the protection and conservation of heritage.	The proposal would not impact any items of heritage significance. Management measures to conserve and protect heritage matters are provided in Chapter 24 – Heritage.
(d) To promote a cooperative approach to the protection and management of the environment involving governments, the community, landholders and Indigenous peoples.	Stakeholder engagement for the proposal is discussed in Chapter 7 – Stakeholder Engagement.
(e) To assist in the cooperative implementation of Australia's international environmental responsibilities.	The proposal would comply with Australia's international obligations relating to cetaceans such as whales and dolphins. Management measures to protect cetaceans are provided in Chapter 12 – Marine Ecology and Chapter 14 – MNES. The proposal would comply with Australia's obligations under the Kyoto Protocol in relation to climate change. Further detail is provided in Chapter 19 – Climate Change and Sustainability.
(f) To recognise the role of Indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity.	Indigenous views on biodiversity are not addressed. However, the role of Indigenous people is recognised and engagement with them is discussed in Chapter 7 – Stakeholder Engagement.
(g) To promote the use of Indigenous peoples' knowledge of biodiversity with the involvement of, and in cooperation with, the owners of the knowledge.	Indigenous knowledge on biodiversity are not addressed. However, the involvement of Indigenous people, and application of their knowledge, is promoted through engagement, which is discussed in Chapter 7 – Stakeholder Engagement.

TABLE 14-14 GUIDING PRINCIPLES OF ESD ADDRESSED IN THE EIS

Guiding principle of ESD	EIS section
Enhance individual and community wellbeing and welfare	The development would provide economic and social benefits to Kangaroo Island, as discussed in Chapter 20 – Economic Environment and Chapter 22 – Social Environment. The development has been designed so it can coexist with current agricultural and hospitality land uses on the Island.
Intergenerational equity	The OEMP and CEMP would be implemented to minimise the legacy impacts of the development.
Protect biological diversity and maintain essential ecological processes	The development has been designed to minimise impacts on biodiversity and ecological processes (refer to Chapter 9 – Marine Water Quality, Chapter 12 – Marine Ecology, Chapter 13 – Terrestrial Ecology and Chapter 14 – MNES). Mitigation measures to protect biodiversity during the construction, operation and decommissioning phases are summarised in Chapter 26 – Environmental Management Framework.
Decision-making based on long-term and short-term considerations	The impact assessment process used for the EIS presents the long-term and short-term economic, environmental and social impacts of the development (see Chapter 13 – Terrestrial Ecology and Chapter 12 – Marine Ecology) to enable informed decision-making. Mitigation and monitoring measures have been developed to address impacts from both a short-term and long-term perspective (se e Chapter 25 – Management of Hazard and Risk).
The precautionary principle	The impact assessment process (Chapter 25 – Management of Hazard and Risk) has been undertaken in accordance with the precautionary principle. Environmental management criteria detailed in the management plans (Chapter 26 – Environmental Management Framework) are best practice and will be implemented irrespective of a lack of scientific certainty.
Global environmental impact	Greenhouse gas emissions, mitigation and reduction options for the development are discussed in Chapter 19 – Climate Change and Sustainability. The development would have a very small carbon footprint and would not impact any internationally protected species or sites.
Development of a strong, growing and diversified economy which can enhance the capacity for environmental protection	Economic impacts of the development are presented in Chapter 20 – Economic Environment. The wharf facility has the capacity to be used by other operators (subject to approvals) which would benefit the local economy.
Enhancing international competitiveness in an environmentally sound manner	The development would adopt industry best practice for woodchip storage and management of stormwater, biofouling and dredging operations, and implement offsets to provide an overall environmental benefit.
Cost-effective and flexible policy instruments	Development design has considered current South Australian and Commonwealth government policy.
Community involvement in decisions and actions	Stakeholder engagement for the proposal is discussed in Chapter 7 – Stakeholder Engagement.

14.7 CONCLUSION

14.7.1 SOUTHERN RIGHT WHALE

The construction and operation of the development is likely to have negligible effects on the southern right whale and is environmentally acceptable for the following reasons:

- the study area is neither near an aggregation area or historic high-use areas, so southern right whales are unlikely to be present during construction or operation of the KI Seaport
- safety zones would be implemented for construction activity and would be monitored by trained observers
- piling would be undertaken during daylight hours only
- the development would result in a negligible (0.7 per cent) increase in shipping traffic visiting South Australian ports
- modelling has shown there is a low probability of whale strikes (one in about 300 years) associated with vessels travelling to and from the KI Seaport along the southern Australian coastline (BMT WBM 2017)
- the proposal meets the objectives of the EPBC Act.

14.7.2 KANGAROO ISLAND ECHIDNA

The construction and operation of the development has the potential for a residual significant impact, as assessed using the Significant Impact Guidelines under the EPBC Act, on the Kangaroo Island echidna for the following reasons:

- echidnas are unlikely to have a large portion of their home range in the study area and construction is unlikely to affect their habitat availability in any meaningful way
- there is a risk that trucks transporting timber products will increase the number of echidna road kills. There is scientific uncertainty over the magnitude of this impact however the existing population is naturally small and an increase in mortality would have a significant effect. Driver education and awareness training would help manage this risk and continued monitoring of vehicle strikes would enable research to further clarify the nature of this risk
- the transport route would be inspected regularly for roadkill. Deceased echidnas would be collected and provided to the University of Adelaide for research purposes. This would also remove a food source for feral cats, which are a threat to echidnas.

In accordance with the precautionary principle, scientific uncertainties exist for the Kangaroo Island echidna population and how it will be impacted by traffic. Actions through an offsets package would be implemented by KIPT to reduce that impacts to Kangaroo Island echidna (Section 14.5).

The proposal and draft offsets package meets the objectives of the EPBC Act.

14.7.3 HOODED PLOVER (EASTERN)

The construction and operation of the KI Seaport is likely to have negligible effects on the hooded plover (eastern) and is environmentally acceptable for the following reasons:

- although a small amount of beach habitat may be affected by the proposal, the site is not a known breeding site or flocking site (critical habitat for this species). There are many other beaches in the surrounding region that provide similar or better foraging habitat for the hooded plover (eastern)
- if a hooded plover (eastern) nest was discovered at the site, a protection zone (determined in consultation with DEW) would be implemented around the location for operators and contractors during the breeding season
- vehicle speed limits would apply in the study area to reduce the risk of vehicle strikes
- waste and rubbish would be minimised and managed to prevent attracting predators and scavengers
- standard vehicle hygiene protocols would be followed to reduce the risk of introducing or spreading weeds and pathogens
- the proposal meets the objectives of the EPBC Act.

14.7.4 SOUTHERN BROWN BANDICOOT (EASTERN)

The construction and operation of the KI Seaport is likely to have negligible effects on the southern brown bandicoot (eastern) and is environmentally acceptable for the following reasons:

- the study area does not contain suitable bandicoot habitat and there are no records of this species on the site
- to protect habitat in the surrounding area, the CEMP includes management measures to prevent the introduction or spread of weeds as a result of construction activities
- trenching guidelines would be set to ensure that uncovered trenches did not pose a risk to fauna
- vehicle speed limits would apply in the study area to reduce the risk of vehicle strikes
- waste and rubbish would be minimised and managed to prevent attracting predators and scavengers
- the proposal meets the objectives of the EPBC Act.

15. BIOSECURITY

Guideline		Comments
3	Kangaroo Island's remoteness and isolation has created a unique environment, free from many of the pests and diseases found on mainland Australia. The development of a port will increase the potential for the introduction of pest and nuisance species (both terrestrial and marine) which are a major threat to, and can have devastating impacts on, the Island's environment and agricultural industries. Details on strategies to prevent and manage potential pest species is required to ensure the proposal will not impact upon the Island's biosecurity.	
3.1	Provide information on the proposed management techniques for incoming ship ballast and bilge waters.	See Section 15.5.4, Appendices D2 and U2
3.2	Describe how the introduction of exotic marine organisms or notifiable pathogens (disease) will be avoided or managed.	See Sections 15.5.4, 15.5.5, Appendices D2 and U2
3.3	Outline strategies to monitor for the early detection of marine exotic organisms at or near the site, especially on and around the causeway and wharf.	See Section 15.5.5 and Appendix U2
3.4	Outline strategies to prevent the introduction of exotic marine organisms and disease (including from incoming ship ballast and bilge waters or biofoulings).	See Sections 15.5.4, 15.5.5 and Appendix D2
3.5	Detail the response procedure that will be followed in the event of a new exotic organism being detected.	See Sections 15.5.4, 15.5.5 and Appendix D2
3.6	Outline measures to ensure consistency with the Australian Ballast Water Management Requirements (version 6) (Clth) and National Biofouling Management Guidelines<http://marinepests.gov.au/marine_pests/publications/Pages/default.aspx>.	See Appendices D2 and U2
3.7	Outline strategies to monitor and prevent the introduction of vermin and other nuisance species that can be attracted to port facilities, and measures to manage and monitor such species.	See Chapter 12, Section 15.5.2 and Appendix U2
3.8	Outline strategies to prevent, monitor and manage invasive weed species (including terrestrial, coastal and marine species).	See Chapters 12, 26, Sections 15.5.2, 15.5.3, 15.5.4, 15.5.5, Appendices U1 and U2
3.9	Outline strategies to monitor, control and manage biofouling of wetted surfaces.	See Sections 15.5.3, 15.5.4 and Appendix U2
3.10	Describe how the proposal is consistent with the Biosecurity Strategy for Kangaroo Island 2016–2021.	See Section 15.6

15. BIOSECURITY

15.1 INTRODUCTION

Biosecurity is the protection of terrestrial and marine environments, agriculture, horticulture and aquaculture industries, and human and animal health from the adverse impacts of biological threats, usually referred to as pests, weeds and diseases (KINRMB 2017a).

Kangaroo Island's remoteness and isolation have created a unique environment, free from many of the pests and diseases found on mainland Australia, which is separated from the Island by Investigator Strait and Backstairs Passage. Smith Bay is on Kangaroo Island's north coast, about 20 km west of Kingscote, between Emu Bay and Cape Cassini. The study area lies within the Kangaroo Island Natural Resources Management (NRM) Board region.

This chapter addresses Guideline 3, which stipulates that the EIS should provide information on potential biosecurity impacts that have been considered for the proposal.

The chapter:

- describes the biosecurity management framework
- describes the existing terrestrial and marine environment
- describes existing agricultural industries on Kangaroo Island
- describes existing pest animals, pest plants (weeds) and pathogens/diseases in the study area
- outlines strategies to monitor and prevent the introduction of pest species as a result of the proposal
- describes how the proposal is consistent with the Biosecurity Strategy for Kangaroo Island 2017–2027.

15.2 REGIONAL SETTING

15.2.1 CONTEXT

Natural Resources Kangaroo Island (NRKI) is the organisation with overarching responsibility for activities that protect Kangaroo Island's environment from biosecurity threats.

NRKI manages the list of declared pest plants under the South Australian *Natural Resources Management Act 2004* (NRM Act). The list includes declared plants that have been detected on Kangaroo Island and declared pest plants yet to be recorded on Kangaroo Island (NRKI 2017a). NRKI has also developed a list of priority weeds to be managed, which includes horehound and bridal creeper (NRKI 2017b).

The priorities expressed in the South Australian Biosecurity Policy are reflected in the Biosecurity Strategy for Kangaroo Island, 2017–2027 (KINRMB 2017a). This strategy '*articulates a framework that will support a robust biosecurity system for Kangaroo Island*' and addresses terrestrial and marine biosecurity threats (See Section 15.6 for further discussion).

The South Australian Biosecurity Policy and Biosecurity Strategy for Kangaroo Island 2017–2027 forms part of the overall biosecurity management framework.

15.2.2 BIOSECURITY MANAGEMENT FRAMEWORK

International context

The Australian Government fulfils its international biosecurity obligations and protects Australia's resources from biosecurity threats by implementing the *Biosecurity Act 2015*. A risk assessment approach is used to assess an import proposal or new information on a biosecurity risk in accordance with all international obligations, statutes and values (DAWR 2016).

One of the more significant environmental issues associated with the proposal is the biosecurity risk arising from the discharge of ships' ballast water. Australia is a signatory to the International Convention for the Control and Management of Ships' Ballast Water and Sediments (BMW Convention) (IMO 2004) which came into effect on 8 September 2017.

Parties to the BWM Convention undertake to fully implement the provisions of this Convention and its annex to prevent, minimise and ultimately eliminate the transfer of harmful aquatic organisms and pathogens through the control and management of ships' ballast water and sediments.

Chapter 5 of the Biosecurity Act reflects this Convention by regulating the biosecurity risks associated with the discharge of ballast water by domestic and foreign vessels in Australian waters. The ballast water management provisions of the Act came into effect on the same day as the Convention. The 'base' position of the Commonwealth under the Biosecurity Act is that it is an offence for a vessel to discharge ballast water into Australian seas – that is to the limits of the exclusive economic zone (EEZ) that extend 200 nautical miles from the Australian shoreline. A summary of the regulatory regime for the management of ships' ballast water in Australian seas and the related operational factors for bulk carriers transporting timber from the KI Seaport is presented in Appendix D2.

Biofouling (the marine plants and animals that attach and grow on the submerged parts of a vessel) from international vessels and fishing vessels as well as private yachts is also a major pathway for the introduction of exotic pest species and aquatic diseases into Australian waters. Biofouling can also translocate marine pests and diseases from one part of the Australian coastline to another. The Department of Agriculture and Water Resources (DAWR) is currently undertaking activities to develop new biofouling standards that are consistent with the direction of the International Maritime Organization (IMO) (DAWR 2017a).

National and state context

The policy context for the application of biosecurity controls is provided by a range of Commonwealth, state and Kangaroo Island-specific policies. Australian governments have recognised that national and state biosecurity is a shared responsibility, as reflected in the Intergovernmental Agreement on Biosecurity 2012 (IGAB) (COAG 2012). The agreement was developed:

> *to improve the national biosecurity system by identifying the roles and responsibilities of governments and outlines the priority areas for collaboration to minimise the impact of pests and disease on Australia's economy, environment and the community.*

Through the *Biosecurity Act 2015* the Commonwealth Government has principal responsibility for protecting the nation's agricultural and environmental resources from incursion by pest plants, animals and diseases. It is co-administered by the ministers responsible for Agriculture and Water Resources, and Health. The states and territories assume responsibility for biosecurity management within their respective jurisdictions, acknowledging through the IGAB the need to cooperate nationally.

The South Australian Biosecurity Policy 2017–21 is guided by the National Framework for the Management of Established Pests and Diseases of National Significance, a key deliverable of the IGAB.

Weeds and pests in South Australia are managed by the *Natural Resources Management Act 2004* (NRM Act). Regional Natural Resource Management Boards were established under the NRM Act and work together with relevant state agencies to administer this act in the terrestrial and marine environments. Biosecurity SA is a division of Primary Industries and Regions SA (PIRSA) that provides leadership in biosecurity policy development and emergency response at a state-level.

In response to growing concerns about the significance of the problem of marine pests (plants and animals) and aquatic diseases, there have been several national and state policy developments released in relation to their control, including:

- Australian Ballast Water Management Requirements, Version 7 (DAWR 2017b)
- National Biofouling Management Guidelines for Commercial Vessels (Commonwealth of Australia 2008)
- EPA – Code of Practice for Vessel and Facility Management (Marine and Inland Waters) (Ballantine 2017)
- Kangaroo Island Natural Resources Management Board's Biosecurity Strategy for Kangaroo Island (KINRMB 2017a)
- Marine Pest Plan 2018–2023: National Strategic Plan for Marine Pest Biosecurity (DAWR 2018a).

15.3 ASSESSMENT METHODS

Field surveys were undertaken to identify terrestrial and marine weed and pest species present within the study area.

EBS Ecology carried out a field survey of the study area (terrestrial flora and fauna) on 17 August 2016, in late winter (Appendix J2). An additional field survey was undertaken in February 2018, in late summer. The methodology is described in Section 13.3.2 of Chapter 13 –Terrestrial Ecology.

SEA Pty Ltd undertook marine surveys of habitats in the vicinity of the development site (see Appendix I1) using scuba equipment and underwater cameras. The methodology is described in Chapter 12 – Marine Ecology.

15.4 EXISTING ENVIRONMENT

15.4.1 KANGAROO ISLAND INDUSTRY

Kangaroo Island has a diverse industry profile, encompassing cropping, grazing, horticulture, forestry, fishing, aquaculture, tourism and value-added products such as wine, cheese, marron, olive oil, free-range chickens and Ligurian honey (SATC 2018).

Kangaroo Island's potato and apiary industries are free of major diseases that are found on the mainland (KINRMB 2017a). Kangaroo Island is a sanctuary for Ligurian bees (PIRSA 2015a). Apiary products are restricted from entry into Kangaroo Island unless they have been tested and verified as free of disease. The seed potato industry is considered to be relatively pest and disease free (KINRMB 2017a). The industry is protected by the *Plant Health Act 2009* which provides for biosecurity measures relating to potatoes (for consumption) as well as seed potatoes.

Kangaroo Island is currently free of the giant pine scale beetle (*Marchalina hellenica*), a biosecurity threat to pine forestry and timber production. It is expected that KIPT would work with PIRSA and with timber growers and processors in other parts of the State, under the *Plant Health Act 2009*, to ensure that these threats are well-managed both at Smith Bay and at other points of entry to the Island.

The Island is notable for the absence of European rabbits (*Oryctolagus cuniculus*) and red foxes (*Vulpes vulpes*) (KINRMB 2009). The Commonwealth Department of the Environment and Energy declared Kangaroo Island free from feral goats and the effective eradication of feral deer from the Island has also been achieved (Press statement by The Hon. Melissa Price MP, then Assistant Minister for the Environment and Energy 2018).

There is a land-based abalone farm adjacent to the proposed site. The two most significant abalone diseases relevant to the study area are abalone viral ganglioneuritis (AVG), which has been detected in wild abalone stock in Victoria and in abalone farms in Victoria and Tasmania (but not in South Australia), and the abalone parasite *Perkinsus*, which is already present (and have persistent, high levels of infection) in the wild abalone populations in South Australia at Neptune Island and at the south-eastern tip of Yorke Peninsula. PIRSA assist land-based abalone farms to manage *Perkinsus* in their abalone populations (PIRSA 2018a).

There are three aquaculture licences for oysters on Kangaroo Island located at American River and Western Cove. Pacific oysters (*Crassostrea gigas*) are susceptible to the disease Pacific oyster mortality syndrome (POMS). In February 2018, the first detection of POMS in South Australia was discovered in feral oysters in the Port River (PIRSA 2018b).

15.4.2 TERRESTRIAL ENVIRONMENT

Weeds and pathogens

The study area is dominated by weeds, reflecting the overall degraded nature of the vegetation. Of the 19 weed species recorded within the study area during the field survey, four are listed as declared under the NRM Act, which were:

- African boxthorn (*Lycium ferrocissimum*)
- bridal creeper (*Asparagus asparagoides* f. *asparagoides*)
- horehound (*Marrubium vulgare*)
- soursob (*Oxalis pes-caprae*).

Figure 15-1 shows the location of African boxthorn and bridal creeper that were recorded during an August 2016 field survey (EBS Ecology 2018).

Bridal creeper, which was found on the study site as scattered individuals, is also a Weed of National Significance (WoNS). Horehound and soursob were common throughout the study area.

Natural Resources Kangaroo Island (NRKI) has developed a list of declared pest plants under the NRM Act that have been detected on the Island and those declared pest plants yet to be recorded on Kangaroo Island (NRKI 2017b). NRKI has also developed a list of priority weeds to be managed, which includes horehound and bridal creeper (NRKI 2017a).

Phytophthora is a soil-borne parasitic fungus that attacks the roots of plants and can cause significant plant death in affected vegetation communities. In South Australia, dieback caused by phytophthora has been found within a number of high-rainfall areas, including Kangaroo Island (Government of South Australia 2006). There is no record of phytophthora in the study area; however, it has been recorded within the local area (DEWNR 2012) and the study area is considered a moderate risk area for the pathogen (Government of South Australia 2006).

Giant pine scale beetle (*Marchalina hellenica*) is a scale insect that sucks the sap of pine trees. Giant pine scale beetle has been detected in metropolitan Adelaide and Victoria. Eradication was believed to be successful in metropolitan Adelaide in 2016. Victoria is now transitioning to management of the insect rather than eradication. The insect poses a threat to Kangaroo Island's softwood plantation industry by causing:

- branch dieback
- gradual desiccation
- tree death (PIRSA 2015b).

Pest animal species

Alert pest animals are introduced animals that are declared under the NRM Act. These animals pose a serious threat to native animals as well as industry and must be reported as soon as possible (PIRSA 2014a).

No introduced fauna species were recorded within the study area; however, it is likely that a number of species, such as cats, rats and mice, use the study area. These species are common on Kangaroo Island (KINRMB 2009).

Emergency plant pests

The *Plant Health Act 2009* prescribes measures for the eradication or control of declared pests in South Australia. The Plant Quarantine Standard, South Australia, was established under Section 2 – Part 3 of the *Plant Health Act 2009* and provides a full list of the Emergency Plant Pests for South Australia (<http://pir.sa.gov.au/biosecurity/plant_health>).

Emergency Plant Pests are pests and diseases of such concern they are considered a national threat. Emergency Plant Pests are either:

- not present in Australia; or
- present in Australia and under an official containment and/or eradication program (PIRSA 2017).

Anyone who suspects or diagnoses an Emergency Plant Pest is legally required to report it immediately.

FIGURE 15-1 LOCATIONS OF DECLARED WEED SPECIES DURING 2016 FIELD SURVEY

15.4.3 MARINE ENVIRONMENT

More than 250 introduced marine species have been recorded in Australia (DAWR 2018b), including more than 20 in Kangaroo Island waters (Wiltshire et al. 2010). No introduced marine species have previously been recorded near Smith Bay, including during the marine surveys undertaken in 2016 and 2018. The closest records to the east are of the European fan worm at the Bay of Shoals and a number of species at Kingscote, and to the west a barnacle and a number of ascidians at Western River Cove (Wiltshire et al. 2010).

15.5 IMPACT ASSESSMENT AND MANAGEMENT

15.5.1 POTENTIAL RISKS

Activities anticipated to have potential risk to biosecurity during construction, operation and decommissioning of the KI Seaport include:

Construction:

- importation of rock material
- importation of earthmoving equipment (construction and decommissioning)
- importation of terrestrial plants to be used in landscaping and for visual screening
- dredging activity
- the spread of pest plants, animals and/or pathogens from Smith Bay to other locations on KI, interstate or other countries via machinery
- importation of marine works vessels and equipment (construction and decommissioning)
- importation of the pontoon from outside of Australian waters (construction and operation)
- importation of foods (by crews working on shipping vessels) that may contain weed seeds, pest animals and/or pathogens (construction and operation)
- ballast water discharge from domestic vessels used during construction activities
- biofouling from domestic vessels used during construction activities

Operation:

- importation of equipment for loading timber onto the ship
- movement of international shipping vessels into Australian waters which could potentially bring in pest animals (vertebrates and invertebrates) as stowaways
- discharge of ballast water from international shipping vessels into Australian waters
- discharge of ballast water (sourced from the same risk area) from domestic shipping vessels into the waters of Smith Bay
- biofouling from international shipping vessels
- biofouling from domestic shipping vessels
- the export of pest plants, animals and/or pathogens that have hitch-hiked on timber products
- the migration of pest plants, animals and/or pathogens offsite from Smith Bay, or onto Kangaroo Island, during an uncontrolled vessel emergency situation
- introduction of contaminated soil via vehicle movements (construction and operation)
- attraction of nuisance species (including vermin) to the study area.

15.5.2 BIOSECURITY MANAGEMENT FRAMEWORK

Figure 15-2 shows the proposed management framework to minimise the biosecurity risk at the KI Seaport (see Chapter 25 – Management of Hazard and Risk and Chapter 26 – Environmental Management Framework). These documents include practical measures for the phases of development that aim to protect the marine and terrestrial environment of Kangaroo Island.

15.5.3 TERRESTRIAL ENVIRONMENT

Of the 19 weed species recorded in the study area, four are listed as declared species under the *NRM Act 2004* and one is listed as a WoNS. Weed infestations are identified as a key threatening process for many threatened flora species and fauna habitats. No listed threatened or protected flora species were present in the study area during the August 2016 field survey (EBS Ecology 2018).

Although there are no known phytophthora infestations in the study area, dieback remains a threat to remnant vegetation on the site. Phytophthora may be introduced through contaminated soil on vehicles, construction equipment and landscaping materials, including plants. The risk of introducing phytophthora would be greatest during the construction period and would be managed using standard hygiene protocols outlined in the Construction Environmental Management Plan (CEMP) (see Appendix U1).

Given the cleared and degraded nature of the study area, the introduction or spread of weeds would be unlikely to cause impacts on native flora and fauna on the site. However, it could have the potential to spread offsite in the absence of appropriate controls on the movement of plants and plant-related material attached to machinery. Details of the proposed controls are provided in the CEMP (see Appendix U1).

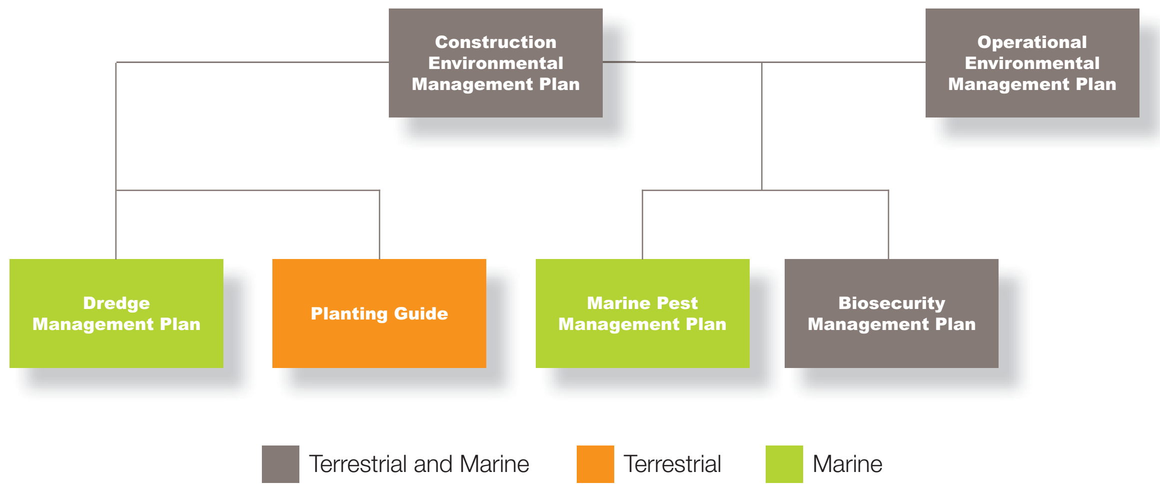


FIGURE 15-2 BIOSECURITY MANAGEMENT FRAMEWORK

Management and mitigation measures

Implementing the CEMP and the Operational Environmental Management Plan (OEMP) (see Appendix U2) would reduce potential onsite and offsite impacts. See Table 15-1 for the proposed management measures to address the terrestrial biosecurity risk for the proposed development.

The risk of introducing and spreading weeds (including declared weeds) and pathogens during construction would be managed by implementing the CEMP, which would include vehicle hygiene measures (see Chapter 26 – Environmental Management Framework). Equipment would be sourced locally wherever possible to minimise the likelihood of spreading weeds in the local area.

Local native species would be planted under a landscaping plan for the study area following construction. Where possible, materials such as seeds and tubestock would be sourced on Kangaroo Island to minimise potential biosecurity risks. A planting guide, including a recommended species list of local native plants, is available in Appendix J1. Species-specific weed management measures would be undertaken by trained personnel where appropriate as part of the landscaping program.

If an Emergency Plant Pest or suspected Emergency Plant Pest (declared under the *Plant Health Act 2009*) was detected in the study area, the terrestrial biosecurity response procedure would be implemented and the relevant authorities notified via the National Pest Hotline. Operators would be trained in this procedure as part of the induction process for construction and operation of the facility. Every possible assistance would be offered to relevant government agencies to prevent the spread of any plant pests. Further detail on incident response would be provided in the OEMP (see Chapter 26 – Environmental Management Framework).

There is potential for a biosecurity threat to be detected on the Island and the KI Seaport could be a vector for this threat to leave Kangaroo Island. Biosecurity officers would not be located at Smith Bay (see Section 15.5.4) and in the event of a vessel emergency the port operator would enforce strict controls on the movement of any plant material, soil and equipment from Kangaroo Island. Ship repairs would not be undertaken at Smith Bay as there would not be any purpose-built facilities. The transfer of any parts, technicians and/or machinery from Kangaroo Island to the vessel would be controlled by measures outlined in the OEMP to minimise the likelihood of translocating pests and/or diseases off the Island (see Chapter 26 – Environmental Management Framework). The operators would maintain open communication channels with stakeholders, including NRKI and Biosecurity SA, to enable access to current information on pest outbreaks on Kangaroo Island. Induction sessions for operators and construction staff would include biosecurity awareness as well as information on pest identification.

To minimise the introduction of pests and diseases that could impact Kangaroo Island's potato and apiary industries, compulsory induction training of construction and operation personnel would include implementing the relevant biosecurity measures, such as the prohibition on imports of honey, apiary products and unwashed potatoes, and weed identification. Ship's crews would also be made aware of Kangaroo Island biosecurity requirements. It is considered that they represent a relatively low risk, being few in number and making regular visits to the Island.

It is unlikely that the proposal would introduce any pest vertebrate animal species, such as goats, deer and/or cats that could potentially impact native flora and fauna by the introduction of new animal diseases. Rodents are of particular concern as they are often stowaways on ships. The Pacific rat is a pest alert species for South Australia (PIRSA 2014b). International sea freight is a key pathway for invasive ants to enter Australia. Exotic invasive ants have been identified as the seventh most important in the National Plant Pest Priority list 2016 (DAWR 2017d).

Although Smith Bay is not currently proposed to be a first point of entry, vigilance would still be required to detect any pest species that could remain on the ship (see Section 15.5.4).

For quality control purposes, woodchips are expected to be completely free of plastic, metal or waste of any sort. The study area site must be kept clean to minimise contamination and the chances that a shipment would be rejected on this basis.

Fumigation of any timber products to address biosecurity pest and pathogen concerns would be undertaken at the port of exit (and not at KI Seaport) subject to the market requirements.

Induction programs for construction, operation and decommissioning would include information on how to identify pest animal species, the potential damage they could cause and how to report sightings (National Pest Alert Hotline: 1800 084 881) (see Appendix U2 – OEMP for further detail). Signage would also be erected to act as a constant reminder to operational staff to act upon any animal sightings on the pontoon or causeway. Should any rodents be detected on board, standard precautions would be adopted, such as the use of physical barriers on mooring lines.

The CEMP would include waste management practices to minimise the possibility of scavenging fauna being attracted to the study area during construction activity. These would include secure storage of waste and regular collection of waste materials (see Chapter 26 – Environmental Management Framework).

Similarly, the OEMP would include such practices to deter scavengers during operation (see Chapter 26 – Environmental Management Framework). Species such as rats, mice and feral cats could potentially be attracted to the KI Seaport. Mitigation strategies would include:

- secure storage of waste (lids on bins)
- regular collection of waste from the site
- dedicated crib facilities for employees and contractors to take meal breaks
- induction training for operators to help them identify pest animal species
- implementation of control measures for pest species that have been detected
- good housekeeping practices to minimise the number of areas that could harbour pest plants or animals.

The OEMP would include the following mitigation measures to reduce the risk of transferring terrestrial pest animal (vertebrate and invertebrate) species, terrestrial plant pest species and pathogens into Smith Bay:

- crew, plant material, food and putrescible wastes would not alight from the vessel during docking at the KI Seaport
- in the event of a vessel emergency (e.g. damage to the ship) equipment and/or technical staff would be transferred to the vessel (see Chapter 26 – Environmental Management Framework) and not transferred onto Kangaroo Island
- regular inspections along the port infrastructure during shiploading activities for any pest animals that may have hitch-hiked on the vessel
- biosecurity signage would be installed.

Specific measures would be detailed in the OEMP to reduce the risk of terrestrial pest plants, animals and pathogens being spread from the Smith Bay area to other ports, including:

- full de-barking of any logs that will ultimately be exported without fumigation
- no plant material (excluding timber products) or food would be transferred from Smith Bay to the vessel during ship-loading at the KI Seaport
- in the event of a biosecurity event on Kangaroo Island, strict controls would be implemented at the KI Seaport in accordance with all directions given by regulatory authorities
- in the event of a vessel emergency any equipment or persons that were transferred to the vessel (either by air or sea) would be free of any soil, plant and animal material
- ongoing weed management activities would minimise the likelihood of spreading weeds from the study area
- the operators would maintain open communication channels with stakeholders, including NRKI and Biosecurity SA, to have access to current information on pest outbreaks on Kangaroo Island
- operators would be required to undergo induction training on biosecurity awareness and pest identification.

TABLE 15-1 ENVIRONMENTAL MANAGEMENT MEASURES FOR TERRESTRIAL BIOSECURITY RISK

Environmental aspect	Phase (construction, decommissioning or operation)	Potential impact to terrestrial environment	Mitigation or management measure	Monitoring measure	Responsibility	Relevant plan
Importation of rock material	Construction	Spread of pest plants, pest animals and/ or pathogens onto Kangaroo Island from interstate as well as other parts of the Island.	Quarry certificates to be provided for all materials imported onto the study area.	Auditing of quarry records.	Construction Manager	CEMP (Appendix U1)
Importation of earthmoving equipment	Construction and decommissioning	Spread of pest plants, pest animals and/ or pathogens to other parts of Kangaroo Island and onto Kangaroo Island from the mainland.	Biosecurity signage would be installed at the site entry and exit. Induction training of construction personnel would include implementing the relevant biosecurity measures, such as the prohibition on imports of honey, apiary products and unwashed potatoes, and weed identification. Vehicles must be free from soil and plant material prior to entering and exiting the site. Earthmoving equipment would be sourced locally wherever possible.	Vehicle inspections.	Construction Manager	CEMP (Appendix U1)
Importation of foods (by construction crews)	Construction and decommissioning	Spread of pest plants (via seeds), pest animals and/or pathogens.	Biosecurity signage would be installed on site. Induction training of construction personnel would include implementing the relevant biosecurity measures, such as the prohibition on imports of honey, apiary products and unwashed potatoes, and weed identification.	Induction records.	Construction Manager	CEMP (Appendix U1)
Importation of foods (by shipping crews)	*Operation*	Spread of pest plants (via seeds), pest animals and/or pathogens.	No plant material (excluding timber products) or food would be transferred from Smith Bay to the vessel during shiploading at the KI Seaport. Regular inspections along the port infrastructure during shiploading activities for any pest animals that may have hitch-hiked on the vessel. Biosecurity signage would be installed along the causeway and pontoon. Ship's crews would be made aware of Kangaroo Island biosecurity requirements.	Inspection records.	KI Seaport Project Manager	OEMP (Appendix U2)

TABLE 15-1 ENVIRONMENTAL MANAGEMENT MEASURES FOR TERRESTRIAL BIOSECURITY RISK (CONT'D)

Environmental aspect	Phase (construction, decommissioning or operation)	Potential impact to terrestrial environment	Mitigation or management measure	Monitoring measure	Responsibility	Relevant plan
Importation of equipment for loading timber onto the ship	Operation	Spread of pest plants, pest animals and/or pathogens to other parts of Kangaroo Island.	International vessels must meet the requirements of the *Biosecurity Act 2015.* Arrival of all international vessels at a first port of entry prior to arrival at Smith Bay.	Refer to the Maritime Arrival Reporting System (MARS).	DAWR Biosecurity Officers at the first port of entry	OEMP (Appendix U2)
Movement of shipping vessels into Australian waters (the Australian EEZ)	Operation	Spread of pest animals (invertebrate and vertebrate) that may have been stowaways on international shipping vessels.	International vessels must meet the requirements of the *Biosecurity Act 2015.* Arrival of all international vessels at a first port of entry prior to arrival at Smith Bay. Should any rodents be detected on board, standard precautions would be adopted, such as the use of physical barriers on mooring lines.	Refer to the Maritime Arrival Reporting System (MARS).	DAWR Biosecurity Officers at the first port of entry	OEMP (Appendix U2)
Export of timber products	Operation	Spread (export) of pest plants, pest animals and/or pathogens that have hitch-hiked on timber products.	Full de-barking of any logs that will ultimately be exported without fumigation. No plant material (excluding timber products) or food would be transferred from Smith Bay to the vessel during shiploading at the KI Seaport. Ongoing weed management activities would minimise the likelihood of spreading weeds from the study area. Management of declared weeds as required by the NRM Act.	Weed control records.	KI Seaport Project Manager	OEMP (Appendix U2)
Importation of plants for landscaping	Construction	Spread of pest plants and/or pathogens.	Implementation of the Planting Guide for landscaping planting. Plants would be sourced locally wherever possible.		Construction Manager	Planting Guide (Appendix J1)

TABLE 15-1 ENVIRONMENTAL MANAGEMENT MEASURES FOR TERRESTRIAL BIOSECURITY RISK (CONT'D)

Environmental aspect	Phase (construction, decommissioning or operation)	Potential impact to terrestrial environment	Mitigation or management measure	Monitoring measure	Responsibility	Relevant plan
Waste management	Construction	Attraction of nuisance species (vermin, feral cats, scavenging birds) to the study area.	Secure storage of waste (lids on bins). Regular collection of waste from the site. Dedicated crib facilities for employees and contractors to take meal breaks. Induction training for operators to help them identify pest animal species. Appropriate biosecurity signage to remind operators to report any sightings of pest species. Implementation of control measures for pest species that have been detected. Good housekeeping practices to minimise the number of areas that could harbour pest plants or animals.	Regular site inspections for pest species (vertebrate and invertebrate). Regular inspections of waste storage facilities.	Construction Manager	CEMP (Appendix U1) Waste Management and Minimisation Plan (Appendix U5)
Waste management	Operation	Attraction of nuisance species (vermin, feral cats, scavenging birds) to the study area.	Secure storage of waste (lids on bins). Regular collection of waste from the site. Dedicated crib facilities for employees and contractors to take meal breaks. Induction training for operators to help them identify pest animal species. Appropriate biosecurity signage to remind operators to report any sightings of pest species. Implementation of control measures for pest species that have been detected. Good housekeeping practices to minimise the number of areas that could harbour pest plants or animals.	Regular site inspections for pest species (vertebrate and invertebrate). Regular inspections of waste storage facilities.	Construction Manager	OEMP (Appendix U2) Bushfire Hazard Management Plan (Appendix U4) Waste Management and Minimisation Plan (Appendix U5)

TABLE 15-1 ENVIRONMENTAL MANAGEMENT MEASURES FOR TERRESTRIAL BIOSECURITY RISK (CONT'D)

Environmental aspect	Phase (construction, decommissioning or operation)	Potential impact to terrestrial environment	Mitigation or management measure	Monitoring measure	Responsibility	Relevant plan
Movement of equipment and resources during an uncontrolled vessel emergency situation	Operation	Spread of pest plants, pest animals and/or pathogens to Smith Bay.	In the event of a biosecurity event on Kangaroo Island, strict controls would be implemented at the KI Seaport in accordance with all directions given by regulatory authorities. In the event of a vessel emergency any equipment or persons that were transferred to the vessel (either by air or sea) would be free of any soil, plant and animal material.	Incident reports.	KI Seaport Project Manager	OEMP (Appendix U2) Emergency Response Management Plan (Appendix U3) Biosecurity Management Plan Terrestrial Biosecurity Response Procedure
	Operation	Spread of pest plants, pest animals and/or pathogens from Smith Bay to mainland Australian or other countries.	In the event of a biosecurity event on Kangaroo Island, strict controls would be implemented at the KI Seaport in accordance with all directions given by regulatory authorities. In the event of a vessel emergency any equipment or persons that were transferred to the vessel (either by air or sea) would be free of any soil, plant and animal material. The operators (KIPT and the Port Management Officer) would maintain open communication channels with stakeholders, including NRKI and Biosecurity SA, to have access to current information on pest outbreaks on Kangaroo Island.	Incident reports.	KI Seaport Project Manager Port Management Officer	OEMP (Appendix U2) Emergency Response Management Plan (Appendix U3) Biosecurity Management Plan Terrestrial Biosecurity Response Procedure
Importation of equipment and consumables	Construction, operation and decommissioning	Discovery of a suspected emergency pest plant.	Implementation of the terrestrial biosecurity response procedure. The discovery of an emergency pest plant (including suspected) would be reported to the relevant authorities via the National Pest Hotline. Induction programs for construction, operation and decommissioning would include information on how to identify pest animal species, the potential damage they could cause and how to report sightings.	Incident reports.	Construction Manager	Biosecurity Management Plan Terrestrial Biosecurity Response Procedure CEMP (Appendix U1) OEMP (Appendix U2)

Monitoring measures

Monitoring measures would include:

- regular site inspections for declared weeds
- regular site inspections for pest species (vertebrate and invertebrate)
- regular inspections of waste storage facilities
- regular inspections of pest control devices
- review of training records
- reviewing the effectiveness of pest control devices.

15.5.4 MARINE ENVIRONMENT

The vectors of marine pest animals, pest plants and aquatic diseases most relevant to the operation of the KI Seaport are the disposal of ship ballast water, which can contain cysts, larvae or juveniles, and biofouling (encrusting organisms) on ship hulls that can detach or spawn. Although ballast water and biofouling are the two most common vectors for marine pests (NCMCRS 2010), other vectors during construction include anchors, anchor chains and mooring lines.

Construction of the causeway would form additional reef habitat that would be colonised by a range of macroalgae and reef fauna and may result in a more diverse and abundant reef community than currently exists at Smith Bay. The causeway could also potentially be colonised by exotic marine fauna.

Introduced marine species can rapidly increase in numbers after a disturbance, the removal of competitive indigenous species, or the provision of unoccupied hard surfaces (wharf structures). Dredging can create essentially barren sites for colonisation that are free from competition by native species (DAWR 2017b).

A draft Australian priority marine pest list is being developed by the Australian Government (DAWR 2018b). A summary is provided in Appendix I5 of the species that were on the previous priority list (Hayes et. al. 2005) and are of concern in South Australia, have been declared 'noxious' under the *Fisheries Management Act 2007* and/or have been recorded in Kangaroo Island waters. The priority species considered most relevant to the proposal are listed in Table 15-1, and each species is described in Appendix I5. Monitoring would have a focus on the species listed in Table 15-2 and any other species that were identified during biosecurity risk assessments undertaken for Kangaroo Island.

In the context of Smith Bay and the existing land-based abalone farm, it would be essential that measures were taken to ensure the proposal does not introduce any abalone diseases into the marine environment (see Chapter 12 – Marine Ecology, Section 12.5.6).

Domestic shipping, which is likely to be used predominantly during construction activity, has a different biosecurity risk profile than

TABLE 15-2 PRIORITY INTRODUCED MARINE SPECIES RELEVANT TO THE STUDY AREA

Group	Species	Common name (after Edgar 2008)	National priority	PIRSA concern	Declared noxious	Recorded on KI
Bryozoans	*Bugula neritina*		M			Y
Bryozoans	*Watersipora arcuata*		M			
Bryozoans	*Watersipora subtorquata*		M			
Cnidarians	*Megabalanus tintinnabulum*	(a barnacle)	M			Y
Cnidarians	*Sabella spallanzanii*	European fan worm	M	Y	Y	Y
Crustaceans	*Carcinus maenas*	European green shore crab	M	Y	Y	
Echinoderms	*Asterias amurensis*	Northern Pacific seastar	M	Y	Y	
Macroalgae	*Codium fragile* ssp. *tomentosoides*	(green macroalga)			Y	Y
Macroalgae	*Polysiphonia brodiei*	(red macroalga)	M			Y
Macroalgae	*Undaria pinnatifida*	Japanese seaweed	M	Y	Y	
Microalgae	*Gymnodinium catenatum*		H			Y
Molluscs	*Maoricolpus roseus*	New Zealand screwshell	M	Y	Y	
Molluscs	*Musculista senhousia*	Asian date mussel	M		Y	
Molluscs	*Perna viridis*	Asian green mussel	H	Y	Y	

Source: PIRSA 2015c, 2017, Wiltshire et al. 2010, Hayes et al. 2005, P. Jennings, Kangaroo Island NRM group, pers. comm. 23 August 2017. Note for National Priority, H = high priority, M = medium priority international shipping activity. The waters around Port Adelaide have a number of established marine pests including *Caulerpa taxifolia*, European green shore crab (*Carcinus maenas*) and feral Pacific oysters that could be infected with pacific oyster mortality syndrome (POMS) (See Appendix I5 for further detail). Any vessels that came from this port would potentially pose a significant biosecurity risk to Kangaroo Island from the discharge of ballast water as well as from biofouling. Whereas an international vessel entering Smith Bay would have already exchanged their ballast water prior to entering the Australian EEZ in accordance with the Biosecurity Act. Water taken up on the high seas is less likely to contain marine pests and therefore poses a reduced level of risk to the biosecurity of KI (see Appendix T1).

Management and mitigation measures

Biofouling management

The IMO defines biofouling as the 'accumulation of aquatic organisms (micro-organisms, plants and animals) on surfaces and structures immersed in or exposed to the aquatic environment'. This includes wharves and ship surfaces.

The Commonwealth Anti-Fouling and In-Water Cleaning Guidelines (DoA 2015) apply to vessels and other moveable structures in aquatic environments and reflect international conventions intended to protect the environment from invasive pest species and contaminants introduced by shipping. The guidelines are directed largely to managing the risks posed by different biofouling management measures and addressing both the environmental management of anti-fouling coatings and in-water cleaning and maintenance of vessels and moveable structures. The voluntary National Biofouling Management Guidelines for Commercial Vessels also outline procedures for operators of commercial vessels to follow to help prevent the introduction and spread of marine pests (Commonwealth of Australia 2008).

Both these guidelines would apply to commercial shipping likely to service the proposed KI Seaport, wherever these vessels may be located.

The SA EPA Code of Practice for vessel and facility management (marine and inland waters) 2017, requires that operators must not perform in-water hull cleaning, that results in the removal of applied surface coating material (e.g. anti-fouling coatings) without written approval from the EPA. This code of practice applies to the State Waters Jurisdiction. Failure to comply with this requirement is likely to lead to a breach of the Environment Protection (Water Quality) Policy 2015. Vessel cleaning (in-water and dry dock) would not be permitted at the KI Seaport.

Biofouling mitigation measures would be required for dredging activity during construction. A Dredge Management Plan would be implemented. The activity would comply with all licence conditions as issued by the EPA.

Biofouling mitigation measures from associated service vessels that enter Smith Bay during construction and operation of the KI Seaport would also be included in the CEMP and OEMP respectively. The use of anti-fouling paints would comply with Commonwealth and South Australian pollution requirements. Appropriate anti-fouling protocols conforming to Commonwealth and State guidelines would be prepared and their requirements integrated into the CEMP and OEMP.

The Port Management Officer would implement best practice for biofouling management at the KI Seaport in accordance with the International Maritime Organization's (IMO) Guidelines for the control and management of ships' biofouling to minimise the transfer of invasive aquatic species. This would include:

- no in-water or dry dock cleaning would be permitted at the KI Seaport
- the Port Management Officer would review biofouling records for incoming vessels
- shipping operators would be required to:
    - implement a Biofouling Management Plan and maintain relevant records
    - provide evidence of independent hull inspections and ongoing maintenance
    - provide current antifouling certificates
    - provide operational history for the vessel
    - provide dates and reports from dry docking.

See Table 15-3 for the management and mitigation measures proposed to address the marine biosecurity risk.

Ballast Water Management

See Appendix D2 for further detail on the legislative framework for ballast water management.

First point of entry

Ships, aircraft and goods from overseas are automatically subject to biosecurity control once they enter Australian territory. For vessels, this comes into effect when they pass within 12 nautical miles of the coastline. Ships are released from biosecurity control either by a notice issued under the Biosecurity Act authorising the release or by leaving Australian territory.

Under the Biosecurity Act, vessels entering the Australian EEZ are required to arrive at a first point of entry, unless the Commonwealth Department of Agriculture and Water Resources (DAWR) has granted advance permission to dock at a different port. Ports designated as a first point of entry need to meet minimum standards for facilities and processes required to manage biosecurity risks. These processes and procedures include the examination of ballast water management records that vessels are required to keep when in the Australian EEZ.

KI Seaport is not currently proposed to be a first point of entry. International vessels arriving there would need to have travelled via a first point of entry where biosecurity control measures would be undertaken. There are several designated first ports of entry in proximity to the proposed seaport.

Risk and regulation

Vessels carry ballast water in order to increase draft, change trim, to regulate stability or maintain acceptable stress loads. Maintenance of stability is required during loading and unloading operations and when a ship is berthing.

As indicated above, biosecurity risk arises from the uptake of ballast water in oceans and ports in one part of the world and its discharge into other waters and ports. The ballast water initially taken up by the vessel may contain pathogens and organisms that pose a risk to the ecology and natural resources of the marine environment into which the ballast water is later discharged.

Ocean-going shipping is gradually transitioning to the inclusion of ballast water treatment systems on board vessels or the use of land-based treatment systems. Currently, however, biosecurity risk arising from the uptake of ballast water in foreign ports and waters and its subsequent discharge in the waters of other nations is managed principally by ballast water exchange as discussed below. Ballast water management is also required for domestic shipping in Australian waters, i.e. ships moving inter and intra-state.

Since September 2017, regulation of biosecurity risk arising from the discharge of ships' ballast water lies exclusively with the Commonwealth government under the Biosecurity Act. Shipping within the Australian EEZ is obliged to comply with the Act's requirements in this respect. DAWR produced the Australian Ballast Water Management Requirements to provide guidance on how to meet the requirements of the Biosecurity Act when in Australian waters (DAWR 2017b).

With certain important exceptions, it is an offence under the Biosecurity Act for vessels to discharge ballast water into the Australian EEZ - that is, within a distance of 200 nautical miles of the Australian shoreline. Compliance with a relevant exception (and certain other provisions as described below) will result in a valid discharge of ballast water. The exceptions and their application to proposed timber transport from the KI Seaport are as follows:

Ballast Water has been 'Managed for Discharge'

Ballast water has been managed for discharge in two circumstances – where the Director of Biosecurity has approved the manner of discharge, including on-board treatment systems, and where ballast water exchange (see below) is used.

Relatively few ships subject to the Convention have on-board ballast water treatment systems at present. Most shipping, including bulk carriers proposing to berth at the KI Seaport, relies on ballast water exchange which is:

> *a process which involves the substitution of water in ship's ballast tanks using either a sequential, flow-through, dilution or other exchange method which is recommended or made obligatory by the IMO, in order to preserve ecology in biologically rich coastal waters and similarly to those in deep oceanic waters.* (Singh 2016)

Where a vessel proposing to enter the Australian EEZ has sourced its ballast water from the marine waters of another nation, ballast water exchange must occur within an 'acceptable location' under the Act; that is, at least 200 nautical miles from the nearest land. If that is not possible, it must occur at least 50 nautical miles from the nearest land and it that is not practicable, at least 12 nautical miles from the nearest land. Furthermore, any ballast water exchange is subject to requirements such as minimum water depths, the percentage volumetric exchange (at least 95 per cent) and the adoption of a method of exchange acceptable under relevant International Maritime Organisation (IMO) Guidelines.

In order to manage biosecurity risk, vessels entering the Australian EEZ for the purpose of transporting timber from the KI Seaport would normally rely on ballast water exchange prior to entry to those seas – that is, the exchange would occur at least 200 nautical miles from the nearest Australian land.

Approved Discharge to a Ballast Water Reception Facility

A ballast water reception facility would not be constructed as part of the land-based component of the KI Seaport.

Discharge under Prescribed Conditions

It is not an offence to discharge ballast water into the Australian EEZ if certain conditions specified in a statutory instrument under the Act are met. These conditions include:

- where at least 95 per cent of the water to be discharged was taken up on the high seas. That is, where a ship has left its port of origin totally or substantially without ballast and subsequently takes up ballast water on the high seas. In those circumstances a vessel may validly discharge that ballast water within the Australian EEZ, including Smith Bay. Most ships travelling to Smith Bay from overseas ports would do so in ballast and therefore, this option would not be relevant. However, in unusual circumstances where a vessel destined for KI Seaport has left its port of origin without ballast and taken up ballast on the high seas, this exception may be used
- the use of 'same risk areas' for ballast water management is discussed below.

Discharge Covered by an Exemption
The Director of Biosecurity may grant an exemption for the discharge of ballast water in connection with voyages between specified ports, offshore terminals or other locations. It is not considered that circumstances would arise where any bulk timber carrier engaged in voyages to and from the KI Seaport would qualify for or apply for an exemption.

Taking up and Discharging Ballast Water at the Same Place
A vessel may validly take up ballast water in a port, offshore terminal or other point and discharge it in the port, terminal or within 1 kilometre of the other point of uptake.

Safety, Accident or Pollution Prevention
In circumstances specified in the Act, it is not an offence to discharge ballast water for reasons of the safety of the vessel or saving life at sea, accidentally or for avoiding or minimising pollution from the vessel.

Same Risk Areas
The waters of Gulf St Vincent, Spencer Gulf, Backstairs Passage and Investigator Strait (see Figure 15-3), have been declared a 'same risk' area for the purposes of ballast water management under the Biosecurity Act. That is, if the uptake and discharge of ballast water occurs in the specified area, the ballast water is considered low-risk and does not require further management under the Act. DAWR produced the Australian Ballast Water Management Requirements to provide guidance on how to meet the requirements of the Biosecurity Act when in Australian waters (DAWR 2017b).

The use of the South Australian same risk area shown in Figure 15-3, by bulk carriers servicing the KI Seaport is not contemplated. Other than in the unlikely circumstances where a carrier en-route to the KI Seaport is carrying cargo to be unloaded at a port in the same risk area, thus necessitating the uptake of ballast water following unloading and its subsequent discharge when loading at Smith Bay, it would not be economically or operationally sensible to use the same risk area for ballast water exchange purposes for international bulk timber carriers. In any event, it is likely that the Commonwealth government would require explanation as to why such an exchange did not occur on the high seas as a priority under the Biosecurity Act.

PIRSA has expressed concerns at the prospect of large volumes of ballast water being taken up by bulk carriers in ports (e.g. Port Adelaide) and then potentially being discharged within the waters of Smith Bay. As indicated above, this appears unnecessary and is not contemplated for international bulk timber carriers. However, domestic shipping vessels used during construction and operation may use the same risk area exception under the Act thus discharging ballast water from other parts of that area into Smith Bay. This activity poses a higher risk than international shipping to the biosecurity status of Smith Bay. In this circumstance, operating procedures for construction and operation would be developed in consultation with Biosecurity SA to reduce the risk of discharging unacceptable ballast water into Smith Bay.

Special consideration would be required for any vessels entering Smith Bay where the last port of call was Port Adelaide. Ballast water management would be required in order to minimise the risk to Smith Bay. Measures would be detailed in the CEMP and contractors operating procedures (See Appendix U1).

Ballast Water Management Plans, Discharge Reporting and Records of Ballast Water Operations
Subject to any exemption granted under the Act, vessels within the Australian EEZ must have an approved Ballast Water Management Plan and certificate.

With some exceptions, (including ballast water exchange undertaken in conformity with the requirements of the Biosecurity Act) the operator of a vessel must give a report to the Director of Biosecurity if it discharges or intends to discharge ballast water into Australian territorial seas, that is, within the 12 nautical mile limit. Smith Bay lies within Australian territorial seas.

Again, with some exceptions, the Biosecurity Act requires that a vessel in the Australian EEZ must have on board, and maintain, a ballast water management record system. Records of ballast water operations must be recorded within that system in accordance with the Act. The records allow the Director of Biosecurity to identify and assess any biosecurity risk associated with a ship's ballast water and to determine whether records are false or misleading. In the event of detected or suspected non-compliance the Director of Biosecurity may exercise a wide range of powers specified under the Act and in accordance with the Department's Biosecurity Compliance Plan and Statement.

Practical Management Measures – Ballast Water

Strict compliance with the ballast water management provisions of the Biosecurity Act by the operators of bulk timber carriers servicing the KI Seaport would be required.

The CEMP and OEMP, would include a detailed Marine Pest Management Plan produced in consultation with DAWR, Biosecurity SA, South Australian Research and Development Institute (SARDI) and the Biosecurity Advisory Committee of KINRMB and would be implemented before construction commences. In relation to ballast water management, this plan would reflect the requirements of the Biosecurity Act.

See Table 15-3 for the management and mitigation measures proposed to address the marine biosecurity risk.

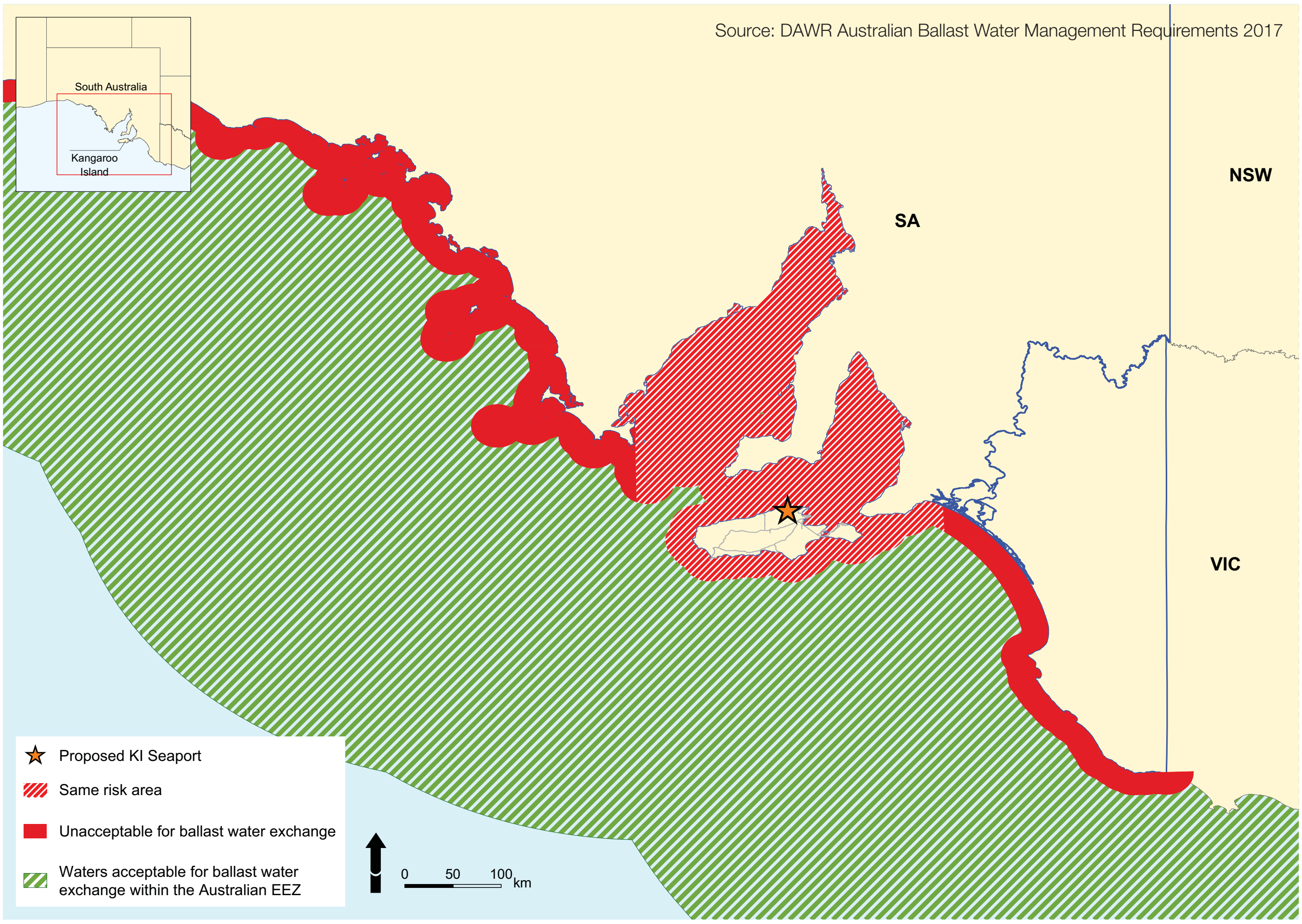


FIGURE 15-3 SAME RISK AREAS FOR BALLAST WATER MANAGEMENT IN SOUTH AUSTRALIA

A single Marine Pest Management Plan (to be implemented during construction and operation) would be developed to address the risk from ballast water and biofouling. The Marine Pest Management Plan would address the following (as a minimum):

- equipment used during construction would meet the national and South Australian standards for biofouling management
- all vessels using the KI Seaport would be required to comply with the policies and guidelines relevant to the management of ballast water disposal
- all vessels using the KI Seaport would be required to comply with state policies relevant to the management of biofouling and pollution prevention
- additional baseline marine surveys would be undertaken in the marine study area to establish a robust baseline detailing the presence of existing pest species
- ongoing monitoring would be undertaken to detect new marine pest species, allowing for an early response to the introduction of marine pests. Monitoring would include a combination of settlement plates or arrays, crab traps and shoreline searches
- the Plan would be continually reviewed to ensure that any new marine pests or aquatic diseases were incorporated into the monitoring program
- particular attention would be paid to risks associated with the potential introduction of abalone-related diseases to Smith Bay, including potentially refusing ships from ports where there are known novel abalone diseases (to be implemented under the port operating agreement)
- the presence of marine pests, including suspected pests, would be reported immediately to the relevant authorities (Fishwatch SA 1800 065 522)
- any cases of suspected abalone diseases or POMS that could be present in feral oyster populations, would be reported immediately to the relevant authority (Fishwatch SA 1800 065 522)
- assistance where appropriate would be provided to the relevant authorities in the event of an emergency incident
- practical response plans and strategies for the control of key pest species would be developed and implemented (as required) in consultation with SARDI, KINRMB, Biosecurity SA and DAWR.

Specific measures, to be included in the OEMP, that would reduce the risk of marine pests (from ballast water) being introduced into Smith Bay include the following:

- the pontoon would be required to complete vessel pre-arrival reporting using the Maritime Arrivals Reporting System (MARS) administered by DAWR (DAWR 2018c). The vessel would also be required to comply with all directives issued by DAWR relating to biosecurity during any inspections
- logs and woodchips exported from Smith Bay to north Asia would be shipped on a relatively small number of log and chip vessels
- other than in exceptional circumstances, vessels would discharge foreign-sourced ballast water on the high seas (that is, further than 200 nautical miles from the Australian shoreline) before entering the Australian EEZ, in conformance with the Biosecurity Act.

Specific measures, to be included in the OEMP, that would reduce the risk of marine pests and aquatic diseases (from biofouling) being introduced into Smith Bay include the following:

- the pontoon (purchased in Korea as a barge) has been sandblasted and repainted with anti-fouling paint and would be inspected by Australian engineers before arrival at Smith Bay
- the use of anti-fouling paints, including any cleaning of the vessel's hull, would comply with Commonwealth and South Australian pollution requirements
- no in-water or dry dock cleaning would be permitted at the KI Seaport
- the port authority would implement best practice for biofouling management in accordance with the IMO's Guidelines for the control and management of ships' biofouling to minimise the transfer of invasive aquatic species.

The implementation of mitigation measures to manage biosecurity risks are reciprocal in nature. Measures to protect the biosecurity status of Kangaroo Island would also protect the biosecurity status of receiving environments, i.e. reduce the risk of introducing pest plants, animals and pathogens into Smith Bay as well as out of Smith Bay.

Aquatic diseases

Two abalone diseases (AVG and Perkinsus parasite) as well as the oyster disease POMS are on Australia's National List of Reportable Diseases of Aquatic Animals and must be reported immediately (DAWR 2017c). Any suspected cases would be reported immediately via Fishwatch (1800 065 522) (see Appendix U2 – OEMP). All directions provided by PIRSA would be followed to prevent further spread of any diseases. Other management measures that would be detailed in the CEMP and OEMP, include:

- no abalone or oyster products would be allowed to enter the study area via Freeoak Road or via the KI Seaport
- induction sessions for construction and operational staff would include a component on aquatic diseases, including abalone and oyster diseases
- any marine surveillance equipment (boats and diving equipment) used during construction and/or operation would be decontaminated in accordance with standard industry protocols to prevent the spread of any aquatic diseases.

See Table 15-3 for the management and mitigation measures proposed to address the marine biosecurity risk.

Monitoring measures

Monitoring measures for marine pests and aquatic diseases would include:

- regular surveys of infrastructure and surrounding sediments associated with the proposal to detect any new pest species (as part of the Marine Pest Management Plan)
- auditing of ballast water management plans by the Director of Biosecurity
- auditing of biofouling management plans during construction/operation by the Port Management Officer
- review of the marine biosecurity response procedure (See Appendix U2 – OEMP)
- review of effectiveness of management measures
- review of training records.

15.5.5 EARLY DETECTION MEASURES FOR EXOTIC MARINE ORGANISMS

After prevention, early detection is vital to prevent the spread and colonisation of new marine exotic organisms and limit any potential impacts on industry and the environment. The following measures would be implemented as part of the Marine Pest Management Plan:

- marine pest surveillance would be undertaken during operation and would include regular diving and inspection of artificial infrastructure (e.g. settlement arrays and crab traps) and associated sediments for pest species. It would also include shoreline searches for marine organisms and pests.
- the Marine Pest Management Plan would be developed in consultation with DAWR, Biosecurity SA and Biosecurity Advisory Committee of KINRMB.
- ballast water management records would be reviewed by the Director of Biosecurity at the first port of entry
- subscriptions to biosecurity alerts would be maintained to ensure up-to-date information on current pest outbreaks was readily available.

TABLE 15-3 ENVIRONMENTAL MANAGEMENT MEASURES FOR MARINE BIOSECURITY RISK

Environmental aspect	Phase (construction, decommissioning or operation)	Potential impact to terrestrial environment	Mitigation or management measure	Monitoring measure	Responsibility	Relevant plan
Importation of marine works vessels and equipment from Port Adelaide (and other South Australian locations)	Construction and decommissioning	Spread or introduction of pest plants, pest animals and/or aquatic diseases into Smith Bay from biofouling.	Induction training of construction personnel. Equipment used during construction would meet the national and South Australian standards for biofouling management. Anti-fouling and In-Water Cleaning Guidelines (DoA 2015). SA EPA Code of Practice for vessel and facility management (marine and inland waters) 2017. No in-water or dry dock cleaning would be permitted at the KI Seaport (during construction).	Review of training records.	Construction Manager	CEMP (Appendix U1) Dredge Management Plan Marine Pest Management Plan
		Spread or introduction of pest plants, pest animals and/or aquatic diseases into Smith Bay from ballast water disposal.	Operating procedures for construction and operation would be developed in consultation with Biosecurity SA to reduce the risk of discharging unacceptable ballast water into Smith Bay. Implementation of the Ballast Water Management Guidelines.	Review of ballast water management plans.	Biosecurity SA	CEMP (Appendix U1) OEMP (Appendix U2)
Importation of employees and associated perishables	Construction and decommissioning	Introduction of an aquatic disease.	No abalone or oyster products would be allowed to enter the study area via Freeoak Road or via the KI Seaport. Induction sessions for construction staff would include a component on aquatic abalone diseases, including abalone and oyster diseases.	Review of training records.	Construction Manager	CEMP (Appendix U1)
	Operation	Introduction of an aquatic disease.	No abalone or oyster products would be allowed to enter the study area via Freeoak Road or via the KI Seaport. Particular attention would be paid to risks associated with the introduction of abalone-related diseases to Smith Bay, including potentially refusing ships from ports where there are known novel abalone diseases (to be implemented under the port operating agreement). Induction sessions for operational staff would include a component on aquatic abalone diseases, including abalone and oyster diseases.	Review of training records.	KIPT Project Manager Port Management Officer	OEMP (Appendix U2)

TABLE 15-3 ENVIRONMENTAL MANAGEMENT MEASURES FOR MARINE BIOSECURITY RISK (CONT'D)

Environmental aspect	Phase (construction, decommissioning or operation)	Potential impact to terrestrial environment	Mitigation or management measure	Monitoring measure	Responsibility	Relevant plan
Dredging	Construction	Spread or introduction of pest plants, pest animals and/or aquatic diseases into Smith Bay.	Dredging activity would require an EPA licence. Implementation of the Marine Pest Management Plan. Implementation of the Dredge Management Plan.	Any conditions as required by the EPA licence.	EPA Construction Manager	CEMP (Appendix U1) Dredge Management Plan Marine Pest Management Plan
Importation of the pontoon from outside the Australian EEZ	Construction	Spread or introduction of pest plants, pest animals and/or aquatic diseases into Smith Bay from biofouling.	International vessels must meet the requirements of the *Biosecurity Act 2015.* Arrival of all international vessels at a first port of entry prior to arrival at Smith Bay. The pontoon would be required to complete vessel pre-arrival reporting using the Maritime Arrivals Reporting System (MARS) administered by DAWR. The vessel would be required to comply with all directives issued by DAWR relating to biosecurity during any inspections. The pontoon (purchased in Korea as a barge) has been sandblasted and repainted with anti-fouling paint and would be inspected by Australian engineers before arrival at Smith Bay. The use of anti-fouling paints, including any cleaning of the vessel's hull, would comply with Commonwealth and South Australian pollution requirements.	Refer to the Maritime Arrival Reporting System (MARS).	DAWR Biosecurity Officers at the first port of entry Vessel operators EPA	
Construction of the causeway	Construction	Increase in population of exotic marine species yia colonisation of hard surfaces.	Investigation (during detailed design) of potential surface treatments or alternative structures to minimise the impact from exotic species.		KIPT	
Movement of domestic shipping vessels into Smith Bay from Port Adelaide	Operation	Spread or introduction of pest plants, pest animals and/or aquatic diseases from the discharge of ballast water.	Implementation of the Ballast Water Management Guidelines. Operating procedures would be developed in consultation with Biosecurity SA to reduce the risk of discharging unacceptable ballast water into Smith Bay.		Vessel operators Port Management Officer	OEMP (Appendix U2)

TABLE 15-3 ENVIRONMENTAL MANAGEMENT MEASURES FOR MARINE BIOSECURITY RISK (CONT'D)

Environmental aspect	Phase (construction, decommissioning or operation)	Potential impact to terrestrial environment	Mitigation or management measure	Monitoring measure	Responsibility	Relevant plan
Movement of domestic shipping vessels into Smith Bay from Port Adelaide (continued)	Construction, operation and decommissioning	Spread or introduction of pest plants, pest animals and/or aquatic diseases from the discharge of ballast water.	The Marine Pest Management Plan would be developed in consultation with DAWR, Biosecurity SA and Biosecurity Advisory Committee of KINRMB. Any marine surveillance equipment (boats and diving equipment) used during operation would be decontaminated in accordance with standard industry protocols to prevent the spread of any aquatic diseases. Regular review and update of the Marine Pest Management Plan to include any new pests and diseases.	Marine pest surveillance which would include regular diving and inspection of artificial infrastructure (e.g. settlement arrays and crab traps) and associated sediments for pest species. Shoreline searches for exotic marine species.		Marine Pest Management Plan
	Construction, operation and decommissioning	Spread or introduction of pest plants, pest animals and/or aquatic diseases from biofouling.	Anti-Fouling and In-Water Cleaning Guidelines (DoA 2015). SA EPA Code of Practice for vessel and facility management (marine and inland waters) 2017. No in-water or dry dock cleaning would be permitted at the KI Seaport.	Auditing of biofouling management plans.	Port Management Officer (under the port operating agreement)	OEMP (Appendix U2) Marine Pest Management Plan
Movement of international shipping vessels into the Australian EEZ	Operation	Spread or introduction of pest plants, pest animals and/or aquatic diseases from the discharge of ballast water.	International vessels must meet the requirements of the *Biosecurity Act 2015.* Logs and woodchips exported from Smith Bay to north Asia would be shipped on a relatively small number of nominated log and chip vessels. Other than in exceptional circumstances, vessels would discharge foreign-sourced ballast water on the high seas (that is, further than 200 nautical miles from the Australian shoreline) before entering the Australian EEZ, in conformance with the *Biosecurity Act 2015.*	Refer to the Maritime Arrival Reporting System (MARS).	DAWR Biosecurity Officers at the first port of entry	OEMP (Appendix U2) Marine Pest Management Plan

TABLE 15-3 ENVIRONMENTAL MANAGEMENT MEASURES FOR MARINE BIOSECURITY RISK (CONT'D)

Environmental aspect	Phase (construction, decommissioning or operation)	Potential impact to terrestrial environment	Mitigation or management measure	Monitoring measure	Responsibility	Relevant plan
Movement of international shipping vessels into the Australian EEZ (continued)	Operation	Spread or introduction of pest plants, pest animals and/or aquatic diseases from biofouling.	International vessels must meet the requirements of the *Biosecurity Act 2015*. SA EPA Code of Practice for vessel and facility management (marine and inland waters) 2017 No in-water or dry dock cleaning would be permitted at the KI Seaport. The port operating agreement would require shipping operators to implement a Biofouling Management Plan and maintain relevant records.	Refer to the Maritime Arrival Reporting System (MARS).	DAWR Biosecurity Officers at the first port of entry Port Management Officer (under the port operating agreement)	OEMP (Appendix U2)
	Construction, operation and decommissioning	Spread or introduction of pest plants, pest animals and/or aquatic diseases from the discharge of ballast water.	The Marine Pest Management Plan would be developed in consultation with DAWR, Biosecurity SA and Biosecurity Advisory Committee of KINRMB Regular review and update of the Marine Pest Management Plan to include any new pests and diseases. Any marine surveillance equipment (boats and diving equipment) used during operation would be decontaminated in accordance with standard industry protocols to prevent the spread of any aquatic diseases.	Marine pest surveillance which would include regular diving and inspection of artificial infrastructure (e.g. settlement arrays and crab traps) and associated sediments for pest species. Shoreline searches for exotic marine species.		Marine Pest Management Plan CEMP (Appendix U1) OEMP (Appendix U2)

TABLE 15-3 ENVIRONMENTAL MANAGEMENT MEASURES FOR MARINE BIOSECURITY RISK (CONT'D)

Environmental aspect	Phase (construction, decommissioning or operation)	Potential impact to terrestrial environment	Mitigation or management measure	Monitoring measure	Responsibility	Relevant plan
Discovery (including suspected) of a new exotic marine organism at the Seaport	Operation	Introduction of a pest plant, pest animal and/or aquatic disease.	Implementation of the marine biosecurity response procedure Subscriptions to biosecurity alerts would be maintained to ensure up-to-date information on current pest outbreaks was readily available. The organism would be reported to the relevant authorities via the Fishwatch 24-hour hotline. Any cases of suspected aquatic diseases would be reported immediately to the relevant authorities via the Fishwatch 24-hour hotline. All directions issued by PIRSA would be followed. Practical response plans and strategies for the control of key pest species would be developed and implemented (as required) in consultation with SARDI, KINMRB, Biosecurity SA and DAWR.	Regular review of the biosecurity response procedure . Incident reports.	Vessel operators Port Management Officer KI Seaport	OEMP (Appendix U2) Marine Pest Management Plan
	Operation	Spread of pest plants, pest animals and/or aquatic diseases from Smith Bay to other Australian or foreign waters.	In the event of a biosecurity event on Kangaroo Island, strict controls would be implemented at the KI Seaport in accordance with all directions given by regulatory authorities. In the event of a vessel emergency any equipment or persons that were transferred to the vessel (either by air or sea) would be free of any soil, plant and animal material. The Port Management Authority and KIPT would maintain open communication channels with stakeholders, including NRKI and Biosecurity SA, to have access to current information on pest and/or disease outbreaks.	Incident reports.	KI Seaport Project Manager	OEMP (Appendix U2) Emergency Response Management Plan (Appendix U3) Marine Pest Management Plan

If a new (including suspected) exotic organism was identified during operation, the marine biosecurity response procedure would be implemented (see Appendix U2 – OEMP for further detail). The organism would be reported to the relevant authorities via the Fishwatch 24-hour hotline and all directions issued by PIRSA would be followed.

If there was a biosecurity incident, PIRSA would assume responsibility for the on-ground management of the incident, including any information that would be provided to the media. Further detail on incident management would be provided in the OEMP.

15.6 BIOSECURITY STRATEGY FOR KANGAROO ISLAND 2017–2027

The Biosecurity Strategy for Kangaroo Island 2017–2027 (KINRMB 2017a) seeks to protect the Island and its community from the harmful impacts of pests, weeds and diseases.

The proposed development is consistent with the five guiding principles of the Biosecurity Strategy (see Table 15-4):

- the uniqueness of Kangaroo Island and its isolation have been considered as paramount when drafting all mitigation and management measures
- a risk-based approach forms the basis of this EIS (see Chapter 25 – Management of Hazard and Risk and Appendix T)
- all terrestrial and marine ecosystems have been taken into consideration during the development of this EIS (see Chapter 9 – Marine Water Quality, Chapter 10 – Coastal Processes, Chapter 11 - Aquaculture, Chapter 12 – Marine Ecology, Chapter 13 – Terrestrial Ecology).

The proposed development is consistent with the following relevant objectives from the Biosecurity Strategy (see Table 15-4):

Objective 1: Systems are in place for early detection of biosecurity threats to Kangaroo Island

The CEMP and OEMP would include further detail on the following mitigation measures to be implemented as part of the proposed development:

- construction equipment would be inspected and confirmed to be free from soil and plant material prior to entering the construction site
- subscriptions to biosecurity alerts would be maintained to ensure up-to-date information on current pest outbreaks was readily available
- regular communication would be maintained with NRKI and other relevant stakeholders to ensure up-to-date information on local pest outbreaks was readily available and acted upon
- regular inspections along the causeway during shiploading activities for any terrestrial pest animals (vertebrate and invertebrate) that may have hitch- hiked on the vessel
- early detection measures (implemented as part of a Marine Pest Management Plan) for marine threats would include shoreline searches and regular surveys of infrastructure and

TABLE 15-4 GUIDING PRINCIPLES AND KEY OBJECTIVES OF THE BIOSECURITY STRATEGY FOR KANGAROO ISLAND 2017–2027

Biosecurity Strategy for Kangaroo Island 2017–2027
Key guiding principles
The Biosecurity Strategy for Kangaroo Island 2017–2027 sets out five guiding principles: • There is a biosecurity risk to everything that arrives on Kangaroo Island and it is impossible to reduce the risk to zero. • All biosecurity risks are taken into account, even if they are not covered by legislation. • Biosecurity is everyone’s responsibility and it is crucial to ensure that people are aware of the environmental risks and help to mitigate risks. • All terrestrial and aquatic environments require consideration to ensure protection from pests and diseases. • Regionally specific risks need to be taken into account, as introduced species could significantly impact Kangaroo Island.
Key objectives
The Biosecurity Strategy for Kangaroo Island 2017–2027 sets out six objectives: • Systems are in place for early detection of biosecurity threats to Kangaroo Island. • A strategic, targeted risk-based response prioritises current and emerging biosecurity threats. • Biosecurity requirements, roles and responsibilities are clearly defined for all agencies, industries and the Kangaroo Island community. • The Island has the capacity to respond to high-risk biosecurity threats. • Management of existing pests, weeds and diseases is coordinated across the public and private sectors to limit their spread and impact. • Effective leadership, planning, evaluation and improvement of Kangaroo Island’s biosecurity system.

other potential substrates that marine pests could colonise. Particular attention would be paid to risks associated with the potential introduction of abalone-related diseases to Smith Bay, including potentially refusing ships from ports where there are known novel abalone diseases.

Objective 5: Management of existing pests, weeds and diseases is coordinated across the public and private sectors to limit their spread and impact.

No marine pests were declared during the baseline assessment (SEA 2016).

The CEMP and OEMP would include further detail on the following mitigation and management measures to be implemented as part of the proposed development:

- the landscaping plan would be developed by suitably qualified personnel and would source local seed from Kangaroo Island wherever possible
- existing terrestrial weeds would be managed as required under the NRM Act and in collaboration with NRKI
- induction programs would include weed identification, pest animal identification and reporting requirements
- the CEMP and OEMP would include standard waste management practices
- the Marine Pest Management Plan would be developed in consultation with DAWR, Biosecurity SA, KI NRMB and SARDI
- the Biosecurity Management Plan would be developed in consultation with Biosecurity SA and the KI NRM Board.

15.7 CONCLUSION

Kangaroo Island is free from some of the pests and diseases found on mainland Australia. The use of the proposed KI Seaport and the movement of ships from other regions into Smith Bay has the potential to increase the likelihood of introducing and translocating pest species and diseases, if not well-managed.

National, state and regional biosecurity management policies and strategies would be followed to minimise the potential for the introduction of pest plants, pest animals and/or pathogens from biofouling and ballast water management.

All international and domestic vessels using the KI Seaport would be required to comply with the *Biosecurity Act 2015*.

Management of biofouling would include the prohibition of dry dock or in-water cleaning of vessels at the KI Seaport during construction and operation.

The CEMP and OEMP would include a detailed Marine Pest Management Plan that would be produced in consultation with DAWR, Biosecurity SA, SARDI and the Biosecurity Advisory Committee of the Kangaroo Island Natural Resources Management Board. The Marine Pest Management Plan would focus on early detection as a priority objective.

In addition to implementing the Marine Pest Management Plan during operations, KIPT have committed to provide funding for marine pest and eradication surveys of Smith Bay in liaison with NRKI.

Waste management practices would be implemented at the onshore facilities to minimise the attraction of scavenging fauna such as rats, mice and feral cats. Vehicle hygiene measures would be implemented to minimise the risk of introducing and spreading weeds. Ongoing management of declared weeds within the onshore area would occur as required. If an Emergency Pest Plant was detected, the terrestrial biosecurity response procedure would be implemented, and the relevant authorities notified.

The wharf structure and wetted surfaces would be inspected routinely to detect any new pest species. The marine biosecurity response procedure would be implemented if new exotic organisms were identified, and the relevant authorities would be notified. The operator of KI Seaport would work closely with all relevant authorities to provide assistance in the event of a biosecurity outbreak on the Island.

The proposal is consistent with the Biosecurity Strategy for Kangaroo Island 2017–2027.

Guideline		Comment
Page 10 of 36	A site history assessment – if development is to occur on land that has the potential to be contaminated (though previous land uses) a site history assessment is required.	See Section 16.3.1 and Appendix L1
2.7	Describe any dredging activity that will be undertaken during the construction phase. Outline impacts that dredging may have on sediment loads and the neighbouring commercial aquaculture operation. Detail measures for managing these impacts, including management of dredge spoil, noting that all dredging should be undertaken in accordance with the Environment Protection Authority's Dredging and Earthworks Drainage Guideline – June 2010.	See Chapters 4, 11, Sections 16.5.1 and 16.5.2
2.8	Describe the design and operational measures to protect water quality and prevent stormwater and other runoff from the site, and in particularly harmful contaminants, entering the coastal and marine environment, during both construction and operation.	See Sections 16.5.1, 16.5.2 and Appendix C3
2.9	Describe the contaminants and toxicants that may accumulate on the property and the risks during stormwater events (where not managed) to the adjacent aquatic environments and commercial industries (e.g. fisheries and aquaculture,) that rely on those environments.	See Section 16.5.2
11.4	Outline the measures proposed to manage stormwater runoff from hard surfaces which are not being used for harvesting water supply, especially access roads. Include measures to: • treat the stormwater • ensure that pre-development volumes will be maintained • ensure the removal of any toxicants and nutrients; and • prevent increases in sediments with associated turbidity in near shore environments.	See Sections 16.5.1, 16.5.2 and Appendix C3
11.5	Outline the measures proposed to manage stormwater runoff/ leachate from the timber product stockpile area. Include measures to: • capture and contain leachate • ensure the removal of any toxicants, nutrients, sediment and biochemical oxygen demand (BOD) • measures to prevent leachate mobilisation to groundwater and the near shore environments.	See Section 16.5.2 and Appendix C3
11.6	Describe the known existing groundwater and surface water related environmental conditions, including consideration of any existing site contamination.	See Sections 16.4.3, 16.4.4 and 16.4.5
11.7	Detail the measures to be taken to manage and monitor the quality of identified groundwater or surface water resources. Identify impact avoidance, minimisation and mitigation measures and their effectiveness (for any polluting activities).	See Sections 16.5.1, 16.5.2, Appendices C3, U1 and U2
11.8	Describe any potential changes to hydrology as a result of the proposed development.	See Section 16.5.2

16. GEOLOGY, SOILS AND WATER

16.1 INTRODUCTION

This chapter outlines the characteristics of the proposed site's geology, onshore soil, surface water, groundwater and offshore sediments and the assessment of how activities during construction and operation of the proposed development might affect the environment.

Reference is made to relevant statutory criteria and guidance regarding protection of the hydrogeological environment. It assesses the potential impact of the construction and operation of the proposed KI Seaport on soils, surface water and groundwater and describes management strategies that would minimise any potential impacts.

16.2 REGIONAL SETTING

16.2.1 GEOLOGY

The study area lies within the northern coastal zone of Kangaroo Island, which comprises a dissected margin of a laterite surface, with occasional ridges and hills on metamorphic (DEWNR 2011, in EBS 2016). Figure 16-1 shows the geology of the study area. The 1:250,000 Kingscote geology map sheet SI-53-16 (Geological Survey of SA, Dept of Mines 1962) indicates that the site is in an area underlain by a sequence of Quaternary and Cambrian age sediments, consisting of:

- Quaternary: Consolidated dune limestone (aeolianite) of the coastal areas; with numerous internal unconformities and fossil soil horizons; siliceous white sands and lesser sheet (soil) travertines extending inland.
- Cambrian: Stokes Bay Sandstone formation, principally massive coarsely current and slump-bedded red and white sandstones and quartzites, with marbles and calcareous slates on the Fleurieu Peninsula.

Two kilometres east of the site is a geological monument called the Smith Bay Glacial Pavements, which extend further along the coast towards Emu Bay for about 1 km.

16.2.2 TOPOGRAPHY

Kangaroo Island is characterised by an undulating upland plain with an extensive laterite cover which gives rise to mottled-yellow duplex soils. The landform is described as a dissected tableland: there are moderate to very steep slopes in the centre of the Island, and coastal dune formations with small plains, swamps, lagoons and lunettes (wind-formed crescent dune shapes) along the coastal fringes and eastern area. The plain rises to an average height of 100–150 metres (see Figure 16-2) and is bounded by a densely dissected scarp falling steeply to the coiffed coastline (Dept of Lands 1990).

16.2.3 SOILS

Kangaroo Island soils, shown in Figure 16-3, include calcareous sandy soil of minimal development, coherent sandy soils, sandy soils with mottled yellow clayey subsoil and cracking clays (DEWNR Soil Mapping).

16.2.4 COASTAL ACID SULFATE SOILS (CASS)

Coastal acid sulfate soils (CASS) are soils and sediments containing iron sulphides. When exposed to air due to drainage or disturbance, they produce sulphuric acid and increase the potential for metals to be released into the environment.

Potentially, CASS are present in the coastal regions of South Australia where low-lying sediments have been deposited. Site observations (elevation of the study area and lower beach area) and maps published by the Australian Soil Resource Information System (ASRIS) indicate it is unlikely CASS is present in and around the Smith Bay site, although this evidence is not conclusive (see Figure 16-4).

According to Coastline – A Strategy for Implementing Coast Protection Board (CPB) Policies on Coastal Acid Sulfate Soils in South Australia, Kangaroo Island does not have any known CASS sites (SA Coast Protection Board 2003). The Kangaroo Island Plan, a volume of the SA Planning Strategy (Department of Planning and Local Government 2011), provides management policies for acid sulfate soils but does not identify locations.

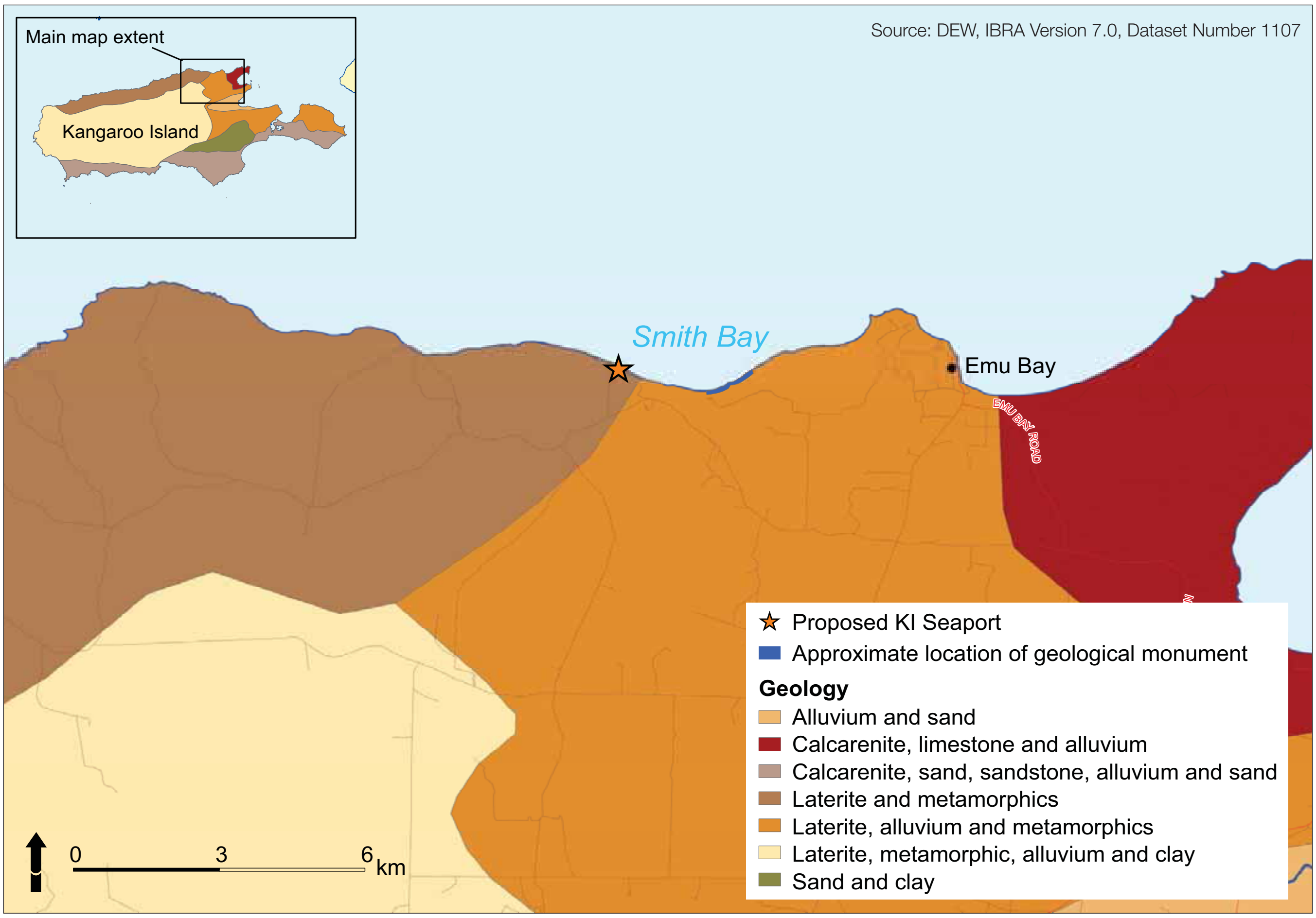


FIGURE 16-1 GEOLOGY MAP

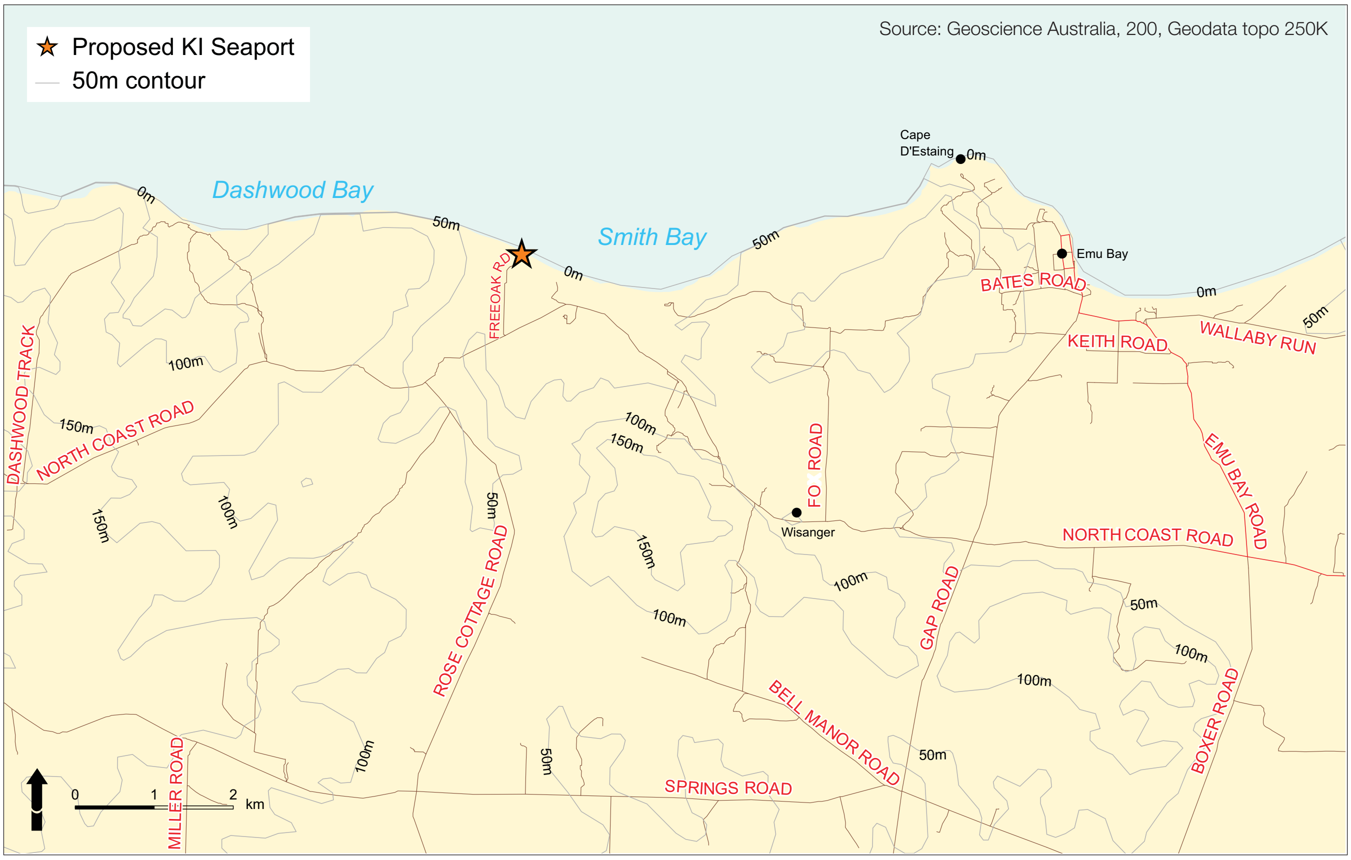


FIGURE 16-2 REGIONAL CONTOURS MAP

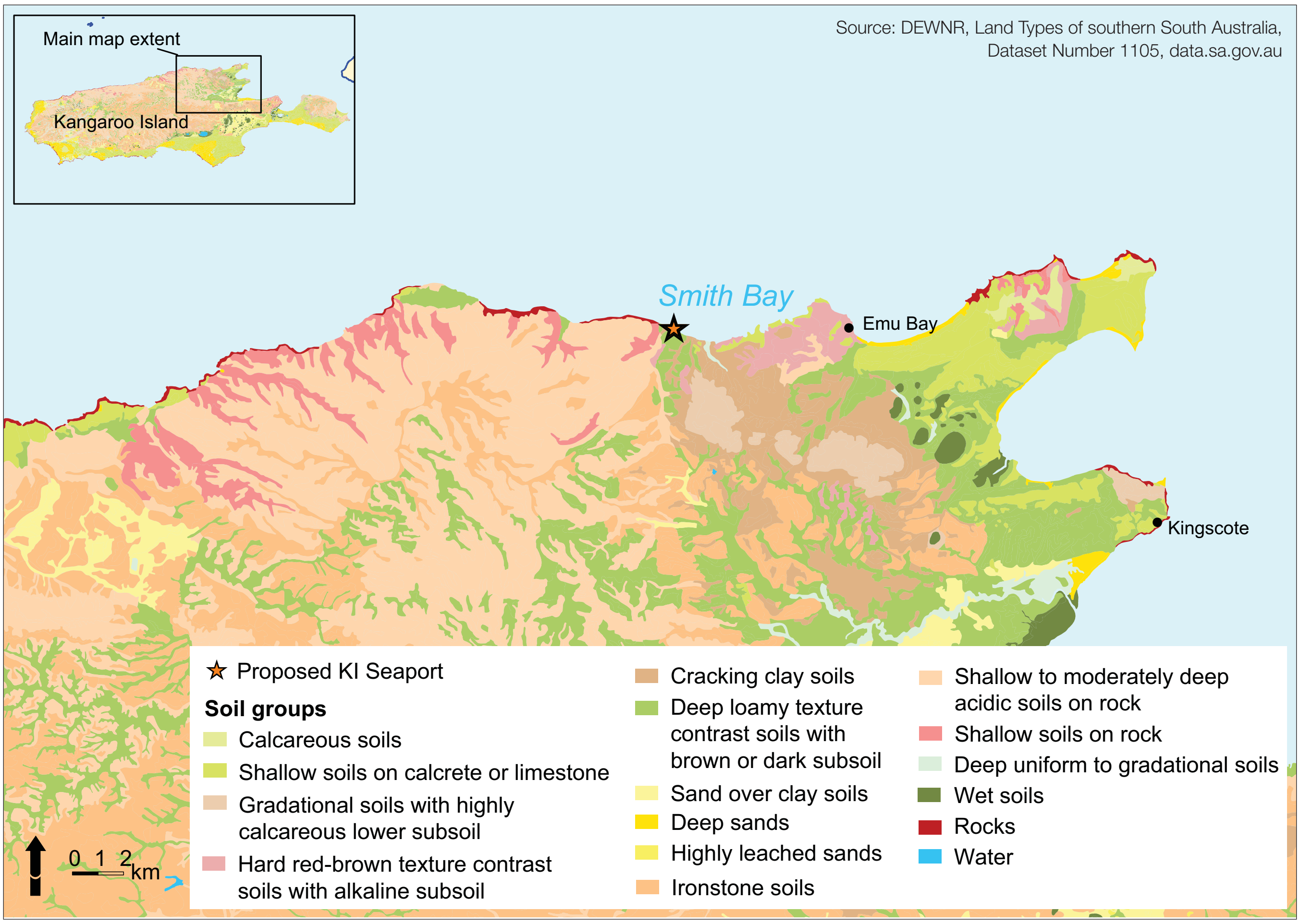


FIGURE 16-3 REGIONAL SOILS MAP

16.2.5 SURFACE WATER

The Smith Bay land area generally consists of shallow, seasonal drainage lines, with occasional seasonal lagoons (see Figure 16-5). Catchments for these drainage lines generally extend inland and deepen, extending south-east and south-west into higher-elevation hinterland. The most significant surface water body (which is also seasonal) is Smith Creek, west of the study area, which has a shallow estuary into Smith Bay. The creek's catchment deepens rapidly as it extends higher toward the south-east, as shown in the topography of the site in Figure 16-9.

16.2.6 GROUNDWATER

The South Australian Government Water Connect database identifies four licensed wells within a 1 km radius of the site. The following was identified from the database results:

- three registered bores were drilled in 2015 for investigative purposes. Their status is recorded as having been backfilled
- one registered bore located off site, adjacent to the eastern boundary, is classed as a water well for stock purposes
- the wells' drilled depths ranged from 20 metres below ground level (mBGL) to 54 mBGL. Depth to groundwater was recorded as 5 mBGL in one well (drilled to 54 mBGL)
- the measured total dissolved solids (TDS) concentration recorded from the off-site stock water well was 11,192 mg/L on 5 January 1996. According to the Environment Protection (Water Quality) Policy 2015, groundwater with TDS concentrations exceeding 1200 mg/L is deemed unsuitable for potable use and marginally suitable for stock watering (National Water Quality Management Strategy, Guidelines for Groundwater Quality Protection in Australia 2013).

