



# Port Kembla Gas Terminal

## Water Quality Management Plan Stage 2A Marine Berth Construction and Onshore Receiving Facilities

Australian Industrial Energy

7 January 2022

→ The Power of Commitment



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# Acronyms

Acronym / Definition	Description
AIE	Australian Industrial Energy
AMB	Automated Monitoring Buoys
ASS	Acid Sulfate Soils
ASSMP	Acid Sulfate Soil Management Plan
Berth 101	MBD Site Compound
CSSI	Critical State Significant Infrastructure
DO	Dissolved Oxygen
DPIE	Department of Planning, Industry and Environment
EC	Electrical Conductivity
EHMP	Ecological Health Monitoring Program
EIS	Environmental Impact Statement
EMS	Environmental Management Strategy
EPA	NSW Environment Protection Authority
EPL	Environmental Protection Licence
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
ESCP	Erosion and Sediment Control Plan
FSRU	Floating storage and re-gasification unit
GHD	GHD Pty Ltd
HSE	Health, Safety and Environmental
KPIs	Key Performance Indicators
LNG	Liquefied natural gas
MBD	Marine berth construction and dredging
MLAs	Marine Loading Arms
NATA	National Association of Testing Authorities
NTU	Nephelometric Turbidity Units
ORF	Onshore receiving facilities
PASS	Potential Acid Sulfate Soils
PIRMP	Pollution Incident Response Management Plan
PKCT	Port Kembla Coal Terminal
PKGT	Port Kembla Gas Terminal
PKGT EIS	Port Kembla Gas Terminal Environmental Impact Statement
POC	Pollutants of Concern
POEO Act	<i>Protection of the Environment Operations Act 1997</i>
QA	Quality Assurance
QC	Quality Control
SMP	Spoil Management Plan
SRD SEPP	State Environmental Planning Policy State and Regional Development
TARP	Trigger Action Response Plan

Acronym / Definition	Description
Three Ports SEPP	State Environmental Planning Policy (Three Ports) 2013
TSS	Total Suspended Solids
WM Act	<i>Water Management Act 2000</i>
WQM	Water quality monitoring
WQMP	Water Quality Management Plan



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# 1. Introduction

## 1.1 Overview

This Water Quality Management Plan (WQMP) has been developed as a sub-plan to the Port Kembla Gas Terminal Project (the Project) Spoil Management Plan (SMP). The SMP is sub-plan to the Project's overarching Environmental Management Strategy (EMS). This WQMP has been prepared by GHD Pty Ltd (GHD) on behalf of Australian Industrial Energy (AIE) to apply to construction activities associated with Stage 2A construction of the Project.

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

## 1.2 Background

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

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

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

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

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

The development has progressed to Stage 2A works located at Berth 101 (referred to as 'the site' or 'MBD Site Compound'). The Stage 2A works include land-based construction works associated with the Marine Berth Construction and Dredging (MBD) and Onshore Receiving Facilities (ORF). The Stage 2A works include:

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

## 1.3 Purpose

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

- Ensure no waters are polluted as a result of the Stage 2A works.
- Ensure compliance with water quality related requirements of EPL No 21529 issued for the construction phase of the Project.
- In the event of an incident (e.g., a spill), implement the Emergency Spill Plan.

This plan addresses the above requirements and includes, but is not limited to:

- Performance criteria for water quality mitigation.
- Mitigation strategies to minimise impacts on water quality.
- A Water Quality Monitoring Plan and reporting requirements with regards to the Project's performance during Stage 2A and overall harbour monitoring

AIE and its contractors acknowledge that maintaining water quality in the vicinity of the MBD Site Compound is paramount to the successful delivery of the construction phase of the Project. AIE is committed to ensuring this WQMP is reviewed and updated regularly to ensure its objectives are met and that the conditions outlined in the Infrastructure Approval (SSI 9471) and EPL No. 21529 are achieved. Staging of the SMP has been approved in accordance with Condition 3 of Schedule 4 of Infrastructure Approval SSI-9471.

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

## 2. Project overview

### 2.1 Site description

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

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

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

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

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





Figure 2.1 Site overview

## 2.2 Project construction scope of works

### 2.2.1 Overview

The Project construction scope of work has been divided into the three main packages (with associated activities), as outlined in Table 2.1. This WQMP applies only to the works associated with Stage 2A.

**Table 2.1** Construction stages/work packages

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

The construction of Stage 2A works is located within the former Port Kembla Coal Terminal (PKCT) Bulk Products Berth (Berth 101). As part of the Early Enabling works the removal of existing structures and services and excavation was undertaken to facilitate subsequent development stages of the Project.

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

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

An outline of the tasks associated with Stage 2A is provided in Section 2.3 through Section 2.5. The site of the works includes the MBD Site Compound with materials being transported to the Emplacement Cell Construction Site. The location of the Stage 2A works, MBD Site Compound, and the Emplacement Cell Construction Site is shown in Figure 2.2.



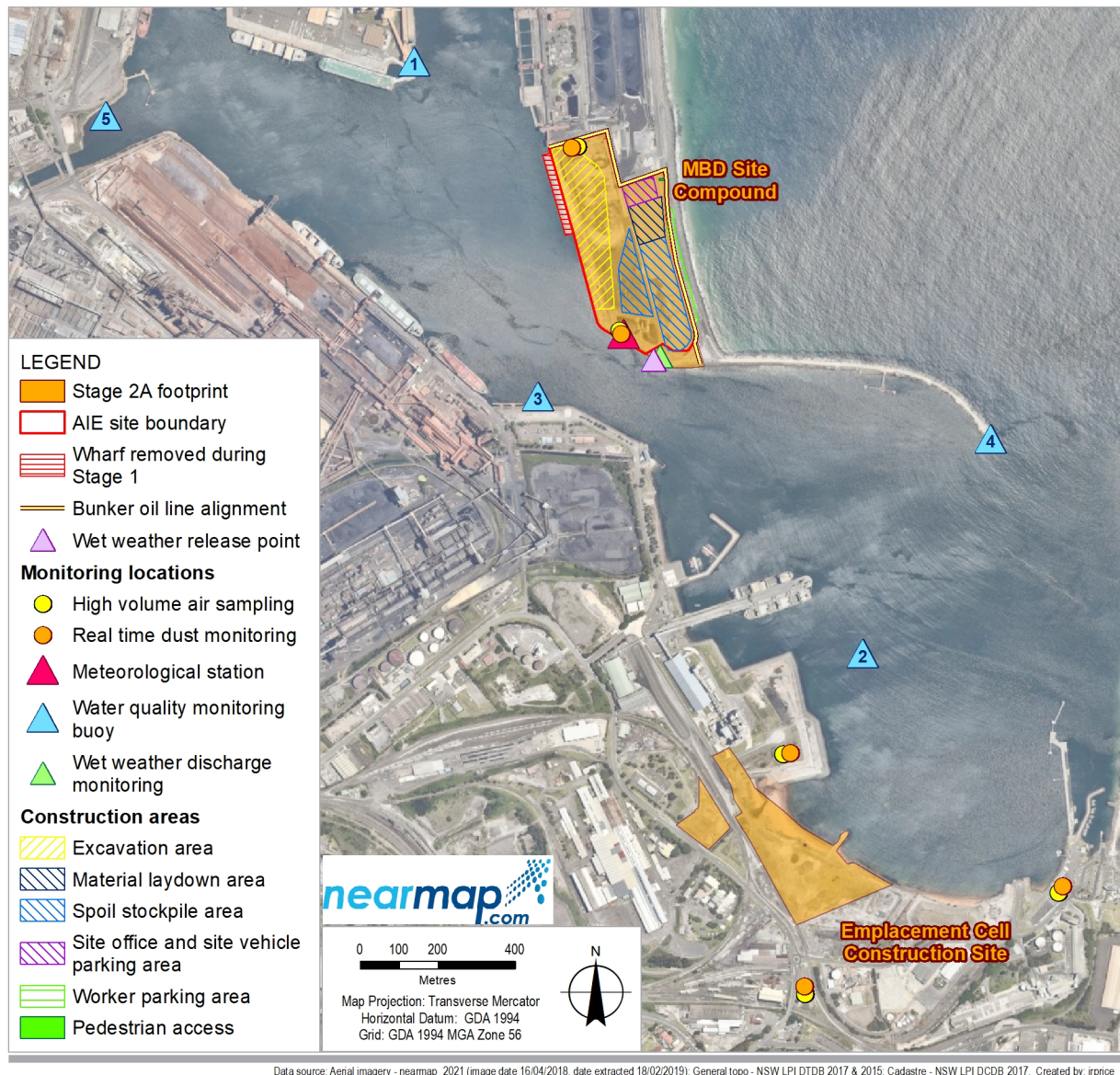


Figure 2.2 Stage 2A works and location of MBD Site Compound and Emplacement Cell Construction Site

## 2.2.2 Traffic

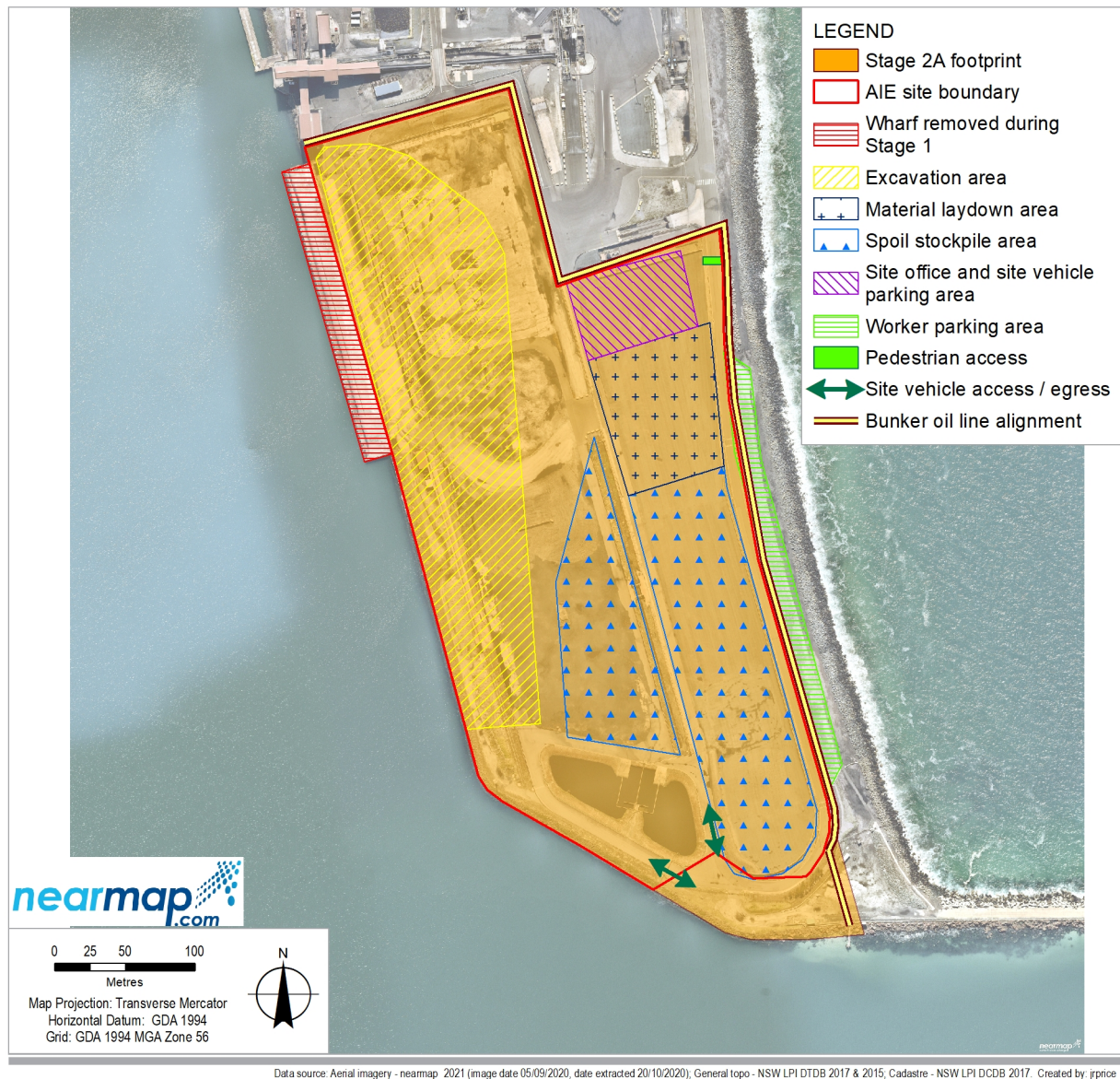
Traffic generated by Stage 2A will be controlled through the gate on Sea Wall Road. Heavy vehicle movements will be generated by the delivery of materials, equipment, and plant to the MBD Site Compound and transport of stockpiled material to the Emplacement Cell Construction Site.

There may be a requirement to transport and tip up to 8000m<sup>3</sup> of crushed concrete and up to 2000m<sup>3</sup> of crushed heavily bound base course to the Emplacement Cell Construction Site via road to increase the storage footprint area within the East Stockyard and to facilitate for later use during the construction of the Emplacement Cell.

The activities associated with this task will involve loading, road transportation via truck and trailer (approximately 30-tonne capacity), unloading, stockpiling, and management of the stockpiles.

Light vehicle movements will be generated from construction workers accessing the MBD Site Compound. Parking will be provided for up to 76 workers on the MBD Site Compound (refer to Figure 2.3).





**Figure 2.3** *Layout of MBD Site Compound*

## 2.2.3 Program

The Stage 2A works are anticipated to commence in January 2022. Stage 2B which includes the continuation of land-based construction and water-based works) are then anticipated to commence in March 2022 (refer to Table 2.1).

## 2.3 Construction of quay wall (MBD – Land Based)

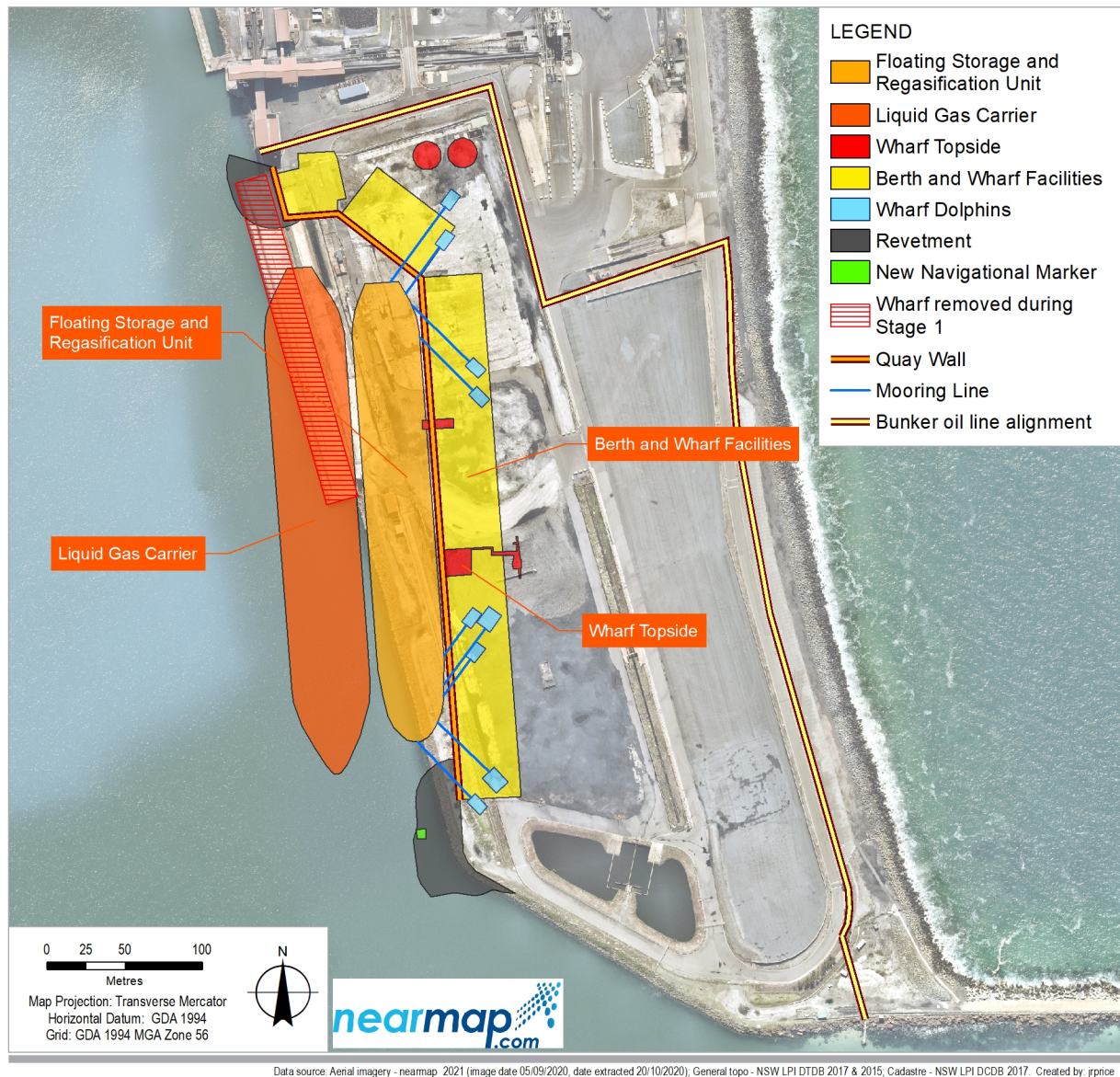
A number of structures will be constructed within the MBD Site Compound to accommodate the FSRU and LNG carrier for the Project. Excavation and stockpiling activities from the Stage 1 Early Enabling Works will continue on-site during Stage 2A to lay the platform for ongoing construction activities at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

The new structures that will commence construction during Stage 2A are summarised in Table 2.2. The location of the quay wall and layout of the marine berth and wharf facilities is shown in Figure 2.4.