Based on topography (elevations dropping towards the coastline) and regional groundwater beneath the site (fractured rock), it is anticipated groundwater flows north toward Smith Bay. Figure 16-6 shows regional groundwater aquifer and hydrogeological characteristics associated with Smith Bay.

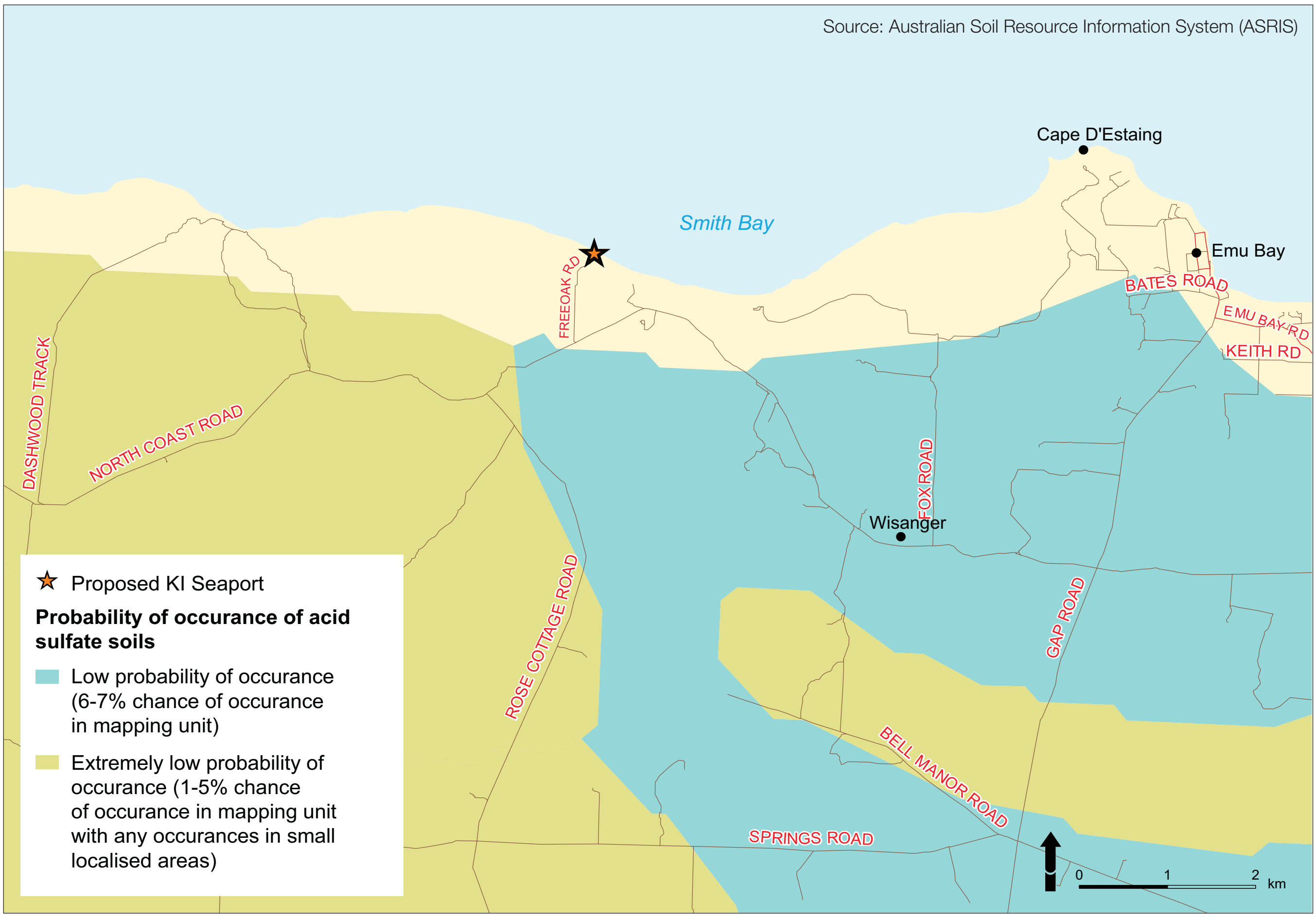


FIGURE 16-4 REGIONAL ACID SULFATE SOILS MAP

16.3 ASSESSMENT – METHODS

16.3.1 SITE INVESTIGATIONS

The environmental site assessment was undertaken in three stages, as follows:

- site history assessment or preliminary site investigation (PSI)
- intrusive onshore sampling – soil and groundwater
- intrusive offshore sampling – seabed sediment.

The site history assessment and intrusive onshore sampling results were reported in:

- Smith Bay Site Investigation, Smith Bay, Kangaroo Island, Environmental Projects, 10 October 2017 (EP 2017), see Appendix L1.

The intrusive offshore sampling results are reported in Appendix F1.

Site history assessment

The results of the site history investigation and identification of relevant potentially contaminating activities (PCAs) informed the required intrusive assessment.

Site history investigation (EP 2017) suggested that the site was used as farmland until 2001, when it was purchased by KI Seafood Marketing, before being transferred to Kangaroo Island Abalone Pty Ltd in 2002. It was then used for onshore abalone farming until sometime before 2010 (the date of deregistration of this business), after which the site has remained disused, other than as a dwelling.

Of the likely and suspected historic on- and off-site uses, the most relevant with respect to potential contamination migrating to or being found on the subject site included:

- fill or soil importation
- agricultural activities
- aquaculture or fish processing.

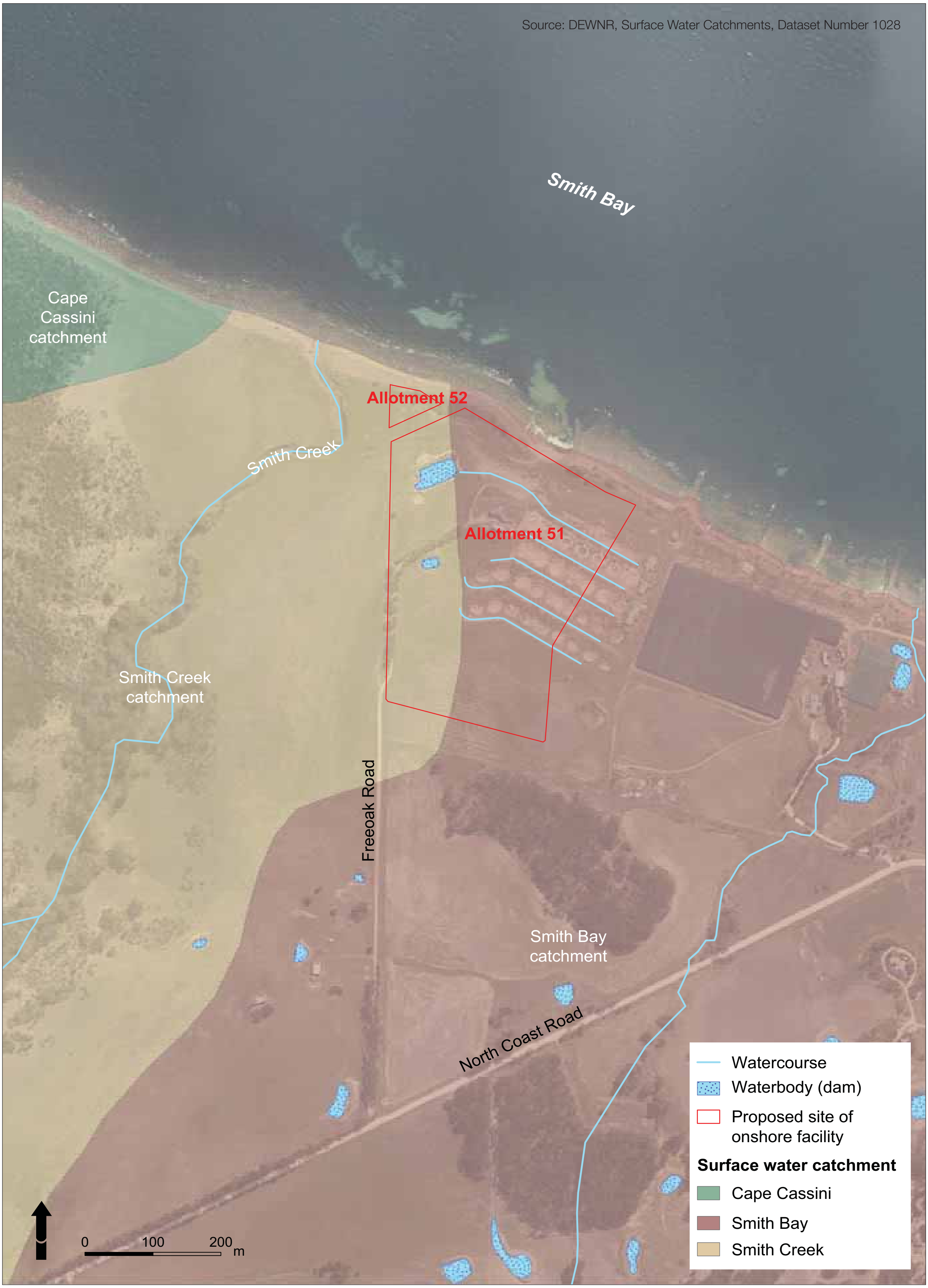


FIGURE 16-5 SURFACE WATER MAP

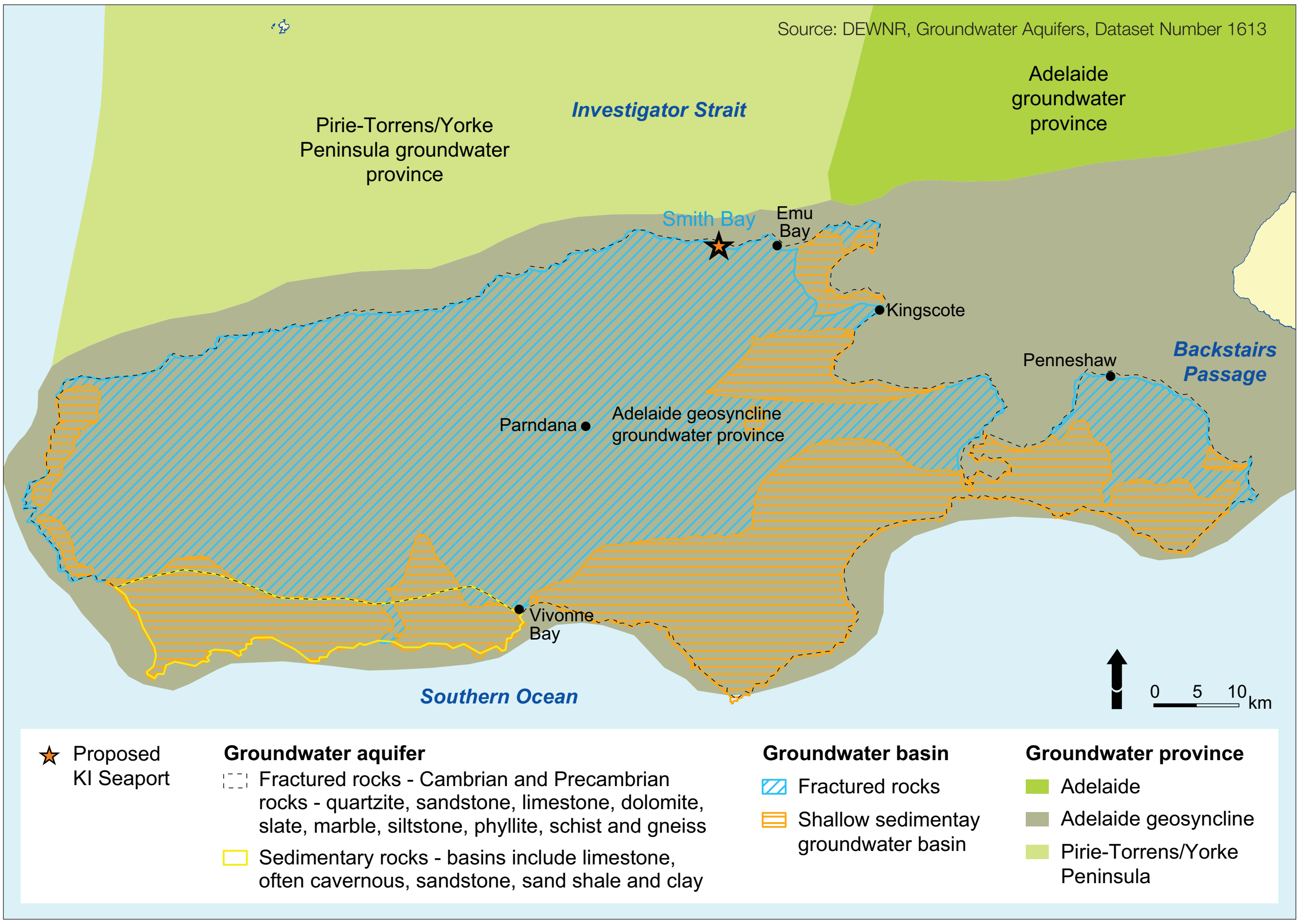


FIGURE 16-6 REGIONAL GROUNDWATER AQUIFER AND HYDROGEOLOGICAL CHARACTERISTICS

Onshore intrusive sampling – soil and groundwater

A sampling plan (EP 2017) was prepared based on initial findings of the site history. The developed investigation program included a combination of systematic (grid-based) and judgemental (targeted) sampling and testing. A sampling grid of 20 soil bore locations (BH01–BH20), shown in Figure 16-7, across an approximate 80-metre grid and six targeted boreholes (T1–T6), was adopted.

Chemical testing generally focused on near-surface soils, where contamination residues were most likely to be present within any potential uncontrolled fill materials or from pesticide application and/or other residues. As well as analysing samples from upper soil layers, a range of deeper samples from across the site were tested to characterise the underlying natural soils.

Selected soil samples recovered from the sampling locations were tested for a broad range of chemicals associated with the identified PCAs.

Groundwater sample GW01 was retrieved using the grab sampling methodology from soil bore location BH13 after the recovery of the soil core (see Figure 16-8).

A liquid grab sample, identified as GW02, was collected from a 100 mm PVC inspection point which was possibly part of a disused septic tank system.

Offshore intrusive sampling – seabed sediment

Sediment samples were collected from 18 locations within the proposed dredging footprint, and pontoon area, and analysed for a comprehensive suite of physical and chemical parameters. Preliminary intrusive offshore sampling (sediment) was reported in Appendix F1.

FIGURE 16-7 SOIL BORE LOCATIONS

FIGURE 16-8 GROUNDWATER GRAB SAMPLE LOCATIONS

16.4 EXISTING ENVIRONMENT

This section describes the existing environment based on site investigations (EP 2017).

16.4.1 LITHOLOGY

The site surface generally consists of a shallow reworked natural layer including various sand or clay mixtures. This fill may have been imported during development of the site for the former land-based aquaculture use.

Approximately half of the grid-based soil bore locations intersected natural soils, which typically consisted of various clay and silt mixtures from the surface.

The underlying natural soils were generally described as medium- to high-plasticity clays with various calcareous, silt and sand inclusions. Sandstone gravels and sandstone were usually encountered with depth.

Field observations indicated that the site soils were free of any physical evidence of contamination.

No CASS was intercepted during site investigation.

16.4.2 LANDFORM AND TOPOGRAPHY

Within the study area, the foreshore is lined by small sand dunes up to two metres high and, further to the east, the beach consists of igneous boulders rounded and polished by wave action, refer to Plate 16-1 and Plate 16-2. Boulders have been removed to create a boat launching/landing site at one small sandy beach on the site foreshore.

Section 10.4.1 provides a description of the coastal landform, which is an intertidal cobble beach, abutting a linear mound of cobbles and boulders running parallel to the coastline, with a small dune system and former creek land-side, which has been significantly altered by previous site development.

According to the topographic map of Yorke Peninsula and Kangaroo Island (Department of Lands 1990), the site has an elevation of approximately 10–30 metres Australian Height Datum (AHD) and slopes north toward Smith Bay. The surrounding land generally slopes north, and west of the site rises to an elevation of more than 100 metres AHD with a steep cliff face along the foreshore. Local topography is shown in Figure 16-9.

Plate 16-3 and Plate 16-4 illustrates the changing landform characteristics of the site from the cobble beach to landside.

PLATE 16-1 FORESHORE AT APPROXIMATE LOCATION OF CAUSEWAY LOOKING WEST

PLATE 16-2 FORESHORE AT APPROXIMATE LOCATION OF CAUSEWAY LOOKING EAST

PLATE 16-3 PHOTOGRAPH ILLUSTRATING SITE SLOPE

PLATE 16-4 PHOTOGRAPH ILLUSTRATING STEEP CLIFF FACE BETWEEN THE UPPER PART OF THE SITE AND THE FORESHORE

16.4.3 SURFACE WATER

Several ephemeral creeks/drainage lines enter Smith Bay, with generally shallow, localised catchments. The largest, Smith Creek, traverses the western edge of the parcel of land adjoining the Smith Bay site and discharges to the sea approximately 100 metres west of the site. The western portion of the study area is within the Smith Creek catchment and the eastern portion is within the Smith Bay catchment. Both catchments are quite shallow in the study area but deeper further inland. The proposed site location occupies a very small proportion of the overall catchments and its location at the very end of these catchments suggests the site has very little contribution to overall catchment flows. Based on observed topography it can be assumed that the site is its own catchment, with land to the south of the site also draining towards the site.

Although Smith Creek has been highly disturbed by past agricultural practices, it continues to support some remnant vegetation along its banks. The proposed development would not have any impact on the watercourses or the associated vegetation.

16.4.4 GROUNDWATER

A groundwater grab sample was collected from a soil borehole near the site's northern boundary (refer Figure 16-8). The depth to water during drilling was measured at 1.65 mBGL. The total depth of the soil borehole was 2.25 mBGL. Groundwater recharge into the soil borehole was slow, suggesting low aquifer yield.

Groundwater in this location had total dissolved solids (TDS) concentration of 18,000 mg/L, indicative of saline conditions. Groundwater here is potentially connected to the marine environment.

The results of groundwater assessment suggest the shallow aquifer has little beneficial use due to high salinity and low yield. Given it's shallowness it is likely to be affected by evaporation and standing water elevation is likely to be highly variable based on rainfall infiltration.

The results suggest that groundwater is unlikely to be in use in the immediate Smith Bay region and there is no intent to use groundwater for site activities.

FIGURE 16-9 SITE CONTOURS (m RL) MAP

16.4.5 SITE CONTAMINATION STATUS

Soil

Concentrations of all analytes in soil samples tested were below the laboratory limit of reporting (LOR) and/or the applicable National Environment Protection (Assessment of Site Contamination) Measure (ASC NEPM) 1999 (amended 2013) Health Investigation and Screening Levels (HIL/HSLs) for the proposed industrial use and ecological investigation and screening levels (EIL/ESL).

The results indicated that soil contaminant concentrations were at background levels so there was no site contamination at the time of investigation (EP 2017).

Groundwater

Iron and lead concentrations in groundwater exceeded the criteria specified in the Australian and New Zealand Environment Conservation Council (ANZECC) aquaculture and human consumption for saltwater production (marine species aquaculture) (EP 2017).

Cobalt and copper concentrations exceeded the ANZECC aquatic marine ecosystems criteria (EP 2017).

Concentrations of total recoverable hydrocarbons (TRH) were reported in groundwater but retesting of the sample confirmed that no petroleum hydrocarbons were present.

Nitrite concentrations exceeded the ANZECC criterion for aquaculture and human consumption for saltwater production (marine species aquaculture) (EP 2017).

Sulphate concentrations exceeded the National Health and Medical Research Council (NHMRC) recreational aesthetic criterion (EP 2017). If groundwater were to be pumped to the surface and used for a recreational purpose such as to fill a swimming pool, the detected concentrations of sulphate would give the water an unpleasant odour and make it aesthetically unpleasant for that use.

All other contaminants included in the extensive analytical suite for the groundwater grab sample had concentrations below the LOR.

The results did not suggest that previous site activities had caused groundwater contamination, and all detected concentrations were considered to be at background (naturally occuring) levels for saline water.

16.4.6 MARINE SEDIMENTS

Marine sediments were assessed for chemical characteristics and particle size distribution reported in Appendix F1.

The overall findings of this site investigation suggest the study area in Smith Bay has no synthetic or natural pollutants.

Sediment depth overlying the hard sea floor ranged from 0–140 cm. The texture of sediment was mostly coarse white and grey sand with shell grit and organic detritus. Deeper sediment (below 65 cm) at one location had more fines and a higher organic content than at the other 11 sampling locations.

Metals and metalloids found at low concentrations were well below the Australian Interim Sediment Quality Guideline low trigger level.

Tests did not detect the presence of synthetic chemicals, including phenols, petroleum hydrocarbons and organotins (tin-based organic compounds), in any sediment samples. Potential acid sulfate soils were not expected in the coarse sand sediments of Smith Bay. The pH of deep sediment was near neutral (pH 6.5).

In summary, the sediment found in Smith Bay was evaluated as being unpolluted, with the concentration of all tested elements and synthetic compounds below the relevant Australian Interim Sediment Quality Guidelines low trigger levels (Appendix F1).

16.5 IMPACT ASSESSMENT AND MANAGEMENT

The key activities associated with construction of the KI Seaport would be:

- removing existing infrastructure that is not required for development, including the disused septic tank
- undertaking bulk earthworks to create benches across the site, form storage areas, build stormwater management infrastructure (settlement ponds), dredge spoil dewatering ponds and cut access roads
- dredging the marine basin and using the coarse fractions of dredge spoil as causeway fill, with the balance used on land
- importing quarry material to create hardstand and paved roads, and to armour the causeway
- trenching for installing services including water, power and sewerage, and for chip reclaim pits and conveyors
- constructing site buildings and infrastructure
- excavating the stormwater retention basin and woodchips leachate management system/basin.

The key activities associated with operation of the facility are:

- storing timber and woodchips on site
- loading timber and woodchips onto ships
- moving heavy vehicles and unloading timber and woodchips into stockpiles
- managing stormwater (and leachate)
- maintaining the site.

The environmental aspects and potential impacts of these activities and general management strategy are described in this section.

Detailed management strategies associated with stormwater are described in the Stormwater Management Strategy (WGA 2018) in Appendix C3.

16.5.1 ENVIRONMENTAL ASPECTS WITH ON-SITE IMPACTS

The potential on site environmental impacts associated with the proposed development are:

- the effect on the natural topography of the site, due to the cut and fill required
- diminishing landscape quality of the coastal environment and of significant geological features
- exposure of any contaminated soil during site excavation, including basin excavation and pile driving
- exposure of CASS during deeper site excavation, including basin excavation and pile driving
- offsite disposal of contaminated site soils surplus to construction requirements
- use of contaminated dredge spoil as site fill.

Based on the various site investigations described above, these risks are considered low to negligible and can be managed effectively.

The potential site-based environmental impacts associated with operation of the facility are:

- contamination of the site soils or groundwater by activities (transport and storage)
- flooding and erosion (including flooding and erosion exacerbated by sea level rise and extreme weather events).

It is considered that these risks can be managed effectively.

Effect on topography

The study area currently consists of:

- a foreshore component at near sea level, which has some landscape value and is not highly disturbed, except at a point where rocks have been moved to create an unofficial boat launching area
- an elevated component at a level of approximately 10 metres AHD (mAHD) atop an artificial escarpment, which extends inland and is highly disturbed, having been levelled and terraced for previous aquaculture activities; the landscape value of this portion is very low
- vacant crop land extending southward and sloping to an elevation of approximately 30 mAHD, with moderate to low landscape value.

The proposed development would not significantly affect the foreshore portion of the site and would require the construction of wide, flat terraces extending southward and linked by roads to the wharf and North Coast Road.

The overall site will be shaped to integrate with the surrounding topography where this does not increase potential for sediment loading of stormwater runoff.

Management

See Chapter 23 – Visual Amenity for discussion on visual amenity with changes to topography of the study area.

Exposure of contaminated soil

Soil contamination has not been detected on site.

Management

Although no site contamination has been detected, a Contamination Management Contingency Plan should be developed for the management of contamination should it be unexpectedly found during excavation work. The plan would be developed in accordance with EPA requirements and be part of the Construction Environmental Management Plan (CEMP) (see Appendix U1).

Exposure of CASS

Although a desktop review of available information could not identify the specific presence of CASS on the site, it is possible that CASS might be present at depth, particularly in the former creek alignment along the coastal frontage. Prolonged exposure of CASS may result in acidification and the release of contaminants.

The offshore sediment sampling did not intersect any CASS in marine sediment.

Management

A CASS Management Contingency Plan would be developed for deeper excavation work such as land-based pile driving.

The Management Plan would provide contingent actions for minimising exposure of CASS, and any treatment if such soils were exposed. The plan would be developed as part of the CEMP (see Appendix U1).

Surplus soil disposal

Soil investigations showed there were no contaminants that would affect the viability of the proposed site use; however, sampling may not have been sufficiently extensive to classify surplus soil to be removed from the study area, should there be any. Offsite disposal without adequate testing could result in inappropriate reuse, or disposal to inappropriately licensed landfill.

Management

The design intent is to balance the site cut and fill quantity by developing a suitable terrace arrangement to allow the establishment of infrastructure without a requirement for externally sourced material or a requirement to dispose of excess material offsite. The exact layout would be determined during detailed design following more detailed geotechnical investigations.

A Soil Management Contingency Plan will however be developed to guide specific sampling of surplus soil (either in situ or once stockpiled) to determine waste classification and disposal options, should surplus soil requiring offsite disposal be generated. The plan would be developed as part of the CEMP (see Appendix U1).

Dredge spoil reuse

Details of the proposed construction dredging activity and of dredge spoil and dewatering management are provided in Chapter 4 – Project Description.

Dredging is required to provide adequate draft depth for incoming vessels which need to approach, berth at and leave the proposed wharf.

The dewatering of the dredge spoil on land (no ocean disposal is planned) and the proposed reuse of suitable dewatered dredge spoil in causeway construction (coarse fraction) or as fill for development of onshore facilities may affect soil, surface water, marine water and groundwater quality.

The dredging activity assessment is provided in Chapters 9, 10 and 12 for the marine environment and in Chapter 11 – Land-Based Aquaculture, for the aquaculture operations.

The results of sediment sampling (see Appendix F1) suggest that the spoil is suitable for use on land and as causeway fill, because the sediment was found to be relatively pristine, with no synthetic or natural pollutants (contaminant concentrations were within SA EPA Waste Fill criteria), and with a high proportion of coarse shell grit and sand.

Management

Dredge spoil will be managed to allow separation of the coarse fraction for the causeway construction continuously during dredge spoil dewatering.

Additional sampling and analysis as part of dredge spoil management would provide validation that dredge spoil meets SA EPA Waste Fill criteria and that it is suitable for use onsite.

Dredge spoil sampling will be incorporated into a Contamination Management Contingency Plan as part of the CEMP (see Appendix U1).

Contamination of site soils by site activities

Site activities during operation could result in the release and accumulation of chemicals, including:

- oil, other hydraulic liquids, metallic contaminants and other debris such as rubber particles from trucks and equipment, such as conveyor systems and loaders, used to transfer and handle logs and woodchips
- chemicals (potentially including oil, fuels, herbicides, pesticides) stored in relatively small quantities for onsite use and for maintenance (importation and storage of bulk fuel beyond site requirements for permanent equipment is not proposed).

The release and accumulation of these chemicals could result in soil contamination.

The potential for long term contamination of site soils from site activities is low as released quantities would be low and most contaminants would biodegrade. General industrial site use is not considered a significant contamination source.

Management

The potential impact from the identified aspects would be managed by an Operational Environmental Management Plan (OEMP). The OEMP would include:

- measures for containment and clean-up of spills
- a requirement to store all chemicals in compliance with appropriate standards
- a site stormwater management system
- bunding of fuel storage areas and generators
- regular maintenance schedule for all equipment
- requirement for refuelling of trucks off-site and procedures for minimising spills during refuelling of site equipment.

Flooding and erosion

Flooding due to sea level rise or off-site rainfall is considered unlikely as the facility would be built on high ground (minimum 10 mAHD).

The facility is designed to ensure stormwater runoff rates should not exceed the rate of discharge from the site that existed pre-development and that erosion and sediment transport are managed.

Increased flooding potential on site due to increase in impervious areas (woodchip and timber storage) is managed by means of on-site drainage system design to cater for one-in-20-year Average Recurrence Interval (ARI) storm events.

Management

The site would be designed to contain and manage all stormwater runoff during construction and operation to eliminate uncontrolled water channelling and concentrated runoff streams – no site stormwater will discharge to surface water bodies untreated.

A stormwater management system will minimise flooding potential.

The internal network of open drains, culvert, pipes and wetland will be designed to ensure sufficient carrying capacity with gradients and appropriate controls to prevent bed erosion and damage.

Erosion at the outlet of the wetland system will be managed via a porous rock weir at the wetland outlet to distribute water flow over a wide area.

Details are provided in Appendix C3.

16.5.2 ENVIRONMENTAL ASPECTS WITH OFF-SITE IMPACTS

The potential off site environmental impacts associated with the development are:

- surface water and groundwater impact from sediment load and contamination from dredge spoil dewatering
- surface water impact from sediment load in site stormwater runoff during construction
- surface water and groundwater impact from the mobilisation of contaminants released during construction.

The potential off-site environmental impacts associated with operation of the facility are:

- surface water (including marine) impact from sediment load in site stormwater runoff
- surface water impact from the accumulation of general (outside of storage areas) site activity generated contaminants and toxicants mobilised during stormwater events (including pontoon discharge to the sea)
- surface water impact by the generation of leachate from woodchip and log storage
- changes to site hydrology including potential for groundwater contamination by site activities.

Detail on engineering design is provided in Chapter 4 – Project Description and Appendix C3.

Dredge spoil dewatering

Spoil from the proposed cutter suction dredge (CSD) method usually contains a high volume of water. The slurry would be pumped to land at the southern (high) end of the development area and discharged through a series of cascading ponds to allow sediment to settle and dewatering to occur.

The transfer of chemical contaminants to surface water and groundwater is unlikely as the marine sediment is not contaminated hence water will not transport any chemicals. There may be some localised and short term increase in groundwater levels due to infiltration but as the groundwater is saline, water quality will not be greatly affected, The majority of entrained water will flow through the system and not infiltrate.

The transfer of sediment to surface water is unlikely as the sediment contains a high proportion of coarse sand and the pind system will be designed and tested to only discharge water with acceptable sediment (turbidity) levels. Sediment load will not impact groundwater.

Management

Dredging activities would comply with the South Australian Environment Protection Authority's Dredging and Earthworks Drainage Guideline (June 2010).

The dredge spoil dewatering system has been designed to discharge water with acceptable sediment levels. No untreated dredge water would be discharged directly into the marine environment or into the adjoining Smith Creek.

The method for controlling dewatering is detailed in Chapter 4 – Project Description.

Sediment and chemical load in general site stormwater runoff for construction and operation

Stormwater runoff could transport sediment to surface water bodies during construction and operation if not appropriately managed. The current site condition may result in some sediment transport to sea however the vegetated foreshore strip may currently act to trap sediment.

Activities during construction and operation could result in the release and accumulation of chemicals which could result in contamination of stormwater runoff and of groundwater.

Stormwater runoff from the loading pontoon may also transport accumulated sediment and contaminants.

If not managed, contaminated stormwater and groundwater could affect the marine environment. The majority of general site contaminants (excluding timber leachate) would however either biodegrade in the environment or be diluted on mixing with seawater, due to the low concentrations that would be present on site from normal activity. The site is a small catchment and even without any management of runoff the off-site impact would be low and likely to be negligible at water intake points offshore.

Management

During the construction phase a Soil Erosion and Drainage Management Plan (SEDMP) will be implemented in accordance with the *Environment Protection Act 1993*.

All up gradient surface water flow will be redirected around the site.

The proposed operational wetland pond, retention basin and swale system will be constructed during the early phase of construction to function as sediment capture basins during the major earthworks and civil works construction phases.

No untreated stormwater would discharge to surface water bodies directly.

All runoff except wood storage areas will be directed to this system during operation through engineered bunds and other structures.

As the captured stormwater will have low levels of contamination, the treatment system will allow infiltration of stormwater into groundwater. Infiltrated surface water will have been treated by the system and would not cause groundwater quality deterioration.

The pontoon surface will be graded to prevent any runoff entering the ocean. Inlet pits will be fitted with a litter basket to trap debris and will discharge to a gross pollutant trap / oil water separator to intercept pollutants prior to discharge to the sea.

In the operational phase, potential impact from surface water would be managed by an OEMP, which will include monitoring of surface water and groundwater in the wetland and basin area.

Treatment system design is detailed in Appendix C3.

Surface water and groundwater impact from woodchip and timber leachate generation

Leachate may be produced when an uncovered store of logs or woodchips is exposed to precipitation and the water emerges as a contaminated liquid (Forest & Wood Products 2008; Tao et al. 2005).

Untreated softwood and hardwood woodchips and logs would be stored on impervious pads.

Leachate from the storage of (predominantly) woodchips is expected to be acidic, with a high biological oxygen demand (BOD) (Tao et al. 2005). It is likely to contain tannins and lignins which do not readily biodegrade (Tao et al. 2005). Toxic and acidic compounds such as phenol and natural resins are expected to be present (Samis, Wernick & Nassichuk 1999). Pine logs and chips may release terpenes, such as pinene. Although terpenes are generally volatile and insoluble, they could nevertheless be transported by water and would require management.

Combined anaerobic and fungal effluent treatment has been proven to reduce tannins and lignins by 38–45 per cent (Kahmark & Unwin 1998).

Constructed wetland systems and reed beds have been found to be effective in removing toxicity and managing of BOD and chemical oxygen demand (COD) (Manios, Stentiford & Millner 2003).

If not managed properly, leachate could impact surface water via direct runoff or through stormwater transport and groundwater via infiltration. Site groundwater is considered to be connected to the marine environment.

Management

Timber log and wood chip storage yards will be established with bunding and impermeable base, to isolate runoff from the general stormwater system and from groundwater. Stormwater runoff (assumed to be leachate) will drain via a concrete forebay (in the bunded area) to intercept gross sediment and debris and to a retention basin (holding pond) designed to contain flows from storm events.

There will be no discharge of leachate to surface water or groundwater.

The pond will be lined to prevent infiltration. Leachate will be removed via evaporation or used for irrigation of adjacent landscape buffer (where contaminants will biodegrade) and for dust suppression (within wood storage areas).

Leachate management is further detailed in Appendix C3 and Appendix U2.

Changes to hydrology

Changes in surface water quality will be managed by the stormwater management system described in Appendix C3.

Changes to site hydrology (groundwater) may occur in terms of:

- standing groundwater level (ecological and human use availability)
- water quality (salinity)
- water quality (contamination).

These characteristics are affected by changes in stormwater infiltration.

The development stormwater management system is designed so that runoff rates do not exceed the rate of discharge from the site that existed pre-development hence significant change is not expected.

The impermeable base of the log and woodchip storage areas and the lined retention basin will prevent infiltration, but the wetland system and detention basin will allow infiltration hence standing groundwater levels are unlikely to be affected significantly outside of the immediate site boundaries. The shallow aquifer is highly saline, shallow and likely to be linked to the marine environment hence other drivers influencing standing water levels are likely to be much more dominant than occasional stormwater infiltration.

Similarly, decrease in salinity may occur beneath the site due to stormwater infiltration but this effect is likely to be highly localised and of no consequence in the context of the much larger catchment area.

Site observation did not suggest significant stormwater runoff occurs from the site hence there is unlikely to be a significant change in off-site discharge after stormwater management systems are in place.

Stormwater runoff from woodchip storage areas would be contained in those areas and not allowed to infiltrate hence increase in groundwater contaminant concentration is not expected. General contaminants on the site will generally be transported by stormwater to the wetland system where they will biodegrade or be absorbed before water infiltrates and any infiltration generally across the site is likely to be low volume and diluted.

In the context of the site area (in comparison to the much larger regional catchment), the existing groundwater quality and availability (saline, low yield, little or no beneficial use) and the likely impact caused by site stormwater infiltration, any changes in hydrology could be considered minimal.

16.6 CONCLUSIONS

16.6.1 EXISTING SITE CONDITIONS

No site contamination or CASS has been identified in development area, so the movement and reworking of soils as part of site development would not require special management or treatment. However, contingency plans to prevent environmental impacts will be developed should contamination or CASS be discovered during construction activities, such as deep excavation works or pile driving.

16.6.2 KI SEAPORT ACTIVITIES

Design features of KI Seaport would mitigate or manage potential environmental impacts resulting from construction and operational activities. Design would include:

- capture and treatment of dredge spoil waters (from dewatering) and runoff (with exposure to rainfall)
- diversion of general site stormwater around operational areas to avoid pollution, such as timber storage areas, chemical and fuel stores, equipment operational areas, roads and car parks
- capture of general site stormwater for settling out of sediment
- treatment of stormwater that is potentially polluted by timber products, equipment and vehicles
- no discharge of untreated stormwater runoff to the marine environment
- impervious pads, cover and bunding for hazardous materials storage
- impervious pads at the base of timber storage areas.

Detail on engineering design is provided in Chapter 4 – Project Description and Appendix C3.

Standard management measures and monitoring would be implemented for construction and operation through implementation of a CEMP (including SEDMP) and OEMP (including other sub plans), respectively, (see Chapter 26 – Environmental Management Framework) for:

- spills response and clean up
- signage and inventory control for hazardous materials
- inspection, maintenance and monitoring of stormwater management systems
- inspection, maintenance and monitoring of timber storage areas
- inspection, maintenance and monitoring of hazardous materials storage.

KI Seaport would not significantly affect the existing geological, hydrological or landforms characteristic of Smith Bay.

17. AIR QUALITY

Guideline		Comment
Page 10 of 36	Provide an air quality assessment report that identifies and assesses all potential pollutants, pollutant sources (for all materials proposed to use the wharf), including operational pollutants (such as combustion products, transport emissions (i.e. dust), and sensitive receivers, and describes the management strategies to manage, minimise and mitigate potential pollutants (and risks of emission of such pollutants) during construction and operations).	See Chapter 17 and Appendix M
2.11	Describe how shiploading operations will minimise incidental timber spillage and dust emissions (point source and fugitive) during loading operations to avoid causing harm to marine and coastal flora and/or fauna species, including migratory species.	See Sections 17.5.1, 17.5.4 and 17.5.5
2.12	Describe the impact of any incidental timber spillage and dust emissions (point source and fugitive) during shiploading operations on the marine environment, in particular on water quality and marine and coastal flora and/or fauna species, including migratory species. Outline the measures that will be taken in the event of a spillage.	See Chapters 9, 11, 12, Sections 9.5.7, 9.6, 11.5.4, 11.5.5 and 17.5.5 Modelling outputs used for relevant discussions are in Chapters 9, 11 and 12
2.13	Describe the impact of dust emissions on the nearby aquaculture industry and identify mitigating measures that will be used to manage these impacts.	See Chapter 11, Sections 11.5.5 and 17.5.4
5.1	Provide an air quality impact assessment for all potential sources of dust/particles and gaseous pollutants associated with the construction and ongoing operation of the proposed port, which includes modelling undertaken in accordance with the Environment Protection (Air Quality) Policy 2016 and the Environment Protection Authority's Ambient Air Quality Assessment 2016 guideline.	See Chapter 17, Section 17.5.5 and Appendix M
5.2	Outline the impacts of dust and/or particle generation on the existing commercial operations and any other identified nearby sensitive receivers in the vicinity of the proposed development, in particular the exiting abalone farm.	See Section 17.5.3
5.3	Describe how all potential sources of air pollution (especially dust and particulates from transport, unloading, storage and shiploading) will be controlled and monitored, including measures for their reduction or elimination.	See Chapter 26, Section 17.4.4, Appendices U1 and U2

17. AIR QUALITY

17.1 INTRODUCTION

This chapter describes the existing air quality and meteorology at Smith Bay. It identifies and assesses any potential changes in air quality that may occur as a result of the storage, handling and use of materials during the construction and operations phases of the KI Seaport development. This includes identifying and assessing those impacts that may result from the combustion of fossil fuels, the handling and storage of logs and woodchips, and of airborne dust from vehicles using onsite roads.

The overall air quality is then compared to relevant standards and guidelines to quantify the impact on nearby receptors with reference to strategies that may be implemented to manage, minimise and mitigate potential impacts during construction and operations.

As noted in Chapter 4 – Project Description the proposed development does not include forestry operations or impacts from other potential users as those operations are subject to separate approvals not associated with the EIS. Activities that have the potential to affect air quality within the study area include:

- land clearing, resulting in the wind erosion of cleared areas (construction phase only)
- the movement of vehicles on unpaved roads (construction and operations)
- vehicle and equipment emissions (construction and operations)
- storage of dredge spoil material (construction phase only)
- the movement of materials and construction activities (construction phase only)
- unloading of fill materials for construction of the pontoon's access causeway (construction phase only)
- unloading of woodchips and logs (operations phase only)
- wind erosion of woodchip stockpiles and stockpile pads (operations phase only)
- loading of woodchips by reclaim hopper to conveyor, and conveying the woodchips to the shiploader (operations phase only)
- loading woodchips into transport vessels (operations phase only).

17.2 REGIONAL SETTING

17.2.1 PROJECT LOCATION AND LAYOUT

KIPT proposes to construct a deep-water port facility at Smith Bay on the north coast of Kangaroo Island, approximately 20 km north-west of Kingscote (refer Figure 1-1). Figure 17-1 shows the conceptual layout of the deep-water port facility.

17.2.2 SENSITIVE RECEPTORS

The closest sensitive receptors to the proposed KI Seaport include the surrounding terrestrial and marine environment and the Yumbah land-based aquaculture operation. Yumbah's main operation's boundary is about 100 metres from the eastern edge of the proposed development at its nearest point. The nearest residences are about 500 metres south-south-west and 700 metres south-east of the site, as shown in Figure 17-2.

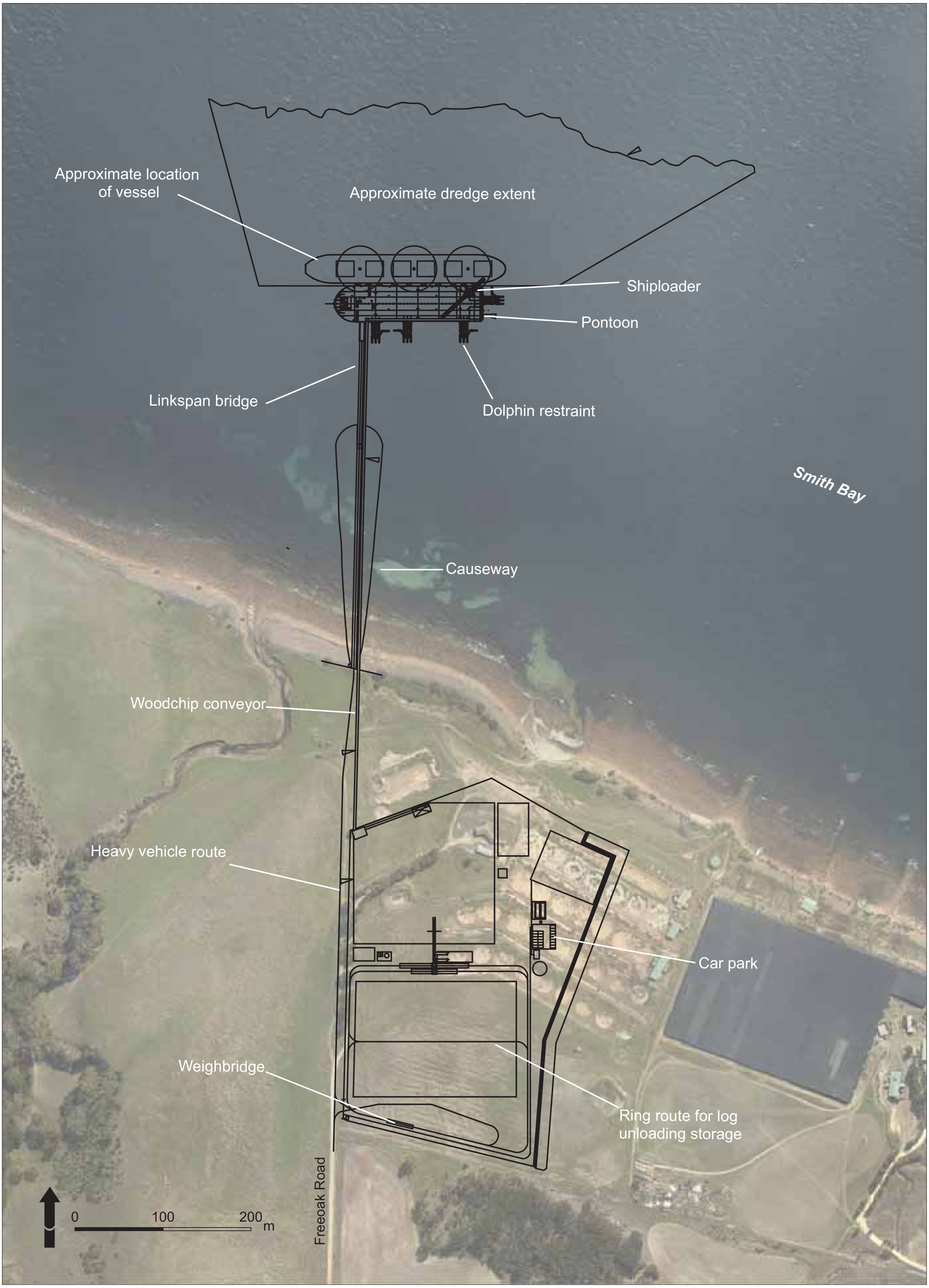


FIGURE 17-1 CONCEPTUAL LAYOUT OF THE PROPOSED KI SEAPORT

FIGURE 17-2 SENSITIVE RECEIVERS IN THE STUDY AREA

17.3 EXISTING ENVIRONMENT

The following sections describe the baseline air environment with reference to climate and air quality.

17.3.1 CLIMATE AND METEOROLOGY

Three Bureau of Meteorology (BoM) monitoring stations are near the study area:

- Kingscote (Station ID 022807, about 19 km west-south-west of Smith Bay)
- Kingscote Aero (Station ID 022841, about 15.5 km south-west)
- Parndana East Research Station (Station ID 022814, about 26 km south-east).

Of these, Kingscote and Kingscote Aero have been operating since 1877 and 1994 respectively. The Parndana East Research Station operated from 1954 and closed in 1984. Analysis of data from the three stations indicates that the data is generally consistent. Due to the availability of hourly wind speed and direction data at Kingscote Aero, this dataset was used in the dispersion modelling (see Section 17.4.4). For completeness, data from both the Kingscote and Kingscote Aero stations are presented in the following sections.

Summary

Table 17-1 presents a summary of monthly climate statistics for Kingscote and Kingscote Aero for the period 1877–2002 and 1994–2018 respectively.

Temperature

Mean monthly maximum and minimum temperatures recorded at the Kingscote and Kingscote Aero monitoring stations are presented in Figure 17-3. The records show mean monthly maximums of around 24–26ºC in summer and 5–8ºC in winter, with Kingscote Aero generally warmer during the day and colder at night than Kingscote.

Rainfall and evaporation

Average monthly rainfall for Kingscote and Kingscote Aero is depicted in Figure 17-4. Evaporation data are not recorded for either monitoring station. Evaporation data for Adelaide Airport (BoM Station ID 023034) are presented to put the rainfall measurements in context, although the evaporation rate in Adelaide is likely to be slightly greater than at Kingscote.

Annual average rainfall is approximately 485 mm at Kingscote and slightly less (443 mm) at Kingscote Aero. The annual evaporation rate at Adelaide Airport is approximately 1920 mm and exceeds monthly rainfall in all months except June and July.

Intensity-Frequency-Duration (IFD) data for the study area was obtained from the BoM, providing design rainfall intensities (mm/h) or design rainfall depths (mm) corresponding to selected standard annual exceedance probabilities (AEPs), based on the statistical analysis of historical rainfall. These data are presented in Figure 17-5.

TABLE 17-1 MONTHLY CLIMATE STATISTICS FOR KINGSCOTE (KC) AND KINGSCOTE AERO (KC-A) STATIONS

	Mean temperature (°C)				Mean monthly rainfall (mm)		Mean 3 pm humidity (%)		Mean 3 pm wind speed (kph)	
	Maximum		Minimum							
Month	KC	KC-A	KC	KC-A	KC	KC-A	KC	KC-A	KC	KC-A
Jan	23.7	26.6	14.9	13.3	15.0	15.7	63	44	19.0	25.4
Feb	23.5	26.5	15.4	13.6	17.1	17.4	65	45	18.1	24.9
Mar	22.2	24.5	14.3	11.3	18.5	25.8	67	47	16.7	22.6
Apr	19.8	21.6	12.5	8.8	34.9	27.2	70	53	15.4	20.9
May	17.5	18.6	10.8	7.9	58.2	47.4	73	63	14.4	19.0
Jun	15.4	16.2	9.3	6.7	72.4	64.6	75	68	15.8	19.9
Jul	14.6	15.4	8.4	6.0	77.7	68.6	74	69	17.4	20.2
Aug	15	16.1	8.3	5.7	64.9	56.9	72	64	18.2	21.2
Sep	16.5	17.8	9.1	6.5	47.4	47.7	70	61	19.0	23.0
Oct	18.5	20.2	10.3	7.1	36.4	29.4	66	55	19.4	22.9
Nov	20.5	23.0	12.0	9.6	22.8	22.7	63	48	19.7	24
Dec	22.3	25	13.6	10.9	19.7	20.1	63	45	19.6	24.2

Source: BoM

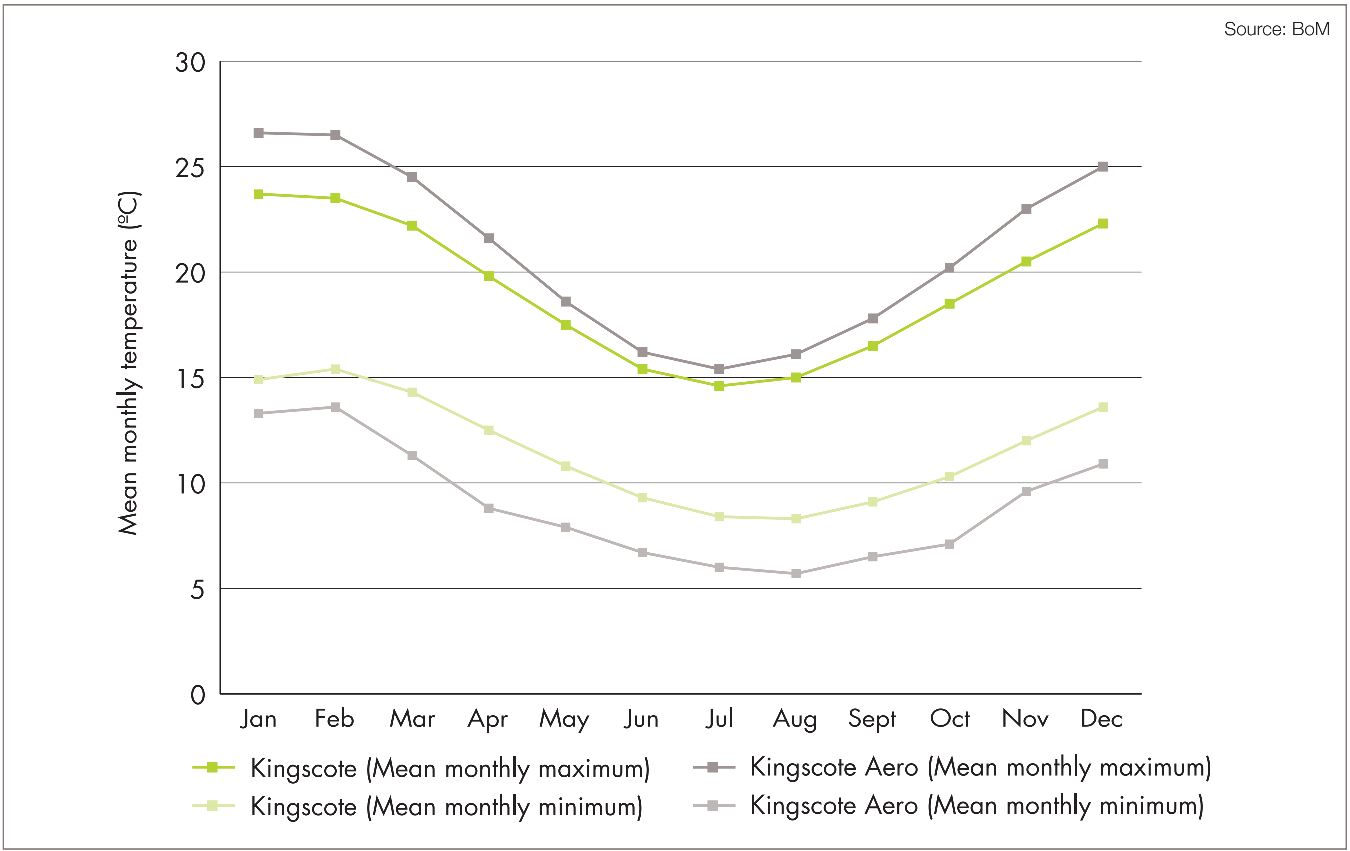


FIGURE 17-3 RECORDED TEMPERATURE TRENDS FOR THE STUDY AREA

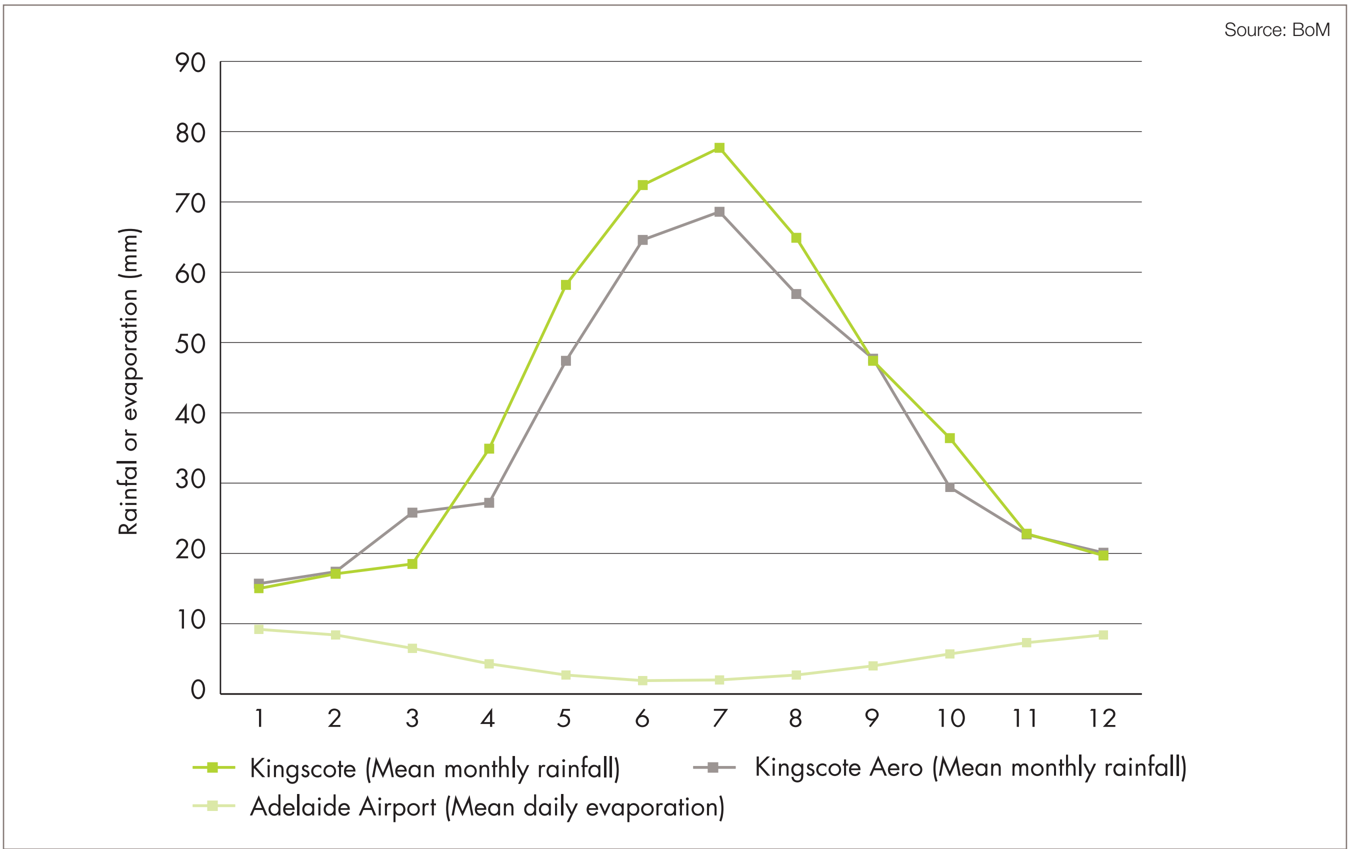
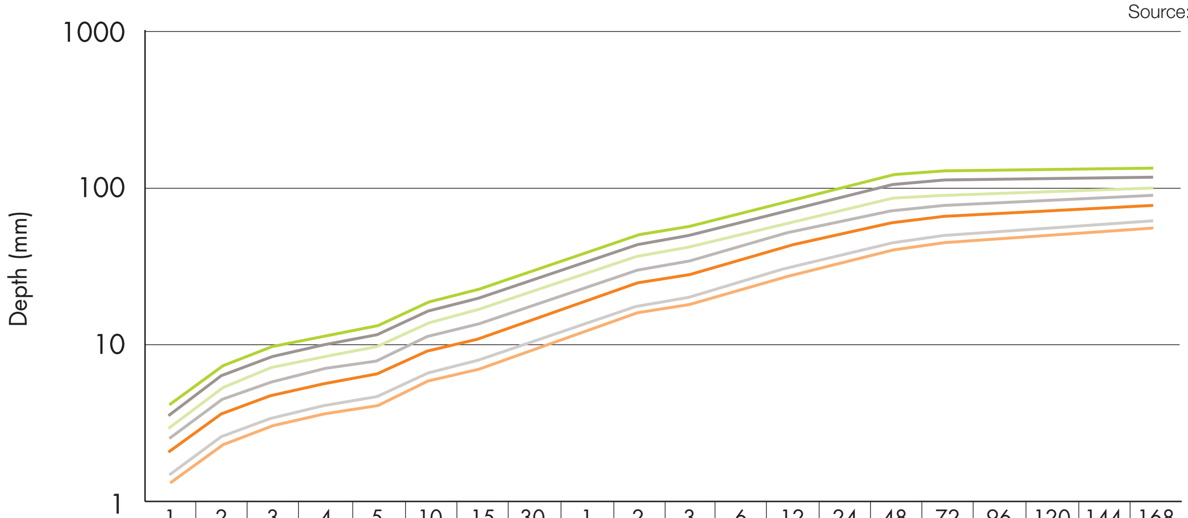


FIGURE 17-4 RECORDED RAINFALL AND EVAPORATION TRENDS FOR THE STUDY AREA

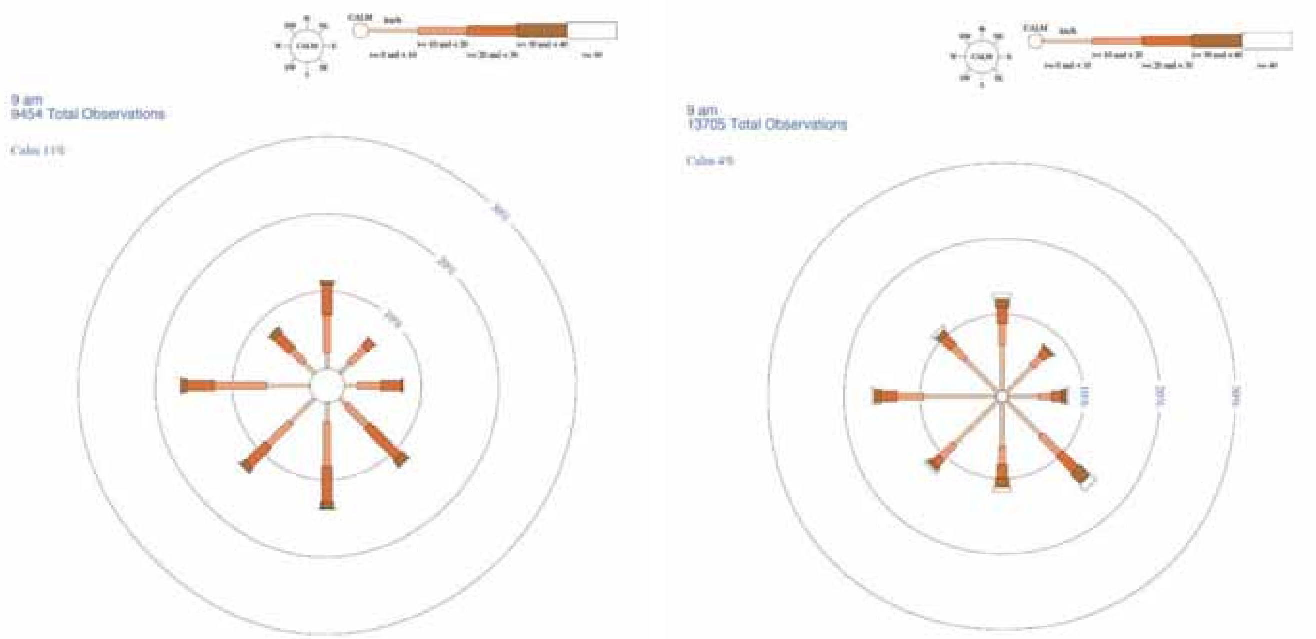
Source: BoM



	1 min	2 min	3 min	4 min	5 min	10 min	15 min	30 min	1 hour	2 hour	3 hour	6 hour	12 hour	24 hour	48 hour	72 hour	96 hour	120 hour	144 hour	168 hour
63.3% AEP	1.28	2.28	3.02	3.6	4.1	5.82	6.99	9.29	12.1	15.5	17.8	22.4	27.6	33.4	39.8	4.4	47.4	50.3	53.1	55.6
50% AEP	1.45	2.57	3.4	4.07	4.63	6.59	7.91	10.5	13.6	17.4	20	25.1	31	37.5	44.5	49	52.5	55.6	58.3	60.9
20% AEP	2.02	3.57	4.73	5.67	6.45	9.22	11.1	14.7	19	24.2	27.7	34.6	42.6	51.2	60.1	65.4	69.2	72.3	75	77.4
10% AEP	2.45	4.34	5.75	6.39	7.84	11.2	13.5	17.8	23	29.3	33.5	41.8	51.3	61.4	71.5	77.1	81	83.9	86.3	88.4
5% AEP	2.92	5.17	6.85	8.2	9.33	13.3	16	21.2	27.4	34.8	39.8	49.5	60.5	72.1	83.3	89.1	92.9	95.5	97.5	99.1
2% AEP	3.6	6.35	8.42	10.1	11.5	16.5	19.8	26.2	33.7	42.7	48.8	60.8	74.7	89.8	104	111	115	116	117	118
1% AEP	4.18	7.28	9.68	11.6	13.3	19.1	23	30.4	39	49.3	56.4	70.5	87.1	105	122	129	133	135	136	136

FIGURE 17-5 INTENSITY-FREQUENCY-DURATION RAINFALL DATA FOR THE SITE

Source: BoM

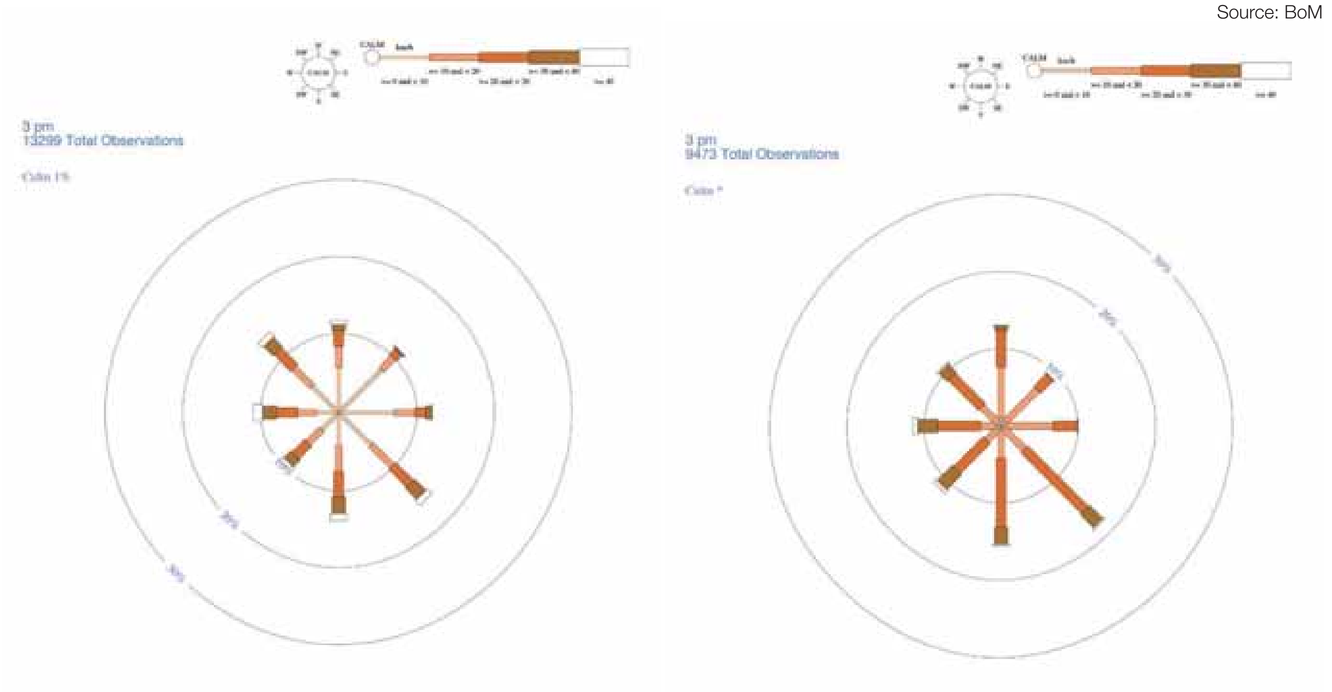


a. Kingscote 9 am wind speed and direction

b. Kingscote Aero 9 am wind speed and direction

FIGURE 17-6 9 AM WIND ROSES FOR KINGSCOTE AND KINGSCOTE AERO STATIONS

Source: BoM



a. Kingscote 3 pm wind speed and direction

b. Kingscote Aero 3 pm wind speed and direction

FIGURE 17-7 3 PM WIND ROSES FOR KINGSCOTE AND KINGSCOTE AERO STATIONS

Wind speed and direction

Wind speed and direction data for both Kingscote and Kingscote Aero are presented in wind roses representing both 9 am and 3 pm readings in Figure 17-6 and Figure 17-7, where the 'arm' in the figure represents the direction the wind was blowing from, and the width of the arm represents the proportion of time the wind blew at a particular speed (where thicker equals a higher speed). Wind speed and direction trends are broadly equivalent between the sites, with a greater proportion of calm mornings at the inland Kingscote Aero site, before trending to stronger wind speeds in the afternoon. Average 9 am wind speed for Kingscote is 14.7 kph (4.08 m/s), increasing to 17.7 kph (4.92 m/s) in the afternoon. As a comparison, the same speeds for Kingscote Aero are 15.5 kph (4.30 m/s) and 22.3 kph (6.19 m/s).

17.3.2 AIR QUALITY

Particulate matter

Kangaroo Island has no air quality monitoring stations – either privately operated, or as components of the EPA monitoring network – and there has been no baseline monitoring in support of the proposed development to date.

Baseline air quality for the assessment was estimated using the results of monitoring at other similar (coastal and agricultural and/or pastoral) sites within South Australia. Table 17-2 presents the assumed baseline air quality.

These values are considered typical for background air quality in South Australia. To provide assurance, the baseline air quality used in other recent assessments, including the results of baseline monitoring, were benchmarked. Table 17-3 presents the results.

TABLE 17-2 ESTIMATED BASELINE AIR QUALITY AT SMITH BAY

Parameter	Value and Unit	Source
Background maximum 24-hour average PM_{10}	22 μg/m³	70th percentile 1-hour average PM_{10}, Whyalla (Schultz Reserve) EPA station (21.4 μg/m³)
Background maximum 24-hour average $PM_{2.5}$	10 μg/m³	70th percentile 1-hour average. $PM_{2.5}$, Adelaide (Netley) 2009 (9.3 μg/m³)
Background annual average PM_{10}	15.7 μg/m³	50th percentile 1-hour average PM_{10}, Adelaide (Netley) 2009
Background annual average $PM_{2.5}$	6.9 μg/m³	50th percentile 1-hour average $PM_{2.5}$, Adelaide (Netley) 2009
Background annual average dust deposition rate (all seasons)	2 g/m²/month	Based on monitoring at Warramboo (Eyre Peninsula)

TABLE 17-3 AIR QUALITY IN SOUTH AUSTRALIA

Project/Site	PM_{10} +		$PM_{2.5}$ +		Dust deposition
	24-hour	Annual	24-hour	Annual	
Central Eyre Iron Project (Iron Road)	22	15.7	10	6.9	2.0
Carrapateena (OZ Minerals)	3.0–23.0	13.0	1.0–7.7	3.9	1.6
Olympic Dam (BHP)	N/A	N/A	N/A	N/A	1.9
Hillside (Rex Minerals)	18.1	N/A	7.2	7.7	N/A
Kanmantoo (Hillgrove Resources)	11.4	16.2–21.3	N/A	N/A	0.4–2.0
Kookaburra Gully (Australian Graphite)	N/A	13	N/A	6	2.2
Tarcoola Gold (WPG Resources)	25	15	12.5	2.5	2
Angas Zinc (Terramin)	N/A	~12	N/A	N/A	1.1
Adelaide CBD (EPA Monitoring)	N/A	~16	N/A	~5	N/A
Southern Adelaide (EPA Monitoring)	N/A	~13	N/A	N/A	N/A
Northern Adelaide (EPA Monitoring)	N/A	~15	N/A	~6	N/A
Eastern Adelaide (EPA Monitoring)	N/A	~12	N/A	N/A	N/A
Western Adelaide (EPA Monitoring)	N/A	~16	N/A	~7	N/A
Port Pirie (EPA Monitoring)	N/A	~17	N/A	N/A	N/A
Whyalla (EPA Monitoring)	N/A	~15	N/A	N/A	N/A

+ Note: 24-hour maximum average PM_{10} and $PM_{2.5}$ is derived as the 70th percentile of the hourly results in accordance with the Victoria State Environment Protection Policy (Ambient Air Quality) 1999.

The results of the benchmarking show that air quality in South Australia is generally consistent across regions, and that the estimated baseline air quality for the study area is conservative compared with other locations within the state, taking into account the arid and built-up nature of some of these sites.

Gaseous pollutants

The only significant human sources of gaseous pollutants in the study area are vehicle exhaust emissions on nearby roads and seasonal prescribed burning of vegetation. For the purposes of this air quality assessment, the baseline ground-level concentration of gaseous pollutants was assumed to be zero.

17.4 ASSESSMENT METHODS

Dispersion modelling was undertaken using the Calmet (meteorology) and Calpuff (emissions) system of dispersion models, and was used to assess potential changes to the baseline air quality environment at Smith Bay to determine ground-level concentrations and dust deposition rates, in accordance with the requirements of the Environment Protection Authority's (EPA's) Ambient Air Quality Assessment 2016 guideline (EPA SA 2016). The outputs of the dispersion modelling were compared with relevant criteria described in the Environment Protection (Air Quality) Policy 2016 to evaluate the potential impact of the KI Seaport on human health.

The modelling outputs were also used to inform the ecological impact assessment presented in Chapter 11 – Land-Based Aquaculture.

The following sections describe the site-specific topographic and meteorological inputs to the dispersion modelling.

17.4.1 TOPOGRAPHY

Land elevations data used for this assessment were processed from United States Geological Survey (USGS) Shuttle Radar Topography Mission (SRTM) data (JPL 2015). This database has global coverage with horizontal resolution of approximately 90 metres. This data was applied to the meteorological model study area, defined in Section 17.4.2.

17.4.2 METEOROLOGY

Smith Bay is on the north coast of Kangaroo Island, where the local weather is affected by synoptic-scale meteorological conditions, convective processes, and coastal effects such as sea breezes. In addition, winds are affected by terrain east, west and south of Smith Bay.

It is important that the complex mechanisms that affect air movements are incorporated into dispersion modelling studies for accurate predictions of dust concentrations, as they were for this study. Surface and upper-air meteorological data for 2009, the selected model year required by the EPA, were generated for this study by the CSIRO's prognostic model known as TAPM (The Air Pollution Model). TAPM can generate meteorological data for any location in Australia using a synoptic database created from meteorological modelling for the wider Australian region. The year 2009 was selected for modelling because its meteorological data are considered to be most representative of conditions in South Australia up to 2009, with the fewest extreme weather events.

TAPM was used to generate three-dimensional (3D) surface and upper-air temperatures, wind vectors, air pressures and other meteorological parameters for the northern Kangaroo Island study area. The meteorological data generated included 8760 hourly average (one year) records for each meteorological parameter, covering a study volume centred at the site of the proposed KI Seaport.

As part of the quality review of the meteorological data, the TAPM results were assessed to determine whether their output was representative of local meteorology and therefore sufficient for use within Calmet. The closest BoM weather station with hourly data is Kingscote Aero (Station Number 022841), just over 15 km south-east of the study area (see the description of the baseline meteorology presented in Section 17.3.1). The resulting annual wind roses – the frequency of occurrence of wind speed and direction – generated from the hourly data for the BoM observations and TAPM outputs show that although TAPM has reproduced the pattern of the observed winds very well, the model has slightly underestimated wind speed (the annual average wind speed of the TAPM results was 3.5 metres per second (m/s) compared with observed rates of 4.2 m/s). Lower speeds mean less dispersion of particulate matter because there is less turbulence. Therefore, the Calpuff model (see Section 17.4.4) results are expected to be conservative – that is, higher predicted PM_{10} and $PM_{2.5}$ (particulate matter) concentrations, and higher predicted dust deposition closer to the sources (where PM_{10} is particulate matter 10 micrometres or less in diameter; $PM_{2.5}$ is 2.5 micrometres or less in diameter and generally described as fine particles).

Following the generation of the initial wind field using TAPM, Calmet was then used to generate a finer-resolution (200-metre grid spacing) simulation of 3D hourly meteorological conditions specific to the site. The geophysical terrain and land use input data for Calmet were generated using the same resolution (200 metres). Two different areas were generated for input into Calmet to represent the different land uses within the study region (water bodies and agricultural).

17.4.3 EMISSION ESTIMATES

Estimates of the rate of emission of particulate matter (in grams per second, g/s) were generated using emission factors that relate site activities to the amount of dust generated using relationships between, for example, the size of an exposed area or the rate of timber throughput. Emissions factors are mathematical equations developed through the monitoring of dust emissions for particular dust-generation operations and are provided by either the Commonwealth Government (in the case of the National Pollutant Inventory, NPI, emission factors) or the US EPA (in the case of the AP-42 emission factors).

Due to the lack of site-specific information (such as soil carry-over particle size information, unpaved road silt content and similar data), the emission estimates provided in this EIS used the default NPI emission factors. This is considered acceptable due to the low overall predicted rate of emissions generation and therefore the low sensitivity of the assessment conclusions to minor changes in emission rates.

17.4.4 DISPERSION MODELLING

The Calpuff (Version 7.3.1) model predicted ground-level concentrations (GLCs). Calpuff is a variable-trajectory dispersion model that simulates the dispersion of pollutants within a turbulent atmosphere by representing emissions as a series of puffs, emitted sequentially. As long as the rate at which the puffs are emitted is sufficiently rapid, the puffs overlap and the serial release represents a continuous release.

The Calpuff model differs from traditional (simpler) Gaussian plume models in that it models spatially varying wind and turbulence fields that are important in complex terrain, long-range transport and near-calm conditions. The TAPM-Calmet-Calpuff combination provides higher-quality results for coastal locations, such as Smith Bay.

TABLE 17-4 ADOPTED AIR QUALITY CRITERIA

Pollutant	Averaging period	Criteria
PM_{10}	24-hour	50 µg/m^3
$PM_{2.5}$	24-hour	25 µg/m^3
	Annual	8 µg/m^3
Dust deposition	Annual	2 g/m^2/month (maximum increase in dust deposition rate)
	Annual	4 g/m^2/month (maximum total dust deposition rate)

The modelling was carried out using the meteorological information provided by the Calmet model (see Section 17.4.2) and the particulate emission estimates for the proposed development. The region has no other significant existing anthropogenic particulate emission sources which would be expected to influence the existing baseline particulate concentrations at the site. An exception may be smoke particles from controlled burning and other fires. These emissions are not usually included in air quality assessments for individual projects; however, they are reflected to some extent in the estimates for background $PM_{2.5}$ and PM_{10}.

The Calpuff model was used to predict the pollutant concentrations at a set of ground-level receptors covering the region surrounding the study area, including land and over water. A grid receptor spacing of 100 metres across a domain of 5.0 km by 5.0 km meant that a total of 2601 gridded receptors in the horizontal plane were used. In Calpuff, dispersion coefficients used turbulence computed from micrometeorology and the partial plume path method was used for terrain adjustment.

The particulate emission sources for the KIPT construction and operations scenarios such as a woodchip storage area, unpaved roads and shiploading activity were represented using individual volume emission sources. Time-varying emissions were incorporated to represent the timing and duration of emissions; for example, during the unloading of woodchips on the site in daylight hours.

17.4.5 ASSESSMENT CRITERIA

Schedule 2 of the South Australian Environment Protection (Air Quality) Policy 2016 (Air EPP) provides criteria for ambient air ground-level concentrations. Compliance with the Air EPP is primarily assessed by comparing the model-predicted ambient concentrations with the Air EPP ground-level concentration criteria. Ground-level concentration criteria are provided for both PM_{10} and $PM_{2.5}$. No criteria are provided for the protection of amenity from nuisance dust. For the assessment of nuisance dust for this project, the NSW Environment Protection Authority criteria for deposited dust were adopted (NSW EPA 2017). The use of NSW (or similarly the Victorian) assessment criteria for deposited dust is common practice for assessments in South Australia. The ambient air quality assessment criteria apply at the sensitive receptors.

The relevant assessment ground-level concentrations for this modelling study are summarised in Table 17-4.

17.5 IMPACT ASSESSMENT AND MANAGEMENT

The project description forms the basis for the development of emissions source terms, reflecting the activities that generate dust and their location (see Section 17.1). The following sections describe the modelled activities and assumptions.

17.5.1 DUST-GENERATING ACTIVITIES AND ASSUMPTIONS

The specifics of dust-generating activities are described in the following sections.

Construction

Potential dust-generating activities during construction would include:

- land clearing, resulting in the wind erosion of cleared areas
- vehicle movement on unpaved roads
- movement of materials and construction activities
- unloading of fill materials for construction of the pontoon's access causeway
- storage of dredge spoil material.

Construction is assumed to occur seven days a week for 15 months during daylight hours only.

Land clearing and wind erosion

A total of about 10 ha of land would be cleared, just over half of it (5.6 ha) associated with woodchip and log storage areas. The remaining clearance would be associated with the construction of:

- access roads
- stormwater systems
- site offices and ablutions facilities
- electricity distribution infrastructure
- shore-based works for causeway construction.

Part of the existing site was previously cleared for the adjoining abalone operation. However, for the purpose of this air quality assessment it was assumed that 10 ha would need to be cleared and that construction would take nine months. It was assumed that long-term construction material stockpiles would not be required and that the site earthworks could be completed solely through balanced cut-and-fill operations. The use of a single grader/scraper was assumed, with an active working area of 5.6 ha representing the final wood storage area. It was assumed that water sprinklers would be used during the operation of the grader/scraper to suppress dust.

According to Australian National Pollutant Inventory (NPI) emissions estimation methodologies, wind erosion is assumed to occur only when the dust lift-off wind speed threshold is reached (DoEE 2012). In the absence of site-specific data, this threshold was assumed to be the NPI default value of 5.4 m/s. Below this speed, wind erosion emissions were assumed to be zero.

The default NPI wind erosion rates for total suspended particulate (TSP) and PM_{10} particulate of 0.4 kg/ha/hour and 0.2 kg/ha/hour respectively were applied in the air quality assessment.

Vehicle traffic on unpaved roads

The access road to the causeway from the site entrance is approximately 500 metres long and is unpaved. The amount of fill required for the causeway was assumed to be about 200,000 tonnes, requiring around 6700 truckloads for the nine-month construction phase (assuming a maximum vehicle weight of 30 tonnes). Vehicle kilometres travelled (VKT) was therefore calculated to be 6700 over the construction phase (6700 deliveries, 6700 exits, and a 0.5 km two-way vehicle trip length). Vehicle speed was assumed to be restricted to 15 kph within the site.

The NPI default emission factors of 4.23 kg of TSP emission per VKT and 1.25 kg of PM_{10} particulate per VKT were used in this air quality assessment (DoEE 2012).

Unloading of causeway construction materials

It was assumed that the approximately 200,000 tonnes of fill required to construct the causeway would be end-dumped into place and would not require significant additional handling. As the material would be deposited into the water, dust emissions would be mitigated immediately. The NPI emission equation for the unloading of fragmented stone (being 0.00008 kg/tonne of PM_{10} and an inferred 0.00016 kg/tonne of TSP) was used for this assessment (DoEE 2014).

Storage and handling of dredge spoil material

The placement and handling of dredge spoil material would be expected to generate little dust, as the material would have a relatively high moisture content that is considered likely to be above the dust extinction moisture content of around 10 per cent. However, the dredge spoil stockpile, covering about 1.3 ha, could become dry during storage, creating the potential for surface wind erosion.

The default NPI wind erosion rates for TSP and PM_{10} particulate of 0.4 kg/ha/hour and 0.2 kg/ha/hour respectively were applied in the air quality assessment.

Operations

Potential dust-generating activities during operations would include:

- unloading of woodchips and logs
- wind erosion of woodchip stockpiles and stockpile pads
- loading of woodchips by reclaim hopper to conveyor, and conveying of woodchips to shiploader
- loading of woodchips into transport vessels
- movement of vehicles on unpaved roads.

Normal operations were assumed to occur five days a week during daylight hours only, with shiploading occurring up to 25 times a year on a continuous basis (24-hours-a-day, seven-days-a-week).

Vehicles on unpaved roads

The preliminary design incorporates a ring route to allow for single-lane traffic. On entering the site, a truck would be weighed at the weighbridge on the south-western corner and travel clockwise along the western section of the 1.2 km unpaved ring road (refer Figure 17-1). After unloading at the storage yards, the truck would be weighed again on the way out.

Up to 730,000 tonnes per annum (tpa) of woodchips and logs would be transported to the site. It was assumed that 19-metre semi-articulated trucks with a maximum capacity of 30 tonnes would be used. It was assumed the trucks would be empty for half of their total journey, so the average weight of these vehicles (laden and unladen) on unpaved roads was estimated at 20 tonnes. VKT was estimated to be 24,000 annually.

Light vehicles would also use the unpaved access road on the way to and from the site office, but these volumes would be minor compared to heavy vehicle movements and have not been included in the air quality assessment. All vehicles were assumed to be restricted to 15 kph within the site.

The NPI default emission factors of 4.23 kg of TSP emission per VKT, and 1.25 kg of PM_{10} particulate per VKT were used in this air quality assessment.

Unloading of woodchips and logs

Up to 730,000 tonnes of timber would be brought to the site each year and unloaded in their respective storage areas (see Figure 17-9) before export.

The Australian NPI and the US EPA AP-42 emission estimation technique manuals do not specify emission factors for unloading woodchips or handling logs.

The US EPA report, Assessment of Fugitive Particulate Emission Factors for Industrial Processes, states that 'log handling and bucking (log length shortening) are normally negligible sources of fugitive emissions' (Zoller et al. 1978). A review of available literature and air quality assessments for other, similar projects, failed to reveal any documented emission or dust generation information appropriate to the handling of logs (including the unloading, stockpiling and subsequent transfer to the pontoon and shiploading area).

The lack of published data on the potential for dust emissions from logs is not considered material to the air quality assessment as, in any event, it is considered that the dust emissions from the handling, treatment and storage of woodchips would represent a worst-case emissions scenario for the study area.

The large size of woodchips prohibits them from being readily dispersed during handling operations and so emissions would be restricted to woodchip fines and ingrained and/or surface dusts collected during the felling and woodchipping processes. The US EPA report also assessed debarking and sawmilling operations in developing an emission factor for debarking that was suitable for use as an estimate of the TSP generated during woodchipping operations (Zoller et al. 1978). This value was 0.012 kg per tonne (kg/tonne) of dust TSP.

It was assumed that the majority of this particulate matter would be generated and deposited at the plantation site (where the woodchipping generally occurs), with more of the attached particulate being dislodged during transport.

For the purposes of this air quality assessment, the emission factor for the handling of woodchips was estimated to be 0.0012 kg of TSP per tonne moved, or, alternatively, 10 per cent of the overall woodchipping emission factor. This figure was based on the emission factor for each handling operation, developed by the US EPA, as well as other aggregate material emission factors developed during emission monitoring and material handling trials, specifically:

- 0.012 kg/tonne (log debarking and woodchipping)
- 0.005 kg/tonne (high-moisture-content ores (greater than 8.4 per cent moisture))
- 0.03 kg/tonne (low-moisture-content ores)
- 0.012 kg/tonne (truck dumping of coal overburden)
- 0.004 kg/tonne (loading of coal to stockpiles)
- 0.0022 kg/tonne (loading and unloading of coal to and from trucks)
- 0.00016 kg/tonne (unloading and loading of fragmented stone).

It was assumed that 50 per cent of this woodchip dust (0.0006 kg/tonne) was in the PM_{10} size fraction, consistent with the ratio of TSP to PM_{10} applied through the NPI documentation.

Quality control processes which may be required to re-size woodchips to meet customer specifications, would nominally be undertaken either at the plantation or at the intermediate logistics yard (should this be constructed). It is common practice for timber ports to have some level of woodchip quality control screening. Even though the proposed development would not include physical re-sizing of woodchips at KI Seaport, for the purposes of this air quality impact assessment, it was assumed that a conservative five per cent of the total volume of stored woodchips are resized as a worst-case (conservative) assessment of the potential impacts of woodchip handling on the surrounding receivers at Smith Bay. Should future operation require re-sizing of woodchips at KI Seaport, expected volumes would be insignificant, and much less than the conservative emissions factor used as an input into the air quality impact assessment undertaken as part of the Draft EIS.

The emissions factor for woodchipping described earlier has been applied to the scenario that re-sizing would happen at KI Seaport. This value was 0.012 kg per tonne (kg/tonne) of dust (TSP). It was assumed that 50 per cent of this woodchip dust (0.006 kg/tonne) was in the PM_{10} size fraction, consistent with the ratio of TSP to PM_{10} applied through the NPI documentation.

Wind erosion of woodchip stockpiles and stockpile pads

The emission of particulates during the loading of the stockpile was covered previously. As described previously, once on the stockpile, woodchips generally would resist dispersion because of their size, although they may contain fine material from previous handling operations that would be subject to wind erosion. This was, however, considered to be a lesser source that the potential for the wind erosion of fines remaining in stockpile areas that were not covered in woodchips (i.e. exposing the empty pad and/ or cleared ground) as may occur following shiploading. This can be demonstrated mathematically:

- the amount of emission associated with 80,000 tonnes of woodchips on a fully-stocked stockpile (conservative, as this ignores surface area considerations and assumes the stockpile was full the whole time) would be approximately 96 kg over 20 days (i.e. the time between shiploading activities), corresponding to an emission rate of 0.05 g/s of TSP
- the emission rate from bare stockpile areas would be approximately 0.4 kg/ha/hour. With an area of up to 5.6 ha, this equates to an emission rate of 0.62 g/s of TSP, an order of magnitude greater.

In order to present a conservative assessment, the latter scenario was carried through the modelling. The default NPI wind erosion rates for TSP and PM_{10} particulate of 0.4 kg/ha/hour and 0.2 kg/ha/hour respectively were applied in this air quality assessment.

Reclaiming, conveyor transfer and shiploading of woodchips

As described previously, it had been assumed that handling of woodchips generated up to 0.0012 kg/tonne of TSP – half of it PM_{10} dust – per handling operation. For the purposes of air quality assessment, it was assumed that this rate of dust

TABLE 17-5 CONSTRUCTION EMISSIONS INVENTORY

Construction activity	Input data	Unit	Duration (months)	Hours per day	Intensity	Units	Size fraction	Emission factor	Units	Emissions (g/s)	Mitigation factor (%)	Controlled emission rate (g/s)
Cleared land wind erosion	6	ha	9	24			TSP	0.4	kg/ha/hour	0.67	0	0.67
							PM_{10}	0.2	kg/ha/hour	0.33	0	0.33
							$PM_{2.5}$	0.04	kg/ha/hour	0.07	0	0.07
Storage and handling of dredge spoil stockpiles	4	ha	7	24			TSP	0.4	kg/ha/hour	0.44	0	0.44
							PM_{10}	0.2	kg/ha/hour	0.22	0	0.22
							$PM_{2.5}$	0.04	kg/ha/hour	0.04	0	0.04
Vehicle traffic	6700	VKT	9	11	2.225	VKT/hour	TSP	4.23	kg/VKT	2.61	75	0.65
							PM_{10}	1.25	kg/VKT	0.77	75	0.19
							$PM_{2.5}$	0.25	kg/VKT	0.15	75	0.04
Unloading of rock at causeway	20,000	tonnes	3	11	20.20	tonnes/ hour	TSP	0.00016	kg/tonne	0.0009	0	0.0009
							PM_{10}	0.00008	kg/tonne	0.0004	0	0.0004
							$PM_{2.5}$	0.000016	kg/tonne	0.0001	0	0.0001
Excavator cut-and-fill	44,800	tonnes	2	11	66.949	tonnes/ hour	TSP	0.025	kg/tonne	0.4649	50	0.23
							PM_{10}	0.012	kg/tonne	0.2232	50	0.11
							$PM_{2.5}$	0.0024	kg/tonne	0.0446	50	0.02
							PM_{10}	0.0006	kg/tonne	0.0285	0	0.0285
							$PM_{2.5}$	0.00012	kg/tonne	0.0057	0	0.0057

TABLE 17-6 OPERATIONS EMISSIONS INVENTORY

Operations activity	Input data	Unit	Days per week	Hours per day	Intensity	Units	Size fraction	Emission factor	Units	Emissions (g/s)	Mitigation factor (%)	Controlled emission rate (g/s)
Vehicle traffic	24,000	VKT/year	7	24	2.740	VKT/hour	TSP	4.23	kg/VKT	3.22	75	0.80
							PM_{10}	1.25	kg/VKT	0.95	75	0.24
							$PM_{2.5}$	0.25	kg/VKT	0.19	75	0.05
Unloading of woodchips	730,000	tonnes/ year	7	24	83.333	tonnes/ hour	TSP	0.0012	kg/tonne	0.028	0	0.028
							PM_{10}	0.0006	kg/tonne	0.014	0	0.014
							$PM_{2.5}$	0.00012	kg/tonne	0.003	0	0.003
Resizing of woodchips[+]	36,500	tonnes/ year	7	24	4.167	tonnes/ hour	TSP	0.012	kg/tonne	0.014	0	0.014
							PM_{10}	0.006	kg/tonne	0.007	0	0.007
							$PM_{2.5}$	0.0012	kg/tonne	0.001	0	0.001
Stockpile pad wind erosion	5.6	ha	7	24			TSP	0.4	kg/ha/hour	0.62	0	0.62
							PM_{10}	0.2	kg/ha/hour	0.31	0	0.31
							$PM_{2.5}$	0.04	kg/ha/hour	0.06	0	0.06
Reclaiming of woodchips	730,000	tonnes/ year	73 (days per year)	24	416.67	tonnes/ hour	TSP	0.0012	kg/tonne	0.139	0	0.139
							PM_{10}	0.0006	kg/tonne	0.069	0	0.069
							$PM_{2.5}$	0.00012	kg/tonne	0.014	0	0.014
Shiploading of woodchips	730,000	tonnes/ year	73 (days per year)	24	416.67	tonnes/ hour	TSP	0.0012	kg/tonne	0.139	0	0.139
							PM_{10}	0.0006	kg/tonne	0.069	0	0.069
								0.00012	kg/tonne	0.014	0	0.014

[+] Quality control screening and resizing of woodchips is not proposed as a component of the development, however was included in the air quality impact assessment to represent a worst-case emissions scenario.

FIGURE 17-8 LOCATION OF CONSTRUCTION PHASE EMISSIONS SOURCES

FIGURE 17-9 LOCATION OF OPERATIONS PHASE EMISSIONS SOURCES

generation also applied during stockpile reclaiming activities (loading and dumping to the conveyor feed hopper) and during shiploading operations.

The specific emission rates were assumed to apply only when a ship was berthed at the facility, estimated to be 50 to 75 days a year, during which the annual production of logs and woodchips would be transferred. It was assumed that no dust mitigation (water sprays and/or enclosures) was used during the woodchip reclaiming and shiploading operations. It was also assumed there would be no emissions during conveying operations, when the conveyor would be covered and therefore shielded from the wind. This is consistent with the mitigation factors applied within the NPI documentation for conveyor materials handling systems.

A summary of the emissions inventory is provided in Table 17-5 and Table 17-6 for the construction and operations scenarios respectively. Emissions sources (locations) are illustrated in Figure 17-8 for the construction phase and in Figure 17-9 for the operations phase.

17.5.2 GASEOUS EMISSIONS

Gaseous emissions associated with the proposed KI Seaport would be restricted to minor emissions from:

- vehicle movements associated with the transport of construction materials to the site during construction
- vehicle movements transporting woodchips and logs to the site
- vehicle movements associated with servicing the site and transporting employees
- materials handling equipment such as graders, loaders and excavators during construction
- vehicle and equipment movements associated with the transport of logs and woodchips within the site during operations
- materials handling equipment such as front-end loaders during operations
- generators used periodically during operations.

Given that the volume of vehicle movements is a small fraction of the existing vehicle movements on the roads in the vicinity of Smith Bay, and are consistent with other industrial operations involving small materials handling fleets that are commonly found near residential areas, the volume of emissions of gaseous pollutants was considered to be immaterial and would not result in a significant change to the baseline air quality.

17.5.3 MODELLING OUTPUTS

Results of the air quality modelling for both the construction and operations phases indicated that the compliance criteria are likely to be achieved for PM_{10} and $PM_{2.5}$ particulate (both 24-hour maximum and annual average) within the site boundary for the construction phase, and within the immediate vicinity of the site boundary during operations. At the nearest sensitive receptors it is expected there would be only slight increases in the ground-level concentration of pollutants, all of which would comply with the relevant air quality criterion. A copy of the raw output from the Calpuff model for the construction and operations phases is presented in Appendix M1.

Similarly, dust deposition rates are expected to meet the criterion within the site boundary, with an increase of around 0.1–0.4 g/m^2/month over the baseline of 2 g/m^2/month expected at the nearest receptor (see Table 17-7). Model outputs are shown in Figure 17-10a to d and Figure 17-11a to d.

TABLE 17-7 SUMMARY OF AIR QUALITY MODELLING OUTPUTS (INCLUDING BACKGROUND)

Scenario	Maximum value (within site)	Yumbah	South-east residence	South-west residence
Construction phase				
PM_{10} 24-hour average (µg/m^3)	**54.4**	29.8	23.4	24.2
$PM_{2.5}$ 24-hour average (µg/m^3)	16.5	11.6	10.3	10.5
$PM_{2.5}$ annual average (µg/m^3)	8.1	7.1	6.9	6.9
Annual dust deposition (g/m^2/month)	3.6	2.3	2.0	2.0
Operations phase				
PM_{10} 24-hour average (µg/m^3)	**106.0**	41.3	32.2	35.0
$PM_{2.5}$ 24-hour average (µg/m^3)	**26.9**	14.1	12.3	12.8
$PM_{2.5}$ annual average (µg/m^3)	**10.5**	7.3	7.0	7.0
Annual dust deposition (g/m^2/month)	**4.6**	2.4	2.0	2.1

Note: Numbers in bold represent exceedances of the nominated air quality criterion.

Figure 17-10a. Construction Phase PM_{10} – Maximum 24-hour average ground-level concentration (µg/m³) (including background)

Figure 17-10b. Construction Phase $PM_{2.5}$ – Maximum 24-hour average ground-level concentration (µg/m³) (including background)

FIGURE 17-10 CONSTRUCTION PHASE MODELLING OUTPUT ISOPLETHS

Figure 17-10c. Construction Phase $PM_{2.5}$ – Annual average ground-level concentration (µg/m³) (including background)

Figure 17-10d. Construction Phase – TSP dust deposition rate (g/m²/month) (including background)

FIGURE 17-10 CONSTRUCTION PHASE MODELLING OUTPUT ISOPLETHS (CONT'D)

Figure 17-11a. Operations Phase PM_{10} – Maximum 24-hour average ground-level concentration (µg/m³) (including background)

Figure 17-11b. Operations Phase $PM_{2.5}$ – Maximum 24-hour average ground-level concentration (µg/m³) (including background)

FIGURE 17-11 OPERATIONS PHASE MODELLING OUTPUT ISOPLETHS

Figure 17-11c. Operations Phase $PM_{2.5}$ – Annual average ground-level concentration (μg/m³) (including background)

Figure 17-11d. Operations Phase – TSP dust deposition rate (g/m²/month) (including background)

FIGURE 17-11 OPERATIONS PHASE MODELLING OUTPUT ISOPLETHS (CONT'D)

17.5.4 MITIGATION AND MANAGEMENT

The following control measures were assumed during the air quality assessment (see Section 17.5.1):

- watering unpaved roads during construction and operation
- covering the woodchip shiploading conveyor
- watering cleared areas during construction/land clearing activities
- limiting vehicles' speed within the site to 15 kph
- designing the layout to minimise vehicle movements
- ensuring vehicles and equipment are regularly maintained to minimise emissions.

The proposed KI Seaport is currently in detailed design. Pending this, the details of specific dust mitigation measures beyond those committed to above is not available. For the purposes of undertaking the air quality impact assessment, the air quality modelling considered only those dust mitigation measures to which KIPT have committed. These measures are commonly applied at industrial facilities and their effectiveness is well documented.

Applying this methodology to the air quality assessment allows for a worst case assessment of the potential air quality impacts associated with the development, assuming minimal mitigation has been applied. Additional mitigation measures that may be implemented to reduce emissions further during construction and operations include the following, noting that the implementation of these remains subject to detailed design and cost/benefit analysis:

- scheduling construction works where practical to avoid dry, windy weather conditions where the wind is blowing towards sensitive receptors
- sizing woodchips to minimise the risk of them becoming airborne, subject to commercial arrangements
- covering loads
- using water sprinklers on cleared areas before infrastructure construction during periods of adverse (hot and windy) weather
- damping down internal tracks in periods of dry and windy weather or when dust crosses property boundaries
- using water sprays on bare stockpile pads during adverse weather
- locating woodchip stockpiles furthest from sensitive receptors and shielding them from wind through the surrounding pontoon infrastructure and log stockpiles
- using variable-height woodchip stackers and/or telescopic chutes for shiploading
- using water sprays during shiploading
- using water sprays on the woodchip reclaim hopper during conveyor loading
- using water sprays during woodchip and log unloading.

A series of gauges would be established on the site boundaries to monitor dust deposition rates before and during construction and during operation. A number of these gauges would be established at locations considered to represent the background site air quality (i.e. not influenced by site operations). Over time, this would allow the operational contribution to local air quality changes and/or amenity impacts to be quantified.