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

Component	Works required
Earthworks and stockpiles	<ul style="list-style-type: none"> <li>– Completion of excavation and backfilling works from Stage 1 Early Enabling Works.</li> <li>– A nominal 15-metre-wide section on the northern end and a circa 60-metre 'wedge' at the south- west corner of the excavation zone was left to facilitate contractor access and will required completion at commencement of Stage 2A.</li> <li>– Excavated materials from the Early Enabling Works have been stockpiled within the Eastern and Western Stockyards of the MBD Site Compound and the Emplacement Cell Construction Site.</li> <li>– The excavated materials stockpiled include: <ul style="list-style-type: none"> <li>• Approximately 15,000m<sup>3</sup> of demolished concrete crushed to nominal 70mm minus.</li> <li>• Approximately 30,000m<sup>3</sup> of heavily bound base course crushed to nominal -150mm minus.</li> <li>• Approximately 25,000<sup>3</sup> of mixed slag, general fill, and coal nominally &lt; 150mm in size.</li> <li>• Approximately 10,000m<sup>3</sup> of predominantly sand with some slag and coal.</li> </ul> </li> <li>– The excavated materials will be used/reused for quay wall construction and to backfill the landside area of the quay wall or transported to the Emplacement Cell Construction Site for storage and use in construction of the Emplacement Cell.</li> </ul>
Quay wall	<ul style="list-style-type: none"> <li>– Construction of a new piled quay wall keyed into bedrock complete with sheet pile anchor wall, capping beam and tie rods to the south of the existing coal terminal.</li> <li>– Excavated and processed materials from the Stage 1 Early Enabling Works are stockpiled within the MBD Site Compound and will be used during construction of the quay wall and to backfill on landside area of the wall.</li> <li>– Installation of a marine fender system attached to the capping beam along the quay wall to protect the quay wall from berthing and mooring loads.</li> <li>– Installation of a cathodic protection system to the quay wall and associated elements, including assessment of the potential impacts the FSRU and pipeline cathodic protection will have on quay wall.</li> <li>– Backfilling and compaction on landside area of wall utilising the site stockpiled materials.</li> </ul>
Mooring dolphins	<ul style="list-style-type: none"> <li>– Installation of landside mooring dolphin structures on reinforced concrete platforms supported by steel piles.</li> <li>– Mooring equipment will be installed and comprise the following: <ul style="list-style-type: none"> <li>• 20 load sensing quick release hooks.</li> <li>• Up to four land-based mooring winches on mooring dolphins may be required.</li> <li>• Up to four swivel fairleads may be required to enable each mooring line to land-based winches to be fed in a horizontal alignment.</li> </ul> </li> </ul>
Equipment MLA station foundation	Construction of a new reinforced concrete foundation supported on steel piles, located behind the new quay wall.
Gangway tower foundation	Construction of foundation for Gangway tower
Fire monitor foundation	Fire monitor foundations, subject to risk studies.





**Figure 2.4** Location of quay wall and layout of MBD and ORF

## 2.4 Power, communications, and water connections

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

**Table 2.3** Construction of power connections for Stage 2A

Component	Works required
Power and communications	<ul style="list-style-type: none"> <li>Construction and installation of a new 11kV power cable in a buried conduit and Substation.</li> <li>Energisation of the Padmount Substation and 415kV Temporary Building Supply.</li> <li>Installation of communication conduit and pits.</li> </ul>
Potable water	<ul style="list-style-type: none"> <li>Extension of existing potable water line within MBD Site Compound.</li> </ul>

## 2.5 Construction of ORF

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

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

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

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

### 3. Roles and responsibilities

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

**Table 3.1** *Roles and responsibilities of Project Team*

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

Project Role	Responsibility
Principal Contractor Environmental Representative	<ul style="list-style-type: none"> <li>– Delivers environmentally focussed toolbox talks and provides applicable site inductions.</li> <li>– Provides environmental advice, assistance, and direction to Project Manager to ensure construction activities are conducted in accordance with regulatory legislation and this EMS.</li> <li>– Participate and cooperate with AIE HSE Manager with regards to undertaking of joint weekly environmental site inspections.</li> <li>– Coordinate / undertake wet-weather inspections as per EPL No. 21529 and report accordingly to the AIE HSE Manager.</li> <li>– Develop strong working relationships with the AIE team and Consultants.</li> <li>– Ensure environmental risks are appropriately identified, communicated, and effectively managed.</li> <li>– Ensure communication of relevant environmental information to Project personnel.</li> <li>– Provide specialist advice and input as required.</li> <li>– Ensure construction manager, superintendents and field supervisors fully understand the environmental constraints and how construction practices must ensure any such constraints are considered and mitigated against during construction.</li> <li>– Orders STOP WORK for any environmental breaches and immediately reports incidents to Principal Contractor Project Manager and AIE HSE Manager.</li> </ul>
AIE Environmental Representative	<ul style="list-style-type: none"> <li>– Develop strong working relationships with the Principal Contractor Team and Consultants.</li> <li>– Ensure environmental risks are appropriately identified, communicated, and effectively managed.</li> <li>– Instruct and advise management team on compliance issues.</li> <li>– Provide specialist advice and input as required.</li> <li>– Co-ordinate internal audits of this WQMP.</li> <li>– Conduct audit review as required.</li> <li>– Reports on the performance of this WQMP and recommends changes or improvements to Project Manager.</li> <li>– Orders STOP WORK for any environmental breaches and immediately reports incidents to the AIE Construction Manager and AIE HSE Manager.</li> <li>– Conducts investigation and response to environmental complaints and inquiries, where required.</li> </ul>
Subcontractors and construction personnel	<ul style="list-style-type: none"> <li>– Undertake an environmental induction prior to accessing to site.</li> <li>– Comply with legislative requirements.</li> <li>– Participate in weekly inspections and audits.</li> <li>– Follow environmental procedures.</li> <li>– Report all environmental incidents and hazards.</li> <li>– Introduce environmental topics to prestart meetings.</li> <li>– Ensure that all relevant permits and clearances are in place prior to commencing work.</li> </ul>
NSW EPA Accredited Site Auditor	<ul style="list-style-type: none"> <li>– Reviews various documentation associated with the contaminated land aspects of the Project.</li> <li>– Prepares and issues a Section A site audit statement confirming the suitability of the site for its intended use at the completion of dredging, excavation and disposal.</li> </ul>



## 4. Legislative requirements

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

**Table 4.1**      *Legislation and relevant policy applicable to this WQMP*

Legislation and Regulation	Description	Applicability
<b>State</b>		
<i>Protection of the Environment Operations Act 1997 (POEO Act)</i>	The objectives of the POEO Act are to protect and enhance the environment of NSW with regard to the need of ecologically sustainable development. The Act provides mechanisms to reduce risks to human health and the degradation of the environment. The POEO Act also outlines the Scheduled Activities that require an EPL in order to be carried out.	Section 120 of the Act states that 'any person who pollutes any waters is guilty of an offence'. AIE is committed to ensuring that the Stage 2A works will not pollute any waters through the implementation of water quality controls and management.  Water quality monitoring/management measures will be implemented with reference to this plan throughout the Stage 2A works to mitigate the impact of excavation activities and to maintain water quality and prevent pollution of Port Kembla Harbour waters.  All works will be undertaken in accordance with the issued EPL No 21429 conditions.
<i>Water Management Act 2000 (WM Act)</i>	The objectives of the WM Act are to provide for the sustainable and integrated management of NSW water sources for the benefit of both present and future generations.	The Stage 2A works will involve excavation within 40 metres of the shoreline and has the potential to intercept water within an aquifer during excavation. The Stage 2A works are not anticipated to require major dewatering from a water source and is not expected to trigger the need for a water use approval, water management works approval or controlled activity approval in accordance with Sections 89, 90 or 91. Accordingly, these approvals are not required for CSSI in accordance with Section 5.23 of the EP&A Act.
<b>Environmental Planning Instruments</b>		
State Environmental Planning Policy (Three Ports) 2013 (Three Ports SEPP)	The Three Ports SEPP provides a consistent planning regime for the development and delivery of infrastructure of land within Port Botany, Port Kembla and the Port of Newcastle for port purposes. Certain developments are identified as State Significant Development or State Significant Infrastructure under the Three Ports SEPP.	Stage 2A has been assessed and approved as part of the overall Infrastructure Approval. Additional development consent under the Three Ports SEPP is not required.

## **5. Planning requirements**

### **5.1 Conditions of approval**

The planning requirements and the corresponding water quality management measures applicable to Stage 2A are listed in Table 5.1 and Table 5.2. Management measures are detailed in Section 6.1 through Section 7.

The planning requirements include the conditions set out in the Infrastructure Approval (SSI 9471) dated 24 April 2019, the EPL No. 21529 conditions and the mitigation/management measures outlined in the PKGT EIS.

Table 5.1 Approval conditions

Requirement	Reference	Responsibility	Evidence	Applicability to this WQMP
<b>Infrastructure Approval Requirements (SSI 9471)</b>				
<b>Operation of plant and equipment</b> The Proponent must ensure that all plant and equipment used on site, or to monitor the performance of the development is (a) maintained in a proper and efficient condition; and (b) operated in a proper and efficient manner.	Schedule 2, Condition 13	<ul style="list-style-type: none"> <li>– AIE HSE Manager</li> <li>– Principal Contractor Construction Foreman</li> <li>– Principal Contractor Project Manager</li> <li>– Principal Contractor Environmental Rep</li> </ul>	Section 6.2 Section 7.2.1	Applicable
<b>Water Pollution</b> Unless an environment protection licence authorises otherwise, the Proponent must comply with Section 120 of the POEO Act.  <i>Notes: Section 120 of the POEO Act makes it an offence to pollute any waters. The NSW Environment Protection Authority (EPA) has recommended the following limits for water pollutants should apply for the development: an equivalent suspended sediment of no more than 50 mg/L above background turbidity levels during the construction stage; No more than 20 ug/L of Total Residual Chlorine and a temperature of no less than 7° C below ambient water temperature for water discharges from the FSRU</i>	Schedule 3, Condition 1	<ul style="list-style-type: none"> <li>– AIE HSE Manager</li> </ul>	This Plan	Applicable
<b>Aquatic Habitat</b> The Proponent must design and construct the water intake on the FSRU to minimise entrainment of aquatic organisms and plankton.	Schedule 3, Condition 2			Not applicable
<b>Discharge Limits</b> 2A. The water discharge rate from the FSRU from the regasification process must not exceed 13,000 cubic metres per hour. 2B. The average annual water discharge rate from the FSRU from the regasification process must not exceed 8,125 cubic metres per hour.	Schedule 3, Condition 2A and 2B			Not applicable
<b>Water Quality Verification and Monitoring Program</b> Prior to the commencement of operations, the Proponent must prepare a Water Quality Verification and Monitoring Program, in consultation with the EPA and DPI Fisheries and to the satisfaction of the Planning Secretary.	Schedule 3, Condition 3			Not applicable
The Proponent must implement the approved Water Quality Verification and Monitoring Program	Schedule 3, Condition 4			Not applicable
<b>Soil Erosion</b>	Schedule 3, Condition 5	<ul style="list-style-type: none"> <li>– AIE Environment Rep</li> </ul>	Section 6.1	Applicable

Requirement	Reference	Responsibility	Evidence	Applicability to this WQMP
The Proponent must minimise any soil erosion associated with the construction of the development in accordance with the relevant requirements in the Managing Urban Stormwater: Soils and Construction (Landcom, 2004) manual, or its latest version.		<ul style="list-style-type: none"> <li>– Principal Contractor Project Manager</li> <li>– Principal Contractor Environmental Rep</li> </ul>	Refer to SMP Erosion and Sediment Control Plan (ESCP)	
<b>Acid Sulfate Soils (ASS)</b> The Proponent must ensure that any construction activities in identified areas of ASS risk are undertaken in accordance with ASS Manual (Acid Sulfate Soil Management Advisory Committee (ASSMAC), 1998).	Schedule 3, Condition 6	<ul style="list-style-type: none"> <li>– Principal Contractor Project Manager</li> <li>– Principal Contractor Environmental Rep</li> </ul>	Section 7.6.2 Refer to Acid Sulfate Soil Management Plan (ASSMP)	Applicable
<b>Spoil Management Plan</b> Prior to the commencement of construction, the proponent must prepare a Spoil Management Plan to the satisfaction of the Planning Secretary and in consultation with the EPA, Department of Planning, Industry and Environment (DPIE) Water, NSW Ports, PANSW and, an EPA accredited contaminated site auditor. The plan must be consistent with the Emplacement Cell Report and include: (a) a Contaminated Spoil Protocol	Schedule 3, Condition 11A	<ul style="list-style-type: none"> <li>– Principal Contractor Project Manager</li> <li>– Principal Contractor Environmental Rep</li> </ul>	Refer to SMP and Contaminated Spoil Protocol	Applicable
(b) a Dredge and Excavation Management Plan	Schedule 3, Condition 11B			Not applicable
(c) a Water Quality Monitoring Plan that includes: a description of the water quality monitoring that would be undertaken to monitor turbidity and pollutant concentrations surrounding dredging and disposal works, including real-time turbidity monitoring a broader program to monitor harbour-wide water quality trends and the ecological health of Port Kembla Harbour objectives and performance criteria, including trigger levels for investigating any potential or actual adverse impacts associated with construction activities on water quality and the ecology of Port Kembla Harbour a plan to respond to any exceedances of the trigger levels and/or performance criteria, and minimise any adverse water quality impacts of the development; and reporting procedures for the results of the monitoring program	Schedule 3, Condition 11C	<ul style="list-style-type: none"> <li>– AIE Environment Rep</li> <li>– Principal Contractor Project Manager</li> <li>– Principal Contractor Environmental Rep</li> </ul>	This WQMP	Applicable
The Proponent must implement the approved Spoil Management Plan for the development.	Schedule 3, Condition 12	<ul style="list-style-type: none"> <li>– AIE Environment Rep</li> <li>– Principal Contractor Project Manager</li> <li>– Principal Contractor Environmental Rep</li> </ul>	This WQMP Refer to SMP	Applicable

Requirement	Reference	Responsibility	Evidence	Applicability to this WQMP
At the completion of any dredging, excavation and disposal works, the Proponent must engage a site auditor accredited by the EPA to issue a Section A Site Audit Statement confirming the suitability of the site for its intended use.	Schedule 3, Condition 13			Not applicable
<b>PKGT EIS Management Measures</b>				
The location of the proposed terminal berth has been refined through navigation simulations to be located as close possible to the existing turning basin. This approach minimises hydrodynamic impacts and reduces dredging and disposal volumes as far as possible.	EIS W1 – water quality and hydrodynamics			Not applicable
The footprint of the Outer Harbour placement area has been minimised by raising the proposed fill height to include emergent reclamation. This approach minimises the quantity of material to be bottom dumped and thereby reduces the potential for generation of turbid plumes and mobilisation of sediments.	EIS W4 – water quality and hydrodynamics			Not applicable
Preparation of an EMS including specific dredge management plan to provide a framework for the environmental management of construction activities to minimise the environmental risks to a level that is as low as practically possible for this Project.	EIS W5 – water quality			Not applicable
Design and implementation of a Water Quality Monitoring Program to ensure construction works do not cause exceedance of the marine water quality criterion of background plus 50 mg/L of suspended sediment, in accordance with recent EPLs for similar activities within Port Kembla such as the Berth 103 Stage 2 Dredging & Spoil Disposal EPL 20563).	EIS W6 – water quality	<ul style="list-style-type: none"> <li>– AIE Environment Rep</li> <li>– Principal Contractor Project Manager</li> <li>– Principal Contractor Environmental Rep</li> </ul>	This plan	Applicable
<p>Continuous turbidity monitoring would be undertaken using a series of monitoring buoys to provide impact and background data (turbidity (Nephelometric Turbidity Units (NTU)), pH, temperature)</p> <p>Prior to commencement of the dredging works, buoys would be deployed for an agreed period of time to confirm background conditions in the vicinity of the monitoring points. Data would be logged and transmitted to an onshore recording station where it would be processed to allow automated comparison of median turbidity levels to a series of green, amber and red trigger levels. When exceeded, an alarm would be triggered, automated email and SMS alerts sent to the Environmental Representative and agreed procedures implemented.</p> <p>Such procedures include hand-held monitoring to verify readings, reduction in the rate of dredging, relocation of dredging activities or cessation of turbidity generating works until turbidity readings reach acceptable levels.</p>	EIS W6 – water quality	<ul style="list-style-type: none"> <li>– AIE Environment Rep</li> <li>– Principal Contractor Project Manager</li> <li>– Principal Contractor Environmental Rep</li> </ul>	Section 7.6	Applicable



Requirement	Reference	Responsibility	Evidence	Applicability to this WQMP
Daily visual observations would be undertaken during dredging operations to monitor the potential release of oil or grease. Collection of water samples and laboratory analysis for an agreed set of contaminants would be undertaken on a weekly basis during dredging operations	EIS W6 – water quality			Not applicable
Silt curtains would be installed prior to commencement of the works in order to minimise the spread of any sediments entrained within the water column during dredging and disposal operations. Silt curtains are available in a range of designs and would be provided by the successful Contractor. It is envisaged that the silt curtain would comprise a geocomposite material consisting of a non-woven geotextile sewn to a woven geotextile, which would provide the required filtering capacity and rigidity respectively. Vessel access would be via gated or overlapped curtains or through installation of a bubble curtain. The top of the curtain would be supported by a floating boom, whilst the lower portion of the curtain would be weighted with appropriate ballasting (e.g. bars or chains) to ensure that the full length of the curtain is maintained at all times. The curtain would be anchored or fixed to existing structures as necessary.	EIS W7 – water quality			Not applicable
Subaqueous sediment removal would be undertaken using a backhoe dredge. The use of mechanical dredging (rather than hydraulic dredging) ensures that sediments are removed, transported and placed as close to their insitu density as possible. Thereby minimising the suspension and mobilisation of sediments at the dredge and disposal sites. Method statements would be prepared by the contractor to ensure that loading of dredged materials into the hopper barges is undertaken in a manner that reduces spillage and avoids overfilling barges	EIS W8 – water quality			Not applicable
A perimeter bund would be constructed within the Outer Harbour placement area to ensure long term stability of dredged materials and to minimise sediment migration during placement.	EIS W9 – water quality			Not applicable
A site specific ESCP will be prepared as part of the EMS to provide control of all land based excavation and stockpiling requirements. All erosion and sediment control measures shall be designed, implemented, and maintained in accordance with 'Managing Urban Stormwater: Soil and Construction Volume 1' (Landcom 2004) ('the Blue Book').	EIS W10 – water quality	<ul style="list-style-type: none"> <li>– AIE Environment Rep</li> <li>– Principal Contractor Project Manager</li> <li>– Principal Contractor Environmental Rep</li> </ul>	Section 7.4 Refer to ESCP	Applicable
A site specific emergency spill plan will be developed and will include spill management measures in accordance relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers)	EIS W11 – water quality, chemical and fuel impacts on flora and fauna	<ul style="list-style-type: none"> <li>– AIE HSE Manager</li> <li>– Principal Contractor Project Manager</li> <li>– Liberty Industrial Environmental Rep</li> </ul>	Refer to Emergency Spill Plan	Applicable

Requirement	Reference	Responsibility	Evidence	Applicability to this WQMP
An emergency spill kit will be kept on site at all times. All staff will be made aware of the location of the spill kit and trained in its use.	EIS W12– water quality, chemical and fuel impacts on flora and fauna	<ul style="list-style-type: none"> <li>– AIE HSE Manager</li> <li>– AIE Environment Rep</li> <li>– Principal Contractor Project Manager</li> <li>– Principal Contractor Construction Foreman</li> <li>– Principal Contractor Environmental Rep</li> <li>– Subcontractors and construction personnel</li> </ul>	Section 6.2 Refer to Emergency Spill Plan	Applicable
Machinery will be checked daily to ensure there is no oil, fuel or other liquids leaking from the machinery. All staff will be appropriately trained through toolbox talks for the minimisation and management of accidental spills	EIS W13 – water quality, chemical and fuel impacts on flora and fauna	<ul style="list-style-type: none"> <li>– AIE HSE Manager</li> <li>– Principal Contractor Construction Foreman</li> <li>– Principal Contractor Environmental Rep</li> </ul>	Section 6.2	Applicable
Prior to re-releasing the seawater back into the surrounding area, the operators of the vessel will aim to match the profile of the discharged water, as close as possible, to the pre-discharge profile and well below agreed thresholds for residual concentrations of sodium hypochlorite. Changing the profile of the discharge water will be done by modifying the frequency of production and the concentration of sodium hypochlorite produced on-board from the intake of sea water	EIS W14 – water quality			Not applicable
A stormwater management system would be designed and constructed to control discharges from the import terminal site, including traps and filters where required. Design would be undertaken in accordance with emergency spill plans and the objectives and development criteria outlined in the Port Kembla Development Code (NSW Ports 2016).	EIS W15 – water quality			Not applicable
A site specific emergency spill plan will be developed and will include spill management measures in accordance relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Roads and Maritime and EPA officers). An emergency spill kit will be kept on site at all times. All staff will be made aware of the location of the spill kit and trained in its use	EIS W16 – water quality	<ul style="list-style-type: none"> <li>– AIE HSE Manager</li> <li>– AIE Environment Rep</li> <li>– Principal Contractor Project Manager</li> <li>– Principal Contractor Construction Foreman</li> <li>– Principal Contractor Environmental Rep</li> <li>– Subcontractors and construction personnel</li> </ul>	Section 6.2 Refer to Emergency Spill Plan	Applicable

Requirement	Reference	Responsibility	Evidence	Applicability to this WQMP
Works to remove the current quay wall and piles will commence after a visual inspection for protected mobile fauna (e.g., Syngnathids). If present, these will be relocated to adjacent habitats, outside the zone of influence by the proposed works, where feasible.	EIS ME1- Biofouling and benthic community disturbance			Not applicable
<p>The following controls should be implemented prior to dredge activities:</p> <p>Physical controls such as installation of silt curtains prior to commencement of construction works would be adequate in minimising the spread of any sediments within the water column at the dredging and disposal locations.</p> <p>Dredging techniques that minimise sediment resuspension during excavation and disposal (such as using mechanical methods over hydraulic methods) should be implemented throughout the Project. Barge loads will also be controlled such that overflow of barge loads is avoided.</p> <p>Screening technologies will be implemented to ensure that any contaminated sediments are disposed of responsibly. Contaminated dredge material will be placed such that it will be capped by uncontaminated material in accordance with a dredge management plan.</p> <p>Implementation of a water quality monitoring program to ensure construction works do not exceed the Project's agreed marine water quality criteria.</p> <p>Daily visual observations of any potential toxic dinoflagellate blooms within the Inner Harbour.</p>	EIS ME 2- Biofouling and benthic community disturbance			Not applicable

## 5.2 Environmental Protection Licence

AIE have been issued an EPL under the POEO Act as of 2 June 2021. The conditions of EPL No. 21529 related to water quality and monitoring are provided in Table 5.2.

Table 5.2 EPL No. 21529 conditions

Condition	Reference	Evidence
<b>Location of monitoring/discharge points and areas</b> The following points referred to in the table are identified in this licence for the purposes of the monitoring and/or the setting of limits for discharges of pollutants to water from the point.	Condition P1.2	Section 7.1
Except as may be expressly provided in any other condition of this licence, the licensee must comply with section 120 of the POEO Act.	Condition L1.1	Section 4 Refer to Emergency Spill Plan
<b>Concentration limits</b> For each monitoring/discharge point or utilisation area specified in the table below (by a point number), the concentration of a pollutant discharged at that point, or applied to that area, must not exceed the concentration limits specified for that pollutant in the table (refer to Table 7.1, Table 7.2 and Table 7.3). Where a pH quality limit is specified in the table, the specified percentage of samples must be within the specified ranges. To avoid any doubt, this condition does not authorise the pollution of waters by any pollutant other than those specified in the table.	Condition L4.1	Section 7.6
<b>Monitoring and Recording Conditions</b> The results of any monitoring required to be conducted by this licence or a load calculation protocol must be recorded and retained as set out in this condition. All records required to be kept by this licence must be: <ul style="list-style-type: none"> <li>a. in a legible form, or in a form that can readily be reduced to a legible form</li> <li>b. kept for at least 4 years after the monitoring or event to which they relate took place; and</li> <li>c. produced in a legible form to any authorised officer of the EPA who asks to see them.</li> </ul> The following records must be kept in respect of any samples required to be collected for the purposes of this licence: <ul style="list-style-type: none"> <li>a. the date(s) on which the sample was taken</li> <li>b. the time(s) at which the sample was collected</li> <li>c. the point at which the sample was taken; and</li> <li>d. the name of the person who collected the sample.</li> </ul>	Condition M1.1-1.3	Section 9.2
<b>Requirement to monitor concentration of pollutants discharged</b> For each monitoring/discharge point or utilisation area specified below (by a point number), the licensee must monitor (by sampling and obtaining results by analysis) the concentration of each pollutant specified in Column 1. The licensee must use the sampling method, units of measure, and sample at the frequency, specified opposite in the other columns (refer to Table 7.1, Table 7.2 and Table 7.3).	Condition M2.1, 2.3, 2.4	Section 7
Water quality parameter probes on the Automated water quality buoys must be calibrated in accordance with manufacturer instructions, or relevant Australian Standards, whichever is more frequent	Condition M2.5	Section 7.2
Subject to any express provision to the contrary in this licence, monitoring for the concentration of a pollutant discharged to waters or applied to a utilisation area must be done in accordance with the Approved Methods Publication unless another method has been approved by the EPA in writing before any tests are conducted.	Condition M3.2	Section 7.6.3
<b>Port Kembla Harbour Water Quality and Ecological Monitoring Program</b> The licensee must implement the Port Kembla Harbour Ecological Health Monitoring Program and associated reporting as per the GHD / AIE proposal dated September 2021, Rev G (EPA reference DOC21/864104-1).	Condition M5.1	Section 7.3

Condition	Reference	Evidence
Note: the initial monitoring frequency is specified in the above proposal, from a baseline event to the first year of operation. Following the first operational report, the ongoing monitoring frequency will then re-determined by the EPA in consultation with the licensee.		
<p><b>Recording of pollution complaints</b></p> <p>The licensee must keep a legible record of all complaints made to the licensee or any employee or agent of the licensee in relation to pollution arising from any activity to which this licence applies.</p> <p>The record must include details of the following:</p> <ul style="list-style-type: none"> <li>a. the date and time of the complaint</li> <li>b. the method by which the complaint was made</li> <li>c. any personal details of the complainant which were provided by the complainant or, if no such details were provided, a note to that effect</li> <li>d. the nature of the complaint</li> <li>e. the action taken by the licensee in relation to the complaint, including any follow-up contact with the complainant; and</li> <li>f. if no action was taken by the licensee, the reasons why no action was taken.</li> </ul> <p>The record of a complaint must be kept for at least 4 years after the complaint was made.</p> <p>The record must be produced to any authorised officer of the EPA who asks to see them.</p>	Condition M6.1-6.4	Section 7
<p><b>Telephone complaints line</b></p> <p>The licensee must operate during its operating hours a telephone complaints line for the purpose of receiving any complaints from members of the public in relation to activities conducted at the premises or by the vehicle or mobile plant, unless otherwise specified in the licence.</p> <p>The licensee must notify the public of the complaints line telephone number and the fact that it is a complaints line so that the impacted community knows how to make a complaint.</p>	Condition M7.1-7.3	Section 7
<p><b>Other monitoring and recording conditions</b></p> <p>The licensee must carry out, as a minimum, daily inspections of all water pollution control measures required by this licence. A record of each inspection must be made and produced to an EPA authorised officer if requested. The record must include:</p> <ul style="list-style-type: none"> <li>a. Date and time of inspection</li> <li>b. Details of the location of dredging operations</li> <li>c. Condition of silt curtains and other water pollution controls.</li> </ul> <p>Note: No movement of dredge spoil is permitted when a silt curtain required by this licence has not been maintained or is not achieving the requirements of this licence.</p>	Condition M9.1	Section 7.6.1 Section 9.2
<p><b>Notification of environmental harm</b></p> <p>Notifications must be made by telephoning the Environment Line service on 131 555.</p> <p>Note: The licensee or its employees must notify all relevant authorities of incidents causing or threatening material harm to the environment immediately after the person becomes aware of the incident in accordance with the requirements of Part 5.7 of the Act.</p> <p>The licensee must provide written details of the notification to the EPA within 7 days of the date on which the incident occurred</p>	Condition R2.1-2-2.2	Section 8 Section 9
<p><b>Process and management</b></p> <p>The licensee must continue to treat water from the southern ponds in Berth101 prior to discharge from Licensed Discharge Point 20. The treatment method must be provided in writing to the EPA and cannot be changed without APA approval</p>	Condition O4.12	Section 7.4

## 6. Control measures

### 6.1 Excavation works

The Principal Contractor will manage the impacts of the Stage 2A works on the marine environment of Port Kembla's Harbour in order to maintain compliance with monitoring limits and water quality monitoring obligations stipulated in the PKGT EIS, EPL No. 21529, Infrastructure Approval (SSI 9471), and Section 120 of the POEO Act.

Excavated works for the Stage 1 Early Enabling Works are due to be completed in December 2021. Excavated materials will be temporarily stockpiled at the southern end of the East Stockyard of the MBD Site Compound and within the Emplacement Cell Construction Site. Completion of excavation works from the Stage 1 Early Enabling Works will be undertaken during Stage 2A (refer to Table 2.2).

The Principal Contractor will implement a number of control procedures during Stage 2A, in line with the Project's ESCP. These will include:

- Installing surface runoff control measures, such as diversion drains, silt fences, sumps and pumping systems to prevent runoff entering or leaving excavation areas, and to prevent runoff/suspended solids entering the Inner Harbour.
- Placing stockpiles away from drainage lines, the water's edge, gutters or stormwater pits and inlets. Covering stockpiles likely to generate dust or odours and ensuring stockpiles of contaminated soil are stored in a secure area.

### 6.2 Equipment

The Principal Contractor is responsible for supplying the necessary equipment for the Stage 2A works. It is anticipated that the following equipment would be used during the Stage 2A works:

- Franna and crawler cranes.
- Piling ground frame and piling rigs.
- Drilling rigs and vibratory hammers.
- Elevated work platforms.
- Backhoe or tracked excavator for excavation and soil sampling.
- Tractors, Dolly and Jinker.
- Water storage of about 200,000 litres capacity, including metering and pumping equipment.

An emergency spill kit will be kept on site at all times at both the MBD Site Compound and Emplacement Cell Construction Site. All staff will be made aware of the location of the spill kit and trained in its use. In the event of a spill, staff will follow the procedures outlined in the Stage 2A Emergency Spill Plan.

Machinery and plant equipment will be checked daily for visible leaks and excessive exhaust fumes by the Principal Contractor Environmental Representative to ensure no oil, fuel or other liquids are leaking from machinery that could potentially pollute Port Kembla Harbour. All plant and equipment used during the Stage 2A works, including monitoring equipment, will be maintained in efficient condition, and operated by suitably qualified and trained construction personnel.

## 7. Water quality management

Given Stage 2A works are land based, objectives and performance criteria have been developed to reflect the low risk to the surrounding aquatic environment. The objectives and performance criteria for water quality monitoring during Stage 2A works are the following:

- To continue monitoring at relevant water quality monitoring locations based on the current EPL No. 21529 as described in Table 7.1;
- To ensure construction runoff does not cause pollution incident and discharge requirements of EPL No. 21529 are satisfied prior to any passive discharge into the harbour; and
- To implement ecological health monitoring as per the EHMP attached in Appendix C.

### 7.1 Monitoring locations

Water quality monitoring (WQM) within the Port Kembla Harbour is to be undertaken at a total of five locations prior to, and during the Stage 2A works, in accordance with the water quality monitoring requirements of EPL No. 21529. One additional monitoring points have also been included for wet weather discharge monitoring.

Each WQM point will be securely anchored/moored in its location. The location of each WQM point is outlined in Table 7.1, and shown in Figure 2.2.

Three locations have been selected to monitor at the zone of impact (WQM 2) and at nearby management zones upstream and downstream of the MBD Site Compound (WQM 1 and WQM 3) for the Stage 2A works. Two locations have been selected to monitor background water quality (WQM4 and WQM5).

The sampling points will be at a depth of 1.6 metres.

**Table 7.1**      *Monitoring point descriptions*

EPA ID No	WQM ID	Location description	Type of monitoring
1	WQM 1	North of Berth 101	Primary/Impact Works Area Receiver – Water Quality
16	WQM 2	North of the emplacement cell, Outer Harbour. No more than 20m from emplacement cell silt curtain	Primary/Impact Works Area Receiver – Water Quality
17	WQM 3	South West of Berth 101	Primary/Impact Works Area Receiver – Water Quality
18	WQM 4	Near the Pacific Ocean entrance to Outer Harbour	Background Water Quality
19	WQM 5	Near entrance to Allans Creek, near Bluescope Steel	Background Water Quality
20		Berth 101 – Southern Pond	Wet weather discharge quality monitoring

Note: Monitoring EPL Point 24 is not applicable during Stage 2A works as this stage of the Project is purely land based.



## 7.2 Automated WQM buoys

The effectiveness of controls will continually be assessed at the WQM locations through the sampling conducted by Automated Monitoring Buoys (AMB).

AMBs were deployed during the Stage 1 Early Enabling Works and baseline data was provided in accordance with the EPL. The AMBs will remain in place throughout Stage 2A to meet ongoing EPL No. 21529 requirements. The AMBs will monitor:

- Temperature (Celsius).
- Electrical Conductivity (EC) (salinity for harbour wide monitoring purposes).
- pH.
- Turbidity.
- Dissolved Oxygen (DO) (for harbour wide monitoring purposes).

Daily visual observations will also be undertaken for the duration of the Stage 2A works to monitor for potential release of pollutants such as oil or grease. Indicative images of the AMBs are presented in Figure 7.1.

### 7.2.1 Calibration and maintenance of monitoring equipment

AMBs will be calibrated and maintained in accordance with manufacturer's specification or relevant Australian Standard, whichever is more frequent. The AIE Environmental Representative will inspect each AMB weekly, or in response to any observed 'drift' in results. Inspection will also be undertaken as part of an investigation into a triggered alarm level, or anomalous reading (refer to Section 7.2).

Additional maintenance measures for the AMB to prevent pollution and deter formation of biofouling organisms include:

- Anti-fouling wipes: wipes to clean top surface of sensor to prevent biofouling organisms from colonising on probe edge and migrating towards the sensor.
- Sensor port plugs: plastic or copper alloy port plugs to prevent biofouling forming. Copper ports will deter organism settlement.
- Copper tape: anti-fouling protection for probe housing (if housing is plastic or metal).
- Protective plastic sleeves: biofouling will collect on sleeves covering probes and body of equipment and can be then easily removed.
- Sensor guards: metal (copper alloy) sensor guard fitted on the end of the sonde to deter bio-fouling formation.
- Copper alloy screens: placed over conductivity and temperature probes to deter bio-fouling formation. Screens allow water flow to ensure accurate measurements.
- C-spray solution: an environmentally safe, nanopolymer spray to keep surfaces slick and deter bio-fouling settlement.
- Plastic wrap: plastic wrap such as glad wrap or duct tape wrapped around the body of sonde have some anti-fouling properties when used in conjunction with C-spray solution.

In addition to calibration and maintenance of AMBs, hand held water quality monitoring equipment will also be calibrated and maintained in accordance with its manufacturer's specifications.

### 7.2.2 Real-time monitoring of AMBs

Data will be logged at 15-minute intervals, based on a moving 15-minute median, and transmitted to an onshore recording station where it will be processed to allow automated comparison of median turbidity/Total Suspended Solids (TSS) levels to a series of green, amber, and red trigger levels (refer to Section 7.6.4). When exceeded, an alarm will be triggered, and an automated email and SMS alerts will be sent to the Principal Contractor Environmental Representative and AIE HSE Manager with appropriate procedures to be implemented.

The individual values of WQM 1, WQM 2 and/or WQM 3 will be compared against background levels at WQM 4. Real time data will be provided to the Principal Contractor Project Manager which will be incorporated into environmental reports and site inspection records (refer to Section 9).

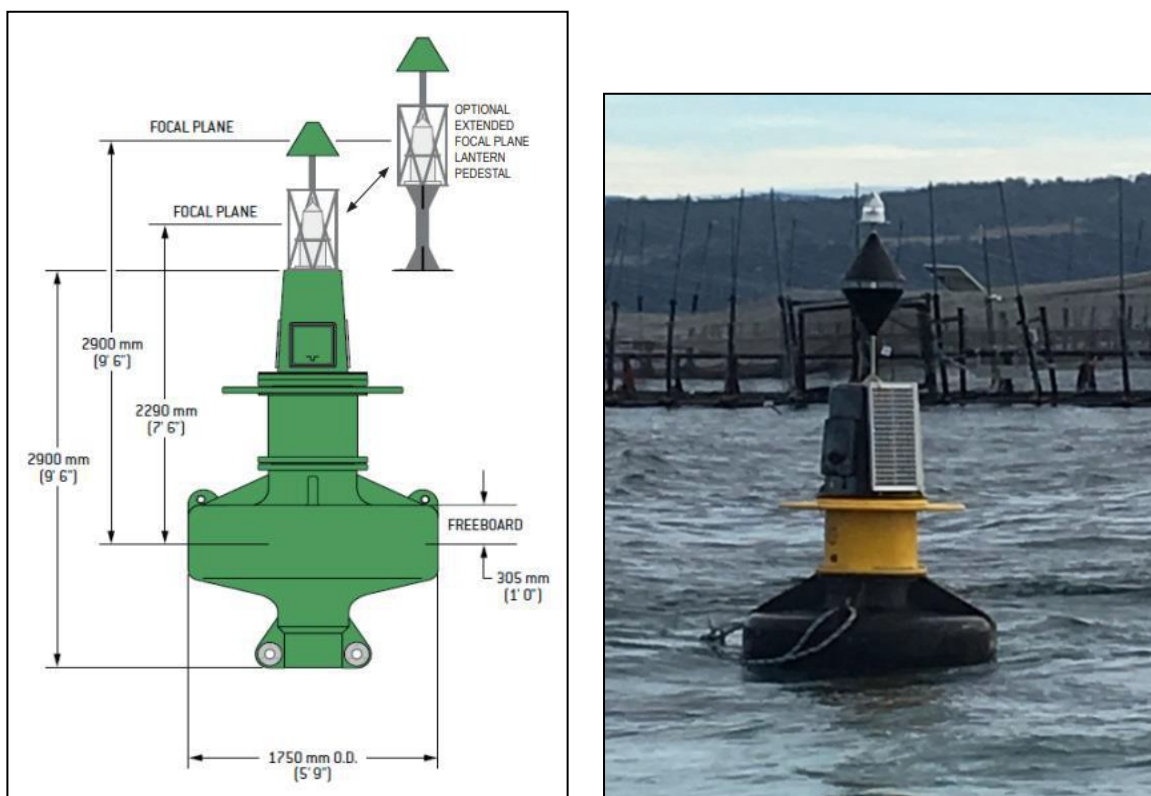


Figure 7.1 Automated Water Quality Monitoring Buoy dimensions

## 7.3 Harbour-wide Ecological Health Monitoring Program

AIE has developed an Ecological Health Monitoring Program (EHMP). Implementation of EHMP is imminent pending approvals; it is to be followed in the next stages of the project including Stage 2A. The purpose of the Ecological Health Monitoring Program is to assess and monitor impacts of the PKGT construction and operational activities on the ecological health of Port Kembla Harbour. The monitoring program has been designed in accordance with the NSW EPA requirements as specified in EPL No. 21529 and Condition 11 and 3 of Schedule 3 of the Infrastructure Approval SSI 9471. The EHMP will complement this WQMP, which has been approved by the Department of Planning, Industry and Environment (DPIE) and the EPA. A copy of the EHMP is provided in Appendix C.