Ongoing monitoring of PM_{10} and $PM_{2.5}$ ground-level concentrations would not be needed due to the low predicted concentrations and the minimal expected dispersion of dust to nearby receptors.

17.5.5 IMPACT ASSESSMENT

The following sections describe the impact of the predicted change in the air quality environment on human health, amenity and ecology.

Human health

The criteria nominated within the Air EPP are based on a significant body of research into how exposure to particulates affects human health (e.g. NEPC 2011; Standing Council on Environment and Water 2012; EPA Victoria 2012).

Table 17-7 provides details of the maximum ground-level concentrations (in $\mu g/m^3$) predicted as a result of project activities. These were compared against the PM_{10} 24-hour average criterion of 50 $\mu g/m^3$ and the 24-hour and annual average criterion for $PM_{2.5}$ of 25 $\mu g/m^3$ and 8 $\mu g/m^3$ respectively, detailed within Schedule 3 of the South Australian Environment Protection (Air Quality) Policy 2016.

Beyond the general health effects associated with inhaling particulate material, exposure to some wood dusts can cause allergic and hypersensitivity reactions in some people. There are no specific criteria for public exposure to wood dusts, as this reaction is highly variable and person-dependant. Safe Work Australia publishes Workplace Exposure Standards for Airborne Contaminants (Safe Work Australia 2013a and 2013b), which note that the occupational exposure limits for hardwood dusts and softwood dusts are 10 per cent and 50 per cent of the general occupational dust exposure standards. As assessed, wood dusts would make up only a small percentage (approximately eight per cent) of the total dust generation from activities during operation, so it is considered that compliance with the Air EPP criteria is sufficient to protect those people who may be sensitive to wood dust exposure.

The results indicate that all areas outside the boundary of the operation would comply with the nominated criterion, inclusive of background, during construction and operation phases. As a result, the development is not expected to have an impact on human health through air pollutants.

Amenity

It has been demonstrated that community and/or individual perceptions of dust do not correlate with measured dust concentrations but are based on visual cues such as dust deposition onto roofs or cars and general haze (Dean et al. 1987; ACARP 1999). Studies undertaken in the Hunter Valley in New South Wales indicate that the perception of dust is more closely related to the receivers' previous exposure to dusty environments, the nature of their relationship to the generator of the dust, and the rate of increase or decrease in dust concentrations over time, with dust more noticeable the more its concentration varied in intensity.

The dust deposition rate has been used as an analogue for understanding amenity impacts on the basis that day-to-day operation associated with the development would significantly vary the volume of emitted dust. The predicted deposition rate is a total of 2.3 g/m^2/month during construction and 2.4 g/m^2/month during operations at the nearest sensitive receptor, including a contribution of 2.0 g/m^2/month from background and non-development-related sources; that is, a development contribution of 0.3 g/m^2/month during construction and 0.4 g/m^2/month during operations. These rates compare favourably to the criteria proposed by the Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (Department of Environment and Conservation 2005). This guide suggests that a project should contribute no more than 2.0 g/m^2/month and a total (from all sources) of 4 g/m^2/month. On this basis, no significant impacts to amenity in relation to dust or air pollutants are predicted as a result of the proposed development.

Turbidity

Two potential impacts to the benthic marine environment that may occur as a result of dust deposition: being increased turbidity reducing light penetration and influencing marine plant growth, and the smothering of benthic flora and fauna. Dust deposition over Smith Bay is predicted to peak at approximately 2.5 g/m^2/month, approximately 0.5 g/m^2/month above the existing baseline dust deposition (representing a worst-case 25 per cent increase). Given the limited extent of the affected area, the small predicted increase in dust deposition (that is likely within existing natural dust deposition variations) and the expected dispersion of the deposited dust as a result of coastal processes (see Chapter 10 – Coastal Processes), this is considered not material, and is not predicted to result in any measurable change to the turbidity of the marine environment. This is consistent with the outcomes of other, similar assessments of port operations-related dust deposition for deepwater ports in South Australia (e.g. Iron Road 2015). Assessment of the effect of dust-related increases in turbidity on ecology is presented in Chapter 12 – Marine Ecology.

Ecology

The primary impact pathway identified is the exposure of farmed abalone at the nearby onshore operation to dust as a result of KI Seaport activities. The predicted dust deposition rates at the abalone farm are predicted to be low (no greater than 2.4 g/m^2/month over existing rates). The assessment of ecological impacts associated with dust deposition are presented Chapter 11 – Land-Based Aquaculture.

17.6 CONCLUSIONS

The expected change in baseline air quality as a result of emissions from the development was assessed based on site-specific emissions-generating activities, local topography, prevailing climate and meteorology, and the existing baseline air quality. The assessment did not include potential air quality impacts associated with the forestry operations of transport between the plantations and the site. The results indicate that changes to air quality as a result of the proposed KI Seaport are likely to be limited to relatively minor increases in ground-level concentrations of dust, confined to within around 1–2 km of the operations.

The impacts of this change in air quality on human health, amenity and ecology were assessed, and the results demonstrated there would be no likely significant nearby impacts. Nevertheless, a number of mitigation and management measures could be implemented during construction and operations to further reduce dust generation, as detailed in Section 17.5.4.

18. NOISE AND LIGHT

Guideline		Comment
2.6	Describe the impacts of drilling or screw piling activities on marine communities, in particular … vibration and underwater noise on vulnerable or sensitive receivers and any mitigating measures that may be used.	See Section 18.4
12.1	Detail the expected levels of environmental noise associated with the construction and operation of the development, identifying all potential noise sources, and describe the impact upon the immediate and wider locality (include sensitive receivers).	See Sections 18.2 and 18.3
12.2	Identify if the predicted noise from ongoing operational sources associated with the project will meet the noise goals in the Environment Protection (Noise) Policy 2007 (Noise Policy) at the nearest noise sensitive receivers.	See Section 18.3.4
12.3	Detail how noise emissions will be reduced and contained (such as via building design/materials, noise barriers and buffers, and/or implementing operational procedures) to meet the requirements of the Noise Policy and minimise impacts upon the immediate and wider locality, including the effects from increased transport.	See Section 18.3.4
12.4	Detail how construction noise will meet the mandatory construction noise requirements of Part 6, Division 1 of the Noise Policy.	See Section 18.3.4
12.5	Detail what reasonable and practicable measures will be taken pursuant to Clause 23(1)(c) of the Noise Policy to minimise construction noise.	See Section 18.3.4
12.6	Identify the sources and expected levels of light pollution associated with the construction and operation of the development. Describe the impact upon the immediate and wider locality (including sensitive receivers), and outline mitigation measures.	See Section 18.5

18. NOISE AND LIGHT

18.1 INTRODUCTION

This chapter addresses guidelines related to the existing noise, vibration and lighting environment at Smith Bay, and the predicted noise and lighting levels associated with the construction and operation phases of the proposed KI Seaport. Where relevant, these are then compared to relevant standards and guidelines to quantify the impact to nearby (i.e. sensitive) receivers.

18.2 REGIONAL SETTING

18.2.1 PROJECT LOCATION AND SENSITIVE RECEIVERS

KIPT owns the vast majority of Kangaroo Island plantations, all of which are on the western part of the Island. The proposed KI Seaport at Smith Bay is on the north coast, about 20 km north-west of Kingscote.

The nearest noise-sensitive receiver is a residence about 500 metres south-west of the site (R1), while a bed and breakfast style property is about 700 metres south-east (R2). KIPT has recently concluded an option to buy the R1 property, although it is still included in this chapter as a sensitive receiver because it includes a residence.

Yumbah Aquaculture's Kangaroo Island abalone farm is about 100 metres from the eastern edge of the proposed development location at its nearest point. The location of the KI Seaport and the nearest receivers are described in Figure 18-1.

18.2.2 NOISE CONTEXT

Noise is the term used to describe the vibration of air particles and the term vibration is usually used for the oscillating movement of any (solid) object. Noise can lead to vibration of objects, and vibration transmitted through the ground can radiate from a surface into the air and be perceived as noise when it is referred to as ground-borne noise. In this manner, noise can be described as what a person hears, and vibration as what they feel.

This environmental noise impact assessment relates to noise from construction and operation of the KI Seaport at Smith Bay, as described in Chapter 4 – Project Description. The boundary limits for the purpose of describing construction and operation noise emissions at the KI Seaport are:

- the entrance to the wharf facility via the existing public road (Freeoak Road) at the intersection of North Coast Road, including upgrades to the intersection and access road to meet relevant standards for heavy vehicle access
- all subsequent (downstream) construction and operational activities within the KIPT land parcel at Smith Bay, including offshore activities associated with the development of the wharf and berthing area (during construction) and the manoeuvering, berthing and loading of vessels (operations).

The main offshore construction activities relevant to this noise impact assessment include:

- dredging the berth pocket using cutter suction dredging and potentially grab dredging, if required
- installing barge restraint dolphins by pile driving from a jack-up barge, located approximately 350–400 metres from the shoreline
- towing the floating pontoon wharf to site and securing to the restraint dolphins
- constructing a causeway to approximately 250 metres from shore, using a combination of consolidated coarse dredge spoil material, with geotextile sheeting and rock armouring to provide the appropriate level of stability and damage resistance
- constructing approximately 90 metres of piled suspended jetty from the end of the end of the causeway to approximately 340 metres from shore
- installing a linkspan bridge from the suspended jetty to the pontoon.

The main onshore construction activities will include:

- site clearing and earthworks using balanced cut and fill
- construction of dewatering and settlement ponds for dredge spoil
- constructing the truck access route around the site
- delivering and assembling materials handling infrastructure
- constructing site offices and ablutions facilities
- installing electricity distribution infrastructure
- carrying out shore-based works for causeway construction.

During operations, the following activities have been identified as having the potential to influence the baseline noise environment:

- the materials handling plant, equipment and mobile fleet, including:
  - log handlers
  - trucks/trailers (for transporting logs to the berth face)
  - bulldozer
  - conveyor
  - woodchip stacker-reclaimer
  - shiploader
  - crane
- diesel-powered electricity generators (gensets)
- tug and shipping (vessel) movements.

Although not a part of the scope of the proposed development, noise generation from on-site woodchip quality control screening and re-sizing plant was included in the noise assessment in order to present a worst-case noise scenario.

Lighting context

The KI Seaport, as a 24-hour-a-day, seven-day-a-week operation, would need artificial lighting so that operations could be undertaken safely and efficiently. The lighting section of this chapter provides an overview of the existing artificial lighting environment within Smith Bay and provides conceptual details of the proposed lighting arrangements and objectives for the KI Seaport, noting that detailed design for the facility has yet to be concluded.

18.3 TERRESTRIAL NOISE AND VIBRATION

This section describes the terrestrial noise environment and impact assessment. The underwater noise assessment is presented in Section 18.4. Further details regarding the assessment of terrestrial noise are in Chapter 13 – Terrestrial Ecology.

18.3.1 REGULATORY ENVIRONMENT

The EIS guidelines require environmental noise emissions from the proposed development to comply with the Environment Protection (Noise) Policy 2007 (Noise EPP), which is also the most relevant guideline to address the requirements of the overarching *Environment Protection Act 1993* (SA). The criteria for compliance differ during the construction and operations phases, as detailed in the following sections.

Construction

Division 1 of the Noise EPP contain provisions in relation to noise from construction, demolition and related activities. The following provisions apply to construction activity resulting in noise with an adverse impact on amenity:

a) *subject to paragraph (b), the activity –*
   - i) *must not occur on a Sunday or other public holiday*
   - ii) *must not occur on any other day except between 7 am and 7 pm.*

b) *a particular operation may occur on a Sunday or other public holiday between 9 am and 7 pm, or may commence before 7 am on any other day –*
   - i) *to avoid an unreasonable interruption of vehicle or pedestrian traffic movement*
   - ii) *if other grounds exist that the Authority or another administering agency determines to be sufficient.*

c) *all reasonable and practicable measures must be taken to minimise noise resulting from the activity and to minimise its impact, including (without limitation) –*
   - i) *commencing any particularly noisy part of the activity (such as masonry sawing or jack hammering) after 9 am*
   - ii) *locating noisy equipment (such as masonry saws or cement mixers) or processes so their impact on neighbouring premises is minimised (whether by maximising the distance to the premises, using structures or elevations to create barriers or otherwise)*
   - iii) *shutting or throttling equipment down whenever it is not in actual use*
   - iv) *ensuring that noise reduction devices such as mufflers are fitted and operating effectively*
   - v) *ensuring that equipment is not operated if maintenance or repairs would eliminate or significantly reduce a characteristic of noise resulting from its operation that is audible at noise-affected premises*
   - vi) *operating equipment and handling materials to minimise impact noise*
   - vii) *using off-site or other alternative processes that eliminate or lessen resulting noise.*

FIGURE 18-1 PROJECT LOCATION AND SENSITIVE RECEIVERS

Construction noise with an adverse impact on amenity is defined as that which results in a noise level greater than 45 dB(A) L_{eq} (continuous level) or 60 dB(A) L_{max} (maximum level) at a noise-affected premises such as a residence. However, Clause 23(4) of the Noise EPP also states that:

- If measurements of ambient noise at the affected premises show that the continuous source level exceeds 45 dB(A), the construction activity noise does not have an adverse impact on amenity unless the continuous level exceeds the ambient level.
- If measurements of ambient noise at the affected premises show that the maximum source level consistently exceeds 60 dB(A), the construction activity noise does not have an adverse impact on amenity unless the maximum level exceeds the maximum ambient level or the frequency at which it occurs.

The above provisions recognise that construction is inherently noisy, with limited opportunity for mitigation. However, given the temporary nature and limited duration of construction noise, it is considered acceptable provided it is undertaken within reasonable hours and all reasonable and practicable measures to mitigate noise are implemented.

Operations

The goals in the Noise EPP are based on the zoning of the proposed development and the closest noise- affected premises in the relevant development plan.

In this case, the proposed development located in a Coastal Conservation Zone, while the most affected residences are located in a Primary Production Zone under the Kangaroo Island Council Development Plan. The Yumbah Aquaculture facility to the east of the Project site is also within the Coastal Conservation Zone. The following types of development are envisaged in the Coastal Conservation Zone:

- coastal protection works
- conservation works
- interpretive signage and facilities
- tourism/visitor facilities
- tourist accommodation.

The guidelines for use of the Environment Protection (Noise) Policy 2007 note that the Rural Living land use category may be assigned to a locality that principally promotes a park or reserve set aside for public recreation or enjoyment in a country or non-urban setting. On this basis the Rural Living land use category is therefore the best fit for this locality. However, although the criteria appropriate to this land use category has been assigned in this assessment, it is noted that the noise limits for this zone are primarily intended to protect rural-residential and recreational amenity and that they are therefore not appropriate for assessing the impact of noise on the existing Yumbah Aquaculture facility, which is not used for residential or recreational purposes.

The following types of development are envisaged in the Primary Production Zone in the Kangaroo Island Council Development Plan:

- bulk handling and storage facility
- conference facility (in association with tourist accommodation or tourism facilities)
- dairy farming
- farming
- farm building
- home based industry
- horticulture
- intensive animal keeping
- land-based aquaculture
- tourist accommodation (including through the diversification of existing farming activities and conversion of farm buildings)
- tourism activities and facilities
- wind farm and ancillary development
- wind monitoring mast and ancillary development.

The guidelines for use of the Environment Protection (Noise) Policy 2007 state that:

> *The title 'Rural Industry' is not intended to create a link to the term 'industry' as defined in the Development Act 1993. The term 'industry' has been used in the Policy to indicate that the locality principally promotes a primary industry or associated activity. For example, in general farming zones, where the land use principally promoted is agriculture and residences are contemplated, the Rural Industry land use category would be assigned.*

TABLE 18-1 PLANNING NOISE CRITERIA FOR THE KI SEAPORT

Sensitive receiver	Planning noise criteria ($dB(A)_{Leq}$)	
	Day (7 am to 10 pm)	Night (10 pm to 7 am)
Nearest residences (rural industry land use category)	47	40
Aquaculture facility (rural living land use category)	42	35

The Rural Industry land use category therefore applies to receivers in this zone.

Clause 5(5) of the Noise EPP requires that if the noise source and the noise-sensitive premises are in zones where different land use categories are promoted, then the indicative noise level is the average of those relevant indicative noise factors. In this case, the indicative noise level for receivers in the Primary Production Zones is the average of Rural Living and Rural Industry factors – 52 dB(A) during the day and 45 dB(A) at night.

In accordance with Part 5 of the Noise EPP, the relevant planning assessment criterion for this development is the determined indicative noise level minus 5 dB(A). The guidelines for use of the Environment Protection (Noise) Policy 2007 note that the more stringent criteria which are applied to assessment of development applications recognises a range of factors, including increased sensitivity to noise from a new source, increased scope for inclusion of reasonable and practicable noise reduction measures to a new development, and the cumulative effect of noise. The planning criteria apply to external noise levels predicted at the facade of any noise-sensitive receiver (see Table 18-1).

Under Part 5, Clause 20(6) of the Noise EPP, exceedance of the planning noise criterion does not necessarily mean the development will be non-compliant. The following matters are also considered when considering compliance:

- the amount by which the criterion is exceeded (in dB(A))
- the frequency and duration for which the criterion is exceeded
- the ambient noise that has a level similar to the predicted level
- the times when the noise occurs
- the number of people likely to be adversely affected by the noise source and whether there is any special need for quiet
- land uses existing in the vicinity of the noise source.

18.3.2 EXISTING ENVIRONMENT

Baseline noise and vibration monitoring was conducted in the area surrounding the site, between 7 and 16 December 2017. Attended ambient noise measurements were also undertaken in the area on 7 and 8 December 2017. Figure 18-2 shows the baseline measurement locations – selected to be representative of the ambient noise environment at noise-sensitive receiver locations and their surrounding area.

The results of the attended baseline noise measurements are presented in Table 18-2, and a summary of the unattended measurements (noise loggers) presented in Table 18-3.

Measured baseline noise levels were relatively low at all locations, particularly at night, and are consistent with expected noise levels in a rural area based on the experience of the noise consultants.

TABLE 18-2 ATTENDED BASELINE NOISE MEASUREMENTS

Location	Date and time	Measured noise level (dB(A))			Noise sources at the time of measurement
		L_{max}	L_{eq}	L_{90}	
A1	7/12/17 13:43	58	46	39	Wind, SODAR*
A2	8/12/17 6:26	53	42	37	Wind, birds, insects, waves, SODAR
A3	8/12/17 6:36	69	45	29	Birds, waves, wind
A4	8/12/17 6:43	55	33	26	Birds
A5	8/12/17 6:53	58	40	34	Birds, insects

* SODAR (Sonic Detection and Ranging) is a meteorological instrument used as a wind profiler to measure the scattering of sound waves by atmospheric turbulence.

TABLE 18-3 UNATTENDED NOISE MONITORING SUMMARY

Period	Measured noise level (dB(A))								
	B1			B2			B3		
	L_{max}	L_{eq}	L_{90}	L_{max}	L_{eq}	L_{90}	L_{max}	L_{eq}	L_{90}
Day	74	47	31	79	52	39	77	47	30
Night	70	43	27	75	44	33	83	44	32

FIGURE 18-2 BASELINE MEASUREMENT LOCATIONS

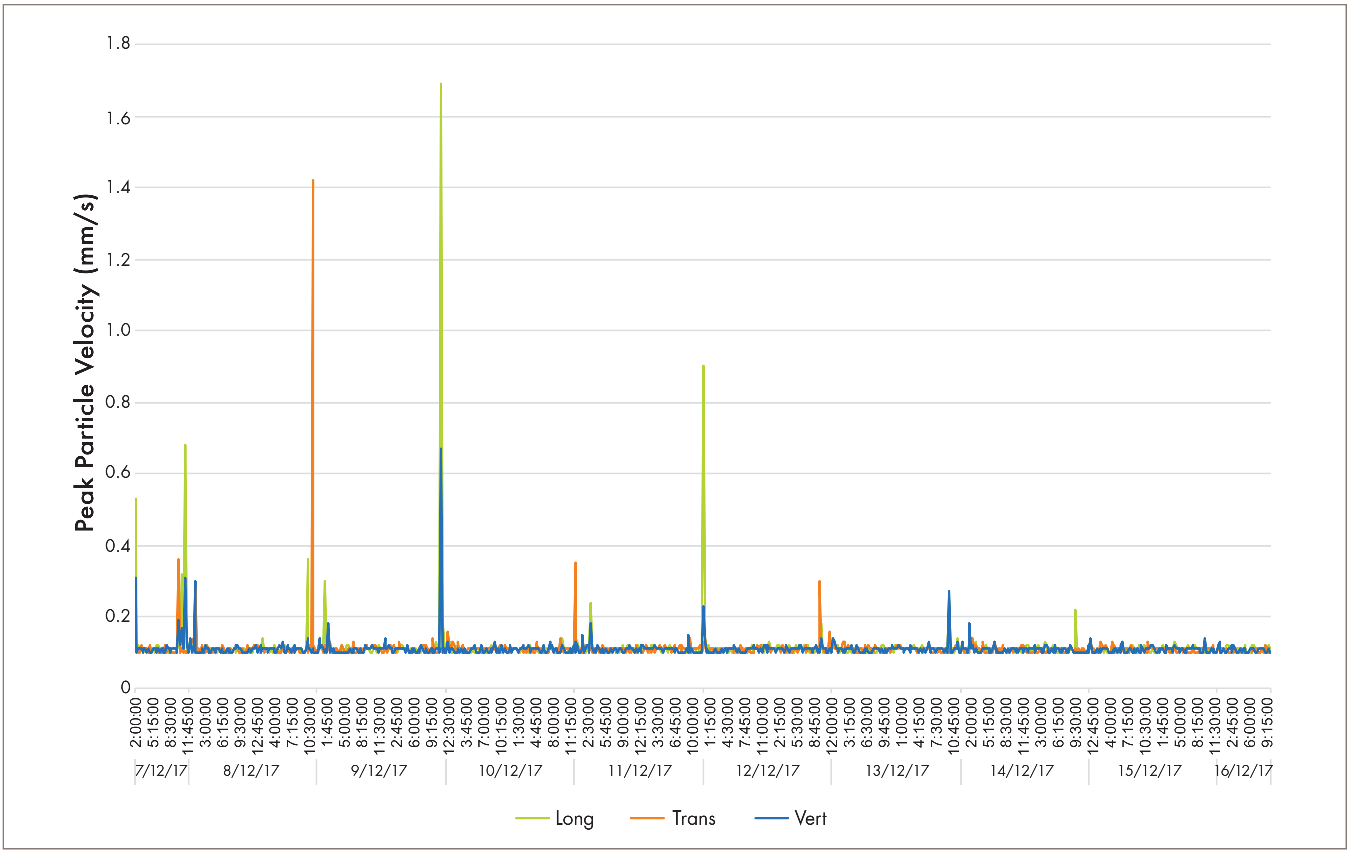


FIGURE 18-3 VIBRATION BASELINE MONITORING RESULTS

TABLE 18-4 OPERATIONAL NOISE SOURCES

Noise source	Quantity	Sound power level per unit (dB(A))
Bulldozer	1	105
Trucks (idling)	2 on site at any one time	91
Trucks (moving)	3 movements in a worst-case 15-minute period	99
Log handlers	2	99
Re-sizing plant[1]	1	100
Generator	1	93
Conveyer	1	105
Woodchip stacker	1	105
Shiploader	1	109
Crane	1	95

[1] Not within the scope of the proposed development. Included to present a worst-case noise scenario.

Vibration measurement results are shown in Figure 18-3. Baseline vibration levels were generally very low in all three axes, with the exception of occasional events generating a vibration of up to 1.6 mm/s at night, possibly due to wildlife movement close to the noise monitoring equipment.

18.3.3 ASSESSMENT METHODOLOGY

Noise modelling

Noise emissions from the site have been modelled in SoundPLAN Environmental Software v8.0, using the CONCAWE method. The model takes into consideration:

- attenuation of noise source due to distance
- barrier effects from buildings, topography and the like
- air absorption
- ground effects
- meteorological conditions.

CONCAWE has six difference weather categories. Category 1 represents weather conditions that are least conducive to noise propagation (best-case situation with the lowest predicted noise levels); Category 4 represents neutral conditions; and Category 6 represents conditions that are the most conducive to noise propagation (the worst-case situation with the highest predicted noise levels).

In accordance with DAC's guidelines for the EIS and the guidelines for the use of the Environment Protection (Noise) Policy 2007, Category 6 has been used for night-time noise emissions, and Category 5 has been used for daytime noise emissions.

A ground absorption factor of 0.0 (completely reflective) has been adopted for water areas, while all onshore areas have been modelled with a ground absorption factor of 0.5.

Noise sources

Construction

Construction equipment associated with offshore works may include tugboats, barges, dredging vessels, piling rigs, and the like. Onshore construction equipment may include trucks, excavators, bulldozers, generators, cranes, concrete pumps, hand tools, dewatering plant (for dredge spoil) and other plant. Typical noise levels associated with these sources are generally expected to be in the same order as operational noise levels due to the similarities between the construction and operations mobile fleet and fixed plant.

Operations

For the purposes of the operational noise impact assessment, the following noise sources (see Table 18-4) have been modelled as occurring concurrently, with the exception of truck deliveries to the site at night (after 10 pm and before 7 am).

During operations, log and woodchip stockpiles would mitigate noise where they blocked line of site between noise sources and receivers. However, because the quantities and locations of materials stored on site would vary, this mitigation has not been relied on in the noise modelling. The modelling therefore represents a conservative approach.

18.3.4 IMPACT ASSESSMENT

Construction

Provided the majority of construction work is done between 7 am and 7 pm Monday to Saturday, and all reasonable and practicable measures are undertaken to minimise noise, construction noise would comply with Division 1 of the Noise EPP, as described in Section 18.2.1.

Some construction work may need to be done outside these hours; for example, some offshore activities could require stable sea conditions, which are more likely at night. While the extent and type of construction activities which may occur outside standard hours are not known at this stage, it is clear from operational noise modelling of the same types of equipment and activities that would be undertaken during the construction phase that many of these activities could be undertaken at night while still complying with the criteria of 45 dB(A) L_{eq} and 60 dB(A) L_{max} at the nearest residences. Ad hoc monitoring may be undertaken from time-to-time during the construction phase to ensure compliance with this criterion should night-time construction works be undertaken.

Operations

Predicted noise levels for the operation are shown in Table 18-6 at the nearest receivers, and the corresponding noise contour plot is presented in Figure 18-4. Due to the continuous nature of the KI Seaport operations, the noise levels are relatively constant across daytime and night-time periods.

Based on the above results, noise levels are expected to comply with daytime criteria at all residential receiver locations with the exception of a slight exceedance of the the night-time criteria (by 2 dB) at receiver R1. The predicted noise levels at the residences are consistent with existing baseline noise levels at these locations.

With respect to the aquaculture facility, predicted noise levels are expected to vary between 36-53 dB(A)$_{Leq}$ at the facades of buildings within this site, averaging around 45 dB(A)$_{Leq}$ if no mitigation is applied. As discussed previously, although the criteria appropriate to the Rural Living land use category has been assigned in this assessment based on the site zoning, it is noted that the noise limits for this zone are primarily intended to protect rural-residential and recreational amenity and that they are therefore not appropriate for assessing the impact of noise on the existing Yumbah Aquaculture facility, which is not

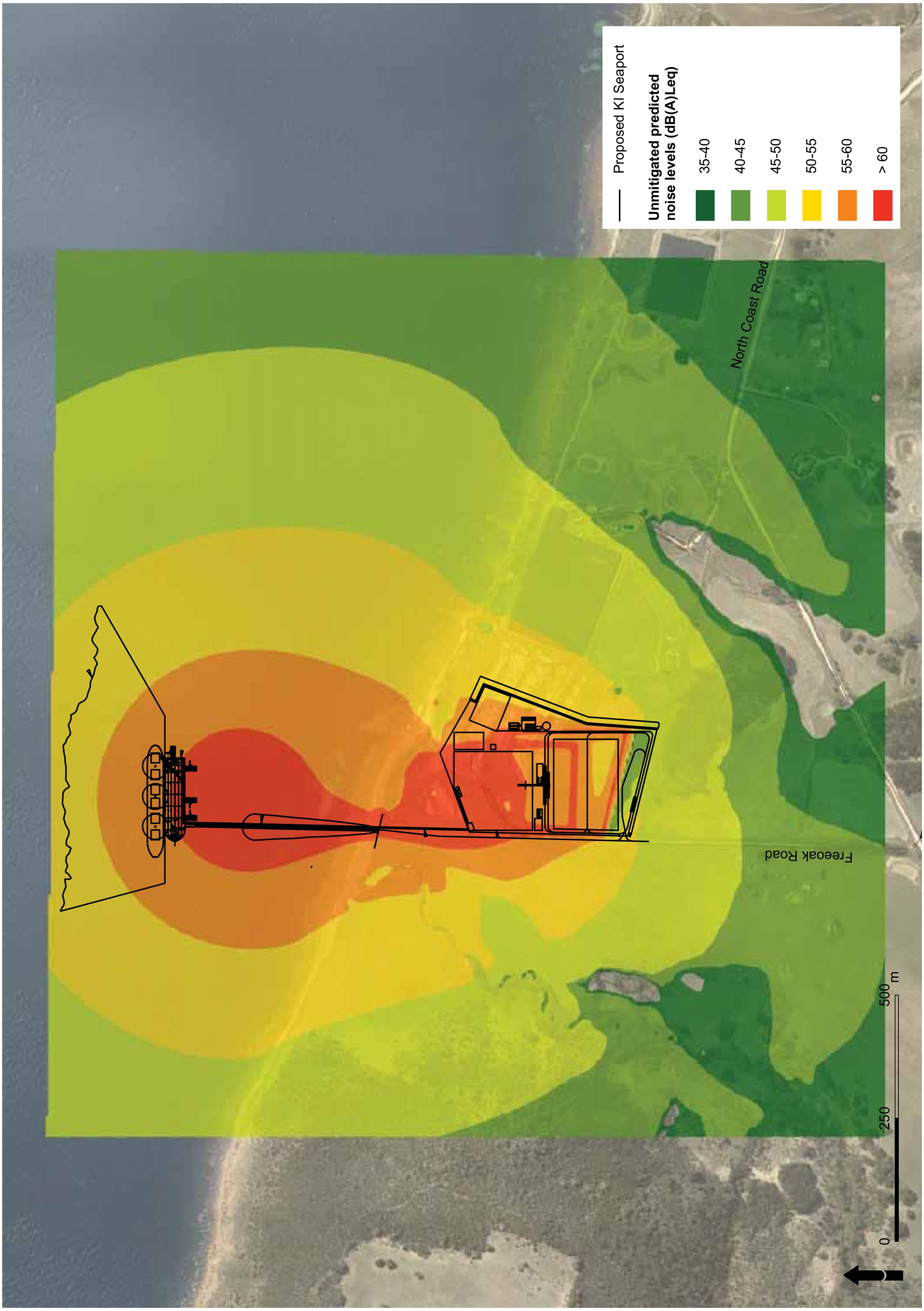


FIGURE 18-4 PREDICTED NOISE LEVELS (NO MITIGATION)

used for residential or recreational purposes. Further, review of documentation provided in support of the development of a similar aquaculture facility in Victoria demonstrates that the predicted noise levels associated with the aquaculture operation are predicted to be in the range of 40-55 $dB(A)_{Leq}$ within the tankhouse buildings, varying depending on proximity to pumping and pipeline infrastructure (Yumbah 2018).

In accordance with Part 5, Clause 20(6) of the Noise EPP, the matters detailed in Table 18-5 should be considered in relation to the predicted exceedance at this location.

Management and mitigation

The terrestrial noise impact assessment has predicted that, without mitigation, night-time operational noise levels may exceed the Noise EPP criterion at one of the nearby residential receivers and at the nearby aquaculture facility under the conservative assumptions outlined previously. Further, in accordance with the Noise EPP, KIPT would seek to minimise noise during the construction phase so amenity at the nearby receivers was not unduly impacted.

The proposed KI Seaport is currently in detailed design. Pending this, the details of specific noise mitigation measures is not available. For the purposes of undertaking the noise impact assessment, the noise modelling did not consider any noise mitigation measures, and assumed that woodchip quality control screening and resizing operations were undertaken at the facility. This presents a worst-case noise emission scenario.

Potential noise mitigation measures for both construction and operation are presented in Table 18-6, this list having been developed based on the experiences of the Acoustic Consultant undertaking the modelling in consultation with KIPT and their construction partners. The implementation of these measures remains subject to detailed design and cost/benefit analysis, however all have been demonstrated to reduce noise levels at other similar operations when implemented appropriately and thus KIPT is confident that the noise criteria at the residences will be complied with at all times for all phases of the development.

TABLE 18-5 NOISE EPP MATTERS FOR CONSIDERATION

Relevant matter for consideration	Assessment
Ambient noise that has a noise level similar to the predicted noise level	Average existing ambient noise levels at logger location B2 were 52 dB(A) during the daytime and 44 dB(A) at night. These are similar levels to predicted noise levels. Predictions of noise from similar proposed facilities (Yumbah 2018) indicates noise levels in proximity to the facility of 40-55 $dB(A)_{Leq}$, indicating that the noise from the proposed KI Seaport would not be audible within the aquaculture facility. We also note that the Yumbah facility is likely to generate heavy vehicle movements from time to time, which are expected to produce similar or higher noise levels than the noise sources associated with the Project, when received within the Yumbah site.
The number of persons likely to be adversely affected by the noise source and whether there is any special need for quiet.	The predicted noise levels are within the range anticipated within the Noise EPP for industrial or commercial land uses. Our understanding is that no people reside within the Yumbah site. On this basis no persons are likely to be adversely affected by the noise source. There is no established special need for quiet at the Yumbah Aquaculture site.
Land uses existing in the vicinity of the noise source.	Land use at the Yumbah Aquaculture site is generally consistent with Primary Production or Rural Industry. The land use is not consistent with the type of development envisaged in the Coastal Conservation Zone, or with typical activities associated with the Rural Living land use category.

TABLE 18-6 PREDICTED NOISE LEVELS (NO MITIGATION)

Receiver	Predicted noise level ($dB(A)L_{eq}$)
R1	42
R2	40
Aquaculture facility	45

TABLE 18-7 POTENTIAL NOISE AND VIBRATION CONTROL MEASURES

Control measure
Design
The potential shielding provided by site topography, woodchip and log stockpiles and intervening buildings would be taken into account in locating plant and equipment.
Processes and equipment that generate lower noise levels would be selected, where feasible.
Noisy plant, site access roads and site compounds would be located as far from occupied premises as practicable to allow efficient and safe completion of work.
Equipment that emits noise predominantly in a particular direction would be sited so noise was directed away from occupied premises, where feasible.
Acoustic enclosures would be installed around above-ground equipment where noise levels are predicted to exceed the relevant noise level targets at sensitive land uses, where safe and practicable.
Noise bunds (made from recycled dredge spoil) and/or noise attenuating fencing may be established around noise-generating equipment and/or at the site boundary.
General (all phases)
Noisier construction and operational maintenance works would be scheduled with due consideration to the nearest sensitive land uses.
Employee induction would cover noise and vibration management and complaints, and this would be reiterated through on-site training such as toolbox talks or pre-starts.
Effective stakeholder communication would be undertaken, advising of upcoming noise-generating activities or works.
Works planning would consider preventing vehicles and equipment queuing, idling or reversing near occupied premises, where practicable.
Truck movements on local roads would be limited as much as is practicable, and vehicles with a larger load capacity (therefore fewer total movements) chosen wherever possible.
Two-way radios would be set to the minimum effective volume where possible for safety reasons.
Truck operators would ensure tailgates (or equivalent) were cleared and locked at the designated points.
Trucks would be restricted to minimum speed (less than 15 km/h) along uneven surfaces near sensitive receivers.
Equipment used intermittently would be shut down or throttled down to a minimum when it was not in use.
Equipment would be well maintained and have mufflers and silencers that meet the manufacturer's specifications where relevant.
Works would be planned to minimise the noise from reversing signals from any vehicles without broadband alarms fitted.
Metal-to-metal contact would be avoided where feasible.
Staff would be instructed to avoid dropping material from height into unlined truck trays and barges. Where materials are to be dropped into an empty truck tray, barge, or disposal bin and may cause a loud noise, the tray/bin would be lined, where feasible, with soil or an equivalent material to reduce impact noise.

18.4 UNDERWATER NOISE

This section describes the underwater noise environment and impact assessment. The terrestrial noise assessment was presented in Section 18.3. Further details regarding the assessment of underwater noise are in Chapter 12 – Marine Ecology and Chapter – 14 MNES (for Southern right whales).

18.4.1 REGULATORY ENVIRONMENT

Regulation

The *Environment Protection and Biodiversity Conservation Act 1999* (the EPBC Act) is the central piece of environmental legislation relevant to this assessment. It provides the legal framework to protect and manage nationally and internationally important biota, ecological communities and heritage places, which are defined in the Act as matters of national environmental significance (MNES). Under the provisions of the Act, it is an offence for any person to take an action that is likely to have a significant impact on MNES without approval.

Regulation of underwater noise impacts is currently limited to policy outlined by the Department of the Environment and Energy which falls under the EPBC Act, namely the EPBC Act Policy Statement 2.1 – Interaction Between Offshore Seismic Exploration and Whales (DEWHA 2008).

TABLE 18-7 POTENTIAL NOISE AND VIBRATION CONTROL MEASURES (CONT'D)

Control measure
All reversing plant used at night would be fitted with broadband reversing alarms where practicable, although it may not be possible to do so when plant was called in at short notice to replace other plant requiring maintenance. All broadband reversing alarms would be installed and operated in accordance with all relevant Occupational Health and Safety requirements.
Where it could not be guaranteed that all plant was fitted with broadband reversing alarms (such as on trucks that visit only occasionally), then the site would be set up as far as practicable, so those vehicles did not need to reverse.
Construction phase-specific
Respite periods would be considered for longer-term exposed sensitive receivers, such as by alternating the locations of noise-generating construction activities.
Noise associated with packing up plant and equipment at the end of works would be minimised.
Where noisy plant was in a stationary location where it may affect sensitive receivers for a significant length of time (such as a generator located in a stockpile site for the duration of the development), an acoustic enclosure would be installed where practicable or an appropriately silenced generator or lighting tower used.
Low-vibration plant alternatives, such as the smallest practicable vibratory compactor, would be used where feasible.
For high-noise construction activities, the installation of temporary solid hoarding (e.g. plywood) or earth bunds would be considered where this was reasonable and where it could reduce noise noticeably, such as by blocking line-of-sight to sensitive receivers.
Plant with high and low vibration operation settings would be run on the lowest effective setting.
Where reasonable and practicable, construction works would be programmed so noisier activities occurred after 7 am and before 10 pm.
Where reasonable and practicable, sensitive receivers would be given respite from night-time activities. For example, works occurring over several nights would be programmed, where possible, so they did not occur close to individual receivers on consecutive nights.
Earthmoving plant would not shake buckets near sensitive receivers.
Operations phase-specific
Purchase the nearest sensitive receiver (R1).
Truck deliveries of timber products to the KI Seaport would be restricted to between 7 am and 10 pm.
Material haulage routes would be planned to minimise impacts to the community, where practicable.

The aims of the EPBC Act Policy Statement 2.1 are to provide:

- practical standards to minimise the risk of acoustic injury to whales in the vicinity of geophysical survey operations
- a framework that minimises the risk of biological consequences from acoustic disturbance from geophysical sources to whales in biologically important habitat areas or during critical behaviours
- advice to operators conducting geophysical surveys on their legal responsibilities under the EPBC Act.

The policy states:

> *This Policy has been written with the goal of minimising the likelihood of injury or hearing impairment of whales based on current scientific understanding. Calculations are primarily based on received sound energy levels that are estimated to lead to a temporary threshold shift (TTS) in baleen whale hearing. This Policy is not intended to prevent all behavioural changes, which might occur in response to detectable, but non-traumatic sound levels. In fact, it is likely that whales in the vicinity of geophysical surveying will avoid the immediate area due to an aversive response to the sound.*

It is noted that the policy is intended to minimise the likelihood of injury, rather than prevent behavioural changes in whales, and while the policy may be suitable for temporary construction noise sources with impulses similar to airgun noise, it is not considered suitable as a criterion for long-term and fixed-location industrial noise.

In addition to the Commonwealth EPBC Act, South Australia's DPTI has prepared the Underwater Piling Noise Guidelines (DPTI 2012) to provide a framework for its staff and contractors to determine practicable mitigation measures that minimise impacts to marine mammals in the vicinity of piling activity.

Precaution zones are defined for both impulsive (impact piling) and continuous noise sources based on calculations of sound levels to prevent temporary or permanent hearing impairment in marine mammals. Animals exposed to sufficiently intense sound may exhibit an increased hearing threshold, called a noise-induced threshold shift (NITS). If the hearing threshold eventually returns to normal, the NITS is called a temporary threshold shift (TTS). The magnitude of a TTS is a function of the recovery time – the amount of time that has elapsed since the cessation of the noise exposure. If the hearing threshold does not return to normal, but leaves some residual NITS, the remaining NITS is called a permanent threshold shift (PTS). The DPTI guidelines adopt these TTS and PTS physiological noise exposure criteria for hearing impairment, which are based on a study presented by Southall et al. (2007), and interim noise exposure criteria adopted in 2011 by the United States National Oceanic and Atmospheric Administration (NOAA).

Criteria

Appropriate noise criteria have been determined by analysing noise source types and expected activity durations against the potentially affected marine fauna species likely to inhabit or migrate through the study area. The noise source durations may be split into two distinct categories: construction sources and operational sources.

Construction

Construction activities create temporary noise sources that emit noise for specific periods during a project's construction phase.

Noise mitigation can be achieved either by implementing source control methods, or strategic planning of activities to avoid known times of potential marine fauna sensitivity, such as during whale migration periods.

Operations

Operational activities are long-term and emit noise over the life of a project. Unlike construction noise sources, they are not temporary, so the noise may impact an area for a long period over a number of consecutive years. For this reason, it is desirable that operational noise does not significantly add to the existing ambient underwater noise in an area. This approach is similar to that adopted for industrial facilities located near residential areas or other sensitive land uses.

The adopted underwater noise criteria (see Table 18-8) take into account the EPBC Act species that are identified as possible or likely to occur at Smith Bay (see Chapter 14 – Matters of National Environmental Significance), the NOAA

TABLE 18-8 ADOPTED UNDERWATER NOISE CRITERIA

Species	Source character	Organ damage	Permanent threshold shift	Temporary threshold shift	Behavioural response
Low-frequency (LF) cetaceans: • blue whale • southern right whale • humpback whale	Continuous	>SPL 200 dB	SEL_C 199 dB(M_{lf})	SEL_C 179 dB(M_{lf})	SPL 120 dB
	Impulsive	>SPL 200 dB	Peak 219 dB SEL_C 183 dB(M_{lf})	Peak 213 dB SEL_C 168 dB(M_{lf})	SPL 160 dB
Otariid pinnipeds: • Australian sea-lion	Continuous	>SPL 200 dB	SEL_C 219 dB(M_{ow})	SEL_C 199 dB(M_{ow})	SPL 120 dB
	Impulsive	>SPL 200 dB	Peak 232 dB SEL_C 203 dB(M_{ow})	Peak 226 dB SEL_C 188 dB(M_{ow})	SPL 160 dB
Fish (no swim bladder): • great white shark	Continuous	N: Low I: Low F: Low	N: Low I: Low F: Low	N: Moderate I: Low F: Low	N: Moderate I: Moderate F: Low
	Impulsive	Peak 213 dB SEL_C 219 dB	Peak 213 dB SEL_C 216 dB	SEL_C 186 dB	N: High I: Moderate F: Low
Turtles: • loggerhead turtle • green sea turtle • leatherback turtle	Continuous	N: Low I: Low F: Low	N: Low I: Low F: Low	N: Moderate I: Low F: Low	N: High I: Moderate F: Low
	Impulsive	Peak 207 dB SEL_C 210 dB	N: High I: Low F: Low	N: High I: Low F: Low	N: High I: Moderate F: Low

Where: N is Near = tens of metres from the source; I is intermediate = hundreds of metres from the source; and F is Far = thousands of metres from the source.

Marine Mammal Acoustic Technical Guidance (NOAA 2018), and the Sound Exposure Guidelines for Fishes and Sea Turtles (Popper et al. 2014).

These represent the most up-to-date research and approach for the species considered in this assessment and are generally more stringent than the DPTI Underwater Piling Noise Guidelines criteria that may otherwise apply (DPTI 2012). Further details regarding the basis for the adopted noise criteria are described in Appendix N1.

18.4.2 EXISTING ENVIRONMENT

Background information

The ocean is filled with sound generated by a variety of natural sources, such as rain, breaking waves, marine life, and human sources, such as shipping and sonar activity. Between 20 Hz and 500 Hz, ambient noise is primarily due to noise generated by distant shipping. Even after removing any noise generated by ships close to the receiver, distant ships can be detected. The amount of noise is greater in regions with heavy shipping traffic. The tendency for there to be fewer ships in the southern hemisphere means low-frequency ambient noise levels are substantially lower.

Between 500 Hz and 100 kHz, ambient noise is mostly due to spray and bubbles associated with breaking waves, where the noise increases with rising wind speed. Above 100 kHz, ambient noise is dominated by the noise generated by the random motion of water molecules, which is called thermal noise.

Physical processes that intermittently generate sound in the ocean include rain, lightning striking the sea surface, cracking sea ice, undersea earthquakes, and eruptions from undersea volcanoes. Some of these phenomena generate extremely loud sounds, such as lightning strikes, which can reach up to 260 dB at one metre distance. Heavy rain can increase noise levels by up to 35 dB across a broad range of frequencies extending from several hundred hertz to greater than 20 kHz.

The sounds produced by marine life can also contribute to the ambient noise levels. Marine mammal calls can increase ambient noise levels by 20–25 dB in some locations at certain times of the year. Certain types of fish and marine invertebrates also produce sounds. For example, sound generated by colonies of snapping shrimp, which inhabit shallow warmer waters with a bottom of rock, shell, or weed that offers some concealment, can dominate other sources of background noise.

Shallow water

For the purposes of the noise assessment, the study area is considered a shallow-water coastal environment. Ambient noise levels in shallow water vary widely in frequency and level distributions depending on time and location (Richardson et al. 1995). The three primary sources in most shallow-water regions are distant shipping, industrial or geophysical-survey noise, wind and wave noise, and biological noise.

Compared with deep water, shallow water has a wider range of ambient noise levels under corresponding wind and wave conditions (Richardson et al. 1995). Above approximately 500 Hz, ambient noise levels in coastal areas are often 5–10 dB higher than in deep water for the same wind speeds. In the absence of shipping and biological noise, however, low-frequency (<300 Hz) ambient noise levels can be lower in shallow water than in deep water.

The development site is on the northern side of Kangaroo Island within St Vincent Gulf and therefore sheltered to some extent from strong onshore winds. Ambient noise levels in shallow waters are directly related to wind speed. For wind speeds above 2.5 m/s, the ambient noise level in the frequencies range between 50 Hz and 20 kHz is better predicted by wind speed than by wave height (Richardson et al. 1995).

The main shipping route between Adelaide and Western Australia via Investigator Strait is about 20 km due north of the study area. Calculations indicate that the noise levels from shipping traffic are likely to be at a similar level to the ambient background; that is, approximately 90 dB at frequencies below 1 kHz.

Baseline monitoring

The ambient noise environment within the marine study area was measured between 7 and 16 December 2017. Data were collected at a sampling rate of 50 kHz. Measurements were undertaken in the location shown in Figure 18-5, about 600 metres north of the shoreline, with the hydrophone at a depth of about 14 metres.

The hydrophone was deployed from a boat and anchored to the seabed using weights. The instrument was suspended in the water column by a combination of self-buoyancy and a supplementary buoy, such that the transducer was approximately 1.5 metres above the sea bed. A surface buoy marked the location for retrieval.

Underwater noise data were processed in intervals of 100 seconds. For each interval, the overall sound pressure level and spectra were calculated from the raw waveform data. The variation of overall sound pressure level (SPL dB re 1 µPa) over time is shown in Figure 18-6, along with wind speed measured at the nearest Bureau of Meteorology (BOM) station (Kingscote). The results show noise levels generally varied between approximately 85 and 130 dB re 1 µPa, with the exception of the beginning and end of the measurement

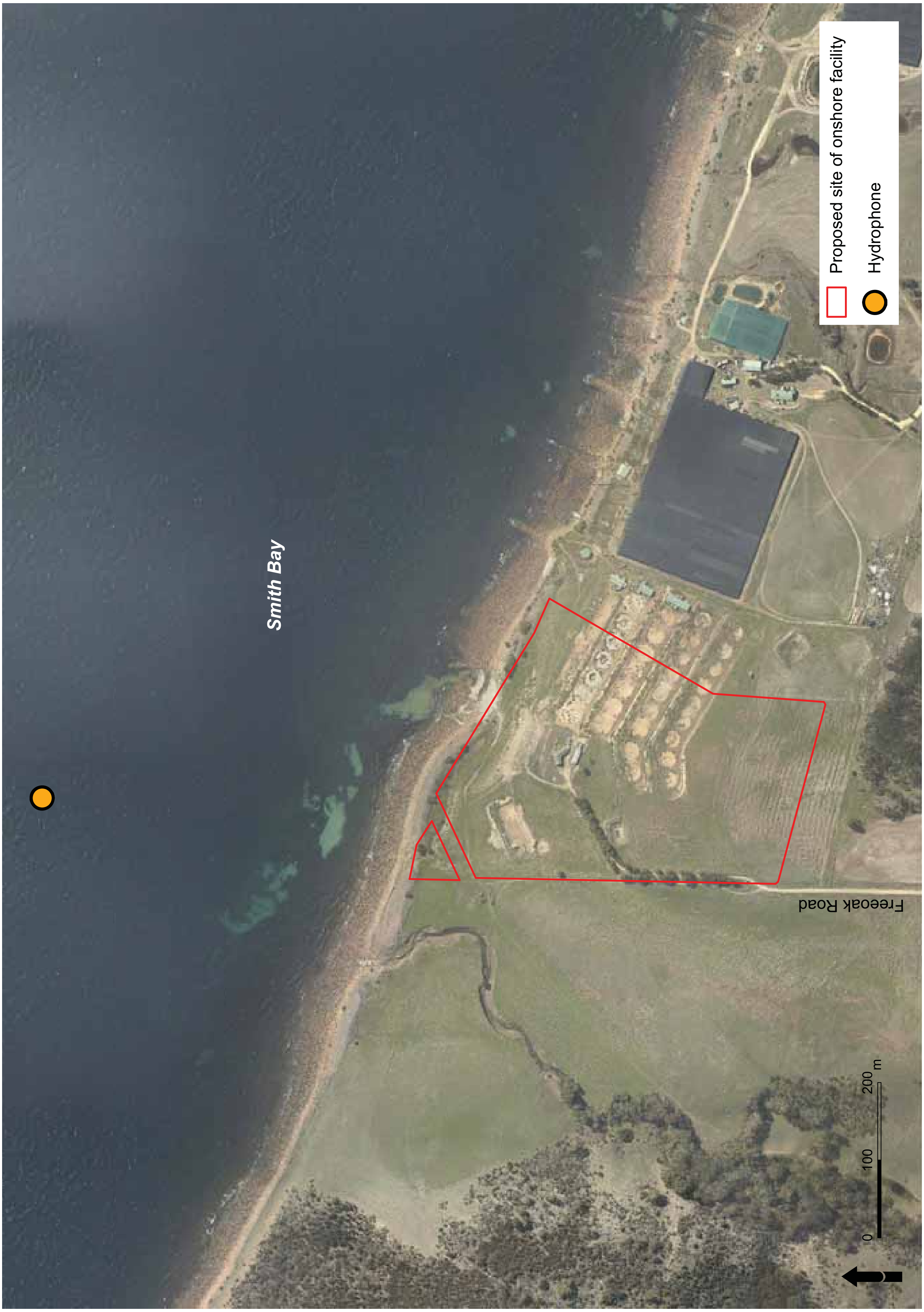


FIGURE 18-5 BASELINE UNDERWATER NOISE MEASUREMENT LOCATION

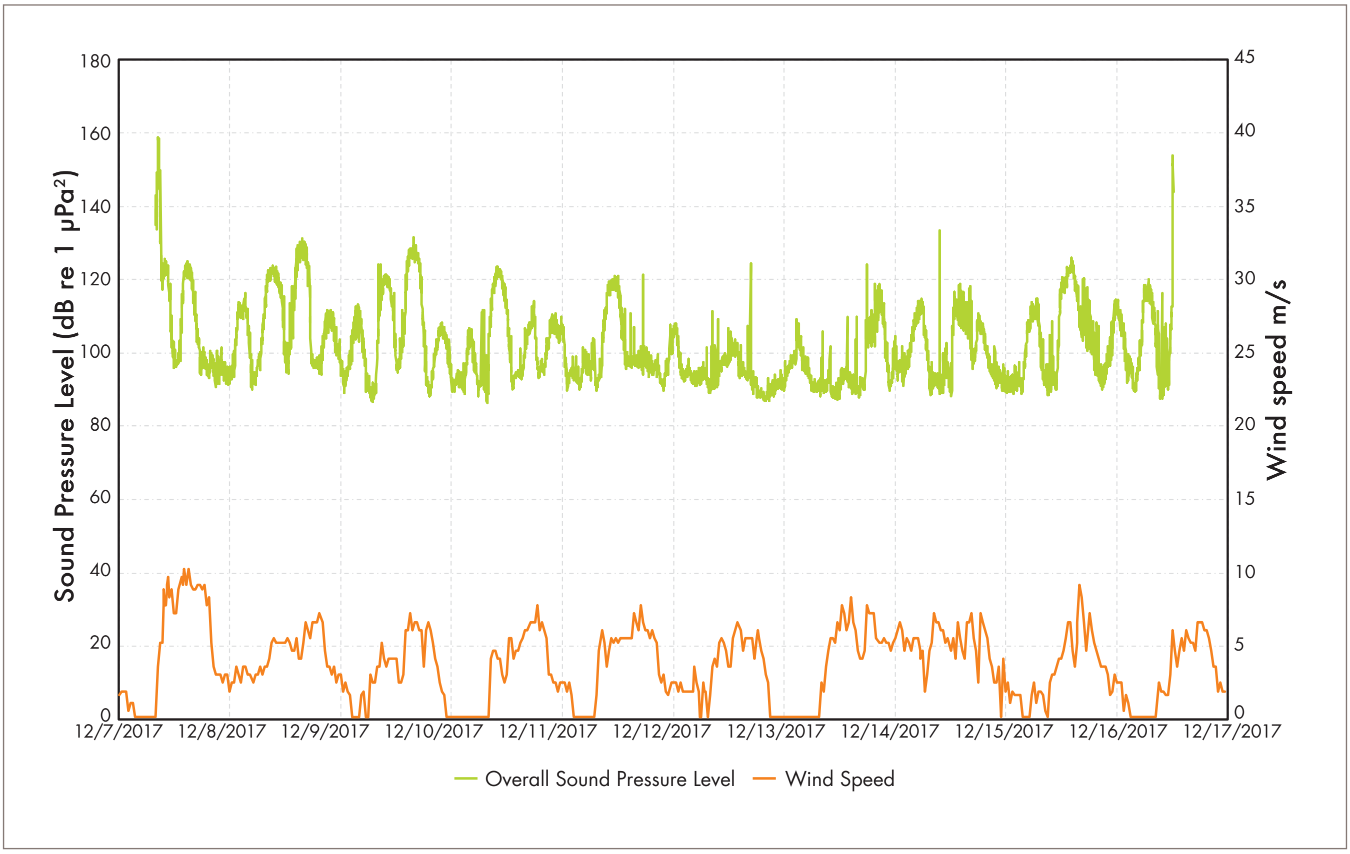


FIGURE 18-6 OVERALL SOUND PRESSURE LEVEL VARIATION OVER TIME

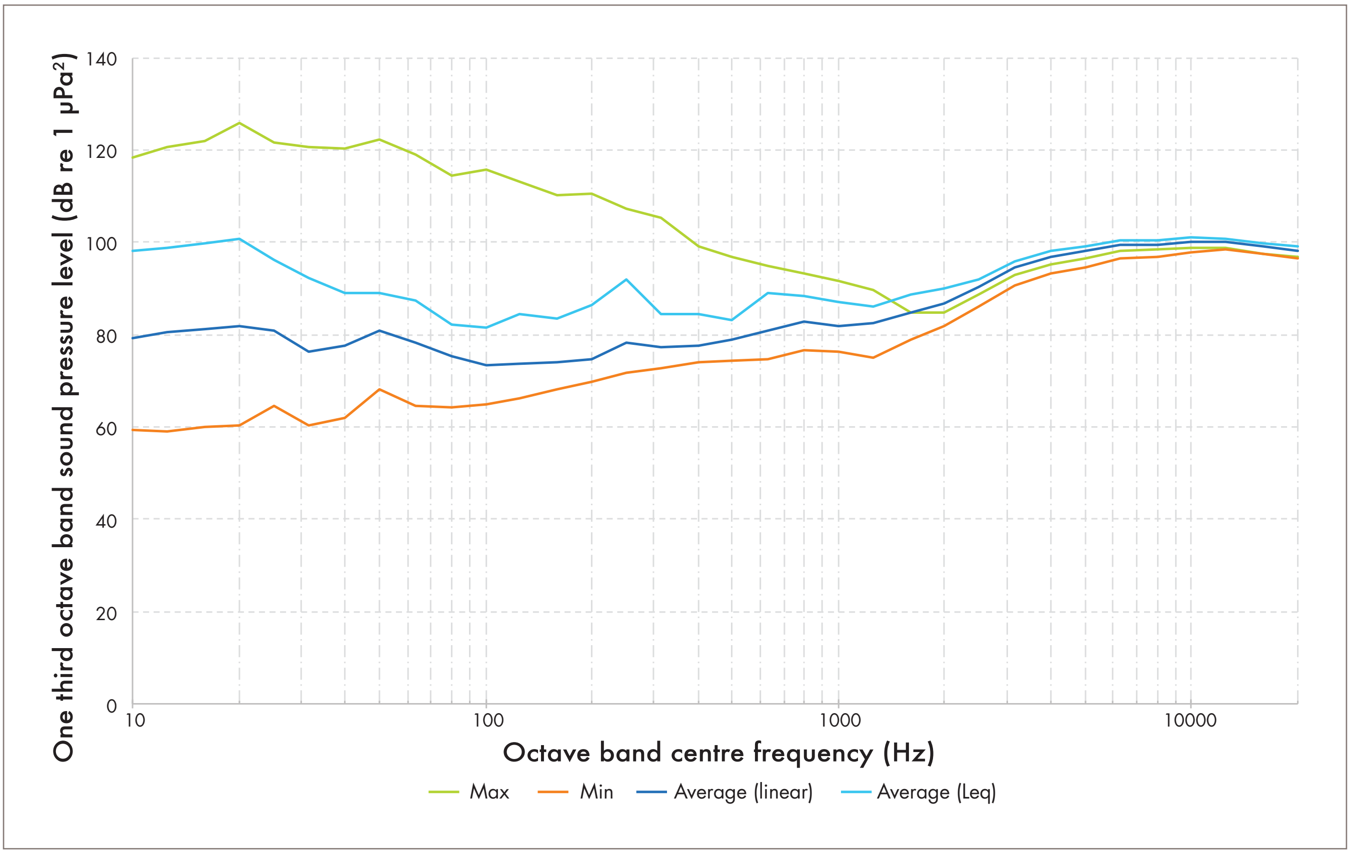


FIGURE 18-7 ONE-THIRD OCTAVE BAND SOUND PRESSURE LEVELS FOR SELECTED PERIODS

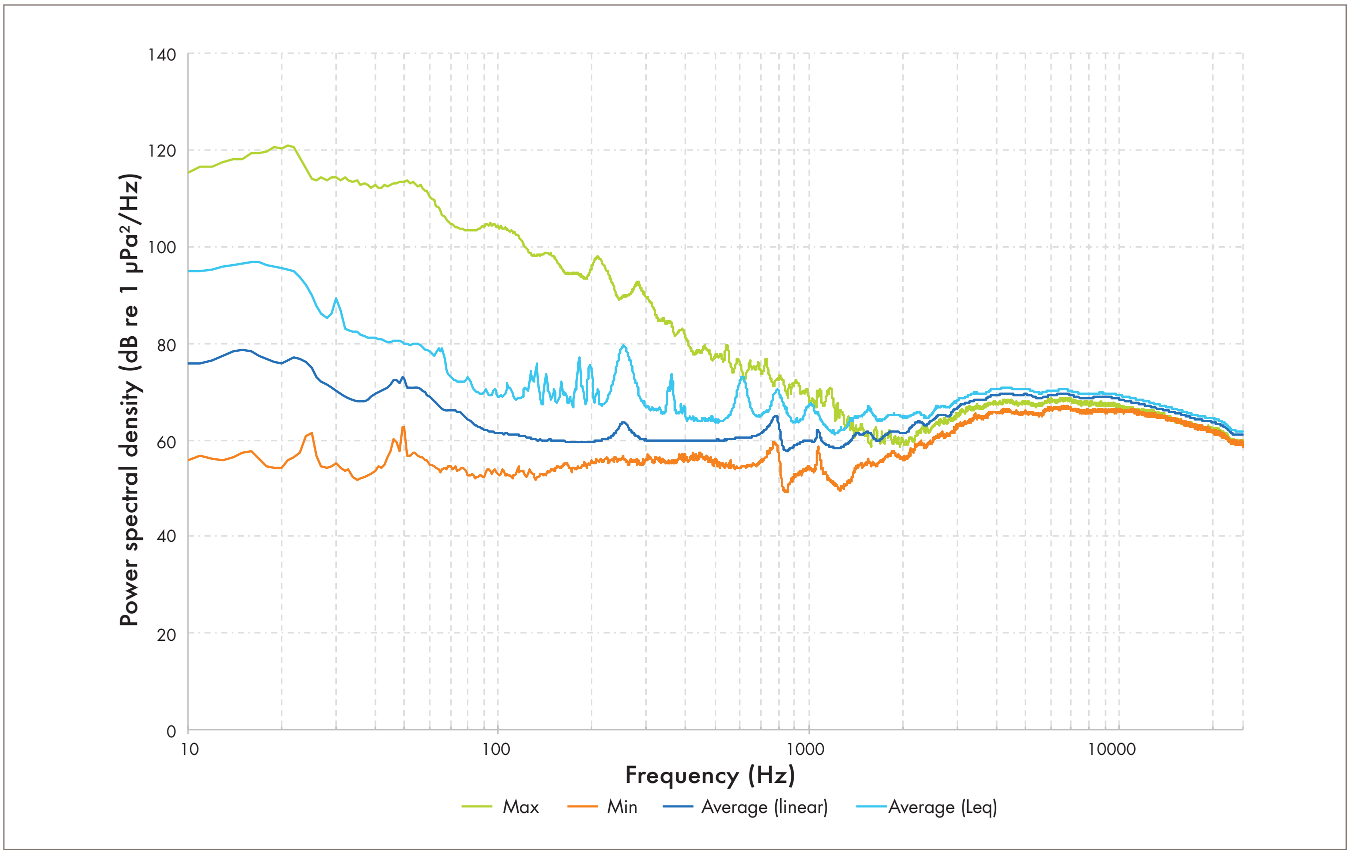


FIGURE 18-8 POWER SPECTRAL DENSITY FOR SELECTED PERIODS

period, which were affected by noise from the boat used for deployment and retrieval. A noise level exceeding 130 dB re 1 µPa was also measured on 14 December. The audio for this period indicates a series of impacts on the hydrophone, possibly from a fish or similar.

A reasonably strong correlation between wind speed and overall sound pressure level was observed as expected from Richardson et al. (1995). One-third octave spectra and power spectral density were also determined for periods with the maximum, minimum and average overall sound pressure levels, and are shown in Figure 18-7 and Figure 18-8 respectively. The average period was determined both as an energy (L_{eq}) average and a linear average of overall sound pressure levels. Averaged spectra are within the expected limits of prevailing noise.

18.4.3 ASSESSMENT METHODOLOGY

As described previously in this chapter, construction activities include dredging and piling, and operational activities include the movement of timber export and other vessels. The following sections describe the approach taken in modelling these noise sources.

Noise modelling

The spreading of source noise throughout the ocean environment is generally modelled using the source-path-receiver model. This model recognises that an underwater noise assessment involves a noise source with particular characteristics, changes in noise characteristics as the noise propagates away from the source, and a receiver with specific hearing or detection capabilities. The transmission path is often not only the straight line between the source and receiver. Multiple transmission paths can occur due to reflections from the surface and sea floor. Furthermore, a rough surface or sea floor causes scattering of the source noise, and the sea floor absorbs some of the noise. As a result, the total sound transmission loss between a source and receiver is typically a combination of various transmission loss mechanisms such as geometrical spreading, absorption, scattering and refraction.

Along the direct path between the source and the receiver, the noise level drops off at 20 $\log_{10}(r)$ with r the distance from the source (the range). This effect is referred to as spherical spreading or the geometric spreading of the sound energy emitted by the noise source. Additional transmission losses (on top of the spherical transmission loss) typically occur due to, for instance, absorption of sound and scattering of sound waves at the surface and sea floor. These transmission loss mechanisms are generally frequency-dependent and depend on the sea floor's geo-acoustic properties and the surface and sea floor roughness.

The total transmission loss between a source and a receiver can also be smaller than the transmission loss due to spherical spreading alone. For example, this occurs when surface and sea floor reflected sound waves interfere at the receiver location such that the noise level is increased; that is, the transmission loss is reduced. For the frequencies important to this assessment, the transmission loss is expected to be less than spherical spreading because the sea surface and sea bed of the study area are highly reflective at the small grazing angles that are important for long-range propagation.

The US Naval Research Laboratory's Range-dependent Acoustic Model (RAM) has been used to compute acoustic propagation via a parabolic equation solution to the acoustic wave equation. The model inputs are bathymetry, sediment properties and sound speed profile. RAM has been extensively benchmarked and is widely employed in the underwater acoustics community. The RAM model is most applicable to low frequencies and shallow water.

Noise levels have been modelled at third octave band frequencies between 12.5 Hz and 2 kHz. The modelled frequency range is considered representative of the noise source and hearing sensitivity of relevant species and is within the accepted range of accuracy of the model.

Noise levels were predicted in five-degree intervals around a 180-degree arc with a radius of 10 km from the source location. The nominal source location is a point approximately 400 metres from the shoreline (at the position of the proposed wharf). Both the source and receivers were modelled at five metres depth.

Other input data

Bathymetry data obtained from Geoscience Australia was used to determine the sea bed depth within the area of interest (Geoscience Australia 2018).

The seabed structure assumed in the RAM model is based on the Assessment of Marine Sediments report (see Appendix F), and the Geotechnical Investigation report (see Appendix C1). This suggests that the seabed consists of sediment (silty sand) to a depth of up to 1.4 metres, overlying a substrate of clay, cobbles, gravel, sandstone, mudstone, and conglomerate of unknown depth. To simplify the calculation steps required within the sound transmission model, a bedrock layer was included below the substrate at a depth of 500 metres. Based on the expected range of water temperature and salinity, the sound speed is not expected to vary significantly with water depth. A constant sound speed of 1506 m/s in water was adopted for this assessment.

Noise sources

Cutter-suction dredging (construction)

Based on previous measurements in the literature, source levels for cutter-suction dredging (CSD) range from 158–187 dB re 1 μPa at one metre depending on the vessel size, activity being undertaken and the environmental conditions at the time of monitoring. A source level of 187 dB re 1 μPa at one metre has been adopted for this assessment, representing worst-case noise levels.

Grab dredging (construction, if required)

There is limited noise data in the literature relating to grab dredging (GD) noise levels. One study (Dickerson et al. 2001), measured noise from various GD activities at a distance of 150 metres. A level of 124 dB re 1 μPa was measured due to bottom contact of the bucket, and 113 dB re 1 μPa during digging of sediment. Assuming a propagation loss of 15 $Log_{10}(r)$, these equate to source levels of 157 and 146 dB re 1 μPa @ 1 metre, respectively.

Backhoe dredging (construction)

Noise sources associated with dredging by means of an excavator on a jack-up barge are essentially the same as for backhoe dredging, with the exception of spud anchoring and 'walking' associated with backhoe dredge pontoons. Source levels are therefore expected to range between 154 and 179 dB re 1 μPa at one metre.

Piling (construction)

Pile driving techniques 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 is impulsive in character with multiple pulses occurring at blow rates in the order of 30–60 impacts per minute. Typical source levels range from SEL 170–225 dB re 1 $\mu Pa^2 \cdot s$ 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 sea bed material and depth
- vibro-driving is 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 further from the source.

For the purposes of this assessment it is assumed that the primary piling methodology is impact piling. On average, around one pile would be installed per day, with a total of approximately 140 piles to be installed. Up to 1800 impacts per day may be expected during piling.

Based on a steel pile diameter of approximately 0.9 metres, a source level of SEL 198 dB re 1 μPa^2·s per impact and a peak level of 225 dB re 1 μPa at one metre have been determined from Rodkin and Pommerenck (2014).

Vessels (construction and operation)

The underwater noise associated with both construction and operational activity varies significantly depending on the type of vessels used and how they are operated. The range of noise from boats is generally SEL 110–195 dB re 1 μPa^2·s. A source level of 170 dB re 1 μPa^2·s has been assumed for this assessment and is considered to represent the upper range of expected vessels. Up to 10 vessel movements a day may be expected during peak times during construction or operation, with the majority of these being smaller boats.

18.4.4 IMPACT ASSESSMENT

Dredging

Figure 18-9 shows predicted levels for CSD in SPL dB re 1 μPa. For comparison with adopted hearing impairment criteria for TTS and PTS in marine fauna, an assumption regarding the duration of exposure must be made. Note that the predicted noise levels for CSD are based on a source level of 187 dB re 1 μPa, which represents the worst-case level, which is unlikely to be generated for significant periods. Furthermore, the species considered in this assessment are mobile and have the ability to move away from a noise source if experiencing discomfort.

Table 18-9 shows the effect of duration on predicted SEL_C noise levels, based on an SPL of 145 dB re 1 μPa (predicted approximately 500 metres from the noise source).

At this distance, noise levels are expected to be less than the temporary shift threshold for the most sensitive category of species (low frequency cetaceans) for an exposure duration of 30 minutes or less to the worst-case CSD noise.

Piling

Figure 18-10 shows predicted peak piling noise levels. The peak levels are expected to be below TTS and PTS thresholds for all mammals, with the exception of very close (less than five metres) to the source, where levels may exceed the TTS threshold for low frequency cetaceans.

TABLE 18-9 EFFECT OF EXPOSURE DURATION ON PREDICTED SEL_C

Exposure duration (minutes)	SEL_c
1	163
5	170
10	173
30	178
60	181

Vessels

Predicted vessel noise levels are based on a worst-case scenario of 10 vessel movements in a day, bearing in mind that vessels are mobile and in-practice would not remain in one location for any significant time. The RAM model does not allow for noise predictions from moving sources. However, the noise level at distance from a single vessel pass-by can be estimated using the relationship SEL receiver = SEL source – 15 $\log_{10}(r)$, where r is the distance to the vessel.

Predicted noise levels using this approach are shown in Table 18-10. It can be seen that predicted levels, even at minimal distances, are significantly below temporary hearing impairment thresholds for the relevant species. At distances beyond 5 km (or 5000 metres) predicted noise levels are in the same order of magnitude as existing ambient levels.

Summary

Based on the adopted noise criteria, the size of the zone of influence was predicted for each of the construction and operational noise sources using the noise propagation modelling results. The results of these predictions are summarised in Table 18-11.

18.4.5 MANAGEMENT AND MITIGATION

The impact assessment has shown impact piling to be the development's highest-impact activity in terms of noise exposure. To mitigate this impact, an appropriate combination of the noise mitigation strategies outlined in Table 18-12 may be adopted. These strategies would be implemented only when they did not cause significant delay or extend the duration of piling activities, because doing so may increase the risk of exposing marine fauna to high noise levels.

TABLE 18-10 PREDICTED NOISE LEVELS WITH DISTANCE FROM A VESSEL

Distance (m)	Predicted noise level, SEL dB re 1 μPa^2 ·s
10	155
50	145
100	140
200	135
500	130
1000	125
2000	120
5000	115
10,000	110

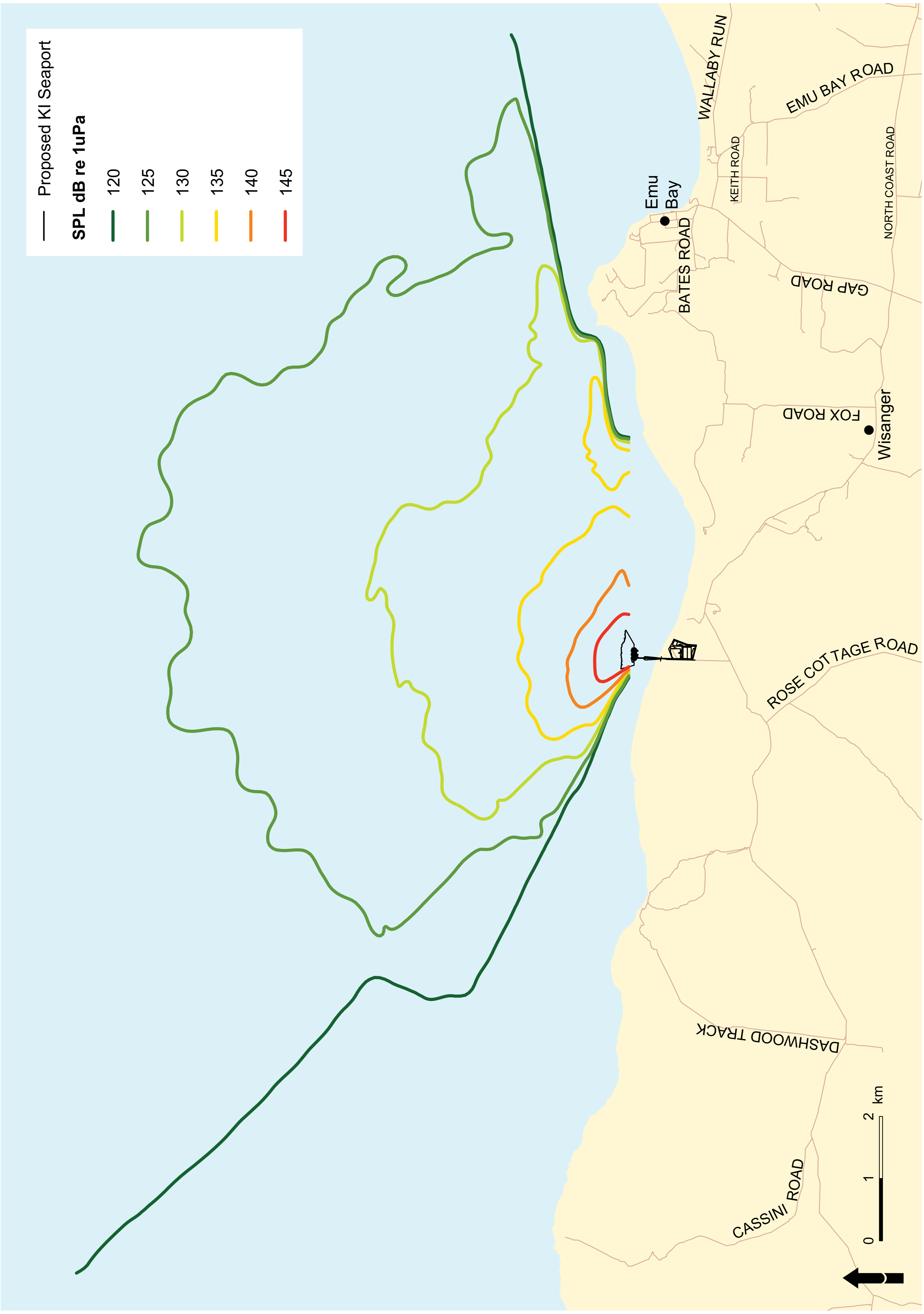


FIGURE 18-9 PREDICTED CUTTER-SUCTION DREDGING NOISE LEVELS (SPL dB re 1 μPa)

TABLE 18-11 SUMMARY OF UNDERWATER NOISE PREDICTIONS SHOWING THRESHOLD DISTANCES

Species	Noise source	Threshold distances (metres)			
		Organ damage	Permanent threshold shift	Temporary threshold shift	Behavioural response
Low-frequency (LF) cetaceans: • blue whale • southern right whale • humpback whale	Dredging	-	-	500(1)	6000
	Piling	-	900	6500	1600(2)
	Vessels	-	-	10	2000
Otariid pinnipeds: • Australian sea-lion	Dredging	-	-	25(1)	6000
	Piling	-	-	110	1600
	Vessels	-	-	-	2000
Fish (no swim bladder): • great white shark	Dredging	-	-	<100	<1000
	Piling	6	6	680	<1000
	Vessels	-	-	<100	<1000
Turtles: • loggerhead turtle • green sea turtle • leatherback turtle	Dredging	-	-	<100	<1000
	Piling	20	<100	<100	<1000
	Vessels	-	-	<100	<1000

(1) Based on an exposure time of 30 minutes to worst-case dredging noise.

(2) TTS and PTS thresholds for low-frequency cetaceans are expressed in SELC, while behavioural response criteria are expressed as RMS noise levels. The SELC descriptor takes into account the assumed duration of exposure and results in a significantly more stringent threshold than RMS criteria, which only consider noise from a single impact. This results in a larger TTS threshold distance than predicted for behavioural response.

TABLE 18-12 POTENTIAL UNDERWATER NOISE CONTROLS

Type of mitigation	Mitigation measure	Details
Operational modifications	Use of alternative piling methods	Low-noise-impact techniques such as suction piling or vibro-piling should be used in preference to impact piling where possible.
	Implement a soft-start procedure at commencement of piling	Impact energy should be gradually increased over 3–5 minutes so noise levels gradually rise to their maximum values. Soft-start procedure should be implemented when piling begins each day; if piling is stopped for longer than three hours; or if piling is stopped due to marine mammals or turtles entering the impact zone where the TTS criterion is exceeded.
	Control construction program to avoid noise exposure	Impact piling should be scheduled to minimise its total practicable duration, to reduce the likelihood that endangered species will be exposed to piling noise. Impact piling should be avoided during the night, when marine mammals are difficult for observers (MMOs) to see. Also, this is the time of day when turtle movements are more likely to occur (Gitschlag & Herczeg 1994). Piling should be scheduled outside the months when cetaceans may be in or near the development area.

TABLE 18-12 POTENTIAL UNDERWATER NOISE CONTROLS (CONT'D)

Type of mitigation	Mitigation measure	Details
Observation	Safety zones	Safety zones typically include observation and shutdown zones. In the observation zone, the movement of marine species should be monitored to determine whether they are approaching or entering the shutdown zone. When a marine species is sighted within or appears to enter the shutdown zone, pile driving should be stopped as soon as is reasonably possible. Safety zones dimensions are based on the radial distance from the noise source. The safety zone areas should be based on the size of the predicted zones of noise impact, but also need to account for practicality of monitoring for the presence of marine fauna. For example, a shutdown zone of greater than 1 km is difficult to monitor. Implementing large safety zones is difficult because their size relative to the shutdown zone makes observations at sea very difficult. For this reason, piling would only occur during daylight hours, to ensure adequate visibility.
	Marine mammal observers (MMOs)	Trained MMOs should be used to monitor safety zones during, and before, all pile driving activities.

18.5 LIGHTING

The KI Seaport would operate 24-hours-a-day, seven-days-a-week and at night external lighting would be needed to:

- enable site activities to be observed
- enable personnel to safely traverse the site
- ensure site security
- provide emergency lighting. This lighting would include different types of illumination and equipment suited to different applications.

The KI Seaport is currently undergoing detailed design, including the design and layout of the lighting and at this time a detailed lighting assessment for the KI Seaport has not been undertaken. All lighting would be designed and installed in compliance with relevant Australian Standards for lighting. The following sections qualitatively outline the existing lighting environment in Smith Bay, relevant legislation and standards and the conceptual basis of design for KI Seaport lighting.

18.5.1 REGULATORY ENVIRONMENT

There is no specific legislation related to light emissions in South Australia. Section 25 of the *Environment Protection Act 1993* (SA) sets out the general environmental duty as:

> *A person must not undertake an activity that pollutes, or might pollute, the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm.*

However, the notion of harm is difficult to correlate with impacts to the amenity of neighbours. Under common law, a legal nuisance involves a substantial, unreasonable and repeated or ongoing interference with the use or enjoyment of a neighbour's land. It is for the court to decide what is substantial and unreasonable, and this will often depend on the nature of the local area. For example, noisy or smelly factories will not normally be regarded as causing a nuisance if they are sited in industrial areas. Nor will it be a nuisance if the occupier who suffers the damage has put up with it without complaint for a long time, or if the occupier suffered the damage because of an unusual sensitivity (for example, unusually delicate plants).

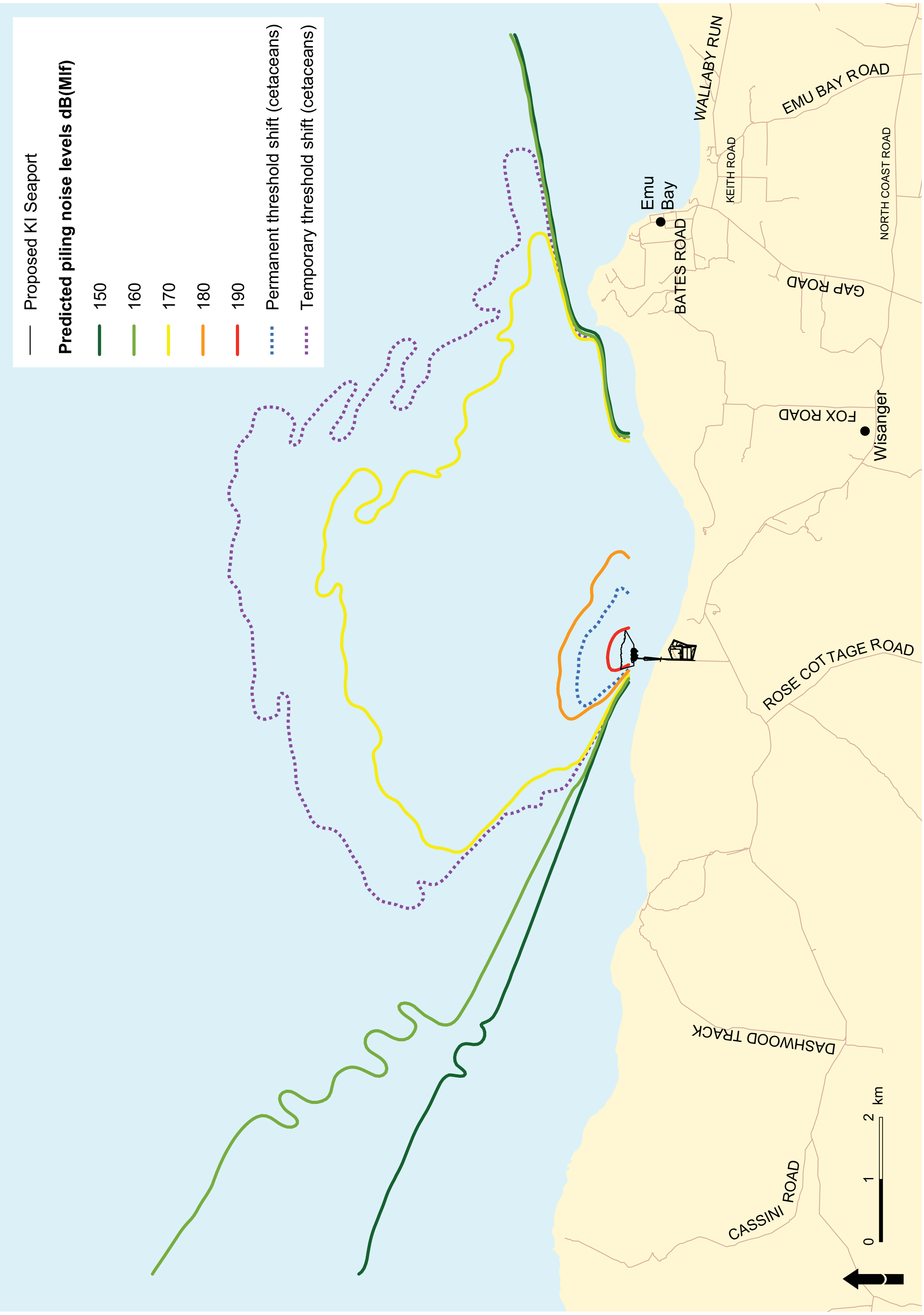


FIGURE 18-10 PREDICTED PILING NOISE LEVELS (PEAK dB re 1 μPa)

To mitigate against the potential for causing unreasonable nuisance, the KI Seaport would comply with the requirements of AS4282-1997: Control of the obtrusive effects of outdoor lighting. This standard provides guidance for development relative to property boundaries, and states:

> *With any outdoor lighting it will rarely be possible to contain all light within the boundaries of the property on which the lighting system is installed. Some light will inevitably be spilled outside the property boundaries, either directly or by reflection. The determination of when the spill light becomes obtrusive to others is difficult since both physiological and psychological effects are involved.*

The objective of this standard is to provide a common basis for assessing the likely effects of developments that involve outdoor lighting.

18.5.2 EXISTING ENVIRONMENT

The major source of artificial lighting at Smith Bay is associated with the existing land-based aquaculture operation, adjacent to the proposed KI Seaport. It is continuously lit during the night, illuminating the beachfront north of the facility, the vacant land between the aquaculture facility and the proposed KI Seaport and the abalone tanks themselves. Light spill from the current aquaculture operation current encroaches on the proposed KI Seaport site.

The dwelling currently located on the proposed KI Seaport site (which would be demolished) is also an existing source of light when occupied, which in intermittent.

Other minor lighting sources include the two nearby residences, both of which have occasional lighting that is generally turned off late in the evening, and the lights of vehicles using North Coast Road. Vessels are infrequent night-time visitors to Smith Bay, although shipping and navigation lights may be seen as vessels traverse Investigator Strait.

18.5.3 SEAPORT LIGHTING

The final design and specification of lighting for the KI Seaport would be developed during a detailed design phase. KIPT would base this design on the guidance provided in AS4282, as detailed in the following sections.

Examination of alternatives

Before arriving at the final design, consideration would be given to alternative lighting systems with respect to their capability of fulfilling both the functional and environmental design objectives.

Location of illuminated area/activity

When there is some flexibility about where an illuminated area/activity can be sited, it would be located and oriented where it would have the least effect on existing or potential developments. This would take into account any screening which may be provided by the surrounding topography or other physical features such as buildings, trees or earth embankments, including those proposed to be installed by KIPT.

Selection of floodlights

The selected luminaires (also known as light fixtures) would have a light output distribution appropriate for the application and would not emit excessive light outside the property boundaries. Where necessary, consideration would be given to adding louvres, baffles or shields to floodlights to control spill light where this did not significantly influence the performance of the lighting system.

Siting and aiming of floodlights

Floodlight locations are often determined by the nature of the activity for which the lighting is provided. Small departures from the recommended positions may be acceptable if this would result in a greater degree of control of the spill light; however, excessive departures to suit environmental needs may negate the effectiveness of the lighting installation for its intended purpose. As the amount of light reduces in proportion to the inverse of the square of the distance from the floodlight, it follows that the further the floodlights can be set back from the property line, the lower will be the amount of light spill at and beyond the property line. The objective of the design would be to ensure that, as far as was practicable, direct view of the bright parts of the floodlights is prevented from positions of importance at eye-height, on neighbouring properties.

When determining the mounting height of the lights, the following would be considered:

- higher mounting heights can often be more effective in controlling spill light because floodlights with a more controlled light distribution (a narrower beam) may be used and the floodlights may be aimed in a more downward direction, making it easier to confine the light to the design area
- lower mounting heights may have the advantage of making a lighting installation less obtrusive by day but can accentuate its effect on the night environment by:
  - increasing the light spill beyond the property boundaries because, to illuminate the space satisfactorily, it will often be necessary to use floodlights with a broader beam and to aim them more horizontally than may be required if the lights were positioned higher
  - making bright parts of the floodlights more visible from positions outside the property boundary.

18.5.4 IMPACT ASSESSMENT

Generally, the potential effects of lighting on occupants of surrounding properties and on transport users in the vicinity of the installation including the following:

- changes to the amenity of an area due to the intrusion of spill light into otherwise dark areas, both outdoors and indoors, and to the direct view of bright lights
- glare from bright lights making it harder for road users to clearly see the route ahead, including signalling systems and traffic signs
- changes to night sky viewing conditions due to a general luminous glow caused by the scattering of light in the atmosphere.

People will have a range of reactions to the installation of outdoor lighting; responses may vary from positive acceptance to outright rejection. The degree of response will depend, in part, on the nature of surrounding developments, past experiences, novelty of the installation, and frequency and times of operation.

Effects on residents generally involve a perceived change in amenity arising from either of the following:

- the illumination from spill light being obtrusive, particularly where the light enters rooms that are normally dark, such as bedrooms. The illuminance on surfaces, particularly vertical surfaces, is an indicator of this effect
- the direct view of bright lights causing annoyance, distraction or even discomfort.

KIPT would design the lighting system to avoid or minimise the potential for these two impacts to occur. With the implementation of the design measures, it is assessed that obtrusive light will be minimised. This is due to the reduction in inclination angle and subsequent glare associated with the major lighting structures.

Occupiers of the two nearby residences may be sensitive to changes in lighting due to the properties' generally dark surroundings. However, existing lighting provides a visual reference for the proposed lighting system at the new facility and, for the residence south-east of the site, KI Seaport's lights would likely blend into the existing lighting.

Lighting effects on the nearby aquaculture facility are not expected to be material, as this facility is currently well lit at all hours of the day, with black shade cloth provided over the tank houses to diffuse sunlight to a level equivalent to the natural lighting generally encountered by abalone (Yumbah 2018b) and internal lighting operating at night.

The addition of plant and infrastructure lighting is likely to result in the localised concentration of insects that may result in a change in the feeding habits of terrestrial fauna, particularly bats and avian fauna. This is unlikely to result in negative impacts, rather numbers have the potential to increase, but the flow-on effects of these on the wider ecological community are difficult to quantify. The effects of light emissions are poorly studied and there exists significant uncertainty associated with the expected impacts. In the context of existing industrial lighting in the area, impacts are not, however, predicted to be significant.

18.6 CONCLUSIONS

18.6.1 TERRESTRIAL NOISE AND VIBRATION

Terrestrial noise impacts have been assessed in accordance with the Kangaroo Island Council Development Plan and the Noise EPP, at all noise-affected premises. The modelling and assessment considers baseline noise levels, attenuation of noise due to distance; barrier effects from buildings, topography and the like; air absorption; ground effects; and worst-case meteorological conditions.

Without mitigation, operational noise levels at the KI Seaport are predicted to comply with the daytime noise criterion and slightly exceed the night-time criterion at the nearest residential receptors. With the application of some controls described previously, operational noise emissions are expected to comply with daytime and night-time criteria at all residential receptor locations.

Noise levels are predicted to exceed the noise planning criteria at the nearby aquaculture facility, however this is not expected to be material based on an assessment of the current operations at the facility and the measured and predicted noise levels currently associated with this facility. Noise mitigation measures will be investigated during detailed design to ensure noise levels from the KI Seaport are as low as reasonably achievable.

Noise levels associated with port construction are expected to be similar to operational levels. Provided the majority of construction work is carried out during normal hours, and reasonable and practicable steps are taken to minimise noise, compliance with Division 1 of the Noise EPP can be readily achieved.

18.6.2 UNDERWATER NOISE AND VIBRATION

Underwater environmental impacts have been assessed based on the existing conditions (such as ambient noise environment, local bathymetry, wave and wind climate); the significant marine species in the study area; the significance of the area as a habitat for marine species; the species' sensitivity to sound; the characteristics of the identified noise sources in terms of duration, source level and frequency; and the sound propagation characteristics of the marine study area. Significant underwater noise sources associated with construction and operation of the port are dredging, piling and shipping.

The potential impacts that have been considered in the risk assessment are, in increasing order of severity, behavioural change, temporary threshold shift in marine species' hearing, permanent threshold shift in hearing, and organ damage (possibly leading to death). To assess the impacts of the construction and operational sources, noise criteria have been established for each of the considered impact levels.

The adopted underwater noise criteria are based on NOAA Marine Mammal Acoustic Technical Guidance and the Sound Exposure Guidelines for Fishes and Sea Turtles. These represent the most up-to-date research and approach for the species considered in this assessment and are generally more stringent than the DPTI Underwater Piling Noise Guidelines.

Without mitigation, the overall risk of adverse noise effects on the relevant marine species is low, except for a medium level of risk associated with impact piling potentially resulting in PTS in southern right whales.

To minimise the environmental impacts of underwater noise, the following mitigation and management strategies may be implemented:

- using alternative piling methods
- implementing a soft-start procedure when piling begins
- controlling the construction program to avoid noise exposure, including scheduling piling to occur outside the months when cetaceans may be present in the area
- establishing safety and shut-down zones, and using marine mammal observers to monitor the presence of relevant species.

With these controls in place, the impacts from underwater noise associated with construction are likely to be minimal.

18.6.3 LIGHT

A qualitative assessment of the potential impacts associated with light emissions has been presented, outlining the basis for the proposed KI Seaport lighting design that may be implemented to avoid or reduce the obtrusive effects of outdoor lighting associated with the development.

Occupiers of the two nearby residences may be sensitive to changes in lighting due to the properties' generally dark surroundings. However, existing lighting from the nearby onshore aquaculture facility provides a visual reference for the proposed lighting system at the new facility and, for the residence south-east of the site, the KI Seaport's lights would likely blend into the existing lighting.

Lighting effects on the nearby aquaculture facility are not expected to be material, as this facility is currently well lit at all hours of the day, with black shade cloth provided over the tank houses to diffuse sunlight to a level equivalent to the natural lighting generally encountered by abalone (Yumbah 2018b) and internal lighting operating at night.

Effects on terrestrial fauna are difficult to quantify with certainty, however an increase in the concentration of insects associated with the lighting is expected to result in an increase in avian fauna and bat numbers. The impact is expected to be insignificant in the context of existing security lighting already installed in the area.

19. CLIMATE CHANGE AND SUSTAINABILITY

Guideline		Comment
13.1	Outline the potential effects of climate change on the proposed development (including predicted sea level rise in line with Coast Protection Board allowances) from a risk management perspective, including adaptive management strategies.	See Sections 19.3 and 19.4.4
13.2	Identify strategies to protect the causeway and wharf structures from extreme weather events, including a 1-in-50-year event, and to include mitigation strategies should the structure not withstand such an event.	See Section 19.4.4
13.3	Describe measures to minimise, reduce and ameliorate greenhouse gas emissions, particularly the use of alternative or renewable energy sources and offsets, energy efficiency and energy conservation measures, and identify barriers to their implementation	See Section 19.4
14.8	Identify the flooding and erosion risks to the site (including flooding and erosion exacerbated by sea level rise and extreme weather events) and measures to reduce the risks.	See Section 19.3 and 19.4.4

19. CLIMATE CHANGE AND SUSTAINABILITY

19.1 INTRODUCTION

19.1.1 GUIDELINE REQUIREMENTS

The proposed KI Seaport includes elements adjacent to, and within, the coast and sea bed. Measures would be required to protect the proposed infrastructure from the expected long-term impacts of a changing climate, and to reduce any greenhouse gas emissions associated with its construction and use. This chapter addresses elements of the guidelines related to greenhouse gases and climate change.

19.1.2 CLIMATE CHANGE

Climate change refers to the long-term change in the average pattern of weather over time (the climate). Earth's climate has varied enormously many times since the planet formed 4.5 billion years ago; it has been both warmer and cooler than today, driven by changes in the sun's intensity, Earth's orbit around the sun, the changing configuration of continents and oceans, and natural variations in the level of greenhouse gases in the atmosphere (SA EPA 2017).

Earth's climate is powered by solar radiation. In periods of climatic stability, incoming solar energy is in balance with outgoing radiation (Cubasch et al. 2013). Gases in Earth's atmosphere that selectively absorb radiation are termed greenhouse gases, and have a propensity to transmit incoming solar radiation and absorb outgoing radiation.

The Intergovernmental Panel on Climate Change (IPCC) has concluded:

> *Warming of the climate system is unequivocal, and since the 1950s many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and sea level has risen.*
>
> *Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of greenhouse gases (specifically carbon dioxide, methane and nitrous oxide) that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely to have been the dominant cause of the observed warming since the mid-20th century.*
>
> *In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans. Impacts are due to observed climate change, irrespective of its cause, indicating the sensitivity of natural and human systems to changing climate. Changes in many extreme weather and climate events have been observed since about 1950. Some of these changes have been linked to human influences, including a decrease in cold temperature extremes, an increase in warm temperature extremes, an increase in extreme high sea levels and an increase in the number of heavy precipitation events in a number of regions.*

19.2 REGULATORY SETTING

The national, state and local regulatory environment is described in the following sections.

19.2.1 LOCAL REGULATORY ENVIRONMENT

Greenhouse gas and climate change policy at a local level is directed through the actions of the Natural Resources Management (NRM) Board for Kangaroo Island (Natural Resources Kangaroo Island, [NRKI]), which delivers a range of programs and projects on behalf of the regional NRM board and the Department for Environment and Water.

Together, NRKI and the Kangaroo Island Council have developed a Climate Change Position Statement that sets out a vision for managing the causes and effects of climate change (NRKI 2014). Specifically, it states:

> *The Kangaroo Island community is working together to mitigate and adapt to climate change and is innovative and open-minded in identifying solutions, embracing opportunities for positive change. We think outside the square, are well informed, and make decisions that do not limit future options. Taking advantage of the opportunity offered by our iconic status, intact*

landscape and self-reliant and resilient community, Kangaroo Island thrives and sets the example for others to learn from and follow.

To achieve this vision, NRKI and the Kangaroo Island Council will:

- recognise the reality of human-induced climate change
- accept responsibility for demonstrating suitable leadership on this critical issue in our region, and lead by example in the conduct of their business
- ensure that climate change projections inform their work and that the best available science and knowledge underpin their decisions.

19.2.2 STATE REGULATORY ENVIRONMENT

The State Government's climate change policy is outlined in South Australia's Climate Change Strategy 2015–2050 (DEWNR 2015). The strategy includes five targets established to guide action over the coming decades:

- South Australia will achieve net zero emissions by 2050.
- Adelaide will be the world's first carbon-neutral city.
- South Australia will achieve $10 billion in low-carbon investment by 2025.
- South Australia will generate 50 per cent of its electricity from renewable sources by 2025.
- South Australia will improve the energy efficiency of government buildings by 30 per cent above 2001 levels by 2020.

The policies and programs which support the strategy are presented according to the following themes:

- South Australia leading on climate change
- towards net zero emissions
- carbon-neutral Adelaide
- innovating to drive a resilient and competitive low-carbon economy
- creating a prosperous and resilient state
- building community capacity to act.

19.2.3 COMMONWEALTH REGULATORY ENVIRONMENT

On 10 November 2016, Australia ratified the Paris Agreement and the Doha Amendment to the Kyoto Protocol, reinforcing Australia's commitment to action on climate change. Australia has a comprehensive suite of policies to reduce domestic emissions and support effective international efforts. At the same time the Government is working to maintain energy security and affordability. Its climate change plan includes:

- reducing emissions by five per cent below 2000 levels by 2020
- reducing emissions by 26–28 per cent below 2005 levels by 2030
- doubling Australia's renewable energy capacity by the end of 2020
- boosting energy productivity by 40 per cent by 2030
- ensuring Australia's largest emitters continue to reduce emissions
- helping to expand and protect green spaces and iconic places such as the Great Barrier Reef
- spurring businesses, communities, households and individuals into ongoing action to reduce emissions
- investing in innovation and clean technology to help capture the opportunities of a cleaner future
- managing climate risks by building resilience in the community, economy and environment.

These goals are underpinned by a range of policies and programs designed to promote action on climate change.

19.3 EXISTING ENVIRONMENT

The existing meteorological environment and prevailing climate for the Smith Bay region are presented in Chapter 17 – Air Quality. The following sections focus on the likely changes within the Smith Bay region as a result of climate change, presenting a summary of work undertaken by Resilient Hills and Coasts (2015), taking into account the latest IPCC climate change modelling across a variety of Representative Concentration Pathways (RPCs) models, specifically:

- RCP2.5 'Peak and decline scenario' – an emissions pathway leading to very low greenhouse gas concentration levels; a so-called 'peak' scenario (radiative forcing (that is, the change in energy within the atmosphere as a result of greenhouse gas emissions) peaks at approximately 3 watts per square metre (W m^2) before 2100 and then declines).
- RCP4.5 'Intermediate, stabilisation scenario' – an emissions pathway where the impact of climate change on the atmosphere is stabilised before 2100 by using a range of technologies and strategies for reducing greenhouse gas emissions (radiative forcing stabilises at approximately 4.5 W m^2 after 2100).
- RCP6.0 'Intermediate, stabilisation scenario' – an emissions pathway where the impact of climate change on the atmosphere is stabilised after 2100 by using a range of technologies and strategies for reducing greenhouse gas emissions (radiative forcing is stabilised at approximately 6.0 W m^2 after 2100).
- RCP8.5 'High-emissions scenario' – An emissions pathway characterised by increasing emissions over time, leading to high greenhouse gas concentration levels.

In summary, under RCP4.5 (as the most likely intermediate emissions scenario) the following changes in climate are predicted for Kangaroo Island by 2070:

- rainfall totals to fall by 7.9 per cent
- rainfall intensity to rise by 8 per cent
- average maximum temperatures to rise by 1.2ºC
- average minimum temperatures to rise by 1.0ºC
- sea levels to rise by 33 cm by 2070, with a corresponding average increase in sea surface temperatures of 1.2°C by 2090.

A summary of the projected annual climate change is presented in Table 19-1.

19.3.1 RAINFALL AND RAINFALL INTENSITY

Total rainfall is predicted to decrease across all climate change scenarios. Under intermediate and high-intensity scenarios, annual rainfall in Kingscote is expected to drop from the current average of 489 mm to around 450 mm and 428 mm, respectively, by 2050. Spring will be the season most affected, with a 13.9 to 23.8 per cent reduction, depending on scenario, and winter the least affected, with a 4.7 to 5.1 per cent reduction.

Rainfall is projected to be heavier under all scenarios, with increases of 8 and 9 per cent, respectively, in maximum daily falls by 2050 under the intermediate and high-intensity scenarios. This increases to 8 and 13 per cent by 2070.

19.3.2 TEMPERATURE

Temperatures on Kangaroo Island are projected to rise under all emissions scenarios. Compared to current temperatures, maximums are predicted to rise by 1.1°C and 1.2°C by 2050 and 2070, respectively, under the intermediate-emissions scenario, and by 1.3°C and 1.9°C under the high-emissions scenario. Seasonal differences in effect size are minimal, with temperatures increasing relatively uniformly across the year.

Minimum (overnight) temperatures are also predicted to increase under all scenarios, with rises of between 0.7°C and 1.2°C by 2050 under the intermediate and high-emissions scenarios, with little seasonal variation in the distribution of the increase.

19.3.3 HEAT EXTREMES AND FIRE DANGER WEATHER

Kangaroo Island is likely to experience more extreme heat days (those over 35°C). In Victor Harbor (the nearest location to Smith Bay to be modelled), the number of days over 35°C is predicted to increase from the current average of 7 up to 10 such days under the intermediate scenario by 2050, and to 11 by 2070. The number of days of extreme heat would increase to 14 by 2070 under the high-emissions scenario. Victor Harbor has never recorded a day over 40°C but is projected to have one to one and a half such days a year by 2050 and up to two days a year by 2070.

Using the McArthur Forest Fire Danger Index, the number of severe fire danger days on KI is expected to increase from 1.7 a year in 1995 to 2.6 in 2030 and 4.0 in 2090.

TABLE 19-1 SUMMARY OF PROJECTED ANNUAL CLIMATE CHANGE FOR KANGAROO ISLAND

Scenario	2030	2050	2070	2090
Rainfall (changes in %)				
RCP4.5	-3.6 (-8.3 to -2.3)	-7.5 (-10.2 to -4.5)	-7.9 (-13.2 to -6.2)	-8 (-11.3 to -5.4)
RCP8.5	-5.9 (-8.8 to -3.1)	-8.9 (-13.9 to -3.8)	-12.5 (-22.2 to -9.7)	-16.9 (-26.4 to -13.3)
Maximum Temperature (changes in °C)				
RCP4.5	0.7 (0.6 to 0.8)	1.1 (0.8 to 1.2)	1.2 (1 to 1.5)	1.4 (1.1 to 1.9)
RCP8.5	0.8 (0.6 to 1.1)	1.3 (1.1 to 1.8)	1.9 (1.7 to 2.6)	2.6 (2.3 to 3.6)
Minimum Temperature (changes in °C)				
RCP4.5	0.6 (0.4 to 0.7)	0.8 (0.6 to 1.1)	1.0 (0.7 to 1.4)	1.2 (0.9 to 1.7)
RCP8.5	0.7 (0.5 to 0.9)	1.1 (0.9 to 1.6)	1.6 (1.5 to 2.3)	2.2 (2 to 3.1)
Sea Level Rise (changes in m)				
RCP2.5	0.12 (0.07 to 0.16)	0.21 (0.13 to 0.28)	0.30 (0.18 to 0.42)	0.38 (0.23 to 0.55)
RCP4.5	0.12 (0.08 to 0.16)	0.22 (0.14 to 0.30)	0.33 (0.21 to 0.46)	0.45 (0.28 to 0.63)
RCP6.0	0.11 (0.07 to 0.16)	0.21 (0.13 to 0.29)	0.32 (0.20 to 0.45)	0.46 (0.28 to 0.64)
RCP8.5	0.13 (0.08 to 0.17)	0.24 (0.16 to 0.33)	0.40 (0.26 to 0.55)	0.60 (0.39 to 0.83)

19.3.4 SEA SURFACE TEMPERATURES AND SEA LEVEL RISE

As global air temperatures increase, so too does the sea surface temperature, resulting in thermal expansion of the water leading to increases in sea level. Projections for Victor Harbor indicate that sea surface temperatures may increase by 0.5°C by 2030, and by 1.2°C and 2.2°C by 2090 under the intermediate- and high-emissions scenario, respectively.

This is expected to result in a sea level increase of 11 cm and 13 cm under the intermediate- and high-emissions scenario by 2030, and 33 cm and 40 cm by 2070 under the same scenarios. The peak predicted sea level rise by 2090 is 83 cm under the upper range of the high-emissions scenario.

19.4 IMPACT ASSESSMENT AND MANAGEMENT

19.4.1 CARBON SEQUESTRATION IN PLANTATIONS

Trees remove carbon dioxide from the atmosphere through a process called photosynthesis. This process involves plant cells converting the carbon from carbon dioxide to a solid form in sugars (the carbohydrates glucose and starch) that can be stored in leaves, stems, trunks, branches and roots, and contribute to tree growth. Oxygen is released back into the atmosphere as a by-product of photosynthesis.

Carbon constitutes approximately 50 per cent of the dry mass of trees, and when trees are used to make wood products the carbon is stored for life in those products. This carbon storage lasts approximately 100 years in house frames, 30 years in furniture and railway sleepers and six years in pallets and paper (noting that increased rates of paper and cardboard recycling have the capacity to extend the sequestration period associated with these products).

Stored carbon is released back to the atmosphere only when the wood product is burned or decays.

The amount of carbon stored in trees depends on a number of factors, including species, growth conditions in the environment, tree age, and density of surrounding trees. Typically, one tonne of green timber consists of 35 per cent (350 kg) water and 65 per cent (650 kg) solid mass. Of this, about 50 per cent (325 kg) of the solid mass is carbon. To determine the equivalent amount of carbon dioxide (note one tonne carbon equals 3.67 tonnes of carbon dioxide), the carbon figure is multiplied by a factor of 3.67 (325 x 3.67), equating to 1193 kg of CO_2-e.

The estimated total mass of product timber in the KIPT-managed plantations is approximately 3.87 million tonnes of hardwood and 0.71 million tonnes of softwood. Conservatively estimating that product timber comprises 80 per cent of the total green mass, the total carbon sequestration of the KIPT-managed plantations is approximately 6.8 million tonnes of CO_2-e. As individual plantations would be replanted or coppiced following harvesting, this amount of sequestration would remain relatively constant over the life of the operation. Infill planting and estate expansion has the capacity to increase the amount of carbon sequestered as standing timber, while still producing timber products that themselves sequester carbon for various periods up to 100 years.

The majority of KIPT-generated hardwood product would be used for Dissolving and Kraft pulp (paper and related products) production, while the majority of the softwood product would be used to manufacture housing construction materials.

19.4.2 GREENHOUSE GAS EMISSIONS

Methodology

Predicted direct (Scope 1) greenhouse gas emissions from project activities have been calculated in accordance with the National Greenhouse Accounts Factors – July 2017 (DoEE 2017a), using estimates of fossil fuel consumptions associated with on-site materials handling equipment and electricity generation during the worst-case operations phase. It is estimated that, at peak throughputs, KI Seaport would consume up to 500,000 litres of diesel a year directly, assuming that there is no connection to the Kangaroo Island electricity grid. Should KI Seaport gain access to the grid, greenhouse gas emissions are likely to be significantly less than presented here as a result of the relatively high proportion of renewable electricity in the South Australian generation mix.

The major Scope 3 (indirect) emissions associated with the project (that KIPT has an ability to influence) would be generated from the transport of timber products from the plantations to KI Seaport. Other Scope 3 emissions (including the transport of timber products to their destination markets and workforce travel to and from site) are considered to be either beyond the control of KIPT or negligible in the context of the main two sources of Scope 3 emissions. The assumptions informing the assessment of Scope 3 emissions are:

- timber transport from the plantations to KI Seaport requires 24,300 two-way vehicle movements annually for the highest throughput year using standard semi-articulated trucks with 30-tonne payload capacity
- the average journey length from plantation to port is 70 km (one-way)
- the average specific fuel consumption for a semi-articulated truck fleet is 71.5 L/100 km (average of loaded and unloaded fuel consumptions, ARTSA 2012).

Total peak annual (Scope 3) diesel consumption is therefore 2.43 ML.

Emissions

Peak emissions of greenhouse gases during operations are detailed in Table 19-2.

19.4.3 IMPACT ASSESSMENT

The estimate of greenhouse gas emissions during operations is detailed in Table 19-2. These have been compared to existing and projected emissions estimates for South Australia and Australia to put the values in context. This is detailed in Table 19-3.

The results demonstrate that the project would produce a negligible change in South Australian and Australian emissions projections.

19.4.4 MITIGATION AND MANAGEMENT

Greenhouse gas mitigation

Notwithstanding its very small relative contribution to South Australian and Australian greenhouse gas emissions, KIPT is committed to reducing its carbon footprint to as low as is reasonably achievable. To help achieve this goal, the following mitigation and management measures are proposed to be investigated during detailed design:

- minimising electricity consumption through the use of energy-efficient infrastructure such as low-friction conveyors, lighting and air-conditioning
- investigating the installation of solar photovoltaic panels to supply electricity to site buildings and for site lighting, minimising the potential for downtime associated with power outages under peak load situations
- maintaining regular maintenance schedules for site vehicles and timber transport trucks to ensure they remain compliant with relevant legislation and operate as efficiently as possible
- seeking to use grid electricity wherever possible and increase the use of renewably-generated electricity, to reduce the reliance on diesel-powered on-site generation
- use of the most efficient permissible haulage vehicle configuration
- use of the most direct permissible haulage route.

In addition, while outside the scope of consideration, KIPT and its offtake partner Mitsui & Co would also seek to use the largest and most efficient seagoing timber vessels possible and to use shiploading methods that achieve worlds'-best practice in hold compaction, to minimise the fossil fuel consumption associated with delivery of its timber products to market.

TABLE 19-2 ESTIMATION OF GREENHOUSE GAS EMISSIONS DURING OPERATIONS

Scope	Source	Volume/amount consumed	Energy content	Emission factor	Emission (t CO_2-e per annum)
1 (direct)	Materials handling fleet and on-site electricity generation	500 kL/annum	38.6 GJ/kL	70.5 kg CO_2-e/GJ	1360
3 (indirect)	Timber products transport fleet	2430 kL/annum	38.6 GJ/kL	3.6 kg CO_2-e/GJ	340
				TOTAL	**1700**

TABLE 19-3 PROJECT-RELATED GREENHOUSE GAS EMISSIONS IN A SOUTH AUSTRALIAN AND NATIONAL CONTEXT

Year	Emission (t CO_2-e per annum)	South Australian Emissions		Australian Emissions	
		Mass (Mt)	Proportion (%)	Mass (Mt)	Proportion (%)
Current	1700	30.1+	0.005	543.3++	0.0003
2020	1700	25*	0.007	599**	0.0003
2030	1700	24*	0.008	592**	0.0003

+ DoEE 2015

++ DoEE 2017b

* DEWNR 2015 (business as usual scenario)

** DoEE 2016

Climate change management

The following design and management measures have been identified to minimise the potential impacts to KI Seaport infrastructure and operations as a result of climate change:

- designing marine and coastal infrastructure to take into account the predicted worst-case sea level rise and sea temperature rise. Under a worst-case emissions scenario, the predicted sea level rise at Smith Bay is up to 0.17 metres by 2030, up to 0.33 metres by 2050, up to 0.55 metres by 2070 and up to 0.83 metres by 2100. In accordance with the Coastal Protection Board (CPB) Policy Document dated 29 July 2016, a sea level rise of 0.3 metres to 2050 would be adopted in the causeway design. For the purposes of the KI Seaport, substantiated sea level rise beyond the 0.3-metre prediction would necessitate upgrades, including raising of the causeway height and potential modifications of its profile. Piles established during the initial construction phase would be designed for predicted maximum sea level rise to 2100. This would prevent the flooding of infrastructure and ensure that construction materials were adequate for the predicted sea temperature and acidity changes. Consideration would also be given to the predicted increase in storm intensity and frequency
- designing the causeway structure for a 1-in-500-year storm event (that is, a 10 per cent encounter probability over the 50-year life of the structure) on the basis that the wave modelling undertaken demonstrates that the additional engineering required to meet this standard is not significantly greater than for lesser storm event frequencies. Causeway maintenance (for example, replacement of a small percentage of armour rocks) would be required after major storm events
- determining the size of surface water catchments, including sedimentation ponds and drainage/diversion infrastructure, by considering the likely worst-case changes in the magnitude and duration of rainfall events, to prevent below-quality water being discharged to the environment
- ensuring that construction materials for onshore infrastructure were designed to cope with the expected change in surface temperatures and different wind conditions associated with increased storm intensity and frequency
- considering emergency response requirements to acknowledge the predicted increase in the number of severe fire danger days, and the exposure of the workforce to work-induced heat stress
- designing habitable buildings to promote passive cooling, thereby reducing energy demands and providing respite for the workforce during extreme heat days
- minimising on-site water requirements by investigating alternative sources of industrial water to meet needs such as for dust suppression. This would reduce the risk of supply shortages that may occur as a result of greater evaporation rates and/or higher consumption associated with warmer weather
- use of a floating pontoon for the berth face itself, to ensure that the wharf height above water is maintained at a constant level despite predicted changes in sea level.

19.5 CONCLUSIONS

The proposal has been reviewed in the context of the expected climate change and the projected emissions as a result of proposed KI Seaport activities.

In summary, under a medium-emissions scenario, the following climate changes are predicted for Kangaroo Island:

- rainfall totals down 7.9 per cent
- rainfall intensity up by 8 per cent
- average maximum temperatures up by 1.2ºC
- average minimum temperatures up by 1.0ºC
- sea levels 33 cm higher by 2070, with a corresponding increase in sea surface temperatures of 1.2°C by 2090.

Carbon sequestration associated with the KIPT-managed plantations is estimated to total approximately 6.8 million tonnes of CO_2-e, a value which would remain relatively constant over the life of the operation as harvested plantations were replanted and/or coppiced for subsequent rotations.

Emissions as a result of the KI Seaport are expected to be no greater than 1700 tonnes of CO_2-e annually, which represents a negligible change to current projections for South Australia and Australia, and is a small fraction of the CO_2-e sequestered in KIPT plantation assets. As a result, no negative impacts as a result of a change in greenhouse gas emissions are predicted.

20. ECONOMIC ENVIRONMENT

Guideline		Comment
	The proposal is likely to generate jobs on Kangaroo Island, directly and indirectly, during both the construction and operational phases of the proposed development. Given the proximity to the nearby existing aquaculture operation, consideration needs to be given to how the proposed development and use of the port and wharf may impact on the operation of this established business, and how any such impacts will be managed. As the facility is proposed to be multi-user facility, this may have potential positive impacts on other components of the Kangaroo Island economy.	The impact of the proposed development on the nearby land-based aquaculture operation, and the options to mitigate any impacts, is discussed in full elsewhere in the EIS, including Chapter 11, and is not repeated in this chapter. The potential for the facility to be a multi-user facility is acknowledged and remains an integral feature of the proposed development. This matter is discussed in Section 20.6.5. However, following discussions with DPTI, it has been agreed the requirement to analyse the potential impacts of such other users and uses (see below) is not required.
4.1	Provide a full economic analysis of the proposal including the long term economic viability and efficiency of the operational aspects of the development, incorporating the cost-benefit (risk return) analysis.	See Section 20.4 and Section 20.6 for the assessment of the economic impact. See Section 20.7, Appendices O1, O2 and O3
4.2	Identify employment and investment opportunities, including the ‘multiplier effect’ for Kangaroo Island and South Australia. Include an analysis of existing supply chain and prospective suppliers, as well as any gaps in the supply chain on the Island.	See Section 20.6
4.3	Identify how the proposal will promote Kangaroo Island, grow regional prosperity and not be in conflict with ‘Brand Kangaroo Island’.	See Section 20.6.5
4.4	Provide information on local and indigenous employment and training opportunities associated with the proposal.	See Section 20.6.4
4.5	Outline the skill level requirements of the new workforce, the component of the workforce that is expected to be hired locally, and the type of employment this would entail (e.g. full time, permanent, sub-contractors, casual, skilled labour, truck drivers etc) and identify if this employment would be continuous/year-round.	See Section 20.6.4
4.6	Identify and analyse the economic benefits for further investment in the area arising from the proposal for other potential users of the wharf and port facilities (e.g. agriculture, tourism). Include the anticipated demand and sustainability of each use and discussions had with the relevant sectors.	See Sections 20.6.5 and 20.7

Guideline		Comment
4.7	Provide information on the ability to use the wharf/port facility to be used as a base for tourist and/or cruise ships. Outline what other facilities would be required at the site for this purpose, and the capacity of the site to accommodate these facilities. Include details of discussions had with tourist and/or cruise industry operators in relation the likelihood and viability of using the proposed facilities for this purpose. Outline, where possible, the potential economic benefits of this to the Island.	See Section 20.6.5
4.8	Identify the economic effect the construction and ongoing workforce would have regionally.	See Section 20.6
4.9	Identify the potential economic impacts on the existing aquaculture operation in the vicinity of the proposed development. Include the multiplier effects on the broader Kangaroo Island economy and community as a result of these impacts.	See Section 20.6.5
4.10	Identify the existing tourism, commercial and recreational fishing activities and facilities in the project area (and any adjacent spawning areas). Identify and evaluate the economic impacts the project will have on these existing activities and facilities, and outline methods to mitigate these impacts.	See Section 20.6.5
4.11	Describe the impact on existing local and regional land and marine uses, including primary production, conservation and tourism operators. In relation to primary productions, include potential impacts on fences, water supply and stock watering points, movement of agricultural machinery and trucks and power requirements.	See Section 20.6.5
4.12	Identify adequate separation distances (land and sea) from adjoining land and marine uses and the effects of access loss due to shipping traffic and anchorages.	See Section 20.6.5
4.13	Describe the impacts (economic, social and environmental) of use of the upgraded public boat ramp. Outline potential users, the impacts expected from increased public access to and use of Smith Bay (including on the water quality in relation to the existing aquaculture operation in the vicinity). Describe measures that will be undertaken to mitigate these impacts.	N/A with public boat ramp removed from proposal
4.14	Outline the expected consequences of not proceeding with the development (i.e. 'do nothing' option).	See Section 2.6

20. ECONOMIC ENVIRONMENT

20.1 INTRODUCTION

This chapter addresses the requirement of Guideline 4 regarding the economic environment and potential impacts as a result of the proposed development.

20.2 REGIONAL SETTING

Demand for timber in Asia is growing, and the supply of timber from native forests is declining. That gap will be filled by plantation timber. The supply of plantation timber in Australia, however, is diminishing with the distortion caused by managed investment schemes coming to an end, and there are long lead-times to grow the end product. About half of Australia's hardwood plantation estate is expected to return to conventional agriculture rather than remain in timber production (Australia's plantation log supply 2015-59, ABARES, 15 December 2016).

The development of large-scale plantation eucalypt forests on Kangaroo Island began in the early 2000s, driven by supportive state government policies actively encouraging farm forestry, and private sector investment in so-called managed investment schemes. These policies were intended to give effect to the ecologically sustainable forest management commitments embodied within the National Forest Policy Statement, which the South Australian government endorsed in December 1992. (Refer to Chapter 2 – Project Justification for a more extensive discussion of the government policy underpinning Kangaroo Island's plantation forestry).

Kangaroo Island has several natural advantages which favour the development of plantation forestry. It has high rainfall (over 600 mm annual average) with low rainfall variability, mild summers (low evaporation), no salinity issues and high growth rates for timber (mean average increment (MAI)).

Moreover, because of the characteristics of the Island's soils, plantation forestry is a more productive and profitable use of the land than many alternative agricultural and pastoral uses. Most of the soils suitable for forestry typically have low pH (i.e. they are acidic). In pastoral terms, such acidic soils present a number of challenges: they adversely affect the health of soil biota; reduce the ability of many perennial grasses to subsist; cause deficiencies in grazing animals in minerals such as copper, selenium, manganese, zinc, molybdenum and cobalt; and leach phosphates extremely quickly (Soil Research Review, Fleurieu Future Farming, Adelaide and Mount Lofty Ranges Natural Resource Management Board, August 2016).

Although these deficiencies can be managed, this is very expensive and, in some cases, not feasible. This is particularly relevant on Kangaroo Island where the availability and cost of transporting suitable materials becomes prohibitive. In contrast, plantation forestry can thrive in these conditions, with species such as *Eucalyptus globulus* well adapted to these soils, with minimal inputs required once the root zone is established.

For these reasons, Kangaroo Island is one of the best regions in Australia for plantation forestry and, this industry represents a significant, long-term sustainable economic opportunity for the Island.

The proposed KI Seaport would contribute to the growth and diversification of the Kangaroo Island economy. It is the critical piece of infrastructure that would enable an economically sustainable plantation forestry industry to begin on the Island, based on the export of timber products to markets in Asia.

20.3 ASSESSMENT METHODS

20.3.1 STUDY AREA

The analysis and discussion of the direct and indirect impacts of the development differentiates between three geographic areas:

- Kangaroo Island
- the rest of South Australia
- Australia.

20.3.2 PROFILE OF THE EXISTING ENVIRONMENT

The existing economic environmental profile is based on the October 2017 assessment report Economic Impact of the Smith Bay Wharf by EconSearch, an Adelaide-based economic consulting practice, using data collected through desktop research, which includes:

- an analysis of quantitative data from the Australian Bureau of Statistics (ABS), state and Australian government departments and other publicly available sources
- a review of reports, plans and policy documents published by Regional Development Australia (RDA), state and local government, and relevant economic development agencies.

A copy of the report is included in Appendix O1. An estimate of how long it would take, at current growth rates, to grow the Kangaroo Island economy and match the contribution of the proposed KI Seaport is included in Appendix O2.

20.3.3 MODELLING TO IDENTIFY POTENTIAL IMPACT AND BENEFITS

The RISE input-output model

EconSearch prepared an independent assessment of the economic impacts of the proposed KI Seaport using standard profiling and modelling techniques, including the use of input-output (I-O) economic models.

Data and other inputs have been sourced from:

- authoritative public sources such as the ABS
- relevant state and local government policy statements and reports
- KIPT's internal financial modelling, which is based on Australian forestry industry benchmarks
- discussions with stakeholders.

The estimates of regional economic impact presented in this chapter use an extended I-O model known as the RISE model (Regional Industry Structure and Employment), which EconSearch developed over the past decade. I-O models are typically used to assess the economic impact of existing or changing levels of economic activity, such as regional infrastructure projects and their associated uses. The EconSearch RISE models are widely used by Australian governments, and the RISE models for the Kangaroo Island, South Australian and Australian economies have been used in this assessment.

Indicators of economic activity and their definitions

The indicators used in impact analysis typically include output, employment, household income and gross state/regional product:

- output (value of) is a measure of the gross revenue from goods and services produced by commercial organisations (such as the value of outputs) and gross expenditure by government agencies
- employment is defined in terms of full-time equivalent (FTE) units on an annual basis
- household income is a component of gross regional/state/domestic product (GRP/GSP/GDP) and is a measure of wages and salaries paid in cash and in kind, drawings by owner-operators, and other payments to labour, including overtime payments, employer's superannuation contributions, and income tax, excluding payroll tax
- gross regional/state/domestic product) is a measure of the contribution of an activity to the economy. GRP/GSP/GDP is measured as value of gross output (business revenue) less the cost of goods and services (including imports) used in producing the output.

Categories of economic activity in the infrastructure supply chain

A useful way to think about economic activity and economic impact (as measured by employment, GRP etc.) is to use the concept of a 'supply chain'. The supply chain, in the context of an infrastructure project, includes the planning and management of all activities involved in sourcing and procurement, conversion of materials, and all the logistics management activities. It also includes coordination and collaboration with suppliers, intermediaries and third-party service providers.

Broadly speaking, there are four categories of employment and GRP along the infrastructure supply chain, as shown in Table 20-1.

The indirect (or flow-on) economic impact is the sum of impacts 2, 3 and 4. In this analysis, direct and flow-on employment, GRP and household income generated by the infrastructure supply chain have been modelled. To avoid double counting, the supply chain value of output is recorded only in terms of the direct impact.

Assumptions

KIPT provided detailed cost estimates to EconSearch for its economic impact assessment of the construction and operation phases of the development.

The detailed expenditure data for the construction phase were broken down into materials, services and labour for each of the years in the construction period. Assumptions were also provided on where the expenditures would be likely to occur: on Kangaroo Island, elsewhere in SA, elsewhere in Australia and outside Australia. Similar data were provided for the number of jobs estimated to be created during the construction phase.

For the analysis of the operation phase, expenditure and employment data were provided using the same method outlined above. Additional data were provided on annual revenue over the life of the project.

Capital expenditure values for the construction phase were based on the wharf costing data provided by KIPT. Total capital expenditure, including contingencies, is estimated to be $41.2 million. Total operating expenditure was based on the cash flow statement, income statement and input workings sheet data provided by KIPT. Sensitivity analysis was undertaken by allowing for low, medium and high activity scenarios.

20.3.4 COST BENEFIT ANALYSIS

Econsearch also prepared an independent cost benefit analysis to determine the net benefit of the proposed development. The analysis conforms with the South Australian and Commonwealth Government guidelines for conducting evaluations of public sector projects, although this is a private sector project that requires no public sector funding.

The cost benefit analysis compared the proposed KI Seaport with a 'base case' scenario, which assumed that a wharf and associated infrastructure would be approved and developed at a different location, namely Cape Dutton. The base case represents the most likely alternative use of the resources under consideration, rather than the 'do nothing option' described in Chapter 2 – Project Justification (see Section 2.6).

The base case scenario assumes development would be delayed by four years, and as a result of the delay the overall volume of timber would be reduced by about 20 per cent, and further costs would be incurred to manage the forest to ensure a commercial yield. Such costs would include thinning of the forests and removal of the thinned trees.

All costs and benefits were specified in real terms, and a discount rate of six per cent was used, which is consistent with the rate commonly used by the South Australian Government in these types of analyses.

The costs and benefits were measured using a 'with' and 'without' project framework, that is, the analysis quantified the incremental changes associated with the proposed KI Seaport compared to the base case. In this way, the cost benefit analysis was used to determine whether the development would increase the net economic benefits relative to the base case.

A copy of the cost benefit analysis is included in Appendix O3.

TABLE 20-1 ECONOMIC ACTIVITY IN THE INFRASTRUCTURE SUPPLY CHAIN

	Impact	Comment
1	Direct employment and GRP	Employment in those firms, businesses and organisations that are directly engaged in project construction and operations. Typically, this would include: • construction companies • construction subcontractors • planning and engineering services • material supply firms.
2	First-round employment and GRP	Employment in firms that supply inputs and services to the 'direct employment' businesses (those categorised under impact 1 above). These inputs and services are: • energy • raw materials • logistics • business support services • other inputs.
3	Industrial-support employment and GRP	The term applied to 'second and subsequent round' effects as successive waves of output increases occur in the economy to provide industrial support, as a response to the original infrastructure expenditure. This category excludes any employment associated with increased household consumption.
4	Consumption-induced employment and GSP	Those effects induced by increased household income associated with the original infrastructure expenditure. The expenditure of household income associated with all three categories of employment (direct, first-round and industrial-support) will generate economic activity that will in itself generate jobs.

20.4 EXISTING ENVIRONMENT

The following section provides an overview of the existing economic environment on Kangaroo Island, and South Australia. The material is sourced from the EconSearch report and ABS data. The related social indicators, including population and population projections, regional migration and education, are discussed in Chapter 22 – Social Environment.

As the Regional Australia Institute (RAI 2015) has noted, many of the socio-economic characteristics described in these two chapters are shared with other agricultural/tourism regions.

These characteristics include:

- slow or declining population growth
- the dominance of agriculture
- the seasonal impact of tourism, which poses a challenge to sustaining year-round hospitality and tourism businesses
- relatively low average incomes
- high freight costs
- a tight labour market with relatively poor employment opportunities.

20.4.1 EMPLOYMENT AND LABOUR FORCE

Labour force

The 2016 Census records 2286 people in the Kangaroo Island labour force – a steady decline from a peak of 2682 in June 2009, while the overall South Australian labour force increased.

For reasons that are unclear, the Island's labour force rose by more than 400 from 2007 to 2009, demonstrating that an increased demand for workers could be quickly met and would be unlikely to lead to significant local wage pressures.

The ABS data show the proportion of the workforce employed full time on Kangaroo Island tends to be lower than in the rest of South Australia.

Unemployment

The 2016 Census records 118 people on Kangaroo Island were unemployed. The total number of unemployed increased steadily over the decade to March 2017.

The 2016 Census reported the unemployment rate on Kangaroo Island was 5.2 per cent, which was lower than the South Australian rate of 7.5 per cent.

Participation rate

The labour force participation rate for Kangaroo Island tended to increase over the decade to 2014–15 and is significantly higher than for the rest of South Australia. The Island's relatively high participation rate suggests that increased demand for labour would encourage more people to move there.

20.4.2 INCOME

The proportion of taxable, compared to non-taxable, Kangaroo Island residents fluctuated slightly over the 12 years to 2014–15, decreasing overall from 75 per cent to 67 per cent. In 2014–15 there were 1708 taxable and 858 non-taxable individuals. Despite a decrease over the 10 years (from 81 per cent to 75 per cent), the proportion of taxable individuals in South Australia as a whole was greater than on Kangaroo Island in all years.

Taxable income is the amount remaining after deducting from assessable income all allowable deductions under the *Income Tax Assessment Act 1936*. The data show taxable income is lower on Kangaroo Island relative to the whole of SA and there is a smaller proportion of taxable individuals, which is clear evidence that the Island is a poorer community than SA generally. This suggests there is significant scope for local economic development projects to improve social outcomes by reducing income inequality, relative to the rest of the state.

20.4.3 BUILDING APPROVALS

Building approval figures provide a barometer for the attractiveness of a region to residents and investors. To an extent, these figures can reflect the status of the regional economy; for example, a sharp increase in dwelling approvals can suggest increased population pressure due to improved opportunities.

The total number of building approvals on Kangaroo Island decreased from 85 in 2004–05 to 21 in 2015–16, a fall of 75 per cent. The total value of approvals also fell by 57 per cent, from $12 million in 2004–05 to $5 million in 2015–16. In real terms the decrease was even greater, with total value of approvals falling by 67 per cent (from $16 million in 2004–05).

20.4.4 BUSINESS

The 2016 Census provides data on the number of businesses by industry on Kangaroo Island. The industries with the most businesses were agriculture, forestry and fishing (45 per cent of the total), construction (12 per cent), accommodation and food services (seven per cent) and rental, hiring and real estate (six per cent).

In contrast, the leading industries in South Australia generally were construction (15 per cent of the total), agriculture, forestry and fishing (12 per cent), rental, hiring and real estate services (12 per cent) and financial and insurance services (10 per cent).

The majority of businesses on Kangaroo Island (64 per cent) did not employ another person, 25 per cent employed between one and four people, 11 per cent employed between five and 19, less than one per cent employed between 20 and 199 and no businesses employed more than 200. These figures are similar to those in South Australia as a whole.

20.4.5 ECONOMIC STRUCTURE OF THE KANGAROO ISLAND ECONOMY

The RISE model estimated gross regional product for Kangaroo Island in 2015–16 was $257 million, with the top six contributors by industry being:

- agriculture, forestry and fishing (30 per cent)
- transport, postal and warehousing (14 per cent)
- ownership of dwellings (six per cent)
- health care and social assistance (five per cent)
- retail trade (five per cent)
- accommodation and food services (five per cent).

20.5 DESIGN CHOICES TO PROTECT ECONOMIC VALUES

The development of the KI Seaport and the related forestry operating model incorporate a number of design choices intended to maintain and protect the economic diversity, viability and wellbeing of potentially affected communities and industries on Kangaroo Island and increase the economic benefits from the development. These choices include:

- **Site selection:** The reasons for selecting Smith Bay are discussed in Chapter 2 – Project Justification, but KIPT believes Smith Bay is the best option from the perspective of maximising the benefits and minimising the adverse impacts of the development. For example:
  - the on-land site is already cleared and somewhat degraded
  - being located on the mid-north coast, west of Kingscote, it minimises conflict with the Island's major population centres, tourism and agriculture.

TABLE 20-2 CONSTRUCTION PHASE IMPACTS, 2016–17 TO 2018–19

	Total impact		
	GRP ($m)	Employment (FTE)+	H/hold income ($m)
Kangaroo Island			
Direct	5.4	15	5.3
Production-induced	0.4	1	0.2
Consumption-induced	1.8	5	0.8
Total Kangaroo Island	**7.5**	**22**	**6.3**
Rest of South Australia			
Direct	11.2	30	8.3
Production-induced	9.2	24	6.6
Consumption-induced	8.9	14	3.6
Total rest of South Australia	**29.4**	**68**	**18.6**
Rest of Australia			
Direct	0.7	0	0.7
Production-induced	1.8	1	0.4
Consumption-induced	2.5	4	0.8
Total rest of Australia	**5.1**	**6**	**1.9**
Australia			
Direct	17.3	46	14.3
Production-induced	11.4	26	7.3
Consumption-induced	13.3	23	5.2
Total Australia	**42.0**	**96**	**26.8**

+ Note the employment impacts are presented as annual averages for the construction period 2016–17 to 2018–19.

- **A sustainable harvest regime:** About four million tonnes of timber would be ready to be harvested as soon as approval was obtained. However, KIPT would harvest this resource sustainably, with the first rotation of timber harvested over a period of approximately 13 years (at an average annual rate of 600,000 tonnes), and after which the second rotation (mostly regrowth from the original stumps) would follow for the next approximately 12 years. One of the principal drivers for this harvest regime is to avoid the boom-and-bust cycle, which is common to many other resource projects, and ensure there is a regular flow of work for the harvest and haulage contractors each year and over the entire cycle.
- **Multi-user and multi-cargo:** The design and siting of the infrastructure allows other users and other cargoes to share the facility, with the proposed facility required for approximately 20 per cent of the year only for timber exports (refer to Section 20.6.5).
- **Head office:** The company head office would relocate from Adelaide to Kangaroo Island.

TABLE 20-3 OPERATING PHASE IMPACTS, MEDIUM SCENARIO, GROSS REGIONAL PRODUCT ($ MILLION)

	Total impact						
	2018–19	2019–20	2020–21	2021–22	2022–23	2023–24	5-year average+
Kangaroo Island							
Direct	2.9	23.5	33.4	34.4	47.9	35.6	34.9
Production-induced	0.4	3.1	3.2	3.4	3.6	3.1	3.3
Consumption-induced	0.8	3.3	3.5	3.7	3.9	3.3	3.5
Total Kangaroo Island++	**4.1**	**29.9**	**40.0**	**41.4**	**55.4**	**42.0**	**41.7**
Rest of South Australia							
Production-induced	0.6	2.5	2.6	2.9	2.9	2.5	2.7
Consumption-induced	1.0	4.3	4.5	4.7	5.0	4.2	4.5
Total rest of South Australia++	**1.6**	**6.8**	**7.0**	**7.6**	**7.8**	**6.7**	**7.2**
Total South Australia							
Direct	2.9	23.5	33.4	34.4	47.9	35.6	34.9
Production-induced	1.0	5.6	5.7	6.3	6.5	5.6	5.9
Consumption-induced	1.8	7.6	7.9	8.4	8.8	7.5	8.1
Total South Australia++	**5.7**	**36.7**	**47.1**	**49.1**	**63.2**	**48.6**	**48.9**
Rest of Australia							
Production-induced	0.5	1.7	1.8	1.9	2.1	1.6	1.8
Consumption-induced	0.5	2.3	2.5	2.6	2.8	2.3	2.5
Total rest of Australia++	**1.0**	**4.1**	**4.3**	**4.4**	**4.8**	**3.9**	**4.3**
Australia							
Direct	2.9	23.5	33.4	34.4	47.9	35.6	34.9
Production-induced	1.5	7.3	7.6	8.2	8.5	7.2	7.8
Consumption-induced	2.3	10.0	10.4	11.0	11.6	9.8	10.5
Total Australia++	**6.6**	**40.7**	**51.4**	**53.5**	**68.1**	**52.6**	**53.2**

+ 5-year average covers years 2019–20 to 2023–24. Impacts for 2018–19 were excluded from the average because operations cover only part of the year.
++ Rounding error.

20.6 IMPACT ASSESSMENT

20.6.1 CONSTRUCTION PHASE

The development would involve a total capital investment of around $41.2 million over a three-year period. The economic impact would be determined by how much local labour and raw materials were used and the costs associated with using specialised contractors and equipment.

The economic impacts (direct and flow-on) of the construction phase were estimated in terms of gross regional product, employment and household income, as shown in Table 20-2.

20.6.2 OPERATIONS PHASE

The operation of the proposed port, together with the plantation harvesting and the hauling of timber products to the port, constitute the operating phase of the development. The project would cost an average of almost $27 million a year to operate over its first 13 years.

TABLE 20-4 OPERATING PHASE IMPACTS, MEDIUM SCENARIO, EMPLOYMENT (FTE)

	Total impact						
	2018–19	2019–20	2020–21	2021–22	2022–23	2023–24	5-year average+
Kangaroo Island							
Direct	40	161	165	169	175	145	162.9
Production--induced	6	41	42	45	49	41	43.5
Consumption induced	6	26	27	28	30	25	27.2
Total Kangaroo Island++	**52**	**228**	**234**	**242**	**253**	**210**	**233.6**
Rest of South Australia							
Production-induced	3	10	10	12	11	9	10.4
Consumption-induced	3	9	10	11	10	9	9.8
Total rest of South Australia++	**6**	**19**	**20**	**23**	**21**	**18**	**20.2**
Total South Australia							
Direct	40	161	165	169	175	145	162.9
Production-induced	9	51	52	57	59	50	53.9
Consumption-induced	9	36	37	39	40	34	37.0
Total South Australia++	**58**	**247**	**254**	**265**	**275**	**228**	**253.8**
Rest of Australia							
Production-induced	1	3	3	2	3	2	2.7
Consumption-induced	2	11	11	11	12	10	10.9
Total rest of Australia++	**3**	**13**	**14**	**14**	**15**	**12**	**13.6**
Australia							
Direct	40	161	165	169	175	145	162.9
Production-induced	9	54	55	59	63	52	56.6
Consumption-induced	12	46	48	50	52	43	47.9
Total Australia++	**61**	**261**	**268**	**278**	**290**	**240**	**267.5**

+ 5-year average covers years 2019–20 to 2023–24. Impacts for 2018–19 were excluded from the average because operations cover only part of the year.
++ Rounding error.

As with the construction phase, the economic impact of the operating phase on Kangaroo Island would be determined by how much local labour and raw materials were used and how much was spent on specialised contractors and equipment. It is estimated that around two-thirds of operating expenditure would be spent on the Island itself. As with the construction phase, the flow-on impacts were calculated using 2015–16 RISE models.

Gross regional product (GRP)

Estimates of the annual contribution to GRP/GSP/GDP for first five complete years of the operating phase are provided in Table 20-3.

The expected annual average contribution to Kangaroo Island GRP over that five-year period is $41.7 million – $34.9 million directly and $6.8 million in flow-on benefits. On that basis, the boost to the Kangaroo Island GRP, (estimated at $257 million in 2015–16), would be around 16 per cent.

At the state level, the development would generate a further $7.2 million in GSP for an average annual figure of $48.9 million. At the national level, the generation of another $4.3 million would yield an average annual contribution to GDP of $53.2 million.

Employment

The estimates presented in Table 20-4 show the development would be expected to generate total employment of 234 ongoing FTE jobs on Kangaroo Island: 163 directly and 71 from flow-on effects.

The development would generate a further 20 FTE jobs at the state level and 14 at the national level to lift the total to 267 jobs.

Household income ($ million)

Household income is the return to labour component of GRP. The development, once operational, is expected to generate a total average annual household income nationally of $22.5 million, which includes:

- around $16.2 million on Kangaroo Island – $12.4 million directly and $3.9 million from flow-on effects
- a further $4.2 million in household income in South Australia
- a further $2.1 million nationally.

Once operational, the development would result in household income of almost $74,000 per FTE job, in comparison to the Island's average of $57,900.

TABLE 20-5 COMPARATIVE OPERATING PHASE IMPACTS, MEDIUM SCENARIO, GRP, EMPLOYMENT AND HOUSEHOLD INCOME (A)

	Agriculture+	Forestry++
Managed land (ha)	140,078	18,100
Direct gross regional product: total ($m)	80	35
Direct gross regional product: per hectare ($/ha)	569	1931
Direct employment: total (FTE)	540	163
Direct employment: per hectare (FTE/'000 ha)	3.9	9.0
Direct household income: total ($m)	31	12
Direct household income: per hectare ($/ha)	220	683

+ Agriculture estimates for 2015–16.

++ Forestry estimates derived from the average GRP for the first five complete years, medium scenario.

Comparative economic contribution

To put the impact of the proposed KI Seaport into perspective, EconSearch note the average growth rate of the South Australian economy over the last five years (as published by the Australian Bureau of Statistics) was 0.6% in real terms (i.e. adjusted for inflation). If the Kangaroo Island economy continued to grow at that rate, it would take 29 years to match the impact of the proposed KI Seaport.

Moreover, a per-hectare comparison of the existing economic contribution of agriculture and the estimated forestry (operating phase) contribution is provided in Table 20-5. The agricultural data are estimates for 2015–16 and the forestry values were derived from the average indicators for the first five complete years of operation under the medium-activity scenario.

The data show that the employment intensity in forestry is over 230 per cent higher per 1000 ha than agriculture (9.0 direct FTE jobs compared with 3.9) and more than double in terms of GRP and household income. As there is considerable variation within the agriculture sector, it should be recognised that these data represent an average across all agricultural industries on Kangaroo Island.

20.6.3 SUPPLY CHAIN ANALYSIS

For the purposes of this EIS the supply chain refers to:

- businesses and organisations directly engaged in construction and operation of the KI Seaport
- other businesses and organisations that supply inputs and services to those enterprises directly engaged in construction and operation.

KIPT has a stated preference for engaging South Australian-based enterprises and, wherever possible, providing employment and opportunities on Kangaroo Island itself.

Construction supply chain

There is a well-established construction supply chain comprising construction companies, construction subcontractors, planning and engineering services, and materials supply firms located on Kangaroo Island and elsewhere in South Australia who have the experience and capability to provide these services. For the KI Seaport:

- KIPT has already engaged South Australian-based engineering consulting services providers (WGA and KBR) to design the facilities
- Port Adelaide-based Maritime Construction Services have been engaged to provide the marine infrastructure services, including dredging services
- there are a number of Kangaroo Island-based civil construction contractors who could perform the necessary civil works associated with the development, including the on-land site works and upgrades to the unnamed road going to the site from North Coast Road, and there is scope to draw on service providers from the mainland as required
- there are two quarries close to Smith Bay that could supply the rock armour and other materials required to construct the causeway
- quarries on mainland South Australia can supply larger-diameter rock which may be required to construct the causeway, if there are no suitable sources on the Island.

Operations supply chain

The operations supply chain comprises:

- A large number of Australian companies, many of which have existing South Australian operations, with expertise in the key operational functions (harvesting, logging and chipping, haulage and logistics, wharf-side stockpiling and storage, and stevedoring).

  These enterprises would be subcontracted via a closed tender process in which firms with relevant capability and experience would be invited to tender. KIPT has already been approached by contractors who have expressed an interest in participating and are attracted by the scale of KIPT's operations and the long-term nature of the opportunity.
- Suppliers of inputs and services to the direct contractors, including:
  - diesel fuel – Kangaroo Island depends heavily on diesel for transport and to generate power, and has a well-developed diesel supply capacity which can be readily expanded to suit KIPT's demand
  - professional and technical advisory services – a wide array of professional and technical advisory services would be required, including silviculture, environmental management, engineering services, IT and communications, business support services (legal, accounting and auditing), and contract management. Most of these services would be sourced from enterprises based in Adelaide, where there is a well-established provider network.

20.6.4 ADDITIONAL BENEFITS

The full economic impact of the KI Seaport would be linked to the commencement of a new, sustained plantation forestry industry on Kangaroo Island. These benefits, summarised below, are not captured in the multipliers referred to in Section 20.6.2.

Population growth

As indicated in Section 20.6.2, the development is expected to create 234 FTE jobs over the first five complete years of operation. There is not enough available labour on the Island to fill these new positions. The unemployment rate on the Island in March 2017 was estimated at 3.8 per cent, or just under 100 people. Although this number does not take account of under-employment (people currently employed but wanting to work more hours), it shows the expected demand for labour would exceed the available supply, and as a consequence it is likely that many of the new jobs would be filled by people currently not living on the Island.

Many of the jobs directly created would require a specific set of skills and experience that are not currently available on Kangaroo Island, which reinforces the likelihood that there would be a net migration of skilled workers to the Island. Given the current low unemployment and high labour force participation rates, and the need for specific skills and experience not currently available, it is likely that at least 60 per cent of the total (140 FTE jobs) would be taken by people currently living off the Island. Assuming an average household size of 2.4 people in South Australia, the Island's population would increase by a conservative estimate of 336.

The forecast population growth is particularly relevant because the state government's population projections for Kangaroo Island forecast a nine per cent decline in the working age population (i.e. 15-64 years) to the year 2031 (EconSearch 2017a).

New housing demand

The net migration would boost demand for housing, which in the short-term would place some pressure on the existing rental supply and bring some holiday accommodation into the rental market. In the medium to longer term, the population growth would be likely to boost demand for new housing to accommodate the workers employed on the plantation estates, and their families, as well as others drawn to opportunities in other sectors of the local economy. Although this is difficult to estimate, if the majority of households moving to the Island were to require new dwellings, more than 100 extra homes would be required.

Government revenues

State government revenues would increase, principally via payroll tax on wages and salaries arising from the jobs growth and stamp duties associated with conveyancing and other transactions. The assessed capital value of the plantation forest estates would increase as a result of forestry activities, adding to the Kangaroo Island Council rates base; whether this led to a net increase in rate revenue or reduced the rates paid by other landowners would depend on the council's decisions on rating policy.

Government expenditure

State government expenditure on Kangaroo Island would increase through wages and salaries for additional public-sector employees, especially in health and education, and both state and local government would need to spend more money on road maintenance. KIPT and the Kangaroo Island Council had been discussing road funding options when this document was being compiled.

KIPT has indicated it would fund the full cost of the proposed KI Seaport; no government contributions would be sought or required.

Economic resilience

The development of plantation forestry would broaden Kangaroo Island's economic base, which has been a long-stated objective of South Australian government policy, and benefit both the Island and the state. The Econsearch report shows that significant employment, additional to the direct employment in forestry operations, would be generated in a range of local service industries, including the professional, scientific and technical sectors, construction, retail, and personal and other services.

Stable, not seasonal, impacts

Plantation forestry would will ensure a regular flow of work through the year, so as not to exacerbate the seasonality associated with tourism and agriculture, the other dominant economic activities on the Island: tourism and agriculture. Given that business seasonality has been described by the Economic Development Board (EDB 2015) as the 'stand-out issue' affecting all aspects of tourism, service and retail operations on the Island, the stable, year-round economic activity associated with sustainable plantation forestry would be a significant benefit to the local economy.

The new workforce

As discussed in Section 20.5, KIPT would adopt a sustainable harvest regime to avoid the boom-and-bust cycle which is common to many other resource projects. This would ensure there was a steady, predictable flow of work throughout the year, and from year to year over the entire harvest cycle. As a consequence, employment would be continuous or year-round, and most of the jobs created would be full-time.

The new workforce would comprise a wide variety of new occupations on Kangaroo Island, with varying requirements for training, qualifications, skills and experience. The bulk of the workforce would be engaged in one of the six main operational groups, which are summarised below:

- **Plantation management:** These activities include silviculture (managing the trees as they grow), environmental management activities (such as weed control, managing native vegetation, eradicating feral animals) and ongoing site management (fencing, maintaining internal roads, firebreaks, dams etc). This requires a semi-skilled workforce of about 10, with TAFE qualifications in areas such as Forest Growing and Forest Management, plus a small number of tertiary qualified estate managers.
- **Harvest operations:** These activities are heavily mechanised, using highly specialised plant and equipment to maximise the recovery of timber material (saw logs or woodchips) and maximise operator safety. These tasks would be performed by a semi-skilled workforce (Certificate III Harvesting and Haulage or similar as a minimum), supported by some entry-level positions, such as for koala spotters.
- **Haulage:** The timber haulage operations would require a sizeable workforce (at least 20 FTE) of truck drivers who have both the necessary licences, to drive semi-trailers, B-double or A-double high-productivity vehicles, and the aptitude and temperament to adhere to stringent operating protocols required to maximise safety and minimise risk to all other road users. The haulage operations would be supported by a small team of skilled mechanics.
- **KI Seaport operations:** The day-to-day activities at the site would encompass unloading logs and woodchips, managing the log store and chip stockpile, maintaining on-site plant and equipment (principally the woodchip conveyor) and associated administrative functions.
- **Stevedoring:** Shiploading is a specialist function which, in the first instance, is likely to be performed by a specialist crew who fly in from another Australian port for the short duration of loading operations (approximately three to five days each time). Over time it is likely a Kangaroo Island crew would be recruited and trained to perform these functions.
- **KIPT corporate functions:** These functions are likely to include number of management and clerical functions engaged in silviculture, asset management, procurement, human resources, IT, contracts management, finance, business analysis and corporate communications. Most of these positions would be filled by employees with relevant tertiary qualifications.

Wherever possible KIPT (and its sub-contractors and suppliers) will give priority to employing people who already live on Kangaroo Island. KIPT has no plans to employ a fly-in, fly-out workforce. Adopting a sustainable harvest regime would also provide the necessary incentive for the new workforce to move to the Island with their families.

Indigenous employment

The 2016 Census showed there were 69 Aboriginal and/or Torres Strait Islander people on Kangaroo Island, making up 1.4 per cent of the population. KIPT is an equal-opportunity employer and would ensure training and employment opportunities were available for members of the Indigenous community.

Impact on land prices

To the extent that the KI Seaport would support agriculture through cheaper imports, exports of greater volume or higher value, and lower export costs, it has the potential to improve returns from agriculture and, thereby, improve land prices on Kangaroo Island. Current land prices are significantly lower than on the mainland, limiting the ability of farm enterprises to raise capital and to invest in productivity improvements.

Consistency with government economic policy

The proposed development is consistent with the South Australian Government's economic policy. In forestry, it would create a sustainable export industry that would lead to new jobs and population growth in regional South Australia. It would capitalise on Kangaroo Island's natural advantage as one of the best locations to grow plantation timber in Australia. It would be fully funded by the private sector, which means no government funds would be required to subsidise or sustain the operation.

20.6.5 OTHER IMPACTS

Consistency with 'Brand Kangaroo Island'

The Kangaroo Island Industry and Brand Alliance is a member-based organisation established to build a single, collaborative brand under which all of the Island's products, experiences and businesses can work together to promote the region and grow regional prosperity. Members are encouraged to use the 'Authentic Kangaroo Island' and 'Proudly Kangaroo Island' trustmarks. The Alliance currently has more than 90 members, including KIPT.

The proposed development is clearly consistent with objectives of the brand as:

- it would make a substantial, stable and sustainable contribution to the Island's prosperity
- it would provide employment and training opportunities for Kangaroo Island locals, as well as facilitating controlled

growth of the community through the attraction of an additional skilled workforce and their families

- global demand for timber products, especially in Asia, is growing. In the absence of plantation timber products, this demand would need to be met by logging native forests, including the illegal logging of native forests in Asia. This global perspective shows KIPT's products are environmentally friendly because they are 100 per cent plantation timber which is harvested at a sustainable rate.

KIPT would continue to be an active member of the brand.

Other users and uses for the KI Seaport

The KI Seaport could also be used, without significant modification, for other purposes such as exporting containerised agricultural commodities and importing containerised farm inputs.

The cost of exporting produce from Kangaroo Island has long been identified as a constraint affecting economic development opportunities. For example, in its report to the South Australian Government, the former SA Economic Development Board (SA EDB 2011) said the Island was languishing economically and socially, in part because the cost of inputs to production and the cost of delivering goods to market are higher for Kangaroo Island than for mainland producers.

The Commissioner for Kangaroo Island also acknowledged (Office of the Commissioner for Kangaroo Island 2016) that the development of a port to export timber products could help to address this concern:

> *With forestry harvesting about to commence there is an opportunity for the development of a port and associated facilities to accommodate bulk and break-bulk shipping services to enable direct import/export from the Island.*

The opportunity for other users and other cargoes to take advantage of the KI Seaport arises because of the following attributes inherent in the proposed development at Smith Bay:

- **Excess capacity:** Timber ships would be moored at the wharf to load KIPT's timber products for 30 to 75 days a year, or approximately 20 per cent of the time available. This means there would be significant spare capacity at the port for:
  - the independent plantation timber owners to use the facility to export their timber products without exporting through KIPT if they wished
  - other users and other products (e.g. containerised freight).
- **Engineering design:** The wharf is designed to handle largecapacity vessels, such as Handymax and Panamax, to ship timber products to overseas markets. Without significant modification, it could accommodate a wide range of vessels, and other uses:
  - the floating pontoon that would form the actual berth is 40 metres wide, which is sufficient for an articulated truck or a large bus to safely traverse and turn
  - there is sufficient room on land to stockpile containerised freight – the absence of such a stockpile area would effectively preclude most other users who require stockpiling facilities and other cargoes from using the facility
  - the facility has been designed with a roadway to the floating berth.
- **Pricing:** KIPT has publicly stated that all non-timber users would be charged a fee based on the marginal costs associated with their use; however, they would not be expected to contribute to the initial capital cost (the cost of constructing the wharf).

KIPT has had informal discussions with a number of parties to identify what interest there may be in using the KI Seaport. The existing volumes of freight on the Island, however, are not significant in comparison to the projected volumes of timber products. For example, the average annual grain harvest (the largest commodity produced on the Island) for the 10 years to 2017 was 39,600 tonnes (SA Grain Industry Overview, May 2017, PIRSA).

Ultimately, whether other users see opportunities to use the KI Seaport is beyond KIPT's control; the private commercial considerations of third parties would determine these outcomes. To the extent that such other uses eventuated, they would be the subject of separate assessment and approvals processes that would be the responsibility of the individual proponents.

Impact on the existing aquaculture operation in the vicinity

Yumbah operates a land-based abalone farm on land east of the Smith Bay site. Yumbah has indicated it opposes the development because of concerns about adverse impacts on water quality in Smith Bay (especially the risk of suspended sediments being drawn into their intake pipes), dust, noise, light, vibration and water temperature.

Around 25 full-time staff work at the facility. Using an industry average coefficient of 1.85, representing the ratio of direct to flow-on jobs for aquaculture on Kangaroo Island (EconSearch 2017b, p. 41), an additional 21 FTE flow-on jobs would be linked to these operations.

Academic literature and hydrodynamic modelling undertaken for the EIS, discussed in detail elsewhere in this assessment report (refer to Chapter 11 – Land-Based Aquaculture), suggests there is a low likelihood the proposed KI Seaport would have any impact on this operation, either during construction or during operations, and these risks could be managed to ensure there was no impact.

The location of the causeway to the east of Smith Creek is likely to have a beneficial impact on Yumbah, by mitigating the potentially adverse effects that silt-laden discharges from Smith Creek may have on water quality at the abalone farm's seawater intakes after rainfall events. A range of materials are entrained in the runoff from Smith Creek including, for example, agricultural chemicals, pathogenic bacteria, nutrients and other terrigenous toxicants. A solid causeway would direct this effluent several hundred metres out to sea where it becomes entrained by tidal currents, providing a reduction of up to 50 per cent in the average concentration of creek water reaching the Yumbah intakes.

Impact on existing fishing activities (tourism, commercial and recreational) and associated facilities

Smith Bay in the vicinity of the proposed development is used occasionally for recreational boating activities, and two commercial fishers operate in the bay from time to time. There are no records that indicate the extent of these marine activities, and there is no record of Smith Bay being the site of regular tourism fishing ventures.

The impact on recreational and tourism fishing would be negligible given the proposed development would occupy only a small portion at the western end of Smith Bay, which stretches more than five kilometres from east to west.

The unofficial boat launching area at the site would be closed. Although the original development proposal included an upgraded launching facility, the Kangaroo Island Council indicated it was opposed to this aspect of the development because a substantially upgraded recreational boat launching facility is being constructed nearby, at Emu Bay. This aspect of the proposed development, therefore, will not proceed. Because of the Emu Bay facility, it is reasonable to assume the KI Seaport development would have no material impact on tourism or recreational fishing in Smith Bay.

Wildcatch Fisheries SA has facilitated discussions with Kangaroo Island's commercial fishers, of which two fish part-time in Smith Bay. One operates in a small southern calamari fishery currently located where the proposed causeway would be built. There is also a small King George whiting fishery in deeper water near the site of the proposed berth. The total value of these activities is believed to be about $40,000 a year.

The commercial fishers have expressed concerns regarding:

- the impact of the proposed development on their activities
- interference to the natural flows in Smith Bay and the possible consequences for the eastern bay area
- damage to the sea floor due to propeller wash from ships mooring at the seaport and tugboats assisting these vessels
- the security of the floating structure in westerly gales.

The development's impact on the commercial fishing activities cannot be accurately assessed, but the worst-case scenario would be a loss of less than $50,000 a year in gross income from these activities, which could be replaced by fishing elsewhere in Smith Bay or in nearby waters. The remaining concerns are addressed elsewhere in this EIS (see Chapter 10 – Coastal Process, Chapter 11 – Land-Based Aquaculture and Chapter 12 – Marine Ecology).

Impact on existing local and regional land and marine uses

The development's direct impact on local land uses is discussed elsewhere in this EIS (see Chapter 6 – Land Use and Planning and Chapter 7– Stakeholder Engagement).

There is one nearby tourism accommodation business, Molly's Run, on the southern side of North Coast Road opposite Yumbah's operations. The owners of this property have expressed concerns about the impact of noise and lighting on their business. These matters are discussed in detail in Chapter 18 – Noise, Vibration and Lighting.

The main impact on regional land uses, including primary production, conservation and tourism, would be indirect and essentially relates to the traffic and transport impacts associated with forestry activities. These matters are discussed extensively in Chapter 22 – Social Environment, including the scope to introduce measures which would mitigate such impacts.

The KI Seaport would have:

- no impact on fences, water supply or stock watering
- minimal impact on the movement of agricultural machinery (see Chapter 21 – Traffic and Transport)
- no impact on the Island's power supply (see Chapter 4 – Project Description).

Separation distances and impacts on shipping and anchorages

KIPT has approached the Kangaroo Island Council to close that portion of Freeoak Road which provides public access to Smith Bay north of the southern boundary of the proponent's site (Lot 51), which would preclude public access to Smith Bay from this road, as shown in Figure 20-1.

FIGURE 20-1 PROPOSED ROAD CLOSURE

There is no need or requirement to establish separation distances on land between the proposed development and neighbouring land uses.

A Marine Activity Zone (MAZ) would be prescribed in Smith Bay for the construction period, as discussed in Chapter 21 – Traffic and Transport (see Section 21.7.1). This is a well-accepted approach to managing the impacts of marine traffic during construction in South Australia.

The MAZ would provide a clearly defined area to be avoided by members of the public, reducing navigational risks during the term of the construction activities.

The Department of Planning, Transport and Infrastructure has advised the proponent the facility would be declared a harbour and a port under the Harbors and Navigation Regulations 2009, schedules 3 and 4, when operations began. This means certain activities would be prohibited unless approved by the port operator, including obstructing the wharf, landing places (by mooring vessels nearby), fishing, unauthorised entry, and swimming within 200 metres of a vessel entering, moored or at anchorage in Smith Bay.

These regulations apply to 19 other ports and harbours in South Australia.

20.7 COST BENEFIT ANALYSIS

The impact analysis presented in Section 20.6 summarises the economic activity arising from the proposed development. The cost benefit analysis shows whether or not the proposed development represents a better (i.e. more efficient) use of resources compared to the base case (i.e. developing a port at Cape Dutton).

The results of the analysis have been expressed in terms of three evaluation criteria:

- the net present value (NPV) which is a measure of the aggregate net benefits (i.e. benefits less costs) of the development over a 15-year period, expressed as a present value using a discount rate of six per cent
- the benefit cost ratio (BCR) which is the ratio of the present value of the benefits to the present value of the costs over the same period
- the internal rate of return (IRR) which is the discount rate at which the NPV of the development equals zero after 15 years.

The proposed development at Smith Bay would be preferred to the base case if the NPV is greater than zero; if the BCR is greater than 1.0; and if the IRR exceeds the discount rate.

The results of the cost benefit analysis show the proposed development at Smith Bay is preferred to the base case because:

- the NPV is $118.6 million
- the BCR is 2.2, which means every $1.00 of net costs will generate $2.20 of net benefits
- the IRR is 68 per cent.

Sensitivity testing was undertaken separately on both the discount rate (four per cent and eight per cent) and the value of timber sales (+/- 20 per cent), and the proposed development at Smith Bay remains the preferred development option under all scenarios.

20.8 CONTROL AND MANAGEMENT STRATEGIES

20.8.1 HOUSING

As discussed in Section 20.6.1, the construction phase would be expected to generate an additional 15 full-time jobs. It is assumed these workers would be able to find rental accommodation on the Island. The medium to longer-term impacts on housing in the operations phase would be more significant (see Section 20.6.2). The options for managing these issues are discussed in more detail in Chapter – 22 Social Environment.

20.8.2 ADJACENT LAND USERS

As stated in Section 20.6.5, there is no evidence the proposed KI Seaport would have any material effect on Yumbah, either during construction or operations. The application of measures to manage dredging and other construction activities consistent with standard industry practice in South Australia would be sufficient to ensure there was no likelihood of any adverse impact on their operation.

20.9 CONCLUSIONS

The economic impact of the proposed KI Seaport would be positive for South Australia, and Kangaroo Island in particular.

The development would involve a total capital investment of around $41.2 million over a three-year period. It would add approximately $42 million per annum to the Kangaroo Island GRP in the first five years of operations, generate 234 ongoing full-time jobs (163 directly and a further 71 from the flow-on effects) and generate approximately $16 million in additional annual household income on Kangaroo Island.

At current growth rates, it would take nearly 30 years of growth on Kangaroo Island to match the impact of the proposed KI Seaport.

The proposed KI Seaport is the critical piece of infrastructure that would unlock the economic benefits of plantation forestry – a sustainable industry that would be the largest single economic activity on the Island. It also would create opportunities for other users, other industries and other cargoes – which also would boost the Kangaroo Island economy.

The cost benefit analysis shows the NPV is $118.6 million, which means the proposed KI Seaport represents a better investment than the alternative of developing a port facility at Cape Dutton.

The development would have no significant adverse economic impact on any entities or industries on Kangaroo Island, including any businesses located near.

21. TRAFFIC AND TRANSPORT

Guideline		Comment
1.18	Provide further detail on the social and economic costs and/or benefits of undertaking the proposed action, including basis for any estimations of costs and/or benefits, potential employment opportunities expected to be generated at each phase of the proposed action and details of any public and stakeholder consultation activities, including the outcomes.	In relation to public consultation activities, including the outcomes for traffic and transport, see Sections 4.6.4, 7.6, 20.6.1 and 20.6.2
10.1	Identify the traffic impacts on the local and arterial road network, in particular North Coast Road, during both construction and operation, include an assessment of impacts during the tourist season and on neighbouring properties	See Section 21.5.4
10.2	Undertake a full Traffic Impact Assessment, taking into consideration existing traffic data, accident statistics and predicted traffic volumes (including proposed vehicle types, number/frequencies and traffic peaks).	See Chapter 21
10.3	Outline proposed traffic mitigation and management measures for construction and operational phases, particularly the impact on local and arterial roads in terms of road safety, traffic routes and hours of activity.	See Section 21.5.5
10.4	Undertake an assessment of expected marine traffic volumes to and from the wharf, including expected boat/ship movements, timing and patterns. Describe marine traffic impacts associated with these movements (including to the existing tourism operators and the ferry services to/from the Island), and measures that will be undertaken to mitigate these impacts.	See Sections 21.6.3, 21.6.4 and 21.6.5
10.5	Detail the potential increase in public access to Smith Bay. Describe marine traffic impacts associated with increased public access to and use of the Bay and outline safety measures that will be implemented to ensure public safety.	See Section 21.6.3, 21.6.4 and 21.6.5
10.6	Identify traffic impacts that may result from the use of the facility from other non-forestry users (e.g. agriculture, tourist and/or cruise ships).	See Chapter 4 and Section 21.5.4 Future agricultural (and other) users of the facility would seek their own approvals. Cruise ships no longer forms part of the proposal.
10.7	Describe access and parking arrangements for all vehicles during construction, including any approvals and specific access requirements for over-dimensional vehicles.	See Sections 21.3 and 21.5.1
10.8	Describe car-parking provisions for staff and visitors, including how any potential future expansion that may be required as a result of multi-users of the port and facilities, will be accommodated and managed.	See Sections 21.3 and 21.5.1 Other future users of the facility would seek their own approvals for additional car parking provisions should it be required.

Guideline		Comment
14.13	Describe strategies to ensure public safety during construction and operation.	See Sections 4.6.8 and 21.3
15.5	Detail any road infrastructure improvements or upgrades that will be required to provide safe and efficient access to the port including any potential junction/intersections on the arterial road network. Include information of discussions had with the Kangaroo Island Council, and identify funding arrangements for any such improvements or upgrades.	See Sections 4.4.6, 4.6.1 and 21.7
19.14	Describe the management agreements between the Kangaroo Island Council and the proponent during and after construction, including ongoing road maintenance and management.	Section 21.2

21. TRAFFIC AND TRANSPORT

21.1 INTRODUCTION

This chapter addresses Guideline 10, which stipulates that the EIS is required to provide information on various matters relating to the road and marine traffic and transport implications of KIPT's proposed development at Smith Bay, and Guideline 15, which deals with infrastructure, to the extent that it relates to the road network.

DAC's assessment of the proposal during development of its guidelines also identified that information on any existing baseline traffic data, the proposed route between plantations and the port, or regarding the funding, road upgrades or road maintenance was limited (see page 15 of the guidelines). Information and discussion on these matters are provided in this chapter.

21.2 TRANSPORT STRATEGY

KIPT's preferred strategy to transport its timber products from the plantations to the KI Seaport is:

- to establish a defined transport route that minimises the potential impacts associated with traffic movements (e.g. transit times, noise, dust, greenhouse gas emissions, ecological sensitivities and crashes)
- to upgrade the proposed defined transport route as required to permit the use of high productivity vehicles (B-doubles and/or A-doubles)
- in consultation with the logistics provider, implement training and safety initiatives that reduce the potential for timber haulage vehicle crashes and incidents.

The road network on Kangaroo Island is managed and maintained by the Department for Planning, Transport and Infrastructure (DPTI) and the Kangaroo Island Council. KIPT does not have the ability to directly implement many of the identified upgrades and improvements to the road network that are required to facilitate the transport of timber products from the plantations to the KI Seaport using high-productivity vehicles.

KIPT has consulted extensively with DPTI and the Kangaroo Island Council regarding the defined transport route and the use of high-productivity vehicles. Consultation has included:

- the joint development (with the Council) of scope and criteria for investigations/studies used to define a suitable transport route (including road condition and ecological studies)
- discussions regarding the use of high-productivity vehicles and related road network requirements
- clarifying the roles and responsibilities for upgrading and maintaining the road network
- identifying funding options for the upgrades and modification.

Discussions with DPTI and Kangaroo Island Council will continue throughout the detailed design phase with a view to ensuring that the optimal route is suitable for high productivity vehicles. Other stakeholders and interested parties have been, and will continue to be, consulted, including members of the local community and various groups including the KI Road Safety Committee, SA Road Transport Association, Regional Development Australia and the Australian Forest Products Association.

Pending agreement on the implementation of the recommended defined transport route and the use of high-productivity vehicles, KIPT will implement an 'open network' model of road transport, that uses single articulated trucks (19-metres long with a 30-tonne payload capacity), i.e. a prime mover coupled to a single semi-trailer, on the existing Kangaroo Island road network in accordance with existing rules and regulations. This open network model is assessed as the base case in the traffic impact assessment (see Section 21.5.4). The preferred option of a recommended defined transport route using high-productivity vehicles is discussed as a mitigation measure in Section 21.5.5. Routine maintenance and upgrades of roads (such as improving intersection sight lines and signage and maintaining vegetation clearances – see Section 21.5.3, which outlines the existing conditions) would be undertaken by DPTI and/or the Kangaroo Island Council in accordance with their respective Transport Infrastructure and Asset Management Plans.

21.2.1 OBJECTIVES

The objective of this chapter is to assess the potential impact of transporting construction and timber materials from their respective origin to the proposed KI Seaport at Smith Bay. The assessment also investigates potential impacts associated with the shipping component of the proposal, as some construction materials and wharf infrastructure will be shipped to the site and timber products will be exported via established shipping routes to the destination markets.

The gazette notice declaring the project to be of major environmental and economic significance refers to:

> *... all activities and works associated with the construction … and operation of a port terminal, storage facility and associated infrastructure … including … road transport access* (SA Government Gazette 2017).

Although Schedule 2 of the gazette notice specifies the declaration covers KIPT's Smith Bay site, the reference to 'road transport access' has been interpreted more widely. For the purposes of the EIS, impact assessment related to transport and traffic within the bounds of the Smith Bay site is discussed in the relevant impact assessment chapters. The scope of the traffic impact assessment (TIA) presented in this chapter begins at the boundary of the various plantation estates and includes the public road network between these estates and the site of the proposed KI Seaport at Smith Bay.

A summary of the transport task is illustrated in Figure 21-1.

This chapter describes the existing environment along current transport routes on Kangaroo Island, and to and from Smith Bay by sea, to provide context to the potential changes as a result of KIPT's activities. Specifically, the following aspects of the existing environment are considered:

- vehicle movements
- road condition and access
- road safety
- vessel movements
- ecology
- social environment, specifically noise, dust and visual amenity associated with the vehicle movements.

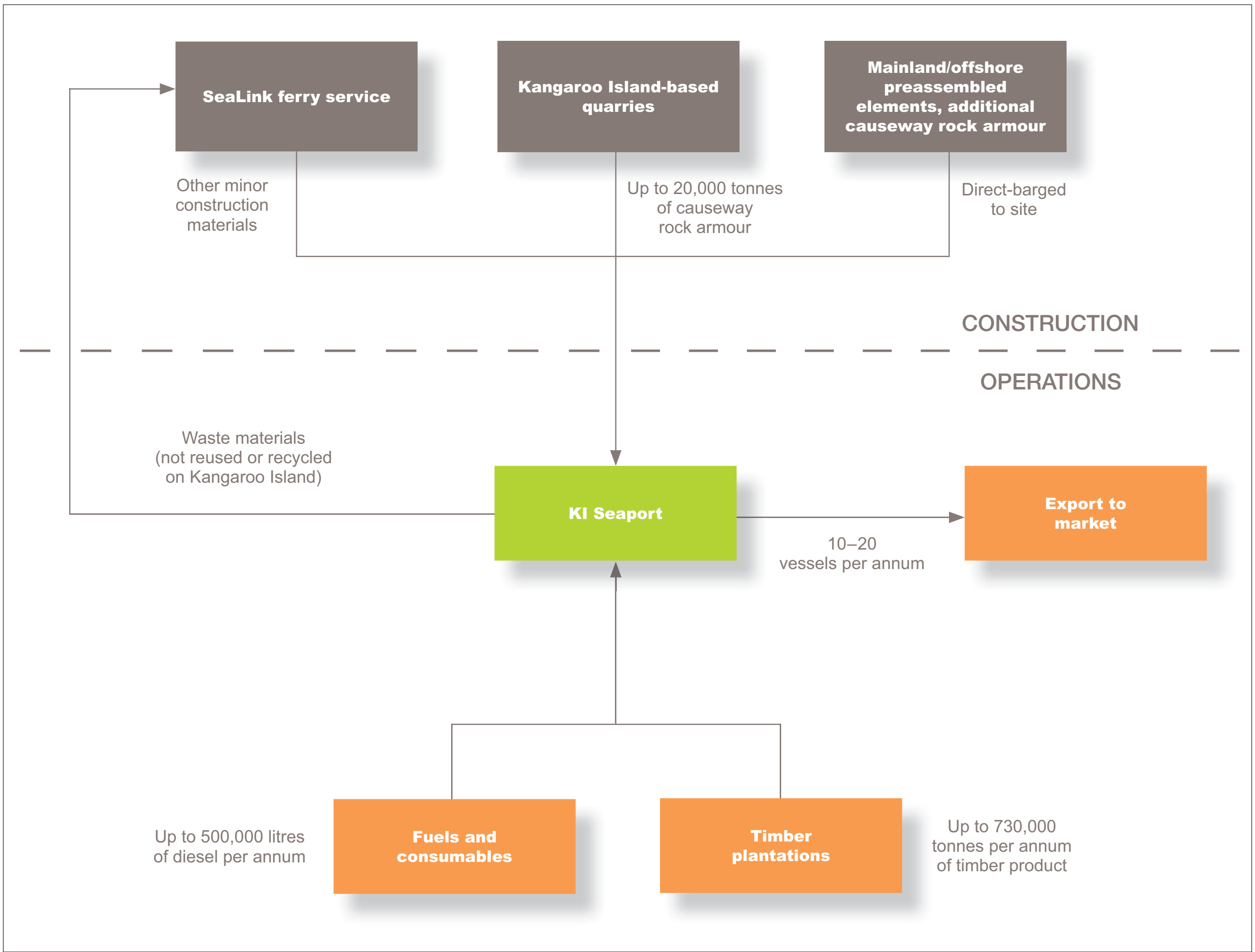


FIGURE 21-1 KIPT TRANSPORT TASK

21.3 KIPT'S PROJECT

KIPT's plantations are on the western part of Kangaroo Island, as shown in Figure 21-2. Smith Bay is on the north coast, approximately 20 km north-west of Kingscote. In addition to the plantations and the proposed KI Seaport at Smith Bay (refer Chapter 4 – Project Description), KIPT is proposing to use its existing operations base at the former sawmill on Timber Creek Road and, subject to implementation of the defined transport route upgrades (see Section 21.5.5), may establish an intermediate logistics yard at some point along the haulage route, subject to separate consent. Both of these are relevant to the traffic impact assessment and are described in the following sections.

Timber Creek Road operations base

An operations base (to be known as the Heartland Hub) is located at the site of the former sawmill (owned by KIPT) on Timber Creek Road and, if required, would be subject to separate planning approvals outside the scope of the EIS. This facility consists of:

- operations offices and facilities
- areas to park and service KIPT and contractor's mobile fleet
- bulk diesel storage facilities, including refuelling facilities
- water storage tanks for the collection of rainfall runoff.

The existing site consists of a timber products treatment works and a number of larger machinery sheds, currently containing disused sawmilling equipment. The timber treatment works may be retained, but the sawmilling equipment would be disposed of and the shed repurposed as an undercover area for heavy vehicle servicing. There is a 70,000-litre bunded diesel tank onsite, which would be used to supply fuel for KIPT and contractor vehicles, and to fill diesel tankers that would travel to the KI Seaport and the plantations to refuel the on-site mobile fleet.

Intermediate logistics yard

Following the upgrade of McBrides Road under the defined transport route proposal (see Section 21.5.5), an intermediate logistics yard of approximately 15 ha may be established on one of KIPT's properties located on the designated transport route. This would avoid the need for truck movements between the transport route and the operations base (a 28-km round trip from the nearest point on the transport route) at the end of each shift. This facility would be subject to separate planning approvals and is outside the scope of this EIS.

The intermediate logistics yard would consist of the following infrastructure:

- an unsealed hardstand area for the parking of trucks
- a separate, unsealed hardstand area for employee and contractor vehicles to park, separate from the truck fleet
- an administration/office building, including crib and ablution facilities, which would be a temporary 'ATCO-style' complex that would be delivered to site as pre-assembled modules
- truck refuelling infrastructure, including powered diesel pumping equipment. Diesel would nominally be stored within bladderised 20-foot containers. The refuelling and diesel storage areas would be sealed (using concrete) and bunded in accordance with the requirements of Australian Standards and relevant South Australian EPA bunding guidelines
- fire mitigation infrastructure installed in accordance with relevant Australian Standards, with fire fighting water contained in two aboveground tanks fitted with diesel-powered pumps
- a surface water management system surrounding the hardstand areas, including the refuelling facilities, consisting of excavated drains graded to drain to a sedimentation pond for management before discharge to an existing watercourse. The sedimentation pond intake would also be fitted with an oil/water separator
- security fencing and lockable access gates plus monitored closed-circuit television (CCTV) coverage of the site.

21.4 ASSESSMENT METHODS

This chapter comprises the full TIA for the terrestrial and marine components of the wider transport task and outlines proposed traffic mitigation and management measures for construction and operation.

A number of studies and assessments, specifically commissioned for KIPT's project and proposed development, have been used to inform the assessment presented in this EIS. The studies and assessments associated with traffic and transport are listed in Table 21-1 and provided in Appendix P.

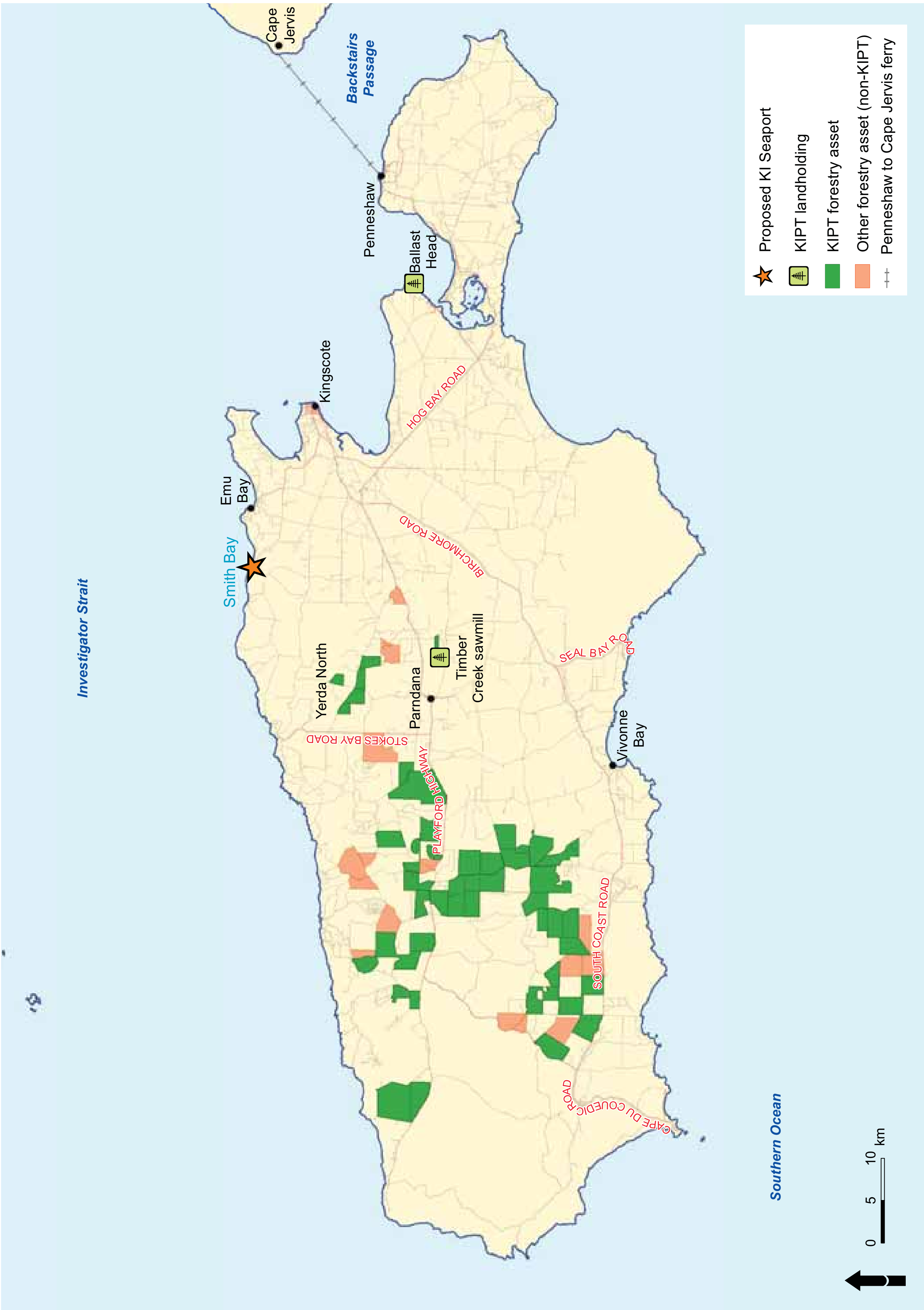


FIGURE 21-2 FORESTRY AND KIPT'S OPERATIONS

TABLE 21-1 REPORTS USED FOR TRAFFIC IMPACT ASSESSMENT

Report name	Author	Date	Commissioned by	Purpose
Forestry Access Route Assessment (W&G 2017)	Wallbridge & Gilbert	February 2017	KIPT	An initial investigation into the route options to haul timber products from the various plantation estates to Smith Bay.
KIPT Road Freight Options Assessment (Osman 2017)	Osman Solutions	September 2017	KIPT	To investigate potential route options for a dedicated forestry haulage route which would mitigate the impacts identified in the W&G report.
Recommended road safety policies and practices for Kangaroo Island Plantation Timbers (CASR 2017)	Centre for Automotive Safety Research, The University of Adelaide	November 2017	KIPT	To identify options which KIPT could adopt to maximise the safety and efficiency of the forest haulage operation on the public road network.
KIPT Freight Access Route Options – PBS Level 2B Heavy Vehicle Route Assessment (HDS 2018a)	HDS Australia	March 2018	Kangaroo Island Council	An independent assessment requested by Kangaroo Island Council of the two selected heavy vehicle route options, based on cost estimates of upgrades required to reduce hazards to acceptable risk levels.
KIPT Transport Route Options	Limitation Summary (EBS Ecology 2018)	April 2018	Environmental Projects	Commissioned for the TIA to summarise key constraints for the two principal options for a dedicated timber haulage route.
KIPT Transport Route Options – Ecological Assessment (EBS Ecology 2018)	EBS Ecology	May 2018	Environmental Projects	Commissioned for the EIS to assess the impacts on native vegetation of the two principal options for a dedicated timber haulage route.
Kangaroo Island Seaport Development, Traffic Impact Assessment (HDS 2018b)	HDS Australia	September 2018	Environmental Projects	To assist in preparing the Traffic Impact Assessment presented in this chapter, as required by EIS Guideline 10.2.

21.5 LAND-BASED TRAFFIC

25.5.1 TRANSPORT TASK

The transport task is broadly divided into two distinct phases: construction and operations. Each of these phases is described in the following sections.

Construction phase

The majority of bulky construction materials for the development of KI Seaport would be delivered by barge from overseas or from the mainland (refer Figure 21-1) and the land-based (terrestrial) traffic during the construction phase would consist of:

- transporting office buildings, weighbridge, ablutions buildings, lighting equipment and security fencing to site, either from suppliers on Kangaroo Island or from the mainland via the SeaLink ferry
- transporting up to approximately 20,000 tonnes of rock armour material for the causeway. This would be preferentially sourced from the Kangaroo Island quarry near Chapman River, approximately 1.5 hours by road from Smith Bay. This material would be supplemented as required by larger diameter rock sourced from quarries on mainland South Australia (e.g. Southern Quarries, Sellicks Hill). Mainland rock would be trucked to a designated wharf and loaded onto flat-top barges for shipment to Smith Bay
- a small construction workforce of approximately 15 personnel on site at any one time, who would access the site in light vehicles which would be parked in a designated area
- deliveries, such as building materials, and despatches, such as waste materials, would be serviced by a mixture of light vehicles and trucks.

It is expected that no oversized loads would be required to access the road network during the construction phase.

Construction materials would be transported via the existing road network as required using single articulated trucks. The movement of the non-quarry construction materials is likely to require up to approximately 20 vehicle movements across a 12-month construction period. The movement of quarried rock would require approximately 700 vehicle movements over approximately 150 to 200 days, averaging up to five round-trips per day (i.e. 10 one-way movements).

Operations phase

Logistics strategy

The base case logistics strategy for transporting timber products from the plantations to the KI Seaport is an open network model under which general access vehicles (specifically 19-metre single articulated trucks with 30-tonne loads) use any passable road within the existing road network between the plantations and the KI Seaport, refer to Figure 21-3. Roads most likely to be used frequently under this 'open network' include:

- Playford Highway
- Stokes Bay Road
- Bark Hut Road
- Ropers Road
- Gap Road
- Miller Road
- Gum Creek Road
- Springs Road
- Rose Cottage Road
- Boxer Road
- Ten Tree Lagoon Road
- Birchmore Road
- North Coast Road.

There are other feeder roads, serving the plantations themselves, that may be used depending on the location of the particular source plantation being harvested at any given time. These roads would be used whether or not an open network model is adopted, and include:

- South Coast Road
- West End Highway
- Baxters Road
- Church Road
- Gosse Ritchie Road
- Mount Taylor Road
- Jump Off Road
- Turkey Lane
- Snug Cove Raod
- Tin Hut Road
- Yacca Jacks Road.

In addition, Rowland Hill Highway and Timber Creek Road would be used to access the operations base at the sawmill site near Parndana, and various local and main roads would be used by staff commuting to and from their place of work. Additional roads would be accessed to harvest third party plantations, in the event that this timber is also exported through the proposed KI Seaport, as is anticipated. These roads include Colmans Road, Berrymans Road, Mays Raod, Maylands Road and Johncock Road.

West End Highway, South Coast Road, Birchmore Road, Playford Highway and Stokes Bay Road are sealed. The remaining roads listed above, including many of the roads that comprise the open network model, are unsealed and in varying condition.

Vehicle movements

Timber products from the various plantations would be transported 24-hours-a-day, seven-days-a-week from the plantations to the KI Seaport via the main road network (and a series of plantation feeder roads). A summary of the anticipated vehicle movements along the minor plantation feeder roads is presented in Table 21-2.

It should be noted that these are peak traffic volumes created by harvest activity, and that there would be many years in which the forestry-related traffic volumes on any given feeder road would be close to zero.

Once off feeder roads, vehicles would travel on the road network using the route chosen given the road conditions at the time. At the peak Annual Average Daily Traffic (AADT) rate (corresponding to 730,000 tpa of timber product movement plus a return trip), a single articulated truck would be expected to pass along the transport route every 22 minutes. Total traffic movements per annum vary with the timber production schedule (see Chapter 4 – Project Description) and are summarised according to the timber production rate in Table 21-3.

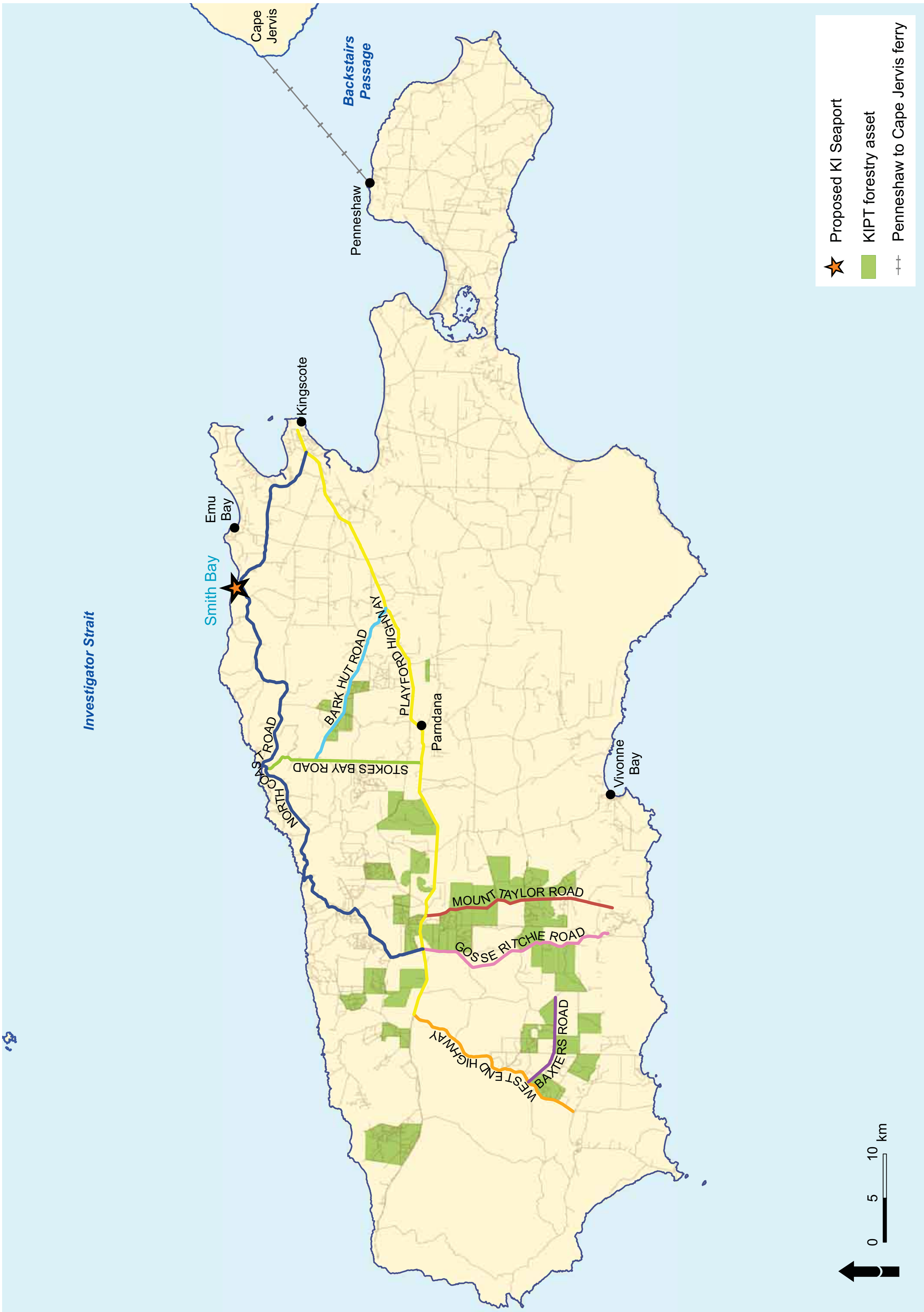


FIGURE 21-3 ROADS WHICH COULD BE FREQUENTLY USED IN AN OPEN NETWORK (SINGLE ARTICULATED TRUCK) MODEL

TABLE 21-2 KIPT PLANTATION ACCESS ROAD TRAFFIC MOVEMENTS

Road name	Total traffic movements (2019–2030)	Peak traffic movements (Annual Average Daily Traffic)
Jump Off Road	40,150	80
Snug Cove Road–Colmans Road	47,450	68
West End Highway	11,680	32
Baxters Road	44,530	44
South Coast Road	35,040	94
North Coast Road–Berrymans Road	39,420	64
Gosse-Ritchie Road	46,720	42
Turkey Land–Johncock Road	88,330	136
Coopers Road	16,060	44
Tin Hut Road	16,790	40
Mount Taylor Road	159,870	120
Stokes Bay Road–North Coast Road	27,740	60
McBrides Road	8760	24
Bark Hut Road	42,340	54
Yacca Jacks Road	7300	10
Timber Creek Road	2920	8
Church Road	24,820	42
Playford Highway	45,250	120

Source: HDS 2018b

TABLE 21-3 KIPT TRANSPORT ROUTE VEHICLE MOVEMENTS

Timber production rate (t)	Single articulated (30 t GML)	
	Total annual trips+	Daily average (AADT)
400,000	26,667	73
500,000	33,333	91
600,000	40,000	110
700,000	46,667	127

+ Total annual trips include one loaded movement to KI Seaport and an empty return movement to the plantation.
GML = General Mass Limits

In addition to timber products, it is expected that the KI Seaport operations and the timber haulage fleet would consume approximately 3 ML per annum of diesel. Approximately 500,000 litres per annum would be transported to the KI Seaport, necessitating approximately 10 diesel supply truck movements per annum. The remaining 2.5 ML per annum would be delivered to the intermediate logistics yard, which would require approximately 50 single articulated truck trips per annum. It is most likely that diesel would be sourced from the mainland and transferred to the Island on the SeaLink ferry and then moved by road to KIPT's operations.

Vehicle parking

A 20-vehicle open air and uncovered car park, considered sufficient for the expected workforce during both the construction and operations phases, would be established on hardstand adjacent to the KI Seaport site office.

Heavy vehicles would not park or be stored at the KI Seaport. A heavy vehicle turn-out may be established on Freeoak Road that connects North Coast Road to the KI Seaport facility, to allow for some contingency in unloading or weighing heavy vehicles.

Third-party use of the KI Seaport may be permitted subject to KIPTs requirements (see Chapter 4 – Project Description). In these instances, third parties would be permitted to use the light vehicle parking provided within the KI Seaport to the extent that it does not interfere with KIPTs ongoing operations. Heavy vehicle parking of third-party vehicles has not been allowed for within the KI Seaport facility, and thus any future consents associated with third-party use will need to address heavy vehicle parking (if required).

21.5.2 REGULATORY ENVIRONMENT

Roads

In South Australia, DPTI manages around 25 per cent of the road network, which consists of 13,000 km of sealed roads and 10,000 km of unsealed roads. The remaining 75 per cent of roads (totalling 75,000 km) are managed by local government.

The sealed and unsealed roads on Kangaroo Island and their relationship to KIPT landholdings, forestry assets, KI Seaport and community centres (defined by the presence of a post office, school, hospital, firefighting service and/or information centre) are shown in Figure 21-4.

On Kangaroo Island, DPTI is responsible for the following roads:

- Kingscote-Penneshaw Road–Hog Bay Road (state road)
- American River Road
- Playford Highway (state road east of Parndana).

South Coast Road, West End Highway, North Coast Road and all other roads are managed by the Kangaroo Island Council in accordance with its Transport Infrastructure and Asset Management Plan (KIC 2015). The objectives of the plan are to:

- ensure the road transport network is maintained at a safe and functional standard as set out in the plan
- maintain appropriate and sustainable community infrastructure
- continually review and investigate best practice in roads and construction methods.

The Kangaroo Island Council's Transport Infrastructure and Asset Management Plan contains provisions for the establishment of a forestry industry on Kangaroo Island, specifically identifying the:

> *' ... impact on sealed and unsealed major roads through steady growth in agricultural bulk production with increasing emphasis on the use of B-double (that is a prime mover coupled to two semi-trailers, connected via a B coupling) configuration freight vehicles. Potential for major shift in volumes on specific routes should forestry start to mobilise'* (KIC 2015).

Vehicles

Light vehicles (of less than 4.5 tonnes gross vehicle mass) in South Australia are regulated under the *Motor Vehicles Act 1959* (SA) and the associated Motor Vehicles Regulations 2010 (SA). These instruments define the standards for light vehicles that use public roads.

The Heavy Vehicle National Law (HVNL), which came into effect on 10 February 2014, applies to all heavy vehicles over 4.5 tonnes. This law and its associated regulations operate in Queensland, New South Wales, Victoria, Tasmania, South Australia and the Australian Capital Territory. The law covers vehicle standards, mass, dimensions and loadings, fatigue management, the Intelligent Access Program (a national program developed in partnership with all Australian road agencies), heavy vehicle accreditation and on-road enforcement.

The objectives of the HVNL are:

- to promote public safety
- manage the impact of heavy vehicles on the environment, road infrastructure and public amenity
- promote industry productivity and efficiency in the road transport of goods and passengers by heavy vehicles
- encourage and promote productive, efficient, innovative and safe business practices.

The national regulations prescribe mandatory standards for heavy vehicles using public roads.

Driver behaviour

The Australian Road Rules contain the basic road rules and required behaviour for all road users to support safe and efficient use of roads in Australia. They are administered by the National Transport Commission, which reviews the rules every two years. Each state and territory adopts the Australian Road Rules in its own legislation which, with minor exceptions, are applied consistently. In South Australia, the rules are embodied in the *Road Traffic Act 1961* (SA).

Environmental

The major elements of environmental regulation related to the potential impacts of traffic are the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the state *Environment Protection Act 1993* (EP Act).