Port Kembla Harbour has received industrial discharges from the Port Kembla Industrial precinct for over 100 years. At the same time, significant improvements in water quality and ecological health have been observed over the past several decades with reductions in pollutant loads and improvements in discharge water quality.

The construction and operation of the PKGT could potentially introduce:

- A short-term acute impact associated with the dredging and construction phase of the Project.
- A longer term and ongoing chronic impact associated with the discharge of cold water and biofouling compounds.

The overall aim of the EHMP is to undertake an ongoing water quality and health assessment of Port Kembla Harbour to monitor any change in water quality and ecology associated with the discharges from the PKGT.

The aims of the EHMP are to:

- Provide a quantitative assessment of the species diversity and abundance of aquatic hard-substrate sessile organisms in Port Kembla Harbour.
- Implement an ecological monitoring program to complement the licensee's existing Water Quality Monitoring Plan.
- Assess the presence (if any) and extent of change to the diversity and abundance of aquatic hard-substrate sessile organisms and water quality in Port Kembla Harbour during the construction and operation of the PKGT.

- Build upon the existing scientific literature concerning the water quality and broader ecological health of Port Kembla Harbour.

WQM 4 and WQM 5 have been included in the EHMP for background water quality for the purpose of monitoring harbour-wide water quality trends and the ecological health of Port Kembla Harbour. The information obtained by WQM 4 and WQM 5 will be used to track water quality indicators in the Inner Harbour, remote of the Project. The trends will be reported monthly for information purposes only.

WQM 5 may also at times be used as an alternative background data point. In the event of tidal changes, ship movement or weather impacts the quality of the data from the primary background monitoring buoy (WQM 4), the Principal Contractor Environmental Representative may adopt the use of WQM 5 based on observation of the event and data. Both data sets will be recorded throughout the Project.

## **7.4 Construction site run-off**

An ESCP has been developed for the MBD Site Compound to ensure that any stormwater runoff flows to an appropriately sized sediment basin. In addition, a water treatment system has been in place to ensure compliance with the EPL No. 21529 Condition O4.12 and EPL discharge limits.

A treatment plant will be in place during Stage 2A to satisfy EPL No. 21529 Condition O4.12. The EPA has been provided details and description of the treatment system (treatment via filtration media).

The quality of water held in the sediment basin must be ensured to meet EPL No. 21529 discharge limit requirements, via water treatment plant, prior to release from the site. Water quality will be ensured via checking the treatment plant in place is operating correctly and providing its expected performance prior to discharge. Daily monitoring and sampling are to be undertaken during any times of discharge.

Whenever necessary, maintenance of the treatment system in place will be undertaken to ensure that the system is providing the required discharge quality.

Daily grab sampling during discharge of water from Point 20, will be undertaken in accordance with the sampling methodology described in Section 7.6.3 which includes testing for TSS and Oil & Grease. Visual inspection for Oil & Grease is also being undertaken prior to discharge event and during sampling.

Erosion control devices will be inspected within 24 hours after major rainfall events (>10mm in 24 hours). Where controls are deemed inadequate, additional controls will be installed e.g., sandbags additional sediment fences, channels. Sediment removed from devices will be assessed for suitability and combined with stockpiled Project spoil for reuse or disposal.

## **7.5 Monitoring data requirements**

Water quality monitoring will be undertaken as per the monitoring requirements set out in EPL No. 21529. Details regarding sampling method, units of measure and sampling frequency of applicable pollutants of concern (POC) for WQMs are provided in Table 7.2.

**Table 7.2**      *Water quality monitoring requirements for WQMs 1-5*

<b>Pollutant</b>	<b>Unit of Measure</b>	<b>Frequency</b>	<b>Sampling method</b>
Aluminium (dissolved)	µg/L	Weekly	Grab Sample
Arsenic (dissolved)	µg/L	Weekly	Grab Sample
Cadmium (dissolved)	µg/L	Weekly	Grab Sample
Chromium (dissolved)	µg/L	Weekly	Grab Sample
Cobalt (dissolved)	µg/L	Weekly	Grab Sample
Copper (dissolved)	µg/L	Weekly	Grab Sample
DO	%	Special Frequency 1	Special Method 1
EC	µS/cm	Special Frequency 1	Special Method 1
Lead (dissolved)	µg/L	Weekly	Grab Sample
Mercury (dissolved)	µg/L	Weekly	Grab Sample
Nickel (dissolved)	µg/L	Weekly	Grab Sample
pH	pH units	Special Frequency 1	Special Method 1
Polycyclic Aromatic Hydrocarbons	µg/L	Weekly	Grab Sample
Temperature	degrees Celsius	Special Frequency 1	Special Method 1
Tributyltin	µg/L	Weekly	Grab Sample
TSS	µg/L	Weekly	Grab Sample
Turbidity	NTU	Special Frequency 1	Special Method 1
Zinc (dissolved)	µg/L	Weekly	Grab Sample

1. Special Method 1 means parameters are recorded from automated monitoring buoys
2. Special Frequency 1 means parameters requiring monitoring at 15-minute median intervals.

Water quality monitoring requirements for wet weather discharge (Point 20) are provided in Table 7.3.

**Table 7.3**      *Water quality requirements for wet weather discharge (Point 20)*

<b>Pollutant</b>	<b>Unit of Measure</b>	<b>Frequency</b>	<b>Sampling method</b>
Aluminium (dissolved)	µg/L	Every day a discharge occurs (prior to commencement)	Grab Sample
Arsenic (dissolved)	µg/L	Every day a discharge occurs (prior to commencement)	Grab Sample
Cadmium (dissolved)	µg/L	Every day a discharge occurs (prior to commencement)	Grab Sample
Chromium (dissolved)	µg/L	Every day a discharge occurs (prior to commencement)	Grab Sample
Cobalt (dissolved)	µg/L	Every day a discharge occurs (prior to commencement)	Grab Sample
Copper (dissolved)	µg/L	Every day a discharge occurs (prior to commencement)	Grab Sample
Lead (dissolved)	µg/L	Every day a discharge occurs (prior to commencement)	Grab Sample
Mercury (dissolved)	µg/L	Every day a discharge occurs (prior to commencement)	Grab Sample
Nickel (dissolved)	µg/L	Every day a discharge occurs (prior to commencement)	Grab Sample
Oil and Grease	visible	Every day a discharge occurs (prior to commencement)	Visual Inspection
pH	pH units	Every day a discharge occurs (prior to commencement)	Grab Sample
Polycyclic Aromatic Hydrocarbons	µg/L	Every day a discharge occurs (prior to commencement)	Grab Sample
Tributyltin	µg/L	Every day a discharge occurs (prior to commencement)	Grab Sample
TSS	µg/L	Every day a discharge occurs (prior to commencement)	Grab Sample
Zinc (dissolved)	µg/L	Every day a discharge occurs (prior to commencement)	Grab Sample

Assessment criteria have not been developed for the majority of water quality parameters outlined in Table 7.2 and Table 7.3 for Stage 2A as the works are for land-based activities only, (exception of TSS and turbidity as outlined in Section 7.6). Monitoring is currently being undertaken for all required water quality parameters as per EPL No. 21529 has been undertaken to establish baseline and to inform performance criteria when moving to Stage 2B water-based activities.

TSS and turbidity will continue to be evaluated using the set trigger levels and EPL limits (refer to Section 7.6.4 and Section 7.6.5).

## 7.6 Monitoring of turbidity and physical parameters

### 7.6.1 Daily inspections

Environmental inspections will be completed daily at the MBD Site Compound and the Emplacement Cell Construction Site during the Stage 2A works. The environmental inspections will be undertaken by the Principal Contractor Environmental Representative who will be required to complete the Inspection Checklist.

With respect to water quality, the following observations will be recorded on the Inspection Checklist:

- Date and time of inspection.
- Condition of water pollution controls.
- Presence of sediment plumes.
- Presence of oil and grease.
- Potential toxic Dinoflagellate blooms within the Inner Harbour.

Other observations (aside from the above) are also to be recorded, as necessary.

### 7.6.2 Acid Sulfate Soil (ASS) monitoring

Material classified as high risk of containing Potential ASS (PASS) and ASS has been identified during geotechnical investigations carried out as part of the EIS and additional baseline and targeted assessments (GHD, 2021). The Stage 2A works may encounter unexpected PASS which occurs at a depth below the proposed level of excavation during this stage of the works. Additional management and monitoring for ASS are provided in the Stage 2A ASSMP (Sub-Plan to the SMP).

The AMBs have capacity to identify any decreasing trends in pH. These readings will be monitored by RARE Environmental and provided to the Principal Contractor Environmental Representative. If a drop  $>0.5$  over two consecutive readings (15-minute intervals) is detected an investigation will ensue.

### 7.6.3 Sampling methodology

Grab sampling at each monitoring location indicated in Table 7.1 will be undertaken in accordance with the sampling frequency provided in Table 7.2 and Table 7.3, at a depth of 1.5 metres for monitoring buoys. The same procedure is followed for Point 20; however, this would be taken at the outlet location.

Sampling will be undertaken by appropriately qualified and trained personnel and with reference to relevant statutory requirements, standards, and quality assurance (QA) and quality control (QC) protocols. This includes sampling personnel wearing powderless nitrile gloves during sampling and the sampling equipment being decontaminated between samples.

Samples will be submitted to a National Association of Testing Authorities (NATA) accredited laboratory on a standard turnaround time, and where necessary, on a fast turnaround time, to facilitate a timely response to elevated concentrations. The water sampling procedure is provided in Appendix B.

### 7.6.4 Trigger Action Response Plan

The TARP is a tool used for the monitoring and tracking of any trends associated with water quality and enables reactive management to be implemented in the event of an observed decrease / deterioration in the selected water quality parameters. Immediate response can only be practically undertaken for parameters with real time data including pH, temperature, turbidity, EC, DO, and TSS.

Given Stage 2A is purely land based activities, the main parameter of concern is turbidity and/or TSS. In addition, monitoring data collected to date (including baseline data) show consistency of concentrations for all the other water quality parameters (both real time and weekly grab sampling parameters per Table 7.3). This is expected to be consistent moving to Stage 2A. Therefore, for Stage 2A AIE will continue to monitor all required parameters as per the EPL but will only set a trigger level for parameters with the EPL limit which is TSS/ turbidity.

In the event where TSS or turbidity exceed the recommended trigger values, the Principal Contractor's Environmental Representative (or delegate) will assess the situation with the Principal Contractor Project Manager (or delegate) and the AIE Environmental Representative with the primary aim to identify the likely cause of any trigger event.

If the elevated turbidity or TSS levels are determined to be a direct result of the Stage 2A works activities, the Contractor Environmental Representative (or delegate) will determine the appropriate mitigation measures to be implemented in consultation with the AIE Environmental Representative. These measures may include undertaking further sampling and/or installation of absorbent booms and/or further modifications of the activities.

The proposed measures will consider the significance of the exceedance and the impacts that the increased turbidity/pollutants may be having on the physical and ecological parameters of Port Kembla Harbour (Inner and Outer).

Any exceedance that is found to be caused solely by contractor activities will be recorded by the Principal Contractor Environmental Representative (or delegate) and lodged as an official Environmental Incident Report to AIE. These details will include, but not be limited to:

- Location, time, and date.
- Tidal movements.
- Details of construction processes.
- Level of turbidity or TSS (from real time and/or grab samples taken prior to the event and following the event).

In addition to the actions provided in Table 7.4, where there has been an exceedance of monitoring trigger levels, the Principal Contractor Environmental Representative in Consultation with the AIE Environmental Representative will:

- Establish that all plant, equipment, and environmental controls are operating in a proper and efficient manner.
- Identify the likely source of contamination.
- Implement any required corrective measures.
- Apply rules and controls established in Figure 7.2 (where applicable) of this WQMP if an exceedance is suspected or confirmed to be related to the Stage 2A works.
- Stop work activities if required as per of this WQMP when an exceedance is demonstrated to be caused by the Stage 2A works and is above the background +50 mg/l trigger level.

Any exceedance is to be analysed in order to confirm if it has been caused by the Stage 2A works.

Additionally, possible mitigating measures that can be considered in the event of an exceedance that has been attributed to the Stage 2A works include the replacement of underperforming compressors/hoses if needed.

It is noted that trigger level is only set for turbidity and TSS. These parameters are measured using real time monitoring buoys (turbidity) and NTU-TSS correlation (TSS) recommended in the current EPL No. 21529 or from in-field study approved by the EPA, whichever is more appropriate at the time of measurement.

## 7.6.5 Investigation of exceedance in POC's (TSS or Turbidity)

A case-by-case investigation process will be implemented for exceedance in POC (TSS or turbidity) trigger levels throughout the Stage 2A works. Further to this, an Environmental Incident Report will be completed by the Principal Contractor Environmental Representative if the values of TSS or turbidity exceeds those listed in the monitoring limits table (refer to Table 7.4). Information recorded in the investigation will include, but is not limited to:

- Weather (tides, rainfall, winds etc.).
- Port activities on the day.
- Excavation or disposal being undertaken works on the day.
- Shipping movements in and out of the port not related to the Stage 2A works.

The initial goal of the investigation will be to identify the source of the exceedance, then determine the responsible party(s) for the exceedance and report on how the problem can be solved. A process flow diagram for exceedance of trigger level is shown in Figure 7.2, and is to be followed where applicable.

Table 7.4 Trigger Action Response Plan for TSS or Turbidity

Normal Situation	Level 1 Trigger (Background + 30mg/l)	Level 2 Trigger (Background + 40mg/l)	Level 3 Trigger (Background + 50mg/l)
Controls effective	Check controls and Work Practices	Respond, check work practices and controls, reduce suspended sediment	Respond, intervene, reduce, and investigate
	<ul style="list-style-type: none"> <li>Alert Construction Foreman.</li> <li>Employ adaptive work management practices to minimise suspended sediment, examples include: <ul style="list-style-type: none"> <li>Work speed and timing – Brief suspension of operations depending on tide and/or optimisation/alteration of works</li> <li>Location – Change location of equipment</li> <li>Magnitude – adjust works intensity, including brief suspension of in water works.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Alert Project Manager.</li> <li>Reduce suspended sediment attributable to Stage 2A works by implementing one or more adaptive management practices.</li> <li>A check of Water Quality Controls must be undertaken to ensure they are functional. Return to normal operations can only take place if sediment generating activities are reduced by employing adaptive work management practices to minimise suspended sediment, examples include: <ul style="list-style-type: none"> <li>Work speed and timing – Brief suspension of operations depending on tide and/or optimisation/alteration of works</li> <li>Location – Change location of equipment</li> <li>Magnitude – adjust works intensity, including brief suspension of in water works.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Alert Project Manager.</li> <li>Project Manager to immediately instruct all plant to go to established operational modes known to reduce sediment generating activities.</li> <li>Alternatively, temporarily suspend operations associated with the exceedance, and works highly likely causing the exceedance, until such time contractor can demonstrate that the operation is “environmentally secure”, and all controls are functioning and in place.</li> <li>Contractor to investigate and identify the source of the exceedance (this can be in conjunction with the Environmental Representative).</li> <li>Return to normal operations can only take place if sediment generating activities are reduced by employing adaptive work management practices to minimise suspended sediment, examples include: <ul style="list-style-type: none"> <li>Work speed and timing – Brief suspension of operations depending on tide and/or optimisation/alteration of works</li> <li>Location – change location of equipment</li> <li>Magnitude – adjust works intensity, including brief suspension of in water works.</li> </ul> </li> </ul>

**Note:**

- 1) Given that TARP is intended for immediate response, this TARP is only applicable for monitoring locations EPL 1, EPL16, and EPL 17 (which are the primary/ impact works area receiver as described in the EPL 21529).
- 2) Background is calculated based on the average reading at EPL18 and EPL19 30 minutes before and after the time of exceedance.
- 3) If turbidity is used in lieu of TSS, TSS will be converted to turbidity using the NTU-TSS correlation recommended in the EPL (i.e., 50 mg/L is equivalent to 50 NTU) or using a correlation based on in-field study approved by the EPA. The correlation that will be used to convert TSS to turbidity are both for background and impact monitoring locations.



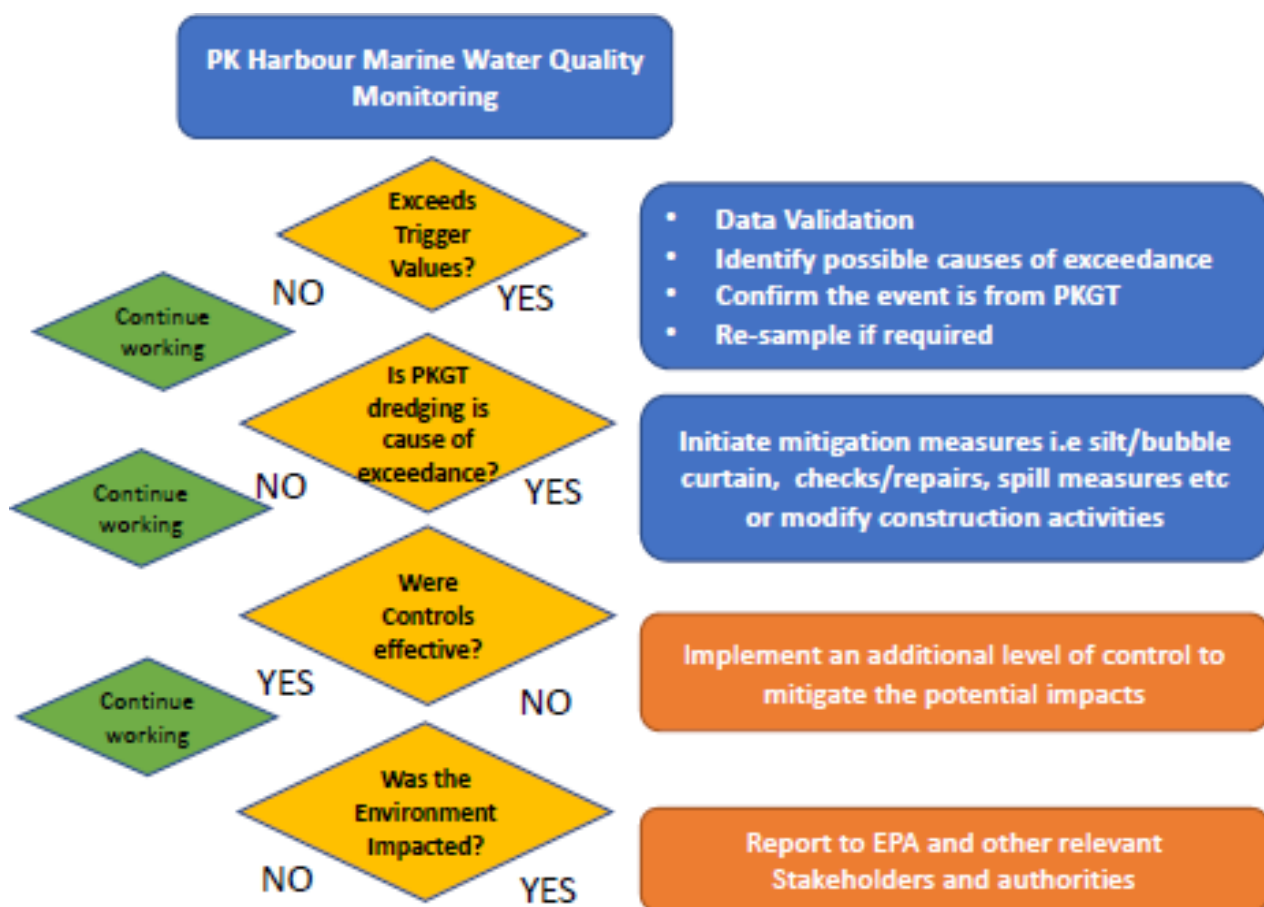


Figure 7.2 Triggered event process flow chart

## 8. Communication and complaints

Effective communication between the Principal Contractor and construction personnel, AIE project team, sub-contractors and external stakeholders will be undertaken throughout the Project to ensure effective implementation of this WQMP.

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

### 8.1 Internal communications

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

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

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

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

### 8.2 External communications

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

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

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

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

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

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

## 8.3 Complaints management

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

AIE will operate a free 24-hour Community Information Line (1800 789 177) where members of the community can leave details about an inquiry, they may have regarding construction activities related to water quality. This message will be passed on to site personnel and/or the Stakeholder Engagement Team, as appropriate.

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

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

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

The Complaints and Disputes Register will be maintained by the Project's HSE Manager or delegate, and will detail what the issue was, initial response provided, how and when the issue was resolved, and by whom.

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

Records will be kept for at least four years after the complaint was made and will be produced on request by any authorised officer of the EPA. The phone number is listed on the AIE website (<https://ausindenergy.com/contact-us/>) and will be provided on all community newsletters. The AIE HSE Manager has notified the Port Kembla Harbour Environment Group of the Community Information Line.

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

## 9. Inspections, monitoring and audits

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

### 9.1 Environmental inspections

#### 9.1.1 AIE and Principal Contractor joint environmental weekly inspection

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

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

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

#### 9.1.2 Contractor environmental inspections

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

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

The HSE Manager is responsible for the initial reporting of significant non-compliances with the WQMP or relevant legislation to the AIE Project Director and government authorities (refer to Section 10).

### 9.2 Monitoring

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

Monitoring requirements applicable to the WQMP include:

- Water quality monitoring results.
- Exceedances of POCs.

### 9.3 Auditing

AIE will conduct internal audits at frequencies as determined in the risk-based auditing schedule. The purpose of auditing is to verify compliance with:

- The EMS and this WQMP

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

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

## 9.4 Environmental reporting

### 9.4.1 DPIE reporting

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

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

Reporting applicable to this WQMP will consist of:

- Water quality monitoring results.
- Requirements of EPL No. 21529.
- Construction works progress and appraisal of water quality controls.
- Environmental Incident Report(s), as required.
- Annual returns, as required by EPL No. 21529.

### 9.4.2 Other reporting requirements

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

Further reporting requirements are provided in Section 9.6 and Section 10.

## 9.5 Compliance tracking register

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

### Compliance Reporting

*The proponent must provide regular compliance reports to the Department on the development in accordance with the relevant requirements of the Department's guideline Compliance Reporting Post Approval Requirements (2020), or its most recent edition.*

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

- Infrastructure Approval (SSI 9471).
- EPL No. 21529.
- Requirements of this WQMP.

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

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

## 9.6 Non-conformance, corrective, and preventative actions

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

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

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

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

The Department must be notified in writing to [compliance@planning.nsw.gov.au](mailto:compliance@planning.nsw.gov.au) within 7 days after the identification of any non-compliance issue. The notification must identify the development, including the application number, set out the condition of approval that the development is non-compliant with, the way in which it does not comply, the reasons for the non-compliance (if known) and what actions have been taken, or will be taken, to address the non-compliance.

# 10. Incident management and emergency response

## 10.1 Incident management

### 10.1.1 Overview

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

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

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

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

The AIE HSE Manager will be responsible for regulatory notification of all notifiable environmental incidents (refer to Section 10.1.2 for notifiable incidents). All environmental incidents will be reported immediately to DPIE in writing via the Planning Portal after AIE becomes aware of the incident, as per Schedule 4 Condition 5 of the Infrastructure Approval (SSI 9471). The notification must identify the development, including the application number, and set out the location and nature of the incident.

In the event of a notifiable non-compliance incident arising, the Principal Contractor will notify the AIE HSE Manager immediately to allow the AIE HSE Manager to notify DPIE in writing (via the Planning Portal) within 7 days of AIE becoming aware of the non-compliance, as per Schedule 4 Condition 6 of the Infrastructure Approval SSI 9471. The notification must identify the development, including the application number, set out the condition of approval that the development is non-compliant with, the way in which it does not comply, the reasons for the non-compliance (if known) and what actions have been taken, or will be taken, to address the non-compliance.

### 10.1.2 Notifiable incident under the POEO Act

In the event of a Notifiable Incident as defined under the POEO Act, AIE is responsible for immediately notifying the EPA, and any other relevant authority, of pollution incidents on or around the site via the EPA Environment Line (telephone 131 555) in accordance with Part 5.7 of the POEO Act. The circumstances where this will take place include:

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

Follow-up written notification to the EPA and any other relevant authorities will be required in accordance with the POEO Act and requirements of the EPA. This includes the provision of written details of the notification to the EPA within 7 days of the date on which the incident occurred.

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

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

### 10.1.3 Notifiable incident under the Infrastructure Approval (SSI-9471)

In accordance with Condition 5 of Schedule 4, DPIE must be notified in writing to [compliance@planning.nsw.gov.au](mailto:compliance@planning.nsw.gov.au) immediately after AIE becomes aware of an incident on site.

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

## 10.2 Emergency response

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

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

In the event of an emergency, the following plans shall be consulted and implemented as relevant:

- The Principal Contractor's site-specific Emergency Response Plan.
- AIE Port Kembla Gas Terminal Emergency Spill Plan.
- Pollution Incident Response Management Plan (PIRMP).
- AIE Emergency Management Procedures.



# 11. Document management and review

## 11.1 Record management

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

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

## 11.2 Review and revision of the WQMP

This WQMP will be reviewed and updated, as required under Condition 3 of Schedule 4 of Infrastructure Approval (SSI 9471) to ensure the objectives of the applicable approval conditions contained within are being met throughout Stage 2A. Where a review leads to revisions, then within 4 weeks of the review the revised document must be submitted to the Planning Secretary for approval, unless otherwise agreed with the Planning Secretary.

In addition, as required under Condition 4 of Schedule 4 of Infrastructure Approval (SSI 9471), the WQMP must be reviewed, and if necessary, revised within 3 months (unless otherwise agreed with DPIE) for any of the following:

- Following the submission of an incident report as per Condition 5, Schedule 4 of Infrastructure Approval (SSI 9471) (refer to Section 10).
- Following approval of any modification to the conditions of approval outlined in Infrastructure Approval (SSI 9471).
- At the direction of the Planning Secretary as per Condition 4, Schedule 2 of Infrastructure Approval (SSI 9471).

## 11.3 Access to information

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

- The PKGT EIS.
- Current statutory approvals for the Project.
- Approved strategies, plans or programs required under the conditions of Infrastructure Approval (SSI 9471).
- A comprehensive summary of the monitoring results of the development, reported in accordance with the specification of any conditions, or any approved plans and programs relating to Infrastructure Approval (SSI 9471).
- A summary of complaints (updated monthly).

- Any independent environmental audit, and responses to the recommendations in any audit.
- The approved premises map (EPL No. 21259, Condition A2.4).
- PIRMP (EPL No. 21529, Condition E2).
- Any other matter required by the Planning Secretary.

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

# References

DPIE 2020, *Compliance Reporting Post Approval Requirements*.

Environmental Protection Licence No. 21529, dated 5 October 2021.

GHD 2018, Port Kembla Gas Terminal Environmental Impact Statement.

Infrastructure Approval SSI 9471 dated 24th April 2019.

Landcom 2004, Managing Urban Stormwater: Soils and Construction Volume 1 and Volume 2. - Volume 2A (the "Blue Book").

NSW Ports 2014, Berth 103 Stage 2 Extension - Dredging and Spoil Disposal Works.

NSW Ports 2016, Port Kembla Development Code.

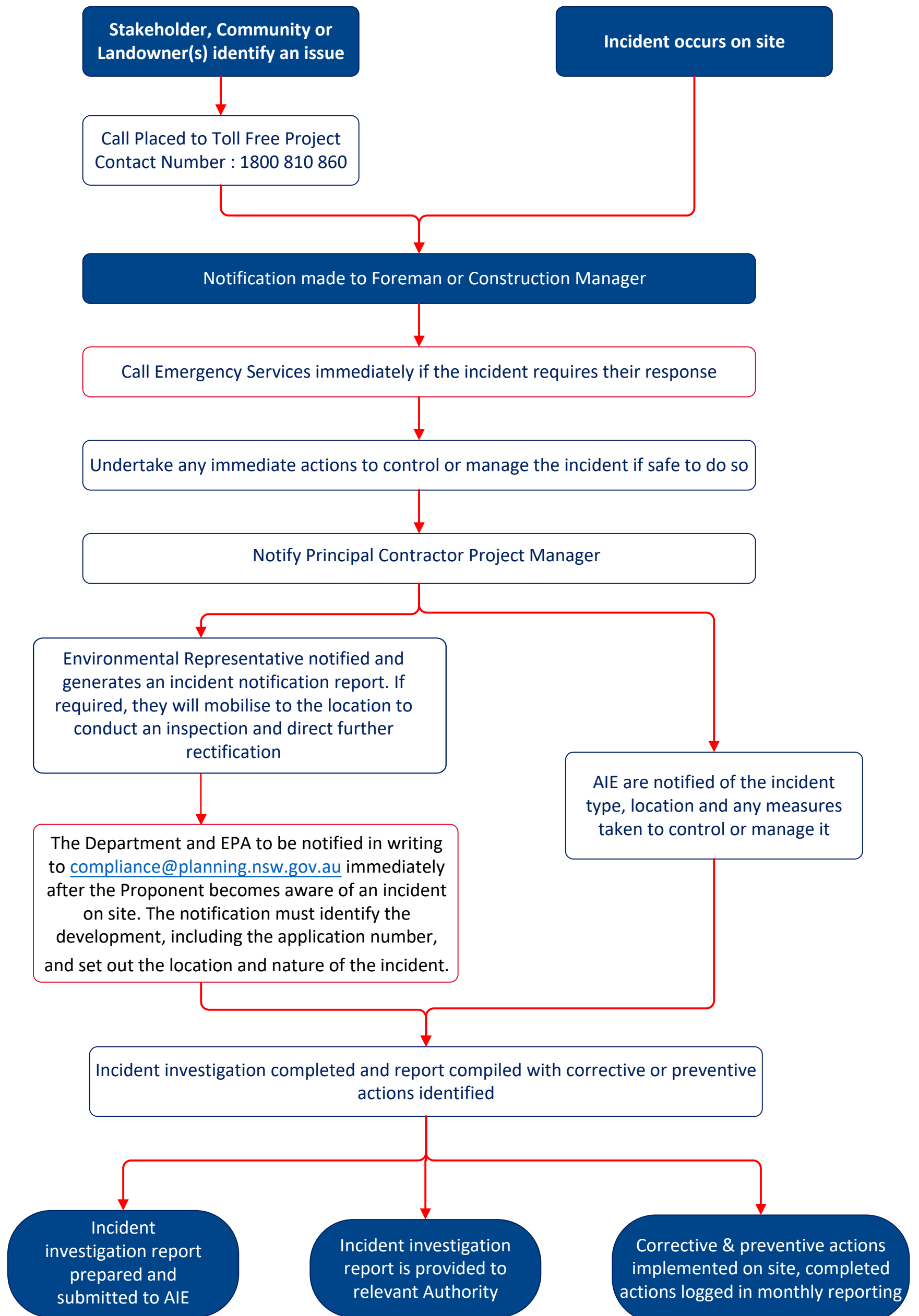
# Appendices

# **Appendix A**

## **Incident Notification flow chart**

# Port Kembla Gas Terminal (PKGT) Project

## Incident Notification & Response Flow Chart





# **Appendix B**

## **Water sampling procedure**

<b>Marine Water Sampling</b>	<b>Document ID</b>	<b>A.020 – Water Sampling Procedure</b>
	<b>Prepared by</b>	<b>Rhys Blackburn</b>
	<b>Reviewed by</b>	<b>Rhys Blackburn</b>
<b>Purpose:</b> This procedure describes how to collect water quality readings and water samples from water from a boat.	<b>Authorised by</b>	<b>Rhys Blackburn</b>
	<b>Date of Issue</b>	<b>01/04/2020</b>

## Key Definitions:

**Grab Sample** – means a sample of water collected in the field, and transferred to a laboratory supplied sample container.

**Physical Parameters** – Turbidity, temperature, pH,, electrical Conductivity and dissolved oxygen measure

**Quality Reading** – a field measurement taken by a Water Quality Meter, or other device, in the field.

**Sample collection boat** – The sample collection boat is where the samples are collected from. It will be crewed by a driver and environmental professional to collect samples or collect water quality data

## Sample Location:

Fixed sample locations may as outlined in the project documentation. Locations may include lateral and vertical requirements. The Sample Collection boat should be positioned using either hand held GPS, or on board GPS. An onboard sounder may be used to determine depth at each location if required.

Non-fixed samples locations should be recorded using the same equipment. sample locations include samples or data collected in response to an incident, investigation or other reason



Photo 1 Sample vessel

## Grab Samples:

Samples are to be collected using a dedicated (Project) submersible pump attached to a Teflon hose. The pump should be a waters typhoon, or similar purpose built water sampling pump. The pump and line should be a suitable length to achieve the required depth. A weighted line may be required to overcome current and reinforce the setup.

Once lowered to the sample location the pump should be activated and the pump and line purged for a minimum of 10 seconds, to ensure representative sample. The flow should be directed into a receptacle, where the Water quality meter's probes can be accommodated, and Physical parameters can be observed to stabilise.

Physical parameters may be recorded at this time.

Once stable readings have been recorded, the sample hose should be directed to the laboratory supplied bottles for the required laboratory analysis

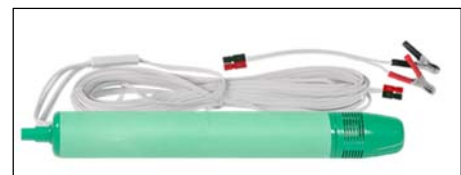


Photo 2 Submersible pump

## Sample container and preservation:

<u>Analysis</u>	<u>Bottle Type</u>	<u>PQL</u>	<u>Preservation</u>	<u>Holding Time</u>
TSS or TDS	Plastic or glass, unpreserved 200ml	5mg/L	Cool to <6°C	2 days
Turbidity	Plastic or glass, unpreserved 50ml	0.1 NTU	Store in dark	2 days
BTEX+C6-C9 (or C6-C10)	2 x 40ml vials	1 µg / L	pH <2 (H2SO4 or HCl) or Sodium Bisulphate (NaHSO4)** + Cool to <6°C	14 days
Dioxins	2L Glass		Cool to <6°C + 0.008% Na2S2O3	30 days
PAHs and C10-C40	500ml Glass	1-2 µg / L	Cool to <6°C	7 days
Tributyltin	500ml Glass	0.002µg Sn/L	Cool to <6°C and dark	7 days

<b>Metals (un-filtered)</b>	<b>Plastic or glass 50ml</b>		pH <2 (HNO <sub>3</sub> )	6 months
Aluminium		0.01 mg/l		
Antimony		0.001 mg/l		
Arsenic		0.001 mg/l		
Cadmium		0.0001 mg/l		
Chromium		0.001 mg/l		
Cobalt		0.001 mg/l		
Copper		0.001 mg/l		
Lead		0.001 mg/l		
Mercury		0.0001 mg/l		
Nickel		0.001 mg/l		
Selenium		0.001 mg/l		
Silver		0.001 mg/l		
Vanadium		0.001 mg/l		
Zinc		0.001 mg/l		

## **Physical Parameters:**

Physical parameters may be measured using a hand held water quality meter. The water quality meter can be used by either holding the measuring probes directly in the water being measured. Alternatively, a flow cell may be used (as outlined above). The manufacturers guidance should be followed regarding calibration and calibration testing.