The EPBC Act requires that a proponent not undertake an action that has, will have or is likely to have an impact on a matter of national environmental significance without relevant approvals, where the relevant matters of national environmental significance (MNES) include:

- world heritage properties
- national heritage places

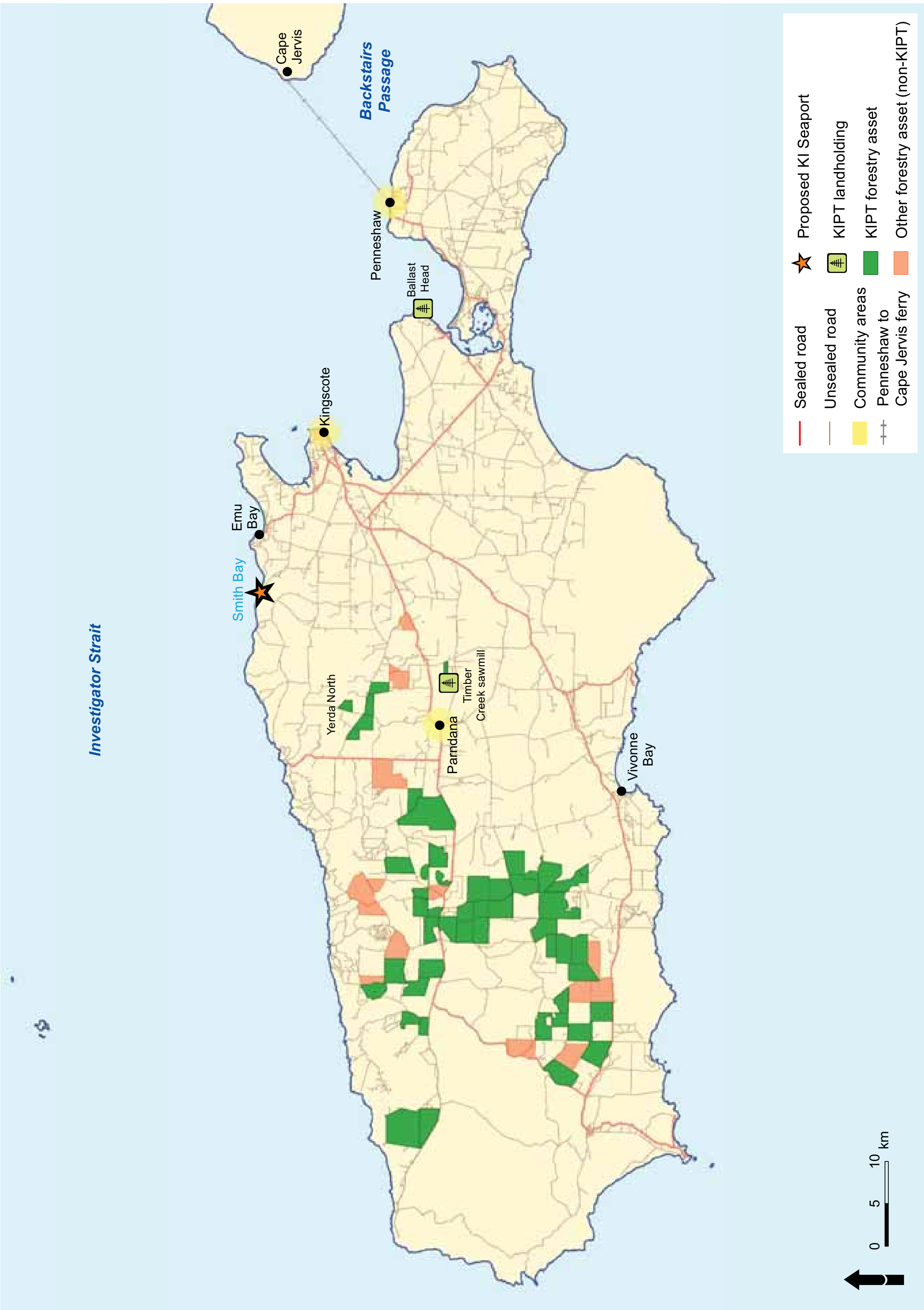


FIGURE 21-4 SEALED AND UNSEALED ROADS ON KANGAROO ISLAND

- wetlands of international importance (listed under the Ramsar Convention)
- listed threatened species and ecological communities
- migratory species protected under international agreements
- Commonwealth marine areas
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mines)
- a water resource, in relation to coal seam gas development and large coal mining development.

Where a road or road network requires vegetation clearance, the potential for significant impacts to MNES must be understood.

The objectives of the EP Act are to promote the principles of ecologically sustainable development. The use, development and protection of the environment should be managed in a way, and at a rate, that will enable people and communities to provide for their economic, social and physical wellbeing and for their health and safety while:

- sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations
- safeguarding the life-supporting capacity of air, water, land and ecosystems; and
- avoiding, remedying or mitigating any adverse effects of activities on the environment.

Central to these objectives is the General Environmental Duty:

> *A person must not undertake an activity that pollutes, or might pollute, the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm.*

Although the Environment Protection (Noise) Policy 2007 generally does not apply to vehicle noise, other provisions of the Act can apply including the offence of causing an environmental nuisance.

In order to preserve noise amenity and demonstrate compliance with the general environmental duty, DPTI has produced Road Traffic Noise Guidelines (DPTI 2016) which provide guidance to DPTI staff, consultants and contractors when addressing road traffic noise as a key part of an infrastructure project's development. The guidelines set out the process that is to be followed and the criteria that is to be applied when assessing the impacts from road traffic noise related to infrastructure projects involving new roads and/or major upgrading of existing roads and/or significant changes in traffic volumes on existing roads.

Further to the above, there is a common law (i.e. a law developed through the courts) requirement to avoid creating a legal 'nuisance'. A nuisance at common law is an unreasonable interference with the use and enjoyment of land. A nuisance can be caused with respect to neighbouring land by activities undertaken on public land such as roads. It is for the court to decide what is an unreasonable interference and this will often depend on the nature of the local area and the activity.

21.5.3 EXISTING ENVIRONMENT

The existing environment along the transport route is described in the following sections.

Vehicle movements

There is limited data available on traffic volumes on Kangaroo Island, particularly on the western end of the Island. Table 21-4 shows the most recent traffic volume data for some of the roads between the plantation estates and Smith Bay. These counts are raw data and are not seasonally adjusted. The measured traffic volumes on Stokes Bay Road and North Coast Road reflect the seasonal influx of tourists to Kangaroo Island during summer, suggesting that the AADT volume would be lower than indicated here. Heavy vehicle data, which is collected only on the main routes throughout the Island, indicates that heavy vehicles generally account for approximately 7–15 per cent of all vehicle traffic (DPTI 2015b).

Road conditions

Surveys of unsealed roads, which may be used under an open network haulage model, were undertaken in 2017 (W&G 2017) to quantify the width and current state of the road surface. These roads are outside the sealed road network, which is generally in a condition suitable for heavy vehicle movements. The results of this survey are presented in Table 21-5.

Junctions that may be used by heavy vehicles under an open network model were also reviewed to assess their suitability with consideration to pavement condition, speed and sight distance. Sight distance requirements for the assessed junctions have been based on Guide to Road Design, Part 4A: Unsignalised and Signalised Intersections (Austroads 2009). Approach Sight Distance (ASD) has been used for the minor road approaches and Safe Intersection Sight Distance (SISD) used for the major road approaches, where:

- ASD is the minimum level of sight distance, which must be available on the minor road approaches to all junctions to ensure that drivers are aware of the presence of a junction
- SISD provides sufficient distance for a driver of a vehicle on the major road to observe a vehicle on a minor road approach moving into a collision situation and to decelerate to a stop before reaching the collision point.

The results of this review are summarised in Table 21-6.

TABLE 21-4 RECORDED TRAFFIC VOLUMES ON KANGAROO ISLAND

Road	Daily traffic count	Heavy vehicle count (and % of all traffic)	Date of count
Playford Highway (near Stokes Bay Road)	470	38 (11%)	2015
Ropers Road	48	NA	Spring 2017
Gap Road	53	NA	Spring 2017
Stokes Bay Road	150	NA	Summer 2017
Bark Hut Road	55	NA	Winter 2017
McBrides Road	13	NA	Spring 2017
North Coast Road	160	41 (15%)	Summer 2017
Kingscote-Penneshaw Road	850–1400	90–130 (8–15.5%)	2015
Kingscote (local main roads)	1000–3500	70–260 (6-7.5%)	2015

Source: HDS 2018, DPTI 2015a and DPTI 2015b

TABLE 21-5 UNSEALED ROAD CONDITION SURVEY SUMMARY

Road	Width (m)	Condition	Other condition aspects
Jump Off Road	6.0	Good	Trees overhanging roadway in a number of places.
Snug Cover Road–Colmans Road	6.5	Good	Trees and vegetation close to roadway.
Baxters Road	8.0–10.0	Good	Trees overhanging roadway in a number of places.
Berrymans Road	7.0–10.0	Good	Trees overhanging roadway.
North Coast Road	6.0–8.0	Good	General rutting observed and pooling of water observed on verges.
Gosse-Richie Road	9.0	Moderate	Boggy sections and areas of rutting observed. Trees overhang roadway.
Turkey Lane	6.0	Poor	Soft and rutted surface and potholes. Trees overhang road.
Johncock Road	6.0	Moderate	Some potholes. Trees overhang roadway.
Coopers Road	7.0	Moderate	Corrugated surface, with areas of potholes. Trees overhang road.
Tin Hut Road	6.5–8.0	Moderate	Soft edges and localised flooding. Trees overhang road.
Mount Taylor Road	6.5–8.0	Good	Some soft sections with rutting and potholes. Trees overhang road.
McBrides Road	3.5–6.0	Poor	Soft surface. Trees overhang road.
Bark Hut Road	8.0	Moderate*	Some soft, boggy and rutted sections. Trees overhang road. **Has been substantially upgraded in the last twelve months*
Yacca Jacks Road	5.0–6.0	Good	Some ruts. Trees overhang road.
Timber Creek Road	10.0	Good	None.
Church Road	6.0–8.0	Good	Some standing water. Trees overhang road.

Source: W&G 2017

TABLE 21-6 JUNCTION CONDITION SURVEY SUMMARY

Junction	Meets standards	Notes
Playford Highway–Jump Off Road	Yes	
Playford Highway–Snug Cove Road	Yes	
Snug Cove Road–Colmans Road	Yes	
Colmans Road–Berrymans Road	No	Vegetation trimming is required.
North Coast Road–Berrymans Road	No	Vegetation trimming is required.
Playford Highway–North Coast Road–Gosse-Ritchie Road	No	Due to advance warning signage available sight distance is considered to be sufficient.
South Coast Road–Gosse-Ritchie Road	No	Warning signage is required; some vegetation trimming is required.
South Coast Road–Church Road	Yes	
West End Highway–Church Road	No	Vegetation trimming is required.
West End Highway–Baxters Road	No	Warning signage is required.
Church Road–Baxters Road	No	Give Way signage is required.
South Coast Road–Mount Taylor Road	No	Warning signage is required.
Playford Highway–Mount Taylor Road	No	Vegetation trimming is required.
Playford Highway–Turkey Lane	No	Warning signage is required.
Turkey Lane–Johncock Road–Mays Road	No	Junction priority arrangement is not clear.
North Coast Road–Coopers Road	Yes	
Playford Highway–Coopers Road	No	Due to advance warning signage available sight distance is considered to be sufficient.
Coopers Road–Tin Hut Road	Yes	
Playford Highway–Yacca Jacks Road	No	Warning signage is required.
Playford Highway–Timber Creek Road	No	Due to advance warning signage available sight distance is considered to be sufficient.
Playford Highway–Bark Hut Road	No	Warning signage is required. Vegetation trimming is required.
Stokes Bay Road–Bark Hut Road	No	Due to advance warning signage available sight distance is considered to be sufficient.
Bark Hut Road–McBrides Road	Yes	
Playford Highway–Stokes Bay Road	No	Due to advance warning signage available sight distance is considered to be sufficient.
North Coast Road–Stokes Bay Road	Yes	
Playford Highway–Ropers Road	No	Vegetation trimming is required.
Gum Creek Road–Ropers Road–Gap Road	No	Vegetation trimming is required. Due to advance warning signage available sight distance is considered to be sufficient following trimming.
Springs Road–Gap Road	Yes	
North Coast Road–Gap Road	No	Vegetation trimming is required.
North Coast Road–McBrides Road	Yes	

Road users

Apart from general road users, the major users of roads on Kangaroo Island include:

- **Community access routes:** Kangaroo Island has several community access routes – that is, routes that link communities of 100 people or more to essential services such as education, health, finance, recreation and emergency services. Stokes Bay Road and the Playford Highway west of Parndana are regionally significant community access routes in the vicinity of the plantation forests and Smith Bay. Community centres, defined by having a post office, school, hospital, firefighting service and/or information centre present, are shown on Figure 21-5.
- **Farms and rural residences:** In many locations, access to farms and rural residences to roads along the transport route is via private driveways. In some cases, sight distances at these junctions do not comply with road standards.
- **Livestock:** The movement of livestock across or along road reserves is not uncommon. Those in charge of the livestock are responsible for maintaining a reasonable standard of care – including warning other road users of the hazard (refer Government of South Australia, Guidelines for Using Stock on Road Signs).
- **Tourists:** The Southern and Hills Local Government Association (S&HLGA) 2020 Transport Plan (which includes Kangaroo Island) defines a number of regionally significant tourist routes in the vicinity of the plantation forests and Smith Bay, including Playford Highway and West End Highway, and a number of secondary routes (defined as a route used by at least one 40-seat bus per day in the tourist season) (S&HLGA 2016). These secondary routes include North Coast Road, Stokes Bay Road and Emu Bay Road. Figure 21-5 shows typical tourist routes suggested by the South Australian Tourism Commission.
- **School bus routes:** There are several school bus routes in the vicinity of the transport route, including Playford Highway, Stokes Bay Road and North Coast Road. The current bus routes on Kangaroo Island are shown in Figure 21-5.
- **Vulnerable road users:** Cyclists and, to a lesser extent, pedestrians are occasional users of the Kangaroo Island road network.

Approximately $12.1 million was spent on fuel products on Kangaroo Island in 2016–17 (Austrade 2018). At an average price of $1.60 per litre, and an average fuel consumption of 13.3 litres per 100 km (ABS 2016), this equates to 57 million kilometres travelled on Kangaroo Island per annum for all vehicles.

Road safety

South Australia

The annual number of road deaths and serious injuries is traditionally used as an indicator of road safety in South Australia.

There were 100 fatalities recorded on South Australian roads in 2017. This is 14 more than the 86 fatalities recorded in 2016 and is 2.6 more fatalities than the previous five-year average (2012–16) of 97.4 fatalities. Serious injuries decreased from 692 in 2016 to 622 in 2017, 16 per cent lower than the previous five-year average (2012–16) of 743 serious injuries per year.

The South Australian Road Safety Strategy 2020 – Towards Zero Together has a target to reduce fatalities to fewer than 80 and serious injuries to fewer than 800 by 2020 (DTEI 2011).

Kangaroo Island

The number of crashes on Kangaroo Island in the period 2012–16 is summarised in Table 21-7.

DPTI data on casualty crashes for South Australia (DPTI 2017a) shows:

- casualty numbers were high in the younger age groups, 16–24-year-olds representing the highest numbers
- 55 per cent were male and 45 per cent were female
- 57 per cent of driver and rider casualties that occur in the Fleurieu Peninsula and on Kangaroo Island are residents of the region, 34 per cent are residents in the Adelaide Metropolitan area, seven per cent are from other rural areas in South Australia and two per cent are from interstate
- while crashes can occur at any time, the most common time for a casualty crash to occur in the Fleurieu Peninsula and on Kangaroo Island is mid-day to 6 pm
- the majority of casualty crashes are the result of a vehicle hitting a fixed object, followed by rollovers and right-angle accidents
- the majority of crashes in the Fleurieu Peninsula and on Kangaroo Island occur on high-speed roads – 74 per cent of all fatal crashes occurred on roads limited to 100 km/h
- 75 per cent of all casualty crashes in the Fleurieu Peninsula and on Kangaroo Island occur at 'mid-block' sections (i.e. where there are no intersecting roads) and the remaining 25 per cent occur at intersections.

TABLE 21-7 CASUALTY CRASHES ON KANGAROO ISLAND (2012–16)

Fatal crashes	Serious crashes	Minor crashes	Total
5	31	51	87

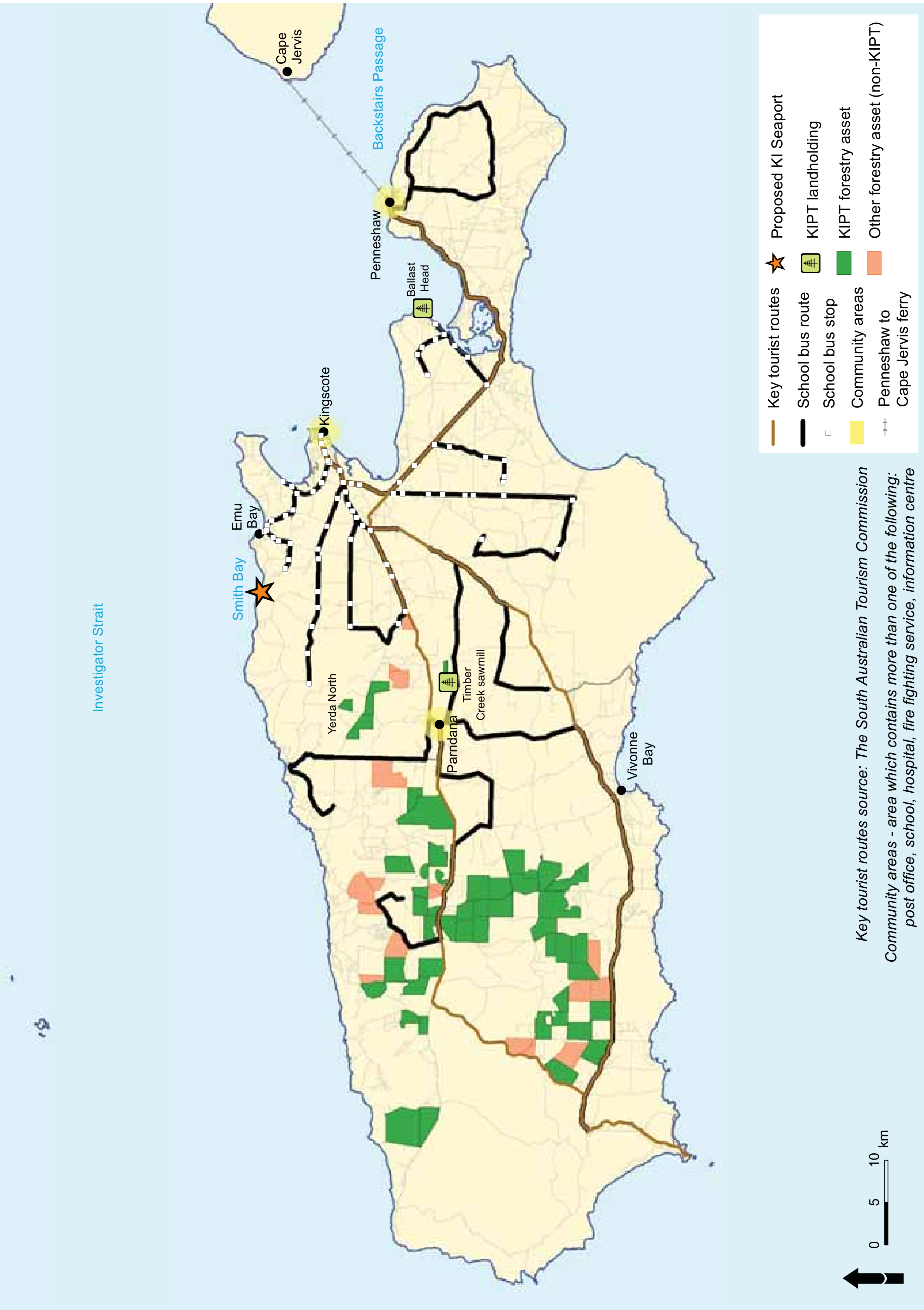


FIGURE 21-5 TYPICAL TOURIST AND CURRENT BUS ROUTES ON KANGAROO ISLAND

The overall vehicle accident and fatality rates in South Australia are 99.1 crashes and 0.51 deaths per 100 million kilometres travelled (DPTI 2017c).

Heavy vehicles

Heavy vehicles travel more than 1.3 billion kilometres per year in South Australia and represent eight per cent of total kilometres travelled in the state. On average (from 2012–16) heavy vehicles were involved in 20 per cent of fatal crashes (over-represented relative to kilometres travelled), seven per cent of serious injury crashes and five per cent of minor injuries (under represented).

There are no heavy vehicle-specific crash statistics available for Kangaroo Island. However, the following DPTI statistics relating to heavy vehicle crashes in South Australia (DTPI 2017b) are considered relevant to this assessment:

- the most common type of serious casualty crashes involving heavy vehicles during 2012–16 were head on crashes (19 per cent). Right angle collisions represented 18 per cent of crashes, rollovers 13 per cent and sideswipe 13 per cent
- the majority of heavy vehicles involved in serious casualty crashes are semi-trailers and rigid trucks larger than 4.5 tonne, together representing almost two-thirds of the total number of heavy vehicles involved in serious casualty crashes, broadly proportional to the number of kilometres travelled by this class of vehicle with respect to total heavy vehicle movements for all classes
- for the five years from 2012–16, there were 88 fatal crashes involving heavy vehicles of which 75 (85 per cent) involved a light vehicle, pedestrian, motorcyclist or cyclist. The heavy vehicle driver was deemed responsible in 20 per cent of these crashes
- for the five years from (2012–16) mid-block crashes accounted for 63 per cent of serious casualty crashes involving at least one heavy vehicle. The majority occurred on rural roads with 68 per cent of fatal crashes and 53 per cent of serious injury crashes occurring in rural South Australia. Half of all serious casualty crashes occurred on road speeds limited to 100 km/h or 110 km/h.

The semi-trailer truck fatality rate outside city areas in Australia is 1.2 deaths per 100 million vehicle kilometres travelled (BITRE 2015), approximately double that of the overall vehicle fatality rate.

Vehicle and fauna interactions

In the period 2012–16 inclusive, there were eight reported serious casualty crashes as a result of interactions with animals in South Australia, all but one occurred in a speed limit zone of 80 km/h or greater and in rural areas (DPTI 2017c). The total number of animal deaths as a result of collisions with vehicles cannot be determined, although a study of insurance claim data presented by AAMI (cited in Xinhua 2016) estimated that approximately 20,000 insurance claims (in Australia) were made per annum as a result of interactions with native mammals, consisting of kangaroos (88 per cent), wallabies (six per cent), wombats (three per cent) and dogs (two per cent).

The total number of vehicle kilometres travelled in Australia was approximately 250,000 million kilometres per annum. However, only 60,700 million kilometres were in rural areas and rural centres (ABS 2016). Assuming that most fauna interaction occurs outside residential areas, the inferred animal accident rate is around one interaction per 3 million kilometres travelled.

Ecological environment

The ecological values associated with various road sections were assessed by EBS Ecology and are detailed in Appendix P6. The various transport routes were broken into 11 sections largely defined by road type (i.e. sealed/dirt minor road/track etc.). These are summarised below in Table 21-8 and shown in Figure 21-6. The sensitivity assessment is based on the overall ecological values of sections, with consideration to the following ecological aspects:

- listed threatened ecological communities
- listed threatened species
- listed migratory species
- listed marine species
- invasive species
- state threatened flora and fauna
- vegetation patterns, associations and unit biodiversity scores.

Social environment

Noise

Noise levels were measured in and around Smith Bay in December 2017, including at receptors near North Coast Road, as a component of the noise impact assessment presented in this EIS (refer Chapter 18 – Noise, Vibration and Lighting) and were found to be generally low, ranging between 47 and 52 dB(A_{Leq}) during the day with maximums of approximately 74–79 dB(A_{Lmax}), reducing to approximately 44 dB(A_{Leq}) at night. The noise was dominated by sounds associated with wind, insects and birds.

TABLE 21-8 TRANSPORT ROUTE SECTION ECOLOGICAL SENSITIVITY

Section	Road type	Sensitivity	Description
Playford Highway (West End Highway–Stokes Bay Road)	Sealed major	Low-moderate	The section had largely intact vegetation for the entire length aside from areas such as house frontages and intersections. The subsequent vegetation unit score was high. However, the width of the existing road discourages ecology interaction.
Stokes Bay Road (Playford Highway –Bark Hut Road intersection)	Sealed minor	Low-moderate	Vegetation was somewhat degraded due to narrow road reserve width and adjacent land use. This section had state conservation rated species such as *Eucalyptus fasciculosa* (pink gum, state-classified as rare and *Xanthorrhoea semiplana* ssp. *tatei* (Tate's grass tree, state-classified as rare) well represented along the alignment as well as some creek crossings which provide potential nesting habitat for *Calyptorhynchus lathami* ssp. *halmaturinus* (glossy black-cockatoo).
Bark Hut Road (Stokes Bay Road–McBrides Road intersection)	Unsealed major	Moderate-high	High-quality vegetation within this section on the road reserves and adjacent paddocks.
McBrides Road (Bark Hut Road– North Coast Road intersection)	Unsealed minor	Moderate-extreme	Sensitivity varied depending on the quality of the vegetation and whether it was substantially intact or not. Extreme values were where intact vegetation occurs including areas where potential glossy black-cockatoo nesting habitat exists and where creek crossings occur.
North Coast Road (McBrides Road–Freeoak Road: site access road)	Unsealed major	Low-moderate	The limestone sheeting material on this road was very stable and appeared to raise limited dust at the time of the survey. Some glossy black-cockatoo feeding habitat and potential nesting habitat occurs in some segments, particularly in the vicinity of Rose Cottage Road intersection which has large remnant patches within close proximity to the road.
Rose Cottage Road (North Coast Road–Springs Road intersection)	Unsealed minor	Low-moderate	Rated as low to moderate sensitivity due to the increased width of this road and lack of high-value vegetation communities. Small sections of *Eucalyptus cladocalyx* (sugar gum) were present in low-lying sections however the condition decreased with direction west.
Springs Road (Rose Cottage Road–North Coast Road)	Unsealed major	Moderate-extreme	Rose Cottage Road had some of the best patches of *Eucalyptus cneorifolia* (Kangaroo Island narrow-leaved mallee) encountered within the project area. Several of these patches fit within criteria as a threatened ecological community and as a result much of the area has been deemed highly sensitive.
North Coast Road (Smith Bay Driveway–Gap Road intersection)	Unsealed major	Low-extreme	This section of road varied between areas of highly degraded habitat and patches of significant stands of vegetation communities, which were poorly represented within the local area. Several areas of potential threatened ecological community Kangaroo Island narrow-leaved mallee patches were present in this section.

TABLE 21-8 TRANSPORT ROUTE SECTION ECOLOGICAL SENSITIVITY (CONT'D)

Section	Road type	Sensitivity	Description
Playford Highway (Stokes Bay Road –Ropers Road intersection)	Sealed major	Low-extreme	Variable sensitivity that was largely driven by areas of critical feeding and nesting habitat for glossy black-cockatoo that exist within and adjacent to the road reserve. There are high levels of traffic associated with general vehicles and heavy vehicles on this section. Some areas where creek crossings have particularly large critical nesting habitat trees for glossy black-cockatoos that overhang the road. This sensitivity is heightened in the area around Bark Hut Road.
Ropers/Gap Road (Playford Highway–North Coast Road)	Unsealed minor		This section has a number of significant areas that provide critical and potential habitat for glossy black-cockatoos as well as numerous areas that support Kangaroo Island narrow-leaved mallee. Many of the Kangaroo Island narrow-leaved mallee road reserve areas have connectivity with adjacent private patches and other large intact areas. Ropers and Gap roads are narrow and there is overhanging mallee vegetation.
Freeoak Road (a site access road from North Coast Road)	Unsealed track	Low-moderate	This road is a degraded narrow track that has intact overstorey in patches over exotic grassland and chenopod shrubs.

Further noise monitoring was undertaken in the vicinity of the proposed Yerda North intermediate logistics yard (on McBrides Road), considered to be generally representative of rural noise away from traffic or ocean-related noises, with noise levels found to be lower than those of the Smith Bay site at 41 and 31 dB(A_{Leq}) for the day and night periods, respectively.

Dust

Dust deposition rates on Kangaroo Island have not been monitored to date. However, a review of baseline dust concentrations in other, similar areas (refer Chapter 17 – Air Quality) has demonstrated that dust deposition rates are likely to be consistent with other rural and agriculture-dominated areas of South Australia at around 2 g/m^2/month as an annual average.

A study of dust deposition adjacent to unsealed roads has found dust deposition rates in the immediate vicinity of unsealed roads of approximately 1.4 g/m^2/day as a result of vehicle traffic (Jones et al. 2015).

Visual amenity

The use of headlights at night is considered necessary to ensure the safety of other road users, property and wildlife. Light emissions from vehicle headlights at night have the potential to be intrusive and negatively affect amenity when they shine into residences along the transport route. Current AADT vehicle traffic volumes on Kangaroo Island are generally low, with lower (inferred) heavy vehicle numbers. It is assumed that the majority of AADT volumes occur during daylight hours, with only occasional and infrequent night time vehicle traffic on the minor unsealed roads on Kangaroo Island. Additionally, most houses along rural roads are set back from the road and are not considered to be materially affected by current light emissions.

21.5.4 TRAFFIC IMPACT ASSESSMENT

The impacts associated with undertaking the transport task (see Section 21.5.1) in the context of the existing regulatory (Section 21.5.2) and physical environment (Section 21.5.3) are presented below.

Vehicle movement impacts

The transport task would increase traffic volumes along the transport route. During the construction phase, this increase in traffic (up to approximately 10 vehicle movements per day over the 15-month construction period) is likely to be indistinguishable from existing traffic volumes.

During the operations phase, heavy vehicle movements may be up to approximately 130 AADT and would be likely to average approximately 85 AADT over the harvest cycle. This is described in Table 21-9 assuming that, using an open network model, timber haulage vehicles may use any of these roads subject to road conditions.

The increase in overall traffic is expected to be approximately 15 per cent on the major roads, increasing further to 28 per cent on the Playford Highway and 81 per cent on North Coast Road. The minor unsealed roads would see traffic

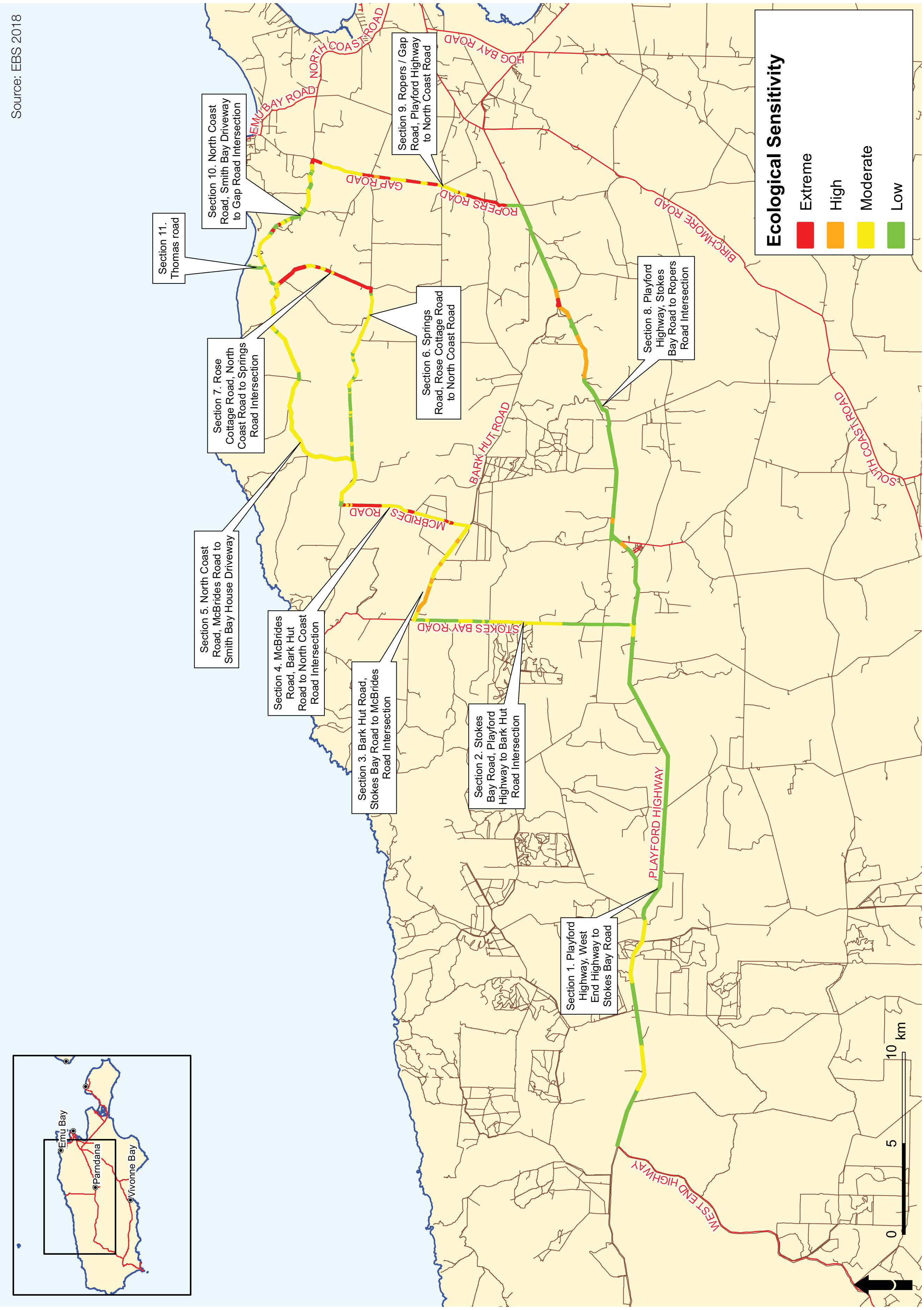


FIGURE 21-6 ECOLOGICAL SENSITIVITY MAP OF TRANSPORT ROUTES

increase three-fold, with the largest increase occurring on McBrides Road, where traffic would increase by an order of magnitude. The proportion of heavy vehicles would increase from the current 6–15 per cent up to approximately 11–22 per cent near the major population centres, and up to 28 per cent on Playford Highway.

Traffic delays as a result of the increased traffic are likely to be minor in nature, in the order of approximately two minutes for some vehicles, to allow for heavy vehicles to accelerate and brake at intersections. Outside of these times, the heavy vehicle fleet would travel at just below the posted speed limit and thus disruption is expected to be minimal. On unsealed roads, the heavy vehicle fleet would travel at no more than 80 km/h in accordance with DPTI Operational Instruction 4.10 which states that on unsealed roads with varying width, alignment and surface condition, a maximum speed of 80 km/h may be appropriate. Should a car that would otherwise travel at 100 km/h on the unsealed road, catch up to a heavy vehicle travelling at 80 km/h, the delay would be approximately two minutes across a 15 km road segment, representing the longest continuous unpaved road segment likely to be used as a component of the transport route.

Road condition impacts

The use of heavy vehicles on unsealed roads is likely to result in increased surface wear, including rutting, potholing and corrugations. Well-drained roads will suffer less wear than those which have simply been graded rather than formed and cambered to shed water efficiently.

Maintenance of the roads is the responsibility of the relevant authority (i.e. DPTI or the Kangaroo Island Council, see Section 21.5.2), which is committed to maintaining roads in fit-for-purpose condition in accordance with their internal standards (DPTI) and the Kangaroo Island Council Transport Infrastructure and Asset Management Plan, respectively.

Kangaroo Island Council's Transport Infrastructure and Asset Management Plan states:

> *The road transport assets will be maintained at a level appropriate with their hierarchy, classification and usage type. We need to ensure key functional objectives are met:*
>
> - *freight accessibility*
> - *tourism satisfaction.*
>
> *The main functional consequence of the planned maintenance and renewal works is a 'fit-for-purpose' road network.*

The transport route under an open network model would vary in response to prevailing road, meteorological and traffic conditions. While some of the transport task may be concentrated on minor access roads for which additional wear may be significant, the up to 3.4 million kilometres that KIPT will travel each year, based on an estimated 47,000 trips for the peak volume of timber to be transported (refer to Table 21-3), multiplied by the average transport distance (70 km one-way trip), is approximately six per cent of the of the 57 million vehicle kilometres travelled per annum on Kangaroo Island currently, and the increased wear on most roads on Kangaroo Island is expected to be not material.

TABLE 21-9 CHANGE IN TRAFFIC VOLUMES ON KANGAROO ISLAND

Road	Existing daily traffic count (AADT)	Existing heavy vehicle count (and % of all traffic)	Predicted peak daily traffic count (and % increase)	Predicted peak heavy vehicle count (and % of all traffic)
Playford Highway (near Stokes Bay Road)	470	38 (11%)	600 (28%)	168 (28%)
Ropers Road	48	NA	178 (270%)	NA
Gap Road	53	NA	183 (245%)	NA
Stokes Bay Road	150	NA	280 (115%)	NA
Bark Hut Road	55	NA	185 (236%)	NA
McBrides Road	13	NA	143 (1000%)	NA
North Coast Road	160	41 (15%)	290 (81%)	171
Kingscote–Penneshaw Road	850–1400	90–130 (8–15.5%)	980–1530 (15%)	220–260 (17–22%)
Kingscote (local main roads)	1000–3500	70–260 (6–7.5%)	1130–3630 (13%)	200–390 (11–18%)

Road safety impacts

Statistical crash rates for all vehicles and heavy vehicles per 100 million vehicle kilometres travelled (VKT) were presented in Section 21.5.3. The KIPT timber haulage fleet is expected to travel approximately 3.4 million kilometres per annum in the peak traffic year, and therefore may be expected (statistically) to be involved in approximately 3.2 accidents per annum, with zero fatalities. With KIPT's six per cent increase in kilometres travelled, the existing crash statistics are unlikely to change significantly. Further, management and mitigation measures (see Section 21.5.5) would be implemented by KIPT (with the agreement of DPTI and the Kangaroo Island Council) as necessary to reduce the potential for accidents to as low as reasonably achievable.

Table 21-5 and Table 21-6 detailed the existing road and junction conditions on a range of roads that potentially may be used by KIPT and which are currently used by a range of heavy vehicles, albeit in lower numbers than would occur under an open network model. In general, these roads require the following works to be suitable for consistent heavy vehicle usage:

- **Carriage widths:** The carriage width of these roads is generally less than seven metres, the recommended minimum for a two-lane, two-way road specified in the Australian Road Research Board Unsealed Roads Manual, Guidelines to Good Practice.
- **Road geometry:** Much of the road network has substandard horizontal and vertical geometry for high volumes of heavy vehicles.
- **Drainage:** Poor stormwater drainage is common throughout the road network and can result in inundation during rainfall. Poor drainage also leads to increased degradation of road surfaces.
- **Native vegetation:** Native vegetation overhangs the roadway throughout much of network. While this encroachment is typically not great enough to affect light vehicle movements, heavy vehicles may strike overhanging vegetation. The encroachment may also interfere with sightlines at curves and intersections throughout the network.
- **Signage:** The signage at intersections and approaches to intersections is deficient at numerous locations. This includes a number of intersections where the right of way is also not clear.

As described in the KIPT transport strategy (refer Section 21.2), KIPT would work with DPTI and the Kangaroo Island Council to implement changes as necessary to facilitate heavy vehicle movements along the transport route.

Ecological impacts

Land and vegetation clearance

The existing ecological sensitivity along various sections of the transport route was summarised in Table 21-8 and illustrated in Figure 21-6. Table 21-5 and Table 21-6 detailed the existing road and junction conditions on a range of roads that potentially may be used by KIPT, highlighting the areas that may require road widening (land clearance) and/or vegetation trimming for the safe operation of heavy vehicles.

The extent and nature of these works would be determined in consultation with relevant authorities and under the appropriate EPBC Act and DPTI/Kangaroo Island Council approvals (as required), with consideration to the sensitivity of the existing environment. This may involve Kangaroo Island Council establishing suitable EPBC offsets and the development of a Significant Environmental Benefit offset under the *Native Vegetation Act 1991* (SA).

Vehicle and fauna interactions

The rate of animal/vehicle interactions (that result in insurance claims) was found to be around one per 3 million kilometres travelled. The rate of interactions that do not result in significant damage to vehicles could not be quantified but is likely to be much greater. KIPT haulage vehicles will travel around 3.4 million kilometres per annum, and therefore it is estimated (statistically) that one collision would occur per annum that would result in some vehicle damage. A greater number of collisions with smaller animals would be expected, although an indicative number cannot be estimated with any certainty. Approximately 57 million kilometres are current travelled on Kangaroo Island per annum, which means the existing local and tourist traffic would remain the most significant contributor to fauna deaths on the roads.

It is expected that the higher speeds on the sealed roads represent a greater danger of collision. However, sealed roads also tend to be well trafficked, which may discourage smaller animals from the immediate areas beside the roads. Unsealed roads are less trafficked and thus more likely to support animals on the road verges. However, in general, KIPT haulage vehicles will be travelling at a lower speed on these sections.

Dust

The passage of heavy vehicles on unsealed roads is likely to result in greater rates of dust deposition due both to the increase in traffic and to the potential for increased degradation of the unsealed road surfaces.

It has been shown that increases in deposited dust concentrations cause a reduction in the growth, yield, flowering and reproduction of vegetation (Saunders and Godzik 1986, cited in Prajapati 2012). The three principal mechanisms by which this occurs are:

- changes in energy exchange (i.e. the absorption and conversion of radiation)
- reductions in light absorption (i.e. effects on vegetation photosynthesis)
- the inhibition of water vapour exchange (i.e. gas diffusion between leaves and air) (Doley 2006).

Critical dust loads that result in significant alterations in the most sensitive plant functions have been found to vary with the particle size distribution and the colour of the dust, from around 1 g/m^2 for ultra-fine carbon black particles to about 8 g/m^2 for more course road or limestone particles with a median diameter of greater than 50 µm (Doley, 2006). Farmer (1993) showed that the direct physical effects of mineral dusts on vegetation become apparent only at relatively high surface loads of greater than 7 g/m^2. Analysis of roadside dust deposition has found that vegetation near unpaved roads can be subjected to up to 10 g/m^2/day of dust deposition (Everett 1980, cited in Farmer 1993). Thomson et al. (1984) found that around 5 g/m^2/day was required to cause a reduction in photosynthesis of roadside vegetation, and a dust load of 10 g/m^2 reduced photosynthesis by between 18 and 30 per cent. His experiments established that dust may affect photosynthesis by shading and obstructing diffusion and that dust was found to have an appreciable effect at concentrations between 5 and 10 g/m^2.

Unsealed roads on Kangaroo Island are subject to existing dust generation as a result of vehicle movements, including frequent intense emissions associated with the movement of harvested grains during the drier summer months. No material impacts to roadside vegetation were noted during the ecological survey of segments of the transport routes. However, this vegetation may have adapted in response to the existing dust levels. Therefore, it is possible that an increase in immediate road-side effects to vegetation may occur as a result of the use of heavy vehicles on the transport route, but with long-term effects varying depending on the longevity of increase in traffic along these routes. It is expected that these effects would be limited to the immediate vicinity of the road. The adoption of a road management regime to maintain a sound road surface will assist in minimising the potential for dust generation on these unsealed roads. It should also be noted that the areas that are most suitable for plantation forestry are those with relatively high rainfall and persistent soil moisture, so that dust-related problems in the forestry areas themselves are likely to be confined to the summer months, when photosynthesis is not the limiting factor in plant health.

With regards to potential impacts on fauna, studies of the effect of dust deposition on the abundance and diversity of fauna in proximity to unsealed roads (Jones et al. 2015) have found that:

> *Pre-upgrade trapping surveys confirmed that the forest supported a diverse and abundant community of ground-dwelling mammal species with eight species detected, including in highly dust-affected sites next to the road. Following the upgrade, there was little change in the abundance of species ... These results suggest that, in certain environments, dust may have far less impact on ground-dwelling mammals than expected.*

The potential for fauna impacts associated with dust from the roads is therefore expected to be low.

Social impacts

Noise

Baseline noise levels considered typical of rural areas on the transport route were presented in Section 21.5.3. As a result of the increase in heavy vehicle traffic, noise levels are expected to increase at receivers (residences) along the transport route. As a rule, a doubling of traffic volumes corresponds to a 3 dB increase in noise levels at locations adjacent to roads assuming that the character of the noise is similar. Applying this to the predicted increases in traffic volumes presented in Table 21-9 allows a prediction of the expected noise levels on various road segments, as summarised in Table 21-10.

Peak noise levels (i.e. the noise level generated by a single truck passing a receiver) will not be any greater than present. Average noise levels are, however, expected to increase across all roads on the transport route when haulage operations commence. Increases on major roads in the vicinity of residential areas are expected to increase marginally (i.e. less than 3 dB), with the lesser used roads predicted to have increases of approximately 6–12 dB. The resultant overall noise levels were compared against the requirements of the DPTI Road Traffic Noise Guidelines criteria, and the results are presented in Table 21-11.

Results of the noise assessment indicate that the predicted noise levels would comply with the DPTI Road Traffic Noise Guidelines along the transport route. With respect to noise amenity, an increase of 3 dB or less is generally considered barely perceptible (YourHome 2018) and therefore, over the majority of the populated areas of the transport routes, there is expected to be no change in existing amenity. Increases in noise of greater than 3 dB along the transport corridor would be restricted to areas with little existing traffic and few residences. However, there is likely to be a decrease in noise

TABLE 21-10 PREDICTED INCREASES IN AVERAGE NOISE LEVELS ALONG THE TRANSPORT ROUTE

Road	Existing daily traffic count (AADT)	Predicted peak daily traffic count (and % increase)	Existing nighttime noise level (dB(A_{Leq}))	Predicted noise level increase (dB)
Playford Highway (near Stokes Bay Road)	470	600 (28%)	47	1
Ropers Road	48	178 (270%)	44	6
Gap Road	53	183 (245%)	44	6
Stokes Bay Road	150	280 (115%)	44	3
Bark Hut Road	55	185 (236%)	44	6
McBrides Road	13	143 (1000%)	31	12
North Coast Road	160	290 (81%)	44	3
Kingscote-Penneshaw Road	850–1400	980–1530 (15%)	52	1
Kingscote (local main roads)	1000–3500	1130–3630 (13%)	52	1

TABLE 21-11 PREDICTED NOISE LEVEL COMPARISON AGAINST DPTI GUIDELINES

Road	DPTI Guideline criteria+ (dB(A_{Leq}))		Predicted noise level (dB(A_{Leq}))	
	Day	Night	Day	Night
Playford Highway (near Stokes Bay Road)	60	55	53	48
Ropers Road	60	55	58	50
Gap Road	60	55	58	50
Stokes Bay Road	60	55	55	47
Bark Hut Road	60	55	58	50
McBrides Road	53 (41+12)	43 (31+12)	53	43
North Coast Road	60	55	55	47
Kingscote–Penneshaw Road	60	55	53	53
Kingscote (local main roads)	60	55	53	53

+ Criteria reflects 'Existing receivers affected by noise from a redeveloped road' as no new roads are being proposed.

amenity at these locations. The primary mitigation measure for these impacts would be to reduce traffic volumes by using high productivity vehicles and the use of a defined transport route (see Figure 21-8), selected such that the route passes by the fewest number of residences (such as the use of McBrides Road that currently has no nearby residences).

Dust

Dust ground-level concentrations would be expected to increase in the immediate vicinity of unsealed roads as a result of the use of heavy vehicles. However, these effects are expected to be contained to the immediate vicinity of the roads and no significant increase in exposure to ambient dusts is expected at residences adjacent to the roads such that it would represent a health risk.

Visual amenity

Visual amenity may be impacted through the generation of additional ambient dusts and/or through the observed increase in vehicle lighting associated with night heavy vehicle movements. Both of these are considered likely to occur, however are not likely to represent significant changes to the current environment except for the less travelled roads that do not currently carry much traffic. People's reaction to changes to amenity can vary, and thus the impact is difficult to quantify with certainty.

Third-party and public access

As discussed in Chapter 2 – Project Justification and Chapter 20 – Economic Environment, KIPT has had informal discussions with a number of parties to clarify whether other users may be interested in using KI Seaport. The existing volumes of freight on the Island, however, are not significant in comparison to the projected volumes of timber products. For example, the average annual grain harvest (the largest commodity produced on the Island) for the 10 years to 2017 was less than 40,000 tonnes (PIRSA 2017). To the extent that such other uses eventuated, they would be the subject of separate assessment and approvals processes that would be the responsibility of the individual proponents. These processes would include an assessment of the associated traffic impacts.

Access to third party operators would only be granted to the extent that it did not interfere with KIPT operations and/or have a detrimental impact on KIPT's relationship with its stakeholders, including neighbouring properties and operations.

Traffic volumes for third party use are unknown at this stage, but are likely to be negligible compared to existing volumes and predicted KIPT freight volumes. Road upgrades required for the KIPT defined route would cater for any foreseeable third-party traffic volumes.

Public access to the onshore and offshore facilities would not be permitted. KIPT has approached the Kangaroo Island Council to close Freeoak Road to the public from the southern boundary of Lot 51 to the foreshore.

21.5.5 MITIGATION AND MANAGEMENT

Construction phase

The proposed construction methodology and transport strategy aims to minimise the need to move material by road on Kangaroo Island, with bulky materials moved preferentially by barge directly to Smith Bay. Any materials that are moved to site by road would be transported using general access vehicles (see Section 21.5.1) and the number of movements is not expected to generate any material impacts. A construction traffic management plan would be implemented.

Operations phase

The potential impacts associated with the base case open network model during the operations phase were described in Section 21.5.1, assuming no mitigation measures are applied. Ecological considerations excepted, this assessment demonstrates that the transport task can be completed without resulting in significant adverse impacts to receptors. Road upgrades would be required even if only single articulated vehicles are used to achieve safety outcomes.

As described in Section 21.2, it is KIPT's preference, with the approval and concurrence of the Kangaroo Island Council and the South Australian government, to implement additional mitigation and management measures as a component of the overall transport management strategy:

- the use of high productivity vehicles, specifically Performance Based Standard (PBS) Level 2A (B-double) and/or PBS Level 2B (short road train or A-double) vehicles
- the use of a 'defined transport route' through the upgrade of the defined transport route to allow all weather continuous access by heavy vehicles
- other, more general, safety measures.

These are detailed in the following sections.

High productivity vehicles

The traditional use of single articulated trucks as 'workhorses' for road freight in Australia has been superseded by B-doubles (illustrated in Figure 21-7). B-doubles offer an increased payload of 61 per cent (more than a single semi-trailer) for a 13 per cent increase in vehicle operating costs (BITRE 2011). This equates to an operating cost saving of approximately 30 per cent while reducing the volume of vehicle traffic using the transport route. For road infrastructure managers (particularly at local government level) the challenge is to ensure that B-doubles can access all desired locations in a safe and sustainable manner, that is, that the roads are built and maintained to the relevant standards.

The use of vehicles larger than B-doubles (i.e. A-double or short road trains) can sometimes also be justified, although the cost savings become more marginal as size increases and operational flexibility can be decreased. The use of these vehicles can only be justified on a case-by-case basis, taking into account the unique freight situation for a given commodity travelling on a given route.

There is a perception that PBS vehicles, by definition, bring with them an increased risk to public safety. However:

- PBS vehicles tend to be newer and often come with more comprehensive safety features than the traditional Australian heavy vehicle fleet
- PBS vehicles are proven to be less likely to be involved in a crash. A key finding of Austroads (2014) was that PBS vehicles were responsible for 66 per cent fewer crashes than conventional vehicles per unit of distance travelled. For serious and major crashes only, this figure rose to 76 per cent
- The use of PBS vehicles reduces the number of vehicles on the road for a given tonnage of freight, so that all forms of road trauma, including to other road users and to fauna, are commensurately reduced.

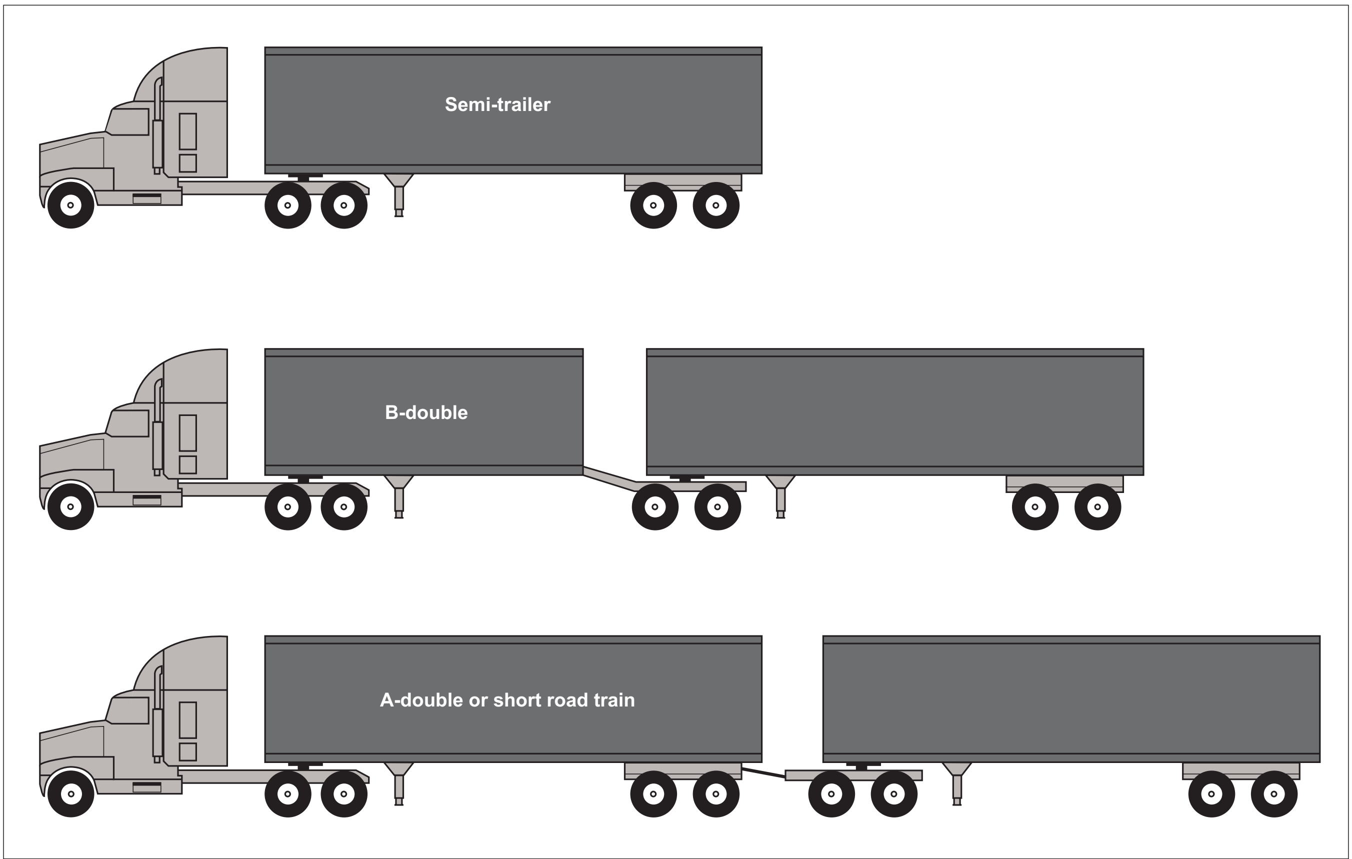


FIGURE 21-7 ILLUSTRATIVE DEPICTION OF VEHICLES BY SIZE AND TYPE

The use of high productivity vehicles rather than semi-trailers would not have a greater impact on road pavement life because the pavement would be affected by overall tonnage and individual axle loads, rather than the size or number of vehicle movements when comparing general mass limits (GML) vehicles. Higher mass limit (HML) vehicles (i.e. PBS vehicles) can carry approximately 10 per cent more payload than GML vehicles and are fitted with improved suspension so axle loading on the pavement is equivalent to that of GML. Screwing forces caused by steering at intersections are similar to those generated by general access heavy vehicles but, because of increased payloads and consequentially reduced numbers of vehicles, occur less frequently for a given tonnage of freight.

The benefit of permitting the use of high productivity vehicles (B-doubles and A-doubles) is measured by the comparison of the number of heavy vehicle movements annually, which is illustrated in Table 21-12. The use of A-doubles would halve the number of vehicle movements. This represents the most effective option for mitigating the adverse impacts of the haulage operation, most of which are related to the number of vehicle movements either directly or through the total number of kilometres travelled.

Defined transport route

The open network model allows the use of any public roads for which specific heavy vehicles are permitted, subject to road conditions. KIPT has identified that the open network model would allow the transport of timber from the plantations to the KI Seaport without significant road upgrades. These roads would be subject to degradation and would require some level of upgrade due to high freight volumes. Their use would be determined by the weather and traffic conditions. When roads are impassable as a result of the deterioration of the road surface or through local flooding, KIPT would need to use alternative routes.

There are significant advantages in having a defined transport route from the centre of Kangaroo Island to the KI Seaport, specifically:

- it is more likely that a defined route would qualify for State and Commonwealth government grants because the economic case for such upgrades is easier to substantiate when the cost of road upgrades is confined to a specific route, rather than the entire network
- a defined route would ensure funding was focused on the appropriate infrastructure to improve safety and meet fit-for-purpose standards

TABLE 21-12 EFFECT OF VEHICLE TYPE ON TRAFFIC NUMBERS

Production rate (t)	Single articulated (30 t GML)		B-double (42.5 t GML)		A-double (60 t GML)	
	Total annual trips+	Daily average (AADT)	Total annual movements	Daily average (AADT)	Total annual movements	Daily average (AADT)
400,000	26,667	73	18,824	52	13,333	37
500,000	33,333	91	23,529	65	16,667	46
600,000	40,000	110	28,235	77	20,000	55
700,000	46,667	127	32,941	90	23,333	64

+ Total annual trips include one loaded movement to the wharf and an empty return movement to the plantation

- where the defined route includes roads that have an existing regionally significant purpose such as for community access or tourism, these roads can be upgraded to meet the fit-for-purpose standard of the joint purpose
- local residents would become familiar with the main route and may choose alternative routes, and signage could be used to encourage tourists to avoid these routes.

Initial work undertaken by Wallbridge Gilbert (W&G 2017), see Appendix P1, investigated a number of route options on the assumption that the haul vehicle would be a 19-metre single articulated truck. Subsequent work undertaken by Osman Solutions (September 2017), see Appendix P2, focused on the use of high productivity vehicles. The route assessment criteria were determined in conjunction with the Kangaroo Island Council as the first step in the assessment scope. Following an initial review of nine route options, a short list of options was agreed with Kangaroo Island Council for more detailed consideration.

This detailed assessment identified two options:

- Option 1 consists of Playford Highway, Stokes Bay Road, Bark Hut Road, McBrides Road and North Coast Road
- Option 2 consists of Playford Highway, Ropers Road, Gap Road and North Coast Road.

Option 1 is the preferred option when considering distance, journey time, interaction with other road users, effects on residences and the estimated total cost of upgrade.

HDS Australia were commissioned by Kangaroo Island Council to undertake a heavy vehicle route assessment of both options (HDS Australia 2018a), see Appendix P4, which favoured Option 2 because it has a lower initial capital cost; HDS Australia recommended a staged implementation of Option 2 based on funding and risk profiling.

HDS Australia's assessment, however, did not consider the potential ecological impacts associated with the two options. EBS Ecology was commissioned to review the ecological sensitivities of the two options with consideration to roadside vegetation, habitats and species with state/federal protection listing (see Appendix P5). The results demonstrated that Option 1, while not free of ecological impacts, presented a significantly reduced ecological impact when compared to Option 2, with Option 2 having higher risk to ecological values, specifically the glossy black-cockatoo, as a result of the loss of critical nesting habitat with roadside vegetation clearance. Additionally, Option 2 would require a bridge upgrade on Ropers Road, the extent and cost of which is subject to significant uncertainty due to the width of the flood plain in this area.

Other factors considered in determining the recommended route (HDS Australia 2018a, see Appendix P7) included:

- Option 1 has fewer houses close to the route than Option 2, reducing potential impacts on local residents
- Option 1 and 2 have similar impacts on school bus routes. However a defined route (regardless of option) will allow for measures to be implemented such as off-road bus stops to minimise risk
- Option 1 has fewer farm access gates than Option 2
- overall, the existing traffic volumes on Option 1 are lower, which reduces potential exposures to risks.

As a result of these assessments, the recommended route for the KIPT operations, shown in Figure 21-8, is Option 1:

- Playford Highway (beginning at the junction of West End Highway) to the junction of Stokes Bay Road
- Stokes Bay Road from Playford Highway to the junction of Bark Hut Road
- Bark Hut Road from that junction to the junction of McBrides Road
- McBrides Road
- North Coast Road from McBrides Road to Freeoak Road which constitutes the entry to the KI Seaport site.

Upgrades would be required to the recommended route to suit restricted access vehicles, and intersections would also need to be upgraded to meet the requirements of the design vehicle.

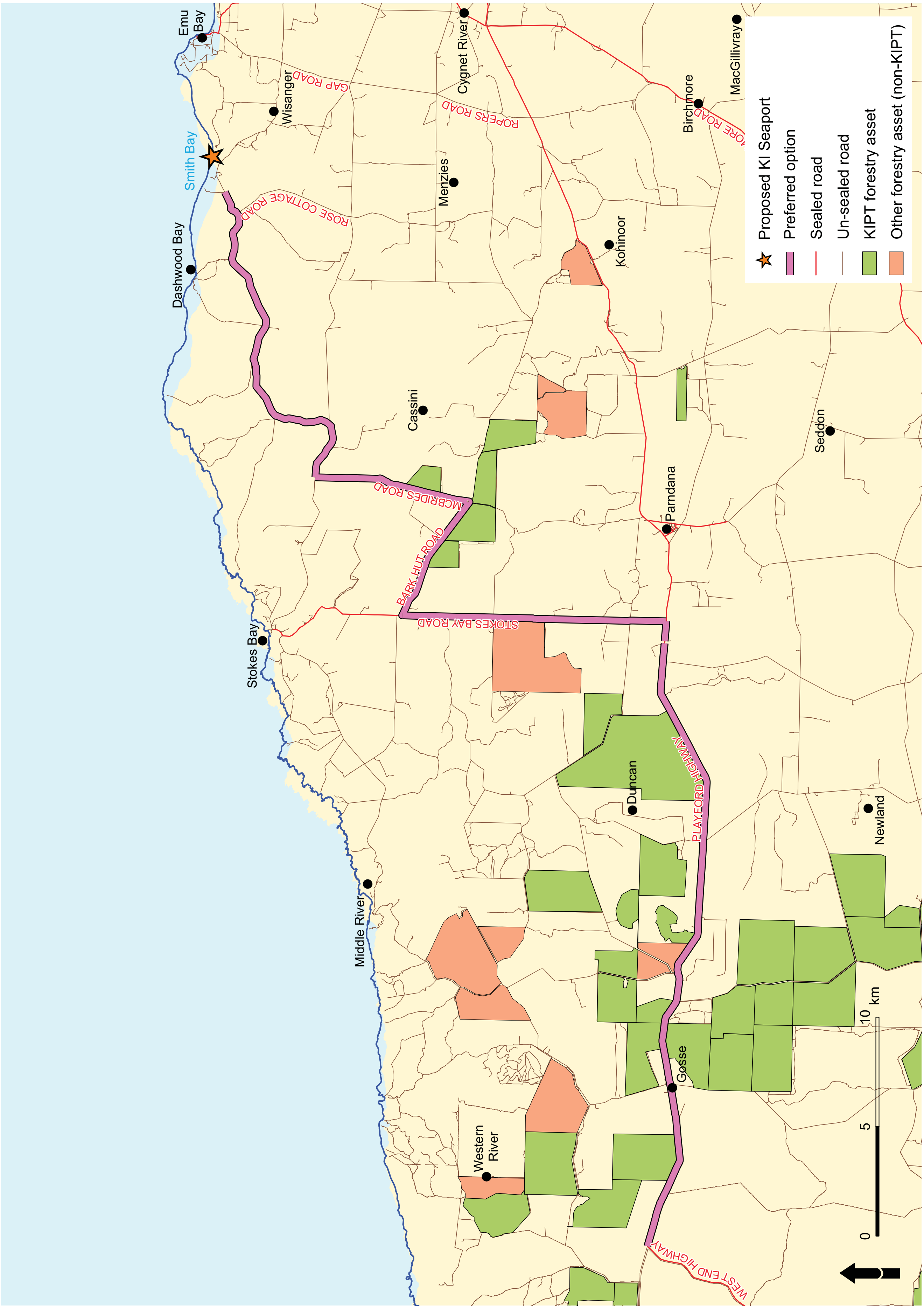


FIGURE 21-8 KIPT'S SELECTED ROUTE

An ecological assessment of route options (see Section 21.5.4) identified that the above route would result in less impact for MNES and native vegetation, and in particular:

- less impacts to critical nesting and feeding habitat of the nationally endangered glossy black-cockatoo
- less impact to significant remnant populations of the Kangaroo Island narrow-leaved mallee, which potentially meet the requirements of a Threatened Ecological Community (TEC) under the EPBC Act
- less impact to McGillivray's spyridium (S*pyridium eriocephalum* var. *glabrisepalum*) which is endemic to Kangaroo Island and found in locations along the route of Option 2.

The recommended route is also away from other sensitive areas such as Parndana Conservation Park and important lower Cygnet River crossings which are commonly associated with the Glossy black-cockatoo.

KIPT has indicated to both DPTI and the Kangaroo Island Council that it supports this transport route option and would seek an agreement with both parties to enable detailed assessment and planning for the necessary upgrades, and to ultimately obtain gazettal for the preferred vehicle type (i.e. 30-metre A-double).

Complementary safety measures

KIPT commissioned the University of Adelaide's Centre for Automotive Safety Research (CASR November 2017, see Appendix P3) to develop a set of other complementary options which would further improve the safety of the timber haulage operations. These are associated with safer roads, driver competency and training, in-vehicle technological aids and safer speeds.

CASR recommendations would be considered by KIPT to mitigate the safety risks associated with the timber haulage operations. KIPT anticipates these options would be negotiated with the Kangaroo Island Council and the South Australian Government as part of continued discussions regarding the haulage operations.

Dust mitigation

Dust mitigation would be managed as required by DPTI and/or the Kangaroo Island Council and may include:

- upgrades to the road surface to prevent deterioration, up to and including the sealing of roads along the transport route
- the application of dust suppression water (and/or chemical binders) when required by prevailing meteorological conditions.

KIPT would implement operational controls such as not overloading trucks, reviewing and implementing suitable speed limits for drivers, and would work with DPTI and/or Kangaroo Island Council to ensure effective and efficient dust minimisation.

Noise mitigation

The DPTI Road Traffic Noise Guidelines contain a number of suggested noise mitigation measures that can be applied by DPTI and/or the Kangaroo Island Council should the predicted (or actual) noise levels exceed the relevant criteria along their roads. The noise assessment has demonstrated that noise levels are not predicted to exceed the relevant DPTI criteria, although amenity may be affected at a number of residences adjacent to roads in more rural areas. Examples of mitigation that may be applied by DPTI and/or the Kangaroo Island Council include:

- road design considerations (where upgrades are proposed), including adjustment to the vertical and horizontal alignments, low noise pavement surfaces, road gradient modifications, speed limit reduction and traffic management measures, where these do not affect the function and safety of the road
- noise barriers (fencing, bunding and barriers)
- property treatments (façade treatments including changes to glazing on windows and doors etc., and upgrades to building insulation)
- acoustic screening close to the building façade.

21.6 MARINE TRAFFIC

21.6.1 TRANSPORT TASK

The transport task is broadly divided into two distinct phases, construction and operations, each described in the following sections.

Construction phase

The principal marine traffic during the construction phase would be caused by:

- mobilisation (and demobilisation) of maritime construction equipment (including a dedicated barge, vessels and dredge)
- if required, the delivery of construction materials (such as armour rock and other quarried materials) by barge
- the delivery of various prefabricated structures such as the restraint dolphins for the floating pontoon, the linkspan bridge, the jetty structure and other dedicated wharf infrastructure to the site by barge
- the arrival of a refitted barge, from the mainland, to be secured to installed restraint dolphins, which would become the permanent floating pontoon of the wharf structure.

Estimates of the number and size of vessels required to facilitate this task have not been determined to date. However these are expected to be infrequent, and the number of vessel movements would be minimised to reduce the costs.

Operations phase

Logs and woodchips would be exported using Panamax vessels of up to 60,000 deadweight tonnes (DWT) and a draft of up to 11.75 metres. Smaller Handymax vessels may also be used, subject to operational requirements.

The number of vessels berthing per year depends on the harvest cycle, commodity prices, road availability, permitted and available vehicle configurations, size of vessels used and initially, availability of woodchip handling systems at KI Seaport.

It is anticipated that between 10 and 20 vessels per year would be loaded with timber at KI Seaport. The total number of berthing days (inclusive of all vessels) would be 30 to 75 days per year.

Timber vessels would enter Smith Bay and broadly align themselves parallel to, and up to approximately 100 metres from the KI Seaport. Tugs and/or bow and stern thrusters (if available) would bring the vessel onto the wharf, where it would be secured prior to shiploading activities. Shiploading activities are likely to take two to three days, whereupon the ship would depart the wharf with the assistance of a tug. Once away from the wharf, the vessel would commence the journey to the next port-of-call.

There would be additional vessel movements associated with the tug operations. It is anticipated that arriving vessels would require up to two tugs for berthing, and a single tug for departure. Tugs would arrive from Port Adelaide or Port Lincoln, taking approximately 10 hours to arrive to Smith Bay. Following berthing of the timber vessel, the tug(s) may depart for their home ports or other assignments. A single tug would return to assist in de-berthing the vessel, although a single tug may remain moored with a tug pen established on the lee side of the wharf for the duration of vessel loading operations, and leave Smith Bay following vessel departure. Tugs would not be permanently berthed at the wharf.

The anchoring of timber product transport vessels in Smith Bay is not proposed as ready access to the wharf will generally be available given the proposed shipping schedule. Provision for the temporary berthing of tugs has been allocated within the wharf facility, and no anchoring of tugs is proposed.

21.6.2 REGULATORY ENVIRONMENT

The movement of vessels in and out of Smith Bay is subject to a wide variety of legislation, standards and guidelines. With respect to traffic and transport, the *Marine Safety (Domestic Commercial Vessel) National Law Act 2012* (the national law) replaces eight federal, state and territory laws with a single regulatory framework for the certification, construction,

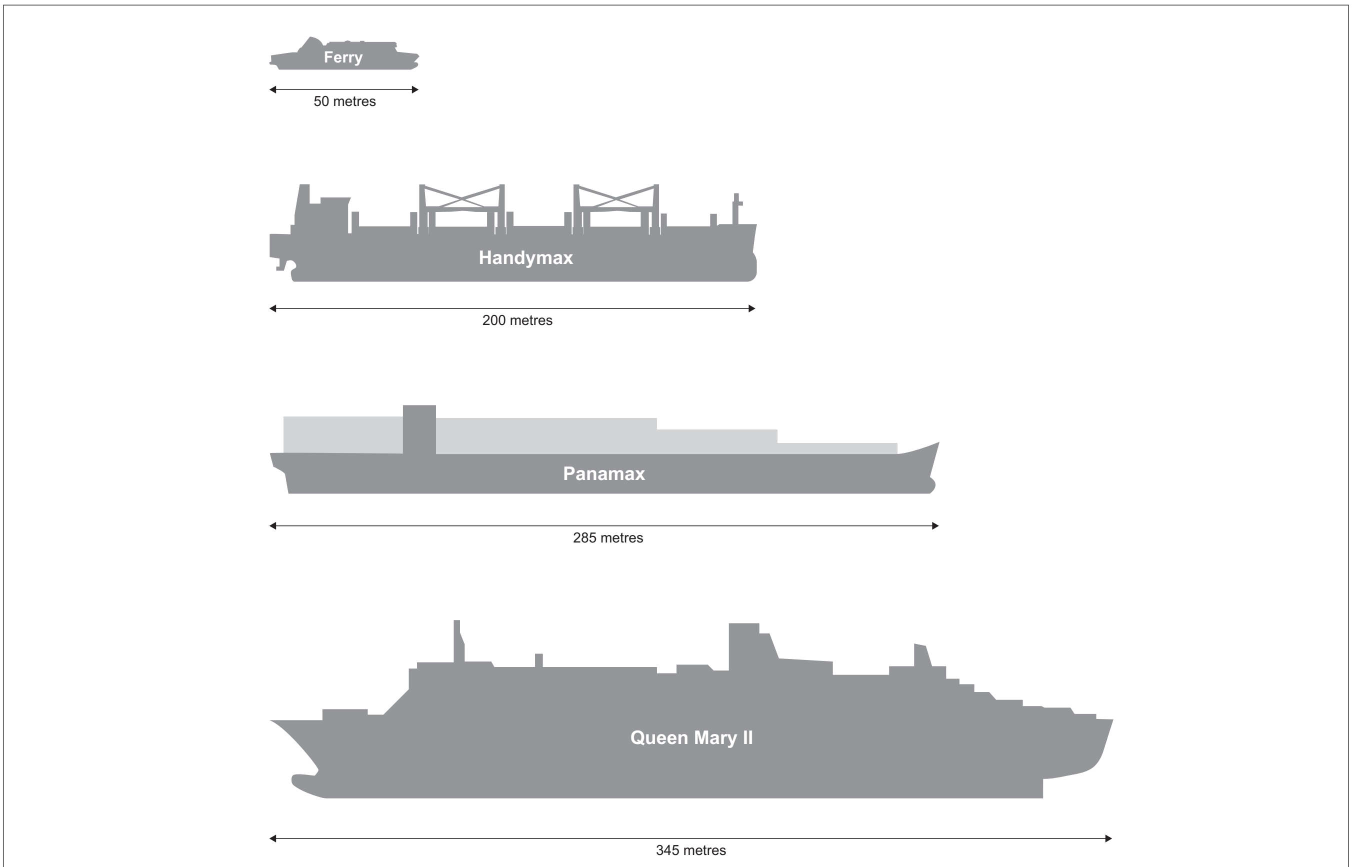


FIGURE 21-9 COMPARATIVE INDICATION OF VESSEL SIZES

equipment, design and operation of domestic commercial vessels inside Australia's exclusive economic zone. The related National Standard for Commercial Vessels (NSCV) contain the standards for vessel survey, construction, equipment, design, operation and crew competencies for domestic commercial vessels.

The *Navigation Act 2012* (Clth) is legislation which covers international ship and seafarer safety, protect the marine environment where it relates to shipping and the actions of seafarers in Australian waters. The Act covers:

- vessel survey and certification
- construction standards
- crewing
- seafarers' qualifications and welfare
- occupational health and safety
- carriage and handling of cargoes
- passengers
- marine pollution prevention
- monitoring and enforcement activities.

Section 140 of the *Navigation Act 2012* (Clth) imposes an obligation on the master of the vessel to prevent marine pollution:

> *The master of a vessel must not operate the vessel in a manner that causes:*
>
> - *pollution to the marine environment in the coastal sea of Australia or the exclusive economic zone of Australia; or*
> - *damage to the marine environment in the coastal sea of Australia or the exclusive economic zone of Australia.*

Refer to Chapter 5 – Legislative Framework of the EIS for a more complete discussion of the maritime and marine pollution legislation.

21.6.3 EXISTING ENVIRONMENT

The existing environment as it relates to maritime traffic and transport is described in the following sections. The ecological and social environment of Smith Bay is described in detail in Chapter 12 – Marine Ecology and Chapter 22 – Social Environment respectively.

Third-party users

Commercial and recreational fishing occurs in the vicinity of Smith Bay. The nearest ports or boat ramps from which commercial and recreational fishers operate are Kingscote and Emu Bay, which are approximately 20 km and 5 km east of Smith Bay respectively. Beach launching of boats at Smith Bay is possible but occurs infrequently. Immediately east of the proposed causeway in front of Smith Bay House is an informal boat launching area, one of a number of such launch sites in the area.

About 10 per cent of current South Australia's charter boat operators have been based in a port on the north coast of Kangaroo Island. Some operators departing from mainland ports may also frequent the north coast of Kangaroo Island.

Smith Bay itself is used occasionally for recreational boating and fishing, and two commercial fishers operate in Smith Bay from time to time. There are no records to indicate the extent of these activities.

Vessel movements

It is expected that vessels docking at KI Seaport will approach from the established shipping route located approximately 20 km due north of Smith Bay in Investigator Strait, which is the main shipping route between Adelaide and Western Australia. Marine traffic density for large (gross tonne 25,000–60,000) and very large (gross tonne above 60,000) vessels is shown in Figure 21-10.

In South Australia there were 1973 commercial shipping movements to and from its major ports in 2017 (Flinders Ports 2018), and there were 60,000 registered boats in South Australia in the 2013–14 year (DPTI 2015c).

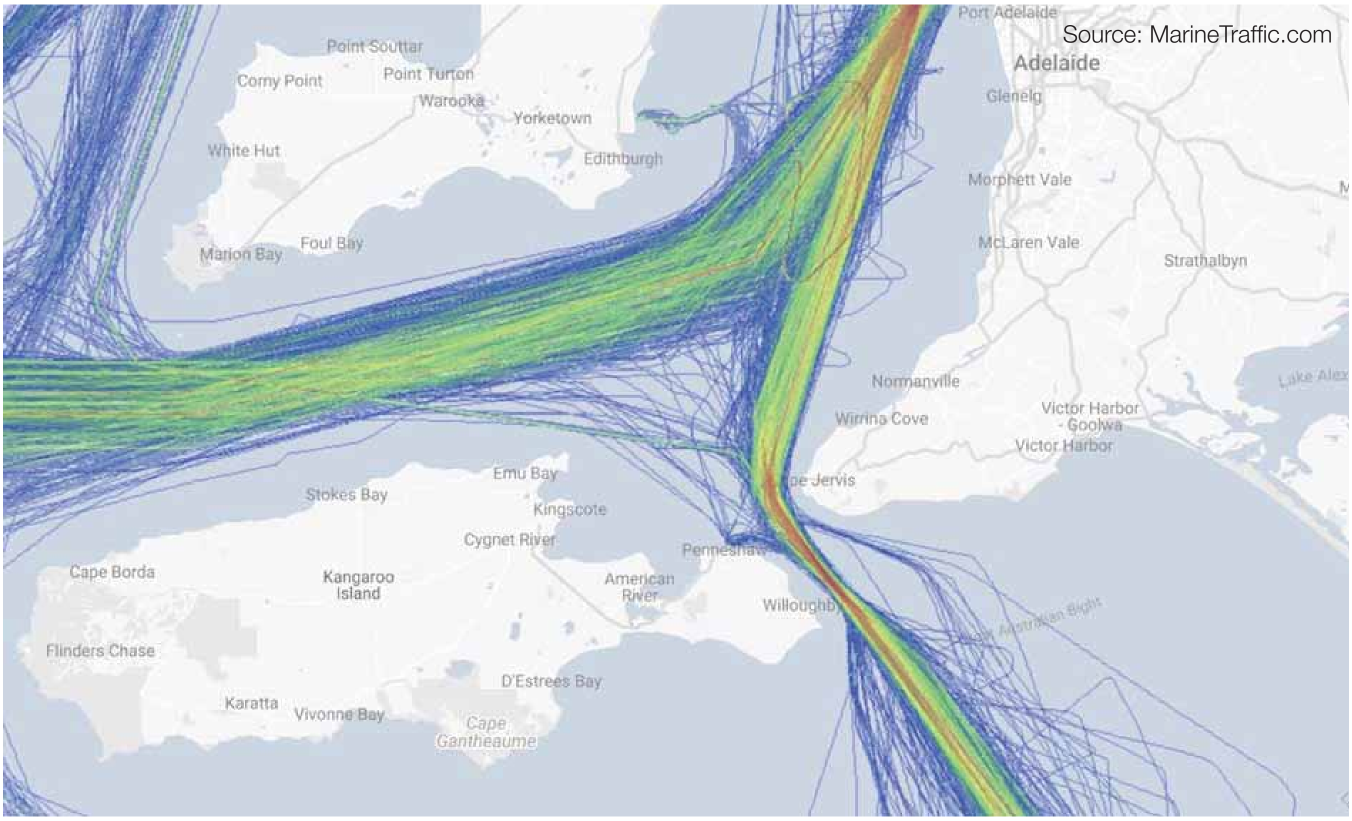


FIGURE 21-10 DENSITY MAP SHOWING LARGE (GROSS TONNE 25,000–60,000) AND VERY LARGE (GROSS TONNE >60,0000) VESSELS PASSING THROUGH INVESTIGATOR STRAIT IN 2017 (MARINETRAFFIC 2018)

Vessel safety

In South Australian waters, from 2005 – 12 inclusive, the Australian Transport Safety Bureau (ATSB 2013) recorded 47 'marine occurrences' involving Australian vessels undertaking trade or commerce (cargo and/or passengers) engaged in international and interstate operations, and foreign trading ships in Australian waters. These incidents occurred at a consistent average of approximately five to seven occurrences per year.

These numbers exclude trading ships on intrastate voyages, Australian fishing vessels on domestic voyages, fishing fleet support vessels on domestic voyages, inland waterways vessels, pleasure craft, offshore industry mobile units that are fixed to the seabed and Australian and foreign defence ships.

Of the 12 occurrences in 2011 and 2012, three were while at berth, three were on the open sea, four were in harbor waters and two were within coastal waters. Other relevant safety statistics noted in the ATSB report include:

- for 2005–12, there was a peak in occurrences between 8 am and 11 am. The number of occurrences is fairly constant through the late morning and afternoon and then gradually decreased to 8 pm. Between 8 pm and 8 am, the number of occurrences each hour remained consistently low
- bulk carriers and cargo vessels made up the vast majority of marine occurrences
- the top three occurrence types were damage to the ship or equipment, serious injury and equipment failure
- between 2005 and 2012, the number of occurrences involving pollution each year has fluctuated between zero and eight. Of the 30 pollution occurrences across the whole period (across all of Australia), 10 involved gas and 10 involved fuel or oil leaks.

More general statistics for South Australia marine accidents could not be found. However, New South Wales publishes annual safety statistics that demonstrate that annual the non-drowning fatality rate for recreational vessels is consistently approximately two per 100,000 vessel registrations (Transport for NSW 2018).

21.6.4 TRAFFIC IMPACT ASSESSMENT

Construction phase

There is expected to be only a small number of arrivals to Smith Bay during the construction period, which is considered unlikely to materially impact existing vessel traffic and routes. The dredging vessel would operate at Smith Bay for up to approximately 200 days during the construction period, which may result in restricted access within 200 metres of the vessel during this time. This may negatively impact access by commercial fishing vessels. However, given the relatively low use of Smith Bay as a fishing area, this is not considered material.

Impacts associated with marine noise, visual amenity and ecological interactions are described elsewhere in this EIS.

Operations phase

Up to 20 smaller Handymax vessels may visit the KI Seaport during the first three or four years of operations, giving way to up to 10 Panamax vessels as the operation switches to woodchips. In terms of vessel traffic, it is unlikely this would have a material impact given that around 2000 vessel movements are currently recorded from South Australian commercial ports each year.

Nevertheless, the introduction of additional marine traffic and large vessels into Smith Bay would cause delays to travel times and/or restrictions on access to parts of Smith Bay for the smaller vessels currently using or travelling within Smith Bay marine waters. Given the low volume and recreational nature of most of these activities, and the low volume and temporary nature of vessel arrivals at the KI Seaport, this impact is considered low.

Impacts associated with noise, visual amenity and ecological interactions are described elsewhere in the Draft EIS.

21.6.5 MITIGATION AND MANAGEMENT

Construction phase

A Marine Activity Zone (MAZ) would be prescribed for the construction period, as shown in Figure 21-11. This is a well-accepted approach to managing the impacts of marine traffic during construction in South Australia.

The MAZ informs the public of a clearly defined area that is to be avoided, reducing navigational risks during the construction period. It has been designed to be slightly larger than the dredging area footprint to allow for anchor positioning outside this area when dredging approaches the footprint boundary.

The MAZ would be occupied by floating plant and land-based civil construction plant during construction operations, comprising dredging activities performed by a cutter suction dredge, causeway and wharf construction activities performed by land-based plant, and construction setup and demobilisation activities.

The details of the zone would be provided to the DPTI, and KIPT would issue a Notice to Mariners advising other users of works that may affect the safe navigation of vessels in the vicinity.

In total, fewer than a dozen vessel movements to the MAZ are expected during the construction period. The impact of these movements on other marine traffic is expected to be negligible because:

- the existing marine traffic in Smith Bay is infrequent and the number of commercial and recreational vessels using Smith Bay is very low
- the marine traffic associated with the construction activities occurs over a relatively short time span (i.e. a few days of movement over a few months of construction activity)
- the construction activities would occur towards the western end of Smith Bay and would have no impact on access to most of the bay.

Operations phase

For the safety of members of the public, temporary exclusion zones would be established around the offshore infrastructure during times when vessels are berthed at the Smith Bay facility, consistent with those established at other harbor facilities such as those at Outer Harbor. These would require third-party vessels to remain at least 50 metres from the wharf face, and at least 25 metres forward and aft of the berthed vessel (see Figure 21-12).

Signs attached to the wharf, causeway and land-side infrastructure would advise third-party vessels, such as recreational fishing boats, of the exclusion zone requirements.

In total, fewer than 20 vessel movements to the KI Seaport are expected per annum during the operations. The impact of these movements, and the subsequent temporary access restrictions, on other marine traffic is expected to be negligible because:

- the existing marine traffic in Smith Bay is infrequent and the number of commercial and recreational vessels using Smith Bay is very low
- the marine traffic associated with the operational activities occurs over a relatively short time span (i.e. two or three days, up to 20 times per annum)
- the location of the KI Seaport activities would occur towards the western end of Smith Bay and would have no impact on access to most of the bay.

21.7 CONCLUSION

Terrestrial traffic during the construction phase of the KI Seaport has been demonstrated to be of a volume sufficiently low that material impacts to travel times, road safety, road condition, ecology and the social environment are considered unlikely.

Timber growing, harvesting and transport by road is already a permitted activity and not the subject of this EIS. Even so, the haulage of timber from the plantations to the proposed KI Seaport warrants considerable attention. This operational transport task is significant, with potential increases in traffic volumes of two-to-three times on minor unsealed roads. For safety and efficiency reasons, KIPT would prefer to use a defined transport route and high productivity vehicles. However, this is subject to agreement by DPTI and the Kangaroo Island Council. Pending this agreement, KIPT would plan to adopt an open network transport model to allow for uncertainties caused by weather, other traffic and road conditions. The traffic impact assessment has demonstrated that some impacts to nearby residents and other road users are likely. However, these are generally minor in nature and, where relevant, the proposed operations comply with appropriate standards and guidelines.

Mitigation and management measures proposed are aimed at reducing the total number of vehicle movements with the use of high productivity vehicles which would be authorised to use a defined transport route. The recommended route has been chosen following extensive studies which were completed with the agreement and support of the Kangaroo Island Council. The recommended route would minimise the number of affected residents, minimise the potential for impacts to local ecology, and optimise the costs of road upgrades and ongoing maintenance.

The ecological survey has, nevertheless, illustrated the sensitivity of the environment surrounding some of the proposed defined transport route, and the implementation of road upgrades as a component of this would require careful management and potentially further approvals and/or offsets to ensure the required works do not adversely affect threatened species and communities.

The marine traffic volumes during both construction and operation are expected to be low, with no significant impact to existing vessel traffic. The exception is some minor inconvenience caused through the establishment of restricted access areas in the immediate vicinity of the construction and operations shipping movements. These restrictions would be temporary and relatively infrequent in nature and the overall potential for marine vessel impacts is assessed as low.

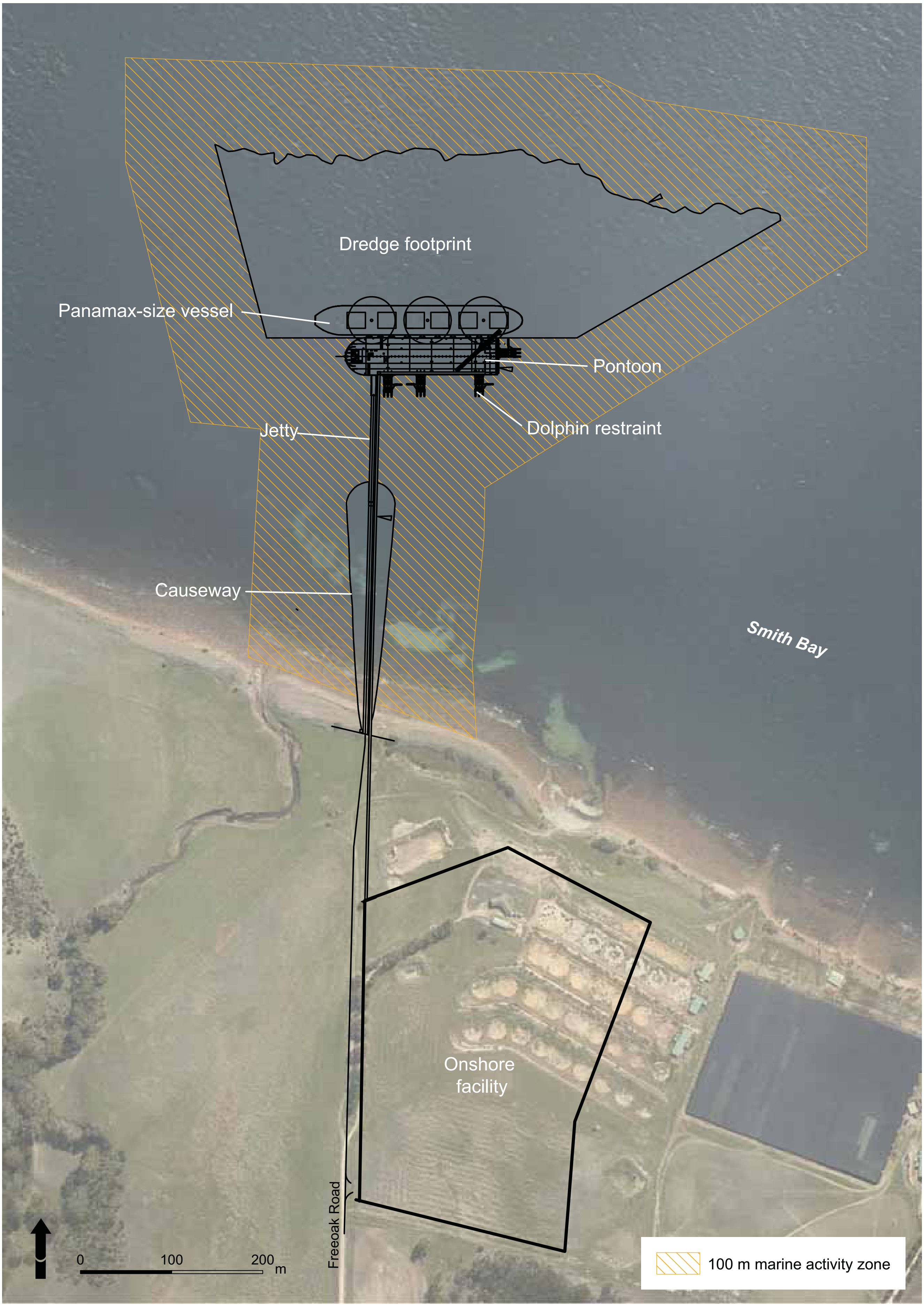


FIGURE 21-11 PROPOSED MARINE ACTIVITY ZONE

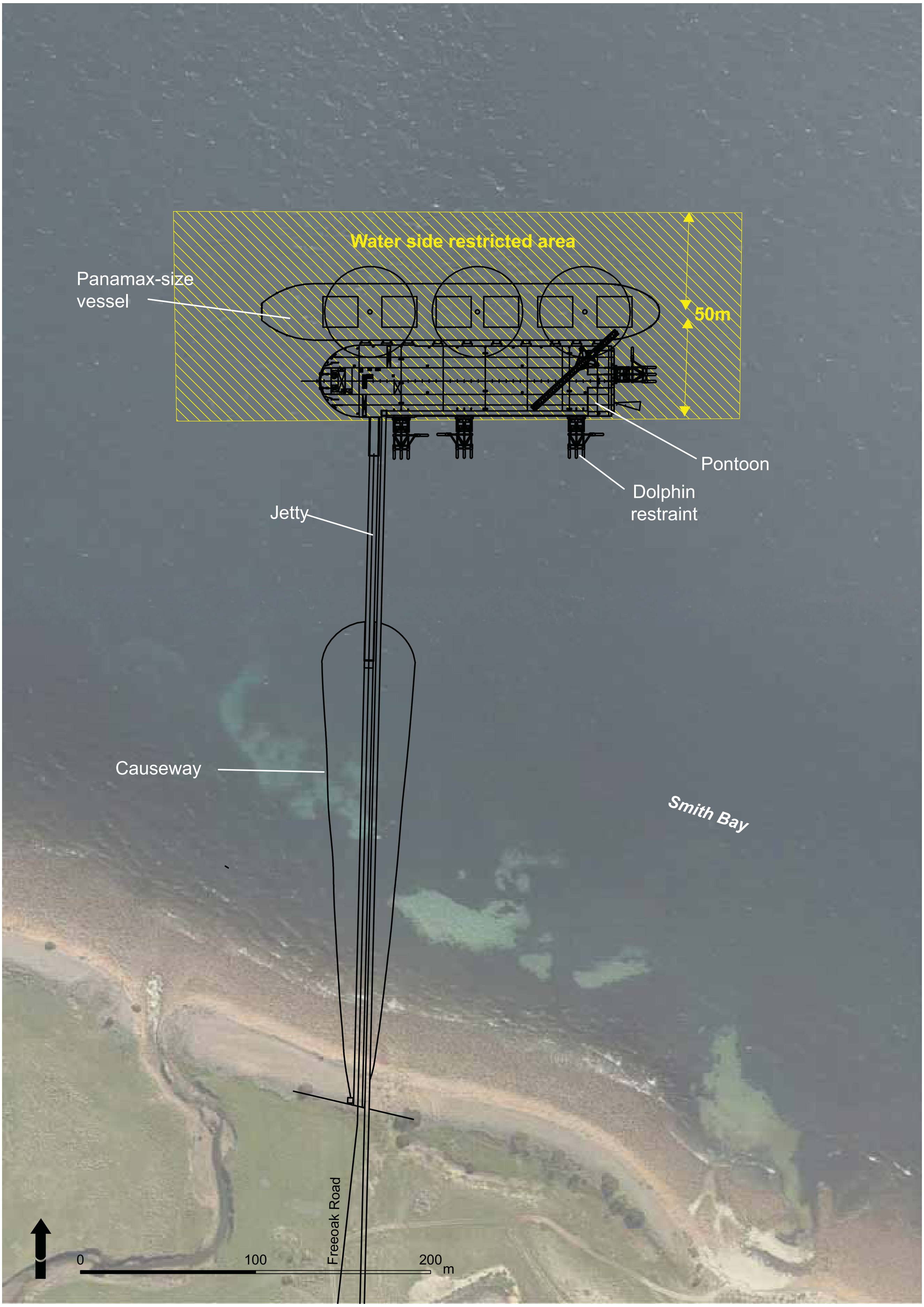


FIGURE 21-12 CONCEPTUAL TEMPORARY EXCLUSION ZONE LAYOUT WHEN VESSELS BERTHED

22. SOCIAL ENVIRONMENT

Guideline		Comment
8 Community	The proposal is likely to lead to a change in The Kangaroo Island population (short term and long term) both during the construction and operational phases of the proposed development. This will lead to a change in demand for various services, infrastructure and accommodation needs on the Island at various times.	
8.1	Outline the likely size and source of the construction workforce and associated employees, and how accommodation requirements for this workforce will be met.	See Chapters 4, 20, Sections 4.8.4, 22.5.1 and 22.5.3
8.2	Provide information on the time of year that construction is likely to occur and identify the impact this may have on tourist accommodation on the Island, especially if construction will occur during the tourist season.	See Chapter 4, Sections 4.1.4, 22.5.3 and 22.6.2
8.3	Describe the expected effects of the change in population on community infrastructure and services (including recreation, health, education, child care and other local human services) and how these are proposed to be managed.	See Section 22.5.4
8.4	Outline the expected impact on the permanent and semi-permanent population of Kangaroo Island during both the construction and operation phases of the project and identify housing needs for the expected increased population. This should include an analysis of existing short and medium term rentals for construction employees, as well as affordable housing options for longer term employees. Include details of discussions had with housing industry/suppliers, Kangaroo Island Council and/or Renewal SA in relation to this issue.	See Chapter 7, Sections 7.6, 22.5.3 and 22.6.2
8.5	Provide information on the potential positive and negative social impacts that could result from a change in population as a result of the proposed development and how this is proposed to be managed.	See Section 22.5
8.6	Describe the impact on the amenity and lifestyle of existing Kangaroo Island residents who use the area for recreation purposes (include information on access to the coast in the vicinity of the port development)	See Chapters 4, 23, Sections 4.5.1, 4.6.8 and 22.5.4
8.7	Describe the consultation strategy adopted in the preparation of the EIS and identify the groups and individuals from whom comments will be sought to make written submissions in relation to the proposal.	See Chapter 7, Sections 7.3.1, 7.3.2, 7.6 and 22.4.6

22. SOCIAL ENVIRONMENT

22.1 INTRODUCTION

This chapter addresses Guideline 8 which is concerned with the social/community-related impacts of the proposed KI Seaport; that is, the direct and indirect impacts that would affect people and communities on Kangaroo Island. A number of these matters have been addressed in other chapters of the EIS, and cross-references to these chapters have been made where relevant.

22.2 REGIONAL SETTING

Kangaroo Island's total population is 4702 (ABS 2016). The main population centres are Kingscote, Penneshaw, Parndana and American River:

- **Kingscote:** South Australia's first site of formal European settlement and was founded in 1836. It is the principal commercial and administrative hub of the Island and has a population of approximately 1600.
- **Penneshaw:** A tourist hub and a point of transfer for goods to and from the Island. The passenger and freight ferry terminal is located at Penneshaw and a ferry transport route links Kangaroo Island with Cape Jervis on the mainland. Penneshaw has a population of approximately 280.
- **Parndana:** A service centre for the western end of Kangaroo Island and has retail, education, community, sport and recreation facilities, and a population of approximately 150.
- **American River:** Approximately 55 km to the east of Smith Bay is an important recreational area for tourists and locals and provides access for boating and recreational fishing as well as commercial aquaculture (oyster). The Pelican Lagoon Conservation Park and American River Aquatic Reserve are near American River.

Other settlements include Emu Bay (7 km to the east of Smith Bay and the closest settlement to the proposed development) and Vivonne Bay on the south coast. Both offer a range of tourist accommodation including guesthouses, holiday homes, cabins and camp sites.

22.3 ASSESSMENT METHODS

22.3.1 SCOPE

The social impact assessment is concerned with impacts that may occur at a regional level; that is, the effects of the proposed development on the wider Kangaroo Island community. The potential impacts to neighbours, including farmers who use adjacent land for grazing and cropping, nearby holiday accommodation and Yumbah, which operates a land-based aquaculture farm on land to the east of the proposed development site, are considered elsewhere in the EIS including:

- Chapter 7 – Stakeholder Engagement
- Chapter 11 – Land-Based Aquaculture
- Chapter 17 – Air Quality
- Chapter 18 – Noise and Light
- Chapter 21 – Traffic and Transport
- Chapter 23 – Visual Amenity.

22.3.2 BASELINE PROFILE

A baseline profile of the existing social environment was prepared using:

- quantitative data from the ABS, government departments and other sources
- relevant community reports, agency plans, and planning documents
- a review of the social services and facilities available in local townships that may be affected by the proposal, based on publicly available information and discussions with local service providers
- a review of other technical reports prepared for the EIS, which are considered relevant to the social aspects of the proposed development.

Appendix Q1 provides more detailed information on the existing social environment of Kangaroo Island.

22.3.3 COMMUNITY AND STAKEHOLDER ENGAGEMENT

KIPT and Environmental Projects (which has been engaged to produce the EIS on behalf of KIPT) have consulted and engaged with various stakeholders during the preparation of the EIS. These efforts, and the feedback received, are discussed in Chapter 7 – Stakeholder Engagement; relevant feedback has been incorporated into the assessment presented in this chapter.

22.3.4 IMPACT ASSESSMENT

The social impact assessment addresses issues defined in the DAC guidelines; principally, the impact of population growth, particularly in terms of its effect on various services and infrastructure and the impact on housing and accommodation on Kangaroo Island.

22.4 EXISTING ENVIRONMENT

22.4.1 DISTINGUISHING SOCIO-ECONOMIC CHARACTERISTICS

A 2015 study of Kangaroo Island by the Regional Australia Institute (RAI 2015) described the following socio-economic characteristics that distinguish Kangaroo Island from other regions in Australia:

- **The 'water gap':** The isolation of the Island (i.e. the consequences of relying on the SeaLink ferry service as the principal means of connecting to the mainland), results in higher freight costs, delays in receiving parts and components, disruptions caused by bad weather, and higher costs to access health, education and other services on the mainland.
- **Small regional centre:** Kingscote, the largest population centre, is very small and, combined with the generally low population densities across the Island, limits the ability to provide services efficiently.
- **High peak population:** The total population of the Island during peak holiday periods is significantly larger than the estimated resident population (approximately double), which creates difficulties for all service providers.
- **Fewer young people:** There are fewer people aged 10–15 on Kangaroo Island than in other similar regions. The age profile of Kangaroo Island shows that the largest demographic group comprises those aged 55–64.