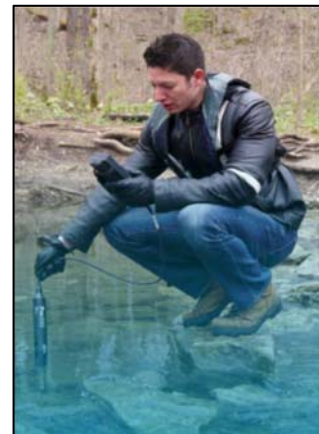


Photo 3 Water Quality Meter

## **Sample Quality Assurance and Quality Control:**

- All samples should be collected by an Environmental professional
- Appropriate sample labelling should be used including, Sample Point ID\_Depth. Date and sample time should also be recorded on each sample container and COC.
- Physical parameter readings will be recorded on a field sheet, including date, time and location.
- Calibration records will be maintained in line with the manufacturers specification
- Sample preservation to include placing immediately into an insulated box, cooled with an ice brick.
- Transport under Chain of Custody (COC) procedures, and within the holding times for the relevant analytes.
- Laboratory analyses conducted within appropriate holding times
- An Intra-laboratory blind field duplicate analysis should be undertaken for each sampling event. A Relative Percent Differences (RPDs) will be calculated and assessed against an RPD criteria set for each project.
- A disposable pair of gloves should be worn for each sample collection to minimise the potential for cross contamination
- Samples shall be submitted to a laboratory that hold NATA accreditation for the sample analysis

## **Training & Certification:**

- Coxswain grade 2 license
- Construction General Induction
- Site Specific induction

## **Equipment Required:**

## **PPE Required:**



<ul style="list-style-type: none"><li>▪ Positioning system and sounder</li><li>▪ Two way radio</li><li>▪ Insulated sample container</li><li>▪ Ice bricks</li><li>▪ Submersible pump, Teflon hose</li><li>▪ Calibrated hand-held water quality meter</li><li>▪ Sample location figure or way-points</li><li>▪ Digital camera</li><li>▪ Sample bottles and marker pens</li></ul>	<ul style="list-style-type: none"><li>▪ Personal flotation devices (PFD)</li><li>▪ Disposable nitrile gloves</li></ul>
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# **Appendix C**

## **Ecological Health Monitoring Program**



# Port Kembla Harbour Ecological Health Monitoring Program

## Port Kembla Gas Terminal

Australian Industrial Energy

September 2021

→ The Power of Commitment





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<b>Project name</b>	East Coast Gas Project
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<b>Revision version</b>	Rev D
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			Name	Signature	Name	Signature	Date
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S3	C	M Hooper	K Rosen				
S4	D	A Boden	K Rosen		K Rosen		3/9/21
S4	E	A Boden	K Rosen		K Rosen		17/9/21
S4	F	A Boden	K Rosen		K Rosen		30/9/21

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# 1. Introduction

## 1.1 Proposed Works

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

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

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

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

The construction of the Project is primarily associated with the establishment of a new berth facility at Port Kembla to enable an LNG Carrier to berth alongside the Floating Storage and Re-gasification Unit (FSRU) and new infrastructure to connect the terminal to the existing gas network. The FSRU is a cape-class ocean-going vessel approximately 300 metres in length and about 50 metres in breadth. The vessels will be procured and operated under long-term charter by Høegh LNG. The vessel will be constructed and assembled offshore and then sailed to Port Kembla to be moored at the Berth 101 site throughout operations.

The development has progressed to the early works stage at Berth 101 (the site or MBD Site Compound), which includes the demolition and removal of all existing surface infrastructure, and disconnection and removal of all underground services. The Early Enabling Works phase is required to facilitate all future stages of development.

The construction phase is expected to last up to 18 months. Construction of the quay wall is scheduled to commence circa January 2022 with dredging and emplacement cell construction scheduled to commence circa March 2022.

Commissioning and operational phases of the Project will follow the completion of construction and are predicted to commence in January 2023. In its operational phase, the Project will operate 24 hours per day and 7 days per week and be capable of supplying in excess of 100 petajoules of gas each year.

## 1.2 Purpose of the Port Kembla Harbour Ecological Health Monitoring Program

The purpose of the Ecological Health Monitoring Program (EHMP) is to assess and monitor impacts of Port Kembla Gas Terminal (PKGT) construction and operational activities on harbour wide ecological health of Port Kembla Harbour. The monitoring program has been designed in accordance with the NSW Environmental Protection Authority (EPA) requirements as specified in Environment Protection Licence 21529 and Condition 11 and 3 of Schedule 3 of AIE's Infrastructure Approval (refer Table 1.1 below). The EHMP will complement the existing Water Quality Monitoring Plan which has been approved by the Department of Planning, Industry and Environment (DPIE) and the EPA.

To adequately identify and monitor impacts, the specific objectives of the EHMP are to:

- Provide quantitative assessment of the species diversity and abundance of aquatic hard-substrate sessile organisms in Port Kembla Harbour (PKH).

- Assess the presence and extent of change to the diversity and abundance of aquatic hard-substrate sessile organisms in Port Kembla Harbour during the study period.
- Complement AIE's existing Water Quality Monitoring Plan, and
- Build upon existing scientific literature concerning the water quality and broader ecological health of PKH.

**Table 1.1 Overview of relevant approval conditions and EHMP section references**

Reference	Condition	EHMP section reference
EPL 21529 E3.3	By September 3 2021 the licensee must submit a draft monitoring program in writing to the EPA for approval. The draft program must be prepared by a person with suitable qualifications in aquatic ecology.	This plan - qualifications of Author and Reviewer are provided in Appendix A.
EPL 21529 E3.4	The draft monitoring program must include, but may not be limited to: <ul style="list-style-type: none"> <li>a) A literature review – of previous similar and relates studies including the Bluescope Steel Report, Pollution Reduction Program 146: Assessment of the ecological condition of Port Kembla Inner Harbour and Allans Creek and a comparison with two references estuaries, June 2012.</li> <li>b) Sampling design and methodology – specifying the species to be monitored and the monitoring frequency and duration.</li> <li>c) Validation of predicted modelling impacts (e.g. verification sampling, bench testing).</li> <li>d) Monitoring point locations including reference, control and impacts site locations.</li> <li>e) Assessment of quantitative and qualitative ecological changes, including water quality monitoring from concurrent sampling undertaken by the licensee.</li> <li>f) Reporting – format and frequency.</li> </ul> <p>Note: Initially EPA requires a 2 year monitoring frequency for the program. That is, the program would be repeated every 2 years. Based on results and recommendations from a suitably qualified person, the EPA will review this frequency after 2 monitoring events in consultation with the licensee.</p>	<p>Section 3 – Literature Review</p> <p>Section 4 – Sampling Design and Methodology</p> <p>Section 4.2.5 – Validation modelling framework</p> <p>Section 4.1.3 – Monitoring Point Locations</p> <p>Section 4.2.3 – Data Analysis</p> <p>Section 5 - Reporting</p> <p>Section 4.1.4 – Duration and Frequency</p>
SSI 9741 Schedule 3, Condition 11	<p><b>Spoil Management Plan</b></p> <p>11. Prior to the commencement of construction, the proponent must prepare a Spoil Management Plan to the satisfaction of the Planning Secretary and in consultation with the EPA, DPIE Water, NSW Ports, Port Authority of NSW and, an EPA accredited contaminated site auditor. The plan must be consistent with the Emplacement Cell Report and include:</p> <p>(a) – (b) <i>not relevant to EHMP.</i></p> <p>(c) a Water Quality Monitoring Plan that includes:</p> <ul style="list-style-type: none"> <li>• a description of the water quality monitoring that would be undertaken to monitor turbidity and pollutant concentrations surrounding dredging and disposal works, including real-time turbidity monitoring;</li> <li>• <b>a broader program to monitor harbour-wide water quality trends and the ecological health of Port Kembla Harbour;</b></li> <li>• objectives and performance criteria, including trigger levels for investigating any potential or actual adverse impacts associated with construction activities on water quality and the ecology of Port Kembla Harbour;</li> <li>• a plan to respond to any exceedances of the trigger levels and/or performance criteria, and minimise any adverse water quality impacts of the development; and</li> <li>• reporting procedures for the results of the monitoring program.</li> </ul>	<p>A Construction Water Quality Monitoring Plan has been developed to provide ongoing monitoring of potential impacts to water quality throughout construction.</p> <p>This EHMP is complementary to the Construction Water Quality Monitoring Plan and aims to address the requirement for a broader program to monitor harbour wide water quality trends and the ecological health of Port Kembla Harbour.</p> <p>The plan will be implemented to monitor trends during baseline, construction and operational phases of the development .</p>

Reference	Condition	EHMP section reference
SSI 9741 Schedule 3, Condition 3	<b>Water Quality Verification and Monitoring Program</b> Prior to the commencement of operations, the Proponent must prepare a Water Quality Verification and Monitoring Program, in consultation with the EPA and DPI Fisheries and to the satisfaction of the Planning Secretary.	To be completed prior to the commencement of operations in 2023 as a complementary program to this EHMP.  Framework provided in Section 4.2.5 – Validation modelling framework

## 1.3 Scope and Limitations

*This report: has been prepared by GHD for Australian Industrial Energy and may only be used and relied on by Australian Industrial Energy for the purpose agreed between GHD and Australian Industrial Energy as set out in section 1.2 of this report.*

*GHD otherwise disclaims responsibility to any person other than Australian Industrial Energy arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.*

*The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.*

*The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.*

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## 2. Local Marine Environment

### 2.1 Physical Environment

Port Kembla's Inner Harbour is considered a relatively low energy environment with low discharges from creeks and drains and little wave energy propagation into the Inner Harbour. In contrast, the Outer Harbour is known to be impacted by long wave events, with long waves from multiple directions occurring at the same time. The predominant directions are from the east, the north, and from the west, which is likely to be due to waves reflecting off the beach.

Land use in the immediate vicinity of Port Kembla contributes to the ambient marine water quality within the Port via terrigenous input during rain events. In addition, the ambient marine water quality within Port Kembla is also subject to tidal influences from the Port Kembla entrance.

Historically water quality within the Inner and Outer Harbours has been impacted by urban and industrial discharges as well as port activities. Water quality monitoring within the port has indicated concentrations of metals (aluminium, cadmium, copper, lead, zinc, tin and arsenic) exceeded the ANZECC (2000) (now ANZG 2018) 95% trigger values for protection of marine waters (GHD, 2018). These exceedances were generally highest in the vicinity of Allan's Creek, Gurungaty waterway and Darcy Road drain. Average total suspended solids were found to be higher within the Inner Harbour than the Outer Harbour. pH levels were generally lower in the Inner Harbour than the Outer Harbour, indicating freshwater discharge influences from the existing waterways within the Inner Harbour.

Water temperatures within the port are generally higher than those measured offshore due to slower tidal flushing patterns and existing industrial thermal discharges (hot water discharge within Allan's Creek) to the Inner Harbour. As a result, water temperatures within the Inner Harbour are generally one to two degrees warmer than temperatures beyond the entrance to the port. The Outer Harbour benefits from greater tidal flushing and is generally less than 0.25 degrees warmer than water temperatures beyond the entrance to the port (AECOM, 2010).

Marine sediments within the port are generally characterised as soft silty clays dominating the surface sediments with an underlying layer of stiff clay. Metals (arsenic, cadmium, chromium, copper, manganese, mercury, lead, vanadium and zinc), Polycyclic Aromatic hydrocarbons (PAH), dioxins and Tributyltin (TBT) have been recorded within these sediments across the Inner Harbour exceeding the screening levels for ocean and land disposal (National Assessment Guideline for Disposal – NAGD, and National Environment Protection Measures – NEPM) (WorleyParsons, 2012; Geochemical Assessments, 2013). Further, bioavailability investigations also found concentrations of cadmium, copper, lead and zinc exceeded NAGD screening level in some samples (Geochemical Assessments, 2013).

Recent investigations undertaken as part of the Environmental Impact Statement (EIS) have indicated the presence of contaminated sediments within the proposed dredging and disposal areas; these results were generally consistent with previous investigations. Concentrations of contaminants of concern were largely consistent across the dredging and disposal areas, with the primary contaminants of concern comprising heavy metals, PAH, dioxins and TBT at concentrations above the nominated screening levels.

### 2.2 Marine Habitat

PKH is a highly modified system, existing in an established industrial setting. PKH is a receiving environment of stormwater runoff and waste discharge from neighbouring industries. GHD (GHD, 2018b) has previously undertaken a marine assessment of PKH in 2018 and found marine habitat to be limited to hard substrate habitat and the soft sediment expanses.

Hard substrate habitat consists of infrastructure such as piles, quay walls and the breakwater around the perimeter of the port. Such hard substrate presents ideal habitat for biofouling communities within the sheltered environment. Assemblages around the Inner Harbour have been described as sparse with community structures reflective of the highly disturbed environment; species noted within these communities are polychaete worms, bryozoans,

barnacles and ascidians (Worley Parsons, 2012). Comparatively, a higher diversity and abundance of sessile invertebrates has previously been reported in the Outer Harbour (Worley Parsons, 2012). More recent surveys (GHD EIS, 2018) undertaken for the EIS found communities generally consistent with those previously described, with the addition of the macroalgae *Dictyota dichotoma* on the shallow subtidal zone of the surveyed piles.

The seabed within the Inner Harbour has previously been described as consisting of fine, unconsolidated silt expanses with large decapod burrows (Worley Parsons, 2012). Historically the seagrass species *Halophila ovalis* has been recorded within the Inner Harbour benthos (Pollard and Pethebridge, 2002; EcoLogical Australia, 2003), however seagrasses have not been detected on more recent surveys (2012, 2018). There are no known mapped seagrass communities adjacent to the PKH.

Macroalgae has been known to occur in sparse distributions across soft sediments habitats within the port. More recent investigations (2018) did not identify any macroalgae within the proposed dredge footprint, other than those observed along the berth piles. The different habitats within the Inner and Outer Harbour have been found to support varying diversities in fish assemblages and compositions. The higher diversity within the Outer Harbour may have reflected the use of area, including macroalgal habitat and breakwater, as nursery for juvenile species (AWT, 1999; AECOM, 2010). The eastern breakwater environments in the Outer Harbour also provided niche habitat for species including mado, yellowtail and moonwrasse, with the red morwong as the only species observed in deeper soft sediment habitat (AECOM, 2010). In contrast the highly utilised and developed Inner Harbour is not known to support as many species. Those that occur are typical of inshore habitats being Glass perchlet and Japanese striped goby (AWT, 1999; Pollard & Pethebridge, 2002; UNSW, 2009). Fish assemblages identified as part of these studies are common across the region and did not include any threatened species. The area also does not support any key fish habitat.

## 2.3 Marine Fauna

Schedule 4, 4A and 5 of the FM Act provides lists of critically endangered, endangered and vulnerable species, populations and ecological communities occurring in NSW. The following species were identified as potentially occurring in the Port Kembla area in the 2018 EIS and were assessed under the FM Act 1994 assessment criteria. The results of this assessment are summarised below:

- The grey nurse shark (*Carcharias taurus*) listed as **critically endangered**. The species may transit the region during local migrations between aggregation sites however, the port environment is not considered to be key habitat for this species.
- The Australian grayling (*Prototroctes marena*) listed as **endangered**. The closest known record of the species is in the estuary at Minnamurra, approximately 50 km south of Port Kembla (NSW DPI, 2016b). Due to the distance from this record, lack of suitable habitat and absence of records from previous port surveys, it is unlikely that the species will be present in the Port Kembla area.
- The black rockcod (*Epinephelus daemeli*) listed as **vulnerable**. Juveniles of the black rockcod are commonly found in inshore areas and estuaries where there is suitable sheltered habitat such as rock crevices, caves and gutters (NSW DPI, 2015). It is possible that the species could use the rock breakwalls, piles and quay walls within the port, however previous investigations within Port Kembla have not identified the black rockcod as present within the port (AECOM, 2010; Worley Parsons, 2012). The black rockcod is therefore identified as having a 'may occur' likelihood of occurrence.
- The great white shark (*Carcharodon carcharias*) listed as **vulnerable**. This species is known to be present near seal colonies and thus may visit the wider region as a transient visitor due to the nearby seal haul out site at the Five Islands Nature Reserve (DSEWPC, 2013). However, it is considered unlikely that the species will venture into the shallow waters of Port Kembla where there is frequent movement of vessels causes disturbance and a lack of food sources.

Schedule 1 of the BC Act 2016 provides lists of critically endangered, endangered, vulnerable species and populations occurring in NSW. The following species were identified as potentially occurring in the Port Kembla area and were assessed under the BC Act 2016 criteria. The results of this assessment are summarised below:

- The southern right whale (*Eubalaena australis*) listed as **endangered**. This species is likely to occur within the Outer Harbour having been previously recorded within the port (Worley Parsons, 2012).

- The blue whale (*Balaenoptera musculus*) listed as **endangered**. This species is unlikely to occur within Port Kembla due to lack of suitable habitat.
- Marine turtles – leatherback (**endangered**), loggerhead (**endangered**) and green (**vulnerable**) turtles could potentially visit the port as transient visitors however, it is unlikely that they use the port for nesting or foraging purposes and as such, these species are considered unlikely to occur within the Port Kembla area.
- The long-nosed fur seal (*Arctocephalus forsteri*) and the Australian fur seal (*Arctocephalus pusillus*) listed as **vulnerable**. These species are likely to occur, having been previously recorded within the Outer Harbour.

The EPBC Act Protected Matters Search Tool was used during the EIS to identify MNES and other matters protected under the EPBC Act that are predicted to occur in or relate to the project area. This search identified the following MNES of relevance to the PKGT:

- No Wetlands of International Significance
- No Commonwealth Marine Areas
- 69 Listed Threatened Species (marine species excluding marine birds)
- 56 Listed Migratory Species (marine species excluding marine birds)
- 83 Listed Marine Species
- 12 Whales and other Cetaceans
- 42 threatened and migratory bird species.

Of these, the following species/groups were identified as likely to occur in the port that were assessed as part of the EIS in accordance with the related Significant Impact Guidelines 1.1 (Commonwealth of Australia, 2013):

- Southern right whale (*Eubalaena australis*)
- Humpback whale (*Megaptera novaeangliae*)
- Long-nosed fur seal (*Arctocephalus forsteri*)
- Australian fur seal (*Arctocephalus pusillus*)
- Indian ocean bottlenose dolphin (*Tursiops aduncus*)
- Bottlenose dolphin (*Tursiops truncatus* s. str.)
- Syngnathids.

## 2.4 Introduced Species

Several introduced marine species surveys have identified an extensive list of species present in the port. Introduced marine species accounted for 50 % of the coverage of the hard substrate assemblages within Port Kembla with more pest species and higher abundances of pest species present in the Outer Harbour compared to the Inner Harbour (Johnston, 2006).

Of the species recorded within Port Kembla, *Alexandrium* spp. dinoflagellates are listed as High National Priority Pests while the ascidians *Ciona intestinalis* and *Styela clava* and bryozoan *Schizoporella errata* are classified as Medium National Priority Pests (Hayes *et al.*, 2005). Whilst the toxic dinoflagellate species *Alexandrium catenella* were recorded during surveys conducted in 2002 and 2009 within the port (Pollard & Pethebridge, 2002; AECOM, 2010), none were found during the 2011 survey (Worley Parsons, 2012). In addition, no toxic dinoflagellate blooms have been recorded within Port Kembla however historic events confirm a possibility of future outbreaks.



### 3. Literature Review

Following over 80 years of steelworks operations at Port Kembla, and associated anthropogenic influences on the marine environment, Bluescope Steel was directed by NSW EPA to implement Pollution Reduction Program (PRP) 146. From 2009 – 2011 PRP146 was implemented to assess the ecological condition of Port Kembla Inner Harbour, and Allans Creek. The results of this program were reported in Dafforn *et al.* (2012). Commensurate with the scale and duration of Bluescope Steel operations, a number of elements were monitored under the program including benthic larval fish, benthic and pelagic adult fish, planktonic larval fish, epibiota (sessile hard-substrate invertebrates), infauna (soft sediment invertebrates), phytoplankton and microphytobenthos (chlorophyll a), and physiochemical variables.

Of relevance to this EHMP is the epibiota component of the PRP146. The biofouling community was assessed over two events at sites of relevance to Bluescope Steel operations. This comprised seven sites at the Inner Harbour, and three sites in Allans Creek. Reference sites were also established in Botany Bay, and Port Jackson. Monitoring comprised of deployment of a settlement plate array, with n=2 replicates at each site. Following a three month deployment period in the 'growing season' (Nov/Dec – Feb/Mar), the settlement plates were retrieved, preserved and analysed using dissecting microscope for estimates of percentage cover. Taxa were identified to the lowest taxonomic level possible, noting that morphospecies were used in many instances.

Results of the assessment indicated that the epibiotic communities differed between the Port Kembla sites and the reference estuaries, and the communities were also different between sampling events. The epibiotic community at Port Kembla was therefore considered different to those at the reference locations, but there was no evidence of reduced ecological condition (Dafforn *et al.*, 2012). Whilst no formal review of the sampling design was included in Dafforn *et al.* (2012), the statistics presented, and firm conclusions reached indicate that n=2 replicates were sufficient for detecting change in ecological condition. Further, Dafforn *et al.* (2012) identified that "*Port Jackson appears most similar to Port Kembla and therefore is a useful reference estuary to determine if conditions worsen*".

To support design of this EHMP a review was also undertaken of the Aquatic Biological Monitoring Framework that was designed to assess impacts of dredging and spoil emplacement activities undertaken for the Port Kembla Outer Harbour Development (NSW Ports, 2015). Similar to PRP146, and earlier Inner Harbour dredge monitoring programs, the NSW Ports program included the assessment sessile invertebrates via the deployment of settlement plates. Whilst implementation of the framework was deferred, the framework was reviewed and approved by Department of Planning and Environment NSW, in consultation with NSW Department of Primary Industries and Fisheries.

The framework was designed for consistency with the PRP146, however sites were located in the Outer Harbour as relevant to the spatial footprint of the development. N=2 replicate settlement plates were proposed to be deployed at each of the four nominated sites in the Outer Harbour. Deployment periods, post-collection treatment and laboratory analysis, and statistical analysis were all proposed to be undertaken in a similar manner to that outlined for PRP146 above.

## 4. Sampling Design and Methodology

### 4.1 Approach

#### 4.1.1 Overview

As described in Section 2, one of the key marine fauna groups in PKH is the biofouling (or epibiota) community. Changes in this community structure is commonly used as an indicator for ecosystem health, and as outlined in Section 4 has previously been successful in Port Kembla monitoring programs. The larval recruitment of ascidians, barnacles, bivalves, bryozoa, sponges, amphipods and polychaetes is commonly targeted in ecological health programs. As a significant component of biological diversity, these filter feeders are generally sensitive to elevated contaminant loadings due to their immobility (NSW Ports, 2015) and larval recruitment is considered more sensitive than impacts to adults.

Methods proposed for this EHMP echoes those used in the PRP146 (Dafforn *et al.*, 2012), and the NSW Ports Outer Harbour Development Aquatic Biological Monitoring Program framework (NSW Ports, 2015). As was done for the NSW Ports framework, the monitoring approach developed and successfully implemented under PRP146 has been adapted for this EHMP to include sites of relevance to the proposed works and incorporate recommendations regarding reference locations from the PRP146.

This EHMP has also been designed to interface with the Construction Water Quality Monitoring Plan (CWQMP). There is intentional alignment with the Inner and Outer Harbour water quality monitoring locations and the proposed ecological health monitoring locations to allow for data synergies. This is further detailed in Section 4.2.3.

#### 4.1.2 Design Principles

The design principles that have been adopted for the EHMP during the construction and operational phases are summarised below:

- Adopt broad principles of the commonly accepted Before/After/Control/Impact (BACI) methodology and utilise robust analysis techniques to determine whether there are any significant ecological changes that may be attributed to the construction and operation of the PKGT.
- Ensure sufficient monitoring effort to detect ecological changes that may be attributed to the construction and operation of the PKGT, commensurate with the level of risk associated with the proposed works, whilst optimising the allocation of resources.
- Utilise a weight of evidence approach to determine impacts on the marine environment.

#### 4.1.3 Monitoring Point Locations

In order to represent the PKH wide environment, GHD will establish impact sites at two monitoring zones within PKH (Figure 4.1), comprising:

- Inner Harbour: Sites 1, 3, 5 and 8
- Outer Harbour: Sites 2, 4, 6 and 7.

The PRP146 assessment (Dafforn *et al.*, 2012) identified that Port Jackson is a “*useful reference estuary to determine if conditions worsen*”. Given the objective of this program is to monitor for potential impact, Port Jackson is therefore considered an appropriate reference location. Port Botany has also been included in the program as a reference estuary, with the expectation that this estuary will provide a “*suitable reference estuary to determine if conditions in Port Kembla improve*” (Dafforn *et al.*, 2012). Eight reference/control sites within Port Jackson (sites R1-R7) and within Port Botany (sites R8-R14) have been selected for monitoring under this program (Figure 4.2 and Figure 4.3), enabling a consistent level of effort across each of the estuaries.

Table 4.1 details the proposed sites. The sites within PKH have been selected to be co-located with water quality monitoring buoys to leverage water quality data when interpreting our results (sites I1-I5). Additional sites (I6-I7) were selected with reference to the outputs of the modelling of potential construction and operational impacts

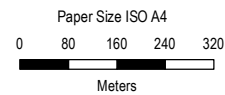
undertaken during the EIS. The reference sites within Port Jackson and Port Botany are representative of habitats in the inner and outer harbour environs. Where appropriate these have also been selected to be consistent with reference sites monitored under PRP146 (Dafforn *et al.*, 2012).

Locations provided are approximate and will be ultimately decided in consultation with the NSW EPA and Port Authority NSW Harbour Master direction and approval.

**Table 4.1 Monitoring Locations and Designations**

Site No. <sup>1</sup>	Monitoring Zone	Site Description	Easting (approx.)	Northing (approx.)
I1	Port Kembla Inner Harbour	Inner Harbour North	307674	6183760
I3	Port Kembla Inner Harbour	Inner Harbour South	307226	6184480
I5	Port Kembla Inner Harbour	Inner Harbour West	305960	6185090
I8	Port Kembla Inner Harbour	Inner Harbour North East	306799	6185490
I2	Port Kembla Outer Harbour	Mid Outer Harbour	305711	6185110
I4	Port Kembla Outer Harbour	Outer Harbour Breakwater East	306531	6185250
I6	Port Kembla Outer Harbour	Outer Harbour Breakwater Middle	307497.1	6184396
I7	Port Kembla Outer Harbour	Outer Harbour Breakwater West	307173.8	6184420
R1	Port Jackson	Port Jackson – Parsley Bay	340529	6253150
R2	Port Jackson	Port Jackson – Shark Bay	339549	6253070
R3	Port Jackson	Port Jackson – Chowder Bay	338335	6254100
R4	Port Jackson	Port Jackson – Whiting Beach	336969	6253520
R5	Port Jackson	Port Jackson – Cockatoo Island	332324	6254270
R6	Port Jackson	Port Jackson – Onion Point (Woolwich)	331253	6254170
R7	Port Jackson	Port Jackson – Balls Head Bay	331083	6252940
R8	Port Jackson	Port Jackson – Balmain	333015	6252460
R9	Port Botany	Port Botany – Kurnell	334488.1	6235548
R10	Port Botany	Port Botany – Yarra Bay	335703	6238963
R11	Port Botany	Port Botany – Foreshore Road	333835.9	6240957
R12	Port Botany	Port Botany – Runway West	331222.8	6242052
R13	Port Botany	Georges River – Taren Point	327410.3	6234843
R14	Port Botany	Georges River – Tom Uglys Point	326002	6236257
R15	Port Botany	Georges River – Shipwrights Point	325278	6235920
R16	Port Botany	Georges River – Kangaroo Point	324259	6235860

<sup>1</sup> Site numbers have been assigned to be consistent with co-located water quality monitoring sites where possible.



Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 56



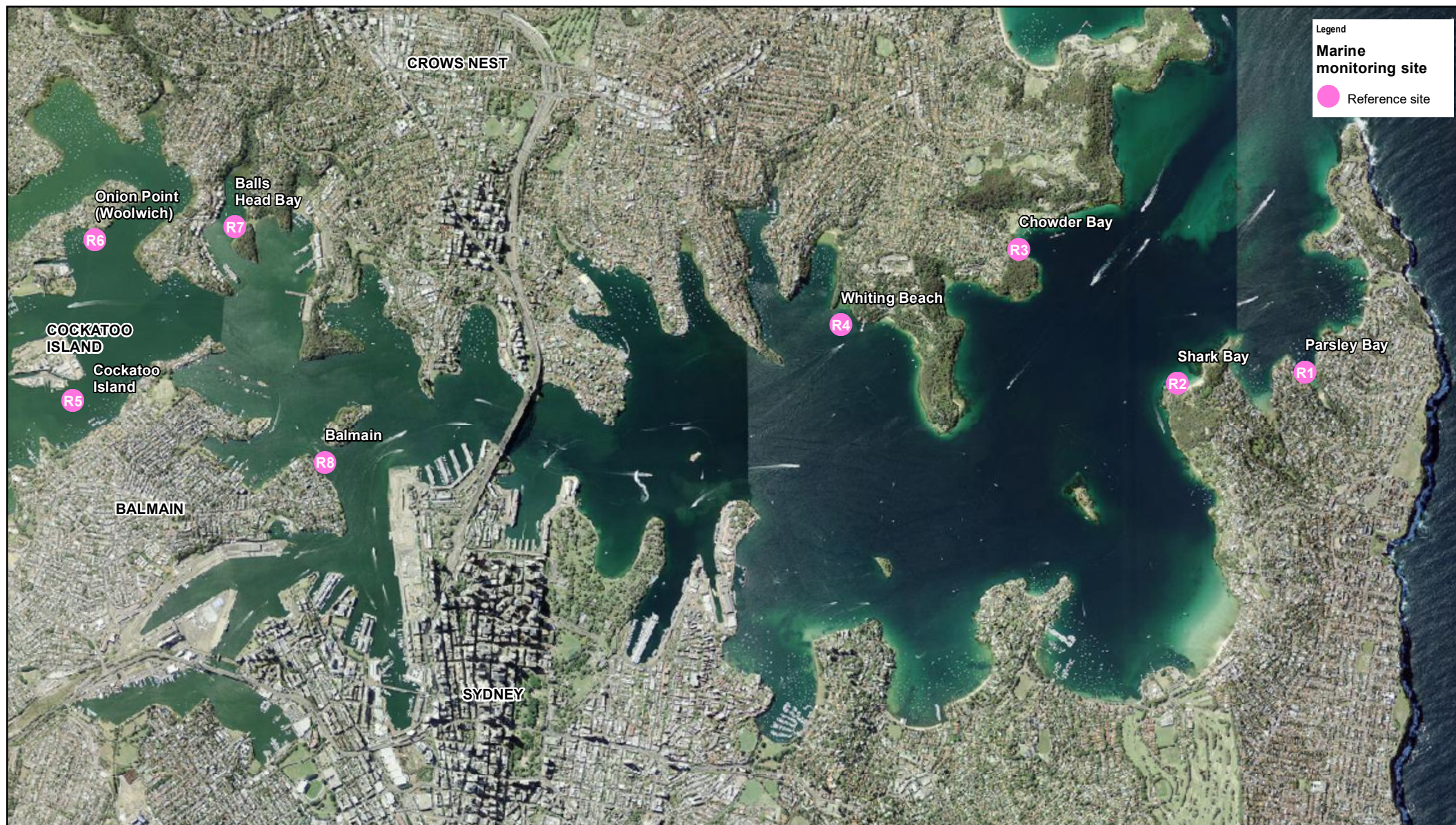
Australian Industrial Energy  
Port Kembla Gas Terminal

Project No. 12542715  
Revision No. B  
Date 28/09/2021

Monitoring Locations - Impact Sites

**FIGURE 4-1**



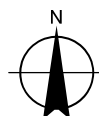


Paper Size ISO A4

0 250 500 750 1,000

Meters

Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 56



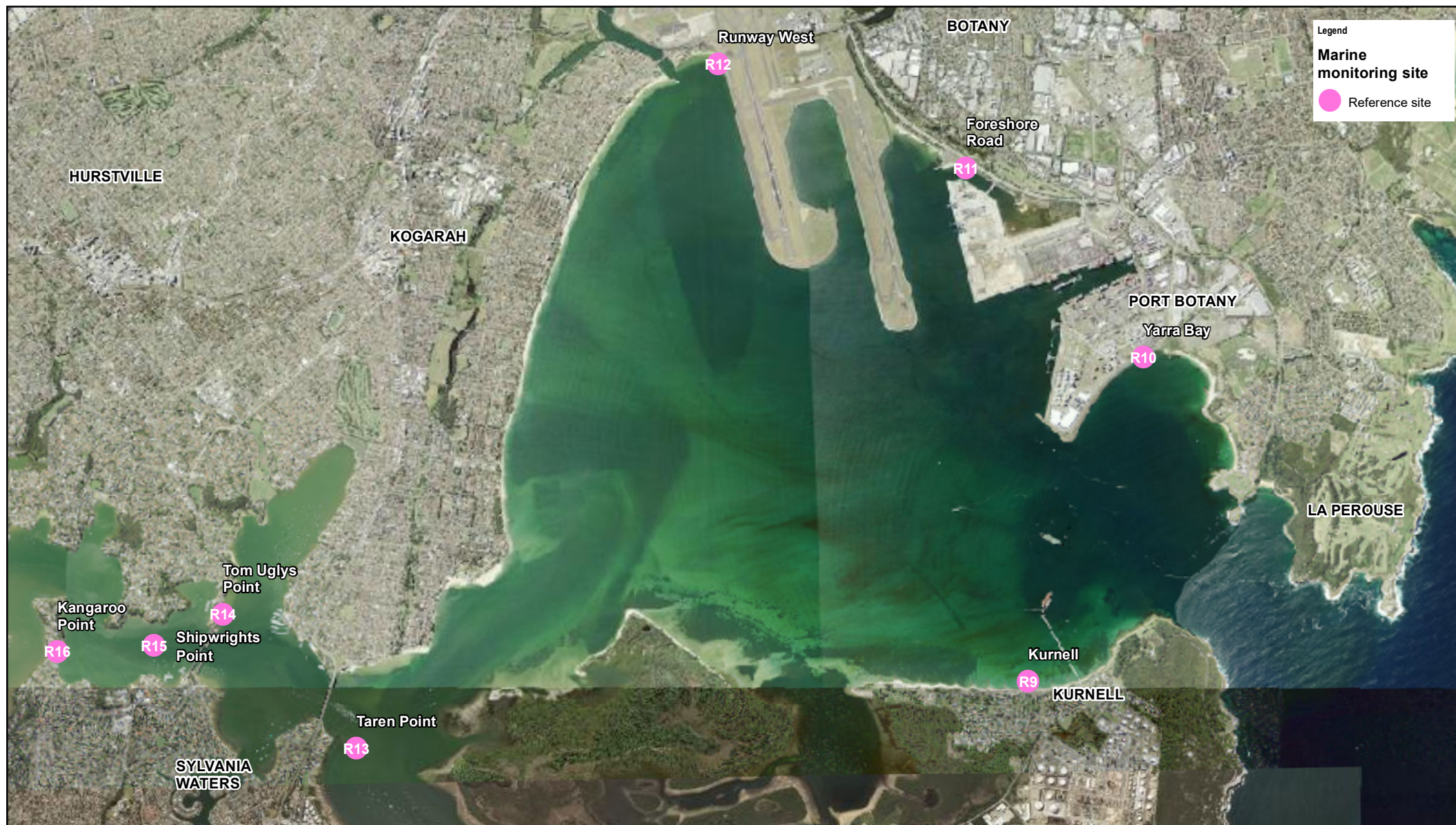
Australian Industrial Energy  
Port Kembla Gas Terminal

**Port Jackson**  
**Monitoring Locations - Reference Sites**

Project No. 12542715  
Revision No. B  
Date 28/09/2021

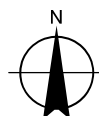
**FIGURE 4-2**





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0 350 700 1,050 1,400  
Meters

Map Projection: Transverse Mercator  
Horizontal Datum: GDA 1994  
Grid: GDA 1994 MGA Zone 56



Australian Industrial Energy  
Port Kembla Gas Terminal

**Monitoring Locations -  
Port Botany Reference Sites**

Project No. 12542715  
Revision No. A  
Date 27/09/2021

**FIGURE 4-3**

## 4.1.4 Duration and Frequency

The EHMP will be implemented over three phases, comprising:

1. Baseline Construction Monitoring<sup>2</sup> Event 1, scheduled for Summer of 2021/22<sup>3</sup>
2. Construction Monitoring Event 2, scheduled for Summer of 2022/23
3. Operational Monitoring Event 1, scheduled for Summer of 2023/24

EPL 2159, condition E3 requires a two year monitoring frequency; after two monitoring events the program is to be reviewed in consultation with the EPA (refer section 6, and Table 1.1). The program shall therefore be reviewed after the Summer 2023/24 monitoring event to enable capture of the required two year frequency prior to program review.

For each monitoring event the monitoring arrays will be deployed for a period of 8 – 12 weeks, with arrays deployed in November/December and collected in February/March. Monitoring will be undertaken during the same season for each event. During the first event a visual check (via underwater drop camera) of deployed equipment will also be undertaken four to six weeks post deployment. This will enable confirmation that deployed plates are appropriately placed and have not been lost.

The program has been designed for scalability should construction phase be delayed, the EHMP can be adapted to facilitate additional monitoring if required.

## 4.2 Methods

### 4.2.1 Indicators

The indicators for the monitoring program are summarised in Table 4.2. The design approach is to employ a settlement plate array system, consistent with those previously deployed under PRP 146 (Dafforn *et al.*, 2012) and that proposed under NSW Ports (2015) Outer Harbour Monitoring Program framework.

An example settlement plate schematic is shown in Figure 4.4. Each array will consist of a backing plate upon which two 11 x 11 cm black Perspex plates will be fixed in a vertical position. The system will be anchored to the seabed at 5 m water depth, and the backing plate will be supported by a float to maintain a depth of 1 m from the seabed.

Limiting each array to two plates will lessen any risks associated with rope breakage due to excessive weight as recruitment accumulates. Vertical orientation of the array will be maintained by an appropriately weighted anchor system that allows for minimum slack necessary to account for movements in tide, wind and wave action. Each array will be orientated in line with the dominant current flow.

Redundancy has also been incorporated into the design, with an additional array to be deployed at each site. These redundancy plates will only be analysed in circumstances where the primary plate is missing.

**Table 4.2 Indicators of Ecological Health Monitoring Program**

Monitoring Zone	Design	Total Units (per event)	Indicator
Inner Harbour (3 sites)	2 plates per array	6 primary plates across 3 arrays	Sessile invertebrate abundance, diversity, richness Multivariate assemblage analysis
	Two arrays per site (1 primary, 1 redundancy)	6 back up plates	
Outer Harbour (4 sites)	2 plates per array	8 primary plates across 4 arrays	Based on % cover of taxa identified to lowest taxonomic unit possible (likely family / species / morphospecies level)
	Two arrays per site (1 primary, 1 redundancy)	8 back up plates	

<sup>2</sup> Baseline monitoring will take place during construction Early-Works (prior to dredging). These activities pose low risk to impacts on water quality.