22.4.2 DEMOGRAPHICS

Population size and predicted growth

The estimated total population for Kangaroo Island is 4700 people (ABS 2016), of whom approximately 51 per cent were female and approximately 49 per cent male; the population density on Kangaroo Island is one person per square kilometre.

South Australian government projections, accessed via the South Australian Government Planning Portal (DPTI 2018) show that, for the period 2011–31, the population of Kangaroo Island is expected to increase by 16 per cent to approximately 5250 persons, which is slightly less than the rate at which the total South Australian population is expected to increase (i.e. 18 per cent). The projected annual population growth rate is 0.8 per cent per annum, which is a stronger growth rate compared to other regions of South Australia such as Eyre Peninsula, (which is projected to grow by 1.2 per cent), and Yorke Peninsula, (which is projected to contract by 5.1 per cent by 2031). More detailed information on the population characteristics of Kangaroo Island is provided in Appendix Q1.

Population age

The 2016 ABS census data shows Kangaroo Island has a relatively old and ageing population:

- the median age is 49 years, compared to the South Australian average of 38 years
- the largest age group is 55–64 years
- between 2011 and 2015, the proportion of people aged between 65 and 74 rose from 9.9 per cent to 13.7 per cent.

The South Australian Government population projections reinforce this ageing trend. Although there is expected to be an increase of eight per cent (from 2011) in the number of persons aged up to 14:

- the working age population (15–64 years) is expected to fall by almost 9 per cent
- the population projections for persons 65 or older indicate that a significant increase of around 123 per cent in this age cohort is expected over the next 20 years.

The combined effect of these two trends is that Kangaroo Island, on current projections, will have a very high and growing dependency ratio, with fewer and fewer people of working age and a growing number of retirees.

22.4.3 HOUSING AND ACCOMMODATION

The ABS 2016 census data shows that the market for housing and accommodation on Kangaroo Island is markedly different from South Australia as a whole. For example:

- **Occupied dwellings:** Of the 3150 private dwellings on Kangaroo Island, 62 per cent were occupied and the remaining 38 per cent were unoccupied, compared with 87 per cent and 13 per cent respectively, in South Australia. (Many of these unoccupied homes are holiday homes at low occupancy, or second homes for mainland residents).
- **Dwelling type:** ninety-four per cent of dwellings on Kangaroo Island were separate houses, compared with 78 per cent for South Australia; three per cent of dwellings were semi-detached, row houses or terrace houses, compared with almost 15 per cent for South Australia.
- **Affordability:** Housing is more affordable on Kangaroo Island: incomes and housing costs are both lower on Kangaroo Island, but the difference in housing costs is greater:
  - the median monthly mortgage payments on Kangaroo Island were 72 per cent of the average for South Australia ($1083 compared to $1491) and median weekly rental payments were 65 per cent of the median weekly rents for South Australia ($170 per week, compared to $260)
  - the average weekly household income on Kangaroo Island was 78 per cent of the average weekly household income for South Australia ($947 compared to $1206).

In 2017 the Office of the Commissioner for Kangaroo Island (OCKI) published a comprehensive report on housing on Kangaroo Island (OCKI 2017), which notes:

- the South Australian Housing Trust Regulations defined affordable housing on Kangaroo Island as a dwelling offered for sale at or below $255,000 or land offered for sale at or below $114,750
- in 2011 (the most recent data) Kangaroo Island had the second highest housing stress levels of any local government area in South Australia, with 16.9 per cent of low-income households with mortgage stress, and 21.9 per cent of low-income households experiencing rental stress
- a survey of Kangaroo Island residents about their future housing intentions indicated 61 per cent of respondents intended to stay where they currently live; 16.6 per cent stated they were intending to purchase a new property on Kangaroo Island; 12.6 per cent stated they intended to leave the Island
- of the respondents looking to purchase a property on Kangaroo Island, most were looking for a separate dwelling with three or four bedrooms; the majority were looking to purchase a property in Kingscote, Penneshaw or Parndana; medical and education services were the most commonly cited services influencing where they wished to live
- of the residents intending to move off the Island, the key motivations were better work and career opportunities, the cost of living on the Island and better services and facilities on the mainland, particularly aged care, health and education
- when the respondents looking to move elsewhere on the Island were questioned about any difficulties they have experienced or could foresee, the most common responses were being unable to sell their current house, a lack of suitable properties that met their needs, the inability to find an affordable property, and difficulties in obtaining finance.

The OCKI report recommended a series of actions to address these issues.

22.4.4 COMMUNITY HEALTH AND WELLBEING

Community services infrastructure

Kangaroo Island has a network of established community service providers, most of which have defined service responsibilities and resources including staff, buildings, equipment and other support infrastructure such as IT and communications systems (see Appendix Q1). The principal service providers are:

- Kangaroo Island Council, which provides local government services for the entire Island community
- Kangaroo Island Community Education (KICE), which provides kindergarten to Year 12 (K–12) education from three campuses at Kingscote, Parndana and Penneshaw
- Kangaroo Island Health Service in Kingscote, which provides acute services ranging from accident and emergency, in-hospital care for adults and children by local general practitioners to specialist surgical, obstetrics, and outpatients, and mental health services
- Kangaroo Island Community Health Centre at Kingscote provides services such as allied health (e.g. physiotherapy, dieticians), aged care, parenting and family support, disability and mental health. Outreach services are also provided at American River, Parndana and Penneshaw. The Community Health Centre includes two state government service providers (SA Housing Authority and Families SA)
- Kangaroo Island Community Centre – Junction Australia provides support for housing, domestic violence, youth services and co-ordinates other counselling and support services provided by government and non-government organisations (NGOs).

Education

ABS data for Kangaroo Island show total primary school enrolments decreased by 34 per cent between 1996 and 2016 (EconSearch 2017). The total number of students enrolled in secondary school on Kangaroo Island decreased by two per cent between 1996 and 2016. The KICE website says there are currently 434 students enrolled in the Kingscote campus, 159 students at Parndana, and 60 students at Penneshaw (Reception to Year 9 only) (KICE 2017).

There are no tertiary education facilities on Kangaroo Island, although courses are available on-line. TAFE SA delivers short course training from a number of community facilities on Kangaroo Island.

Childcare services

There are three childcare facilities on Kangaroo Island. Facilities in Kingscote and Penneshaw provide a combination of long day care and preschool services, along with limited after school care and vacation care. The KICE Parndana campus provides a preschool. Consultation with the community indicates that there is interest for long day care services in Parndana. Increased employment and population around Parndana could provide viability for such a service.

Communications infrastructure and services

There has been a marked improvement in communications connectivity on Kangaroo Island in the last decade. ABS Census data show that, between 2006 and 2016, the total number of Kangaroo Island dwellings with internet access (broadband, dial-up or other) increased from five per cent to 72 per cent. For South Australia, the total number of dwellings with access to some form of internet increased from 54 per cent to 77 per cent over the same period.

22.4.5 INDIGENOUS COMMUNITIES

The 2016 Census showed there were 69 Aboriginal and/or Torres Strait Islander people on Kangaroo Island, comprising 1.4 per cent of the population.

Indigenous groups ceased to inhabit Kangaroo Island about 2500 years ago, and although the Island was uninhabited by Aboriginal people for a long time, remnants of camp sites, middens and stone tools remain in certain locations on the Island.

In the 1800s, Aboriginal women from Tasmania and South Australia were brought to the Island by sealers, resulting in relationships being formed with people from the Kaurna and Ngarrindjeri Aboriginal groups (Clarke 1996). Some of the descendants from these relationships are living on Kangaroo Island today (Flood 2004).

The Indigenous heritage for the proposed development is discussed in Chapter 24 – Heritage.

22.4.6 STAKEHOLDER FEEDBACK

The details of stakeholder engagement and feedback are provided in Chapter 7 – Stakeholder Engagement. A wide range of issues has been raised over the last 24 months. The key themes raised as being relevant to social impacts are:

- the opportunities for Kangaroo Island which would flow from a sustainable forestry industry are well understood and would be welcomed, especially if this leads to a rejuvenation of the western end of Kangaroo Island, and Parndana in particular
- the projected population growth would be particularly beneficial, especially if it leads to an inflow of skilled workers with their families
- there is an aversion to a fly-in, fly-out operation
- there are concerns about the capacity of a range of community services to cope with this projected population growth, and the impact on housing is a particular concern.

This feedback is consistent with the views articulated in a number of official government policy statements about Kangaroo Island's prospects and opportunities. For example, Kangaroo Island Council's strategic plan emphasises the benefit of population growth for Kangaroo Island:

> *Population growth management is essential as a larger resident Island population would assist in making businesses and services on the Island more sustainable as well as growing Council revenue streams, allowing Council to also improve its service levels.*
> (Kangaroo Island Council 2015a).

22.5 IMPACT ASSESSMENT

This section assesses the potential social impacts that may arise from the construction and operation of the proposed KI Seaport. The environmental and economic impacts are addressed elsewhere in the EIS:

- Chapter 7 – Stakeholder Engagement
- Chapter 11 – Land-Based Aquaculture
- Chapter 17 – Air Quality
- Chapter 18 – Noise and Light
- Chapter 21 – Traffic and Transport
- Chapter 23 – Visual Amenity.

22.5.1 SKILLS FORMATION

As indicated in Chapter 20 – Economic Environment, the development is expected to create 234 full-time equivalent (FTE) jobs over the first five complete years of operation, and the new workforce would introduce a wide variety of new occupations on Kangaroo Island, with varying requirements for training, qualifications, skills and experience. This is a potential benefit to Kangaroo Island.

KIPT has a strong preference to employ Kangaroo Island residents or people who have an existing connection to Kangaroo Island. Despite the relatively low unemployment rate on Kangaroo Island and the high workforce participation rates (see Appendix Q1), KIPT expects there would be a significant interest in these new jobs from Kangaroo Island residents who:

- want a better paid job or an opportunity in a new industry
- are currently employed part-time but are looking for stable full-time employment
- work on the mainland – there are more employed residents on Kangaroo Island (2198) than actual workers on the Island (1897) indicating there is a net outward migration of 300 workers, particularly in the construction, agriculture, accommodation and food industries (OCKI 2017).

The new jobs are also likely to be of interest to people who have family connections to Kangaroo Island but live and work on the mainland. A high proportion of these people will, however, require some form of vocational training to obtain the skills for the new positions.

22.5.2 POPULATION GROWTH

Notwithstanding the preference to employ locals, there is not enough available labour on the Island to fill these new positions. The unemployment rate on Kangaroo Island in March 2017 was estimated at 3.8 per cent, or just under 100 people. Although this number does not include the number of under-employed people (i.e. people currently employed but wanting to work more hours), it shows the expected demand for labour would exceed the available supply, and as a consequence, it is likely that many of the new jobs would be filled by people currently not living on the Island.

Many of the jobs directly created would require a specific set of skills not currently available on the Island and this reinforces the likelihood that there would be a net migration of skilled workers to the Island. It is likely that there would be migration to the Island by people with strong connections to the forestry industry but who are new to the Island community. These skilled workers are likely to come particularly from the south-east of South Australia and from the great southern area of Western Australian, two parts of Australia where forestry activity is declining from the peaks created by managed investment scheme plantings in the early to mid 2000s.

Given the current low unemployment and high labour force participation rates, and the need for specific skills and experience not currently available, it is estimated that at least 60 per cent of the total (140 FTE jobs) would be taken by people currently living off the Island. Assuming an average household size of 2.4 people in South Australia, the Island's population would increase by a conservative estimate of approximately 330 people.

The expected population growth is assessed as a potential benefit for Kangaroo Island because:

- the State Government's population projections for Kangaroo Island forecast a 9 per cent decline in the working age population (i.e. 15–64 years) to the year 2031 (EconSearch 2017)
- there is likely to be a significant influx of families with children, which is needed to balance Kangaroo Island's ageing population
- an increased population would provide critical mass to help the Island retain marginal private and public services. These marginal public services include diverse subject offerings at the Island's three educational campuses and obstetric services at the Kangaroo Island Health Service. Private services include the small businesses in retail and hospitality which comprise a large portion of non-farm businesses on Kangaroo Island.

The beneficial impact of a balanced age profile is acknowledged by the Kangaroo Island Council:

> *The social well-being of the community is dependent however on strengthening and improving the economy, the provision and maintenance of services and infrastructure, and the creation of training and employment opportunities in particular to retain a balanced age profile on the Island.*
> (Kangaroo Island Council 2015b).

Like many small, relatively isolated and geographically dispersed communities, Kangaroo Island depends heavily on the work of local volunteer organisations to maintain quality of life for the residents. Many of these organisations struggle to achieve the necessary levels of participation and financial viability because of the Island's low population levels.

22.5.3 HOUSING AND ACCOMMODATION

Impacts during construction

The construction program is scheduled to take 15 months. Commencement depends on when the full set of planning and construction approvals have been granted. The construction workforce would be no more than 15 people at any one time, and it is anticipated that their accommodation needs would be met from within the existing supply of short-term accommodation on Kangaroo Island. This would not constitute a significant impact.

Impacts during operation

Housing demand and supply

The operating impacts would be more complex. An increase in the demand for permanent housing (to accommodate the new workforce employed directly on the plantation estates) is anticipated, as is an increased demand from people drawn to flow-on opportunities in other sectors of the local economy. Although this is difficult to estimate, if the majority of households moving to Kangaroo Island required new dwellings, more than 100 extra homes could be needed, given the current estimate that the Island's population growth (EconSearch 2017).

Discussions with real estate agents in Kingscote confirm a number of features that characterise the local housing market:

- there are two distinct segments:
  - homes owned and occupied by long-term residents
  - a large stock of holiday homes, a large proportion of which are owned by non-residents and are unoccupied outside the peak tourist seasons (38 per cent of private dwellings on Kangaroo Island are unoccupied)
- there is a relatively high proportion of housing for sale, and sellers are having trouble finding buyers, as evidenced by the relatively long period that many properties are on the market. As a consequence, some would-be sellers are not listing their houses for sale.

These factors suggest there is some scope in the short-to-medium term (i.e. 12–24 months of operations) for the increased demand for housing accommodation to be met from within the existing market:

- the relatively large number of unoccupied houses represents buffer stock that could come onto the market either as properties available for long-term rent, or for sale by vendors who see opportunities to sell in a more buoyant market
- the number of owner-occupiers who would be willing to sell is also likely to grow, especially from among the currently discouraged potential vendors. In this context it is relevant to note the survey of housing and accommodation conducted by the OCKI showed more than 12 per cent of respondents were looking to leave the Island (OCKI 2017).

Despite this, it is anticipated that in the medium to longer-term (i.e. beyond 24 months) more new houses would be required as an outcome of the project's operations.

Housing finance

The OCKI's study of the Kangaroo Island housing market concludes that securing home loans is a key barrier to purchasing a home on Kangaroo Island and cites anecdotal evidence that financiers 'may be applying more onerous financial criteria to Islanders due to their location' (OCKI 2017).

The OCKI also states that job security and access to finance are two key issues affecting the financial wellbeing of Kangaroo Island residents.

The real issue is that lending for housing on Kangaroo Island is inherently riskier, (compared to mainland South Australia) because of two inter-related factors:

- incomes on the Island are relatively low (average weekly incomes are 78 per cent of the South Australian average) and unstable (as evidenced by the high proportion of part-time and seasonal work associated with tourism and agriculture), which increases the risk to the lender
- in the event of a default, the housing market is less liquid (i.e. houses for sale tend to be on the market longer before attracting a buyer) which increases the cost and risk to the lender in recovering the monies lent. These factors are exacerbated outside Kingscote and as a consequence the loan to valuation ratio (the amount financiers are prepared to lend as a proportion of the property valuation) is lower.

The mobilisation of forestry on a large scale on Kangaroo Island would affect this issue because:

- the majority of new jobs would be permanent and full-time and pay more than the average income on Kangaroo Island (an average of $74,000 per job compared with the current average on Kangaroo Island of $57,900, see Chapter 20 – Economic Environment). As a consequence, people employed in the new industry are likely to present as less risky borrowers
- the industry would provide an additional $42 million in gross regional product (GRP) per annum (see Chapter 20), including an additional $16 million per annum in household income (i.e. wages). This represents a 16 per cent increase in the size of the Kangaroo Island economy, which is sustained over the long term. The flow-on benefits of a larger and more robust local economy also include a stronger housing market which reduces the inherent risk in home finance for borrowers and lenders alike
- the benefits of a higher GRP and household income accrue throughout the year (i.e. they are not seasonal like tourism and agriculture) and the industry itself is sustainable over the long term, with the first two rotations (i.e. harvest cycles) expected to take approximately 25 years. This should also have a beneficial impact on the housing market on Kangaroo Island by reducing the risk of lending and borrowing.

22.5.4 COMMUNITY WELLBEING

Social and community services

The impacts on Kangaroo Island's social and community services are also complex.

The forecast population growth is likely to generate new demand across the full range of community and social services. This should improve the viability of some essential community services such as the school system on Kangaroo Island, which has seen a long-term decline in enrolments (refer Section 22.4.4).

Some services, such as health, law enforcement and education, may require extra resources to meet the demand of an increased population. There is excess capacity in most infrastructure, such as previously decommissioned classrooms at the Parndana campus of KICE but human resources, such as teachers, would need to be supplemented.

There are a significant number of volunteer and community groups on Kangaroo Island, such as the Country Fire Service and the myriad sporting and social clubs, for whom the impacts would potentially be beneficial. All of these organisations depend on volunteers, and all are threatened by the long-term decline of the number of people aged under 55, which would be reversed with an increase in the number of new workers and families.

Recreational activities

Smith Bay itself is not a unique or popular destination for recreation activities on Kangaroo Island. The foreshore consists mostly of boulders and there is little sandy beach available for recreation. The most frequent users are recreational fishers, and occasionally tourism operators and charter fishing vessels visit Smith Bay. The development would occupy only a small portion of the foreshore at the western end of the bay, and although public access to the facility would not be allowed, the development would not prevent any of these activities occurring elsewhere in Smith Bay. The development would therefore have a negligible impact on these recreational activities.

22.6 MANAGEMENT AND MITIGATION

22.6.1 SKILLS FORMATION

The State Government has committed to spend $100 million to create 20,000 new places in vocational education and training over the next four years. KIPT has had preliminary discussions with the Minister for Industry and Skills and officers from the Department of Industry and Skills about accessing these funds to train the new forestry workforce. These discussions are ongoing, and it is anticipated to lead to a commitment to fund relevant training on Kangaroo Island.

Such an injection of funds would enhance the ability of Kangaroo Island residents to obtain employment should the project go ahead, and the resulting upgrade in the skills and qualifications of the local workforce would be of ongoing benefit to the wider Kangaroo Island community.

KIPT has engaged with Adelaide Training and Education Centre (ATEC), Finding Workable Solutions (FWS) and Workskil Australia representatives on Kangaroo Island about KIPT's future training requirements and job opportunities for the clients of these employment and training providers. KIPT has provided employment to one long-term unemployed person through Workskil.

22.6.2 HOUSING

Management Plan for Housing on Kangaroo Island

The complex and multi-faceted long-term housing needs on Kangaroo Island are well known to the relevant State Government agencies (SA Housing Authority and the Department of Planning, Transport and Infrastructure) (DPTI), and the Kangaroo Island Council. The OCKI consulted with all of these agencies and developed a management plan to respond to these matters (OCKI 2016).

The plan recognises the Island's population is expected to grow to around 6000 by 2036 – 33 per cent above the 2011 population estimate – excluding the demand for short- and long-term accommodation that would result from the roll-out of public- and private-sector projects over the next three to five years, including the KI Seaport. This projected population increase would require about 640 additional homes, assuming an average of 2.4 people were living in each household (OCKI 2016).

The management plan notes:

> *The ability to secure investment from prospective developers on the Island will be strengthened with the availability of suitable employee housing. It is essential that a lack of suitable housing does not impede prospective investment in Kangaroo Island's economy, which is why this housing need must be considered as part of this management plan. In addition, the flow-on effects of additional employment and relocation to Kangaroo Island, in terms of economic growth and social capital, will benefit the Kangaroo Island community.*

Implementation of the plan by State Government and the Kangaroo Island Council should allow the housing market to respond to these emerging needs.

KIPT would assist, where it can, and sees benefit to the company and the community in having a settled resident workforce, living and working permanently on Kangaroo Island.

Land supply

The OCKI highlighted land supply is a particular issue on Kangaroo Island. In this context it is worth noting the key issues in the Kangaroo Island Plan (DPLG 2011) (which is part of the South Australian Planning Strategy) include:

- ensuring an adequate supply of residential land is available for future development, including maximising the use of surplus farm houses resulting from farm amalgamations
- encouraging the development of affordable housing in locations that support employment industries, particularly in the western part of the Island
- ensuring development supports centres with existing infrastructure and services, such as Kingscote, Penneshaw, American River and Parndana, to better service the wider rural population.

The OCKI recommended (OCKI 2017):

- the Council and DPTI ensure that an appropriate stock of residential land is available to meet community needs
- the Council explore options for using the land it owns to provide more housing
- the Council investigate introducing differential rating to discourage land banking (i.e. buying blocks of undeveloped land with a view to selling the land at a profit) of vacant land zone for residential development that is ready for development.

The OCKI evidence suggests the constraints limiting the supply of residential land are known and could be addressed.

The Kangaroo Island Council estimates there are 1300 vacant blocks on Kangaroo Island, mainly comprising large lots (between 500 square metres and 1000 square metres) within the urban areas of Kingscote, Parndana, Penneshaw and American River.

The Kangaroo Island Council itself owns a number of allotments in Kingscote, and also owns vacant land on Beare Street which has the potential to provide up to 10–15 townhouses. There is also a large piece of privately-owned land on the fringe of Kingscote which could be sub-divided into 150 blocks at 500 square metres each (OCKI 2017).

There is also scope to increase the size of Parndana township through residential subdivision. The Kangaroo Island Community Club (based in Parndana) has specific plans to subdivide and release housing allotments created from the scrubland immediately to the west of the township between Smith Street and Rowland Hill Highway. KIPT has committed to provide a seed loan of up to $100,000 to cover the initial project costs prior to the marketing and sale of housing lots. This assistance expressly recognises that mobilising the forestry industry on the Island would create a pressing need for more housing, and that this in turn represents a unique opportunity to add critical mass to Parndana's population and underpin business, community facilities, and volunteer organisations that draw upon and serve the Island community.

There is also potential for residential development on the western end of Kangaroo Island by re-establishing housing vacated during the farm consolidation and switch to forestry that occurred in the 1990s and 2000s. KIPT owns at least 30 potential residential allotments that could be created with a change to planning rules to allow the existing forestry estates to be subdivided. Thirty new homes would accommodate about 70 people. Every property has, at the very least, a house site with a dam, phone connection and electricity; some have habitable dwellings and others have dilapidated structures that could be replaced, or repaired and refurbished.

Seaside housing estate – a subdivision of 78 allotments – has recently been established at Emu Bay by a private developer and is offering house and land packages for sale. Emu Bay is just 10 minutes from the KI Seaport site and is the closest settlement for that part of the KIPT workforce which will be based at the wharf.

Each of these opportunities would reduce the strain on the market for residential housing on Kangaroo Island, and accordingly the impact on housing associated with the growth of forestry is assessed as well controlled.

22.7 CONCLUSION

A common theme in the principal policy documents for Kangaroo Island, (including the Kangaroo Island Council Strategic Plan and the Kangaroo Island Development Plan), is concern about the adverse consequences for the community of a currently declining and ageing population. These policies are, therefore, all predicated on the benefit to the community of population growth, especially in the working age cohort.

The KI Seaport would allow a large-scale, sustainable plantation forestry industry to begin, which would lead to a significant increase in the Island's population and changes to the configuration of the workforce in the next few years. The gradual increase in population would be a potential benefit given it would be likely to improve the Island's economy and provide increased opportunity for enhanced services, education and training and community wellbeing.

The principal area of concern is likely to be the provision of suitable housing and accommodation for new and existing population. These issues are well understood by all relevant State Government agencies and the Kangaroo Island Council, which has worked with the OCKI to agree on a management plan to address this issue.

23. VISUAL AMENITY

Guideline		Comment
18	The development is proposed in an area that is a relatively remote coastal landscape that is natural in appearance. There are no other developments of this scale or type situated along this portion of the coastline. The proposed development will establish a prominent visual feature along the coastline. Kangaroo Island is internationally known for its natural beauty and this must be considered in the built form and design of the proposed development.	See Chapters 4 and 23
18.1	Provide details of construction materials, colours and landscaping for all buildings and structures.	See Sections 4.4.1, 4.4.6 and Appendix J1
18.2	Describe and illustrate the visual effect of the proposed development on the locality when viewed from important viewing points, including from the land and sea.	See Section 23.5.2 and Appendix R2
18.3	Describe the rationale for the major design elements of the proposed development and measures to mitigate their visual impact.	See Sections 4.4 and 23.6
18.4	Describe the use of amenity/landscape plantings and potential broad scale revegetation, including the opportunities for the use of locally endemic species.	See Appendix J1
18.5	Describe how the design and construction of all buildings and structures will be controlled to ensure environmental sustainability and cohesive visual amenity.	See Sections 4.4 and 23.6
18.6	Provide details of the shelter, shading and screening treatments of car parks.	See Section 4.4.6

23. VISUAL AMENITY

23.1 INTRODUCTION

This chapter describes how the proposed development would impact existing visual amenity values for the Smith Bay area, in particular for neighbours who live in areas with a view of the proposed KI Seaport.

The objective of the visual impact assessment is to identify and assess these impacts and determine the severity of change to the existing visual amenity, and how these changes may affect people, such as neighbours, who may be considered sensitive receivers.

Strategies that may be implemented to manage, minimise and mitigate potential impacts during construction and operations will also be identified in Section 23.6.

23.2 REGIONAL SETTING

Smith Bay is a 5-km-wide, open, north-facing bay. Cliffs rise to 100 metres at either end, and the central 3 km section is a continuous boulder beach.

The site is surrounded by sparsely populated farmland and has a history of cropping and grazing and, more recently, land-based aquaculture.

Smith Bay is not considered a major tourist location, nor is it associated with any of the main tourist trails on Kangaroo Island. Most tourism is concentrated in areas in south-western, southern and south-eastern parts of the Island – predominantly associated with wilderness and national park areas.

23.3 ASSESSMENT METHODS

The assessment considered potential impacts associated with temporary activities such as construction (to a lesser extent) and longer-term activities such as establishing port infrastructure and operating a port in Smith Bay.

The assessment uses desk-top analysis to assess the potential impacts to landscape and visual values resulting from the proposed development and includes:

- reviewing the existing amenity, including physical attributes and information about the study area, such as landform, infrastructure, land use and vegetation
- assessing the existing landscape character (see Section 23.3.1 for a definition of landscape character)
- presenting the proposed development and its visual components
- assessing the physical attributes using aerial imagery
- evaluating potential changes in site amenity
- identifying sensitive receivers
- evaluating visual impacts for sensitive receivers
- identifying impacts (cumulative and residual).

Two methods of assessment were used:

- an evaluation of landscape character and visual impact assessment based on a rating system (Landscape Sensitivity Analysis) – see Appendix R1
- an evaluation of aerial imagery and three-dimensional (3D) renders of scenery that would be seen from specific viewpoints for the 'before' and 'after' view of Smith Bay; that is, the existing view compared to the view expected once the KI Seaport was built – see Appendix R2.

23.3.1 LANDSCAPE CHARACTER

Landscape character assessment is a system for identifying, describing and classifying what makes one landscape area different from another. It is the assessment of impact, in the aggregate, on an area's built, natural and cultural character or sense of place.

Landscape character assessment includes physical geology and topography, people, wildlife, climate and more. The landscape character assessment conducted for the EIS also included the sensitivity (ability to absorb change) of the study area and the impact of scale of the proposed development within that area.

The landscape character assessment was based on a review of the Coastal Viewscapes project (see Appendix R1 for details) and the application of the associated rating system to the site of the proposed KI Seaport.

Coastal Viewscapes project

The Coastal Viewscapes project was undertaken in 2005 for the Coast Protection Branch of the SA Department for Environment and Heritage (Lothian 2005). The project entailed photographing the South Australian coast (1700 photographs), compiling an internet-based survey with 138 representative photos and rating the scenes on a 10-point scale of aesthetic quality (1 (low) to 10 (high)) based on feedback from over 3000 people.

Of the nine coastal regions, the Kangaroo Island region rated the highest, with a score of 7.15, ahead of western Eyre Peninsula on 7.02. It should be noted this survey did not differentiate the northern coast from any other coastline on the Island.

A separate survey of the visual impacts of coastal developments was undertaken as part of the Coastal Viewscapes project. The survey asked respondents to rate 82 scenes, which were with or without development, on a scale of 1 (low) to 10 (high). These featured mainly housing-type developments (including high-rise) as well as marina and aquaculture scenes.

Criteria used to determine the 1–10 ratings included:

- the level of contrast and potential integration of the development in the existing landscape (which determines the degree of visual change)
- assessing the ability of the landscape to absorb the visual effects of the development from viewpoints along the corridor, including (i) distance, (ii) vertical scale of works, (iii) horizontal scale of works, and (iv) removal or modification of vegetation and landform.

23.3.2 AERIAL IMAGERY MODEL

A 3D conceptual model was developed to show the major components of the proposed onshore and offshore infrastructure for KI Seaport (see Appendix R2). The model also incorporated existing infrastructure at Smith Bay, including the neighbouring commercial aquaculture operation. The model overlaid design drawings onto aerial imagery of the site and incorporated the proposed offshore components of the facility.

A site inspection was undertaken to capture remotely piloted aircraft (RPA or drone) imagery. This imagery was used to supply additional infrastructure heights and confirm the locations of sensitive receivers and associated view paths. Natural features, such as trees, were not included in the model which was based on unobstructed views and thereby provided a worst-case scenario for the visual assessment.

Potential sensitive receivers were identified as part of the EIS investigations (see Section 23.4.2), and location, elevation and screening details were confirmed through the use of the drone imagery.

One offshore location, Location 15 or L15, and twelve onshore locations were identified (L06–L14) for the visual assessment, of which six (private residences) (L07–L12) and one commercial operation (L14) are considered sensitive receivers, due to their proximity to the site. Two viewpoint locations on the Smith Bay coastline to the west (L05A) and east (L05B), and one from the ocean (L15) were also assessed.

The interactive 3D model was viewed using Google Earth Pro to identify sight lines and provide a representation of what would be seen at specific viewpoints in the area.

The 15 viewpoint locations are shown on Figure 23-2. Line-of-sight images captured from each location show 'before' images and modelling produces 'after' images indicating the view with the KI Seaport infrastructure envisaged. See Appendix R2 for more images. Selected images are included in this chapter (see Section 23.5.2).

23.3.3 ENGAGEMENT WITH STAKEHOLDERS AND COMMUNITY

Feedback received from stakeholders and other community members was reviewed to help understand concerns regarding future visual amenity as a result of the proposed development at Smith Bay. See Chapter 7 – Stakeholder Engagement for the methodology used to engage with stakeholders during the preparation of the EIS.

23.4 EXISTING ENVIRONMENT

23.4.1 LANDSCAPE QUALITY

Scenic Solutions, a consultancy practice that quantifies and maps scenic quality, assigned a landscape quality rating of 6.5 to Smith Bay (Lothian 2016, see Appendix R1), which is a similar rating assigned to Kingscote. Admiralty (or Admirals) Arch, located at Cape du Couedic in south-western Kangaroo Island had the highest scenic value rating of 8.65 in the Coastal Viewscapes project (Lothian 2005). Figure 23-1 summarises the apportioned landscape quality ratings for the Smith Bay region, showing that this coastline generally has a similar landscape quality score.

The Smith Bay coastline is approximately 5 km long, and assigned landscape quality ratings rise where the landscape changes from inland, land without a view of the sea (rating 5.0), with a view of the sea (5.5), the coastline of Smith Bay itself (6.0) and at Cape Cassini (west of Smith Bay) and Cape D'Estaing (east of Smith Bay) (7.0).

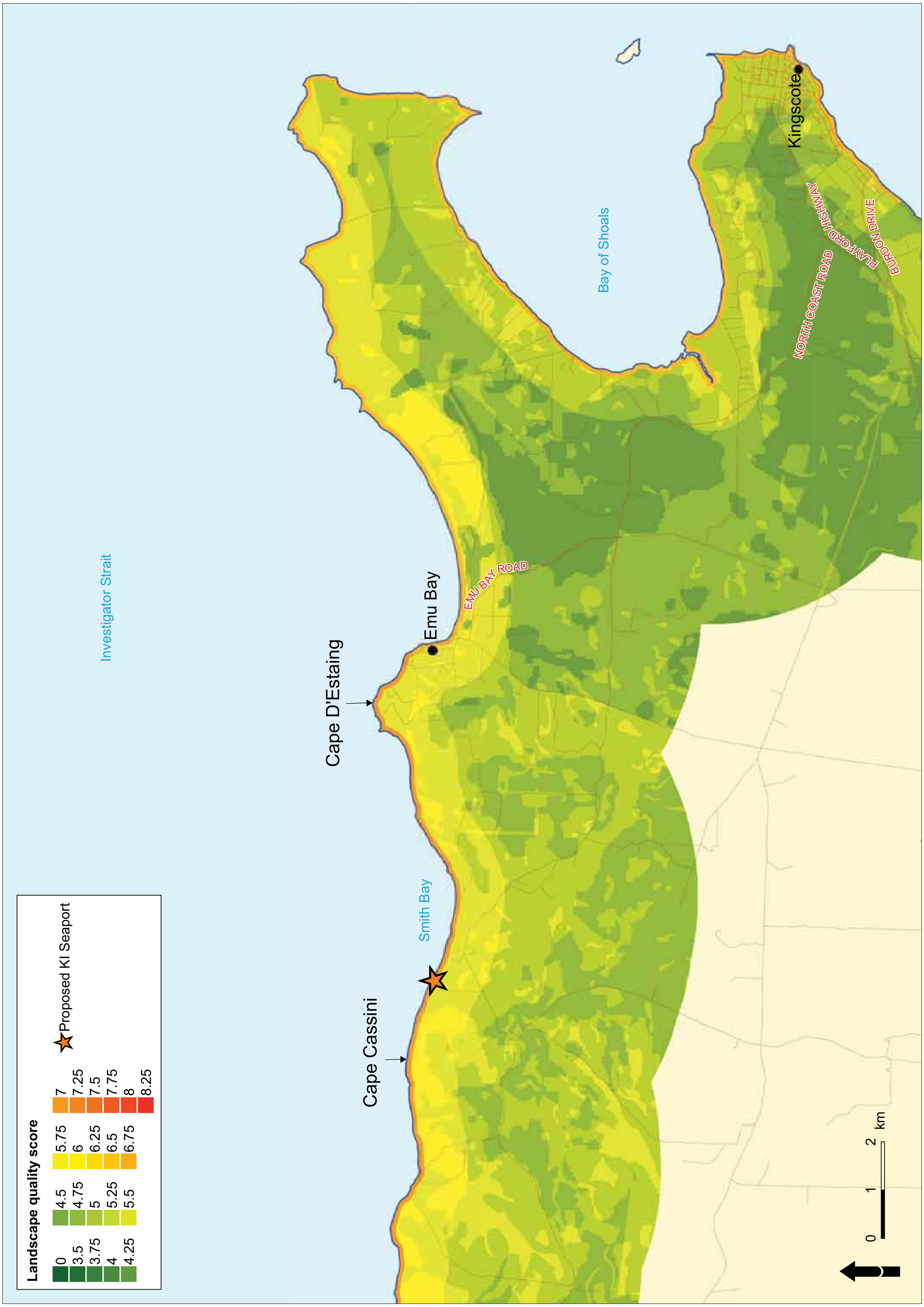


FIGURE 23-1 LANDSCAPE QUALITY RATING FOR THE SMITH BAY REGION

Smith Bay is the site of Yumbah's land-based abalone farm, which is adjacent to, and east of, the study area. This operation includes tanks, buildings, sheds and supporting structures for large areas of shadecloth which cover abalone-growing raceways. The land-based component of the study area is therefore in an already disturbed area, which presents an existing level of visual impact.

The presence of the abalone farm's sheds, vehicles, high fences and buildings creates an industrial-like landscape, which is assigned a much lower scenic quality rating of 5. This is also the rating assigned to the area on which the onshore timber storage would be built for the proposed KI Seaport.

The study area includes the remnants of an on-land abalone aquaculture enterprise. The land is therefore neither pristine nor untouched.

Further inland (going south) across the agricultural land and the cleared paddocks of rising land with blocks of vegetation the assigned landscape quality increases slightly to 5.5. The existing landscape quality ratings for the study area are summarised in Table 23-1.

23.4.2 SENSITIVE RECEIVERS

For the purpose of this impact assessment, it has been assumed that receivers sensitive to changes in visual amenity at Smith Bay are:

- nearby residences, including Molly's Run, which also provides tourism accommodation
- elevated locations within the local area
- people on vessels, with views of the site and the coastline of Smith Bay
- vehicles travelling on North Coast Road, particularly those that approach from the east
- small recreational vessels in the waters of Smith Bay.

There are no communities close to or overlooking Smith Bay. The immediate neighbours include Yumbah Aquaculture and two private landowners who graze and crop nearby agricultural land. One of these properties includes a family holiday home and sheds, which KIPT have an option to acquire should the proposed development be approved.

The Crown and KIPT own the vacant land (previously used for grazing) directly west of the study area.

Local residents, tourists and the general public who use North Coast Road, particularly those who approach from the east, would have some views of Smith Bay and the KI Seaport at elevated locations.

The general public in small recreational vessels in the waters of Smith Bay would have views of KI Seaport from the ocean.

23.5 IMPACT ASSESSMENT

23.5.1 LANDSCAPE CHARACTER IMPACTS

Although the study area is already highly disturbed (i.e. previously cleared for agriculture and the land-based abalone farm), the wharf, onshore infrastructure, and the timber storage and handling activities that constitute the KI Seaport, would change its visual amenity. The elevation and extent of structures means the facility would be visible across the width of Smith Bay. The visual amenity would also change when a ship was in port – expected to be 10–20 ships per year, resulting in 30–75 days of in-port time – for loading of timber products.

Lothian (2016) considered that the proposed development would extend the existing 'industrial-like' character of the existing land-based abalone farm into the foreshore landscape, which would result in a further reduction in landscape quality, to a rating of 5, from the current 6.5 which applies to the Smith Bay area. The landscape quality ratings for the proposed development are summarised in Table 23-2.

TABLE 23-1 LANDSCAPE QUALITY RATINGS FOR THE SMITH BAY DEVELOPMENT AREA

Component	Landscape quality
Smith Bay foreshore	6.5
Proposed timber storage area and abalone farm	5.0
Inland agricultural land with sea view	5.5

TABLE 23-2 LANDSCAPE QUALITY RATINGS FOR THE SMITH BAY DEVELOPMENT AREA AFTER CONSTRUCTION

Component	Existing landscape quality	Landscape quality after construction
Smith Bay foreshore	6.5	5.0
Onshore timber storage area and adjacent abalone farm	5.0	5.0

This change would be less significant for Kangaroo Island given that the Smith Bay coastline comprises less than two per cent of the northern coast and the study area is on highly disturbed coastline between the higher-quality sections of the coast.

Moreover, Smith Bay is largely inaccessible and would be seen by relatively few people. For these reasons Scenic Solutions considered the visual impact to the foreshore area would be judged acceptable (see Appendix R1).

23.5.2 VISUAL AMENITY IMPACTS

The development of a conceptual 3D model of the KI Seaport has incorporated a 'line-of-sight' visual assessment from a range of Smith Bay viewpoint locations for identified sensitive receivers, a western and an eastern coastline location, and an in-ocean viewpoint location (see Figure 23-2).

The images generated by the 3D model show aspects of the proposed development that would be visible as unobstructed views from the various viewpoint locations, both before and after the KI Seaport was built:

- locations L06, L07 and L08 currently have an unobstructed view of the ocean
- locations with a view of Smith Bay itself (L09–L12) have views that include the land-based infrastructure established by Yumbah
- there are no views from location L14 (assumed to be the main operational area for site personnel at Yumbah Aquaculture) to the study area as views are significantly affected by their infrastructure, such as shadecloth screens, sheds, fences and lighting towers.

Aerial drone work at Smith Bay revealed that some locations assessed (including L09–L12) have established shrubbery and trees which would obstruct views to the proposed development site. The imagery developed for this assessment does not show this vegetation and provides a worst-case visual scenario (i.e. if screening, planted, or roadside vegetation, depending on the location, was removed). Stands of trees and high shrubbery would reduce the visual impacts as a result of part or full obstruction of the KI Seaport. The images were also captured to simulate a ship in port during loading operations.

The images generated by the 3D model (see Appendix R2), show that all viewpoint locations assessed would have, to varying degrees, a view of the KI Seaport, if unobstructed (see Figure 23-3). The development would add to the existing visual impact of Yumbah's operations, which currently dominate the landscape.

'Before' and 'after' views of KI Seaport for land-based L08 (nearest residential property to the south-west) and L13 (elevated location to the east) are presented in Figure 23-3 and Figure 23-4. Note that views shown are unobscured and actual views may be screened by vegetation.

'Before' and 'after' views of KI Seaport from the water at L15 is presented in Figure 23-5.

Views for all locations are presented in Appendix R2.

FIGURE 23-2 SMITH BAY – KEY LOCATIONS (L) SHOWING VIEWPOINTS

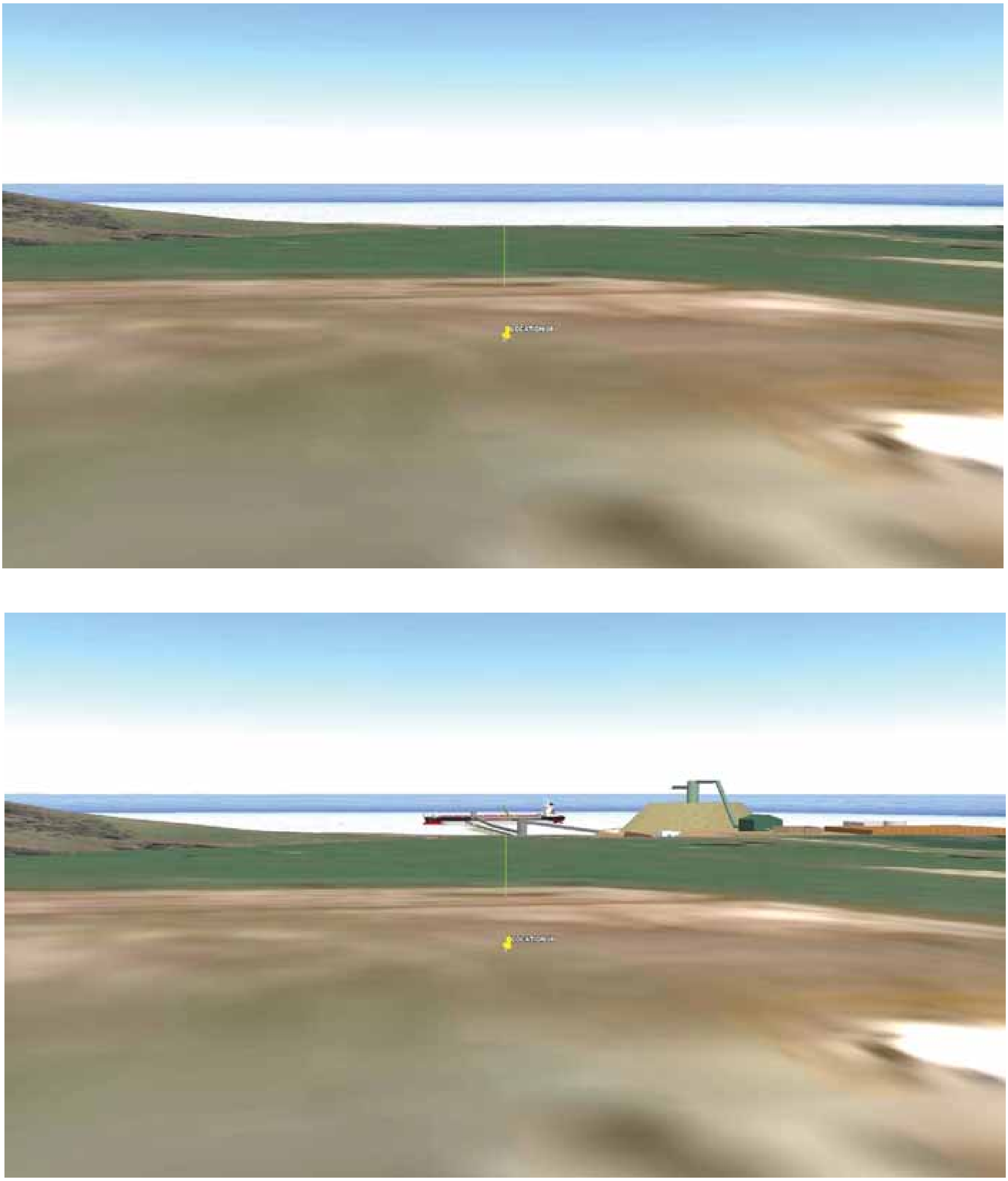
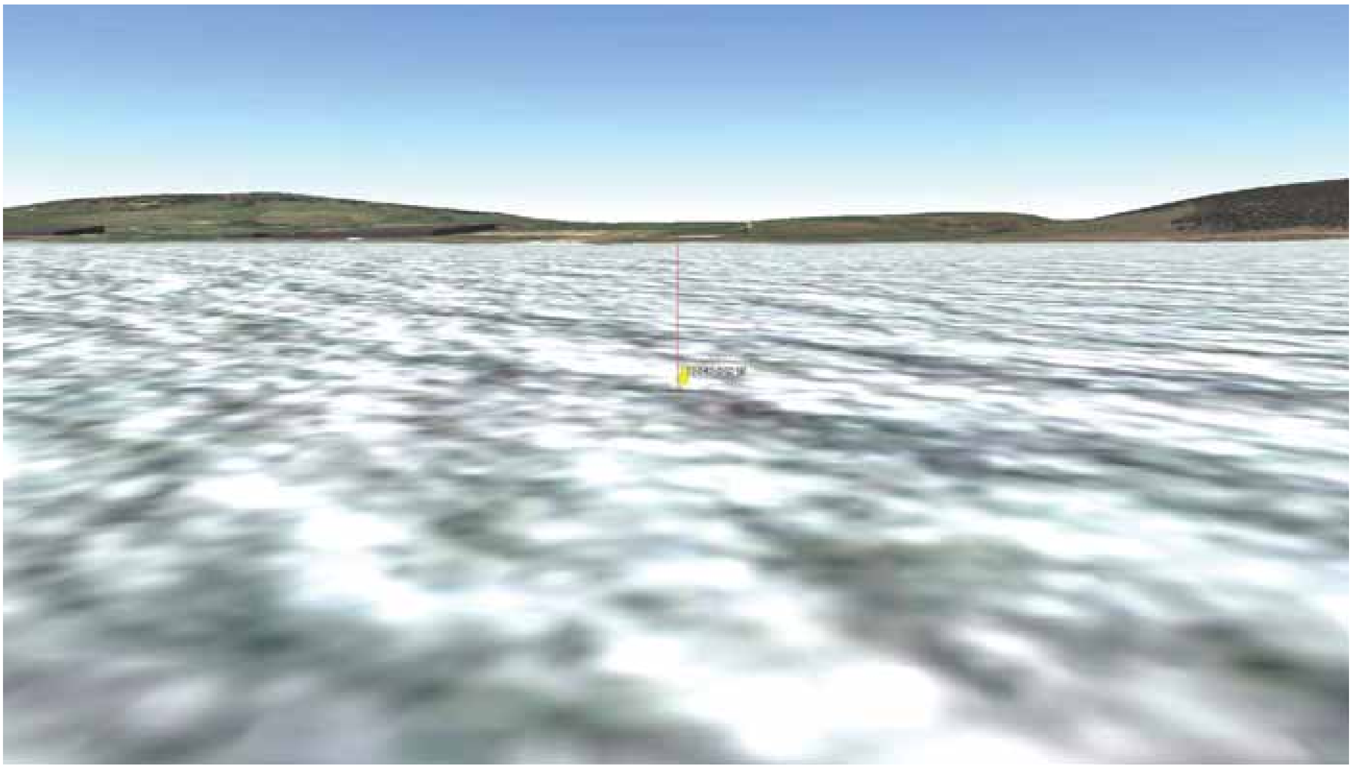


FIGURE 23-3 'BEFORE' AND 'AFTER' UNOBSCURED VIEW OF KI SEAPORT FROM L08

FIGURE 23-4 'BEFORE' AND 'AFTER' UNOBSCURED VIEW OF KI SEAPORT FROM L13



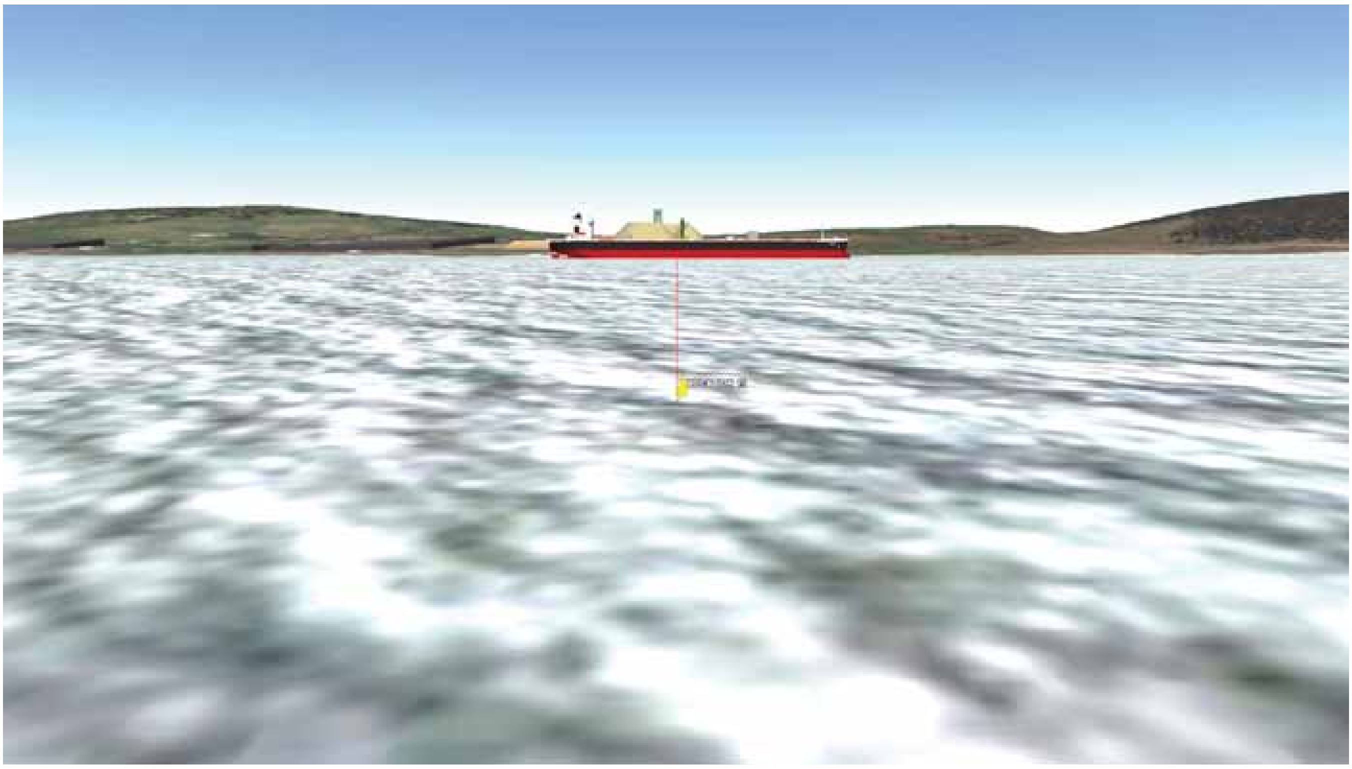


FIGURE 23-5 'BEFORE' AND 'AFTER' UNOBSCURED VIEW OF KI SEAPORT FROM L15

23.6 MITIGATION MEASURES

The interactive 3D conceptual model of the proposed KI Seaport and surrounding landscape, and imagery generated from it, should be used for further assessment and planning, and for consultation with stakeholders and the community.

Mitigation measures would be implemented to soften and minimise visual amenity impacts as much as practicable, including:

- grading any earthworks batters and establishing plantings to reduce the contrast of elevated landform when viewed from various viewpoints
- incorporating sympathetic plantings and pedestrian linkages for visitors and personnel
- establishing vegetation and plantings to integrate with existing land forms and revegetated areas
- integrating structural elements with planting of appropriate scale to reduce the visual presence of structural elements
- establishing buffer revegetation plantings to screen selected viewpoints
- maintaining simplicity of form, colour and patterning in design to reduce the scale and mass of structural elements and to visually integrate with any landscape treatments
- maintaining pre-development views through the proposed structure, where possible
- choosing colours to mitigate the impact on views and landscape character, such as using the darker grey colour of Yumbah's operation to blend into the existing landscape
- selecting materials to integrate into the surroundings, should be low in reflectivity, and complement the surrounding context through use of appropriate tones.

23.7 CONCLUSIONS

The proposed KI Seaport would extend the existing relatively disturbed, industrial-like character of that part of Smith Bay.

The reduction in landscape quality for the study area and Smith Bay is not considered significant. However, the changes to visual amenity would be noticeable and are considered significant for the local neighbours and distant residents who are on elevated land with views to Smith Bay.

Mitigation measures which target design features and finishes, incorporate sympathetic design of elevated areas and use vegetation plantings to integrate the facility into the existing environment as much as is possible and practicable would help soften and minimise visual impacts.

24. HERITAGE

Guideline		Comment
16	Aboriginal and other heritage can include matters such as archaeological sites and Aboriginal remains, Aboriginal sites and objects of significance according to Aboriginal tradition, archaeology, anthropology or history, caves, mines, volcanic features, geological sites, fossils, historical buildings and monuments, relics of agricultural and industrial heritage, shipwrecks, lighthouses, whaling stations, wilderness and coastlines. Coastal areas in particular are prone to discovery of items of Aboriginal heritage and significance. All development should consider the impacts it may have upon Aboriginal and other heritage matters (land and marine).	
16.1	Describe the measures taken in consultation with the Department of State Development Aboriginal Affairs and Reconciliation (DSD-AAR) to identify the Aboriginal heritage in the project and surrounding area, including the outcomes of: • a request for a search of the Register of Aboriginal Sites and Objects maintained by DSD-AAR • discussion with the relevant Traditional Owners, Aboriginal Organisations and interested Aboriginal parties • where applicable, an on ground archaeological and anthropological heritage survey as determined by an informed risk assessment of the likelihood of surface or sub-surface damage, disturbance or interference to Aboriginal sites, objects of Aboriginal remains	See Chapter 7, Section 24.3 and Appendix S5 An on-ground heritage survey was not undertaken based on previous land use.
16.2	Provide information on how the proposal is not in conflict with the distinct beliefs or cultural practices of the relevant Traditional Owners, Aboriginal Organisations or interested Aboriginal parties.	See Section 7.3
16.3	Describe the measures that will be put in place to manage the risk of damaging, disturbing or interfering with any heritage that has been identified by the consultation undertaken above and any plans to manage the discovery of any Aboriginal heritage during work activities.	See Chapter 26, Sections 24.5.1, 24.5.4 and Appendix U1
16.4	Describe the measures taken in consultation with the Department of Environment, Water and Natural Resources (DEWNR), the South Australian Heritage Council, the Kangaroo Island Council and community groups to identify the non-indigenous cultural and other heritage in the project and surrounding area.	See Sections 24.3 and 24.3.2 and 24.3.3

Guideline		Comment
16.5	Identify the impact on the heritage significance of any known non-indigenous heritage places on or in proximity to the project site that have been identified by the consultation undertaken above. Describe the measures that will be put in place to manage the risk of damaging, disturbing, or interfering with any heritage that has been identified.	See Chapter 26, Sections 24.5.3, 24.5.4, Appendices S2, S3, S4, S6, S7, S8 and U1
16.6	Identify measures to protect any historic shipwrecks within the port and coastal area during construction, in accordance with the *Historic Shipwrecks Act 1981*.	See Chapter 26, Sections 24.5.3, 24.5.4 and Appendix U1

24. HERITAGE

24.1 INTRODUCTION

This chapter addresses Guideline 16, which is concerned with how the proposed KI Seaport may affect heritage values of Smith Bay.

The term 'heritage' includes a variety of matters – Aboriginal archaeological sites, objects and sites of significance according to Aboriginal tradition, caves, geological sites, fossils, historical buildings and monuments, relics of agricultural and industrial heritage, shipwrecks, lighthouses, whaling stations, wilderness and coastlines.

24.2 HISTORICAL OVERVIEW

Studies of sea-level depth-age curves for Australia suggest that Kangaroo Island was cut off by the submergence of Investigator Strait between 9300 and 9500 years ago. Backstairs Passage was submerged between 9500 and 9700 years ago, although a channel approximately 3 km wide remained for a few centuries before the Island was finally separated. The distances between the Island and the mainland were as they remain today from around 8500 years ago (Lampert 1981).

There is substantial archaeological evidence of prehistoric occupation on Kangaroo Island dating back approximately 16,000 years (EBS Heritage 2017). Lampert (1980) records that the distribution of sites on Kangaroo Island shows no special association with the Island's present shoreline; rather, the sites were some distance inland. This is relevant to the proposal, as it is less likely that works along the shoreline would encounter sites compared to inland locations (EBS Heritage 2017).

Kangaroo Island has cultural significance to a number of Aboriginal groups, including the Kaurna (Adelaide Plains), Ramindjeri (Encounter Bay) and Ngarrindjeri (Lower Murray and Coorong). There is significant archaeological evidence of Aboriginal occupation, although there were no people living on the Island when Europeans arrived (Lampert 2002). Kangaroo Island was known as 'Karta' to the mainland Aboriginal groups, which broadly translates to 'island of the dead' and relates to the dreaming story of Ngurunderi, who travelled to the Milky Way after crossing to the Island. The spirits of the dead were believed to follow his track to the afterlife in the sky (Tindale 1974 in EBS Heritage 2017).

Archaeological excavations identified the presence of people inhabiting the Island long before European contact (Lampert 1980); however, little else is known of Aboriginal land use and culture and there is little evidence to indicate when and why Aboriginal people ceased to inhabit the Island (EBS Heritage 2017).

This means that archaeological and anthropological knowledge of Kangaroo Island is different from knowledge of the mainland, and archaeological sites are generally less obvious as they are often below the soil surface.

Changes in historic burning patterns of Kangaroo Island's vegetation shown in sediment cores suggest that Aboriginal occupation may have ended about 2250 years ago (Lampert 2002).

British explorer Matthew Flinders was the first non-indigenous person to land on Kangaroo Island; his arrival in 1802 was closely followed by that of French explorer Nicolas Baudin.

From around 1803–30, groups of sealers and whalers occupied Kangaroo Island on a seasonal basis, working from shore-based camps to collect oil, meat and kangaroo skins for the international market (EBS Heritage 2017). Some of these men settled on the Island permanently from the mid-1820s onwards (Taylor 2002) with their 'wives' – Aboriginal women abducted from the mainland and Tasmania. These women were invaluable due to their bush survival skills, including their ability to find water in dry areas, to make clothes from kangaroo skins, and to find food even when it was scarce (Taylor 2002).

The first permanent European settlement in South Australia was at Kingscote (then known as Queenscliff) on Kangaroo Island, when the early shiploads of South Australian Company immigrants arrived in 1836. However, due in part to the lack of a reliable water supply, the settlement moved after a few months to Holdfast Bay on the mainland. Kangaroo Island was never completely abandoned and it became a quiet outpost that was settled gradually over the next century.

The first known Europeans to visit Smith Bay were a party of sealers from Sydney in 1824, two of whom deserted and stayed on the Island (Clarke 1996).

Agricultural settlement probably began near Smith Bay in the 1850s. The Turner family, consisting of brothers John, George and Alfred, began taking up land there in 1882, and eventually held 5000 ha (Section 124, Hundred of Menzies). They cleared the land and began producing high-yielding barley crops and a diversity of other farm produce, including honey from Ligurian bees (Bell & Austral Archaeology 2018). The partnership broke up in 1887 and the brothers managed their own farms as separate concerns. John Turner took out Perpetual Lease 5180 on Section 338, Hundred of Menzies, which includes the study area (Bell & Austral Archaeology 2018).

The pace of settlement increased substantially at the end of World War II with land grants to soldier settlers who were able to rapidly clear the mallee woodland for farming using powerful machinery.

Because of Kangaroo Island's isolation from the mainland, shipping has always played an important role in its settlement and development. The first ships to visit regularly were engaged in early whaling and sealing ventures, which had mostly ceased by the 1850s (Maritime Heritage Surveys 2017). Following European settlement, shipping traffic along the north coast and through Investigator Strait gradually increased as people, goods and materials were transported to and from the Island. Within a few decades of settlement, Investigator Strait had become an important shipping lane (Coroneos & McKinnon 1997).

During the nineteenth and first half of the twentieth centuries, small trading vessels known as ketches operated in the coastal waters of Kangaroo Island (Maritime Heritage Surveys 2017). As pastoral and agricultural industries grew, Island communities became increasingly dependent on sea transport. Ketches would call at local bays to load produce such as wool, grain, fruit, vegetables, timber, livestock, wallaby skins and eucalyptus oil (Parsons 1986). Fishing vessels also frequented the Island's coastal waters following European settlement (Maritime Heritage Surveys 2017).

Farm produce from the Turner farms in Smith Bay (and potentially other farms in the Smith Bay area) was loaded onto small boats on the beach and carried to ketches offshore, which was a common practice in South Australian gulfs and on islands. The small steamship SS *Karatta* was known to call at Smith Bay and Kingscote after 1907 (*The Advertiser* 7 December 1907, p.14).

A timeline of settlement on Kangaroo Island and Smith Bay is provided in Figure 24-1.

Numerous ships have been wrecked along the Island's northern coastline due to occasionally rough conditions and unpredictable weather. Between 1849 and 1982, 26 vessels were wrecked in the waters of Investigator Strait, although many of these wrecks remain undiscovered (DENR 1996).

24.3 ASSESSMENT METHODS

A desktop assessment of relevant databases was undertaken for the study area. These included:

- Australian Heritage Places Inventory (DoEE 2018a, 18 April 2018)
- South Australia Heritage Places Database (DEW State Heritage Branch 2018, 18 April 2018)
- National Native Title Tribunal (NNTT) public registers (NNTT 2016, 18 April 2018):
    - National Native Title Register
    - Register of Native Title Claims
    - Register of Indigenous Land Use Agreements

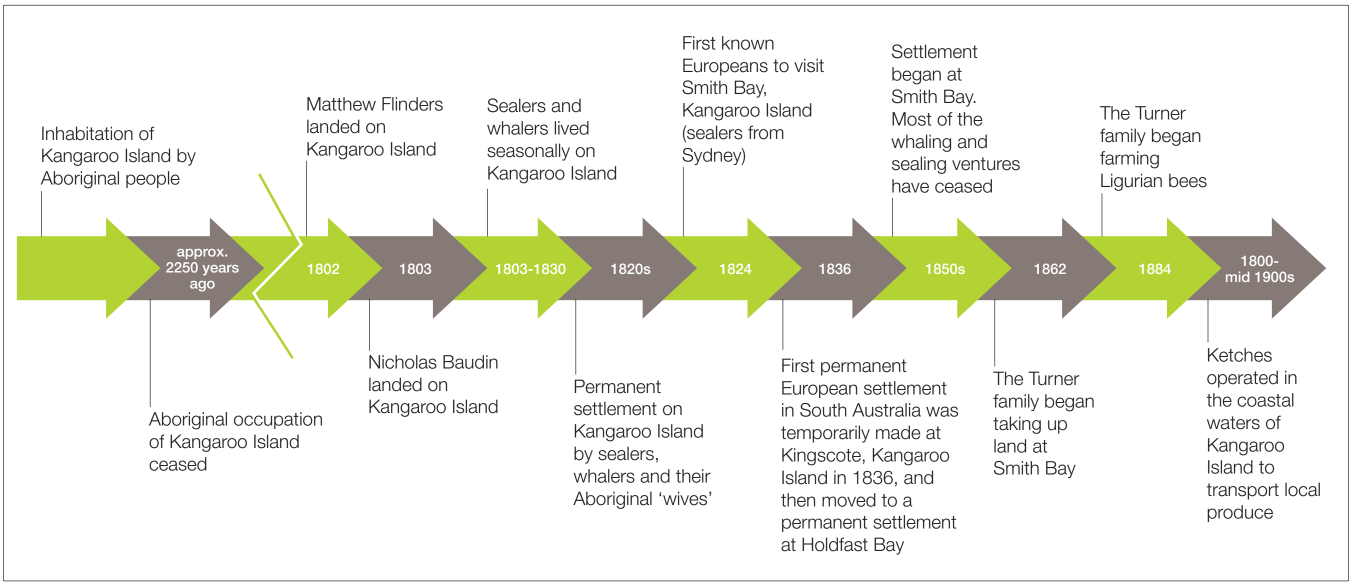


FIGURE 24-1 TIMELINE OF SETTLEMENT ON KANGAROO ISLAND

- Central Archive, Register of Aboriginal Sites and Objects (Aboriginal Affairs and Reconciliation, Department of State Development 2016, 15 December 2016)
- Australian National Shipwreck Database (DoEE 2018a, 18 April 2018).

The Kangaroo Island Council Development Plan – Consolidated 17 September 2015 – was reviewed as part of the assessment.

In addition, three external studies were commissioned:

- Smith Bay Kangaroo Island Heritage Desktop Assessment by EBS Heritage (2017) (Appendix S1)
- Smith Bay Kangaroo Island South Australia History of European Settlement by Bell & Austral Archaeology (2018) (see Appendix S2)
- Smith Bay Underwater Cultural Heritage Assessment by Maritime Heritage Surveys (2017) (Appendix S3).

Consultation was undertaken with the following stakeholders:

- Department of Environment, Water and Natural Resources – State Heritage Branch (currently the Department for Environment and Water)
- Ramindjeri
- Kuarna
- Ngarrindjeri
- Department of State Development – Aboriginal Affairs and Reconciliation (currently the Department of the Premier and Cabinet)
- Kangaroo Island Council
- South Australian Heritage Council.

The results of these assessments and consultation form the basis of this chapter. Refer to Chapter 7 – Stakeholder Engagement for further detail regarding the consultation process.

24.3.1 ABORIGINAL HERITAGE DESKTOP ASSESSMENT

The Smith Bay Kangaroo Island Heritage Desktop Assessment (EBS Heritage 2017) was completed in March 2017 (Appendix S1). The objective of this study was to:

- review the available heritage resources relevant to the study area
- undertake a risk assessment for the study area, by reviewing relevant reports, database search results and consideration of landforms, to determine the likelihood of unrecorded Aboriginal heritage sites or artefacts being present
- outline the legislative requirements that may apply if any heritage sites and/or objects were identified in the study area
- provide recommendations regarding the management of heritage considering the proposed works, relevant heritage protection legislation and best practice.

The following resources were accessed:

- Central Archive and Register of Aboriginal Sites and Objects (DSDAAR 2016, 15 December 2016)
- South Australian Museum (SAM) database search
- previous heritage reports and documents relevant to the study area.

24.3.2 EUROPEAN SETTLEMENT DESKTOP ASSESSMENT

The Smith Bay European Settlement Desktop Assessment (Bell & Austral Archaeology 2018) was completed in November–December 2017 (Appendix S2).

The objective of the assessment was to document the history and development of Smith Bay since European settlement. No field work was undertaken.

24.3.3 UNDERWATER CULTURAL HERITAGE DESKTOP ASSESSMENT

The Smith Bay Underwater Cultural Heritage Desktop Assessment (Maritime Heritage Surveys 2017) was completed in May 2017 (Appendix S3). The objective of this review was to:

- determine whether there were any known shipwrecks that the proposal may directly or indirectly affect
- determine the likelihood of the presence of submerged cultural heritage that the proposal could directly or indirectly affect
- provide recommendations for mitigating the risk of the proposal affecting as-yet-undiscovered maritime cultural heritage.

The assessment involved the review of known shipwrecks within the region and focused on the possibility of wrecks within 500 metres of the study area. The assessment reviewed:

- the Australian National Shipwreck Database
- the Atlas of South Australia
- the Nature Maps database
- books and other relevant publications
- geotechnical studies of the study area.

24.4 EXISTING ENVIRONMENT

Appendix S4, Appendix S5 and Appendix S6 detail outputs from the database searches. Correspondence from the State Heritage Council concerning a recently nominated (but ultimately rejected) potential heritage site at Smith Bay known as Harry Smith's house is also referenced (Appendix S8).

There are no World Heritage, Commonwealth Heritage or National Heritage sites in the vicinity of the study area.

24.4.1 ABORIGINAL HERITAGE

South Australia's *Aboriginal Heritage Act 1988* provides for protection of Aboriginal sites, objects or remains, whether previously recorded or not. An Aboriginal site is defined under the Act as an area or land that is of significance to Aboriginal tradition or that is of significance according to Aboriginal archaeology, anthropology or history.

There are no listed Aboriginal heritage sites within the study area (Appendix S5), although their absence does not eliminate the possibility that such sites do exist. In its assessment, EBS Heritage (2017) concluded that there was insufficient information about the archaeology of Kangaroo Island to clearly assess the risk of affecting unrecorded or unknown sites.

As a result, the Heritage Desktop Assessment (EBS Heritage 2017) recommended a risk management strategy to prevent the proposed works damaging, disturbing or interfering with any Aboriginal cultural heritage sites (see Section 24.5). The strategy would be detailed in the Heritage Management Plan.

24.4.2 NATIVE TITLE

The Commonwealth *Native Title Act 1993* adopts a common law definition of native title as provided in the High Court judgement in *Mabo v. The State of Queensland (1992) 175 CLR 1*. In summary, it may be defined as the rights and interests that are possessed under the traditional laws and customs of Aboriginal people in lands and waters.

Under the *Native Title Act 1993*, native title is extinguished over private freehold land but is relevant to Crown lands. The majority of the land-based component of the proposal is on private land; however, parts of the proposal extend into Crown land (the coastal reserve foreshore) as well as land not within a council area (the offshore component of the proposal).

A search of the National Native Title Tribunal (NNTT) registers on 18 April 2018 found there were currently no active native title claims or Indigenous Land Use Agreements (ILUAs) held over Kangaroo Island. However, the Ramindjeri (SC2010/003) claim Kangaroo Island and the surrounding waters as part of their native title lands, including the study area. This claim was dismissed by the NNTT on 24 March 2011 as it did not meet all requirements of s. 190B of the *Native Title Act 1993*. The Ngarrindjeri and Kaurna also have interests in the area (EBS Heritage 2017).

Under the *Native Title Act 1993*, consultation with native title claimants is required for projects that may affect land subject to native title. Consultation with Aboriginal stakeholders is detailed in Chapter 7 – Stakeholder Engagement.

24.4.3 NON-ABORIGINAL HERITAGE

A search of the South Australian Heritage Places Database (18 April 2018) found no state or local heritage listings within the area of the proposed KI Seaport (see Figure 24-2 and Appendix S6).

The nearest state heritage listing is approximately 4.5 km south-east of the study area, where the former Wisanger School is located (North Coast Road Wisanger, Heritage Number 16047). Another state heritage listing is approximately 5 km from the study area, at multiple locations along the coastline from Cape d'Estaing to Boxing Bay, as a designated place of palaeontological significance (Emu Bay – Heritage Number 16023).

Local heritage places in the vicinity of the study area include:

- Whittakers Cottage (ruin), North Coast Road, Wisanger, Council reference KI36, Heritage Number 20589
- Emu Bay Homestead, Emu Bay Road, Wisanger, Council reference KI40, Heritage Number 20591
- ruin, North Coast Road, Wisanger, Council reference KI41, Heritage Number 20592
- salt lake, off North Coast Road, west of Bay of Shoals, south-east of Emu Bay, Wisanger, Council reference KI56, Heritage Number 20604 (see Figure 24-2).

The ruins of Harry Smith's house and the Jacka family home ruin

The ruins of Harry Smith's house, located on Easement B within the study area, was anonymously nominated for inclusion in the State Heritage Register in early 2017 (see Appendix S8). The nomination identified the ruin as the original house of Harry Smith and one of the few historic European residences at Kangaroo Island. Included in the same nomination was a second associated ruin (known as the Jacka family home ruin, Bird, L 2018, pers. comm.16 May) and a very old mulberry tree and fig tree located close to the site but outside the study area (see Figure 24-3). Both ruins comprise remnant foundations and associated scattered rubble (see Plates 24-1 and 24-2).

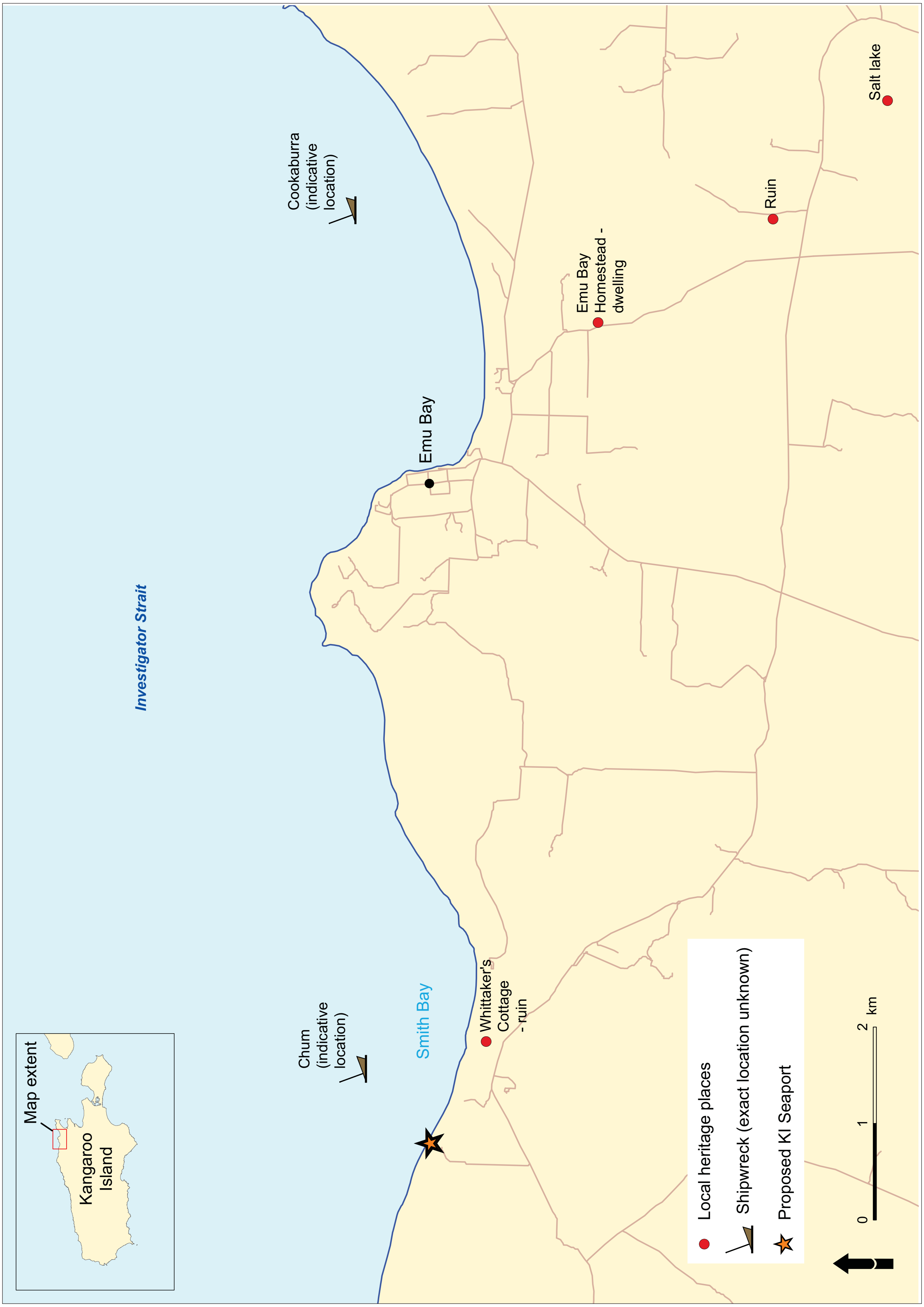


FIGURE 24-2 LOCAL HERITAGE SITES AND THE PROPOSED LOCATION OF THE KI SEAPORT

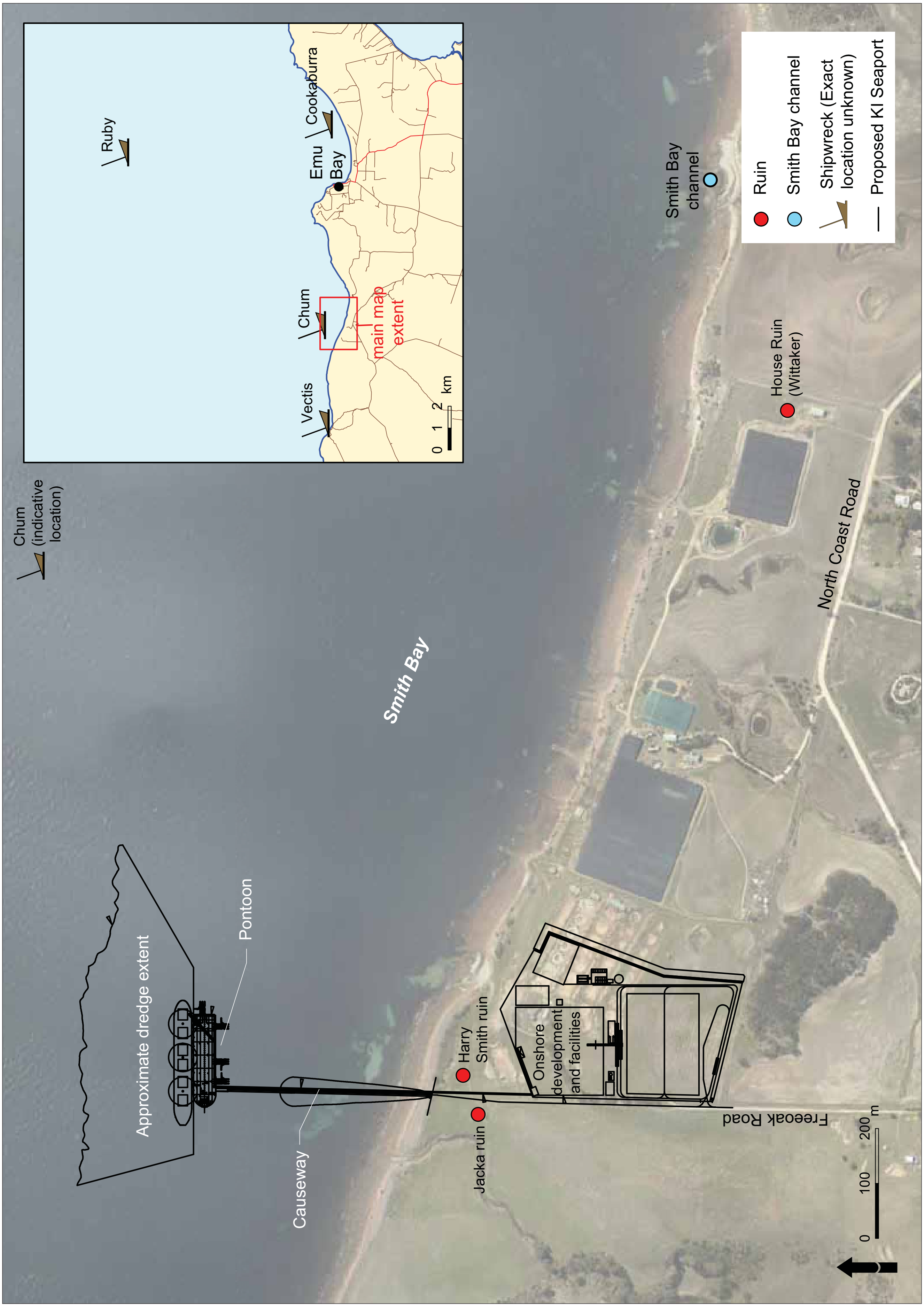


FIGURE 24-3 HERITAGE SITES IN THE VICINITY OF THE STUDY AREA

PLATE 24-1 THE RUINS OF HARRY SMITH'S HOUSE (PHOTO TAKEN 8 JUNE 2017)

PLATE 24-2 THE RUINS OF THE JACKA FAMILY HOME (PHOTO TAKEN 8 JUNE 2017)

PLATE 24-3 LOADING GRAIN SACKS ONTO THE *SS KARATTA* VIA THE SMITH BAY CHANNEL 1920–38

The State Heritage Council decided against listing the site on the State Heritage Register (Appendix S7). However, this does not mean the ruins do not have heritage value, and they may deserve some level of protection. Part of the ruin is located on Crown land, outside the study area, and would not be affected by the proposal. The remainder of the ruin is located within the easement but would not be affected by the proposal.

Origin of the Smith Bay Channel

A heritage survey of the area in 1991 (Dallwitz et al. 1991) identifies a site known as the 'Smith Bay channel' and the Turner family history contains stories of the family manually clearing rocks from the beach between the world wars to create a channel for boats to land and load farm produce (Bell & Austral Archaeology 2018) (see Plate 24-3). This channel is still clearly evident on the foreshore and lies 1.5 km east of the study area (refer to Figure 24-3).

North of the study area an anomalous large depression of the seabed has also been found about 200–300 metres offshore (refer to Figure 12-1, Chapter 12 – Marine Ecology).

It is unlikely that any actual 'shipping channel' was ever 'dredged' (Bell & Austral Archaeology 2018) in the interwar years, given the scale of the depression (about 45,000 cubic metres) and the machinery available at the time.

A similar sandy channel on the foreshore of the study area, which is occasionally used as a public boat ramp, is unlikely to be the historic Smith Bay Channel, (described above), but it may also have been cleared of rocks to provide boat launching facilities as it is adjacent to a public track.

24.4.4 SHIPWRECKS

The underwater cultural heritage assessment reported four shipwrecks (*Chum, Vectis, Ruby and Cookaburra*) are recorded in the vicinity of Smith Bay (refer Figure 24-3). None of the four sites is listed as 'found', indicating that the exact locations of the shipwrecks are unknown. A desktop assessment of whether the vessels and/or material from the wrecks could have been transported into the study area was included in the underwater cultural heritage assessment. The following sections describe these four shipwrecks and the associated assessment by Maritime Heritage Surveys (2017).

Chum

The *Chum* is an unlocated wrecked fishing vessel which state and national databases list as being situated in Smith Bay (Maritime Heritage Surveys 2017). The six-metre wooden cutter was wrecked on 7 January 1942. It is classified as an Historic Shipwreck because of its age and is protected under the Commonwealth *Historic Shipwrecks Act 1976*.

The *Chum* is believed to have been built at Port Adelaide in the early 1900s (Chapman 2007). The last owner, a Kingscote resident, bought the *Chum* in the late 1930s and used her mainly for whiting and snapper fishing in Nepean Bay on the north coast of Kangaroo Island. The vessel was caught in a storm and ran aground in Smith Bay with no loss of life during a fishing expedition (Chapman 2007).

Despite the publication of a highly detailed account of the shipwreck (Chapman 2007), the *Chum* has never been located. The Maritime Heritage Surveys assessment (2017) found no conclusive evidence that the vessel was salvaged and, based on the account of the wrecking event, concluded that it is unlikely that the impact zone for the wreck is within the development footprint. The same assessment determined that material from the wreck is unlikely to have survived within sediment deposits in Smith Bay.

Vectis

The *Vectis* is an unlocated wrecked fishing vessel which state and national databases list as lying approximately 4 km west of the study area (Maritime Heritage Surveys 2017). The 9.8-metre cutter was wrecked on 8 July 1932 (Loney 1983 & 1987). It is classified as an Historic Shipwreck because of its age and is protected under the Commonwealth *Historic Shipwrecks Act 1976*.

The database records describe the wreck as occurring 'one mile east of Dashwood Bay' after the vessel sprang a leak and ran aground on rocks while trying to beach. Salvage attempts were only partially successful and the hull was not recovered (Loney 1983 & 1987; Christopher 1990; Chapman 1973).

Because the wreck of the *Vectis* has never been found, and historical records do not provide a precise location, material from the wreck may have reached Smith Bay. Maritime Heritage Surveys (2017) concluded, however, that the probability of material being preserved in the study area is low, based on the distances involved.

Ruby

The *Ruby* is an unlocated wrecked vessel which state and national databases list as lying approximately 13 km north-east of the study area (Maritime Heritage Surveys 2017). The 20-tonne wooden ketch was wrecked in November 1904 (exact date unknown) (Loney 1983 & 1987). It is classified as an Historic Shipwreck because of its age and is protected under the Commonwealth *Historic Shipwrecks Act 1976*.

Considering this wreck's distance from the study area, it is highly unlikely that any material from the *Ruby* is in Smith Bay.

Cookaburra

The *Cookaburra* is an unlocated wrecked vessel which state and national databases list as lying approximately 10 km east of the study area (Maritime Heritage Surveys 2017). The vessel was wrecked on 19 May 1962 (Chapman 1973; Loney 1983 & 1987) and because of its relatively young age is not protected under the Commonwealth *Historic Shipwrecks Act 1976*.

Maritime Heritage Surveys (2017) advise that it is highly unlikely that any material from this wreck would be in Smith Bay due to the headland that lies between Emu Bay and Smith Bay.

24.5 IMPACT ASSESSMENT AND MANAGEMENT

24.5.1 ABORIGINAL HERITAGE

The study area is highly disturbed. It has been cleared of virtually all native vegetation, cultivated for barley production, and grazed for over 100 years. Parts of the site have been used for a land-based abalone farm. Any Aboriginal heritage sites would have been highly disturbed by cultivation using heavy machinery.

No Aboriginal heritage sites or artefacts have been recorded within the study area (Appendix S5). However, this does not eliminate the possibility that sites do exist there.

Although there is no legal requirement under the *Aboriginal Heritage Act 1988* to undertake an Aboriginal cultural heritage survey of the study area, there is still a possibility that the study area may contain Aboriginal sites, objects or remains as covered by the Act. Under s.23 of the Act, it is an offence to damage, disturb, or interfere with Aboriginal sites, objects or remains unless written authorisation from South Australia's Minister for Aboriginal Affairs and Reconciliation has been obtained.

EBS Heritage prepared a risk management strategy to prevent any proposed works from damaging, disturbing or interfering with any potential Aboriginal cultural heritage sites (EBS Heritage 2017). The risk management strategy would form the basis of the Heritage Management Plan which would include the following management measures:

- an archaeologist would be present in the field during early works to monitor changes in soil profiles and assess the likelihood of encountering Aboriginal heritage sites
- the engagement of Aboriginal monitors during earthworks, if required
- an Aboriginal heritage induction procedure for the construction workforce
- a site discovery protocol for construction activities (see Section 24.5.4).

If a potential Aboriginal heritage site was discovered, it would be reported to the Department of the Premier and Cabinet, Aboriginal Affairs and Reconciliation.

24.5.2 NON-ABORIGINAL HERITAGE

As mentioned above, the foundation of the ruins of Harry Smith's house is located within Easement B of the study area (refer to Section 6.2.3 of Chapter 6 – Land Use and Planning). Although not a listed site, the proponent would protect the site by designing the onshore components of the KI Seaport around the easement which incorporates the ruin. Before construction, the site would be enclosed with fencing that incorporated suitable buffers and would remain fenced off throughout operations.

Unlike Aboriginal heritage, there are no statutory obligations to manage unlisted non-Aboriginal heritage. Under s.27(2) of the *Heritage Places Act 1993*, however, the discovery of any non-Aboriginal 'archaeological artefact' of 'heritage significance' must be reported to the South Australian Heritage Council. The Heritage Management Plan would include a site discovery protocol that details the steps to be taken if a non-Aboriginal artefact of potential heritage significance were discovered. This protocol would include reporting the items to the South Australian Heritage Council.

As no non-Aboriginal heritage sites are listed onsite the potential impacts of the proposal on do not require approval under the *Development Act 1993* with respect to heritage matters.

24.5.3 SHIPWRECKS

Four wrecks are recorded as lying in waters in the vicinity of study area, although their precise locations are unknown. Three of the four wrecks are protected under the Commonwealth *Historic Shipwrecks Act 1976*.

The review of historical records has indicated that the likelihood of material from any of these wrecks being located within the study area is low (Maritime Heritage Surveys 2017). However, the possibility that heritage material exists in the seabed cannot be ruled out. As a result, Maritime Heritage Surveys (2017) recommends that a discovery protocol be established for the construction phase (including dredging) in case unexpected heritage material were to be discovered during on-ground works (see Section 24.5.4). Contractors would be inducted in the use of this discovery protocol. Potential discoveries would be reported to the Commonwealth Department of the Environment and Energy (DoEE).

24.5.4 DISCOVERY PROTOCOL

If a potential heritage item was discovered (Aboriginal and maritime) the following steps would be taken:

- all activity in the area would stop
- the area would be clearly identified and secured
- no material would be removed from the suspected site
- the construction site manager would be informed about the discovery
- the construction site manager would contact the relevant government department to report the potential site
- the site would be assessed by a suitably qualified and experienced expert
- if the area was deemed not to be a heritage site, works would resume
- if the area were deemed a heritage site, the construction site manager would liaise with the relevant government department and other relevant stakeholders to determine how to manage it appropriately
- a permit or authorisation from, or notification to, the relevant government department may be required before site works could resume.

This protocol would form part of the Heritage Management Plan.

24.6 CONCLUSIONS

24.6.1 ABORIGINAL HERITAGE

Although no Aboriginal heritage sites have been recorded within the study area, it is still possible that Aboriginal sites may be discovered during construction.

A Heritage Management Plan which includes an induction procedure and a site discovery protocol, outlined in Section 24.5.4, for construction activities would be developed and implemented. An archaeologist would monitor early site works to check for indicators of potential heritage sites, and Aboriginal site monitors may also be present.

24.6.2 NON-ABORIGINAL HERITAGE

The proposal would have no impact on the heritage significance of listed heritage places because none are located on the study area.

Potential impacts to Harry Smith's house ruin would be minimised by leaving appropriate buffers around the site and fencing off the site before construction and throughout operations.

The Heritage Management Plan would include a site discovery protocol, outlined in Section 24.5.4, that would detail the action required if a non-Aboriginal artefact of potential heritage significance were discovered. Discovery of any items would be reported to the South Australian Heritage Council.

24.6.3 SHIPWRECKS

Four wrecks are recorded as lying in waters in the vicinity of study area, although their precise locations are unknown. Three of the four wrecks are protected under the Commonwealth *Historic Shipwrecks Act 1976*.

Despite the likelihood that the proposal would have an impact on any of these wrecks is considered to be low, a discovery protocol would be implemented if maritime heritage material were discovered during site works. The Heritage Management Plan would provide further detail the protocol outlined in Section 24.5.4.

25. MANAGEMENT OF HAZARD AND RISK

25. MANAGEMENT OF HAZARD AND RISK

25.1 INTRODUCTION

Environmental risk assessment is the process of identifying and analysing:

- the environmental hazards associated with a proposed development
- the development's sensitive receivers
- the likelihood and consequence of impacts that may occur and then applying risk levels to the particular hazards.

KIPT has adopted a risk management framework aligned with AS/NZS ISO 31000:2009 to manage environmental risks associated with the proposed KI Seaport.

The main purpose of this risk assessment is to:

- identify risks
- assess the significance of each risk
- establish a risk profile separating minor risks from major risks
- facilitate the evaluation, mitigation and management of risks.

With the implementation of appropriate controls (including mitigation and management measures) most risks can be avoided or reduced to a level that is deemed 'acceptable; or 'as low as reasonably practical'. However, in some cases, 'residual' risks may remain after controls have been implemented. Further requirements may be implemented if the level of residual risk is considered to be unacceptably high.

The framework for implementing controls to avoid, mitigate or manage impacts is presented in Chapter 26 – Environmental Management Framework and, specifically, within the Draft Construction Environmental Management Plan (CEMP) (see Appendix U1) and the Draft Operational Environmental Management Plan (OEMP) (see Appendix U2).

25.2 METHODOLOGY

A risk assessment workshop was undertaken during the scoping phase of the EIS. It involved and incorporated the views of:

- environmental specialists working on the EIS
- project design engineers
- marine and civil construction contractors
- representatives of the proponent (KIPT).

The risk assessment was semi-quantitative, using an approach aligned with the risk management process ISO 31000:2009, as follows:

- **Establish the Context:** Identify the scope of the profile and the activities involved with the project.
- **Risk Identification:** Identify potential events during each activity, with the ability to impact the environment.
- **Risk Analysis and Risk Evaluation:** Assess the most likely consequences of each potential event and the likelihood of the event occurring; and consider potential synergistic effects for multiple risk events, where the combined risk of two or more independent events may be more than the sum of the individual risks.
- **Risk Treatment:** Identify appropriate control measures where the inherent level of risk for an event was assessed as intolerable, until the residual risk was reduced to a level that was acceptable.
- **Monitoring and Review:** Identify appropriate tracking mechanisms to monitor implementation of agreed controls.

The likelihood and consequence of impacts is rated or 'scored'. The keys to the scores used in the risk assessment are provided in Table 25-1 and Table 25-2, respectively.

Consequences are considered and a score is applied depending on the severity of the consequence and considering the potential impact on environmental/socio-economic, community/reputational and/or legal elements in alignment with KIPT's corporate governance. The consequence level is based on the highest level attained in any of the columns in Table 25-1.

Note that 'likelihood' refers to the probable frequency of an event occurring.

TABLE 25-1 CATEGORIES OF SEVERITY OF CONSEQUENCES BASED ON ENVIRONMENTAL/SOCIO-ECONOMIC, COMMUNITY/REPUTATIONAL AND/OR LEGAL ELEMENTS

Category	Level	Environmental/Socio-economic	Community/Reputational	Legal
A	Negligible effect	Very short-term effects within the project area. Recovery will occur within days. No ecological or socio-economic consequences.	No media, regulator or community interest.	Minor non-compliance and/or breach of regulation. No legal consequences.
B	Minor effect	Short-term effects within the project area. Recovery will occur within weeks. Minor ecological or socio-economic consequences. No changes to biodiversity or ecological function.	Local media coverage. Some interest by regulator(s) and local NGOs. One or two community complaints.	Breach of regulation with investigation or report to authority with possible prosecution and fine.
C	Moderate effect	Medium-term effects within the project area. Recovery likely to occur within months. Moderate ecological or socio-economic consequences. Local changes to biodiversity, but no changes to ecological function.	State media coverage. Investigation by regulator(s) and NGOs. Persistent community complaints.	Breach of regulation with litigation and moderate fine. Involvement of senior management.
D	Major effect	Long-term effects, potentially extending beyond the project area. Recovery is likely to take years and complete recovery may not occur. Major ecological or socio-economic consequences. Significant local changes to biodiversity and measurable changes to ecological function.	National media coverage. Detailed investigation by regulator(s). Long-term community unrest and outrage significantly impacting business.	Major breach of regulation with litigation and substantial fine. Possible suspension of operating licence.
E	Disastrous effect	Very long-term effects extending beyond the project area. Recovery is likely to take decades and complete recovery may not occur. Severe ecological or socio-economic consequences. Loss of biodiversity on a regional scale, and significant loss of ecological function.	International media coverage. Extensive investigation by regulator(s) involving government minister(s). Complete loss of trust by affected community threatening the continued viability of the business.	Major litigation or prosecution with very substantial fines. Possible cancellation of operating licence.

TABLE 25-2 LIKELIHOOD OF AN EVENT OCCURRING

Level		Criteria
1	Virtually impossible	Has almost never occurred elsewhere in similar situations, but is conceivable over the next 100 years.
2	Unlikely	Has occurred a few times elsewhere in similar situations. May occur within decades.
3	Possible	An occasional occurrence elsewhere in similar situations. May occur within the next few years.
4	Likely	A regular occurrence elsewhere in similar situations. Likely to occur within months.
5	Virtually certain	A very frequent occurrence elsewhere in similar situations. Expected to occur within days to weeks, or ongoing.

Table 25-3 is the matrix for assessing risk based on the combination of consequence and likelihood. It was used to establish the overall risk level associated with a particular activity before any control measure was applied. This identifies the level of 'inherent risk' (or potential risk).

The risk matrix shows risk levels from 'Low' to 'Extreme' and identifies where controls are required to mitigate potential impacts.

An important component of the risk assessment was the identification of, and commitment of KIPT to implement, 'appropriate controls' that would reduce risks where they were considered to be 'unacceptably high'.

Appropriate controls were determined and defined based on the findings of studies and investigations undertaken as part of the EIS.

After the agreement to implement controls was reached, the level of risk associated with each potential impact was re-assessed. This determines the level of 'residual' (or remaining) risk.

25.3 RISK ASSESSMENT OUTCOMES

The outcomes of the risk assessment are provided in Appendix T.

Some risk outcomes were assessed as 'low' or 'nil' following the rigorous impact assessment process.

Some risk outcomes were assessed as having residual risks that were 'acceptable' and 'as low as reasonably practicable'. This acceptable outcome was achieved with the implementation of controls developed by considering the impact assessments, any resultant design modifications, any alterations to construction methods.

25.4 CONCLUSION

Following the risk assessment process, a risk register (see Appendix T) is constructed. This register provides a structure to identify, rank, mitigate and track the range of environmental risks associated with the proposed development.

As mentioned above 'inherent risks' could be managed to 'acceptable' levels by implementing appropriate controls.

The level of residual risk associated with each of the potential impacts was identified as 'low' or 'as low as reasonably practical', and therefore 'acceptable'.

See Chapter 26 – Environmental Management Framework, which provides the basis for implementing and tracking the effectiveness of all control measures.

TABLE 25-3 MATRIX FOR ASSESSING RISK

			Likelihood				
			1 Virtually impossible	2 Unlikely	3 Possible	4 Likely	5 Virtually certain
Consequence	1	Negligible effect	1 (Low)	2 (Low)	3 (Low)	4 (Low)	5 (Medium)
	3	Minor effect	2 (Low)	4 (Low)	6 (Medium)	8 (Medium)	10 (High)
	3	Moderate effect	3 (Low)	6 (Medium)	9 (Medium)	12 (High)	15 (Extreme)
	4	Major effect	4 (Low)	8 (Medium)	12 (High)	16 (Extreme)	20 (Extreme)
	5	Disastrous effect	5 (Medium)	10 (High)	15 (Extreme)	20 (Extreme)	25 (Extreme)

>=0	0 – Low	> Low risks will be maintained under review but it is expected that existing controls will be sufficient and no further action will be required to treat them unless they become more severe.
>=5	5 – Medium	> Medium risks can be expected to form part of routine operations but they will be explicitly assigned to relevant managers for action, maintained under review and reported upon at senior management level.
>=10	10 – High	> High risks demand attention at the most senior management level to ensure that they are mitigated and controlled as rapidly as possible. They are reported on at the executive level.
>=17	17 – Extreme	> Extreme risks demand urgent attention at the most senior (including executive) level and must be immediately controlled. Operations must cease if the risk cannot be controlled.

26. ENVIRONMENTAL MANAGEMENT FRAMEWORK

Guideline		Comment
	This chapter addresses Guidelines 1, 2, 3 and 19 and describes the Environmental Management Framework (EMF) for the proposed KI Seaport. It describes the overarching environmental management process to be implemented for the construction, operational and decommissioning phases of the development.	
1.3	Describe the environment and management practices of the proposal site and the surrounding areas and other areas that may be affected by the proposal.	See Chapter 26
1.9	Provide a consolidated list of mitigation measures proposed to be undertaken to prevent, minimise or compensate for the relevant impacts of the action, including mitigation measures proposed to be undertaken by State governments, local governments or the proponent.	See Draft CEMP (Appendix U1) and Draft OEMP (Appendix U2)
1.11	Provide a detailed outline of a plan for the continuing management, mitigation and monitoring of the impacts on the above listed MNES. Include provisions for any independent environmental auditing. Include the name of the agency responsible for endorsing or approving each mitigation measure of monitoring program.	See Chapter 14
1.19	Provide an environmental record of the person(s) proposing to take the action. Include details of any proceedings under a Commonwealth, State or Territory law for the protection of the environment of the conservation and sustainable use of natural resources against: the person proposing to take the action; and if the person proposing to take the action is a corporation – details of the corporation's environmental policy and planning framework	See Chapter 26
2.11	Describe how ship loading operations will minimise incidental timber spillage and dust emissions (point source and fugitive) during loading operations to avoid causing harm to marine and coastal flora and/or fauna species, including migratory species.	See Draft OEMP (Appendix U2)
2.12	Describe the impact of any incidental timber spillage and dust emissions (point source and fugitive) during ship loading operations on the marine environment, in particular on water quality and marine and coastal flora and/or fauna species, including migratory species. Outline the measures that will be taken in the event of a spillage.	See Draft OEMP (Appendix U2)
2.16	Outline measures to protect water quality and the marine environment from shipping activities, especially turbulence during docking and manoeuvring. Include turbidity impacts on any identified shell fish or other filter feeders and on macro algal habitats in the region.	See Draft OEMP (Appendix U2)

Guideline		Comment
2.17	Detail measures to protect foreshore areas during and after construction, including potential marine and terrestrial protection areas and associated buffers.	See Draft CEMP (Appendix U1) and Draft OEPM (Appendix U2)
3.5	Detail the response procedure that will be followed in the event of a new exotic organism being detected.	See Biosecurity Response Procedure in Draft OEMP (Appendix U2)
3.6	Outline measures to ensure consistency with the Australian Ballast Water Management Requirements and national management http://marinepests.gov.au/marine_pests/publications/Pages/default.aspx).	See Draft OEMP (Appendix U2)
3.7	Outline strategies to monitor and prevent the introduction of vermin and other nuisance species that can be attracted to port facilities, and measures to manage and monitor such species.	See Draft OEMP (Appendix U2)
3.8	Outline strategies to prevent, monitor and manage invasive weed species (including terrestrial, coastal and marine species).	See Draft OEMP (Appendix U2)
3.9	Outline strategies to monitor, control and manage biofouling of wetted surfaces	See Draft OEMP (Appendix U2)
14.10	Identify the fire and bushfire risks at the site and to/from the site (e.g. from heavy vehicle movements) and detail fire measures to reduce risk. Include details of discussions had with CFS.	See Sections 7.6, 25.4 and Appendix U4
19	During the construction and operation of a large infrastructure projects, such as what is proposed at Smith Bay, there will be a range of standard impacts that can occur. Many of these can be adequately managed through construction and operational environmental management plans. As the wharf is proposed to be multi-user, information is needed on who the other potential users may be and how often it is anticipated to be used for other purposes.	See Draft CEMP (Appendix U1)
19.1	Provide draft environmental management plans, for both construction and operational activities, for all components of the development	See Draft CEMP (Appendix U1) and Draft OEMP (Appendix U2)
19.4	For each component, provide a site construction plan and outline strategies to minimise effects on the local environment	See Section 26.2, Draft CEMP (Appendix U1) and Draft OEMP (Appendix U2)
19.6	Identify all sources of waste during construction and operation and describe how the State Waste Strategy will be implemented.	See Draft Waste Management and Minimisation Plan (Appendix U5)
19.12	Describe the implementation of environmentally acceptable work practices and monitoring program.	See Chapter 26
19.13	Describe the proposed monitoring of impacts during and after construction, including reporting and auditing measures.	See Chapter 26
19.17	Describe the rehabilitation strategy to be adopted if the development ceases prior to completion, during any stage of the development or during its operational phase. Include details on funding for any rehabilitation that may be required.	

26. ENVIRONMENTAL MANAGEMENT FRAMEWORK

26.1 ENVIRONMENTAL MANAGEMENT FRAMEWORK

KIPT proposes to establish and operate the KI Seaport adopting this Environmental Management Framework (EMF) that is consistent with Australian Standards (AS/NZS ISO 14001:2015 Environmental Management Systems) and based on the Plan-Do-Check-Act (PDCA) approach to achieve continual improvement, as shown in Figure 26-1.

This framework provides an overarching strategy to manage potential environmental impacts during the construction, operation and decommissioning of the KI Seaport through implementation of Environmental Management Plans (EMPs), namely a Construction Environmental Management Plan (CEMP) (see Appendix U1) and an Operational Environmental Management Plan (OEMP) (see Appendix U2).

Activities at Smith Bay would be undertaken in accordance with the EMPs to avoid, mitigate, manage and/or control any potential adverse impacts of the KI Seaport on the biological, physical, social or economic environment. The EMPs would also give effect to any approval conditions imposed, and all commitments made by KIPT.

26.1.1 SCOPE

Timber product (logs and woodchips) would be transported to Smith Bay and stored before loading onto vessels for export. The KI Seaport would consist of a deep-water port and associated onshore facilities to handle and load these products into Panamax vessels, with the option of using smaller Handymax-size vessels as requirements dictate.

The EMF would apply to the construction and operation of all components (see Chapter 4 – Project Description) of the facility:

- Port/offshore components
  - dredged berth pocket and dredged approach area
  - navigation aids
  - floating pontoon wharf with wharf furniture (fenders, bollards, kerbs etc.)
  - restraint dolphins for restraint of pontoon
  - mooring dolphin at either end of wharf for vessel head and stern lines
  - linkspan bridge
  - approach (causeway and suspended deck)
  - tug mooring facility/pen.

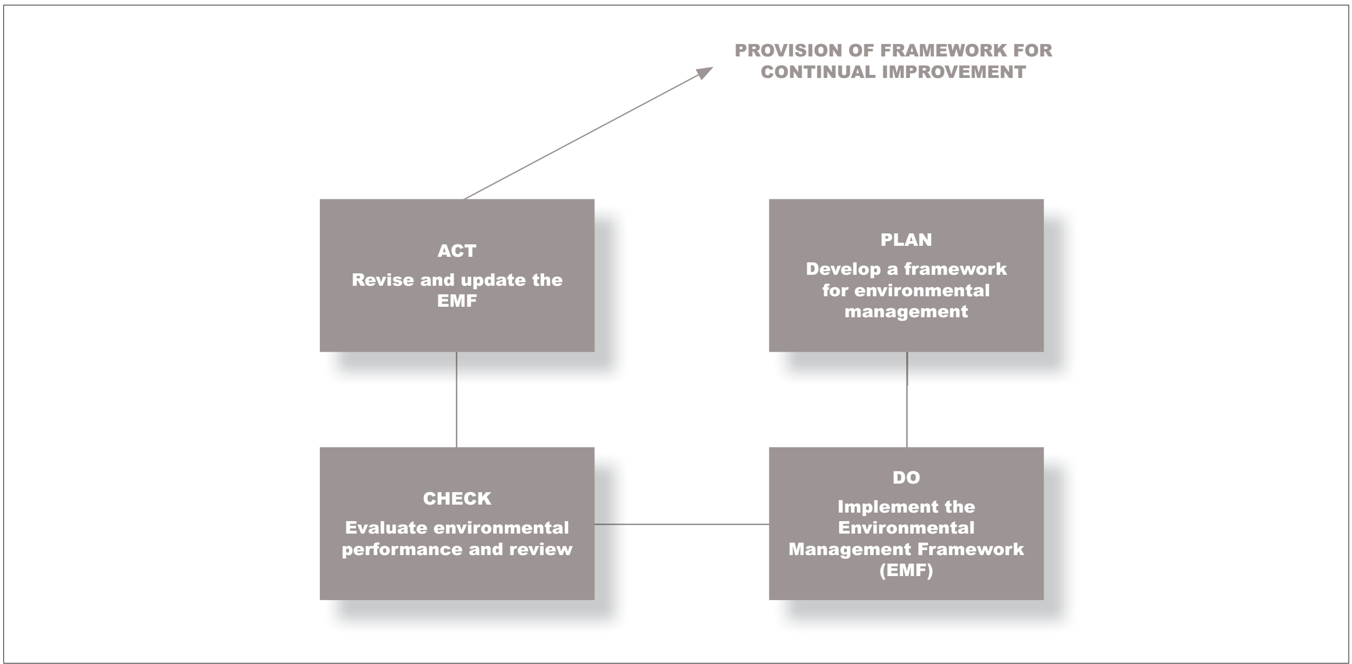


FIGURE 26-1 PLAN-DO-CHECK-ACT APPROACH TO ENVIRONMENTAL MANAGEMENT

- Onshore components
  - storage areas for logs and woodchips
  - internal access roads
  - site access road to North Coast Road
  - stormwater drainage and retention system
  - site security fencing and lighting
  - site offices, product testing room and crib/lunchroom
  - generator, diesel tanks and associated spill bunding.
- Materials handling components
  - receival, stockpile, reclaim and export conveyor system (including receival, stockpile management system, reclaim hopper/s, export/causeway conveyor, shiploader feed conveyor, shiploader)
  - truck weighbridge
  - truck wash facilities (if required).

The EMF would apply to all contractors and sub-contractors, and users of the facility. With relevant plans and EMPs the framework would be included in contractor documentation and provided to future users of the KI Seaport.

26.1.2 LEGISLATIVE REQUIREMENTS

Chapter 5 – Legislative Framework describes the relevant South Australian and Commonwealth environmental legislative requirements for the proposed KI Seaport. In addition to whole-of-project approvals, several legislative requirements, at both State and Commonwealth levels, must be met, including permits and/or licences for specific activities. The following environmental legislation, regulations and guidelines provide the regulatory framework upon which the EMF is based:

- *Biosecurity Act 2015*
- *Environmental Protection Act 1993*
- *Environment Protection and Biodiversity Conservation Act 1999*
- Environment Protection (Water Quality) Policy 2015
- Environment Protection (Air Quality) Policy 2016
- Environment Protection (Noise) Policy 2007
- National Environment Protection (Ambient Air Quality) Measure
- National Environment Protection (National Pollutant Inventory) Measure
- Guideline for Air Quality Impact Assessment Using Design Ground Level Pollutant Concentrations (EPA South Australia 2006)
- Guideline for the use of the Environment Protection (Noise) Policy (EPA South Australia 2007)
- Guidelines for the Assessment and Remediation of Groundwater Contamination (EPA South Australia 2009)
- Code of Practice for vessel and facility management (marine and inland waters) (EPA South Australia 2017)
- Code of Practice for Materials Handling on Wharves (EPA South Australia May 2017)
- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC & ARMCANZ 2000).

KI Seaport would operate under an authority and specific licences issued by the South Australian Environment Protection Authority (EPA). The EMPs would refer to the conditions of these authorities/licences, ensuring that all on-site works comply.

KIPT would also ensure that its employees have relevant competencies and that contractors provide copies of their permits and licences to KIPT. Contractors would also be required to be responsible for ensuring their staff had relevant permits and licences before they commence work on the development.

26.1.3 ENVIRONMENTAL ASPECTS

The environmental aspects are defined as elements of an organisation's activities, products or services that could interact with the environment. A significant environmental aspect has, or could have, a significant environmental impact (AS/NZS ISO 14001:2015). The significant environmental aspects for the proposal were identified from the environmental assessment and are shown in Table 26-1. Every three years, or if there are approved changes to the design or operation of KI Seaport in the future, the table and the corresponding EMPs would be updated to reflect these changes.

26.1.4 OBJECTIVES AND TARGETS

The overall objectives are to construct and operate the KI Seaport in a sustainable way, through avoiding or minimising potential negative impacts and enhancing, where possible and practical, the beneficial impacts on the environmental, cultural, social and economic values of Smith Bay. KIPT is committed to complying with environmental legislation and the commitments made in the EIS.

Objectives and targets are required to manage significant aspects of the development. The objectives state the overall goals for environmental performance to meet the commitments of the EIS and to address environmental risks associated with the development. The targets define the performance level and timeframe to meet specified objectives. The objectives and targets are incorporated into the draft Construction Environmental Management Plan (CEMP) and draft Operational Environmental Management Plan (OEMP) (see Appendix U1 and U2). The objectives for the significant environmental aspects for the development are listed in Table 26-1 and KIPT's list of commitments to mitigate these impacts are listed in Chapter 27 – Commitments.

TABLE 26-1 ENVIRONMENTAL ASPECTS, OBJECTIVES AND POTENTIAL IMPACTS TO BE MANAGED

Environmental aspect	Objective	Activity	Potential impacts
Marine disturbance: • dredging • seagrass clearance • silt plumes • interruption of coastal processes • mobilisation of potentially contaminated material in sediments.	No increase in turbidity (above background levels) at the intake for the abalone farm. Minimise the impact on seagrass communities and offset any impacts. No significant adverse impacts to specified marine environmental values at Smith Bay.	Construction of berth pocket (dredging) Pile-driving Causeway construction	• poor water quality (turbidity) at intake for abalone farm • direct loss of 10 ha of mixed habitat (seagrass and associated invertebrate communities) • temporary decline in productivity of seagrass within 500 metres of dredging site due to sediment deposition • visible silt plume around construction site in Smith Bay • potential impacts on marine heritage items (shipwrecks) • interruption of movement of seawater, sand and seagrass wrack (shed leaf material) along the coast • loss of small area of pipefish habitat and some individuals of ring-backed pipefish
Interaction with marine mammals: • underwater noise and vibration generation • cruising at sea.	To minimise the disturbance to marine mammals.	Construction of berth pocket (dredging) Pile-driving Shipping	• potential collisions with whales • hearing damage, changes to migration, breeding or social behaviour of whales and dolphins due to excessive underwater noise and vibration
Biosecurity: • introduction or spread of pest plants, pest animals and/or diseases • ballast water discharge • biofouling (including in-water and dry dock vessel cleaning) • stowaways on shipping vessels.	To minimise the risks to the biosecurity status of Kangaroo Island. To minimise the risk of the development adversely impacting the biosecurity status of locations other than Kangaroo Island and its waters. No introduction of new pest plants or pest animals, nor material increase in the abundance or area of existing pest plant or pest animal. No introduction of plant or animal diseases.	Shipping activity – sea freight as a vector for pests and diseases Onshore operational activities – importation of equipment, timber product and/or consumables as a vector for pests and diseases	• introduction of pest species and/or diseases (particularly the abalone disease AVG and the abalone parasite *Perkinsus*) that could harm industry • introduction of vertebrate or invertebrate pest species and/or diseases that could harm native fauna, flora, ecosystems and industry • adverse impacts (disease, predation, increased competition, reduction in habitat) on flora and fauna from pest plants, pest animals and/or diseases • financial impacts to industry as a result of new pest plants, pest animals and/or diseases on the Island
Land disturbance: • native vegetation clearance • soil disturbance • excavation • introduction or spread of pest plants and animals.	No introduction of new weeds or pests, nor material increase in the abundance or area of existing weed or pest species. No loss of abundance or diversity of native vegetation. No disturbance to Aboriginal or European heritage items (unless prior approval obtained from relevant legislation).	Onshore construction activities Upgrading of access road Shipping	• loss of 2.93 ha of remnant native vegetation (very poor to moderate condition) including 0.48 ha of remnant Kangaroo Island narrow-leaf mallee • loss of fauna habitat • potential impacts on Aboriginal or non-Aboriginal heritage items • unanticipated disturbance of contaminated soil • potential for introduction of phytophthora (soil-borne parasitic fungus) through contaminated soil on vehicles, construction equipment and landscaping materials, including plants

TABLE 26-1 ENVIRONMENTAL ASPECTS, OBJECTIVES AND POTENTIAL IMPACTS TO BE MANAGED (CONT'D)

Environmental aspect	Objective	Activity	Potential impacts
Interaction with terrestrial fauna: • traffic movements • noise generation.	To minimise the disturbance to terrestrial fauna. No significant adverse impacts to listed threatened species (South Australia and Commonwealth) populations in the development area.	Construction traffic Transport along the access road (Freeoak Road)	• impacts on echidnas that occasionally forage on site • road kills of native fauna (particularly echidnas) • disturbance to fauna, particularly the hooded plover
Community interaction: • changes to visual amenity • light emissions • dust • noise emissions and vibration • fire risk • socio-economic values.	To ensure that impacts to amenity are reduced to levels as low as reasonably practicable. No adverse public nuisance impact from dust, noise or light emissions from the site. To reduce the fire risk within the development area. To maintain or improve the existing social and economic values of the region.	Onshore construction activities Pile-driving Wharf operations Onshore operational activities	• temporary disturbance to abalone farm/ neighbouring farms (from light and noise) • nuisance impacts from dust, noise or light on neighbours • effects on visual amenity of Smith Bay • possibility of timber stockpiles catching fire should a bushfire occur in the area • increase in employment for the region
Generation of waste and discharges: • stormwater runoff • waste generation • accidental release/spill of chemicals/fuels/diesel • ballast water discharge.	To ensure that the quality and quantity of discharged surface water and stormwater affected by site activities meets required standards and objectives. No adverse effects on marine water quality. No introduction of marine pests. No significant contamination of soils as a result of storage and/or use of hazardous materials. To minimise the generation of general wastes, maximise their reuse and recycling, and ensure safe and lawful disposal of waste.	Onshore activities On-site diesel storage and use On-site fuel/ chemical storage and use Shipping – ballast water and biofouling Woodchip storage	• accidental release/spill of chemicals/fuels/ diesel resulting in soil contamination • generation of wastes requiring disposal • leachate from woodchip or log stockpiles entering groundwaters or stormwater runoff • marine pollution and effects on marine communities • potential introduction of pest species and diseases (particularly the abalone disease AVG and the abalone parasite *Perkinsus*)
Emissions from plant and equipment: • noise and vibration generation • fugitive dust • winnowing of sediments and silt plumes (shipping) • greenhouse gas emissions.	No adverse public nuisance impact from noise/vibration or dust generation from the site. No adverse effects on marine water quality. To minimise greenhouse gases generated as a result of the development.	Onshore construction activities Wharf operations Vehicle traffic Shipping (vessel noise and winnowing of sediment) Overall development	• disturbance to neighbouring farms/abalone farm (from noise and fugitive dust) • temporary loss of seagrass productivity due to light reduction and smothering from turbidity • poor water quality (turbidity) at intake for abalone farm • carbon footprint of the development and contribution to global warming • sea level rise potentially impacting coastal developments

26.1.5 IMPLEMENTATION

The EMF structure and approach to implementation of the EMPs and its plans and procedures are shown in Figure 26-2. The draft EMPs for construction (CEMP) and operation (OEMP) (see Appendix U1 and U2, respectively) are the core documents, informed by the EIS and based on KIPT's Environmental Policy and commitments. The draft EMPs address the significant environmental aspects and describe management strategies to mitigate the impacts and risks associated with those aspects.

26.1.6 RESPONSIBILITIES

Successful implementation of the EMF would require:

- a commitment by KIPT, its employees and contractors to comply with the EMPs
- a clear chain of responsibilities to be established
- ensuring that key management personnel understand the environmental controls described in the EMF
- environmental requirements and standards are communicated effectively and successfully to contractors
- all employees and contractors (via management reports, onsite supervision, audits) are monitored to ensure adherence to all environmental procedures.

The key responsibilities for implementing the EMF are summarised in Table 26-2.

Throughout detailed planning and construction phases, names would be allocated to the roles prescribed in the draft EMPs.

26.1.7 TRAINING

All KI Seaport staff and contractors involved in the development would be required to undertake training in environmental management as part of their induction to the site and its activities before any construction or operational activities could begin. Staff and contractors would also undertake job-specific training relevant to their roles.

26.1.8 COMMUNICATION

KIPT has consulted and engaged with stakeholders throughout the EIS process. Outcomes from this engagement have been considered in the identification and development of management and control measures. Public consideration and comment on the EIS will inform the finalisation of the draft EMPs.

A communication strategy would also be developed and implemented to inform stakeholders and the community during construction and operation of the KI Seaport.

A formal procedure would also be developed to manage internal and external communication regarding the EMF and relevant EMPs.

26.1.9 REVIEW AND CONTINUOUS IMPROVEMENT

The EMF would be regularly reviewed, updated and improved. Reviews would include assessing the effectiveness of its management measures. A formal review schedule would be developed to manage this process.

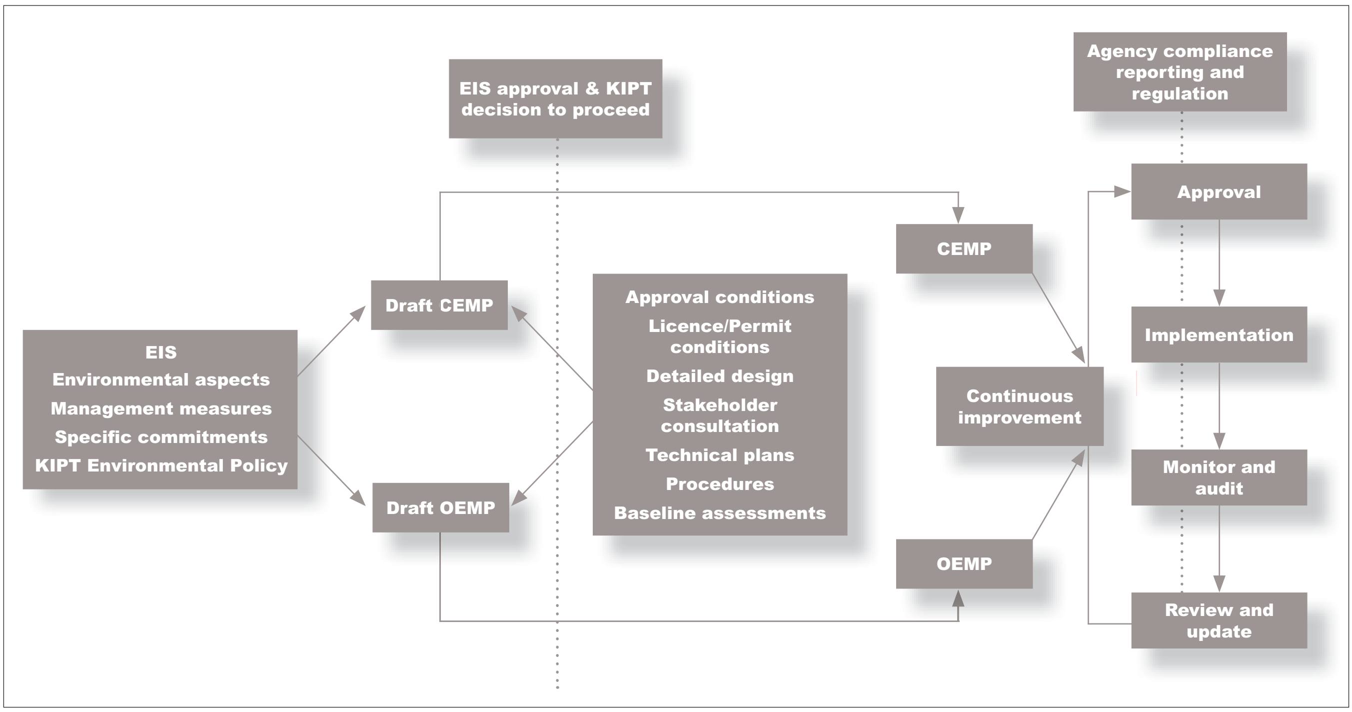


FIGURE 26-2 ENVIRONMENTAL MANAGEMENT FRAMEWORK IMPLEMENTATION

TABLE 26-2 EMF ROLES AND RESPONSIBILITIES

Role	Responsibilities
KIPT	Responsible for implementing requirements set for the development in legislation, regulation, codes of practice, and industry standards and implementing its environmental policy to minimise impacts and demonstrate commitment to sustainable practices. Ultimately responsible for compliance.
KI Seaport General Manager	Promoting the culture of environment protection and providing clear expectations and guidelines. Overseeing the involvement of all internal and external stakeholders and addressing issues raised. Supporting the Project Manager in resourcing project teams. Ensuring resources are provided to implement the EMF. Intervening, if required, to ensure any deviation from EMF requirements is corrected. Reporting to the KIPT Board.
KI Seaport Project Manager/s	Ensuring that EMF requirements are communicated to all relevant contractors and consultants involved in construction and operations at Smith Bay. Overseeing the development and implementation of the CEMP and OEMP. Ensuring resources are available to implement the CEMP and OEMP. Monitoring performance and reporting on progress against EMF objectives. Intervening, if required, to ensure any deviation from EMF requirements is corrected. Reviewing and updating the EMF as required.
KI Seaport Construction Manager/s	Ensuring that all environmental management requirements in the CEMP are clearly communicated to all relevant contractors through appropriate inductions. Providing contractors with written instructions/protocols/methods regarding environmental management requirements and responsibilities. Ensuring all necessary environmental approvals and licences are secured before work begins. Ensuring and monitoring compliance of construction activities with conditions of relevant licences, permits and the CEMP. Liaising with the EPA and other regulatory authorities as required. Intervening, if required, to ensure any deviation from EMF requirements is corrected. Notifying any legislative breaches or environmental incidents to authorities. Responding to any complaints received.
KI Seaport Operations Manager	Ensuring that all environmental management requirements in the OEMP are clearly communicated to all relevant staff through appropriate inductions. Providing operations staff with written instructions/protocols/methods regarding environmental management requirements and responsibilities. Ensuring all necessary environmental approvals and licences are secured before operations begin. Ensuring and monitoring compliance of operational activities with conditions of relevant licences, permits and the OEMP. Liaising with the EPA and other regulatory authorities as required. Intervening, if required, to ensure any deviation from EMF requirements is corrected. Notifying any legislative breaches or environmental incidents to authorities. Responding to any complaints received.
KI Seaport Contractors/ Operations staff	All contractors taking their environmental responsibilities seriously and diligently following all environmental procedures communicated to them by their supervisors. Undertaking all required inductions and/or environmental awareness training before starting work on site. Reporting any environmental incidents to the Construction/Operations Manager immediately.
KIPT Environment Manager	Ensure the EMF is implemented, and update documentation as required to reflect environmental legislation, design or operational changes. Coordinate monitoring programs and reporting to authorities. Manage environmental incidents and responses. Ensure KIPT environmental policy is reviewed annually. Manage environmental matters in relation to stakeholder engagement. Coordinate environmental awareness training and implement sustainability initiatives.

26.2 ENVIRONMENTAL MANAGEMENT PLANS

The draft CEMP and OEMP have been prepared to provide the basis for the public consultation and review as part of the EIS and its approvals process (see Appendix U). Draft EMPs will be finalised after the public consultation period and when the approvals processes is complete. Comments and submissions from the public, agencies and government's may be incorporated into them. The EMPs would then be submitted to the relevant government regulators for approval before construction or operational activities begin.

26.2.1 CONTENT OF EMPS

The practical implementation of the EMPs is structured around environmental aspects and key construction and operational activities that have a potential to affect the environment (see Table 26-1). The implementation of the management controls to lower risks to acceptable levels is therefore required.

Table 26-3 summarises the information provided in the draft EMPs for each environmental aspect.

TABLE 26-3 CONTENT OF ENVIRONMENT MANAGEMENT PLANS

Element	Description
Background/Scope	An overview of the key issues related to the aspect requiring management. This provides a summary of the potential impacts of the activities on environmental values and/or sensitive receivers.
Legal obligations and other requirements	The key legislation (South Australian and Commonwealth), policies, standards, guidelines and other requirements that apply to the aspect.
Values	The environmental values that are considered to be the most important and/or unique to the development and which require protection. These values provide the basis for implementing management and mitigation measures. The aim of the EMP is to enhance, protect and/or conserve these identified values.
Objectives	The environmental objectives are succinctly stated to ensure that the goals of the management measures are clearly understood. The objectives are developed based on the environmental values that have been identified as requiring protection/conservation and/or enhancement. The objectives are also based on features of the environment that are measurable.
Control/ Management strategies	The management measures and controls identified in the EIS that are proposed to avoid or mitigate potential impacts on the environmental values are listed. These controls and measures may, in appropriate circumstances and with the approval of regulators, be modified or replaced with other appropriate measures during the course of the detailed design, construction, operation and decommissioning of the development.
Management plans/ procedures	Where required, a list of separate plans and/or procedures that function as technical documents (operational and adaptive) for management of specific activities or aspects. These stand-alone plans can facilitate communication of management requirements to contractors and ensure that controls are implemented.
Assessment criteria (targets)	Assessment criteria are proposed for each environmental objective. The criteria may be derived from numerous sources including regulatory criteria, industry standards, Codes of Practice and baseline surveys undertaken for the development. The assessment criteria can be used to assess the effectiveness of management measures and inform the development of monitoring programs. The assessment criteria are likely to be further refined in response to new information from baseline and ongoing monitoring surveys during detailed design, construction and operation.
Monitoring	Monitoring programs would be developed for each environmental aspect of the development, as required. They are based around the measurement of appropriate assessment criteria that are designed to trigger management actions if critical thresholds were exceeded. Monitoring programs would be routinely revised and updated as further data became available.
Reporting	A reporting procedure would be developed to ensure that monitoring data was regularly collated, analysed, interpreted and reported to appropriate personnel, including government regulators. The procedure would highlight performance problems that would trigger corrective actions by appropriate personnel. Follow-up monitoring and reporting would be necessary to 'close out' performance problems.
Non-conformance/ corrective action	Management actions would be triggered if the monitoring program revealed that agreed thresholds were being exceeded. These would be likely to result in changes to the operating procedures and/or management controls to ensure that environmental performance reached acceptable standards.
Key government departments	Government departments with primary responsibility for administering legislation and regulations related to this aspect of the EMP would be listed to facilitate reporting and consultation.

26.2.2 REVIEW

The EMPs will be dynamic documents that are subject to regular review and continual improvement. The reviews will include an assessment of the effectiveness of management measures in achieving the stated objectives. A formal review schedule would be developed as work progressed.

The EMPs would also be reviewed in response to:

- a change in the scope and design of the development
- changes in regulatory standards
- reported non-compliances following environmental incidents or in response to complaints
- subsequent to environmental audits where outcomes warranted improvement.

26.2.3 MANAGEMENT PLANS AND PROCEDURES

As indicated in Table 26-3, more detailed stand-alone management plans and/or procedures may be required to address specific activities and aspects of the development. These include:

- Emergency Response Management Plan (see Appendix U3)
- Bushfire Hazard Management Plan (see Appendix U4)
- Waste Management and Minimisation Plan (see Appendix U5)
- Dredge Management Plan
- Biosecurity Management Plan (which includes the Biosecurity Response Procedure (see OEMP, Appendix U2)
- Spill Response Plan
- Marine Pest Management Plan
- Heritage Management Plan
- Planting Guide (see Appendix J1)
- Contamination Management Contingency Plan
- Coastal Acid Sulfate Soil (CASS) Management Contingency Plan
- Stormwater Management Plan
- Flora and Fauna Management Plan
- Offset Implementation Plan
- Native Vegetation Management Plan (to address SEB requirements)
- Water Quality Management Plan.

Where appropriate, some of these draft plans have been provided in the EIS. The plans and procedures required would be finalised, as systems documents for continuous improvement, before construction or operation began.

26.2.4 MONITORING PROGRAMS

Measurement, and leading indicator, criteria would be identified to develop programs to measure and monitor the performance of implemented mitigation and management measures against:

- conditions set for the proposed development
- specific licence or permit requirements
- objectives and targets set for the proposed development (see Section 26.1.4).

26.3 REHABILITATION AND DECOMMISSIONING

After operations ceased, development-related infrastructure would be removed, and the site rehabilitated so the landscape function matched the pre-operational function and/or was returned to a condition similar to that of the surrounding landscape. A detailed Rehabilitation and Decommissioning Plan would be developed before operations shut down.

26.3.1 CLOSURE OBJECTIVES

The closure objectives for the development are summarised in Table 26-4.

26.3.2 FINAL LAND USE

After operations cease and the development footprint has been successfully rehabilitated, it is anticipated that the pre-operational land use, such as agriculture, may be resumed.

26.3.3 CLOSURE ACTIVITIES

At closure, the following activities would be undertaken:

- in the lead-up, site timber product inventories, together with chemical, hydrocarbon and spare parts inventories, would be reduced to minimise the volume of materials requiring subsequent rehandling and/or return
- communication with the Kangaroo Island Council, government agencies and other stakeholders would take place to assess the potential interest in purchase of the site for alternative uses

- all onshore surface infrastructure would be removed and either transported to an appropriately licensed landfill for disposal or salvaged and on-sold wherever possible
- the former log and woodchip storage areas may be reshaped to resemble the surrounding topography, ensuring there would be no increase to soil runoff to Smith Bay
- concrete footings would be removed, and hardstand areas reclaimed, and ripped to encourage revegetation
- the offshore infrastructure would be removed, with the floating barge wharf and linkspan bridge/ramp towed away for sale and reuse or for scrap, dolphins and associated navigational aids removed (these may be cut at sea-bed level, where removal would be too difficult and/or disruptive)
- the causeway would remain a permanent structure and would, after rehabilitation, remain open for public use under the jurisdiction of the Kangaroo Island Council.

26.3.4 UNPLANNED CLOSURE

In the event of a temporary suspension of timber export activities, a care and maintenance plan would be prepared. Relevant government agencies would be notified of the nature of the suspension and measures would be put in place to limit an impact to the environment, and to ensure health and safety requirements were met during the care and maintenance phase.

The care and maintenance plan would not comprise a full rehabilitation plan and closure strategy but would incorporate interim measures. Should the phase extend beyond two years from the end of operations, a full rehabilitation plan would be prepared and implemented.

TABLE 26-4 PRELIMINARY CLOSURE OBJECTIVES

Element	Description
Soil quality	Ensure the physical and chemical properties of surface soils are compatible with agreed post-closure land uses.
Water quality	No reduction in beneficial use of natural water drainage systems, streams and rivers or groundwater as a result of development-related contamination.
Air quality	No human health impacts as a result of dust emissions. No nuisance impacts to local landholders or reduction in vegetation and habitat abundance and diversity as a result of post-closure dust emissions.
Groundwater resources	No adverse impacts to existing groundwater users (including groundwater-dependent ecosystems) as a result of changes to groundwater levels or flow patterns.
Surface water systems	Ensure post-closure flow systems reinstated pre-operation flow patterns, to a practicable extent. Ensure post-closure flows did not make built landforms unstable, release contaminated sediment to natural drainage lines, or cause waterlogging or flooding.
Vegetation	Ensure the diversity and structure of revegetated areas showed a satisfactory trend, approaching comparable values for species richness, species abundance and vegetation condition in appropriate analogue communities.
Safety	Ensure engineered landforms are stable and/or safe through effective access controls. Leave no reactive, chemically toxic or radioactive materials on the land surface, or place these in locations where they could cause pollution that harmed the environment.
Landscape amenity	Ensure permanent landforms are compatible with the surrounding landscape.
Social	Minimise disruption and/or impact on the community caused by infrastructure closure.
Economic	Ensure the South Australian community and future generations bear no residual liability or costs for land rehabilitation or post-closure maintenance.

27. COMMITMENTS

27. COMMITMENTS

KIPT is seeking government approval for a deep water port facility at Smith Bay, Kangaroo Island. The activities proposed for construction and operation of the port, known as KI Seaport, are described in Chapter 4 – Project Description, with remaining chapters of the EIS presenting the findings of environmental, social and economic assessments of these activities.

Conclusions are drawn from the impact assessments completed as part of the EIS and findings are used to determine management measures where potential impacts cannot be mitigated. Outcome based objectives have been developed for the sustainable construction and operation of KI Seaport. Management measures aim to avoid or minimize potential negative impacts and enhance, where possible and practical, the beneficial impacts on the environmental, cultural, social and economic values of Smith Bay and the wider community.

Management measures may be further refined or amended as a result of continuous improvement, technological advances or changes to regulatory frameworks and as such, have been linked to the ongoing management of the operation via the Environmental Management Framework (see Chapter 26 – Environmental Management Framework) and associated CEMP, OEMP and specific management plans.

Explicit commitments associated with the KI Seaport are outlined in Table 27-1.

TABLE 27-1 COMMITMENTS

Identifier	Chapter/Section	Commitment	Relevant agencies
Design and Infrastructure-based			
BIOSEC43	15.5.5	Investigation (during detailed design) of potential surface treatments or alternative structures to minimise the impact from exotic species.	-
GSW6	16.5.2	The dredge spoil dewatering system has been designed to discharge water with acceptable sediment levels. No untreated dredge water would be discharged directly into the marine environment or into the adjoining Smith Creek.	-
GSW8	16.5.1	The site would be designed to contain and manage all stormwater runoff during construction and operation as to eliminate uncontrolled water channeling and concentrated runoff streams - no site stormwater would discharge to surface water bodies untreated.	-
GSW9	16.5.1	The internal network of open drains, culvert, pipes and wetland will be designed to ensure sufficient carrying capacity with gradients and appropriate controls to prevent bed erosion and damage.	-
GSW10	16.5.1	Erosion at the outlet of the wetland system will be managed via a porous rock weir at the wetland outlet to distribute water flow over a wide area.	-

TABLE 27-1 COMMITMENTS (CONT'D)

Identifier	Chapter/Section	Commitment	Relevant agencies
GSW18	16.5.2	Timber log and wood chip storage yards will be established with bunding and impermeable base, to isolate runoff from the general stormwater system and from groundwater. Stormwater runoff (assumed to be leachate) will drain via a concrete forebay (in the bunded area) to intercept gross sediment and debris and to a retention basin (holding pond) designed to contain flows from storm events. There will be no discharge of leachate to surface water or groundwater.	-
GSW21	16.5.2	The proposed operational wetland pond, retention basin and swale system will be constructed during the early phase of construction to function as sediment capture basins during the major earthworks and civil works construction phases.	-
AQ5	17.5.4	Layout designed to minimise vehicle movements.	-
CCS8	19.4.4	Designing marine and coastal infrastructure to take into account the predicted worst-case sea level rise and sea temperature rise. This would prevent the flooding of infrastructure and ensure that construction materials were adequate for the predicted sea temperature and acidity changes. Consideration would also be given to the predicted increase in storm intensity and frequency.	-
CCS9	19.4.4	Designing the causeway structure for a 1-in-500-year storm event (that is, a 10 per cent encounter probability over the 50-year life of the structure) on the basis that the wave modelling undertaken demonstrates that the additional engineering required to meet this standard is not significantly greater-than for lesser storm event frequencies. Causeway maintenance (for example, replacement of a small percentage of armour rocks) would be required after major storm events.	-
CCS10	19.4.4	Determining the size of surface water catchments, including sedimentation ponds and drainage/diversion infrastructure, by considering the likely worst-case changes in the magnitude and duration of rainfall events, to prevent below-quality water being discharged to the environment.	-
CCS11	19.4.4	Ensuring that construction materials for onshore infrastructure were designed to cope with the expected change in surface temperatures and different wind conditions associated with increased storm intensity and frequency.	-
CCS13	19.4.4	Designing habitable buildings to promote passive cooling, thereby reducing energy demands and providing respite for the workforce during extreme heat days.	-
CCS15	19.4.4	Use of a floating pontoon for the berth face itself, to ensure that the wharf height above water is maintained at a constant level despite predicted changes in sea level.	-
NVL1	18.3.4	The potential shielding provided by site topography, woodchip and log stockpiles and intervening buildings would be taken into account in locating plant and equipment.	-
NVL3	18.3.4	Noisy plant, site access roads and site compounds would be located as far from occupied premises as practicable.	-
NVL4	18.3.4	Equipment that emits noise predominantly in a particular direction wasbe sited such that noise is directed away from occupied premises where feasible.	-
NVL5	18.3.4	Acoustic enclosures would be installed around above ground equipment where noise levels are predicted to exceed the relevant noise level targets at sensitive land uses, where safe and practical.	-
AC2	11.5.4	Stormwater diversion channels, compacting proposed storage areas, construction of first-flush ponds and the use of closed conveyors and telescopic shiploaders, would reduce the potential impacts to negligible at the abalone farm's three seawater intake points.	-

TABLE 27-1 COMMITMENTS (CONT'D)

Identifier	Chapter/Section	Commitment	Relevant agencies
AC9	11.5.8	If considered necessary, an open bypass system could be installed in the near-shore section of the causeway to minimise the interruption to tidal currents. This could comprise either large culverts or a pier, the size of which would be determined by hydrodynamic modelling. Given the small predicted maximum increase in temperature such a measure is not considered essential and it needs to be recognised that the benefit of such a bypass system may be offset by compromising the protective barrier formed by the causeway in relation to effluent from the degraded Smith Creek during rainfall events.	-
AC10	11.5.8	It may be possible to engineer a gated culvert through the causeway that could fulfil a dual function by allowing through-flows during summer (thereby managing the risk of small temperature increases). The gate could then be closed during other months and thereby facilitate the redirection of Smith Creek discharges further offshore during major flow events (particularly during autumn and winter) thus improving nearshore water quality.	-
TT7	21.5.5	Road design considerations (where upgrades are proposed), including adjustment to the vertical and horizontal alignments, low noise pavement surfaces, road gradient modifications, speed limit reduction and traffic management measures, where these do not affect the function and safety of the road.	DPTI
MWQ5	9.5.2	The fines content of material used in the causeway core construction will be minimised in order to minimise the impact of plume due to causeway construction.	-
MWQ6	9.5.2 10.5.1	The length of exposed causeway core before geotextile fabric and armour placement will be minimised in order to minimise the impact of plume due to adverse sea states, and erosion prior to rock armouring, during causeway construction.	-
Schedule-based			
NVL39	18.4.5	Piling should be scheduled outside the months when cetaceans may be present in or near the development area.	-
Equipment-based			
BIOSEC2	15.5.3	Earthmoving equipment would be sourced locally wherever possible.	-
BIOSEC32	15.5.4	Equipment used during construction would meet the national standards for biofouling management.	DAWR
BIOSEC41	15.5.4	The pontoon (purchased in Korea as a barge) has been sandblasted and repainted with anti-fouling paint and would be inspected by Australian engineers before arrival at Smith Bay.	DAWR
AQ14	17.5.4	Variable-height woodchip stackers and/or telescopic chutes may be used for shiploading.	-
CCS1	19.4.4	Minimising electricity consumption through the use of energy-efficient infrastructure such as low-friction conveyors, lighting and air-conditioning.	-
CCS2	19.4.4	Investigating the installation of solar photovoltaic panels to supply electricity to site buildings and for site lighting, minimising the potential for downtime associated with power outages under peak load situations.	-
MNES16	14.4.4	The number of vehicles required to transport timber products would be minimised wherever possible by using high productivity vehicles such as B-doubles and A-doubles.	-

TABLE 27-1 COMMITMENTS (CONT'D)

Identifier	Chapter/Section	Commitment	Relevant agencies
NVL2	18.3.4	Processes and equipment that generate lower noise levels would be selected where feasible.	-
NVL25	18.4.1	Low-vibration plant alternatives, such as the smallest practicable vibratory compactor, would be used where feasible.	-
NVL34	18.4.5	Low-noise-impact techniques such as suction piling or vibro-piling should be used in preference to impact piling where possible.	-
TT2	21.5.5	The use of high productivity vehicles, specifically Performance Based Standard (PBS) Level 2A (B-double) and/or PBS Level 2B (short road train or A-double) vehicles.	-
AC2	11.5.4	Stormwater diversion channels, compacting proposed storage areas, construction of first-flush ponds and the use of closed conveyors and telescopic shiploaders, would reduce the potential impacts to negligible at the abalone farm's three seawater intake points.	-
AC2	11.5.4	Stormwater diversion channels, compacting proposed storage areas, construction of first-flush ponds and the use of closed conveyors and telescopic shiploaders, will reduce the potential impacts to negligible at the abalone farm intake area.	-
Process methodology			
MNES4	14.4.3	Evaluating alternative piling methodologies that have lower noise emissions.	-
NVL2	18.3.4	Processes and equipment that generate lower noise levels would be selected where feasible.	-
NVL25	18.4.1	Low-vibration plant alternatives, such as the smallest practicable vibratory compactor, would be used where feasible.	-
NVL34	18.4.5	Low-noise-impact techniques such as suction piling or vibro-piling should be used in preference to impact piling where possible.	-
MWQ4	9.5.1	Realtime monitoring and reactive management (detailed in the Dredge Management Plan (DMP)) will provide protection against acute plume impacts at key sensitive receptors including: • monitoring water quality at the Yumbah seawater intakes and at an appropriate location between the dredge and the seawater intakes • water quality monitoring sensors that provide 'real time' data on water quality via telemetry • assessing monitoring data in 'real time' against threshold triggers • providing the monitoring data in 'real time' to the dredge operator, KIPT environmental management personnel and EPA • triggering audible stop work alarms on the dredge if thresholds are exceeded • dredge work ceases until turbidity levels return to acceptable levels and have stabilised (these levels to be defined in the DMP). Due to the relatively close proximity of key receptors and the dredge plume source (i.e. approximately 500 metres), turbidity trigger exceedances would need to be closely monitored and the timescale for management response actions would need to be short (~30 minutes) in order to be of practical benefit in mitigating acute plume impacts.	-

TABLE 27-1 COMMITMENTS (CONT'D)

Identifier	Chapter/Section	Commitment	Relevant agencies
Offsets			
MNES43	14.5.1	KIPT would commit funds towards the Kangaroo Island Feral Cat Eradication Program, a joint program, led by NRKI and the Kangaroo Island Council, with the aim of eradicating feral cats, as part of KIPT's offset for potential impacts to Kangaroo Island echidna.	NRKI
TE2	13.5.2	Under the *Native Vegetation Act 1991*, clearing a small amount of terrestrial native vegetation would require the preparation of an offset strategy developed in consultation with the NVC (see Chapter 26 – Environmental Management Framework). The offset package would likely include an on-ground SEB to protect an area of vegetation and provide fauna habitat.	DEW - NVC
TE14	13.5.3	KIPT proposes to continue providing significant ongoing support to the Glossy Black-Cockatoo Recovery Program on Kangaroo Island to ensure that KIPT's activities on Kangaroo Island result in a net environmental benefit to the glossy black-cockatoo species.	DEW – NRKI
Utilities			
CCS4	19.4.4	Seeking to use grid electricity wherever possible and increase the use of renewably-generated electricity, to reduce the reliance on diesel-powered on-site generation.	-
CCS14	19.4.4	Minimising on-site water requirements by investigating alternative sources of industrial water to meet needs such as for dust suppression. This would reduce the risk of supply shortages that may occur as a result of greater evaporation rates and/or higher consumption associated with warmer weather.	-
Other			
BIOSEC61	15.7	KIPT would fund the marine pest and eradication surveys of Smith Bay in addition to implementing an operational Marine Pest Management Plan.	NRKI
NVL31	18.4.1	Purchase the nearest sensitive receptor (R1).	-
SE2	22.6.2	KIPT would assist government with understanding housing needs, where it can, and sees benefit to the company and the community in having a settled resident workforce, living and working permanently on Kangaroo Island.	-
SE3	22.6.2	There is also scope to increase the size of Parndana township through residential subdivision. The Kangaroo Island Community Club (based in Parndana) has specific plans to subdivide and release housing allotments created from the scrubland immediately to the west of the township between Smith Street and Rowland Hill Highway. KIPT has committed to provide a seed loan of up to $100,000 to cover the initial project costs prior to the marketing and sale of housing lots.	-
SE4	22.6.2	There is also potential for residential development on the western end of Kangaroo Island by re-establishing housing vacated during the farm consolidation and switch to forestry that occurred in the 1990s and 2000s. KIPT owns at least 30 potential residential allotments that could be created with a change to planning rules to allow the existing forestry estates to be subdivided. Thirty new homes would accommodate about 70 people. Every property has, at the very least, a house site with a dam, phone connection and electricity, some have habitable dwellings and others have dilapidated structures that could be replaced, or repaired and refurbished.	-

28. REFERENCES

28. REFERENCES

CHAPTER 1: INTRODUCTION

Bell, P & Austral Archaeology 2018, *Smith Bay Kangaroo Island, South Australia History of European Settlement*, report prepared for Environmental Projects, Adelaide.

Clarke, PA 1996, 'Early European Interaction with Aboriginal Hunters and Gatherers on Kangaroo Island, South Australia', *Aboriginal History*, vol. 20, pp. 51–81.

CHAPTER 2: PROJECT JUSTIFICATION

ABARES—see Australian Bureau of Agricultural and Resource Economics.

ABC *Country Hour*, interview with David Evans, New Forests asset management, 24 October 2016.

Adelaide and Mount Lofty Ranges Natural Resource Management Board 2016, *Soil Research Review*, Fleurieu Future Farming, AMLRNR, South Australia.

AMLRNR—see Adelaide and Mount Lofty Ranges Natural Resource Management Board.

Australian Bureau of Agricultural and Resource Economics 2015, *Outlook scenarios for Australia's forestry sector: key drivers and opportunities*, ABARES, Department of Agriculture and Water Resources, Canberra, ACT.

Australian Bureau of Agricultural and Resource Economics. *Australia's Forests at a Glance 2015*, ABARES, Department of Agriculture and Water Resources, Canberra, ACT.

Department of Primary Industries and Regions, South Australia 2017, *SA Grain Industry Overview*, PIRSA, Adelaide.

New Forests 2015, Timberland Investment Outlook 2015–2019, New Forests, North Sydney.

Office of the Commissioner for Kangaroo Island 2016, *KI Economic Development Outlook*, Kangaroo Island, South Australia.

'Paradise Girt by Sea', June 2011, SA Economic Development Board, report to SA Government, p. 4.

PIRSA—see Department of Primary Industries and Regions, South Australia.

Planning SA, September 2004, Report to Parliament on The Planning Strategy for South Australia, 1 July 2003–30 June 2004.

Timberland Investment Outlook 2017.

World Wildlife Fund 2012, *WWF Living Forests Report: Chapter 4*, WWF, Gland, Switzerland.

WWF—see World Wildlife Fund.

CHAPTER 3: PROJECT ALTERNATIVES

ABARES—see Australian Bureau of Agricultural and Resource Economics.

Atlas of Living Australia 2018, Atlas of Living Australia, viewed 15 May 2018, <https://www.ala.org.au/>.

Australian Bureau of Agricultural and Resource Economics 2015, *Australia's Forests at a Glance*, ABARES, Department of Agriculture and Water Resources, Canberra, ACT.

Australian Bureau of Agricultural and Resource Economics 2015, *Outlook scenarios for Australia's forestry sector: key drivers and opportunities*, ABARES, Department of Agriculture and Water Resources, Canberra, ACT.

BMT WBM 2018, 'Smith Bay Design Wave and Water Level Assessment', R.B22454.001.01, unpublished report, BMT, Brisbane, Queensland.

Department of the Environment and Energy 2017, Species Profile and Threats Database, viewed 29 July 2017, <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>.

DoEE—see Department of the Environment and Energy.

EBS Ecology 2018, *Smith Bay Ecological Assessment*, sub-consultant's report prepared for Environmental Projects on behalf of KIPT Pty Ltd, v.3, Adelaide, South Australia.

Flinders Ports 2018, 'Kangaroo Island Smith Bay Maritime Constructions Soundings', job no. HA 2500, drg. no. FP4422, Flinders Ports, Port Adelaide, South Australia.

'Timberland Investment Outlook 2015–2019', New Forests, 1 July 2015.

'Timberland Investment Outlook 2017, New Forests, September 2017.

World Wildlife Fund 2012, *WWF Living Forests Report: Chapter 4*, WWF, Gland, Switzerland.

CHAPTER 4: PROJECT DESCRIPTION

CPB—see Coast Protection Board

Coast Protection Board 2016, *Coast Protection Board Policy Document*, CPB, Adelaide.

DAWR—see Department of Agriculture and Water Resources

Department of Agriculture and Water Resources 2015, *Anti-fouling and in-Water Cleaning Guidelines*, DAWR, Canberra.

Department of Primary Industries and Resources SA 2009, *Guidelines for Plantation Forestry in South Australia 2009*, PIRSA, Adelaide.

EPA—see Environment Protection Authority

Environment Protection Authority 2007, *Code of Practice for Materials Handling on Wharves*, EPA, Adelaide.

— Environment Protection Authority 2016a, *Vessel and Facility Management Information Sheet EPA 926/16: Maintenance areas (includes slipways and hardstands)*, EPA, Adelaide, viewed 20 September 2018, http://www.epa.sa.gov.au/files/477460_info_maintenance.pdf.

— 2016b, *Liquid Storage Guidelines EPA 080/16: Bunding and Spill Management*, EPA, Adelaide, viewed 28 August 2018, https://www.epa.sa.gov.au/files/47717_guide_bunding.pdf.

PIRSA—see Department of Primary Industries and Resources SA

South Australian Fire Authorities 2008, *Built Environs Section Guideline No. 14, Above Ground Water Storage Tanks for Fire Fighting Purposes Policy*, South Australian Fire Authorities, Community Safety Department, Metropolitan Fire Service SA, and Country Fire Service SA, Adelaide.

South Australian Fire Authorities 2014, *Built Environs Section Guideline No. 13, General Guidelines for Rubber Tyre Storage*, South Australian Fire Authorities, Community Safety Department, Metropolitan Fire Service SA, and Country Fire Service SA, Adelaide.

South East Fibre Exports 2011, *Biomass Fuelwood Study: Southeast Region Sawmill Wood By-Product Study*, Australian Government Department of Agriculture, Fisheries and Forestry, June 2011, Melbourne, viewed 27 August 2018, http://www.agriculture.gov.au/SiteCollectionDocuments/forestry/domestic-forestry/prep-for-future/biomass-fuelwood-study.pdf.

Standards Australia 2017, Australian Standard AS1940:2017 – *The storage and handling of flammable and combustible liquids*, Standards Australia, Sydney.

Zero Waste SA 2015, *South Australia's Waste Strategy 2015–2020*, The Office of Green Industries SA, Adelaide, viewed 27 November 2018, https://www.greenindustries.sa.gov.au/_literature_165440/South_Australia's_Waste_Strategy_2015-2020.

CHAPTER 5: LEGISLATIVE FRAMEWORK

For List of Acts referred to in the document (and this chapter) see List of Legislation.

Coast Protection Policy Document revised 29 July 2016, Appendix 1: '*Standards Applying to New Development with Regard to Coastal Flooding and Erosion and Associated Coastal Works*'.

CHAPTER 6: LAND USE AND PLANNING

Kangaroo Island Council Development Plan 2015, Department of Planning, Transport and Infrastructure, Adelaide, viewed 14 September 2018, <https://www.sa.gov.au/topics/planning-and-property/development-plans/country-development-plans/kangaroo-island-council-development-plan>.

Department of Planning, Transport and Infrastructure 2017, *Land Not Within a Council Area (Coastal Waters) Development Plan* 2017, DPTI, Adelaide, viewed 14 September 2018, <https://www.sa.gov.au/topics/planning-and-property/development-plans/country-development-plans/land-not-within-a-council-area-coastal-waters-development-plan>.

DPLG—see Department of Planning and Local Government

DPTI—see Department of Planning, Transport and Infrastructure

Department of Planning and Local Government 2011, *Kangaroo Island Plan – A volume of the South Australian Planning Strategy*, DPLG, Adelaide, viewed 9 August 2018, https://www.sa.gov.au/__data/assets/pdf_file/0018/10665/Region_plan_Kangaroo_Island.pdf.

Department of Planning, Transport and Infrastructure 2018, *About the planning strategy for South Australia*, DPTI, Adelaide, viewed 20 September 2018, , <https://www.sa.gov.au/topics/planning-and-property/planning-and-land-management/about-the-planning-strategy-for-south-australia>.

CHAPTER 7: COMMUNITY AND STKEHOLDER ENGAGEMENT

There are no references for Chapter 7

CHAPTER 8: KEY ISSUES

DEWNR—see Department of Environment, Water and Natural Resources

Department of Environment, Water and Natural Resources 2017, Biosecurity Strategy for Kangaroo Island 2017–2027, DEWNR, Adelaide, viewed 21 May 2018, <http://www.naturalresources.sa.gov.au/files/sharedassets/kangaroo_island/plants_and_animals/biosecurity_ki/ki-biosecurity-strategy-2017-sm_002.pdf>.

CHAPTER 9: MARINE WATER QUALITY

ANZECC/ARMCANZ 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Australian and New Zealand Environment and Conservation Council, and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

BMT WBM 2013, *TUFLOW FV Science Manual*, BMT, Brisbane.

Chevron 2010, 'Appendix N3 – Tolerance Limits Report', *Technical Appendices N3 to N10, Draft Environmental Impact Statement/ Environmental Review and Management Programme for the Proposed Wheatstone Project,* Perth.

Delft University of Technology 2006, *SWAN Technical Documentation*, Faculty of Civil Engineering and Geosciences, Environmental Fluid Mechanics Section, DUT, Delft, the Netherlands.

Edyvane, K 1999, *Conserving Marine Biodiversity in South Australia Part 2, Identification of Areas of High Conservation Value in South Australia*, SARDI report no. 39, F2007/000565-9, SARDI research report series no. 816, South Australian Research and Development Institute, Department of Primary Industries and Regions, South Australia (PIRSA), Adelaide.

EPA 1997, *Ambient Water Quality Monitoring of the Port River Estuary*, report no. 1, Environment Protection Authority, South Australian Government, Adelaide.

BMT 2017, *Outer Harbour Channel Widening Project Development Application Report*. Flinders Ports, Adelaide.

Hydro Survey 2018, *Kangaroo Island Smith Bay Maritime Constructions Soundings*, Maritime Constructions, Adelaide.

Kinloch, MA, Brock, DJ, Kirkman, H & Laperousaz, T 2007, *Seagrass Biodiversity on Kangaroo Island*, KI NRM Board Coast and Marine Program report no. CMP07/004, Natural Resources Kangaroo Island, South Australia.

Nelson, M, Gaylard, S & Noble W 2013, *Nearshore Marine Aquatic Ecosystem Condition Reports – Gulf St Vincent bioregional assessment report 2010–11*, Environment Protection Authority South Australia, Adelaide.

Port of Townsville Limited 2016, *Townsville Port Expansion Project Environmental Impact Statement*, Port of Townsville, Townsville.

POTL—*see* Port of Townsville Limited

Tanner, JE & Bryars, S 2007, *Innovative Solutions for Aquaculture Planning and Management – Project 5, Environmental Audit of Marine Aquaculture Developments in South Australia*, FRDC Project 2003/223, SARDI publication no. F2007/000766-1, SARDI research report no. 190, Fisheries Research and Development Corporation, and South Australian Research and Development Institute Aquatic Sciences Research Division, Adelaide.

WA EPA—*see* Western Australia Environmental Protection Authority

Western Australia Environmental Protection Authority 2016, *Technical Guidance – Environmental Impact Assessment of Marine Dredging Proposals, WA EPA, Perth.*

CHAPTER 10: COASTAL PROCESSES

Aztec Analysis 2017, 'Kangaroo Island Plantation Timbers (KIPT) Export Facility at Smith Bay. Basis of Design Report', unpub. report to Kangaroo Island Plantation Timbers, 28 July 2017, Aztec Analysis, Adelaide.

Flinders Ports 2017, *Outer Harbour Channel Widening Project Development Application Report*, report for Flinders Ports, Adelaide, by BMT, Brisbane.

BMT 2018, *Smith Bay Design Wave and Water Level Assessment*, prepared for KIPT, February 2018, Ref: R.B22454.001.01. Design_Waves_Assessment.docx, BMT, Brisbane.

BMT WBM 2013, *TUFLOW FV Science Manual*, BMT, Brisbane.

Delft University of Technology 2006, *SWAN Technical Documentation*, Faculty of Civil Engineering and Geosciences, Environmental Fluid Mechanics Section, Delft, DUT, the Netherlands.

Edyvane, K 1999, Conserving Marine Biodiversity in South Australia Part 2, *Identification of Areas of High Conservation Value in South Australia*, SARDI report no. 39, PIRSA, F2007/000565-9, SARDI research report series no. 816, South Australian Research and Development Institute, Department of Primary Industries and Regions SA, Adelaide.

CHAPTER 11: LAND-BASED AQUACULTURE

ABARES—*see* Australian Bureau of Agricultural and Resource Economics and Sciences

Aguirre, JD & McNaught, DC 2010, 'Habitat modification affects recruitment of abalone in central New Zealand', *Marine Biology*, vol. 158, no. 3, pp. 505–513.

Ahmed, F, Segawa, S, Yokota, M & Watanabe S 2008, 'Effect of light on oxygen consumption and ammonia excretion in Haliotis discus discus, H. gigantea, H. madaka and their hybrids', *Aquaculture* vol. 279, pp. 160–165.

Allen, VJ, Marsden, ID, Ragg, NLC & Gieseg, S 2006, 'The effects of tactile stimulants on feeding, growth, behaviour, and meat quality of cultured Blackfoot abalone, *Haliotis iris*', *Aquaculture*, vol. 257, nos 1–4, pp. 294–308.

Alter, K, Andrewartha, SJ & Elliott, NG 2016, 'Hatchery conditions do not negatively impact respiratory response of early life-stage development in Australian hybrid abalone', *Journal of Shellfish Research*, vol. 35, no. 3, pp. 585–587.

ANZECC & ARMCANZ—*see* Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand

Australian and New Zealand Environment and Conservation Council & Agriculture and Resource Management Council of Australia and New Zealand 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 1, The Guidelines (Chapters 1–7)*, ANZECC and ARMCANZ, Canberra.

Australian Bureau of Agricultural and Resource Economics and Sciences 2017, *Australian Fisheries and Aquaculture Statistics 2016*, ABARES, Department of Agriculture and Water Resources, Canberra.

Cannon, JA 1990, 'Development and dispersal of red tides in the Port River, South Australia', in E Graneli, B Sundstrom, L Edler & DM Anderson (eds), *Toxic Marine Phytoplankton*, Elsevier, New York, pp. 110–115.

Cannon, JA 1993, 'Germination of the toxic dinoflagellate, Alexandrium minutum, from sediments in the Port River, South Australia', in TJ Srnayda & Y Shimizu (eds), *Toxic phytoplankton blooms in the sea*, Elsevier, Amsterdam, pp. 109–114.

Cheshire, AC & Miller, DJ 2000, *The impact of sand dredging on Benthic Community Structure at Pt Stanvac Dredge Site: Final report on the results of surveys 1992 to 1999*, report to the Coast Protection Board, South Australian Department of Environment and Natural Resources, Adelaide, no. 4, pp. 1–38.

Chew, CA, Hepburn, CD & Stephenson, W 2013, 'Low-level sedimentation modifies behaviour in juvenile *Haliotis iris* and may affect their vulnerability to predation', *Marine Biology*, vol. 160, pp. 1213–1221.

Chung, E-Y, Shin, Y-K & Lee, J-H 1993, 'Effects of Silt and Clay on Respiration and Mortality of the Abalone, Nordotis discus', *Korean Journal of Malacology*, vol. 9, no. 2, pp. 23–29.

Department of Economic Development 2015, *Victorian Wild Harvest Abalone Fishery Management Plan*, State of Victoria Department of Economic Development, Jobs, Transport and Resources, Melbourne.

Erftemeijer, PL & Lewis, RR 2006, 'Environmental impacts of dredging on seagrasses: a review', *Marine Pollution Bulletin,* vol. 52, pp. 1553–1572.

Lee, K-S 2008, 'The effects of suspended solids on the mortality and the glycogen content of abalone*, Haliotis discus hannai*', *Journal of the Korean Society of Marine Environment & Safety*, vol. 14, no. 3, pp.183–187.

Lee, K-S 2015, 'Review on the Biological Effects of Suspended Solids on Shellfish, Fish, and Seaweed', *Journal of the Korean Society of Marine Environment and Safety*, vol. 21, no. 1, pp. 109–118.

McShane, PE 1992, 'Early life history of abalone: a review', in SA Shepherd, MJ Tegner & SA Guzmán del Proó (eds), *Abalone of the World: Biology, Fisheries and Culture*, Blackwell, Oxford, pp. 120–138.

McShane, PE 2017, *Impacts of a proposed wharf development on the marine environment and an existing abalone aquaculture facility, Smith Bay, Kangaroo Island, South Australia*, Global Marine Resource Management, Melbourne.

Periera, L, Riquelme, T & Hosokawa, H 2007, 'Effect of Three Photoperiod Regimes on the Growth and Mortality of the Japanese Abalone *Haliotis* discus *hannai* ino', *Journal of Shellfish Research*, vol. 26, no. 3, pp. 763–767.

Phillips, NE & Shima, JS 2006, 'Differential effects of suspended sediments on larval survival and settlement of New Zealand urchins *Evechinus chloroticus* and abalone *Haliotis iris*', *Marine Ecology Progress Series 314*, pp. 149–158.

Sainsbury, KJ 1982, 'Population dynamics and fishery management of the paua, *Haliotis iris*. I. Population structure, growth, reproduction, and mortality', *New Zealand Journal of Marine and Freshwater Research*, vol. 16, pp. 147–161.

Shepherd, SA 1973, 'Studies on southern Australian abalone (genus *Haliotis*). I. Ecology of five sympatric species', *Australian Journal of Marine and Freshwater Research*, vol. 24, no. 3, pp. 217–257.

Steffen, W, Hughes, L & Perkins, S 2014, *Heatwaves: Hotter, Longer, More Often*, Climate Council of Australia, Potts Point, Sydney.

Stone, DAJ, Bansemer, MS & Harris, JO 2014, *Final Report, Development of formulated diets for cultured abalone*, CRC Project No. 2010/736, South Australian Research and Development Institute Aquatic Sciences Research Division, Adelaide.

Theil, M, Wear, R, Tanner, J, Bryars, S & de Jong, S 2004, *Environmental Risk Assessment of Land-Based Aquaculture in South Australia*, SARDI publication no. RD04/0156, South Australian Research and Development Institute Aquatic Sciences Research Division, Adelaide.

Vandepeer, M 2006, *Abalone Aquaculture Subprogram: Preventing summer mortality of abalone in aquaculture systems by understanding interactions between nutrition and water temperature*, SARDI publication no. RD02/0035-2, South Australian Research and Development Institute Aquatic Sciences Research Division, Adelaide.

CHAPTER 12: MARINE ECOLOGY

Airoldi, L 2003, 'The effects of sedimentation on rocky coast assemblages', *Oceanography and Marine Biology Annual Review,* vol. 41, pp. 161–236.

AMSA—*see* Australian Marine Safety Authority

ANZECC/ARMCANZ 2000, *Australian and New Zealand Guidelines for Fresh and Marine Water Quality*, Australian and New Zealand Environment and Conservation Council, and Agriculture and Resource Management Council of Australia and New Zealand, Canberra.

Australian Government 2009, *National Biofouling Management Guidelines for Commercial Vessels*, National System for the Prevention and Management of Marine Pest Incursions, Canberra.

Australian Marine Safety Authority 2016, *Marine Notice 15/2016: Minimising the risk of collisions with cetaceans*, AMSA, Canberra, viewed 22 August 2017, <https://apps.amsa.gov.au/MOReview/MarineNoticeExternal.html>.

Baker, JL 2004, *Towards a System of Ecologically Representative Marine Protected Areas in South Australian Marine Bioregions – Technical Report*, report to Coast and Marine Conservation Branch, Department for Environment and Heritage, Adelaide.

Baker, JL 2008, *Marine Species of Conservation Concern in South Australia: Volume 1 – Bony and Cartilaginous Fishes*, report for the South Australian Working Group for Marine Species of Conservation Concern, Adelaide (J Baker, consultant), web version published by Reef Watch, Conservation Council of South Australia, Adelaide, viewed 26 March 2008, <http://www.reefwatch.asn.au/pages/bin/view/Publications/SamsccBonyFamilies>.

Ballantine, J 2017, *Code of practice for vessel and facility management (marine and inland waters),* Environment Protection Authority, Government of South Australia, Adelaide.

Barrett, NS & Buxton, C 2002, *Examining underwater visual census techniques for the assessment of population structure and biodiversity in temperate coastal marine protected areas,* Tasmanian Aquaculture and Fisheries Technical Report Series 11, Tasmanian Aquaculture and Fisheries Institute, University of Tasmania, Hobart.

Brock, DJ & Kinloch, MA 2007, *Reef Fish Biodiversity on Kangaroo Island,* KI NRM Board Coast and Marine Program Report No. CMP07/006, Kangaroo Island Natural Resources Management Board, Kangaroo Island, South Australia.

Bryars, S 2003, *An Inventory of Important Coastal Fisheries Habitats in South Australia,* Fisheries Habitat Program, Department of Primary Industries and Resources South Australia (PIRSA), Adelaide.

Bulthuis, DA 1983, 'Effects of in-situ light reduction on density and growth of the seagrass *Heterozostera tasmanica* (Martens ex Aschers.) den Hartog in Western Port, Victoria, Australia', *Journal of Experimental Marine Biology and Ecology,* vol. 67, no. 1, pp. 91–103.

Campbell, S, Miller, C, Steven, A & Stephens, A 2003, 'Photosynthetic responses of two temperate seagrasses across a water quality gradient using chlorophyll fluorescence', *Journal of Experimental Marine Biology and Ecology,* vol. 291, no.1, pp. 57–78.

Carroll, E, Patenaude, N, Alexander, A, Steel, D, Harcourt, R, Childerhouse, S, Smith, S, Bannister, J, Constantine, R & Baker, CS 2011, 'Population structure and individual movement of southern right whales around New Zealand and Australia', *Marine Ecology Progress Series*, vol. 432, pp. 257–268.

Cheshire, AC & Miller, DJ 1999, *The impact of sand dredging on Benthic Community Structure at Pt Stanvac Dredge Site: Final report on the results of surveys 1992 to 1999,* report to the Coast Protection Board, Department of Environment and Natural Resources, Adelaide.

Cheshire, AC, Collings, GJ, Edyvane, KS & Westphalen, G 2000, *Overview of the Conservation Status of Australian Marine Macroalgae: A report to Environment Australia*, Department of Environmental Biology, University of Adelaide.

Clarke, S 1987, ‘Seagrass-sediment dynamics in Holdfast Bay: summary’, *SA Fish*, vol. 11, no. 2, pp. 4–10.

Collier, CJ, Lavery, PS, Ralph, PJ & Masini, RJ 2009, ‘Shade-induced response and recovery of the seagrass *Posidonia sinuosa*’, *Journal of Experimental Marine Biology and Ecology,* vol. 370, nos 1–2, pp. 89–103.

DAWR—*see* Department of Agriculture and Water Resources

DEW—*see* Department for Environment and Water

— Department for Environment and Water 2018a, ‘EGIS data: Marine Benthic Habitats’, DEW, Adelaide, viewed 12 December 2018, <http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1224&pu=y&pa=dewnr>.

— 2018b, ‘EGIS data: Topography - Bathymetry - Navigation Chart’, DEW, Adelaide, viewed 12 December 2018, <http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1221&pu=y&pa=dewnr>.

Department for the Environment, Water, Heritage and the Arts 2009, *National Assessment Guidelines for Dredging,* DEWHA, Canberra.

Department of Agriculture and Water Resources 2017, *Australian Ballast Water Management Requirements,* version 7, DAWR, Canberra.

Department of Planning, Transport and Infrastructure 2012, *Underwater Piling Noise Guidelines,* DPTI, Adelaide.

Department of Sustainability, Environment, Water, Population and Communities 2012, *Conservation Management Plan for the Southern Right Whale: A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999 2011–2021,* DSEWPaC, Canberra.

Department of the Environment and Energy 2016, *Draft National Strategy for Mitigating Vessel Strike of Marine Mega-fauna*, DOEE, Canberra.

DEWHA—*see* Department for the Environment, Water, Heritage and the Arts

DEW—*see* Department for Environment and Water

DoEE—*see* Department of the Environment and Energy

DPTI—*see* Department of Planning, Transport and Infrastructure

DSEWPaC—*see* Department of Sustainability, Environment, Water, Population and Communities

Duarte, CM 1991, ‘Seagrass depth limits’, *Aquatic Botany,* vol. 40, no. 4, pp. 363–377.

Edgar, GJ 2001, *Australian Marine Habitats in Temperate Waters,* Reed New Holland, Frenchs Forest, New South Wales.

Edgar, GJ 2008, *Australian Marine Life – The Plants and Animals of Temperate Waters*, 2nd edn, New Holland Publishers, Sydney.

Edyvane, K 1999, *Conserving Marine Biodiversity in South Australia Part 2, Identification of Areas of High Conservation Value in South Australia,* SARDI report no. 39, PIRSA, F2007/000565-9, SARDI research report series no. 816, South Australian Research and Development Institute, Department of Primary Industries and Regions SA, Adelaide.

Environment Protection Authority 2010, *Water quality guidelines: Dredging and Earthworks Drainage,* EPA 396/10, EPA, Adelaide.

EPA—*see* Environment Protection Authority

Erftemeijer, PL & Lewis, RR 2006, ‘Environmental impacts of dredging on seagrasses: A review’, *Marine Pollution Bulletin,* vol. 52, no. 12, pp. 1553–1572.

Giri, K & Hall, K 2015, *South Australian Recreational Fishing Survey,* Fisheries Victoria Internal Report series no. 62, Department of Economic Development, Jobs, Transport and Resources (DEDJTR), Melbourne.

Gordon, D, Grey, K, Chase, S & Simpson, C 1994, ‘Changes to the structure and productivity of a *Posidonia sinuosa* meadow during and after imposed shading’, *Aquatic Botany,* vol. 47, nos 3–4, pp. 265–275.

IMO—*see* International Maritime Organization

International Maritime Organization 2009, *Guidance Document for Minimising the Risk of Ship Strikes with cetaceans*, International Maritime Organization – Marine Environment Protection Committee, viewed August 2016, <https://www.amsa.gov.au/file/1448/download?token=GXkxl0yh>.

Irving, A 2014, 'Seagrasses of Spencer Gulf', in SA Shepherd, SM Madigan, BM Gillanders, S Murray-Jones & DJ Wiltshire (eds), *Natural History of Spencer Gulf*, Royal Society of South Australia, Adelaide.

Jones, GK 2009, *South Australian Recreational Fishing Survey,* South Australian Fisheries Management Series, paper no. 54, Fisheries Division, Department of Primary Industries and Resources SA, Adelaide.

Jones, GK & Doonan, A 2005, *2000-01 National Recreational and Indigenous Fishing Survey*, South Australian Fisheries Management Series, paper no. 46, Fisheries Division, Department of Primary Industries and Resources SA, Adelaide.

Jones, GK, Connolly, RM & Bloomfield AL 2008, 'Ecology of fish in seagrass', in SA Shepherd, S Bryars, IR Kirkegaard, P Harbison & JT Jennings (eds), *Natural History of Gulf St Vincent,* Royal Society of South Australia, Adelaide, pp. 148–161.

Kangaroo Island Natural Resources Management Board 2017, *Biosecurity Strategy for Kangaroo Island 2016 – 2019*, final draft, July 2017, KINRM Board, Natural Resources Kangaroo Island, South Australia.

Kemper, C 2008, *Analysis of South Australian Museum's cetacean data: distribution, seasonal trends and circumstance of death*, report for the Department of Environment, Water, Heritage and the Arts, South Australian Museum, Adelaide.

Kinloch, MA, Brock, DJ, Kirkman, H & Laperousaz, T 2007, *Seagrass Biodiversity on Kangaroo Island*, KI NRM Board Coast and Marine Program Report No. CMP07/004, Kangaroo Island Natural Resources Management Board, Natural Resources Kangaroo Island, South Australia.

KINRM—see Kangaroo Island Natural Resources Management Board

Manzanera, M, Pérez, M & Romero, J 1998, 'Seagrass mortality due to oversedimentation: an experimental approach', *Journal of Coastal Conservation*, vol. 4, no. 1, pp. 67–70.

McArdle, A, Lashmar, K & Klein, H 2015, *Diving deeper: a community assessment of Kangaroo Island's rocky reefs,* Caring for our Country Community Action Grants no. CEG-1217992-261, Natural Resources Kangaroo Island, South Australia.

McDonald, B & Tanner J 2002, 'Investigating the Complexity of Seagrass Faunal Relationships in Spencer Gulf at Two Spatial Scales', in S Seddon & S Murray-Jones (eds), *Proceedings of the Seagrass Rehabilitation and Restoration Workshop for Gulf St Vincent,* 15–16 May 2001, Department for Environment and Heritage, and South Australian Research and Development Institute Aquatic Sciences Research Division, Adelaide.

McMahon, K, Lavery, PS & Mulligan, M 2011, 'Recovery from the impact of light reduction on the seagrass *Amphibolis griffithii*, insights for dredging management', *Marine Pollution Bulletin,* vol. 62, no.2, pp. 270–283.

Mills, KE & Fonseca, MS 2003, 'Mortality and productivity of eelgrass *Zostera marina* under conditions of experimental burial with two sediment types', *Marine Ecology Progress Series,* vol. 255, pp. 127–134.

Neverauskas, VP 1988, 'Response of a *Posidonia* community to prolonged reduction in light', *Aquatic Botany,* vol. 31, nos 3–4, pp. 361–366.

Peel, D, Smith, JB & Childerhouse, S 2016, *Historical data on Australian whale vessel strikes,* SC/66b/HIM/05, presented to the International Whaling Commission, Cambridge, UK.

Reef Life Survey 2016, Reef Life Survey Data Portal, Institute for Marine and Antarctic Studies, University of Tasmania, viewed 24 July 2016, <http://reeflifesurvey.imas.utas.edu.au/static/landing.html>.

Reef Watch 2014, *Seadragons and their friends: a guide to Syngnathidae fishes in South Australia,* prepared by Janine Baker for the Reef Watch program, Conservation Council of South Australia, Adelaide.

Shepherd, SA & Brook, JB 2007, 'Distribution and ontogenetic shifts in habitat and abundance of the temperate western blue groper, *Achoerodus gouldii*', *Journal of Fish Biology,* vol. 71, pp. 1–22.

Shepherd, SA, Brook, JB & Brown, A 2002, *A preliminary survey of the western Blue groper on Kangaroo Island*, report for Reef Watch, Adelaide.

Shepherd, SA, McComb, AJ, Bulthuis, DA, Neverauskas, VP, Steffensen, DA & West, R 1989, 'Decline of seagrasses', in AWD Larkum, AJ McComb & SA Shepherd (eds), *Biology of seagrasses,* Elsevier, Amsterdam, pp. 346–388.

Shepherd, SA, Baker, JL, Brown, A, Smith, K & Cawford, H 2009, *Summary of Reef Fish Surveys on Northern Kangaroo Island, 2002–08,* unpub. report, Adelaide.

Short, J, Fraser, M, McLean, D, Kendrick, GA, Byrne, M, Caley J, Clarke, D, Davis, A, Erftemeijer, P, Field, S, Gustin-Craig, S, Huisman, J, Keesing, J, Keough, M, Lavery, P, Masini, R, McMahon, K, Mergersen, K, Rasheed, M, Statton, J, Stoddart, J & Wu, P 2017, *Effects of dredging-related pressures on critical ecological processes for organisms other than fish or coral*, Report of Theme 9 –Project 9.1 prepared for the Dredging Science Node, Western Australian Marine Science Institution, Perth.

Southgate, R 2005, *The health and cover of seagrass in the bays of eastern Kangaroo Island,* Kangaroo Island Natural Resources Management Board, Kingscote, South Australia.

Spencer Gulf Port Link 2013, *Port Bonython Bulk Commodities Export Facility: Draft Environmental Impact Statement,* Spencer Gulf Port Link, Adelaide.

Thorhaug, A & Austin, CB 1976, 'Restoration of seagrasses, with economic analysis', *Environmental Conservation*, vol. 3, no. 4, pp. 259–267.

Tanner, JE, & Bryars, S 2007, *Innovative Solutions for Aquaculture Planning and Management – Project 5, Environmental Audit of Marine Aquaculture Developments in South Australia,* FRDC Project 2003/223, SARDI Aquatic Sciences publication no. F2007/000766-1 SARDI research report no. 190, Fisheries Research and Development Corporation, and South Australian Research and Development Institute Aquatic Sciences Research Division, Adelaide.

Tsolos, A 2013, *South Australian Charter Boat Fishery Report 2012,* report to PIRSA Fisheries and Aquaculture, SARDI publication no. F2007/000847-3, SARDI research report series no. 686, South Australian Research and Development Institute Aquatic Sciences Research Division, Adelaide.

Turner, DJ 2004, 'Effects of sedimentation on the structure of a phaeophycean dominated macroalgal community', PhD thesis, Department of Environmental Biology, University of Adelaide.

Turner, DJ, Kildea, TN & Murray-Jones, S 2006, *Examining the health of subtidal reef environments in South Australia, Part 1: Background review and rationale for the development of the monitoring program,* RD03/0252-5, South Australian Research and Development Institute Aquatic Sciences Research Division, Adelaide.

Vermaat, JE, Agawin, N, Fortes, M, Uri, J, Duarte, C, Marba, N, Enriquez, S & Van Vierssen, W 1997, 'The capacity of seagrasses to survive increased turbidity and siltation: the significance of growth form and light use', *Ambio*, vol. 26, pp. 499–504.

Victory, K, Kildea, T, Bohm, S & Pannell N 2010, *Environmental management driving solutions – a novel approach to minimising environmental impacts associated with construction of the Adelaide Desalination Plant,* Australian Water Association, Adelaide.

Wiltshire, K, Rowling, K & Deveney, M 2010, *Introduced marine species in South Australia: a review of records and distribution mapping,* SARDI publication no. F2010/000305-1, SARDI research report series no. 468, South Australian Research and Development Institute Aquatic Sciences Research Division, Adelaide.

CHAPTER 13: TERRESTRIAL ECOLOGY

Augee, ML, Gooden, B & Musser, A 2006, *Echidna – Extraordinary egg-laying mammal*, CSIRO Publishing, Collingwood, Victoria.

Barrett, G, Silcocks, A, Barry, S, Cunningham, R & Poulter, R 2003, *The New Atlas of Australian Birds,* Birds Australia, Melbourne.

Biological Databases of South Australia 2016, Department of Environment, Water and Natural Resources, Adelaide, accessed 8 August 2016.

Department of Environment, Water and Natural Resources 2011, *Interim Biogeographic Regionalisation for Australia (IBRA)*, version 7.0, DEWNR, Canberra.

Department of Environment, Water and Natural Resources 2012, *Vulnerability of DEWNR reserves on Kangaroo Island*, Science Resource Centre, Adelaide.

Department of Environment, Water and Natural Resources 2017, *Guide for Applications to Clear Native Vegetation Under the Native Vegetation Act 1991 and Native Vegetation Regulations 2017*, DEWNR, Adelaide.

Department of the Environment 2014, *Kangaroo Island narrow-leaved mallee (Eucalyptus cnerifolia) Woodland: a nationally protected ecological community,* DoE, Australian Government, Canberra.

Department of the Environment and Energy 2018, *EPBC Act Protected Matters Report*, report created 3 April 2018, DoEE, Canberra.

Department of Water, Land and Biodiversity Conservation 2005, *Guidelines for a Native Vegetation Significant Environmental Benefit Policy: For the clearance of native vegetation associated with the minerals and petroleum industry*, prepared for the Native Vegetation Council, DWLBC, Adelaide.

DEWNR—*see* Department of Environment, Water and Natural Resources

DoE—*see* Department of the Environment

DoEE—*see* Department of the Environment and Energy

DWLBC—*see* Department of Water, Land and Biodiversity Conservation

EBS Ecology 2018, *Smith Bay Ecological Assessment KIPT – Kangaroo Island*, sub-consultant's report prepared for Environmental Projects on behalf of Kangaroo Island Plantation Timbers Pty Ltd, Adelaide.

Government of South Australia 2006, *Phytophthora Management Guidelines, Phytophthora Technical Group*, 2nd edn, Department for Environment and Heritage, Primary Industries and Resources SA, Department for Transport, Energy and Infrastructure, Adelaide.

Government of South Australia 2017, *Native Vegetation Council (NVC) Bushland Assessment Manual*, Native Vegetation Management Unit, South Australia, viewed 8 May 2018, <https://www.environment.sa.gov.au/files/sharedassets/public/native_veg/march_2018/bushland_assessment_manual_2017.pdf>

Kangaroo Island Natural Resources Management Board 2009, *Kangaroo Island Natural Resources Management Plan 2009: Volume 1 State of the Region 2009*, Government of South Australia, Kingscote.

Kangaroo Island Natural Resources Management Board 2017, *Kangaroo Island Natural Resources Management Plan 2017–2027: Volume A – Strategic Plan 2017–2027,* Government of South Australia, Kingscote.

KINRMB—*see* Kangaroo Island Natural Resources Management Board

Natural Resources Kangaroo Island 2015, *Feral cat eradication on Kangaroo Island 2015–2030 Prospectus,* Government of South Australia and Kangaroo Island Council.

NRKI—*see* Natural Resources Kangaroo Island

Natural Resources Adelaide and Mount Lofty Ranges n.d.(a), *Common Brushtail Possum – Bioregional Resources*, Government of South Australia, viewed 6 February 2018, <http://www.naturalresources.sa.gov.au/files/sharedassets/adelaide_and_mt_lofty_ranges/plants_and_animals/bioregion_factsheets/common-brushtail-possum-bio-region-fact.pdf>.

— n.d.(b), *Help save the Heath Goanna – Factsheet,* Government of South Australia, viewed 6 February 2018, <http://www.naturalresources.sa.gov.au/files/sharedassets/eyre_peninsula/plants_and_animals/heath-goanna-fact.pdf>.

NRAMLR—*see* Natural Resources Adelaide and Mount Lofty Ranges

Stokes, AL, Heard, LM, Carruthers, S & Reynolds, T 2006, *Guide to the Roadside Vegetation Survey Methodology for South Australia,* draft report, Department for Environment and Heritage, Adelaide, viewed 6 March 2018, <http://www.environment.sa.gov.au/files/89d4a70d-e24d-44f5-adec-9e3001188ccd/roadside_manual.pdf>.

CHAPTER 14: MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (MNES)

ALA—*see* Atlas of Living Australia

AMSA—*see* Australian Maritime Safety Authority

Atlas of Living Australia 2018, *Atlas of Living Australia*, ALA, Canberra, viewed September 2017 & June 2018, <https://www.ala.org.au/>.

Australian Marine Mammal Centre 2009, *Report of the Australian Southern Right Whale Workshop 19-20 March 2009, Australian Antarctic Division, Kingston, Tasmania*, AMMC, Department of the Environment and Energy, Hobart, Tasmania, viewed 13 December 2018, <http://www.marinemammals.gov.au/__data/assets/pdf_file/0005/1103/AMMC---Southern-right-whale-workshop-report-March-2009.pdf>.

Australian Maritime Safety Authority 2016, *Minimising the risk of collisions with cetaceans*, AMSA, Canberra, viewed 30 August 2017, <https://apps.amsa.gov.au/MOReview/MarineNoticeExternal.html>.

Augee, ML 1995, 'Short-beaked echidna *Tachyglossus aculeatus*', in R Strahan (ed), *The Mammals of Australia,* 2nd edn, Reed New Holland, Sydney, pp. 40–43.

Baird, B & Dann, P 2003, 'The breeding biology of Hooded Plovers, *Thinornis rubicollis*, on Phillip Island, Victoria', *Emu – Austral Ornithology,* vol. 103, no. 4, pp. 323–328.

Baker-Gabb, D & Weston, M, 2006, 'South Australian Recovery Plan for the Hooded plover, *Thinornis rubricollis*', fourth draft August 2006*, Southern Fleurieu Coastal Action Plan and Conservation Priority Study, 2007*, Department of Environment and Heritage, Adelaide.

Bannister, JL 2001, 'Status of southern right whales *Eubalaena australis* off Australia', *Journal of Cetacean Research and Management (Special Issue),* vol. 2, pp. 103–110.

Bannister, JL 2007, *Southern right whale Aerial Survey and Photoidentification, Southern Australia, 2006*, final report, Commonwealth of Australia, and the Western Australian Museum, Western Australia.

Bannister, JL, Hammond, PS & Double, MC 2016, *Population trend in right whales off southern Australia 1993-2015*, Report to the International Whaling Commission, SC/66b/BRG/09, IWC, Cambridge, England, viewed 13 December 2018, <https://www.nespmarine.edu.au/system/files/Bannister%20et%20al%20IWC%20Population%20trend%20right%20whales%20off%20sthn%20Australia%201993-2015%20IWC%20RS6111_SC_66b_BRG_09.pdf>.

Barrett, G, Silcocks, A, Barry, S, Cunningham, R & Poulter, R 2003, *The New Atlas of Australian Birds,* Birds Australia, Melbourne.

Biological Databases of South Australia 2016, recordset number DEWNRBDBSA160808-2, Department of Environment, Water and Natural Resources, Adelaide, accessed 8 August 2016.

BMT WBM 2017, email (technical note), 24 January, *Whale Strike Probability Modelling*.

BOM—*see* Bureau of Meteorology

Braithwaite, RW 1995, 'Southern brown bandicoot *Isoodon obesulus*', in Strahan, R (ed.), *The Mammals of Australia*, 2nd edn, Reed New Holland, Sydney, pp. 176–177.

Bureau of Meteorology 2018, *Daily Rainfall: Smith Bay,* BOM, Melbourne, viewed 13 February 2018, <http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_display_type=dailyDataFile&p_nccObsCode=136&p_stn_num=022811&p_c=-104068116&p_startYear=2016>.

Carroll, E, Patenaude, N, Alexander, A, Steel D, Harcourt, R, Childerhouse, S, Smith, S, Bannister, J, Constantine, R & Scott Baker, C 2011, 'Population structure and individual movement of southern right whales around New Zealand and Australia', *Marine Ecology Progress Series*, vol. 432, pp. 257–268.

COAG—*see* Council of Australian Governments

Council of Australian Governments 1992, *National Strategy for Ecologically Sustainable Development – Part 1 Introduction,* COAG, Canberra, viewed 19 February 2018, <http://www.environment.gov.au/about-us/esd/publications/national-esd-strategy-part1>.

DEC—*see* Department of Environment and Conservation NSW

Department of Environment and Conservation NSW 2006, *Southern Brown Bandicoot (Isoodon obesulus) recovery plan,* Department of Environment and Conservation, NSW.

— Department of the Environment 2013a, *Matters of National Environmental Significance Significant Impact Guidelines 1.1: Environment Protection and Biodiversity Conservation Act 1999,* DoE, Canberra, viewed 11 July 2018, <http://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf>.

— 2013b, *Draft survey guidelines for Australia's threatened orchids: Guidelines for detecting orchids listed as 'Threatened' under the Environment Protection and Biodiversity Conservation Act 1999,* DoE, Canberra.

Department of the Environment 2014, *Kangaroo Island narrow-leaved mallee (Eucalyptus cnerifolia) Woodland: a nationally protected ecological community,* DoE, Australian Government, Canberra.

Department of the Environment 2015, *Factsheet: Threatened Species Strategy Action Plan 2015–16, 20 Birds by 2020*, DoE, Canberra.

— Department of the Environment 2018a, *Eubalaena australis* Species Profile and Threats Database, DoE, Canberra, viewed 17 July 2017, <http://www.environment.gov.au/sprat>.

— 2018b, *Isoodon obesulus obesulus* Species Profile and Threats Database, DoE, Canberra, viewed 17 July 2018, <http://www.environment.gov.au/sprat>.

— 2018c, *Tachyglossus aculeatus multiaculeatus* Species Profile and Threats Database, DoE, Canberra, viewed 17 July 2017, <http://www.environment.gov.au/sprat>.

— 2018d, *Thinornis rubricollis rubricollis* Species Profile and Threats Database, DoE, Canberra, viewed 17 July 2018, <http://www.environment.gov.au/sprat>.

— Department of the Environment and Energy 2014a, 'National Conservation Values Atlas', DoEE, Canberra, viewed 13 November 2018, <http://www.environment.gov.au/webgis-framework/apps/ncva/ncva.jsf>.

— 2018b, Biologically important areas of regionally significant marine species, viewed 13 November 2018, <http://www.environment.gov.au/marine/marine-species/bias>.

Department of the Environment and Energy 2016, *Draft National Strategy for Mitigating Vessel Strike of Marine Mega-fauna*, DoEE, Canberra, viewed 17 July 2018, <http://www.environment.gov.au/marine/marine-species/draft-national-vessel-strike-strategy>.

— Department of the Environment and Energy 2018a, *About the EPBC Act – Glossary*, DoEE, Canberra, viewed 19 February 2018, <http://www.environment.gov.au/epbc/about/glossary>.

— 2018b, *EPBC Act Protected Matters Report*, Commonwealth of Australia, report created 3 April 2018, DoEE, Canberra.

Department of the Environment, Water, Heritage and the Arts 2008, *Threat Abatement Plan for predation by the European red fox*, DEWHA, Canberra.

Department of Planning, Transport and Infrastructure 2012, *Underwater Piling Noise Guidelines*, DPTI, Adelaide, viewed 18 July 2018, <https://www.dpti.sa.gov.au/__data/assets/pdf_file/0004/88591/DOCS_AND_FILES-7139711-v2-Environment_-_Noise_-_DPTI_Final_word_editing_version_Underwater_Piling_Noise_Guide.pdf>.

Department of Sustainability, Environment, Water, Populations and Communities 2011, *Environment Protection and Biodiversity Conservation Act 1999 draft referral guidelines for the endangered southern brown bandicoot (eastern), Isoodon obesulus obesulus,* DSEWPaC, Canberra.

— Department of Sustainability, Environment, Water, Populations and Communities 2012a, *Conservation Management Plan for the Southern Right Whale: A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999, 2011–2021,* DSEWPaC, Canberra, viewed 11 July 2018, <http://www.environment.gov.au/system/files/resources/4b8c7f35-e132-401c-85be-6a34c61471dc/files/e-australis-2011-2021.pdf>.

— 2012b, *Environment Protection and Biodiversity Conservation Act 1999 – Environmental Offsets Policy*, DSEWPaC, Canberra, viewed 11 July 2018, <http://www.environment.gov.au/system/files/resources/12630bb4-2c10-4c8e-815f-2d7862bf87e7/files/offsets-policy_2.pdf>.

— 2012c, *Environment Protection and Biodiversity Conservation Act 1999 – Offsets assessment guide*, DSEWPaC, Canberra, viewed 11 July 2018, <http://www.environment.gov.au/system/files/resources/12630bb4-2c10-4c8e-815f-2d7862bf87e7/files/offset-assessment-guide.xlsm>.

Department of Water, Land and Biodiversity Conservation 2005, *Guidelines for a Native Vegetation Significant Environmental Benefit Policy: For the clearance of native vegetation associated with the minerals and petroleum industry*, DWLBC, Adelaide.

DEWHA—*see* Department of the Environment, Water, Heritage and the Arts

DEWNR—*see* Department of Environment, Water and Natural Resources

DoE—*see* Department of the Environment

DoEE—*see* Department of the Environment and Energy

DPTI—*see* Department of Planning, Transport and Infrastructure

DSEWPaC—*see* Department of Sustainability, Environment, Water, Populations and Communities

DWLBC—*see* Department of Water, Land and Biodiversity Conservation

EBS Ecology 2018, 'Smith Bay Ecological Assessment', report (unpub.) prepared for Environmental Projects on behalf of Kangaroo Island Plantation Timbers, Adelaide.

Franks, DM, Brereton, D, Moran, CJ, Sarker, T & Cohen, T 2010, *Cumulative Impacts – A good practice guide for the Australian coal mining industry*, Centre for Social Responsibility in Mining and Centre for Water in the Minerals Industry, Sustainable Minerals Institute, University of Queensland, Brisbane, viewed 11 July 2018, <https://www.csrm.uq.edu.au/publications/cumulative-impacts-guide>.

Garnett, ST & Crowley, GM 2000, *The Action Plan for Australian Birds 2000*, Environment Australia and Birds Australia, Canberra, viewed 19 June 2018, <http://www.environment.gov.au/resource/action-plan-australian-birds-2000>.

Garnett, ST, Szabo, JK & Dutson, G 2011, *The Action Plan for Australian Birds 2010,* CSIRO Publishing, Melbourne.

Government of South Australia 2017, *Native Vegetation Council (NVC) Bushland Assessment Manual February 2017*, Native Vegetation Management Unit, Adelaide, viewed 18 July 2018, <https://www.environment.sa.gov.au/files/sharedassets/public/native_veg/march_2018/bushland_assessment_manual_2017.pdf>.

Haby, N & Long, K 2005, *Recovery plan for the southern brown bandicoot in the Mount Lofty Ranges, South Australia 2004 to 2009*, Department of Environment and Heritage, Government of South Australia, Adelaide and the Natural Heritage Trust.

Jacobs 2015, 'Central Eyre Iron Project: Port Site Marine Assessment', *Iron Road 2015, Central Eyre Iron Project Environmental Impact Statement*, report E-F-34-RPT-0039, Appendix Q, Jacobs Pty Ltd, Adelaide, viewed 18 July 2018, <http://www.ironroadlimited.com.au/central-eyre-iron-project/mining-lease-proposal-environmental-impact-statement>.

Kemper, C, Coughran, D, Warneke, R, Pirzl, R, Watson, M, Gales, R & Gibbs, S 2008, 'Southern right whale (*Eubalaena australis*) mortalities and human interactions in Australia, 1950–2006', *Journal of Cetacean Research and Management*, vol. 10, no. 1, pp. 1–8.

Ketten, DR 1997, 'Structure and function of whale ears', *Bioacoustics*, vol. 8, nos 1–2, pp. 103–135.

Leeuwenburg, P 2004, 'Roadkill on Kangaroo Island: Identification of Patterns and Predictors of Roadkill', hons thesis, University of South Australia, Adelaide.

Ling, JK 2002, 'Chapter 9: Marine Mammals', in M Davies, CR Twidale & MJ Tyler (eds), *Natural History of Kangaroo Island*, 2nd edn, Royal Society of South Australia, Richmond.

Marchant, S & Higgins, PJ (eds) 1993, *Handbook of Australian, New Zealand and Antarctic Birds, vol. 2 – Raptors to Lapwings,* Oxford University Press, Melbourne.

Mathews, GM (1913–1914), *The Birds of Australia, vol. 3*, Witherby and Company, London, UK.

National Research Council 2003, *Ocean Noise and Marine Mammals*, Committee on Potential Impacts of Ambient Noise in the Ocean on Marine Mammals, National Academies Press, Washington DC, USA.

National Marine Fisheries Service 2018, 'Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts', Technical Memorandum NMFS-OPR-59, National Oceanic and Atmospheric Administration (NOAA), Department of Commerce, Washington DC, USA.

Natural Resources Kangaroo Island 2015, *Feral cat eradication on Kangaroo Island 2015–2030 Prospectus*, Government of South Australia, and Kangaroo Island Council, viewed 6 July 2018, <http://www.naturalresources.sa.gov.au/files/sharedassets/kangaroo_island/plants_and_animals/pest_animals/feral_cat/ki_feral_cat_eradication_project_prospectus.pdf>.

— Natural Resources Kangaroo Island 2017a, *Rosenberg's goanna*, NRKI, South Australia, viewed 9 June 2018, <http://www.naturalresources.sa.gov.au/kangarooisland/plants-and-animals/native-animals/rosenbergs_goanna>.

— Natural Resources Kangaroo Island 2018a, *Kangaroo Island Feral Cat Eradication Program*, NRKI, South Australia, viewed 18 June 2018, <http://www.naturalresources.sa.gov.au/kangarooisland/plants-and-animals/pest-animals/Kangaroo-Island-Feral-Cat-Eradication-Program>.

— 2018b, *Summary of preliminary findings of the Kangaroo Island Feral Cat Eradication Program*, NRKI, South Australia, viewed 13 August 2018, <https://www.naturalresources.sa.gov.au/kangarooisland/plants-and-animals/pest-animals/Kangaroo-Island-Feral-Cat-Eradication-Program/Summary_of_preliminary_findings_of_the_Kangaroo_Island_Feral_Cat_Eradication_Program>.

NRKI—*see* Natural Resources Kangaroo Island

Paull, DJ 2008, 'Southern brown bandicoot *Isoodon obesulus*', in S Van Dyck & R Strahan (eds), *The Mammals of Australia,* 3rd edn, Reed New Holland, Sydney, pp. 180–182.