<sup>3</sup> Subject to approval from the Harbour Master and EPA

Monitoring Zone	Design	Total Units (per event)	Indicator
Port Jackson (7 sites)	2 plates per array	14 primary plates across 7 arrays	
	Two arrays per site (1 primary, 1 redundancy)	14 back up plates	
Port Botany (7 sites)	2 plates per array	14 primary plates across 7 arrays	
	Two arrays per site (1 primary, 1 redundancy)	14 back up plates	

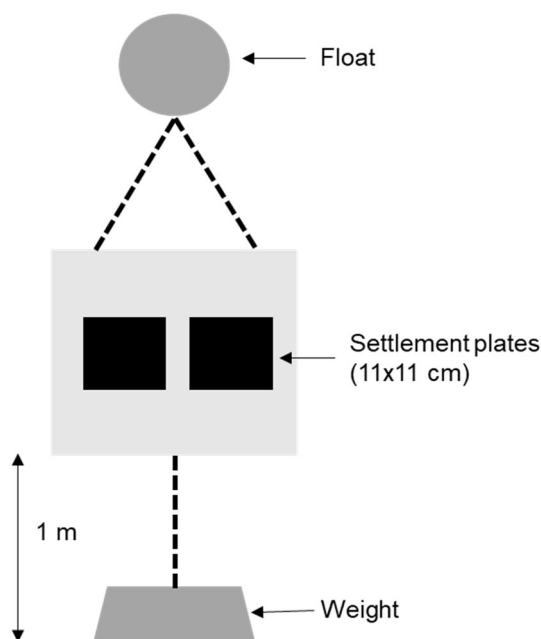


Figure 4.4 Example Settlement Plate Schematic

## 4.2.2 Collection and Preservation

At the end of the 8 to 12-week period, plates will be collected and photographed. Plates will be stored in-tact in a mesh bag submerged in formalin diluted to a 7 to 10% concentration with sea water for preservation until received by the nominated laboratory. Clear Site identification slates and rulers will be present in each field photo and each container will be clearly labelled. Once preserved in the mesh bag, the plates will be shipped in fully sealed plastic containers, kept in a cool and dark environment, and transported in sealed poly-drums.

Due to the formalin preservative, samples will be transported in accordance with Australian Dangerous Goods Code and carried as hazardous goods.

## 4.2.3 Data Analysis

Samples will be analysed by a laboratory experienced in taxonomic identification. Upon receipt the laboratory will visually inspect the samples for any damage and confirm samples received against the chain of custody. Prior to any examination, the laboratory will take a photograph of each aspect of the plate before visually inspecting presence/absence of all visible attached organisms, as certain small or translucent species may be missed in photo analysis, may not have been captured in the field and may have been damaged in transit. To minimize edge effects, the centre 8 x 8 cm of the plate will be analysed, with the remaining 3 cm boundary excluded from assessment.



## Image analysis

A custom overlay using GIMP software will outline the 8 x 8 cm marking. Following this percent cover analysis will be performed by identifying species beneath 100 randomly placed points using Coral Point Count with Excel extensions software. In the event of dense settlement, abundance will be obtained by sub sampling with total abundances extrapolated by counting individuals within 10 randomly selected 1 cm<sup>2</sup> areas.

The laboratory will identify to the lowest possible taxonomic classification, noting that use of morphospecies was appropriate for detection of change under PRP 146 (Dafforn *et al.*, 2012). Taxonomic identification will be supported using dissecting microscopes, with species codes input to the Coral Point Count software. A photographic reference collection will be collated for the project, and updated following each event.

## Statistical analysis

Univariate and multivariate statistical analysis will be used to explore the collected data and determine if impacts have occurred due to PKGT activities. In order to statistically inform potential impacts, the multivariate assemblage to the site, zone, and phase will be analysed using permutational multivariate analysis of variance (PERMANOVA) based on Bray-Curtis similarity of abundance data.

This approach allows no assumption of normality (i.e.  $p=0.05$  as in ANOVAs) allowing for comparison of unbalanced data sets. Post-hoc permutational pair wise tests using PERMANOVA will be performed to examine interactions of variables of a significant nature. In cases where the number of permutations is  $< 100$ , Monte Carlo P-values can be used to calculate the P value. To discriminate between variables (i.e. site, phase, etc), multivariate data will be graphically represented using non-metric multi-dimensional scaling (NMDS).

Univariate analysis will be carried out to investigate the differences in taxon richness and taxon abundance. As above, this will be undertaken using PERMANOVA+ to run permutational analyses of variance based on Euclidian distance of all possible pairs of samples of the variable of interest. Following this the underlying distribution of the data can be determined.

## Interfacing with other Monitoring Plans

GHD will use data collected as part of the Construction Water Quality Monitoring Plan (CWQMP) to contextualise the results of the ecological health monitoring plan. The CWQMP is proposing to use a combination of daily visual observations, weekly grab samples and Automated Monitoring Buoys (AMB) for harbour wide water quality monitoring at 5 locations (Figure 4.5). There is intentional alignment with the water quality monitoring locations and the proposed ecological health monitoring locations to allow for data synergies. The approach to water quality monitoring is outlined in Table 4.3.

GHD will obtain the raw data from the CWQMP, in addition to the monthly reports, to establish trends, and align results with construction activities or metocean events that may be influencing factors on the results.



Figure 4.5 Construction Water Quality Monitoring Plan Locations

Table 4.3 Construction Water Quality Monitoring Plan Design Outline

Contaminant of Concern	Frequency	Sampling method	Location
Laboratory analysis			
Aluminium	Once weekly	Water sample	Points WQMs 1,2,3 and 4
Anthracene	Once weekly	Water sample	Points WQMs 1,2,3 and 4
Arsenic	Once weekly	Water sample	Points WQMs 1,2,3 and 4
Benzo(a)pyrene	Once weekly	Water sample	Points WQMs 1,2,3 and 4
Cadmium	Once weekly	Water sample	Points WQMs 1,2,3 and 4
Chromium (total)	Once weekly	Water sample	Points WQMs 1,2,3 and 4
Cobalt	Once weekly	Water sample	Points WQMs 1,2,3 and 4
Copper	Once weekly	Water sample	Points WQMs 1,2,3 and 4
Fluoranthene	Once weekly	Water sample	Points WQMs 1,2,3 and 4
Lead	Once weekly	Water sample	Points WQMs 1,2,3 and 4
Mercury	Once weekly	Water sample	Points WQMs 1,2,3 and 4
Naphthalene	Once weekly	Water sample	Points WQMs 1,2,3 and 4

Contaminant of Concern	Frequency	Sampling method	Location
Nickel	Once weekly	Water sample	Points WQMs 1,2,3 and 4
pH	Once weekly	Water sample	Points WQMs 1,2,3 and 4
Total PAHs	Once weekly	Water sample	Points WQMs 1,2,3 and 4
Tributyltin	Once weekly	Water sample	Points WQMs 1,2,3 and 4
Zinc	Once weekly	Water sample	Points WQMs 1,2,3 and 4
TSS	Once weekly	Water sample	Points WQMs 1,2,3 and 4
Visual indicators			
Oil and grease	Daily	Inspection	From tugs, dredge daily or from the shoreline during Stage 1
Sediment plume	Daily	Inspection	
Marine mammals, Dinoflagellate Cyst Bloom	Daily	Inspection	
Physical parameters			
Temperature	Continuous (15-minute recording intervals)	AMB	Points WQMs 1,2,3 and 4
pH	Continuous (15-minute recording intervals)	AMB	Points WQMs 1,2,3 and 4
EC	Continuous (15-minute recording intervals)	AMB	Points WQMs 1,2,3 and 4
DO	Continuous (15-minute recording intervals)	AMB	Points WQMs 1,2,3 and 4
Turbidity	Continuous (15-minute recording intervals)	AMB	Points WQMs 1,2,3 and 4

## 4.2.4 Water sampling

During each deployment and retrieval of the settlement plate arrays a water sample will be collected and tested for the following:

- Physical parameters – Temperature, pH, EC, DO, Turbidity.
- Laboratory analysis – Aluminium, Anthracene, Arsenic, Benzo(a)pyrene, Cadmium, Chromium (total), Cobalt, Fluoranthene, Lead, Mercury, Naphthalene, Nickel, Total PAHs, Tributyltin, Zinc, TSS, Total Residual Chlorine.

Physical parameters will be measured using a calibrated, hand-held water quality meter. Sampling will be undertaken by appropriately qualified and trained personnel and with reference to relevant statutory requirements, standards and quality assurance and quality control protocols. Laboratory analysis will be undertaken by a National Association of Testing Authorities (NATA) accredited laboratory.

## 4.2.5 Validation modelling framework

Condition E3.4(c) of the EPL 21529 requires validation of the water quality modelling that was undertaken during the preparation of the EIS for FSRU operation. Namely, relating to the discharge of cool water and residual chlorine from the FSRU. Given the temporal disconnect between the writing of this EHMP, and the commencement of operations and resulting model validation exercise, it is proposed that a detailed model validation program be developed as a stand alone document. This will enable consultation with the FSRU operators and specialist subconsultants to ensure the program is designed appropriately to meet intended objectives. The model validation program design document will be submitted to relevant regulatory agencies, including the NSW EPA for agreement at least three months prior to the commencement of operations.

Presented following is a framework which will form the basis of the design document. Model validation will be undertaken in a staged approach:

- **Stage 1** will comprise field sampling which will be undertaken to understand the spatial and temporal extent of discharges during the operational phase. Field sampling will be undertaken across multiple events, enabling comparison with various modelled scenarios. Following sampling, results will be analysed and compared to modelling predictions. Should a disconnect between sampling and modelling predictions be identified (ie. a larger impact) and attributed to departures from the assessed FSRU operations or adopted modelling approach, then Stage 2 will be triggered.
- If required, **Stage 2** of the model validation will comprise a desktop assessment to understand level of impact associated with discrepancies between the modelling and field results. If further information is required to support this assessment Stage 3 will be triggered.
- If required, **Stage 3** of the model validation will be undertaken by specialist subconsultants experienced in toxicity bench testing. Tests will be designed for relevance to the species present within the Port Kembla region, and where possible will be undertaken in accordance with NATA accredited methodology.

Should the results of the model validation exercise identify impacts greater than those predicted, consideration will be given to practical measures to reduce the impacts of the discharge to the levels assessed in the EIS. The design of this EHMP will be revisited in conjunction with the implementation of any impact reduction measures to ensure monitoring objectives are still being met.

## 5. Reporting

Sessile invertebrate recruitment requires extensive field time, laboratory analysis and post processing effort and therefore is not appropriate to be relied upon for real time environmental management of dredging impacts. Adaptive management is best approached using real time, continuous data inputs such as electronic field instruments.

GHD will utilise the data collected from the CWQMP to compliment the results of the Ecological Health Monitoring Program and identify trends in water quality throughout the phases of the project and resultant impacts to sessile recruitment and surrounding water quality.

The findings from the EHMP, and associated findings from the CWQMP, will provide overall indication as to the impact of PKGT relative to the reference sites and baseline conditions observed at the impact sites pre-construction. Further, the results of the EHMP will determine, in part, the need for further monitoring to track the recovery and stabilisation of ecological health indicators if impacts are detected.

Each interim report will confirm that works have been carried out successfully and in accordance with the EHMP, identify any issues encountered, departures from the agreed EHMP and provide interim data and summary statistics. Should any impacts be identified by the interim reports, the program will be reviewed to identify appropriate management measures.

The end of operational event 1 report will provide an overarching summary of the interim reports and detailed data analysis at the end of the EHMP. This is summarised in Table 5.1.

GHD will provide one report within four months of each monitoring event to AIE with copies to NSW EPA, DPI Fisheries and the Department of Planning, Industry and Environment NSW.

*Table 5.1 Proposed Reporting Frequency*

Phase	Interim progress report	End of Operational Event 1 report
Phase 1 – Baseline	Y	
Phase 2 – Construction	Y	
Phase 3 – Operation		Y – to be provided following one operational monitoring events

## 6. Program Review

Condition E3.4 of the EPL 21529 notes that the EPA requires operational monitoring to be undertaken every 2 years. Based on the results and recommendations from a suitably qualified person, the EPA will review the frequency after two monitoring events in consultation with AIE.

Therefore, this document will be subject to review and revision following submission of the end of project report. Other triggers for review of the program include:

- Substantial changes to proposed works (scope/timeframes/footprint),
- Identification of broadscale impacts from dredging through complementary water quality monitoring programs,
- Identification of impacts beyond what was predicted during EIS modelling (via model validation exercise), or
- Identification of logistical issues beyond what has been accounted for with programmed redundancy.

Any revisions to this EHMP will be through approval by the EPA and a variation of licence condition E3.

Consultation with other regulatory agencies will be undertaken as necessary. EHMP revisions will be documented for audit purposes.

## 7. References

AECOM. (2010). Port Kembla Outer Harbour Development – Environmental Assessment. Prepared for Port Kembla Port Corporation.

Bridgewood, S. (2010). Community Based Monitoring Program for Introduced Pests. Fisheries Research Report No. 201. Department of Fisheries. Western Australia.

Clark, G.F., B.P. Kelaher, K.A. Dafforn, M.A. Coleman, N.A. Knott, E.M. Marzinelli, E.L. Johnston. (2015). What does impacted look like? High diversity and abundance of epibiota in modified estuaries. *Environmental Pollution* 196: 12-20

Connor, P. M. (1972). Acute toxicity of heavy metals to some marine larvae. *Marine Pollution Bulletin* 3:190-192.

Dafforn, K.A., Clark, G.F., McKinley, A.C., and Johnston, E.L. (2012) Pollution Reduction Program 146: Assessment of the ecological condition of Port Kembla Inner Harbour and Allans Creek and a comparison with two reference estuaries. Report prepared for Lawrence Zammit Bluescope Steel. University of New South Wales.

Environmental Scientists and Engineers (CEE) (2018). Chlorine in seawater heat exchange process at Crib Point: AGL Gas Import Jetty Project, Crib Point, Western Port. Report to Jacobs Group (Australia) Pty Ltd).

GHD. (2018a). Contamination Assessment Report for Berth 101, Proposed Port Kembla Gas Terminal (Report ref: 2127477-75508, October 2018). GHD Pty Ltd.

GHD. (2018b). Marine Ecology Impact Assessment – Port Kembla Gas Terminal (November 2018). GHD Pty Ltd.

Hall Jr., L. W., M. C. Scott, and W. D. Killen (1998). Ecological risk assessment of copper and cadmium in surface waters of Chesapeake Bay watershed. *Environmental Toxicology & Chemistry* 17:1172-1189.

Johnston, E. L., and M. J. Keough (2002). Direct and indirect effects of repeated pollution events on marine hard-substrate assemblages. *Ecological applications* 12:1212-1228.

Johnston, E. L., and M. J. Keough (2003). Competition modifies the response of organisms to toxic disturbance. *Marine Ecology Progress Series* 251:15-26.

Knott, N.A. and E.L. Johnston (2007). Ecological assessment of the immediate impacts of dredging in Port Kembla Harbour. New South Global Consulting, University of New South Wales. Prepared for Port Kembla Port Corporation.

Knott, N.A., D. Roberts, E.L. Johnston (2008). Assessment of the ecological effects of dredging activities in Port Kembla Harbour: 1 to 4 months post-dredging. New South Global Consulting, University of New South Wales. Prepared for Port Kembla Port Corporation.

NSW Ports (2015). Draft Aquatic Biological Monitoring Program – Outer Harbour Development Port Kembla.

# Appendices



# **Appendix A**

## **Author Qualifications**



## **Anna Boden** MAPPSc, BSc

### Technical Director – Ecology



#### **Location**

Brisbane, QLD, Australia

#### **Experience**

16 years

#### **Qualifications/Accreditations**

- Masters of Applied Science (Environmental Science), University of Sydney, 2002
- Bachelor of Science (Marine Science and Biology), University of Sydney, 2001

#### **Key technical skills**

- Marine impact assessment
- Project management
- Coastal development projects
- Environmental management
- Environmental reporting
- Experimental design and statistics

#### **Relevant experience summary**

Anna is one of GHD's leading ecologists with over 16 years' experience. She has a proven track record in technical leadership, collaboration and delivery. In her role as Technical Director she uses her leadership skills to guide delivery of work to meet client expectations. Anna has a proven track record in natural resources management, focussing on marine and estuarine ecology, water quality and sediment quality.

Anna has been responsible for the delivery of whole of life programs, from the initial establishment of baseline conditions, impact understanding, development of trigger values for management of sensitive receptors, and compliance monitoring in accordance with regulatory requirements. Anna has in-depth knowledge and understanding of approvals and permitting processes for natural resources projects, and has completed a number of assessments across NSW, Australia and Internationally.

Anna is highly familiar with the marine ecosystems of temperate Australia. Her post-graduate studies involved an assessment of heavy metals in marine sediments and mussels in Sydney Harbour. Subsequent to this she worked for four years as a research assistant at the University of Sydney's Centre of Research on Ecological Impacts of Coastal Cities.

Anna has also been approved by the Commonwealth Department of Agriculture, Water and the Environment to undertake compliance audits of EMPs conditioned under the EPBC Act, recognising her technical authority in environmental management.



## Madelaine Hooper

MEnvSc, BEnvSc(Bio)(EnvM), BIntBus, BCom(Economics)

Senior Marine Scientist / Economist



### Location

Sydney, Australia

### Experience

7+ years

### Qualifications/Accreditations

- MEnvSc(with Distinction), BEnvSc (Biology)(Environmental Monitoring), BIntBus, BCom(Economics)
- Coastal Hazard Management Course II: Advanced (Griffith University)
- Introduction to Reef Restoration – Great Barrier Reef Orpheus Island (Reef Ecologic/James Cook University)
- Registered consultant with Fiji Department of Environment (Specialist areas: Marine Flora and Fauna and Marine Pollution)
- PADI, OGUK/UKOOA, Boat License, MSIC, Survival at Sea, Fight and Extinguish Fires on Coastal Vessels, LROCP Marine Radio, First Aid and CPR/Basic Life Support, White Card, Operate and recover a 4WD, General Purpose Hand (Crew) Commercial Vessels (Search and Rescue) Certification.

### Key technical skills

- Lead scientist
- Sample design, planning and execution
- Environmental impact assessments
- Marine ecology, sediment and water quality
- Seagrass impact assessments

### Memberships

- Environment Institute of Australia and New Zealand (EIANZ)
- Professional Scientists Australia
- Australian Coastal Society (ACS)

### Relevant experience summary

Madelaine has over 7 years' experience in consulting and scientific research throughout Australia, the Pacific and the Middle East. Madelaine has experience in large scale environmental impact assessments and ecological monitoring programs, particularly in the resources sector, from project inception to establishing and operating ongoing monitoring phases of the project. Madelaine has led numerous projects both in Australia and internationally in country and has particular experience with designing and leading complex field programs to a high scientific standard. Madelaine's special interest areas include seagrass management, artificial reef design, coral reef restoration, emergency response and coastal hazard management.