Peel, D, Smith, JN & Childerhouse, S 2016, *Historical data on Australian whale vessel strikes*, presented to the IWC Scientific Committee, SC/66b/HIM/05, International Whaling Commission, Cambridge, UK.

Resonate 2018, *Kangaroo Island Plantation Timbers EIS – Environmental Noise Impact Assessment*, report A17557RP1, rev. A, Resonate Consultants, Adelaide.

Rismiller, PD 1999, *The Echidna: Australia's Enigma*, Levin Associates, Hugh Lauter Publishing, Fairfield, Connecticut, USA.

Rismiller, PD & McKelvey, MW 2000, 'Frequency of breeding and recruitment in the short-beaked echidna, *Tachyglossus aculeatus'*, *Journal of Mammalogy*, vol. 81, no.1, pp. 1–17.

SA Whale Centre 2017, *Live Sightings Log,* Victor Harbor, SA, viewed 18 September 2017, <http://www.sawhalecentre.com.au/whale-sightings/sightings-log/>.

Spencer Gulf Port Link 2013, 'Port Bonython Bulk commodities Export Facility: Draft Environmental Impact Statement', Spencer Gulf Port Link, Adelaide.

Stokes, AL, Heard, LMB, Carruthers, B & Reynolds, T 2006, *Guide to the Roadside Vegetation Survey Methodology in South Australia: Draft – Working Document*, Department for Environment and Heritage, Adelaide.

Threatened Species Scientific Committee 2014, *Conservation Advice: Thinornis rubricollis rubricollis, hooded plover (eastern)*, TSSC, Department of the Environment, Canberra.

Threatened Species Scientific Committee 2015, *Conservation Advice: Tachyglossus aculeatus multiaculeatus, Kangaroo Island echidna*, Department of the Environment, Canberra.

Threatened Species Scientific Committee 2016, *Conservation Advice: Isoodon obesulus obesulus, Southern brown bandicoot (eastern),* TSSC, Department of the Environment, Canberra.

TSSC—*see* Threatened Species Scientific Committee

Wallage, A, Ferguson, A, Clarke, L, Thomas, L, Pyne, M, Beard, L, Lisle, A & Johnston, S 2015, 'Advances in the captive breeding and reproductive biology of the short-beaked echidna (*Tachyglossus aculeatus*)', *Australian Journal of Zoology*, vol. 63, pp. 181–191.

Weston, MA 2003, *Managing the Hooded Plover in Victoria: a Review of Existing Information*, Parks Victoria Technical Series 4, Parks Victoria, Melbourne.

Wildcare Australia n.d., *Rehab Easy Reference Sheet – Caring for Echidnas*, Tallebudgera Valley, Qld, viewed 6 August 2018, <http://wildcareaustraliainc.camp9.org/resources/Documents/ERS/ERS%20-%20Caring%20for%20ECHIDNAS.pdf>.

Woinarski, JC, Burbridge, AA, & Harrison, P 2014, *The Action Plan for Australian Mammals 2012,* CSIRO Publishing, Melbourne.

CHAPTER 15: BIOSECURITY

Ballantine, J 2017, *Code of practice for vessel and facility management (marine and inland waters),* Environment Protection Authority, Adelaide, viewed 21 May 2018, <http://www.epa.sa.gov.au/files/47792_vessels.pdf>.

Commonwealth of Australia 2008, *National biofouling management guidelines for commercial vessels*, Canberra, viewed 26 March 2018, <http://www.marinepests.gov.au/marine_pests/publications/Documents/Biofouling_guidelines_commercial_vessels.pdf>.

COAG—*see* Council of Australian Governments

Council of Australian Governments 2012, *Intergovernmental Agreement on Biosecurity*, COAG, Canberra, viewed 24 January 2018, <https://www.coag.gov.au/content/intergovernmental-agreement-biosecurity>.

DAWR—*see* Department of Agriculture and Water Resources

Department of Agriculture 2015, *Anti-fouling and in-water cleaning guidelines*, DoA, Canberra, viewed 26 March 2018, <http://www.agriculture.gov.au/SiteCollectionDocuments/animal-plant/pests-diseases/marine-pests/antifouling-consultation/antifouling-guidelines.pdf>.

Department of Agriculture and Water Resources 2016, *Australia's international biosecurity obligations*, DAWR, Canberra, viewed 4 July 2018, <http://www.agriculture.gov.au/biosecurity/risk-analysis/conducting/international-obligations>.

— Department of Agriculture and Water Resources 2017a, *Managing biofouling in Australia*, DAWR, Canberra, viewed 18 July 2018, <http://www.agriculture.gov.au/biosecurity/avm/vessels/biofouling>.

— 2017b, *Australian Ballast Water Management Requirements*, version 7, DAWR, Canberra, viewed 26 March 2018, <http://www.agriculture.gov.au/SiteCollectionDocuments/biosecurity/avm/vessels/ballast/australian-ballast-water-management-requirements.pdf>.

— 2017c, *Australia's National List of Reportable Diseases of Aquatic Animals*, endorsed by the Animal Health Committee April 2016, DAWR, Canberra, viewed 27 June 2018, <http://www.agriculture.gov.au/animal/aquatic/reporting/reportable-diseases#molluscs>.

— 2017d, *National Priority Plant Pests 2016,* viewed 12 November 2018, <http://www.agriculture.gov.au/pests-diseases-weeds/plant/national-priority-plant-pests-2016>.

— Department of Agriculture and Water Resources 2018a, *Marine Pest Plan 2018–2023: National Strategic Plan for Marine Pest Biosecurity*, DAWR, Canberra, viewed 18 June 2018, <http://www.marinepests.gov.au/marine_pests/publications/Documents/mpp-2018-23.pdf>.

— 2018b, *Marine Pests – Draft Australian Priority Marine Pest Species List,* DAWR, Canberra, viewed 21 May 2018, <http://www.agriculture.gov.au/pests-diseases-weeds/marine-pests>.

— 2018c, *Vessels*, DAWR, Canberra, viewed 4 April 2018, <http://www.agriculture.gov.au/biosecurity/avm/vessels#mars-and-vessel-arrival-support-tools>.

Department of Environment, Water and Natural Resources 2012, *Vulnerability of DEWNR reserves on Kangaroo Island*, Science Resource Centre, DEWNR, Adelaide.

Department of the Environment and Energy 2018, *Draft National Invasive Ant Biosecurity Plan 2018-2028*, DoEE, Canberra, viewed 10 December 2018, <http://www.environment.gov.au/system/files/consultations/efa0c80f-95c2-4654-a0d2-bead9dbfd04a/files/draft-national-invasive-ant-biosecurity-plan-2018-2028.pdf>.

DEWNR—*see* Department of Environment, Water and Natural Resources

DoA—*see* Department of Agriculture

DoEE—*see* Department of the Environment and Energy

EBS Ecology 2018, *Smith Bay Ecological Assessment KIPT – Kangaroo Island,* sub-consultant's report prepared for Environmental Projects on behalf of KIPT Ltd, Adelaide.

Environment Protection Authority 2017, *Code of practice for vessel and facility maintenance (marine and inland waters)*, EPA South Australia, Adelaide.

EPA—*see* Environment Protection Authority

Government of South Australia 2006, *Phytophthora Management Guidelines, Phytophthora Technical Group,* 2nd *Edition*, Department for Environment and Heritage, Primary Industries and Resources SA, and Department for Transport, Energy and Infrastructure, South Australia.

Hayes, K, Sliwa, C, Migus, S, McEnnulty, F & Dunstan, P 2005, *National priority pests: Part II – Ranking of Australian marine pests,* technical report for the Department of Environment and Heritage, Canberra, viewed 21 May 2018, <http://www.environment.gov.au/system/files/resources/02d33408-ad61-4d11-b5a4-6bf1aa333776/files/priority2.pdf>.

IMO—*see* International Maritime Organization

International Maritime Organization 2004, *International Convention for the Control and Management of Ships' Ballast Water and Sediments (BWM)*, London, viewed 24 January 2018, <http://www.imo.org/en/About/Conventions/ListOfConventions/Pages/International-Convention-for-the-Control-and-Management-of-Ships'-Ballast-Water-and-Sediments-(BWM).aspx>.

Kangaroo Island Natural Resources Management Board 2009, *Kangaroo Island Natural Resources Management Plan 2009: Volume 1 State of the Region 2009,* Government of South Australia, Kingscote, <http://www.naturalresources.sa.gov.au/files/6c638870-9796-48ce-b54d-a1e300902b8e/vol-1-state-of-the-region-2009-plan.pdf>.

Kangaroo Island Natural Resources Management Board 2017a, *Biosecurity Strategy for Kangaroo Island 2017–2027*, Department of Environment, Water and Natural Resources, Adelaide, viewed 21 May 2018, <http://www.naturalresources.sa.gov.au/files/sharedassets/kangaroo_island/plants_and_animals/biosecurity_ki/ki-biosecurity-strategy-2017-sm_002.pdf>.

2017b, *Kangaroo Island Natural Resources Management Plan 2017–2027: Volume A – Strategic Plan 2017–2027,* Government of South Australia, Kingscote, viewed 21 May 2018, <http://www.naturalresources.sa.gov.au/files/sharedassets/kangaroo_island/about_us/our_regions_plan/climate_change_ready_ki_nrm_plan/ki-nrm-plan-2017-web-smm.pdf>.

KINRMB—*see* Kangaroo Island Natural Resources Management Board

National Centre for Marine Conservation and Resource Sustainability (Australian Maritime College) 2010, *The relative contribution of vectors to the introduction and translocation of marine invasive species*, report prepared by CL Hewitt & ML Campbell, Department of Agriculture, Fisheries and Forestry, Canberra.

— Natural Resources Kangaroo Island 2017a, Pest Plants*,* viewed 3 July 2018, <http://www.naturalresources.sa.gov.au/kangarooisland/plants-and-animals/pest-plants>.

— 2017b, *Weeds Declared for KI*, viewed 3 July 2018, <http://www.naturalresources.sa.gov.au/files/sharedassets/kangaroo_island/plants_and_animals/pest_plants/declared-weeds-ki-fact.pdf>.

NCMCRS—*see* National Centre for Marine Conservation and Resource Sustainability

NRKI —*see* Natural Resources Kangaroo Island

PIRSA—*see* Primary Industries and Resources South Australia

Price, M (Assistant Minister for the Environment) 2018, *No goat zone: Kangaroo Island now feral goat free*, media release, Parliament House, Canberra, viewed 17 July 2018, <http://www.environment.gov.au/minister/price/media-releases/mr20180612.html>.

— Primary Industries and Resources South Australia 2014a, *Alert pest animals in South Australia*, PIRSA, Adelaide, viewed 3 July

2018, <http://www.pir.sa.gov.au/biosecurity/weeds_and_pest_animals/animal_pests_in_south_australia/alert_pest_animals_in_south_australia>.

— 2014b, *Animal pest alert – Pacific rat fact sheet*, PIRSA, Adelaide, viewed 3 July 2018, <http://www.pir.sa.gov.au/__data/assets/pdf_file/0016/232027/animal_pest_alert_pacific_rat.pdf>.

— Primary Industries and Resources South Australia 2015a, *Giant Pine Scale*, PIRSA, Adelaide, viewed 24 January 2018, <http://www.pir.sa.gov.au/biosecurity/plant_health/emergency_plant_pests/giant_pine_scale>.

— 2015b, *Moving Bees and Bee Products*, PIRSA, Adelaide, viewed 17 January 2018, <http://pir.sa.gov.au/biosecurity/animal_health/bees/moving_bees_and_bee_products>.

— 2015c, *Noxious fish list*, PIRSA, Adelaide, viewed 24 July 2017, <http://pir.sa.gov.au/biosecurity/aquatics/aquatic_pests/noxious_fish_list>.

— Primary Industries and Resources South Australia 2018a, *Perkinsus Olseni*, PIRSA, Adelaide, viewed 9 September 2018, <http://www.pir.sa.gov.au/biosecurity/aquatics/aquatic_diseases/abalone_diseases/perkinsus_olseni#toc2>.

— 2018b, Pacific Oyster Mortality Syndrome, viewed 10 December 2018, <http://www.pir.sa.gov.au/aquaculture/aquatic_animal_health/pacific_oyster_mortality_syndrome>.

SEA 2016, 'Smith Bay Marine Ecological Assessment', unpublished report prepared for Kangaroo Island Plantation Timbers Pty Ltd, SEA, Newstead, Queensland.

Singh, B 2016, Everything you Wanted to Know about Ballast Water Exchange and Management Plan, Marine Insight, Marine Environment, Maritime Law, viewed 20 November 2018, <https://www.marineinsight.com/maritime-law/everything-you-wanted-to-know-about-ballast-water-exchange-and-management-plan/>.

South Australian Tourism Commission 2018, *Kangaroo Island Visitor Guide 2018-2019*, SATC, Adelaide, viewed 13 December 2018 < http://kangarooislandvisitorguide.realviewdigital.com/#folio=1>.

SATC—*see* South Australian Tourism Commission

Wiltshire, K, Rowling, K & Deveney, M 2010, *Introduced marine species in South Australia: a review of records and distribution mapping,* SARDI publication no. F2010/000305-1, SARDI research report series no. 468, South Australian Research and Development Institute Aquatic Sciences Research Division, Adelaide.

CHAPTER 16: GEOLOGY, SOILS AND WATER

ASRIS—*see* Australian Soil Resource Information System

Australian Soil Resource Information System 2014, *The Australian Soil Resource Information System*, CSIRO Land and Water, Canberra, viewed15 August 2018, <http://www.asris.csiro.au/>.

Department of Environment, Water and Natural Resources 2011, *Interim Biogeographic Regionalisation for Australia (IBRA) Version 7.0*, DEWNR, Canberra.

Department of Environment, Water and Natural Resources 2012, *Soil and Land Mapping, State Land and Soil Mapping Program (1886–2012)*, DEWNR, Canberra, viewed15 August 2018, https://www.environment.sa.gov.au.

Department of Lands 1990, *Topographic map of the Yorke Peninsula and Kangaroo Island*, Department of Lands, Adelaide.

Department of Planning and Local Government 2011, *Kangaroo Island Plan, A Volume of the South Australian Planning Strategy*, DPLG, Adelaide.

DEWNR—*see* Department of Environment, Water and Natural Resources

DPLG—*see* Department of Planning and Local Government

EBS Ecology 2016, *Smith Bay Ecological Assessment KIPT – Kangaroo Island*, EBS, Adelaide.

Environmental Projects 2017, *Smith Bay Site Investigation, Smith Bay Kangaroo Island*, EP, Adelaide.

EP—*see* Environmental Projects

Geological Survey of SA 1962, 1:250,000 Kingscote geology map sheet SI-53-16, Department of Mines, Adelaide.

Kahmark, KA & Unwin, JP 1998, 'Pulp and Paper Effluent Management', *Water Environment Research*, vol. 69, no. 4, Literature Review (June 1997), pp. 641–658, Water Environment Federation, Alexandria, Virginia, USA.

Manios, T, Stentiford, EI & Millner, P 2003, 'Removal of Total Suspended Solids from Wastewater in Constructed Horizontal Flow Subsurface Wetlands', *Journal of Environmental Science and Health Part A – Toxic/Hazardous Substances and Environmental Engineering*, vol. 38, no. 6, pp. 1073–1085.

SA Coast Protection Board 2003, *Coastline – A Strategy for Implementing CPB Policies on Coastal Acid Sulfate Soils in South Australia*, SA Coast Protection Board, Department for Environment and Water, Adelaide.

Samis, SC, Liu, SD, Wernick, BG & Nassichuk, MD 1999, 'Mitigation of fisheries impacts from the use and disposal of wood residue in British Columbia and the Yukon', *Canadian Technical Report of Fisheries and Aquatic Sciences 2296*, Fisheries and Oceans Canada & Environment Canada, Vancouver, pp. viii and 91.

SARIG—*see* South Australian Resource Information Gateway

SEA—*see* Social & Ecological Assessment

Social & Ecological Assessment 2017, *Deep Water Export Facility Assessment of Marine Sediments Smith Bay*, Kangaroo Island Plantation Timbers, SEA, Adelaide.

South Australian Resource Information Gateway 2017, viewed15 August 2018, <https://map.sarig.sa.gov.au>.

Forest & Wood Products 2008, *Wood recovery and recycling: A source book for Australia*, PNA017-0708, by J Taylor & M Warnken, Forest & Wood Products Australia, Melbourne.

Tao, W, Hall, KJ, Masbough, A, Frankowski, K & Duff, Sheldon JB 2005, 'Characterization of Leachate from a Woodwaste Pile', *Water Quality Research Journal of Canada (CAWQ)*, vol. 40, no. 4, pp. 476–483.

WaterConnect 2015, WaterConnect database, Department of Environment, Water and Natural Resources, Adelaide, viewed 20 September 2018, <https://www.waterconnect.sa.gov.au>.

CHAPTER 17: AIR QUALITY

Australian Coal Association Research Program 1999, *Dust in the Hunter Valley: An evaluation of the concentration distributions, meteorological associations and community response*, ACARP, Brisbane.

Dean, M, Holmes, N & Mitchell, P 1987, *Air Pollution from Surface Coal Mining: Community Perception, Measurement and Modelling*, Australian Coal Association Research Program (ACARP), Brisbane.

Department of Environment and Conservation 2005, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*, NSW Environment Protection Authority, Sydney.

Department of the Environment and Energy 2012, *National Pollutant Inventory Emission Estimation Technique Manual for Mining Version 3.1*, DoEE, Commonwealth of Australia, Canberra.

Department of the Environment and Energy 2014, *National Pollutant Inventory Emission Estimation Technique Manual for Mining and Processing of Non-Metallic Minerals Version 2.1*, DoEE, Commonwealth of Australia, Canberra.

DoEE—*see* Department of the Environment and Energy

Environment Protection Authority South Australia 2016, *Ambient Air Quality Assessment*, EPA SA, Adelaide.

Environment Protection Authority Victoria 2012, *Health Risk Assessment – Preliminary Work to Identify Concentration-Response Functions for Selected Ambient Air Pollutants*, report prepared by B Jalaludin & C Cowie, EPA Victoria, Melbourne.

EPA SA—*see* Environment Protection Authority South Australia

EPA Vic—*see* Environment Protection Authority Victoria

JPL 2015, *Shuttle Radar Topography Mission*, NASA Jet Propulsion Laboratory, California Institute of Technology, Pasadena, USA, viewed September 2017, <https://www2.jpl.nasa.gov/srtm/>.

National Environment Protection Council 2011, *National Environment Protection (Ambient Air Quality) Measure Review – Review Report*, NEPC, Adelaide.

NEPC—*see* National Environment Protection Council

New South Wales Environment Protection Authority 2017, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*, NSW EPA, Sydney.

NSW EPA—*see* New South Wales Environment Protection Authority

— Safe Work Australia 2013a, *Workplace Exposure Standards for Airborne Contaminants*, Safe Work Australia, Canberra.

— 2013b, *Guidance on the Interpretation of Workplace Exposure Standards for Airborne Contaminants*, Safe Work Australia, Canberra.

Standing Council on Environment and Water 2012, *Australian Child Health and Air Pollution Study (ACHAPS) – Final Report*, SCEW, Canberra.

Zoller, J, Bertke, T, & Janszen, T 1978, *Assessment of Fugitive Particulate Emissions Factors for Industrial Processes*, US Environmental Protection Agency, North Carolina.

CHAPTER 18: NOISE AND LIGHT

Collins, MD 1996, *Users Guide for RAM Versions 1.0 and 1.0p*, Naval Research Laboratory, Washington DC, USA, accessed November 2018, <http://staff.washington.edu/dushaw/AcousticsCode/ram.pdf>.

Department of the Environment, Water, Heritage and the Arts 2008, *EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales*, DEWHA, Adelaide.

Department of Planning, Transport and Infrastructure 2012, *Underwater Piling Noise Guidelines*, DPTI, Adelaide.

DEWHA—*see* Department of the Environment, Water, Heritage and the Arts

Dickerson, C, Reine, KJ, Clarke, DG & Engler, RM 2001, 'Characterization of underwater sounds produced by bucket dredging operations', *DOER Technical Notes Collection*, no. ERDC-TN-DOER-E14, US Army Engineer Research and Development Center, Vicksburg, Mississippi, USA.

DPTI—*see* Department of Planning, Transport and Infrastructure

Geoscience Australia 2018, *50m Multibeam Dataset of Australia*, Geoscience Australia, Canberra, accessed August 2018, <https://ecat.ga.gov.au/geonetwork/srv/eng/catalog.search?node=srv#/metadata/bc422803-0ab4-5350-e044-00144fdd4fa6>.

Gitschlag, GR & Herczeg, BA 1994, 'Sea Turtle Observations at Explosive Removals of Energy Structures', *Marine Fisheries Review*, vol. 56, no. 2, pp. 1–8.

National Oceanic and Atmospheric Administration 2018, *Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Thresholds for Onset of Permanent and Temporary Threshold Shifts*, United States National Oceanic and Atmospheric Administration Technical Memorandum NMFS-OPR-59, NOAA, Silver Spring, Maryland, USA.

NOAA—*see* National Oceanic and Atmospheric Administration

Popper, AN, Hawkins, AD, Fay, RR, Mann, DA, Bartol, S, Carlson, TJ, Coombs, S, Ellison, WT, Gentry, RL, Halvorsen, MB, Lokkeborg, S, Rogers, PH, Southall, BL, Zeddies, DG & Tavolga, WN 2014, *Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report, ASA S3/SC1.4 TR-2014*, prepared by ANSI-accredited Standards Committee S3/SC1, Springer Briefs in Oceanography, Springer & ASA Press, Switzerland.

Richardson, WJ, Greene Jr, CR, Malme, CI & Thomson, DH 1995, *Marine Mammals and Noise,* Academic Press, San Diego, California.

Rodkin, R & Pommerenck, K 2014, 'Caltrans compendium of underwater sound data from pile driving – 2014 update', *Proceedings of the 43rd International Congress on Noise Control Engineering (inter.noise) in Melbourne*, the International Institute of Noise Control Engineering (I-INCE), Petaluma, California.

SoundPLAN 2017, *SoundPLAN Environmental Software v8.0*, computer software, SoundPLAN GmbH, Germany.

Southall, BL, Bowles, AE, Ellison, WT, Finneran, JJ, Gentry, RL, Greene, CR & Tyack, PL 2007, 'Overview', *Aquatic mammals*, vol. 33, no. 4, pp. 411–414.

Standards Australia 1997, *AS4282-1997, Control of the obtrusive effects of outdoor lighting*, Standards Australia, Sydney.

— Yumbah 2018a, *Yumbah Aquaculture Planning & Works Approval Odour & Noise Impact Assessment for Proposed Nyamat Abalone Aquaculture Facility*, report by GHD for Yumbah Aquaculture, South Melbourne, viewed 17 December 2018, <https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.vic-engage.files/6315/4087/3508/Appendix_F.pdf>.

— 2018b, *Yumbah Aquaculture Ltd Yumbah Nyamat Abalone Farm Works Approval Application*, Yumbah Aquaculture, South Melbourne, viewed 18 December 2018, <https://s3.ap-southeast-2.amazonaws.com/hdp.au.prod.app.vic-engage.files/8915/4087/3509/Yumbah_Nyamat_WAA_FINAL_EPA_281018_Main_Document.pdf>.

CHAPTER 19: CLIMATE CHANGE AND SUSTAINABILITY

ARTSA—*see* Australian Road Transport Suppliers Association

Australian Road Transport Suppliers Association 2012, *A fuel economy rule for Australia?,* ARTSA, Hawthorn, Victoria, viewed 13 July 2018, <http://www.artsa.com.au/assets/articles/2012_02.pdf>.

Coast Protection Board 2016, *Coast Protection Board Policy Document,* revised 29 July 2016, Coast Protection Board, Adelaide, viewed 26 August 2018, <https://www.environment.sa.gov.au/files/sharedassets/public/coasts/coast-protection-board-policy-document-gen.pdf>.

Cubasch, U, Wuebbles, D, Chen, D, Facchini, MC, Frame, D, Mahowald, N & Winther, J-G 2013, 'Introduction', in TF Stocker, D Qin, GK Plattner, M Tignor, SK Allen, J Boschung, A Nauels, Y Xia, V Bex & PM Midgley (eds), *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge & New York.

Department of Environment, Water and Natural Resources 2015, *South Australia's Climate Change Strategy 2015–2050: Towards A Low Carbon Economy*, DEWNR, Adelaide.

Department of the Environment and Energy 2015, *State and Territory Greenhouse Gas Inventories 2015*, DoEE, Canberra.

Department of the Environment and Energy 2016, *Australia's emissions projections 2016*, DoEE, Canberra.

— Department of the Environment and Energy 2017a, *National Greenhouse Accounts Factors July 2017*, DoEE, Canberra.

— 2017b, *Quarterly Update of Australia's National Greenhouse Gas Inventory: December 2016*, DoEE, Canberra, viewed 20 September 2017, <http://www.environment.gov.au/climate-change/greenhouse-gas-measurement/publications/quarterly-update-australias-national-greenhouse-gas-inventory-dec-2016>.

DEWNR—*see* Department of Environment, Water and Natural Resources

DoEE—*see* Department of the Environment and Energy

Environment Protection Authority South Australia 2017, *Climate Change – What Do We Know About It?,* EPA SA, Adelaide, viewed 20 September 2017, <http://www.epa.sa.gov.au/soe_2013/main/clima-2-what-do-we-know-about.html>.

EPA SA—*see* Environment Protection Authority South Australia

Intergovernmental Panel on Climate Change 2013, *Fifth Assessment Report – Climate Change 2013: The Physical Science Basis – Summary for Policymaker*, IPCC, Switzerland.

IPCC—*see* Intergovernmental Panel on Climate Change

Natural Resources Kangaroo Island Management Board 2014, *Climate Change Position Statement*, NRKI, Kingscote, South Australia.

NRKI—*see* Natural Resources Kangaroo Island Management Board

Resilient Hills and Coasts 2015, *Climate change projections for the Adelaide Hills, Fleurieu Peninsula and Kangaroo Island,* report prepared for Alexandrina Council on behalf of project partners by Seed Consulting Services, Adelaide.

CHAPTER 20: ECONOMIC ENVIRONMENT

There are no references for Chapter 20

CHAPTER 21: TRAFFIC AND TRANSPORT

ABS—*see* Australian Bureau of Statistics

ARRB—*see* Australian Road Research Board

ATSB—*see* Australian Transport Safety Bureau

Austrade 2018, *Regional Tourism Satellite Accounts 2016–17*, Austrade, Canberra, viewed 2 August 2018, <https://www.tra.gov.au/research/view-all-publications/all-publications/economic-reports/regional-tourism-satellite-accounts>.

Australian Bureau of Statistics 2016, *Survey of Motor Vehicle Use, Australia, 12 months ended 30 June 2016*, ABS, Canberra, viewed 26 July 2018, <http://www.abs.gov.au/ausstats/abs@.nsf/mf/9208.0/>.

Australian Road Research Board Group 2009, *Unsealed Roads Manual, Guidelines to Good Practice* 3rd edn, ARRB, Port Melbourne, Victoria.

Australian Transport Safety Bureau 2013, *Australian Shipping Occurrence Statistics 2005 to 2012*, ATSB, Canberra.

Austroads 2009, *Guide to Road Design, Part 4A: Unsignalised and Signalised Intersections*, Austroads, Sydney.

Austroads 2014, *Quantifying the Benefits of High Productivity Vehicles*, Austroads Research Report AP-R465-14, Austroads, Sydney.

Bureau of Infrastructure, Transport and Regional Economics 2011, *Truck productivity: sources, trends and future prospects*, BITRE, Department of Infrastructure and Regional Development, Canberra, viewed 2 September 2018, <https://bitre.gov.au/publications/2011/files/report_123.pdf>.

Bureau of Infrastructure, Transport and Regional Economics 2015, *Heavy truck safety: crash analysis and trends*, BITRE, Department of Infrastructure and Regional Development, Canberra.

BITRE—*see* Bureau of Infrastructure, Transport and Regional Economics

CASR—*see* Centre for Automotive Safety and Research

Centre for Automotive Safety and Research 2017, 'Recommended road safety policies and practices for Kangaroo Island Plantation Timbers', unpub. report, CASR, Adelaide.

— Department of Planning, Transport and Infrastructure 2015a, *Annual Average Daily Traffic Estimate 24 hour two-way flows*, DPTI, Adelaide, viewed 26 July 2018, <http://www.dptiapps.com.au/traffic-maps/flowmap_rural.pdf>.

— 2015b, *Heavy Vehicle Traffic Estimates 24 hour two-way flows and percentages of AADT*, DPTI, Adelaide, viewed 26 July 2018, <http://www.dptiapps.com.au/traffic-maps/cvmaps_rural.pdf>.

— 2015c, *Registered Motor Boats*, DPTI, Adelaide, viewed 27 July 2018, <https://data.sa.gov.au/data/dataset/boat-registrations/resource/bb56cca2-c724-4a09-bd09-6dc284f6bc1a>.

Department of Planning, Transport and Infrastructure 2016, *Road Traffic Noise Guidelines*, DPTI, Adelaide.

— Department of Planning, Transport and Infrastructure 2017a, *Road Safety in the Fleurieu and Kangaroo Island Region – A report of road crashes in the Fleurieu and Kangaroo Island Region 2012–2016*, DPTI, Adelaide.

— 2017b, *Heavy Vehicle Drivers Involved in Road Crashes in South Australia*, DPTI, Adelaide.

— 2017c, *Road crashes in South Australia Statistical Summary of Road Crashes & Casualties in 2016*, DPTI, Adelaide.

Department for Transport, Energy and Infrastructure 2011, *South Australian Road Safety Strategy 2020 – Towards Zero Together*, DTEI, Adelaide.

Doley, D 2006, 'Airborne Particulates and Vegetation: Review of Physical Interactions', *Clean Air and Environmental Quality,* vol. 40, no. 2, pp. 36–42.

DPTI—*see* Department of Planning, Transport and Infrastructure

DTEI—*see* Department for Transport, Energy and Infrastructure

EBS Ecology 2018, 'KIPT Transport Route Options – Ecological Assessment', unpub. report, EBS Ecology, Adelaide.

Farmer, AM 1993, 'The Effects of Dust on Vegetation – A Review', *Environmental Pollution*, vol. 79, no. 1, pp 63–75.

Flinders Ports 2018, *Key statistics*, Flinders Ports, Port Adelaide, South Australia, viewed 27 July 2018, <https://www.flindersports.com.au/ports-facilities/port-statistics/>.

— HDS Australia 2018a, 'KIPT Freight Access Route Options – PBS Level 2B Heavy Vehicle Route Assessment', unpub. report, HDS Australia, Adelaide.

— 2018b, 'Kangaroo Island Seaport Development, Traffic Impact Assessment', unpub. report, HDS Australia, Adelaide.

Jones, D, Bernede, L, Blacker, A, Dexter, C & Strong, C 2015, 'Dust as a contributor to the road-effect zone: a case study from a minor forest road in Australia', *Australasian Journal of Environmental Management*, vol. 23, no. 1.

Kangaroo Island Council 2015, *Transport Infrastructure and Asset Management Plan, Revision 3*, KIC, Kingscote, South Australia.

KIC—*see* Kangaroo Island Council

MarineTraffic 2018, *Marine Traffic Online Services*, MarineTraffic, viewed July 2018, <https://www.MarineTraffic.com>.

Osman 2017, 'KIPT Road Freight Options Assessment', unpub. report, Kangaroo Island Plantation Timbers, Adelaide.

Primary Industries and Regions SA 2018, *Crop and Pasture Report South Australia: 2017-18 Crop Performance Summary and Final Crop Estimates*, Agriculture, Food and Wine Division of PIRSA, March 2018, Adelaide.

PIRSA—*see* Primary Industries and Regions SA

Prajapati, SK 2012, 'Ecological Effects of Airborne Particulate Matter on Plants', *Environmental Skeptics and Critics*, vol. 1, no. 1, pp. 12–22.

S&HLGA—*see* Southern & Hills Local Government Association

SA Government Gazette 2017, 'Schedule 1, Specified Development', *The South Australian Government Gazette*, Adelaide, 23 February 2017, p. 604.

Southern & Hills Local Government Association 2016, *2020 Transport Plan – 2015 Update Final Report*, S&HLGA, December 2016, Adelaide.

Thompson JR, Mueller PW, Fluckiger W & Rutter AJ 1984, 'The Effects of Dust on Photosynthesis and its Significance for Roadside Plants', *Environmental Pollution (Series A)*, vol. 34, no. 2, pp 171–190.

Transport for NSW 2018, *Boating statistics*, Centre for Maritime Safety, Transport for NSW, Sydney, viewed 27 July 2018, <http://maritimemanagement.transport.nsw.gov.au/staying-safe/boating-statistics/index.html>.

W&G—*see* Wallbridge and Gilbert Consulting Engineers

Wallbridge and Gilbert Consulting Engineers 2017, 'Forestry Access Route Assessment', unpub. report for Kangaroo Island Plantation Timbers, W&G, Adelaide.

Xinhua 2016, *Kangaroos cause more road crashes in Australia than all other animals: new data*, viewed 26 July 2018, <http://www.xinhuanet.com/english/2016-07/12/c_135506565.htm>.

YourHome 2018, *Noise Control*, Australian Government, Canberra, viewed 2 August 2018, <http://www.yourhome.gov.au/housing/noise-control>.

CHAPTER 22: SOCIAL ENVIRONMENT

ABS—*see* Australian Bureau of Statistics

Australian Bureau of Statistics 2016, *Census 2016, National Regional Profile: Kangaroo Island (Statistical Subdivision)*, ABS, Canberra, viewed 19 September 2018, <http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/41010Main%20Features12004-2008?OpenDocument&tabname=Summary&prodno=41010&issue=2004-2008&>.

Clarke, PA 1996, 'Early European Interaction with Aboriginal Hunters and Gatherers on Kangaroo Island, South Australia', *Aboriginal History*, vol. 20, pp. 51–81.

Department of Planning and Local Government 2011, *Kangaroo Island Plan*, DPLG, Adelaide.

Department of Planning, Transport and Infrastructure 2018, *Population Projections and Demographics*, *Local Government Area Projections 2011–2031*, SA Planning Portal, DPTI, Adelaide, viewed 19 September 2018, <https://www.saplanningportal.sa.gov.au/data_and_research/population_projections_and_demographics#small-area-population-projections-2011-203>.

DPLG—*see* Department of Planning and Local Government

DPTI—*see* Department of Planning, Transport and Infrastructure

EconSearch 2017, 'Economic Impact of the Smith Bay Wharf', unpub. report for Kangaroo Island Plantation Timbers, EconSearch, Adelaide.

Flood, J 2004, *Archaeology of the Dreamtime*, JB Publications, Marleston, South Australia.

Kangaroo Island Council 2015a, *Kangaroo Island Council Strategic Plan 2014–18*, Kangaroo Island Council, Kingscote, South Australia.

2015b, *The Kangaroo Island Development Plan*, Kangaroo Island Council, Kingscote, South Australia.

Kangaroo Island Community Education 2017, *Kangaroo Island Community Education*, Kangaroo Island, South Australia, viewed 19 September 2018, <http://kice.sa.edu.au/>.

OCKI—*see* Office of the Commissioner for Kangaroo Island

Office of the Commissioner for Kangaroo Island 2016, *Management Plan for Housing on Kangaroo Island*, OCKI, Kingscote, South Australia.

Office of the Commissioner for Kangaroo Island 2017, *Kangaroo Island Housing Diversity, Affordability and Availability Report*, OCKI, Kingscote, South Australia.

RAI—*see* Regional Australia Institute

Regional Australia Institute 2015, *The Case for Kangaroo Island*, RAI, Canberra.

CHAPTER 23: VISUAL AMENITY

Lothian, A 2005, *Coastal Viewscapes of South Australia*, report for the Coast Protection Branch, South Australian Department for Environment and Heritage, Scenic Solutions, Adelaide.

Lothian, A 2016, *Visual Amenity Assessment, Proposed Smith Bay Wharf, Kangaroo Island,* report for Environmental Projects, Scenic Solutions, Adelaide.

CHAPTER 24: HERITAGE

Bell, P & Austral Archaeology 2018, *Smith Bay Kangaroo Island, South Australia History of European Settlement*, report prepared for Environmental Projects, Adelaide.

Chapman, GD 1973, *Kangaroo Island Shipwrecks: An account of the ships and cutters wrecked around Kangaroo Island,* Roebuck Society Publication No. 6, Roebuck Books, Canberra.

Chapman, GD 2007, *Kangaroo Island Shipwrecks: An account of the ships and cutters wrecked around Kangaroo Island*, Gifford Chapman, Kingscote, South Australia.

Christopher, P 1990, *South Australian Shipwrecks: A Data Base 1802–1989*, Society for Underwater Historical Research, Adelaide.

Clarke, PA 1996, 'Early European Interaction with Aboriginal Hunters and Gatherers on Kangaroo Island, South Australia', *Aboriginal History* 20, pp. 51–81.

Coroneos, C & McKinnon, R 1997, *Shipwrecks of the Investigator Strait and the Lower Yorke Peninsula*, South Australian Maritime Heritage Series No. 4, Department of Environment and Natural Resources, Adelaide, South Australia & Australian Institute for Maritime Archaeology Special Publication No. 8, viewed 5 September 218, <http://www.museum.wa.gov.au/maritime-archaeology-db/bibliography/shipwrecks-investigator-strait-and-lower-yorke-peninsula>.

Dallwitz, JC, Marsden A, Marsden, S, Linn, R & Linn, J 1986, 'Heritage Survey of Kangaroo Island (Region 14 – South Australia)', unpub. report to Department of Environment and Planning, Adelaide.

DENR—*see* Department of Environment and Natural Resources

Department of Environment and Natural Resources 1996, *Investigator Strait: Maritime Heritage Trail*, DENR State Heritage Branch, DENR, Adelaide.

Department for Environment and Water 2018, *The South Australian Heritage Places Database*, State Heritage Branch, DEW, Adelaide, viewed 18 April 2018, <www.location.sa.gov.au>.

Department of State Development Division for Aboriginal Affairs and Reconciliation 2016, *Register Search Results letter*, received 15 December 2016, DSDAAR, Adelaide.

— Department of the Environment and Energy 2018a, Australian National Shipwreck Database, DoEE, Canberra, viewed 18 April 2018, <http://www.environment.gov.au/heritage/historic-shipwrecks/australian-national-shipwreck-database>.

— Department of the Environment and Energy 2018b, Australian Heritage Places Inventory, DoEE, Canberra, viewed 12 December 2018, <https://www.environment.sa.gov.au/topics/heritage/sa-heritage-register ≥

DEW—*see* Department for Environment and Water

DoEE—*see* Department of the Environment and Energy

DSDAAR—*see* Department of State Development Division for Aboriginal Affairs and Reconciliation

EBS Heritage 2017, *Smith Bay Kangaroo Island Heritage Assessment (Desktop)*, report prepared for Environmental Projects, EBS Heritage, Adelaide.

Lampert, RJ, 1980, 'Variation in Australia's Pleistocene Stone Industries', *Journal de la Société des Océanistes*, no. 68, vol. 36, pp. 190–206.

Lampert, RJ 1981, 'The great Kartan mystery', *Terra Australis 5*, Department of Prehistory, Research School Of Pacific Studies, Australian National University, Canberra.

Lampert, RJ 2002, 'Chapter 7: Aborigines', in M Davies, CR Twidale & MJ Tyler (eds), *Natural History of Kangaroo Island,* 2nd edn, Royal Society of South Australia, Richmond, South Australia.

Loney, J 1983, *Wrecks on the South Australian Coast (including Kangaroo Island),* Lonestone Press, Yarram, Victoria.

Loney, J 1987, *Australian Shipwrecks Volume 4: 1901–1986,* Marine History Publications, Portarlington, Victoria.

Maritime Heritage Surveys 2017, *Smith Bay Underwater Cultural Heritage Assessment,* report prepared for LBW|ep, Maritime Heritage Surveys, West Beach, South Australia.

National Native Title Tribunal 2018, *National Native Title Tribunal Register*, NNTT, Brisbane, viewed 18 April 2018, <www.nntt.gov.au>.

NNTT—*see* National Native Title Tribunal

Parsons, R 1986, *Southern passages: A maritime history of South Australia,* Wakefield Press, Adelaide.

Taylor, R 2002, *Unearthed: the Aboriginal Tasmanians of Kangaroo Island,* Wakefield Press, Adelaide.

CHAPTER 25: MANAGEMENT OF HAZARD AND RISK

There are no references for Chapter 25

CHAPTER 26: ENVIRONMENTAL MANAGEMENT FRAMEWORK

AS/NZS—*see* Australian/New Zealand Standard.

Australian/New Zealand Standard 2016, ISO 14001:2015 *Environmental management systems – Requirements with guidance for use,* 3rd edn, Standards Australia, Sydney, and Standards New Zealand, Wellington.

CHAPTER 27: COMMITMENTS

There are no references for Chapter 27

ACTS REFERRED TO IN THE EIS

1.South Australian Legislation

Aboriginal Heritage Act 1988

Aquaculture Act 2001

Climate Change and Greenhouse Emissions Reduction Act 2007

Coast Protection Act 1972

Dangerous Substances Act 1979

Development Act 1993

Environment Protection Act 1993

Fire and Emergency Services Act 2005

Fisheries Management Act 2007

Harbors and Navigation Act 1993

Heritage Places Act 1993

Historic Shipwrecks Act 1981

Livestock Act 1997

Marine Parks Act 2007

Motor Vehicles Act 1959

National Environment Protection Council (South Australia) Act 1995

Native Title (South Australia) Act 1994

Native Vegetation Act 1991

National Parks and Wildlife Act 1972

Natural Resources Management Act 2004

Planning, Development and Infrastructure Act 2016 to replace the Development Act 1993

Plant Health Act 2009

Protection of Marine Waters (Prevention of Pollution from Ships) Act 1987

Road Traffic Act 1961

2. Commonwealth Legislation

Biosecurity Act 2015

Environment Protection and Biodiversity Conservation Act 1999

Environment Protection (Sea Dumping) Act 1981

Historic Shipwrecks Act 1976

Income Tax Assessment Act 1936

Marine Safety (Domestic Commercial Vessel) National Law Act 2012

Maritime Transport and Offshore Facilities Security Act 2003

National Environment Protection Council Act 1994

National Greenhouse and Energy Reporting Act 2007

Native Title Act 1993

Navigation Act 2012

Protection of the Sea (Prevention of Pollution from Ships) Act 1983

Protection of the Sea (Harmful Anti-fouling Systems) Act 2006

GIS DATA SOURCES

CHAPTER 1 - INTRODUCTION

Figure 1.1: Kangaroo Island showing Smith Bay location

Proposed KI Seaport - EBS created for EIS based on information provided from KIPT

Sealed Road - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

State Marine Park Network - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=989+&pa=dewnr

State Marine Park Special Purpose Area - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=986+&pa=dewnr

Protected Areas - http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=137&pa=dewnr

Land – Geoscience Australia. 2007. Geodata topo 250K

Coastline – Geoscience Australia. 2007. Geodata topo 250K

Place – Geoscience Australia. 2007. Geodata topo 250K

Figure 1.3: KIPT's forestry plantation assets

Place - Geoscience Australia. 2007. Geodata topo 250K

Road - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

KIPT Access Point - EBS created for EIS based on information provided from KIPT

KIPT Forestry Asset - EBS created for EIS based on information provided from KIPT

Other forestry asset (Non KIPT) - EBS created for EIS based on information provided from KIPT - Forestry map

Land - Geoscience Australia. 2007. Geodata topo 250K

Coastline - Geoscience Australia. 2007. Geodata topo 250K

Figure 1.4: Smith Bay site comprising allotment 51 and 52

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Proposed site of onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

CHAPTER 2 - PROJECT JUSTIFICATION

Figure 2.2: Locality map of Kangaroo Islands plantation properties

Silivulture plantations – KIPT

Conservation reserves - http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=137&pa=dewnr

Sealed Road - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Unsealed Road - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Ferry- http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

CHAPTER 3 - PROJECT ALTERNATIVES

Figure 3.1: Evaluated location alternatives for a KI Seaport

Sealed Road - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Unsealed Road - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Alternative Wharf Site - EBS created for EIS based on information provided from KIPT and Geoscience Australia

KIPT Asset - EBS created for EIS based on information provided from KIPT

KIPT Forestry Asset - EBS created for EIS based on information provided from KIPT – Forestry map

Other forestry asset (Non KIPT) - EBS created for EIS based on information provided from KIPT - Forestry map

Land - Geoscience Australia. 2007. Geodata topo 250K

Place - Geoscience Australia. 2007. Geodata topo 250K

Coastline - Geoscience Australia. 2007. Geodata topo 250K

Figure 3.2: Revised concept design for the KI Seaport

Aerial - 2015_KangarooIslandCoast_125mm.ecw

KIPT Wharf Design - 140132 - KIPT Export Facility – Site Plan – AZTEC

KI boundary - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

CHAPTER 4 – PROJECT DESCRIPTION

Figure 4.3: Conceptual layout of the KI Seaport infrastructure

Aerial - 2015_KangarooIslandCoast_125mm.ecw

KIPT Wharf Design - 140132 - KIPT Export Facility – Site Plan – AZTEC

Figure 4.11: Proposed marine and contractor activity zone

Aerial - 2015_KangarooIslandCoast_125mm.ecw

KIPT Wharf Design - 140132 - KIPT Export Facility – Site Plan – AZTEC

100m marine activity zone – EP created

Figure 4.12: Proposed marine and contractor activity zone

Aerial - 2015_KangarooIslandCoast_125mm.ecw

KIPT Wharf Design - 140132 - KIPT Export Facility – Site Plan – AZTEC

100m marine activity zone – EP created

Contractor activity zone – EP created

Figure 4.13: Indicative dredging layout and geometry

Aerial - 2015_KangarooIslandCoast_125mm.ecw

KIPT Wharf Design - 140132 - KIPT Export Facility – Site Plan – AZTEC

Contours - 140132 - KIPT Export Facility – Site Plan – AZTEC

Figure 4.14: Indicative dredge pond layout

Maritime Constructions

Figure 4.15: Conceptual temporary exclusion zone layout

Aerial - 2015_KangarooIslandCoast_125mm.ecw

KIPT Wharf Design - 140132 - KIPT Export Facility – Site Plan – AZTEC

Water side restricted area – EP created

Figure 4.16: Conceptual temporary exclusion zone layout

Aerial - 2015_KangarooIslandCoast_125mm.ecw

KIPT Wharf Design - 140132 - KIPT Export Facility – Site Plan – AZTEC

Waterside restricted area – EP created

CHAPTER 6 – LAND USE AND PLANNING

Figure 6.1: The study (or designated) area

Allotment information - Government Gazette 23 February 2017 & From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Figure 6.2: Land uses

Proposed site of onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Land use – LANDSCAPE_LandUse_ALUM - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=2072+&pa=dewnr

Figure 6.3: Land tenure

Cadastre information - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Figure 6.4: Aquaculture licences

Cadastre and licence information - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

CHAPTER 9 – MARINE WATER QUALITY

Figure 9.1: Location of oceangraphic and water quality instruments and sediment sampling sites at smith bay

KIPT wharf design - 140132 - KIPT Export Facility – Site Plan - AZTEC

Intake pipelines - 140132 - KIPT Export Facility – Site Plan - AZTEC

Sediment sampling location – BMT

Instrument locations – BMT

Elevation - BMT

Figure 9.7: Zones of impact- TSS/Turbidity - Expected Case (summer and Winter)

Proposed dredge footprint - 140132 - KIPT Export Facility – Site Plan - AZTEC

Intake pipelines - 140132 - KIPT Export Facility – Site Plan - AZTEC

Zones of impact - TSS/turbidity (expected case) - BMT

Figure 9.8: Zones of impact- TSS/Turbidity - Worst Case (summer and Winter)

Proposed dredge footprint - 140132 - KIPT Export Facility – Site Plan - AZTEC

Intake pipelines - 140132 - KIPT Export Facility – Site Plan - AZTEC

Zones of impact - TSS/turbidity (worst case) - BMT

Figure 9.10: Zones of impact- TSS/Turbidity - Causeway construction (summer and Winter)

Proposed dredge footprint - 140132 - KIPT Export Facility – Site Plan - AZTEC

Intake pipelines - 140132 - KIPT Export Facility – Site Plan - AZTEC

Zones of impact - TSS/turbidity - BMT

Figure 9.12: Zones of impact- Sediment deposition – worst case (summer and Winter)

Proposed dredge footprint - 140132 - KIPT Export Facility – Site Plan - AZTEC

Intake pipelines - 140132 - KIPT Export Facility – Site Plan - AZTEC

Zones of impact – sediment deposition - BMT

CHAPTER 10 – COASTAL PROCESSES

Figure 10.1: Bathymetry of Smith Bay

Aerial - 2015_KangarooIslandCoast_125mm.ecw

KIPT wharf design - 140132 - KIPT Export Facility – Site Plan - AZTEC

Bathymetry depth & contour lines – 140132 – KIPT Export Facility – Site Plan – AZTEC

CHAPTER 11 – LAND-BASED AQUACULTURE

Figure 11.1 Satellite image showing three aquaculture licences that have been issued by PIRSA to Yumbah Kangaroo Island Pty Ltd

Licence information - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=950

Figure 11.2: Yumbah abalone farm facilities in relation to the proposed KI Seaport

Cadastre information - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Pipelines - 140132 - KIPT Export Facility – Site Plan – AZTEC

Discharging locations - 140132 - KIPT Export Facility – Site Plan – AZTEC

Dredging extents and wharf layout - 140132 - KIPT Export Facility – Site Plan – AZTEC

Bathymetry - 140132 - KIPT Export Facility – Site Plan – AZTEC

CHAPTER 12 – MARINE ECOLOGY

Figure 12.1: Wharf layout showing the proposed extent of dredging

Aerial - 2015_KangarooIslandCoast_125mm.ecw

KIPT wharf design - 140132 - KIPT Export Facility – Site Plan - AZTEC

Bathymetry depth & contour lines - 140132 - KIPT Export Facility – Site Plan - AZTEC

Yumbah seawater intake pipelines - 140132 - KIPT Export Facility – Site Plan - AZTEC

Disused intake pipelines - 140132 - KIPT Export Facility – Site Plan - AZTEC

Yumbah seawater discharge locations - 140132 - KIPT Export Facility – Site Plan - AZTEC

Extents of dredging - 140132 - KIPT Export Facility – Site Plan - AZTEC

KI Seaport - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Figure 12.2: Existing habitat mapping for the central north coast of Kangaroo Island

Bathymetry contour - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1121+&pa=dewnr

RSL Site – http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1224&pu=y&pa=dewnr.

National Benthic mapping - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1224+&pa=dewnr

Road - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Land - Geoscience Australia. 2007. Geodata topo 250K

Place - Geoscience Australia. 2007. Geodata topo 250K

Proposed KI Seaport - EBS created for EIS based on information provided from KIPT

State Marine Park Network - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=989+&pa=dewnr

Figure 12.3: Marine parks around Kangaroo Island

Proposed KI Seaport - EBS created for EIS based on information provided from KIPT

State Marine Park Network - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=989+&pa=dewnr

State Marine Park Special Purpose Area - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=986+&pa=dewnr

Land - Geoscience Australia. 2007. Geodata topo 250K

Place - Geoscience Australia. 2007. Geodata topo 250K

Coastline - Geoscience Australia. 2007. Geodata topo 250K

Figure 12.5: Distribution of marine habitats in Smith Bay

KIPT wharf design - 140132 - KIPT Export Facility – Site Plan - AZTEC

Smith Bay dive site/depth & Spot dives - David Wiltshire Marine survey

Benthic habitat (dive site results) - David Wiltshire Marine survey

Bathymetry - 140132 - KIPT Export Facility – Site Plan - AZTEC

Aerial - Esri

CHAPTER 13 – TERRESTRIAL ECOLOGY

Figure 13.1: Parks and reserves

Protected Areas - http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=137&pa=dewnr

Proposed KI Seaport - EBS created for EIS based on information provided from KIPT

Coastline - Geoscience Australia. 2007. Geodata topo 250K

Land - Geoscience Australia. 2007. Geodata topo 250K

Place - Geoscience Australia. 2007. Geodata topo 250K

Figure 13.2: Regional environmental associations

Roads - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Coastline - Geoscience Australia. 2007. Geodata topo 250K

Land - Geoscience Australia. 2007. Geodata topo 250K

Place - Geoscience Australia. 2007. Geodata topo 250K

IBRA - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1107+&pa=dewnr

Figure 13.3: Vegetation associations

Proposed site for onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Vegetation association - From EBS terrestrial Ecology field survey

Figure 13.4: Vegetation condition

Proposed site for onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Vegetation condition - From EBS terrestrial Ecology field survey

Figure 13.5: Kangaroo Island narrow-leaved mallee woodland ecological community

Potential narrow leaf mallee - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=898&pu=y

Roads - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Coastline - Geoscience Australia. 2007. Geodata topo 250K

Land - Geoscience Australia. 2007. Geodata topo 250K

Place - Geoscience Australia. 2007. Geodata topo 250K

Figure 13.6: Locations of echidna diggings within the study area

Echidna diggings - From EBS terrestrial Ecology field survey

Proposed site for onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Figure 13.7: Distance of Smith Bay to known raptor nests

Threatened birds - From EPBC referral Map 1: Distances from proposed Smith Bay development to protected coastal raptors nest location (DEWNR 2016).

Threatened birds distances - From EPBC referral Map 1: Distances from proposed Smith Bay development to protected coastal raptors nest location (DEWNR 2016).

Proposed KI Seaport - EBS created for EIS based on information provided from KIPT

Land - Geoscience Australia. 2007. Geodata topo 250K

Coastline - Geoscience Australia. 2007. Geodata topo 250K

Roads - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Protected area - http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=137&pa=dewnr

CHAPTER 14 – MNES

Figure 14.1: Location of echidna diggings within the study area

Echidna diggings - From EBS terrestrial Ecology field survey

Proposed site for onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Figure 14.2: Records of the hooded plover (eastern) in the vicinity of the study area

Hooded Plover - 18 July 2017 Dr Grainne Maguire, pers. Comm. (Birdlife Australia)

Proposed site for onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Figure 14.3: Records of the southern brown bandicoot (eastern) in the vicinity of the study area

Southern Brown Bandicoot - Extract from https://data.environment.sa.gov.au/Content/Publications/bdbsa-supertable-field-definitions-fact.pdf

Coast - Geoscience Australia. 2007. Geodata topo 250K

Roads - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Land - Geoscience Australia. 2007. Geodata topo 250K

Proposed KI Seaport - EBS created for EIS based on information provided from KIPT

Conservation Parks - http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=137&pa=dewnr

Place - Geoscience Australia. 2007. Geodata topo 250K

Figure 14.4: Location of reported vessel collisions, or strandings where death was attributed to vessel collision (DoEE 2016)

https://www.environment.gov.au/system/files/consultations/bd6174ee-1a4e-4b6d-b786-2d0675b3dbec/files/draft-national-vessel-strike-strategy.pdf

Figure 14.5: Shipping intensity in relation to important areas for southern right whales (DoEE 2016)

https://www.environment.gov.au/system/files/consultations/bd6174ee-1a4e-4b6d-b786-2d0675b3dbec/files/draft-national-vessel-strike-strategy.pdf

Figure 14.6 Biologically important areas for the southern right whale (DoEE 2014)

Place - Geoscience Australia. 2007. Geodata topo 250K

Land - Geoscience Australia. 2007. Geodata topo 250K

Proposed KI Seaport - EBS created for EIS based on information provided from KIPT

Ferry- http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Breeding, calving buffer, seasonal salving habitat, known core range - http://www.environment.gov.au/fed/catalog/search/resource/details.page?uuid=%7B2ed86f5a-4598-4ae9-924f-ac821c701003%7D

CHAPTER 15 – BIOSECURITY

Figure 15.1: Locations of declared weed species during 2016 field survey

Proposed site for onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Weed points - From EBS terrestrial Ecology field survey

Weed areas - From EBS terrestrial Ecology field survey

Figure 15.3: Same risk areas for ballast water management in South Australia

Proposed KI Seaport - EBS created for EIS based on information provided from KIPT

Ballast water risk areas – EBS created for EIS based on information provided by DAWR Australian Ballast Water Management Requirements 2017

Coast - Geoscience Australia. 2007. Geodata topo 250K

Roads - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Land - Geoscience Australia. 2007. Geodata topo 250K

Protected areas - http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=137&pa=dewnr

CHAPTER 16 – GEOLOGY, SOILS AND WATER

Figure 16.1: Geology map

Geology (from IBRA) - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1107+&pa=dewnr

Roads - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Coastline - Geoscience Australia. 2007. Geodata topo 250K

Land - Geoscience Australia. 2007. Geodata topo 250K

Place - Geoscience Australia. 2007. Geodata topo 250K

Proposed KI Seaport - EBS created for EIS based on information provided from KIPT

Figure 16.2: Regional contours map

Place - Geoscience Australia. 2007. Geodata topo 250K

Land - Geoscience Australia. 2007. Geodata topo 250K

Roads - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Coast - Geoscience Australia. 2007. Geodata topo 250K

50m contour - Geoscience Australia. 2007. Geodata topo 250K

Proposed KI Seaport - EBS created for EIS based on information provided from KIPT

Figure 16.3: Regional soils map

Place - Geoscience Australia. 2007. Geodata topo 250K

Proposed KI Seaport - EBS created for EIS based on information provided from KIPT

Soil groups - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1105+&pa=dewnr

Figure 16.4: Regional acid sulfate soils map

Probability of acid sulfate soils - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1078&pu=y&pa=dewnr

Place - Geoscience Australia. 2007. Geodata topo 250K

Land - Geoscience Australia. 2007. Geodata topo 250K

Proposed KI Seaport - EBS created for EIS based on information provided from KIPT

Roads - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Figure 16.5: Surface water map

Water course - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=903&pu=y&pa=dewnr

Waterbody - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=902&pu=y&pa=dewnr

Proposed site for onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Surface water catchment - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1028&pu=y&pa=dewnr

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Figure 16.6: Regional groundwater aquifer and hydrogeological characteristics

Place - Geoscience Australia. 2007. Geodata topo 250K

Proposed KI Seaport - EBS created for EIS based on information provided from KIPT

Groundwater aquifer - http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=1613&pu=y&pa=dewnr

Groundwater basin - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1950+&pa=dewnr

Groundwater province - https://data.sa.gov.au/data/dataset/9dc7a10f-dc1c-46ec-ade5-f25cd630f727

Figure 16.7: Soil bore locations

Study area boundary - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Geotech locations - From geology survey Joe Pedicini

Figure 16.8: Groundwater grab sample locations

Study area boundary - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Groundwater grab samples - From geology survey Joe Pedicini

Septic locations - From geology survey Joe Pedicini

Figure 16.9: Site contours map (m RL) map

Proposed site of onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Contours - 140132 - KIPT Export Facility - Site – AZTEC

CHAPTER 17 – AIR QUALITY

Figure 17.1: Conceptual layout of the proposed KI Seaport

Aerial - 2015_KangarooIslandCoast_125mm.ecw

KIPT wharf design - 140132 - KIPT Export Facility – Site Plan - AZTEC

Figure 17.2: Sensitive receivers in the study area

Sensitive receptors – Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Proposed site of onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Figure 17.8: Location of construction phase emission sources

Aerial - 2015_KangarooIslandCoast_125mm.ecw

KIPT wharf design - 140132 - KIPT Export Facility – Site Plan - AZTEC

Construction emissions - Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Sensitive receivers – Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Figure 17.9: Location of operations phase emissions sources

Aerial - 2015_KangarooIslandCoast_125mm.ecw

KIPT wharf design - 140132 - KIPT Export Facility – Site Plan - AZTEC

Operations emissions - Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Sensitive receivers – Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Figure 17.10a: Construction phase PM_{10} – Maximum 24-hour average ground-level concentration (µg/m^3) (including background)

Emission contours - Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Sensitive receivers – Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Proposed site of onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Figure 17.10b: Construction phase $PM_{2.5}$ – Maximum 24-hour average ground-level concentration (µg/m^3) (including background)

Emission contours - Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Sensitive receivers – Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Proposed site of onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Figure 17.10c: Construction phase PM_{10} - Annual average ground-level concentration (µg/m^3) (including background)

Emission contours - Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Sensitive receivers – Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Proposed site of onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Figure 17.10d: Construction phase – TSP dust deposition rate (g/m^2/month) (including background)

Emission contours - Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Sensitive receivers – Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Proposed site of onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Figure 17.11a: Operations phase PM_{10} – Maximum 24-hour average ground-level concentration (µg/m^3) (including background)

Emission contours - Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Sensitive receivers – Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Proposed site of onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Figure 17.11b: Operations phase $PM_{2.5}$ – Maximum 24-hour average ground-level concentration (µg/m^3) (including background)

Emission contours - Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Sensitive receivers – Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Proposed site of onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Figure 17.11c: Operations phase PM_{10} – Annual average ground-level concentration (µg/m^3) (including background)

Emission contours - Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Sensitive receivers – Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Proposed site of onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Figure 17.11d: Operations phase – TSP dust deposition rate (g/m^2/month) (including background)

Emission contours - Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Sensitive receivers – Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Proposed site of onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

CHAPTER 18 – NOISE AND LIGHT

Figure 18.1: Project location and sensitive receivers

Sensitive receivers – Lathwida report - Kangaroo Island Plantation Timbers – Dust Assessment 2017 – David Winterburn

Proposed site of onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Figure 18.2: Baseline measurement locations

Measurement locations & residence – Resonate report 2018 – Kangaroo Island Plantation Timbers EIS, Environmental Noise Impact Assessment

Proposed site of onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Figure 18.4: Predicted noise levels (no mitigation)

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Proposed KI Seaport - 140132 - KIPT Export Facility – Site Plan - AZTEC

Unmitigated noise levels - Resonate report 2018 – Kangaroo Island Plantation Timbers EIS, Environmental Noise Impact Assessment

Figure 18.5: Baseline underwater noise measurement location

Measurement location – Resonate report 2018 – Kangaroo Island Plantation Timbers EIS, Environmental Noise Impact Assessment

Proposed site of onshore facility - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Aerial - 2015_KangarooIslandCoast_125mm.ecw

Figure 18.9: Predicted cutter-suction dredging noise levels (SPL dB re 1µPa)

Noise contours - Resonate report 2018 – Kangaroo Island Plantation Timbers EIS, Environmental Noise Impact Assessment

Proposed KI Seaport - 140132 - KIPT Export Facility – Site Plan - AZTEC

Roads - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Place - Geoscience Australia. 2007. Geodata topo 250K

Land - Geoscience Australia. 2007. Geodata topo 250K

Figure 18.10: Predicted piling noise levels (PEAK dB re 1µPa)

Noise contours - Resonate report 2018 – Kangaroo Island Plantation Timbers EIS, Environmental Noise Impact Assessment

Proposed KI Seaport - 140132 - KIPT Export Facility – Site Plan - AZTEC

Roads - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Place - Geoscience Australia. 2007. Geodata topo 250K

Land - Geoscience Australia. 2007. Geodata topo 250K

CHAPTER 20 – ECONOMIC ENVIRONMENT

Figure 20.1: Proposed road closure

KIPT land - From Cadastre http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

Privatised road – EP created

Cadastre information - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=832+&pa=dpti

CHAPTER 21 – TRAFFIC AND TRANSPORT

Figure 21.2: Forestry and KIPTs operations

Place - Geoscience Australia. 2007. Geodata topo 250K

Road - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

KIPT Forestry Asset - EBS created for EIS based on information provided from KIPT – Forestry map

Other forestry asset (Non KIPT) - EBS created for EIS based on information provided from KIPT - Forestry map

Land - Geoscience Australia. 2007. Geodata topo 250K

Coastline - Geoscience Australia. 2007. Geodata topo 250K

Figure 21.3: Roads which could be frequently used in an open network (single articulated truck) model

Proposed KI Seaport- EBS created for EIS based on information provided from KIPT – Forestry map

KIPT forestry asset - EBS created for EIS based on information provided from KIPT - Forestry map

Place - Geoscience Australia. 2007. Geodata topo 250K

Road - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Land - Geoscience Australia. 2007. Geodata topo 250K

Coastline - Geoscience Australia. 2007. Geodata topo 250K

Figure 21.4: Sealed and unsealed roads on Kangaroo Island

Place - Geoscience Australia. 2007. Geodata topo 250K

Road - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Community areas – EP created

Proposed KI Seaport - EBS created for EIS based on information provided from KIPT – Forestry map

KIPT Landholding - EBS created for EIS based on information provided from KIPT – Forestry map

KIPT Forestry Asset - EBS created for EIS based on information provided from KIPT – Forestry map

Other forestry asset (Non KIPT) - EBS created for EIS based on information provided from KIPT - Forestry map

Land - Geoscience Australia. 2007. Geodata topo 250K

Coastline - Geoscience Australia. 2007. Geodata topo 250K

Figure 21.5: Typical tourist and current bus routes on Kangaroo Island

Place - Geoscience Australia. 2007. Geodata topo 250K

Road - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Bus stops and bus routes - KICE – Kangaroo Island Community Education Bus Runs 2017

Community areas – EP created

Key tourist routes – EP created based on information from The South Australian Tourism Commission

Proposed KI Seaport - EBS created for EIS based on information provided from KIPT – Forestry map

KIPT Landholding - EBS created for EIS based on information provided from KIPT – Forestry map

KIPT Forestry Asset - EBS created for EIS based on information provided from KIPT – Forestry map

Other forestry asset (Non KIPT) - EBS created for EIS based on information provided from KIPT - Forestry map

Land - Geoscience Australia. 2007. Geodata topo 250K

Coastline - Geoscience Australia. 2007. Geodata topo 250K

Figure 21.6: Ecological sensitivity map of transport routes

EBS created (EBS Transport Route Options Ecological Assessment)

Figure 21.8: KIPT's selected route

Preferred option - EP created for EIS based on information provided from KIPT

KIPT forestry asset - EBS created for EIS based on information provided from KIPT - Forestry map

Other forestry asset (Non KIPT) - EBS created for EIS based on information provided from KIPT - Forestry map

Place - Geoscience Australia. 2007. Geodata topo 250K

Road - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Land - Geoscience Australia. 2007. Geodata topo 250K

Coastline - Geoscience Australia. 2007. Geodata topo 250K

Figure 21.10: Density map showing large (gross tonne 25,000–60,000) and very large (gross tonne >60,0000) vessels passing through Investigator Strait in 2017 (MarineTraffic 2018)

Marine Traffic 2018 - https://www.marinetraffic.com/en/ais/home/centerx:137.0/centery:-35.5/zoom:8

Figure 21.11: Proposed marine activity zone

Aerial - 2015_KangarooIslandCoast_125mm.ecw

KIPT Wharf Design - 140132 - KIPT Export Facility – Site Plan – AZTEC

100m marine activity zone – EP created

Figure 21.12: Conceptual temporary exclusion zone layout when vessels berthed

Aerial - 2015_KangarooIslandCoast_125mm.ecw

KIPT Wharf Design - 140132 - KIPT Export Facility – Site Plan – AZTEC

Water side restricted area – EP created

CHAPTER 23 – VISUAL AMENITY

Figure 23.1: Landscape quality rating for the Smith Bay region

Proposed KI Seaport - EBS created for EIS based on information provided from KIPT

Roads - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Place - Geoscience Australia. 2007. Geodata topo 250K

Land - Geoscience Australia. 2007. Geodata topo 250K

Landscape quality - Lothian, A 2005, Coastal Viewscapes of South Australia: Report for the Coast Protection Branch South Australian Department for Environment and Heritage, Report by Dr Andrew Lothian of Scenic Solutions.

Figure 23.2: Smith Bay – Key locations (L) showing viewpoints

EP created - 3D Visual Assessment of KI Seaport (Appendix R1)

CHAPTER 24 – HERITAGE

Figure 24.2: Local heritage sites and the proposed location of the KI Seaport

Place - Geoscience Australia. 2007. Geodata topo 250K

Land - Geoscience Australia. 2007. Geodata topo 250K

Coastline - Geoscience Australia. 2007. Geodata topo 250K

Roads - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Shipwrecks - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1038&pu=y&pa=dewnr

Local heritage places - http://www.location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=1576&pu=y

Figure 24.3: Heritage sites in the vicinity of the study area

Place - Geoscience Australia. 2007. Geodata topo 250K

Aerial - 2015_KangarooIslandCoast_125mm.ecw

KIPT wharf design - 140132 - KIPT Export Facility - Site - AZTEC

Ruins - Recorded onsite - EBS created

Shipwrecks - http://location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=1038&pu=y&pa=dewnr

Roads - http://www.location.sa.gov.au/lms/Reports/ReportMetadata.aspx?p_no=558&pu=y

Smith Bay Channel - Dr Peter Bell and Austral Archaeology Pty Ltd (Smith Bay, Kangaroo Island, South Australia History of European Settlement)

Whittaker ruin - http://www.location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=1576&pu=y

Land - Geoscience Australia. 2007. Geodata topo 250K

Coastline - Geoscience Australia. 2007. Geodata topo 250K

29. GLOSSARY

Term	Definition
Acoustic doppler current profiler	Instrument used to measure the velocity of flow in rivers and creeks.
A-double truck	Two semi-trailers linked by a converter dolly between the two trailers.
Alkali	A substance with a pH greater than 7.0.
Allocasuarina	A genus of trees in the flowering plant family Casuarinaceae, which are endemic to Australia, particularly the south.
Alluvium	Soil deposited by river or floodwater.
Amenity (visual)	The pleasantness of a place taken in by sight.
Anaerobic	Living in the absence of oxygen.
Annual Average Daily Traffic (AADT)	The term used to show the average traffic volume in both directions on a section of road, adjusted for seasonal variation.
Anthropogenic	Caused by human activity.
Anthropogenic noise	Sound generated by humans.
Antifoulant	A coating, paint, surface treatment or device used on the bottom of ships to control or prevent the attachment of unwanted organisms.
Aquaculture	The cultivation of aquatic organisms (including fish, shellfish and crustaceans) for the purposes of human use or to replenish wild stocks.
Aquifer	A water-bearing bed of permeable rock, sand or gravel.
Articulated truck	An articulated goods vehicle consisting of a prime mover and a detachable trailer.
Ascidian	A small filter-feeding, sac-like marine invertebrate; commonly known as a seasquirt.
Astronomical tide	The tidal levels of the sea resulting from the gravitational forces exerted by the Moon, the Sun and the rotation of the Earth.
ASX-listed company	A company listed on the Australian Securities Exchange (ASX).
ATCO-style (units)	Portable, modular buildings often used as temporary site offices on building sites.
Audiogram	A graphic record of hearing ability.
Australian height datum (AHD)	The official applied datum for measuring altitude in Australia, which sets mean sea level as zero elevation.
Backhoe dredge	A pontoon equipped with a hydraulic excavator.
Ballast water	Water carried in ships' ballast tanks to improve stability, balance and trim.
Barnacle	A small marine crustacean with a shell, that sticks closely to the bottom of boats and rocks.
Baseline	A basic standard, level or initial known value usually regarded as a reference point for comparison.
Bathymetric (survey)	The measurement of the underwater depth of the ocean floor and the mapping of the ocean floor topography.
Bathymetry	Measurement of depth of water in oceans, seas, or lakes.
Battery limits	A geographic boundary defining the onshore scope of the Project.
Bed shear stress	A measure of the force of moving water against the bed of a water channel.
Benchmark	Standard used as a point of reference for evaluating level of quality or against which things may be compared. Benchmarking often refers to the process of evaluating various aspects of a process in relation to 'best practice'.
Benthic community	Animals and plants that live on the bottom of the ocean floor.
Berthing pocket	A designated location in a wharf structure used for mooring vessels when they are not at sea.

Term	Definition
Berthing velocity	The velocity with which a ship closes with a berth.
Bilge water	Foul water that collects inside a ship's bilges.
Biochemical oxygen demand (BOD)	The amount of dissolved oxygen required by microorganisms to metabolise organic matter in water under specific conditions.
Biofouling	Growth of marine organisms on the surfaces of underwater structures such as ship hulls.
Biomass	Renewable, organic matter that is used to produce energy e.g. wood is burned to create heat.
Bioregion	An area of land or water that contains a geographically distinct grouping of natural communities.
Biosecurity	Security measures taken against the transmission of disease to the plants or animals of a particular region.
Biounit	A geographic (marine) area usually between 30-100 km long which contains similar marine habitats.
Blue carbon	The term for carbon captured and stored by the world's ocean and coastal ecosystems.
Broadcast spawners	Animals who release their eggs and sperm into the water, where fertilisation occurs externally.
Buffer zone	A designated area of land within or around the Project area used to identify and study matters of national environmental significance.
Bund	An area protected by a low wall built to prevent the spread of dangerous substances.
Calcarenite	A type of limestone predominantly made up of carbonate grains.
Calcareous	A sediment, sedimentary rock or soil type that is formed from, or contains a high proportion of calcium carbonate in the form of calcite or aragonite.
Calcrete	A conglomerate cemented together by calcareous material.
Calmet	A diagnostic meteorological model, which reconstructs the 3D wind and temperature fields starting from meteorological measurements, orography and land use data.
CALPUFF	An advanced, integrated puff modelling system for the simulation of atmospheric pollution dispersion.
Cambrian Age	The period of geological time between 500 million and 570 million years ago.
Carbon capture and storage	The capture of carbon dioxide (CO_2) directly from industrial or power plant fossil fuel sources and its removal to secure subsurface reservoirs for long-term storage, either on land or beneath the seabed of the ocean.
Carbon neutrality	Where an organisation or country balances its carbon emissions against its carbon reductions in order to achieve a zero carbon footprint.
Carbon offsets	A reduction of greenhouse gases made in order to compensate for, or to offset, an emission made elsewhere.
Carbon sequestration	A process by which carbon dioxide is removed from the atmosphere and held in long-term storage.
Catch and effort	The catch per unit effort (CPUE) is an indirect measure of the abundance of a target species.
Catchment	An area of land, usually surrounded by mountains or hills, over which water flows and is collected.
Causeway	A raised road, path or railway on top of an embankment usually across a broad body of water, low or wet ground.
Centrifugal force	A force which appears to act on a body moving in a circular path and which is directed away from the centre around which the body is moving.
Coastal dune systems	Sand and gravel deposits within a marine beach system deposited by wave or wind action.
Coastal reserve foreshore	The part of a protected area on the coast between high-water and low-water marks or the ground between the water's edge and developed land.

Term	Definition
Cobalt	A chemical element with symbol Co and atomic number 27; found in the Earth's crust in compounds which afford it a distinctive blue colouring.
Convective processes	The circular motion that occurs when warmer air or liquid rises in the atmosphere, while the cooler air or liquid drops. Convective processes are essential to the formation of many types of clouds, hurricanes and weather phenomena.
Cut-and-fill operations	An earthmoving method by which earth taken away (cut) from one site is used as fill at a nearby site.
Cutter suction dredge	A stationary dredger equipped with a cutter device that excavates the soil before it is sucked up by the flow of the dredge pump(s).
Cyst	A protective capsule enclosing the larva of a parasitic worm or the resting stage of an organism.
Dark respiration	A form of respiration in plants and some microorganisms where carbon dioxide is released without the aid of (sun)light.
Deadweight tonnage (DWT)	DWT is a measurement of the total contents of a ship including cargo, fuel, fresh water, ballast water, provisions, passengers and crew. Often used to specify a ship's maximum permissible weight.
Decarbonise	To reduce or remove the amount of gaseous compounds released into the environment.
Deep-water port	A port which has the capability to accommodate a fully laden Panamax and/or Handymax ship, the size of which ship is determined principally by the dimensions of the Panama Canal's lock chambers.
Default emission factors	A preselected representative value used for calculating the quantity of a pollutant released to the atmosphere by an activity associated with the release of that pollutant.
Delaminated (concrete)	A splitting apart into layers.
Demurrage	A charge payable to the owner of a chartered ship on failure to load or discharge the ship within the time agreed.
Desludging	The process of draining and clearing a tank of waste or other sediment (e.g. septic tank).
Detritus-based food chain	A food chain that begins with dead organic matter and animal waste being eaten by an animal which is then eaten by another animal in the soil. Such ecosystems are thus less dependent on direct solar energy.
Dewater	Remove or drain groundwater or surface water from a riverbed, construction site, caisson, or mine shaft, by pumping or evaporation.
Diatoms	Single-celled algae.
Dispersion coefficients	The measure of the spread of data about the mean value, or with reference to some other theoretically important threshold or spatial location, e.g. the standard deviation.
Dispersion modelling	Computer programs that mathematically simulate how air pollutants disperse in the ambient atmosphere and then predict their concentration at ground level.
Dodge tide	A South Australian term for a neap tide, which is a tide of minimum range occurring at the first and the third quarters of the moon.
Dolphin	A man-made marine structure that extends above the water level and is not connected to shore. Usually installed to provide a fixed structure for berthing and mooring of vessels when it would be impractical to provide a dry-access facility.
Dredge spoil	The sediment, rock, sand and soil removed from the ocean floor during the excavation process.
Dredging	An excavation activity using heavy machinery to remove earth from the bottom of the ocean or river.
Duplex soil	Soils with textural contrast between the surface soil and the subsurface.

Term	Definition
Dynamic heel	During turning of a vessel, heeling will occur depending on ship's speed, rate of turn, metacentric height and tugboat line forces.
Easement	A right to make use of the land of another for the installation and operation of linear infrastructure such as a road, pipeline or transmission line. Also referred to as a right of way.
Ecological receptor	Any living organisms other than humans, the habitat which supports such organisms, or natural resources which could be adversely affected by environmental contaminations as a result of a release at or migration from a site.
Economic diversification	Generally refers to the process in which an economy becomes based on a wide range of profitable sectors, not just a few.
Ecotoxicology	The branch of toxicology concerned with the study of toxic effects caused by natural synthetic pollutants to the constituents of ecosystems, animal (including human), plant and microbial, in an integral context.
Emissions Reduction Fund	A voluntary scheme that provides incentives for Australian businesses, farmers and landholders to adopt new practises and technologies in order to reduce Australia's greenhouse gas emissions.
Environmental offset	An environmental offset involves compensating for residual adverse impacts or consequences of an action on the environment at one site, through activities at another site.
Epifauna	Animals living on the surface of the seabed or a riverbed.
Epiphyte	Plants that grow on other plants or objects merely for physical support.
Epizoic	(Of a plant or animal) growing or living non-parasitically on the exterior of a living animal.
European fan worm	A filter-feeding tube worm with leathery tube and spiral feeding fan, found in shallow subtidal areas.
Exotic organisms	Plants or animals, which are introduced by human intervention to a non-native region or ecosystem.
Fetch	The maximum length of open water over which the wind can blow.
Forest degradation	A process in which the quality of a forest area is destroyed or permanently diminished; degradation makes the forest less valuable and may lead to deforestation.
Free-on-board (FOB)	This term indicates whether the seller or the buyer is liable for goods that are damaged or destroyed during shipping.
FSC Mix Credit	An FSC Mix Credit claim contains 100% FSC credit material. When this claim is used, somewhere in the supply chain (Chain of Custody, COC) there has been a mixwith FSC controlled wood (CW).
Fugitive emissions	Substances that escape into the air from sources associated with a specific process (e.g. gases leaked from pressurised equipment).
Gaussian plume model	An air pollution dispersion model, which is most often used for predicting the dispersion of continuous, buoyant air pollution plumes originating from ground level or elevated sources.
General mass limits (GML) vehicles	The Heavy Vehicle National Law (HVNL) provides General Mass Limits (GML), Concessional Mass Limits (CML) and Higher Mass Limits (HML) for heavy vehicles operating on the national road network.
Geofabric bags	Bags made from permeable fabrics.
Geological monuments	Geological features recognised by earth scientists to be part of our natural heritage and thus merit special recognition and management.
Geophysics (geophysical)	The physics of the Earth, dealing with the evolution of the Earth's crust and interior, as well as its oceans and surrounding space environment.
Geospatial (database)	A set of data associated with a particular location, such as a country or city.
Geosyncline	A large, generally linear trough, which has subsided deeply and in which thick sequences of sedimentary and volcanic rocks have accumulated.

Term	Definition
Geotextile	A strong synthetic fabric that stabilises loose soil and prevents erosion.
Gneiss	A banded or foliated metamorphic rock, typically coarse-grained and consisting of feldspar, quartz and mica.
Grab dredging	A dredger operating with a clamshell.
Grab sampling methodology	A sampling technique in which a single sample or measurement is taken at a specific time or over as short a period as is feasible.
Gradational soils	Soil that becomes increasingly finer textured with depth.
Grated inlet pits	Pits for the collection of water covered by grates.
Green energy	Renewable energy that comes from natural sources such as the sun, wind, rain and tides.
Greenhouse gas emissions	Greenhouse gases are gaseous compounds released into the Earth's atmosphere that are capable of absorbing infrared radiation, thereby trapping heat in the atmosphere. They are released into the atmosphere primarily through human activities such as burning fossil fuels for electricity, heat and transportation. The primary greenhouse gases are: carbon dioxide (CO_2); nitrous oxide (N_2O); methane (CH4); hydrofluorocarbons (HFCs); perfluorocarbons (PFCs); and sulphur hexafluoride (SF6).
Ground absorption factor	Sound propagation near the ground is affected by absorption and reflection of the sound waves by the ground. Sound can either leave a source and follow a straight path to a receiver or be reflected and/or absorbed by the ground.
Ground level concentration	Measured or established concentrations of a pollutant at ground level; estimated values are derived from pollutant dispersion models.
Groundwaters	The water found underground in the cracks and spaces in soil, sand and rock.
Guide/restraint dolphins	Guide dolphins are dolphins used to guide ships to dock. Restraint dolphins are dolphins used to keep a floating structure at its station.
Gulf	A portion of an ocean or sea that is partly enclosed by land.
Gypsum	A soft sulphate mineral composed of calcium sulphate dehydrate. It is a very common mineral and is used as a fertiliser, and as the main constituent in many forms of plaster, blackboard chalk and wallboard.
Habitat protection zone	Established to protect habitats and biodiversity within a marine park and to allow uses that do not harm habitats or the functioning of ecosystems. Refer to the *Marine Parks Act 2007* and the South Spencer Gulf Marine Park Management Plan 2012.
Handymax vessel	A naval architecture term for bulk cargo ships in the Handysize class which typically have a capacity between 40,000 to 50,000 deadweight tonnage.
Hardstand area	A paved area for parking heavy vehicles.
Hardwood	Any of the broadleaved, angiospermous trees with sieve tubes for the conduction of nutrient solutions, most of which have hard wood, such as the eucalypts, but includes trees such as the balsa, despite the wood itself being soft.
Heavy vehicle	This term generally applies to vehicles with a GMV of more than 4.5 tonnes and includes trucks, B-doubles and road trains amongst other vehicles that transport goods across Australia.
Heritage Agreement	An agreement is entered into by the appropriate government minister and a landholder to preserve the heritage significance of a heritage property.
Heritage values	The values embodied in objects and qualities such as historic buildings, unspoilt countryside, and cultural traditions that have been passed down from previous generations.
Hydraulic excavator	A large vehicle consisting of a chassis, boom and bucket, which moves via tracks or wheels to excavate and demolish.
Hydrocarbon	Any class of compound containing only hydrogen and carbon atoms.

Term	Definition
Hydrodynamic modelling	The study of fluids in motion by simulating currents, water levels, sediment transport and salinity.
Hydrodynamic separation	Hydrodynamic separators (flow-through structures with a settling or separation unit) are used to remove sediment and other pollutants from stormwater.
Hydro-fluorocarbon	Any of a class of compounds containing hydrogen, fluorine and carbon; used as a coolant in refrigerators and a propellant in spray cans.
Hydrogeological	Hydrogeology is the study of water both on and beneath the earth's surface.
Hydrographic	Relating to the measurement and description of the physical features of oceans, seas, coastal areas, lakes and rivers, as well as with the prediction of their change over time, for the primary purpose of safety of navigation and in support of all other marine activities, including economic development, security and defence, scientific research, and environmental protection.
Hydrophone	A microphone designed to be used underwater for recording or listening to underwater sound.
Interface (land use)	The area at which land uses interact and affect each other.
Interim Biogeographical Regionalisation for Australia (IBRA)	A landscape-based approach to classifying the land surface of Australia. 89 biogeographic regions and 419 sub regions have been delineated, each reflecting a unifying set of major environmental influences which shape the occurrence of flora and fauna and their interaction with the physical environment across Australia and its external territories.
Intertidal zone	The shore between the high and low tide marks.
Isopleth	A line drawn on a map or chart connecting all points possessing the same numerical value of any element. Commonly used in meteorological maps.
Jack-up barge	A type of mobile platform that consists of a buoyant hull fitted with a number of movable legs, capable of raising its hull over the surface of the sea.
Jet Slinger	A high-speed conveyor belt.
Kilotonnes per annum (Ktpa)	One kilotonne per annum is equal to 1,000,000 kg per year.
Kyoto Protocol	The Kyoto Protocol to the United Nations Framework Convention on Climate Change is an amendment to the international treaty on climate change, assigning mandatory targets for the reduction of greenhouse gas emissions to signatory nations. It was opened for signing on 11 December 1997 in Kyoto, Japan.
Laterite	A reddish clayey soil commonly formed in warm, humid and wet tropical regions.
Leachate	Liquid that takes in substances from the material through which it passes, often making the liquid harmful or poisonous.
Leached sands	Sands from which soluble chemicals or minerals have drained away by the action of percolating liquid.
Lee side	The sheltered side of something; the side away from the wind.
Lignins	A complex organic substance that, together with cellulose, forms the chief part of woody tissue in trees and plants.
Ligurian bees	Bees imported into Kangaroo Island from the Ligurian Alps (now Italy) in the early 1880's, they are the last remaining pure stock of this bee found anywhere in the world.
Limestone	A sedimentary rock composed mainly of calcium carbonate and the remains of marine organisms such as coral, shell and molluscs.
Linkspan	A type of drawbridge used mainly in the operation of moving vehicles on and off a roll-on/roll-off vessel or ferry, which particularly allows for changes in water levels.
Lithology	The description of rocks on the basis of colour, mineralogical composition and grain size.
Littoral	Relating to or situated on the shore of the sea or a lake.

Term	Definition
Live load	Live loads include any temporary or transient forces that act on a building or structure. They are usually unstable or moving loads such as people, furniture and vehicles.
Longshore coastal process	Various coastal processes such as wind, climate, waves, currents and tides create landforms along the coast.
Macroalgae	Refers to several species of macroscopic, multicellular marine algae which form a plant.
Mallee woodland	Semi-arid systems dominated by eucalypt species that produce multiple stems from an underground rootstock known as lignotuber.
Mangrove	A type of small tree found in coastal saline or brackish water in the tropics and subtropics. Also a term for tropical coastal vegetation consisting of this type of tree.
Marine basin(s)	An undersea geological depression.
Marine ecology	The scientific study of living things in the ocean and how they interact with each other and their surrounding environment including abiotic (non-living) factors.
Marine parks	The South Australian government has designed a network of 19 marine parks in South Australia. The Southern Spencer Gulf Marine Park Management Plan and the *Marine Parks Act 2007* provide the legal framework for the objectives of the subject marine park. The objectives are to protect and conserve marine ecology, habitat, environment, and the natural, cultural heritage of the area, as well as to allow for public participation and enjoyment of the amenity.
Marine pests	Marine plants or animals which are introduced by human intervention to a non-native marine environment and have a harmful effect on that environment.
Maritime Zone	Areas of the oceans designated under the United Nations Convention on the Law of the Seas (UNCLOS), each with a different legal status: Internal Waters, Territorial Sea, Contiguous Zone, Exclusive Economic Zone and the High Seas.
Matters of national environmental significance (MNES)	Matters of national environmental significance are defined in the *Environmental Protection and Conservation Biodiversity Act 1999*, which provides a legal framework for the protection of important features in the environment.
Mean (mathematics)	A quantity having a value intermediate between the values of other quantities; an average (e.g. mean monthly rainfall).
Mean low low water (MLLW)	The average of the lower low water height of each tidal day.
Mean sea level (MSL)	The average level of the sea: sea level is measured regularly at the same time and at the same location over a long period of time and the measurements are then averaged to determine the MSL.
Metalloids	Elements which have properties between those of the metal and non-metals, such as arsenic, silicon or bismuth.
Metamorphic (geology)	Metamorphic rocks are sedimentary or igneous rocks that have been altered by heat and/or pressure.
Meteorological parameters	Meteorological parameters that influence air pollution are air temperature, relative humidity, evapotranspiration, wind speed and direction, solar radiation, soil temperature and rainfall.
Meteorology	The interdisciplinary scientific study of the atmosphere that focuses on weather processes and forecasting.
Methyl bromide	An ozone depleting compound gas, bromomethane, is produced industrially and biologically.
Micrometeorology	The branch of meteorology that deals with the study of atmospheric conditions on a small scale, both in terms of space and time, e.g. the study of the layer of air immediately above the Earth or weather conditions of a particular mountain over the period of one day.
Midden	An old dump for domestic waste which may consist of animal bone, human excrement, botanical material, mollusc shells, sherds, lithics, and other artifacts and ecofacts associated with past human occupation.

Term	Definition
Mobile shiploader	A mobile machine used for loading bulk solid materials into ships.
Monotreme	A group of mammals that lay eggs.
Mooring dolphin	An isolated marine structure for mooring of vessels.
Native Vegetation Council (NVC)	An independent statutory body charged with monitoring the overall condition of South Australia's vegetation and making decisions on wide ranging matters concerning native vegetation in the State.
Nautical mile	A unit of measurement of length, used in marine and aeronautical navigation: 1852m.
Noise amenity [already have visual amenity]	The pleasantness of a place auditorily.
Nuisance species	Species which are not native to an ecosystem that threaten the diversity or abundance of native species.
Oceanographic and coastal processes	Coastal processes are processes which cause coastal erosion. Oceanographic processes are the physical processes within the ocean, especially the motions and physical properties of ocean waters.
Octave spectra	Spectra are the plotted data that result from analysing the relationship between the energy level (amplitude) and the frequency of an audio source. The frequency range is divided into smaller sets of frequencies called octave bands, with each band covering a specific range of frequencies. A band is an octave in width when the upper band frequency is twice the lower band frequency. A one-third octave band is defined as a frequency band whose upper band-edge frequency (f2) is the lower band frequency (f1) times the cube root of two.
Offsets	Actions taken outside a development area to 'compensate' for environmental impacts created within the development area that relate directly to the conservation values affected by the development.
Omnivorous	Describes an animal or person that eats a variety of food of both plant and animal origin.
Overstorey	The uppermost canopy level of a forest, formed by the tallest trees.
Particulate	Also referred to as particulate matter (PM), aerosols or fine particles. Particulates are tiny particles of solid (smoke) or liquid (aerosol) suspended in a gas. They range in size from less than 10 nanometres to more than 100 micrometres in diameter.
Pathogen	A bacterium, virus, or other microorganism that can cause disease.
Payload	The part of a vehicle's load from which revenue is derived.
Percentile	A measure used in statistics indicating the value below which a given percentage of observations in a group of observations fall.
pH	A measure of how acidic/basic water is. The scale ranges from 0 to 14, with 7 being neutral. A pH of less than 7 indicates acidity, and a pH of greater than 7 indicates a base.
Phenol	Also known as carbolic acid, phenol is a white, crystalline soluble solid.
Photosynthesis	The process by which green plants and some other organisms use sunlight to synthesise nutrients from carbon dioxide and water.
Phyllite	A fine-grained foliated metamorphic rock formed by the reconstitution of fine-grained sedimentary rocks, such as mudstones or shales.
Phytophthora	A genus of plant-damaging oomycetes (water molds), whose member species are capable of causing enormous economic losses on crops worldwide, as well as environmental damage in natural ecosystems.
Phytosanitary	Of or relating to health measures concerning plant life, as in managing international trade so as not to introduce plant diseases or pests.

Term	Definition
Plume	Refers to a column of one fluid moving through another. The term may be used in the context of air or water.
Pontoon	An air-filled structure providing buoyancy.
Power spectral density	A measure of a signal's power content versus its frequency.
Propwash	The disturbed mass of air or water pushed aft (or fore when in reverse) by the propeller of an aircraft or propeller-driven watercraft.
Putrescible waste	Solid organic waste capable of decaying or decomposing to a putrid state.
Quarternary Age	A geological time period from approximately 2588 million years ago to the present.
Radiative forcing	Expresses the change in energy in the atmosphere due to greenhouse gas emissions.
Radiused	The act of giving a rounded form to; particularly to a corner or edge.
Reclaim hopper	A funnel-shaped receptacle for delivering material reclaimed from a stockpile by, for example, a loader, onto a conveyor system, truck, ship or other form of conveyance.
Red tide	A harmful algal bloom with a higher-than-normal concentration of a microscopic alga (plantlike organism). They become so numerous that they discolour coastal waters.
Renewable resource	A resource that can be used repeatedly and replaced or replenished naturally in good time. Examples include oxygen, fresh water, solar energy and wind energy.
Rhodoliths	Marine red algae that resemble coral.
Rigid trucks	A truck whose axles are fixed to the frame.
Riparian	The interface between land and a river or stream.
Risk	A concept that denotes a potential negative impact to an asset or some characteristic of value, including objectives that may arise from some present process or future event. Risk is measured in terms of 'consequence' and 'likelihood'.
Risk management	The process of measuring, or assessing, risk and developing strategies to manage it. The culture, processes and structures that are directed towards effective management of potential opportunities and adverse effects.
Rock armouring	The piling of rocks to provide the causeway with appropriate stability and to protect it from damage through water erosion.
Seagrass wrack	Marine vegetation that is floating in the sea or has been cast ashore.
Sedimentary rock	Rock formed when fragments of eroded rock, organic remains or other solids (called sediment) are deposited by water, wind or ice and pressed or cemented together.
Sedimentation pond	A place to catch runoff and hold water while the soil and debris in the water settles out to become sediment.
Seismic	Relating to earthquakes or other vibrations of the earth and its crust.
Semi-articulated vehicle	A vehicle consisting of sections connected by a pivoting joint, such as a prime mover and trailer.
Semi-trailer truck	A semi-trailer attached to a tractor unit with a fifth wheel hitch.
Sensitive receptor/receiver	People or other organisms that may have a significantly increased sensitivity or exposure to contaminants by virtue of their health, age, proximity to the contamination or the facilities they use.
Serviceability Limit State	The design to ensure a structure is comfortable and useable.
Sessile	Anchored to a substrate and cannot move about freely.
Ship squat	The ship squat effect occurs when a vessel moving quickly through shallow water creates an area of lowered pressure that causes a decrease in the ship's under-keel clearance.
Significant environmental benefit (SEB)	An action that results in a positive impact on the environment greater than the negative impact of clearing native vegetation.

Term	Definition
Silane	One of a group of silicon hydrides which, applied to concrete, will protect it from surface damage. They either impregnate the pores in the concrete to reduce absorption of water and salts or form an impregnable layer that prevents materials from passing.
Siliceous (sands)	Containing silica.
Silt plumes	A flow of silt through water.
Silviculture	The growing and cultivation of trees.
Softwood	Any of the generally coniferous, gymnospermous trees with sieve cells for the conduction of nutrient solutions, which include pine, spruce and some trees with much harder wood. The timber is light and easily cut.
Soil biota	Complex communities of organisms that play a role in soil formation and that contribute, directly or indirectly, to the nutrient cycling process, breakdown of waste, and the formation of soil structure.
Solar photovoltaic panels	An interconnected assembly of solar cells (also called photovoltaic cells) that convert energy from the sun into electricity.
Sonde	Device for testing physical conditions, often for remote or underwater locations.
Spalled (concrete)	Spalled concrete is caused by moisture in the concrete pushing outward from the inside and forcing the surface to peel.
Spring line	A line led diagonally from the bow or stern of a ship and tied to a point on a wharf to prevent forward and backward motion of the ship.
Stevedoring	The manual labour of loading and unloading ships.
Stockpile	A large supply of (timber products) held for later use.
Stormwater retention pond	An artificial lake with vegetation around the perimeter used to manage stormwater runoff to prevent flooding and downstream erosion, and improve water quality in an adjacent river, stream, lake or bay.
Stormwater runoff	Stormwater runoff is rainfall that flows over the ground surface. It is created when rain falls on roads, driveways, parking lots, rooftops and other paved surfaces that do not allow water to soak into the ground.
Subtidal zone	Below the low-tide mark to a shallow depth of water.
Supernatant (water)	The water lying on the surface.
Suspended jetty	A jetty extending over water, anchored and supported only at the shore.
Sustainable (development)	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
Swells (ocean)	A distant series of waves generated by storm winds over a long period and over a large area of the ocean. Swells are different to waves that are raised by winds blowing locally.
Synoptic	Relating to or constituting a general summary or synopsis.
Synoptic scale (in meteorology)	A horizontal length scale of the order of 1,000 kilometers or more. This corresponds to a horizontal scale typical of mid-latitude depressions, e.g. extratropical cyclones.
Tailwater	Water below a dam or waterpower development; or excess surface water draining.
Telemetry	Automated process by which measurements and other data are collected at remote or inaccessible points and transmitted to receiving equipment for monitoring.
Telescopic chute	A chute made of cylindrical sections that fit or slide into each other, so that it can be made longer or shorter.
Telescopic chutes	Dust control equipment, primarily used when loading bulk material into open trucks, bulkers and containers; also referred to as a loading spout especially used in port mechanisation i.e.loading of barges and ships.

Term	Definition
Temperate (woodlands)	Warm to hot, dry summers with cool, mild and wet winters.
Terrestrial ecology	The study of how land-based organisms interact with each other and their environment.
Thermal expansion (ocean)	As global air temperature increases, the sea surface temperature also increases resulting in the seawater expanding and increasing in volume and ocean levels to rise.
Thinnings	Plants which have been removed to improve the growth of those remaining.
Threatened ecological community (TEC)	A term used for ecosystems in danger of being lost due to some threatening process.
Tidal wetlands	The area where the land meets the sea, including mudflats, marshes and swamps.
Total dissolved solids (TDS)	A measure of the combined total of inorganic salts and organic material that are dissolved in water.
Total suspended particles	A regulatory measure of the mass concentration of particulate matter in community air.
Toxoplasmosis	A parasitic disease.
Transducer	An electronic device that converts energy from one form to another. Common examples include microphones, loudspeakers, thermometers, position and pressure sensors, and antenna.
Transect	A straight line or narrow section through an object or natural feature or across the earth's surface, along which observations are made or measurements taken.
Travertine	A form of limestone deposited by springs.
Trim ballasting	Ballast used to maintain a ship’s trim.
Tubestock	Seeds grown in tubes to the stage where they become seedlings and can be transported for planting in the field or in larger pots.
Turbidity	The amount of fine, solid particles, such as clay and organic matter, that are suspended in water and that prevent light from being transmitted. This results in a loss of transparency, or ‘cloudiness’.
Ultimate Limit States Factor	An agreed computational condition that must be fulfilled, among other criteria, in order to comply with the engineering demands for strength and stability under design loads.
Under keel clearance	The minimum clearance available between the deepest point on a ship and the bottom of the ocean or waterway in still water.
Understorey	A layer of plants and bushes that grows under the thick, high roof formed by branches and leaves of a forest.
Vector (of pest species)	An organism which transmits a disease or parasite from one plant or animal to another.
Vegetation	A general term for all plant life.
Vessel	Any kind of vessel used in navigation by water and includes ‘an installation’ and ‘any floating structure’.
Vibro-driving	The use of vibration to drive vertical elements into the ground.
Vibroseis	A truck-mounted system that uses a large oscillating mass to vibrate the ground and generate sound waves of varying frequencies.
Wave energy	The kinetic energy (i.e. the energy possessed due to motion) of an ocean wave.
Wave response allowance	An allowance for wave action when calculating minimum under keel clearance.
Wetland systems	An engineered sequence of water bodies designed to filter and treat waterborne pollutants found in sewage, industrial effluent or stormwater runoff. They are used for wastewater treatment or for greywater treatment.
Wind speed threshold	The wind speed, which must be exceeded for wind erosion to occur.
Wind vectors	A graphic tool used by meteorologists to indicate wind direction and speed.
Winnowing (sediments)	The removal of fine sediment from coarser sediment by wind or flowing water.